FINE ARTS CLASSROOM BUILDING
FOR
EAST TENNESSEE STATE UNIVERSITY

East Tennessee State University
Johnson City, Tennessee

SBC NO. 166 / 005-08-2013 CM

PROJECT MANUAL
FOR
DESIGN RELEASE PACKAGE 4

December 1, 2017

DESIGNERS
McCARTY HOLSAPLE McCARTY, INC.
ARCHITECTS & INTERIOR DESIGNERS
550 WEST MAIN STREET
SUITE 300
KNOXVILLE, TENNESSEE 37902
TEL: 865.544.2000
FINE ARTS CLASSROOM BUILDING
FOR
EAST TENNESSEE STATE UNIVERSITY

East Tennessee State University
JOHNSON CITY, TENNESSEE
SBC NO. 166 / 005-08-2013 CM

PROJECT MANUAL
FOR
DESIGN RELEASE PACKAGE 4

December 1, 2017

DESIGNERS
McCARTY HOLSAPLE McCARTY, INC.
ARCHITECTS & INTERIOR DESIGNERS
550 WEST MAIN STREET
SUITE 300
KNOXVILLE, TENNESSEE 37902
TEL: 865.544.2000

CIVIL AND STRUCTURAL ENGINEERING
Beeson Lusk and Street, Inc.
207 East Main Street, Suite 3C
Johnson City, TN 37604
TEL: 423-928-1175

LANDSCAPE ARCHITECTURE
The Penland Studio
111 North Central Street, Suite 100
Knoxville, TN 37902
TEL 865 335-3584

MECHANICAL, PLUMBING, FIRE PROTECTION
Facilities Systems Consultants, LLC
713 South Central Street, Suite 101
Knoxville, TN 37902
TEL: 865.246.0164

ACOUSTIC AND
AUDIOVISUAL
Acoustic Distinctions, Inc.
145 Huguenot Street
New Rochelle, NY 10801
TEL 914 712-1300

ELECTRICAL, DATA/COMMUNICATIONS & SECURITY

THEATER DESIGN
Theater Consultants Collaborative, Inc.
6600 Manor Hill Court
Chapel Hill, NC 72516
TEL 919 929-7443

COST ESTIMATING
Vermeulen’s, Inc.
470 Atlantic Avenue, 4th Floor
Boston, MA 02210
TEL 617 273-8430
## SECTION 00.01.10
**TABLE OF CONTENTS**

### PROCUREMENT AND CONTRACTING REQUIREMENTS

#### DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS

- Out-cover and In-cover
  - 00.01.07 - Seals Page
  - 00.01.10 - Table of Contents
  - 00.01.15 - List of Drawing Sheets
  - 00.11.19 - Request For GMP
  - 00.21.19 - Instructions to CM/GC For Producing The GMP
  - 00.31.32 - Geotechnical – Stormwater Information Available to Bidders
  - 00.36.66 - Available Information Regarding Owner’s System Office Access
  - 00.42.23 - GMP Summary
  - 00.42.71 - GMP List of Trade Subcontracts
  - 00.42.75 - GMP Disclosure of General Conditions
  - 00.54.33 - ACH Credits Form
  - 00.61.13 - Contract Bond
  - 00.61.43 – Three Year Roof Bond
  - 00.72.13 - General Conditions, AIA A201
  - 00.73.16 - Supplementary Conditions

### SPECIFICATIONS

#### DIVISION 01 -- GENERAL REQUIREMENTS

- 01.10.00 – Summary
- 01.23.11 – Design Options
- 01.25.13 - Product Substitution Procedures
- 01.25.33 - Product Substitution Request Form
- 01.26.00 - Contract Modification Procedures
- 01.26.20 - Weather Delays
- 01.26.25 - Weather Delay Report
- 01.26.40 - Form for Amendment, Change Order, or Directive
- 01.26.54 - Form for Price Summary
- 01.26.55 - Form for Price of Work
- 01.26.56 - Form for Price of Time
- 01.29.16 - CM/GC-GMP Contingency and Reserve
- 01.29.17 - Form For CM/GC Contingency Log
- 01.29.18 - Form For CM/GC GMP Reserve Fund Log
- 01.29.54 - Retainage Escrow Initiation
- 01.29.73 - Schedule of Values
- 01.29.76 - Applications and Certificates for Payment
01.30.00 - Administrative Requirements
01.31.19 - Project Meetings
01.31.90 - Administrative Logs
01.31.93 - Visitor Log
01.32.15 - Progress Schedules and Reports
01.40.00 - Quality Requirements
01.41.15 - Basic Regulatory Requirements
01.43.25 - Testing Laboratory Services
01.45.33 - Code-Required Special Inspections
01.50.00 - Temporary Facilities and Controls
01.57.23 - Temporary Storm Water Pollution Control
01.60.00 - Product Requirements
01.61.16 - Volatile Organic Compound (VOC) Content Restrictions
01.62.25 - Product Options
01.70.00 - Execution and Closeout Requirements
01.74.19 – Construction Waste Management & Disposal
01.77.70 - Closeout Procedures
01.78.21 - Closeout Submittals
01.78.25 - Data Binder Receipt
01.78.50 - HPBr Reporting
01.78.51 - High Performance Building Requirements CHECKLIST / TRACKING FORM
01.78.88 - Report of Subcontractors and Suppliers
01.79.21 – Demonstration and Training
01.79.25 – Demonstration and Training Verification
01.91.13 – Commissioning
01.91.14 – General Commissioning Requirements
01.91.15 – Commissioning Plan
01.91.23 – Performance Testing Identification Form
01.91.26 – Performance Testing Procedures Form
01.91.29 – Functional Performance Test Certification

DIVISION 02 -- EXISTING CONDITIONS (SEE DRP1)

DIVISION 03 -- CONCRETE (SEE DRP2 for other items)

03.45.00 - Precast Architectural Concrete

DIVISION 04 – MASONRY

04.05.11 - Mortar and Masonry Grout
04.16.00 - Masonry Accessories
04.20.00 - Unit Masonry
DIVISION 05 – METALS (SEE DRP2 for other items)
- 05.40.00 – Cold Formed Steel Framing
- 05.51.00 - Metal Stairs
- 05.70.00 - Decorative Metal
- 05.53.05 - Gratings and Floor Plates
- 05.70.00 – Decorative Metal
- 05.71.13 - Fabricated Spiral Stairs
- 05.73.00 – “V” Rail - LED Lighted Railing
- 05.73.01 – “V” Handrail - Un-Lighted

DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES
- 06.10.00 - Rough Carpentry
- 06.20.00 – Finish Carpentry
- 06.41.00 – Architectural Wood Casework

DIVISION 07 -- THERMAL AND MOISTURE PROTECTION
- 07.11.13 - Bituminous Dampproofing
- 07.21.00 - Thermal Insulation
- 07.21.19 - Foamed-In-Place Insulation
- 07.42.13 - Metal Wall Panels
- 07.42.13.23 - Metal Composite Material Wall Panels
- 07.50.35 – Total Roofing System Warranty Instructions
- 07.50.36 – Total Roofing System Warranty
- 07.53.23 - Thermoset Single-Ply Roofing
- 07.62.00 - Sheet Metal Flashing and Trim
- 07.72.00 - Roof Accessories
- 07.72.36 - Smoke Vents
- 07.81.00 - Applied Fireproofing
- 07.84.00 - Firestopping
- 07.92.00 - Joint Sealants

DIVISION 08 – OPENINGS
- 08.11.13 - Hollow Metal Doors and Frames
- 08.11.73 – Accordion Fire & Smoke Rated Doors
- 08.14.16 - Flush Wood Doors
- 08.31.00 - Access Doors and Panels
- 08.33.23 - Overhead Coiling Doors
- 08.34.73 - Sound Control Door Assemblies
- 08.42.29 - Automatic Entrances
- 08.43.13 - Aluminum-Framed Storefronts
- 08.44.13 - Glazed Aluminum Curtain Walls
- 08.56.59 – Service and Teller Windows
08.56.76 - Operable Sound Control Window Assemblies
08.71.00 - Door Hardware
08.80.00 – Glazing
08.83.00 - Mirrors

**DIVISION 09 – FINISHES**

09.21.16 - Gypsum Board Assemblies
09.22.16 - Non-Structural Metal Framing
09.22.36 – Lath
09.23.00 – Gypsum Plastering
09.27.00 – Plaster Fabrications
09.30.00 – Tiling
09.51.00 – Acoustical Ceilings
09.54.26 – Linear Wood Grilles
09.64.29 – Wood Strip and Plank Flooring
09.64.33 – Platform Wood Flooring
09.65.00 – Resilient Flooring
09.65.19 – Resilient Plank and Tile Flooring
09.66.23 – Resinous Matrix Terrazzo Flooring
09.68.13 – Tile Carpeting
09.72.00 – Wall Covering
09.84.12 – Sound Absorptive Boards
09.84.13 - Sound Absorptive Wall Panels
09.84.15 - Sound Diffusive/Absorptive Panels
09.91.13 - Exterior Painting
09.91.23 – Interior Painting

**DIVISION 10 – SPECIALTIES**

10.11.01 – Visual Display Boards
10.14.00 – Signage
10.14.01 – Signage Schedules
10.14.02 – Signage Elevations
10.14.26.10 – Post and Panel/Pylon Signage
10.21.13.19 – Plastic Toilet Compartments
10.26.01 – Wall and Corner Guards
10.28.00 – Toilet, Bath and Laundry Accessories
10.42.00 – Fall Protection Devices
10.44.00 - Fire Protection Specialties
10.51.00 – Lockers
10.56.13 – Metal Storage Shelving
10.56.17 – Wall-Mounted Standards and Shelving
10.73.00 - Aluminum Walkway Covers
10.73.01 - Aluminum Wall Hung Canopy

**DIVISION 11 -- EQUIPMENT**

11.13.19.13 - Loading Dock Levelers
11.61.00 - Performance Machinery General Requirements
11.61.23 - Portable Platforms
11.61.24 – Orchestra Shell
11.61.33 - Performance Manual Rigging
11.61.37 - Proscenium Fire Safety Curtain
11.61.38 - Tension Wire Grid
11.61.39 - Performance Lifts
11.61.43 - Performance and Acoustic Draperies
11.61.44 - Performance Drapery Tracks
11.61.61 - Performance Lighting Power and Controls
11.61.95 - Stage Protection Nets

**DIVISION 12 -- FURNISHINGS**

12.12.30 – Art Hanging and Display System
12.24.00 - Window Shades
12.36.00 - Countertops
12.61.00 - Fixed Audience Seating

**DIVISION 13 -- SPECIAL CONSTRUCTION**

13.48.23 - Spring Isolated Gypsum Board Ceiling

**DIVISION 14 -- CONVEYING EQUIPMENT**

14.21.00 - Electric Traction Elevators
14.42.16 - Vertical Wheelchair Lifts
14.42.18 - Vertical Shaft Wheelchair Lifts

**DIVISION 21 -- FIRE SUPPRESSION**

21.10.00 - Fire Protection

**DIVISION 22 -- PLUMBING**

22.05.00 - General Provisions for Plumbing
22.05.53 - Identification of Plumbing Piping and Equipment
22.07.19 - Plumbing Insulation
22.08.00 - Commissioning of Plumbing Systems
22.10.05 - Plumbing Piping & Valves
22.10.06 - Plumbing Piping Specialties
22.11.23 - Domestic Water Pumps
22.33.00 - Water Heaters - Electric
22.34.05 - Water Heater, Gas Fired

DIVISION 23 -- HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

23.05.00 - General Provision for HVAC
23.05.05 - Use of Mechanical Systems
23.05.13 - Motor Requirements for HVAC Equipment
23.05.14 - Variable Frequency Motor Drives
23.05.17 - Sleeves, Escutcheons, And Sleeve Seals for HVAC Piping
23.05.29 - Hangers and Supports for HVAC Piping and Equipment
23.05.33 - Heat Tracing for Exterior Chilled Water Piping
23.05.48 - Vibration Control for Mechanical Systems
23.05.49 - Noise Control for Mechanical Systems
23.05.53 - Identification for HVAC Piping and Equipment
23.05.93 - Testing, Adjusting, And Balancing for HVAC
23.07.13 - Duct Insulation
23.07.19 - HVAC Equipment and Piping Insulation
23.08.00 - Commissioning of HVAC Systems
23.09.23 - Direct Digital Control (DDC) System For HVAC
23.21.13 - Hydronic Piping
23.21.14 - Exterior and Underground Chilled Water Distribution Systems
23.21.16 - Hydronic Piping, Valves, And Specialties
23.21.23 - Hydronic Pumps
23.31.13 - Sheet Metal Ductwork - Low Pressure
23.31.15 - Sheet Metal Ductwork - Medium Pressure
23.34.23 - HVAC Power Ventilators
23.36.00 - Air Terminal Units
23.37.13 - Sheet Metal Specialties
23.41.00 - Air filters
23.51.23 - Gas Vents
23.52.33 - Forced Draft Gas Water Tube Boilers
23.64.23 - Scroll Water Chillers
23.73.13 - Modular Indoor Central-Station Air-Handling Units
23.74.13 - Modular, Outdoor, Central Station Air Handling Units
23.82.19 - Fan Coil Units
23.84.15 - Electric Steam Humidifiers

DIVISION 26 -- ELECTRICAL

26.05.00 - Electrical General Provisions
26.05.01 - Basic Electrical Materials and Methods
26.05.16 - Conduit
26.05.19 - Wire and Cable
26.05.26 - Grounding and Bonding
26.05.29 - Supporting Devices
26.05.33 - Outlet and Junction Boxes
26.05.48 - Noise and Vibration Control for Electrical Systems
26.05.53 - Electrical Identification
26.05.73 - Overcurrent Protective Devices
26.08.00 - Commissioning of Electrical Systems
26.09.61 - Performance Lighting Power and Controls Devices Installation
26.09.61.40 - Performance Machinery Devices Installation
26.09.61.99 - Performance Equipment Electrical Responsibility Schedule
26.22.00 - Dry-Type Transformers
26.24.00 - Mechanical Equipment and Controls
26.24.13 - Switchboards
26.24.16 - Panelboards
26.27.01 - Electrical Service Entrance
26.27.26 - Wiring Devices and Plates
26.28.13 - Disconnect Switches
26.43.13 - Transient Voltage Surge Suppressors
26.51.00 - Interior Lighting
26.60.80 - Technical Power Systems for AV
26.60.90 - Cable Raceway Systems for AV
26.61.00 - General Lighting Provisions

DIVISION 27 -- COMMUNICATIONS
27.01.00 - Reference Standards
27.05.28 - Telecommunications Outside Plant (OSP)
27.05.29 - Hangers and Support
27.05.53 - Administration/Labeling
27.11.10 - Telecommunications Spaces
27.15.00 - Voice and Network Horizontal Cabling System
27.15.33 - Coax Horizontal Cabling
27.41.00 - Performance Audio & Video Systems

DIVISION 28 -- ELECTRONIC SAFETY AND SECURITY
28.03.00 - Fire Alarm System
28.31.33.10 - Fire Alarm System Performance Equipment Interface

DIVISION 31 -- EARTHWORK (See DRP 1)

DIVISION 32 -- EXTERIOR IMPROVEMENTS
32.10.00 - Asphalt Concrete Paving
32.16.00 - Concrete Curbs and Walks
32.17.23 - Pavement Markings
32.32.23 - Segmental Retaining Wall Systems
32.33.00 - Site Furnishings
32.84.00 - Landscape Irrigation System
32.92.19 - Seeding
32.92.23 - Sodding
32.93.00 - Trees, Shrubs and Ground Covers

DIVISION 33 -- UTILITIES (NOT USED)

END OF SECTION 00.01.10
<table>
<thead>
<tr>
<th>SHEET NO.</th>
<th>SHEET NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>GENERAL FRONT END</td>
<td></td>
</tr>
<tr>
<td>G001-D</td>
<td>COVERSHEET</td>
</tr>
<tr>
<td>G002-D</td>
<td>SHEET INDEX</td>
</tr>
<tr>
<td>G003-D</td>
<td>NOTES &amp; SYMBOLS</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>CIVIL</td>
<td></td>
</tr>
<tr>
<td>C204</td>
<td>ENLARGED PLAN SITE RETAINING WALLS AND SECTIONS</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>LANDSCAPE</td>
<td></td>
</tr>
<tr>
<td>IR101</td>
<td>IRRIGATION PLAN</td>
</tr>
<tr>
<td>IR102</td>
<td>IRRIGATION SLEEVE PLAN</td>
</tr>
<tr>
<td>IR201</td>
<td>IRRIGATION DETAILS</td>
</tr>
<tr>
<td>L101</td>
<td>LANDSCAPE PLAN</td>
</tr>
<tr>
<td>L201</td>
<td>LANDSCAPE DETAILS</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>ARCHITECTURAL - GENERAL</td>
<td></td>
</tr>
<tr>
<td>AC101</td>
<td>NOISE CRITICAL SPACES</td>
</tr>
<tr>
<td>AG001</td>
<td>INTERIOR PARTITION &amp; DETAILS - TYP</td>
</tr>
<tr>
<td>AG002</td>
<td>INTERIOR PARTITION DETAILS</td>
</tr>
<tr>
<td>AG003</td>
<td>INTERIOR PARTITION DETAILS</td>
</tr>
<tr>
<td>AG010</td>
<td>ADA GUIDELINES - TYPICAL MOUNTING HEIGHTS</td>
</tr>
<tr>
<td>AG020</td>
<td>SITE SIGNAGE LOCATION PLAN</td>
</tr>
<tr>
<td>AG021</td>
<td>INTERIOR SIGNAGE LOCATION PLAN - GROUND FLOOR</td>
</tr>
<tr>
<td>AG022</td>
<td>INTERIOR SIGNAGE LOCATION PLAN - UPPER FLOOR</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>LIFE SAFETY</td>
<td></td>
</tr>
<tr>
<td>LS001</td>
<td>CALCULATED FIRE RESISTANCE</td>
</tr>
<tr>
<td>LS002</td>
<td>UL DETAILS</td>
</tr>
<tr>
<td>LS003</td>
<td>UL DETAILS</td>
</tr>
<tr>
<td>LS004</td>
<td>UL DETAILS</td>
</tr>
<tr>
<td>LS005</td>
<td>UL DETAILS</td>
</tr>
<tr>
<td>LS101</td>
<td>GROUND LEVEL LIFE SAFETY PLAN</td>
</tr>
<tr>
<td>LS102</td>
<td>UPPER LEVEL LIFE SAFETY PLAN</td>
</tr>
<tr>
<td>LS103</td>
<td>TECHNICAL LEVELS LIFE SAFETY PLANS &amp; OCC SCHEDULE</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>ARCHITECTURAL</td>
<td></td>
</tr>
</tbody>
</table>

DESIGN RELEASE PACKAGE 4
ISSUED: 12/01/17
<table>
<thead>
<tr>
<th>Sheet Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A104</td>
<td>COMPOSITE ROOF PLAN</td>
</tr>
<tr>
<td>A111</td>
<td>GROUND LEVEL ENLARGED QUADRANT 1 PLAN</td>
</tr>
<tr>
<td>A112</td>
<td>GROUND LEVEL ENLARGED QUADRANT 2 PLAN</td>
</tr>
<tr>
<td>A113</td>
<td>GROUND LEVEL ENLARGED QUADRANT 3 PLAN</td>
</tr>
<tr>
<td>A114</td>
<td>GROUND LEVEL ENLARGED QUADRANT 4 PLAN</td>
</tr>
<tr>
<td>A121</td>
<td>UPPER LEVEL ENLARGED QUADRANT 1 PLAN</td>
</tr>
<tr>
<td>A123</td>
<td>UPPER LEVEL ENLARGED QUADRANT 3 PLAN</td>
</tr>
<tr>
<td>A124</td>
<td>UPPER LEVEL ENLARGED QUADRANT 4 PLAN &amp; TECH LEVEL PLANS</td>
</tr>
<tr>
<td>A131</td>
<td>AUDITORIUM TECHNICAL LEVEL PLANS</td>
</tr>
<tr>
<td>A141</td>
<td>ROOF LEVEL ENLARGED PLANS</td>
</tr>
<tr>
<td>A201</td>
<td>GROUND &amp; ORCHESTRA LEVEL COMPOSITE RCPS</td>
</tr>
<tr>
<td>A202</td>
<td>UPPER LEVEL COMPOSITE RCPS</td>
</tr>
<tr>
<td>A203</td>
<td>TECHNICAL LEVEL COMPOSITE RCPS</td>
</tr>
<tr>
<td>A211</td>
<td>GROUND LEVEL ENLARGED QUADRANT 1 RCP</td>
</tr>
<tr>
<td>A212</td>
<td>GROUND LEVEL ENLARGED QUADRANT 2 RCP</td>
</tr>
<tr>
<td>A213</td>
<td>GROUND LEVEL ENLARGED QUADRANT 3 RCP</td>
</tr>
<tr>
<td>A214</td>
<td>GROUND LEVEL ENLARGED QUADRANT 4 RCP</td>
</tr>
<tr>
<td>A221</td>
<td>UPPER LEVEL ENLARGED QUADRANT 1 RCP</td>
</tr>
<tr>
<td>A223</td>
<td>UPPER LEVEL ENLARGED QUADRANT 3 RCP</td>
</tr>
<tr>
<td>A224</td>
<td>UPPER LEVEL ENLARGED QUADRANT 4 RCP</td>
</tr>
<tr>
<td>A231</td>
<td>TECHNICAL LEVELS ENLARGED RCPS</td>
</tr>
<tr>
<td>A241</td>
<td>RCP DETAILS</td>
</tr>
<tr>
<td>A301</td>
<td>COMPOSITE EXTERIOR ELEVATIONS</td>
</tr>
<tr>
<td>A302</td>
<td>COMPOSITE EXTERIOR ELEVATIONS</td>
</tr>
<tr>
<td>A311</td>
<td>ENLARGED SOUTH ELEVATIONS</td>
</tr>
<tr>
<td>A312</td>
<td>ENLARGED EAST ELEVATIONS</td>
</tr>
<tr>
<td>A321</td>
<td>ENLARGED NORTH ELEVATIONS</td>
</tr>
<tr>
<td>A322</td>
<td>ENLARGED WEST ELEVATIONS</td>
</tr>
<tr>
<td>A402</td>
<td>LONGITUDINAL BUILDING SECTIONS</td>
</tr>
<tr>
<td>A403</td>
<td>TRANSVERSE BUILDING SECTIONS</td>
</tr>
<tr>
<td>A404</td>
<td>TRANSVERSE BUILDING SECTIONS</td>
</tr>
<tr>
<td>A413</td>
<td>WALL SECTIONS</td>
</tr>
<tr>
<td>A414</td>
<td>WALL SECTIONS</td>
</tr>
<tr>
<td>A415</td>
<td>WALL SECTIONS</td>
</tr>
<tr>
<td>A416</td>
<td>WALL SECTIONS</td>
</tr>
<tr>
<td>A417</td>
<td>WALL SECTIONS</td>
</tr>
<tr>
<td>A418</td>
<td>WALL SECTIONS</td>
</tr>
<tr>
<td>A419</td>
<td>WALL SECTIONS</td>
</tr>
<tr>
<td>A420</td>
<td>WALL SECTIONS</td>
</tr>
<tr>
<td>A421</td>
<td>WALL SECTIONS</td>
</tr>
<tr>
<td>A422</td>
<td>WALL SECTIONS</td>
</tr>
<tr>
<td>A423</td>
<td>WALL SECTIONS</td>
</tr>
</tbody>
</table>
A424  WALL SECTIONS
A425  WALL SECTIONS
A426  WALL SECTIONS
A427  WALL SECTIONS
A451  ENLARGED PLAN DETAILS
A452  ENLARGED PLAN DETAILS
A461  ENLARGED SECTION DETAILS
A462  ENLARGED SECTION DETAILS
A463  ENLARGED SECTION DETAILS
A471  TYPICAL ROOF DETAILS
A501  ENLARGED STAIR 1 PLANS & SECTIONS
A502  ENLARGED STAIR 2 PLANS & SECTIONS
A503  ENLARGED STAIR 3 & 4 PLANS & SECTIONS
A504  ENLARGED STAIR 5 & CONTROL BOOTH STAIR PLANS & SECTIONS
A505  ENLARGED STAIR 6 PLANS & SECTIONS
A506  ENLARGED FLY GALLERY & GRIDIRON STAIRS
A507  ENLARGED MISC. STAIRS & LADDERS PLANS & SECTIONS
A508  ENLARGED ELEVATOR AND AISLE PLANS & SECTIONS
A509  ENLARGED EXTERIOR STAIR & RAMP PLANS & SECTIONS
A511  STAIR & RAILING DETAILS
A512  STAIR & RAILING DETAILS
A513  LOBBY RAILING DETAILS
A601  DOOR SCHEDULE
A602  DOOR DETAILS - INTERIOR
A603  DOOR DETAILS - INTERIOR
A604  DOOR DETAILS - EXTERIOR
A605  DOOR DETAILS - EXTERIOR
A611  INTERIOR WINDOW TYPES
A612  WINDOW DETAILS - INTERIOR
A613  EXTERIOR WINDOW TYPES - LOBBY AND VESTIBULES
A614  EXTERIOR WINDOW TYPES
A615  WINDOW DETAILS - EXTERIOR
A616  WINDOW DETAILS - EXTERIOR
A801  RESTROOM ENLARGED PLANS & ELEVATIONS
A802  RESTROOM ENLARGED PLANS & ELEVATIONS
A803  RESTROOM ENLARGED PLANS & ELEVATIONS
A811  QUAD 1 - ENL PLANS & INTERIOR ELEVATIONS - MAIN AUD
A811.1 QUAD 1 - ENL PLANS & INTERIOR ELEVATIONS - MAIN AUD
A812  QUAD 1 - ENL PLANS & INTERIOR ELEVATIONS - STUDIO
A812.1 QUAD 1 - ENL PLANS & INTERIOR ELEVATIONS - STUDIO
A813  QUAD 1 - ENL PLANS & INTERIOR ELEVATIONS - SCENE SHOP
A814  QUAD 1 - ENL PLANS & INTERIOR ELEVATIONS - COSTUME
<table>
<thead>
<tr>
<th>Drawing</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A815</td>
<td>QUAD 1 - ENL PLANS &amp; INTERIOR ELEVATIONS - DRESSING - GREEN</td>
</tr>
<tr>
<td>A816</td>
<td>QUAD 1 - ENL PLANS &amp; INTERIOR ELEVATIONS - STUDIO SSL</td>
</tr>
<tr>
<td>A817</td>
<td>QUAD 1 - ENL PLANS &amp; INTERIOR ELEVATIONS - MAIN AUD SSL</td>
</tr>
<tr>
<td>A817.1</td>
<td>QUAD 1 - ENL PLANS &amp; INTERIOR ELEVATIONS - MAIN AUD SSL</td>
</tr>
<tr>
<td>A821</td>
<td>QUAD 2 - ENL PLANS &amp; INTERIOR ELEVATIONS - OFFICES</td>
</tr>
<tr>
<td>A822</td>
<td>QUAD 2 - ENL PLANS &amp; INTERIOR ELEVATIONS - DRESSING - GREEN</td>
</tr>
<tr>
<td>A822.1</td>
<td>QUAD 2 - ENL PLANS &amp; INTERIOR ELEVATIONS - DRESSING - GREEN</td>
</tr>
<tr>
<td>A831</td>
<td>QUAD 3 - ENL PLANS &amp; INTERIOR ELEVATIONS - PERC-CHOIR</td>
</tr>
<tr>
<td>A831.1</td>
<td>QUAD 3 - ENL PLANS &amp; INTERIOR ELEVATIONS - PERC-CHOIR</td>
</tr>
<tr>
<td>A832</td>
<td>QUAD 3 - ENL PLANS &amp; INTERIOR ELEVATIONS - INST-GREEN</td>
</tr>
<tr>
<td>A832.1</td>
<td>QUAD 3 - ENL PLANS &amp; INTERIOR ELEVATIONS - INST-GREEN</td>
</tr>
<tr>
<td>A833</td>
<td>QUAD 3 - ENL PLANS &amp; INTERIOR ELEVATIONS - RECITAL</td>
</tr>
<tr>
<td>A833.1</td>
<td>QUAD 3 - ENL PLANS &amp; INTERIOR ELEVATIONS - RECITAL</td>
</tr>
<tr>
<td>A834</td>
<td>QUAD 3 - ENL PLANS &amp; INTERIOR ELEVATIONS - REH SSL</td>
</tr>
<tr>
<td>A841</td>
<td>QUAD 4 - ENL PLANS &amp; INTERIOR ELEVATIONS - LOBBY</td>
</tr>
<tr>
<td>A841.1</td>
<td>QUAD 4 - LOBBY INTERIOR ELEVATIONS</td>
</tr>
<tr>
<td>A842</td>
<td>INTERIOR ELEVATIONS / SECTIONS</td>
</tr>
<tr>
<td>A851</td>
<td>CASEWORK DETAILS</td>
</tr>
<tr>
<td>A900</td>
<td>FINISH SCHEDULES</td>
</tr>
<tr>
<td>A901</td>
<td>GROUND LEVEL FLOOR PATTERN PLAN</td>
</tr>
<tr>
<td>A902</td>
<td>UPPER LEVEL FLOOR PATTERN PLAN</td>
</tr>
<tr>
<td>A913</td>
<td>GROUND LEVEL ENLARGED QUAD 1 PLAN CORNER GUARD DETAIL</td>
</tr>
<tr>
<td>A914</td>
<td>GROUND LEVEL ENLARGED QUAD 2 PLAN CORNER GUARD LOCATION</td>
</tr>
<tr>
<td>A915</td>
<td>GROUND LEVEL ENLARGED QUAD 3 PLAN CORNER GUARD DETAIL</td>
</tr>
<tr>
<td>A916</td>
<td>GROUND LEVEL ENLARGED QUAD 4 PLAN CORNER GUARD DETAIL</td>
</tr>
<tr>
<td>A917</td>
<td>UPPER LEVEL ENLARGED QUAD 1 PLAN CORNER GUARD DETAIL</td>
</tr>
<tr>
<td>A918</td>
<td>UPPER LEVEL ENLARGED QUAD 3 PLAN CORNER GUARD DETAIL</td>
</tr>
<tr>
<td>A919</td>
<td>UPPER LEVEL ENLARGED QUAD 4 PLAN CORNER GUARD DETAIL</td>
</tr>
<tr>
<td>A920</td>
<td>WALL FINISH PAINT LOCATIONS</td>
</tr>
</tbody>
</table>

**Structural**

<table>
<thead>
<tr>
<th>Drawing</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S701</td>
<td>OVERALL LINTEL PLAN AND MASONRY DETAILS</td>
</tr>
</tbody>
</table>

**Mechanical**

<table>
<thead>
<tr>
<th>Drawing</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M001</td>
<td>MECHANICAL NOTES, LEGEND</td>
</tr>
<tr>
<td>M002</td>
<td>MECHANICAL SCHEDULES</td>
</tr>
<tr>
<td>M003</td>
<td>MECHANICAL SCHEDULES</td>
</tr>
<tr>
<td>M004</td>
<td>MECHANICAL SCHEDULES</td>
</tr>
<tr>
<td>M005</td>
<td>MECHANICAL DETAILS</td>
</tr>
<tr>
<td>M006</td>
<td>MECHANICAL DETAILS</td>
</tr>
<tr>
<td>M007</td>
<td>MECHANICAL DETAILS</td>
</tr>
<tr>
<td>M008</td>
<td>MECHANICAL DETAILS</td>
</tr>
<tr>
<td>M009</td>
<td>MECHANICAL DETAILS</td>
</tr>
<tr>
<td>------</td>
<td>--------------------</td>
</tr>
<tr>
<td>M010</td>
<td>MECHANICAL DETAILS</td>
</tr>
<tr>
<td>M011</td>
<td>MECHANICAL CONTROLS</td>
</tr>
<tr>
<td>M012</td>
<td>MECHANICAL CONTROLS</td>
</tr>
<tr>
<td>M013</td>
<td>MECHANICAL CONTROLS</td>
</tr>
<tr>
<td>M014</td>
<td>MECHANICAL CONTROLS</td>
</tr>
<tr>
<td>M015</td>
<td>MECHANICAL CONTROLS</td>
</tr>
<tr>
<td>M111</td>
<td>GROUND LEVEL HVAC PLAN - QUADRANT 1</td>
</tr>
<tr>
<td>M112</td>
<td>GROUND LEVEL HVAC PLAN - QUADRANT 2</td>
</tr>
<tr>
<td>M113</td>
<td>GROUND LEVEL HVAC PLAN - QUADRANT 3</td>
</tr>
<tr>
<td>M114</td>
<td>GROUND LEVEL HVAC PLAN - QUADRANT 4</td>
</tr>
<tr>
<td>M115</td>
<td>UPPER LEVEL HVAC PLAN - QUADRANT 1</td>
</tr>
<tr>
<td>M116</td>
<td>UPPER LEVEL HVAC PLAN - QUADRANT 3</td>
</tr>
<tr>
<td>M117</td>
<td>UPPER LEVEL HVAC PLAN - QUADRANT 4</td>
</tr>
<tr>
<td>M118</td>
<td>HVAC ROOF PLAN - QUADRANT 1</td>
</tr>
<tr>
<td>M119</td>
<td>AHU SECTIONS</td>
</tr>
<tr>
<td>M120</td>
<td>HVAC ROOF PLAN - QUADRANT 2</td>
</tr>
<tr>
<td>M121</td>
<td>HVAC ROOF PLAN - QUADRANT 3</td>
</tr>
<tr>
<td>M211</td>
<td>GROUND LEVEL HYDRONICS PLAN - QUADRANT 1</td>
</tr>
<tr>
<td>M212</td>
<td>GROUND LEVEL HYDRONICS PLAN - QUADRANT 2</td>
</tr>
<tr>
<td>M213</td>
<td>GROUND LEVEL HYDRONICS PLAN - QUADRANT 3</td>
</tr>
<tr>
<td>M214</td>
<td>GROUND LEVEL HYDRONICS PLAN - QUADRANT 4</td>
</tr>
<tr>
<td>M215</td>
<td>UPPER LEVEL HYDRONICS PLAN - QUADRANT 1</td>
</tr>
<tr>
<td>M216</td>
<td>UPPER LEVEL HYDRONICS PLAN - QUADRANT 3</td>
</tr>
<tr>
<td>M217</td>
<td>UPPER LEVEL HYDRONICS PLAN - QUADRANT 4</td>
</tr>
</tbody>
</table>

**FIRE PROTECTION**

<table>
<thead>
<tr>
<th>FP002</th>
<th>FIRE PROTECTION DETAILS, CALCS, AND NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP111</td>
<td>GROUND LEVEL FIRE PROTECTION - QUADRANT 1</td>
</tr>
<tr>
<td>FP112</td>
<td>GROUND LEVEL FIRE PROTECTION - QUADRANT 2</td>
</tr>
<tr>
<td>FP113</td>
<td>GROUND LEVEL FIRE PROTECTION - QUADRANT 3</td>
</tr>
<tr>
<td>FP114</td>
<td>GROUND LEVEL FIRE PROTECTION - QUADRANT 4</td>
</tr>
<tr>
<td>FP115</td>
<td>UPPER LEVEL FIRE PROTECTION - QUADRANT 1</td>
</tr>
<tr>
<td>FP116</td>
<td>UPPER LEVEL FIRE PROTECTION - QUADRANT 2 &amp; 3</td>
</tr>
</tbody>
</table>

**PLUMBING**

<table>
<thead>
<tr>
<th>P001</th>
<th>PLUMBING LEGENDS, NOTES AND SCHEDULES</th>
</tr>
</thead>
<tbody>
<tr>
<td>P002</td>
<td>PLUMBING DETAILS</td>
</tr>
<tr>
<td>P003</td>
<td>FIRE PENETRATION DETAILS</td>
</tr>
<tr>
<td>P111</td>
<td>GROUND LEVEL SANITARY SEWER PLAN - QUADRANT 1</td>
</tr>
<tr>
<td>P112</td>
<td>GROUND LEVEL SANITARY SEWER PLAN - QUADRANT 2</td>
</tr>
<tr>
<td>P113</td>
<td>GROUND LEVEL SANITARY SEWER PLAN - QUADRANT 3</td>
</tr>
</tbody>
</table>
P114  GROUND LEVEL SANITARY SEWER PLAN - QUADRANT 4
P115  ENLARGED GROUND LEVEL SANITARY SEWER AND DOMESTIC WATER
P116  UPPER LEVEL SANITARY SEWER & DOMESTIC WATER - QUADRANT 3
P117  ROOF LEVEL RAINWATER - QUADRANT 1
P118  ROOF LEVEL RAINWATER - QUADRANT 2
P119  ROOF LEVEL RAINWATER - QUADRANT 3
P120  ROOF LEVEL RAINWATER - QUADRANT 4
P211  GROUND LEVEL DOMESTIC WATER & NATURAL GAS - QUADRANT 1
P212  GROUND LEVEL DOMESTIC WATER & NATURAL GAS - QUADRANT 2
P213  GROUND & UPPER LEVEL DOMESTIC WATER & NATURAL GAS - QUADRANT 3

ELECTRICAL
E001  ELECTRICAL LEGEND, NOTES & SCHEDULES
E002  POWER RISER DIAGRAM
E003  LIGHTING FIXTURE SCHEDULE
E004  TYPICAL LIGHTING CONTROL RISER DETAIL
E005  ROOM LIGHTING CONTROL DETAILS A, B, C, D
E006  ROOM LIGHTING CONTROL DETAILS LOBBY
E007  ROOM LIGHTING CONTROL DETAILS CORRIDOR
E008  PANELBOARDS
E009  PANELBOARDS
E111  GROUND LEVEL LIGHTING PLAN - QUADRANT 1
E112  GROUND LEVEL LIGHTING PLAN - QUADRANT 2
E113  GROUND LEVEL LIGHTING PLAN - QUADRANT 3
E114  GROUND LEVEL LIGHTING PLAN - QUADRANT 4
E121  UPPER LEVEL LIGHTING PLAN - QUADRANT 1
E123  UPPER LEVEL LIGHTING PLAN - QUADRANT 3
E124  UPPER LEVEL LIGHTING PLAN - QUADRANT 4
E131  CATWALK LEVEL LIGHTING PLAN
E201  ELECTRICAL UNDERGROUND - QUADRANT 1
E202  ELECTRICAL UNDERGROUND - QUADRANT 2
E203  ELECTRICAL UNDERGROUND - QUADRANT 3
E211  GROUND LEVEL POWER PLAN - QUADRANT 1
E212  GROUND LEVEL POWER PLAN - QUADRANT 2
E213  GROUND LEVEL POWER PLAN - QUADRANT 3
E214  GROUND LEVEL POWER PLAN - QUADRANT 4
E221  UPPER LEVEL POWER PLAN - QUADRANT 1
E223  UPPER LEVEL POWER PLAN - QUADRANT 3
E224  UPPER LEVEL POWER PLAN - QUADRANT 4
E311  GROUND LEVEL HVAC POWER PLAN - QUADRANT 1
E312  GROUND LEVEL HVAC POWER PLAN - QUADRANT 2
<table>
<thead>
<tr>
<th>Sheet Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E313</td>
<td>GROUND LEVEL HVAC POWER PLAN - QUADRANT 3</td>
</tr>
<tr>
<td>E314</td>
<td>GROUND LEVEL HVAC POWER PLAN - QUADRANT 4</td>
</tr>
<tr>
<td>E321</td>
<td>UPPER LEVEL HVAC POWER PLAN - QUADRANT 1</td>
</tr>
<tr>
<td>E323</td>
<td>UPPER LEVEL HVAC POWER PLAN - QUADRANT 3</td>
</tr>
<tr>
<td>E333</td>
<td>ROOF HVAC POWER PLAN</td>
</tr>
<tr>
<td>E334</td>
<td>ENLARGED HVAC POWER PLANS</td>
</tr>
<tr>
<td>E411</td>
<td>GROUND LEVEL TECHNICAL POWER PLAN - QUADRANT 1</td>
</tr>
<tr>
<td>E412</td>
<td>GROUND LEVEL TECHNICAL POWER PLAN - QUADRANT 2</td>
</tr>
<tr>
<td>E413</td>
<td>GROUND LEVEL TECHNICAL POWER PLAN - QUADRANT 3</td>
</tr>
<tr>
<td>E414</td>
<td>GROUND LEVEL TECHNICAL POWER PLAN - QUADRANT 4</td>
</tr>
<tr>
<td>E421</td>
<td>UPPER LEVEL TECHNICAL POWER PLAN - QUADRANT 1</td>
</tr>
<tr>
<td>E423</td>
<td>UPPER LEVEL TECHNICAL POWER PLAN - QUADRANT 3</td>
</tr>
<tr>
<td>E425</td>
<td>AUDITORIUM TECH LEVEL TECHNICAL POWER PLAN</td>
</tr>
<tr>
<td>ES1.0</td>
<td>SITE ELECTRICAL PLAN</td>
</tr>
<tr>
<td>FA111</td>
<td>GROUND LEVEL FIRE ALARM PLAN - QUADRANT 1</td>
</tr>
<tr>
<td>FA112</td>
<td>GROUND LEVEL FIRE ALARM PLAN - QUADRANT 2</td>
</tr>
<tr>
<td>FA113</td>
<td>GROUND LEVEL FIRE ALARM PLAN - QUADRANT 3</td>
</tr>
<tr>
<td>FA114</td>
<td>GROUND LEVEL FIRE ALARM PLAN - QUADRANT 4</td>
</tr>
<tr>
<td>FA211</td>
<td>UPPER LEVEL FIRE ALARM PLAN - QUADRANT 1</td>
</tr>
<tr>
<td>FA213</td>
<td>UPPER LEVEL FIRE ALARM PLAN - QUADRANT 3</td>
</tr>
<tr>
<td>FA214</td>
<td>UPPER LEVEL FIRE ALARM PLAN - QUADRANT 4</td>
</tr>
<tr>
<td>T001</td>
<td>COMMUNICATIONS LEGEND, NOTES &amp; COMM RISER DIAGRAM</td>
</tr>
<tr>
<td>T002</td>
<td>ENLARGED IT/COMM ROOM DETAILS</td>
</tr>
<tr>
<td>T003</td>
<td>COMMUNICATIONS DETAILS</td>
</tr>
<tr>
<td>T004</td>
<td>COMMUNICATIONS DETAILS</td>
</tr>
<tr>
<td>T005</td>
<td>CABLE SCHEDULE</td>
</tr>
<tr>
<td>T111</td>
<td>GROUND LEVEL COMMUNICATIONS PLAN - QUADRANT 1</td>
</tr>
<tr>
<td>T112</td>
<td>GROUND LEVEL COMMUNICATIONS PLAN - QUADRANT 2</td>
</tr>
<tr>
<td>T113</td>
<td>GROUND LEVEL COMMUNICATIONS PLAN - QUADRANT 3</td>
</tr>
<tr>
<td>T114</td>
<td>GROUND LEVEL COMMUNICATIONS PLAN - QUADRANT 4</td>
</tr>
<tr>
<td>T121</td>
<td>GROUND LEVEL A/V PLAN - QUADRANT 1</td>
</tr>
<tr>
<td>T122</td>
<td>GROUND LEVEL A/V PLAN - QUADRANT 2</td>
</tr>
<tr>
<td>T123</td>
<td>GROUND LEVEL A/V PLAN - QUADRANT 3</td>
</tr>
<tr>
<td>T124</td>
<td>GROUND LEVEL A/V PLAN - QUADRANT 4</td>
</tr>
<tr>
<td>T211</td>
<td>UPPER LEVEL COMMUNICATIONS PLAN - QUADRANT 1</td>
</tr>
<tr>
<td>T213</td>
<td>UPPER LEVEL COMMUNICATIONS PLAN - QUADRANT 3</td>
</tr>
<tr>
<td>T214</td>
<td>UPPER LEVEL COMMUNICATIONS PLAN - QUADRANT 4</td>
</tr>
<tr>
<td>T221</td>
<td>UPPER LEVEL A/V PLAN - QUADRANT 1</td>
</tr>
<tr>
<td>Sheet</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>T223</td>
<td>UPPER LEVEL A/V PLAN - QUADRANT 3</td>
</tr>
<tr>
<td>T224</td>
<td>UPPER LEVEL A/V PLAN - QUADRANT 4</td>
</tr>
<tr>
<td>TS1.0</td>
<td>COMMUNICATIONS FIBER PATH</td>
</tr>
<tr>
<td>TS1.1</td>
<td>BRIDGE FIBER PATH</td>
</tr>
</tbody>
</table>

**Audio Visual**

- AV010 AV SYSTEMS - GENERAL NOTES & INSTRUCTIONS
- AV011 AV SYSTEMS - ELECTRICAL COORDINATION
- AV111 AV SYSTEMS - GROUND LEVEL QUADRANT 1 TERMINATIONS
- AV112 AV SYSTEMS - GROUND LEVEL QUADRANT 2 TERMINATIONS
- AV113 AV SYSTEMS - GROUND LEVEL QUADRANT 3 TERMINATIONS
- AV114 AV SYSTEMS - GROUND LEVEL QUADRANT 4 TERMINATIONS
- AV121 AV SYSTEMS - UPPER LEVEL QUADRANT 1 TERMINATIONS
- AV123 AV SYSTEMS - UPPER LEVEL QUADRANT 3 TERMINATIONS
- AV124 AV SYSTEMS - UPPER LEVEL QUADRANT 4 TERMINATIONS
- AV131A AV SYSTEMS - TECHNICAL LEVEL TERMINATIONS
- AV131B AV SYSTEMS - GRID LEVEL TERMINATIONS
- AV201 AV SYSTEMS - CONCERT HALL PRIMARY DEVICES
- AV202 AV SYSTEMS - RECITAL HALL PRIMARY DEVICES
- AV203 AV SYSTEMS - TYPICAL MOUNTING DETAILS
- AV204 AV SYSTEMS - TYPICAL MOUNTING DETAILS
- AV301 AV SYSTEMS - SERIES A PANELS
- AV302 AV SYSTEMS - SERIES B & C PANELS
- AV303 AV SYSTEMS - SERIES D PANELS
- AV304 AV SYSTEMS - SERIES E PANELS
- AV305 AV SYSTEMS - SERIES F & H PANELS
- AV401 AV SYSTEMS - PRIMARY RACK ELEVATIONS
- AV402 AV SYSTEMS - SUPPLEMENTAL RACKS & RACK PANEL DETAILS
- AV701 AV SYSTEMS - RACK ZA SIGNAL FLOW
- AV702 AV SYSTEMS - RACK ZC LINEAR SIGNAL FLOW A
- AV703 AV SYSTEMS - RACK ZC LINEAR SIGNAL FLOW B
- AV704 AV SYSTEMS - RACK ZC NETWORK SIGNAL FLOW
- AV705 AV SYSTEMS - RACK ZD LINEAR SIGNAL FLOW
- AV706 AV SYSTEMS - RACK ZD NETWORK SIGNAL FLOW
- AV707 AV SYSTEMS - RACK ZE LINEAR SIGNAL FLOW
- AV708 AV SYSTEMS - RACK ZE NETWORK SIGNAL FLOW
- AV709 AV SYSTEMS - REHEARSAL ROOM SIGNAL FLOWS
- AV710 AV SYSTEMS - SIGNAL FLOW DETAILS

**Electrical Coordination - Cable Passes**

- EYC100 TEMPORARY CABLE PASSES DETAILS & KEYS
- EYC101 TEMPORARY CABLE PASSES FIRST FLOOR
EYC102  TEMPORARY CABLE PASSES SECOND FLOOR

ELECTRICAL COORDINATION - PERFORMANCE LIGHTING
EYL100  PERFORMANCE POWER, LIGHTING, AND CONTROLS LEGENDS & KEYS
EYL101  PERFORMANCE LIGHTING STUDIO THEATRE PLANS
EYL102  PERFORMANCE LIGHTING AUDITORIUM PLANS
EYL103  PERFORMANCE LIGHTING AUDITORIUM PLANS
EYL104  PERFORMANCE POWER, LIGHTING, AND CONTROLS
EYL105  PERFORMANCE LIGHTING RECITAL HALL PLANS
EYL106  PERFORMANCE LIGHTING DEVICE SCHEDULES

ELECTRICAL COORDINATION - PERFORMANCE MACHINERY
EYM100  PERFORMANCE MACHINERY ELECTRICAL LEGENDS & KEYS
EYM101  PERFORMANCE MACHINERY ELECTRICAL REQUIREMENTS
EYM102  PERFORMANCE MACHINERY ELECTRICAL REQUIREMENTS
EYM103  PERFORMANCE MACHINERY ELECTRICAL REQUIREMENTS
ELECTRICAL COORDINATION - PERFORMANCE MACHINERY: 4

PERFORMANCE LIGHTING
QTC101  PERF EQUIP ELECTRICAL COORDINATION
QTL101  PERFORMANCE LIGHTING STUDIO CONTROL RISER DIAGRAM
QTL102  PERFORMANCE LIGHTING RECITAL CONTROL RISER DIAGRAM
QTL103  PERFORMANCE LIGHTING AUD. CONTROL RISER DIAGRAM
QTL111  PERFORMANCE LIGHTING CONTROL DETAILS
QTL112  PERFORMANCE LIGHTING DISTRIBUTION DET
QTL113  PERFORMANCE LIGHTING DISTRIBUTION DET CONT
QTL114  PERFORMANCE LIGHTING PORTABLE EQUIPMENT

THEATRE EQUIPMENT
QTR100  PERFORMANCE RIGGING PROSCENIUM THEATRE SCHEDULES
QTR101  PERFORMANCE RIGGING PROSCENIUM THEATRE RIGGING PLAN
QTR102  PERFORMANCE RIGGING PROSCENIUM RIGGING SECTION
        PERFORMANCE RIGGING PROSCENIUM THEATRE TRANSVERSE
QTR103  SECTION
QTR104  PERFORMANCE RIGGING PROSCENIUM THEATRE FIRE CURTAIN
QTR105  PERFORMANCE RIGGING PROSCENIUM THEATRE SHELL RIGGING
QTR111  ADJUSTABLE ACOUSTICS PROSCENIUM THEATRE LEVEL 1
QTR112  ADJUSTABLE ACOUSTICS PROSCENIUM THEATRE LEVEL 2
QTR113  ADJUSTABLE ACOUSTICS PROSCENIUM CATWALK LEVEL
QTR114  ADJUSTABLE ACOUSTICS PROSCENIUM THEATRE SECTION
QTR121  ORCHESTRA SHELL PLAN
QTR122  ORCHESTRA SHELL SECTION
QTR201  PERFORMANCE RIGGING STUDIO THEATRE TENSION GRID
QTR202  PERFORMANCE RIGGING STUDIO THEATRE DRAPERY
QTR203  PERFORMANCE RIGGING STUDIO THEATRE LIGHTING PIPES
QTR301  ORCHESTRA PIT LIFT
QTR311  ORCHESTRA PIT LIFT CONTROL RISER
QTR401  ADJUSTABLE ACOUSTICS RECITAL HALL
QTR402  ADJUSTABLE ACOUSTICS RECITAL HALL
QTR501  ADJUSTABLE ACOUSTICS CLASSROOMS
QTR502  ADJUSTABLE ACOUSTICS CLASSROOMS
QTR503  ADJUSTABLE ACOUSTICS CLASSROOMS

END OF SECTION 00.01.15
REQUEST FOR GMP

For Project: SBC #166/005-08-2013 CM
East Tennessee State University
Fine Arts Classroom Building for East Tennessee State University

A. A Guaranteed Maximum Price (GMP) is requested for the Work described in this Project Manual and the associated drawings and addenda. You are to obtain bids for trade subcontracts, and develop the GMP in accordance with the CM/GC Master Contract.

B. The GMP shall be for:
   - [ ] a new Contract.
   - [x] an amendment to an existing Contract.

C. The GMP shall offer alternates as specified. In addition, voluntary alternates:
   - [x] may be proposed, up to ______ -- in number.
   - [ ] may not be proposed.

D. Contract Bond, in the amount of 100% of the Contract Sum, on the Owners standard form is required. If this proposal is for an amendment, a rider to the existing bond acknowledging the amendment and the revised Contract Sum is required. A Three-Year Roof Bond is:
   - [x] required, for All total roof systems
   - [ ] not required.

E. Substantial completion of this Work shall be achieved in the number of calendar days Contract Time allotted each Phase below, from and including the Commencement of each, and accepting the conditions for Liquidated Damages, per day, in the amount set forth for each, wholly and severally for each Phase:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Commencement</th>
<th>Contract Time</th>
<th>Liquidated Damages</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>Notice to Proceed for all Work</td>
<td>315 days</td>
<td>$250.00</td>
</tr>
</tbody>
</table>

END OF SECTION
INSTRUCTIONS TO CM/GC FOR PRODUCING THE GMP

A. Subcontractors that have been disqualified from participating in State Building Commission projects may not be recommended for any part of this Work, and shall not be allowed to perform any part of this Work. The CM/GC and its subcontractors shall not knowingly utilize the services of an illegal immigrant in the performance of this Work, and shall not knowingly utilize the services of any subcontractor, sub-subcontractor, or consultant who utilizes the services of an illegal immigrant in the performance of this Work.

B. The CM/GC shall present the GMP with an acknowledgement of all addenda.

C. If the GMP includes work of a subcontract trade regulated by state licensing laws, the CM/GC shall identify the subcontractor’s license information called for by licensing law.

D. The CM/GC shall provide the following information explaining the derivation of costs:

   1. Standard forms provided for documenting the GMP are recommended for the convenience of the Owner, to provide the CM/GC with a basic format most easily evaluated and accepted by the Owner. These forms are reproduced in this project manual, and are available as Excel spreadsheets in the Designers’ Manual posted on the Owner’s website. Standard forms include:
      - Section 00 42 23 GMP Summary
      - Section 00 42 71 GMP List of Trade Subcontracts
      - Section 00 42 75 GMP Disclosure of General Conditions
      - Section 01 26 55 Form for Price of Work

   2. Provide a Cumulative Summary when adding scope or phases to an existing GMP Contract, and show the history of the current GMP, and the effect of the amending the new GMP to the existing GMP. No standard form is provided, but a format similar to the GMP Summary is preferred.

   3. GMP Summary shall show the cost elements of trade subcontracts, general conditions, self-performance, CM/GC contingency, fee, and a total of these, with percentages for self-performance, contingency, and fee. If alternates are required and/or volunteered, these shall be shown distinct from the cost of the base work, and the cost elements named above provided for each. The standard form accommodates this information as if there are three required and three volunteered alternates; however, it is not intended to infer a required number of alternates for a particular project. The Owner normally expects quality pre-construction services to produce no alternates.

   4. GMP List of Trade Subcontracts shall show hard bids distinct from allowances and estimates. If there are alternates, these shall be shown distinct from the cost of the base work, similar to the GMP Summary. The standard form accommodates this information. List only those allowances that are specified. If an allowance is part of a trade subcontract, show the allowance portion as an allowance, and show the remainder of the trade in the Estimates or Hard Bids, as applicable. Trades may only be so designated to the extent that they are being procured through bidding, either before or after the GMP agreement or amendment, in accordance with the Master Contract. Portions of the Work that the CM/GC will procure through direct purchase without bidding cannot be Trades, and must be a part of Self-Performance. An exception to the requirement of bidding a trade can be in accordance with specification section 01 29 16 paragraph 1.03.F.

   5. Bid Tabulation of Trade Subcontracts shall show the various trade bids in a manner that facilitates easy comparison and determination of the low bidder, with notations explaining post-bid adjustments and rejections. Copies of the bids shall also be provided, to allow the Designer and Owner the opportunity to correlate the Bid Tabulation to the bids. No standard format is provided.
6. The Self-Performance portion of the GMP shall be itemized using the Form for Price of Work, showing the costs, overhead, and profit in a manner similar to that required for change order price itemization. The standard form accommodates this information.

7. GMP Disclosure of General Conditions shall list the line items included in the original proposal by which the CM/GC was selected, and the comparable costs included in the specific GMP being presented, identifying and explaining deviations. The standard form accommodates this information based on commonly used line items, but is not necessarily all-inclusive of line items applicable in this instance.

E. The proposal is to be submitted to the Owner and copied simultaneously to the Designer.

F. Once submitted, the proposal must be firm for thirty (30) days for the Owner to evaluate and complete the award or amendment, including five (5) days allowed for the proposer to sign and return award or amendment documents, once provided by the Owner, plus all required bonds and insurance documents.

END OF SECTION
INVESTIGATIONS AND REPORTS:

A. Sub-surface and stormwater investigations have been performed at the project site. The investigations were conducted, and reports obtained, solely for design purposes and is not a part of the Contract Documents.


B. The use and interpretation of this information will be entirely the responsibility of the using party. The Owner is not responsible for variations in the sub-surface conditions. Bidders shall decide for themselves the character of the material to be encountered.

C. The report of the findings of the investigations will be posted with the bid documents and are also on file in the Designer's office, and may be reviewed there by any prospective Bidder of Record. Bidders must call ahead to schedule an appointment with the Designer's office. A copy will be provided to any Bidder of Record upon request.
AVAILABLE INFORMATION REGARDING
OWNER’S SYSTEM OFFICE ACCESS

1.01 LOCATION

A. The Office of Facilities Development (OFD) physical and mailing address at the Tennessee Board of Regents (TBR) system office is:

Tennessee Board of Regents
Office of Facilities Development
1 Bridgestone Park
Nashville, Tennessee 37214-2428

B. The general contact phone number for TBR OFD is 615-366-4431.

1.02 ACCESS TO TBR SYSTEM OFFICE

A. Meetings related to OFD projects may occur on-site or elsewhere at the involved institution, the designer’s or contractor’s office, or the TBR system office, as befits the needs of those organizing the meeting. Public bid openings are considered meetings.

B. The 1 Bridgestone Park Building is in general an ADA compliant accessible building.

C. Anyone who wishes to enter the TBR System Office, whether to attend a meeting or deliver a bid or proposal or any other purpose, should contact one of the staff members shown below, or the staff member specifically hosting the meeting if known, and make known their intent to enter. Contact may be made in person, by writing, by email, by telephone, or otherwise, and should be received no later than 4:30pm on the third TBR business day prior to the arrival, unless specifically announced otherwise.

For meetings related to bid or proposal solicitations and as back-up to Ms. Froggatt, either
Rilla Froggatt 615-366-3908 rilla.froggatt@tbr.edu
Cindy Potts 615-366-4431 cindy.potts@tbr.edu
Tammy Ray 615-366-4493 tammy.ray@tbr.edu

D. Anyone with a disability, when making their intent to attend a meeting known, per C above, should also at that time request services needed to facilitate attendance. TBR staff responding to such requests will obtain specific information and coordinate accommodations with building management personnel, and then advise the person who made the request.

END OF SECTION
## GMP SUMMARY

**Project:** 166C05-08-2013 Fine Arts Classroom Building for East Tennessee State University  
**Presented by CM/GC:** Denark Construction, Inc.  

<table>
<thead>
<tr>
<th>date</th>
<th>Specified Alternates</th>
<th>Volunteered Alternates</th>
<th>Total if all accepted</th>
<th>GMP Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>#2</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>#3</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>#4</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>#5</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>#6</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

- **Base Work**
- **Allowances**
- **Estimates**
- **Hard Bids**
- **Trade Subcontracts**
- **Self Performance**
- **CMGC Contingency**
- **Fixed Fee**
- **Total**

### Totals

- **Self-performance (% of GMP):**
- **Contingency (% of trades, GCs, self):**
- **Fee (% of GMP):**

**Posted in XLS format**  
**February 2016**  
**OFD 0304223**  
**Page 1 of 1**
# GMP LIST OF TRADE SUBCONTRACTS

**Project:** 166/005-08-2013 Fine Arts Classroom Building for East Tennessee State University

**Presented by CM/GC:** Denark Construction, Inc.

<table>
<thead>
<tr>
<th>Date</th>
<th>Base Work</th>
<th>Specified Alternates</th>
<th>Volunteered Alternates</th>
<th>Total if all accepted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#1</td>
<td>#2</td>
<td>#3</td>
<td>#4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>what allowance, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what allowance, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what allowance, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Trade allowances subtotals:</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what estimate, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what estimate, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what estimate, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Trade estimates subtotals:</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what hard bid, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what hard bid, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what hard bid, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what hard bid, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what hard bid, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what hard bid, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what hard bid, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what hard bid, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what hard bid, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what hard bid, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what hard bid, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what hard bid, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>what hard bid, by whom</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Trade bid subtotals:</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Trades totals:</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

**GMP List of Trade Subcontracts**

00 42 71 - 1
**General Conditions Costs**

<table>
<thead>
<tr>
<th>Date</th>
<th>Original Proposal</th>
<th>This GMP</th>
<th>Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>monthly</td>
<td>monthly</td>
<td>monthly</td>
</tr>
<tr>
<td>Photographs</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Superintendent</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Clerk</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Asst Superintendent</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Project Manager</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Project Director</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Project Engineer / Safety</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Layout Instruments</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Temporary Office Trailer</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Temporary Storage Trailer</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Portable Toilets</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Temporary Utilities</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Employee Parking</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Phones &amp; Beepers</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Safety Measures</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Trash Collection &amp; Disposal</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Pick-up Truck</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Auto</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Fuel</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Office Furniture &amp; Equipment</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Misc Supplies &amp; Expenses</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>monthly subtotal</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>months Contract Time</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>monthlies x months</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>lump sum</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Permits</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>GL, auto, empl Insurance</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Builder's Risk Insurance</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Other Insurance (explain)</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Bond</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Gross Receipts Tax</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Signs</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Other Temporary stuff</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Misc Printing</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>lump sums subtotal</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
STATE OF TENNESSEE
DEPARTMENT OF FINANCE AND ADMINISTRATION

ACH (AUTOMATED CLEARING HOUSE) CREDITS (Not Wire Transfers)

NAME__________________________________________________________

Federal Identification Number or Social Security Number ________________
(under which you are doing business with the State)

I (We) hereby authorize the State of Tennessee, hereafter called the STATE, to initiate credit entries to my (our) (select type of account) _____ CHECKING or _____ SAVINGS account indicated below and the depository named below, hereinafter called DEPOSITORY, to credit the same to such account.

This authority is to remain in full force and effect until the STATE has received written notification from me (or one of us) of its termination in such time and in such manner as to afford the STATE and DEPOSITORY a reasonable opportunity to act on it.

Have you ever received payments from the State through ACH? ______ (Yes or No). If yes, do you intend for this account information to replace existing account information currently used by the State? ______ (Yes or No). If yes, please specify account that should be changed: ABA No. _______________ Account No. _______________. Is this authorization only for certain types of payments? ______ (Yes or No). If yes, please indicate types:
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

Many banking institutions use different numbers for ACH. Please call your bank for verification of ACH transit and account number.
Bank official contacted: _____________________________________ Phone No. _________________________

DEPOSITORY/BANK NAME _____________________________BRANCH ____________________________
CITY ____________________________________________________STATE ___________________________
ACH TRANSIT / ABA NO. _____________________________ACCOUNT NO. _________________________
NAME(S) __________________________________________________________________________________
(Please print names of authorized account signatory)

DATE _______________________SIGNED X ______________________SIGNED X _____________________

PLEASEx ATTACH A VOIDED CHECK (OR FOR SAVINGS ACCOUNTS, A DEPOSIT SLIP):

PLEASE INDICATE ADDRESS TO WHICH YOU WOULD LIKE YOUR REMITTANCE ADVICES ROUTED WHEN PAYMENTS ARE PROCESSED:
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
Contact name: _________________________________________________
Telephone No.: _________________________________________________

FOR STATE USE ONLY:
CONTACT AGENCY – _____________________________
CONTACT PERSON – _____________________________
PHONE NUMBER – _____________________________

FA-0825 (Rev. 4/96)
CONTRACT BOND
standard form for construction contracts under the State Building Commission of Tennessee

BOND NO. ____________________

Know all men by these presents: that we

(hereinafter called the "Principal") and

(hereinafter called the "Surety") do hereby acknowledge ourselves indebted and securely bound and held unto

(hereinafter called the "Owner"), and in the penal sum of

good and lawful money of the United States of America, for the use and benefit of those entitled thereto, for the payment of which, well and truly to be made, we bind ourselves, our heirs, our administrators, executors, successors, and assigns, jointly and severally, firmly by these presents.

But the condition of the foregoing obligation or bond is this: Whereas, the Owner has engaged the principal for the sum of

to complete the Work of the project titled:

as more fully appears in a written agreement or contract bearing the date of

a copy of which said agreement or contract is by reference hereby made a part hereof, as fully and to the same extent as if copied at length herein, and it is the desire of the Owner that the Principal shall assure all undertakings under said agreement or contract and shall assure and protect all laborers and furnishers of material on said Work both as provided by Tennessee Code Annotated Sections 4-15-102(f)(2) and 12-4-201 through 12-4-206, and any and all amendments thereto, and shall assure the prompt payment of claims as provided by Tennessee Code Annotated Sections 12-4-207 through 12-4-208, and any and all amendments thereto. The Principal shall also comply with provisions of Tennessee Code Annotated Sections 12-4-401 through 12-4-415, and any and all amendments thereto, pertaining to the payment of the prevailing wage rate.
Now, therefore, if the Principal shall fully and faithfully perform all undertakings and obligations under the contract hereinebefore referred to and shall fully indemnify and hold harmless the Owner from all costs and damage whatsoever which it may suffer by reason of any failure on the part of the Principal to do so, and shall fully reimburse and repay the Owner any and all outlay and expense which it may incur in making good any such default, and shall fully pay for all of the labor, material and work used by the Principal and any immediate or remote sub-contractor or furnisher of material under him in the performance of said contract, in lawful money of the United States, as the same shall become due, then this obligation or bond shall be null and void, otherwise to remain in full force and effect.

And for value received, it is hereby stipulated and agreed that no change, extension of time, alteration or addition to the terms of the contract or to the Work to be performed thereunder or to the specifications accompanying the same shall in any wise affect the obligation under this bond, and notice is hereby waived of any such change, extension of time, alteration or addition to the terms of the contract or to the Work or to the specifications.

In witness whereof the Principal has hereunto affixed its signature and Surety has hereunto caused to be affixed its corporate signature and seal, by its duly authorized officers, on this ______ day of ______________, 20___.

Executed in ________ counterparts.

Witness:

_________________________      ____________________________
(name of Principal)            (name of Surety)

_________________________      ____________________________
(authorized signature)         (signature of Attorney-in-fact)

_________________________      ____________________________
(name of signatory)             (name of Attorney-in-fact)

_________________________      ____________________________
(title of signatory)            (Tennessee license number of Agent or Attorney-in-fact)

_________________________      ____________________________
(countersignature of resident Agent if not same as Attorney-in-fact)

Surety Company issuing bond shall be licensed to transact business in State of Tennessee by Tennessee Department of Commerce and Insurance. Bonds shall have certified and current Power-of-Attorney for the Surety's Attorney-in-Fact attached. Attorney-in-fact who executes bond on behalf of Surety shall be licensed by and a resident of State of Tennessee, and shall affix license number to bond; or, countersignature by a licensed agent who is a resident of State of Tennessee, and the agent's license number, shall be affixed to the bond in addition to the signature of the Attorney-in-Fact.
THREE YEAR ROOF BOND
standard form for construction contracts under the State Building Commission of Tennessee

BOND NO. __________________

GENERAL INFORMATION:
Principal: ________________________________________________________________
Surety (Name): ____________________________________________________________
(Address): ______________________________________________________________
Building Owner: __________________________________________________________
Project: ________________________________________________________________
Project Contract Date: ___________________________________________________

KNOW ALL MEN BY THESE PRESENTS:
That we, the Principal and the Surety, are held and firmly bound unto the Building Owner in the amount of

for the payment thereof in good and lawful money of the United States of America the Principal and the Surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

Whereas, Principal has, by written agreement referenced above, entered into a contract (hereinafter referred to as "the Contract" and hereby referenced herein) with the Owner for the construction of the Project identified above.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Principal shall fully indemnify the Owner for all loss that the Owner may suffer by reason of any defective material and/or workmanship in the materials furnished for and the installation of the above referenced Project roofing system which become apparent during the period of three (3) years from the date of Substantial Completion of the above referenced Project roofing system, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

Surety hereby agrees that no change, extension of time, alteration or addition to the terms of the contract or to the Work to be performed thereunder or to the specifications accompanying the same shall in any way affect the obligations under this bond, and notice is hereby waived of any such change, extension of time, alteration or addition to the terms of the contract or to the Work or to the specifications.
IN WITNESS WHEREOF the Principal has hereunto affixed its signature and Surety has hereunto caused to be affixed its corporate signature and seal, by its duly authorized officers, on this ____ day of ________, 20__.  
Executed in __________ counterparts.

Witness:

(name of Principal) .................................................................................................................

(authorized signature) .............................................................................................................

(name of signatory) ..................................................................................................................

(title of signatory) ......................................................................................................................

(name of Surety) .......................................................................................................................

(signature of Attorney-in-fact) ...................................................................................................

(name of Attorney-in-fact) ...........................................................................................................

(Tennessee license number of Agent or Attorney-in-fact) ............................................................

(countersignature of resident Agent if not same as Attorney-in-fact)

Surety Company issuing bond shall be licensed to transact business in State of Tennessee by Tennessee Department of Commerce and Insurance. Bonds shall have certified and current Power-of-Attorney for the Surety's Attorney-in-Fact attached. Attorney-in-fact who executes bond on behalf of Surety shall be licensed by and a resident of State of Tennessee, and shall affix license number to bond; or, countersignature by a licensed agent who is a resident of State of Tennessee, and the agent's license number, shall be affixed to the bond in addition to the signature of the Attorney-in-Fact.
General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

Section 00 72 13 of all General Work of the Owner as of June 2009

THE OWNER:
(Name, legal status and address)
Tennessee Board of Regents

THE ARCHITECT:
(Name, legal status and address)

DESIGNER:
The Designer as identified in the Agreement

TABLE OF ARTICLES

1 GENERAL PROVISIONS
2 OWNER
3 CONTRACTOR
4 ARCHITECT/DESIGNER
5 SUBCONTRACTORS
6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
7 CHANGES IN THE WORK
8 TIME
9 PAYMENTS AND COMPLETION
10 PROTECTION OF PERSONS AND PROPERTY
11 INSURANCE AND BONDS
12 UNCOVERING AND CORRECTION OF WORK
13 MISCELLANEOUS PROVISIONS
TERMINATION OR SUSPENSION OF THE CONTRACT

CLAIMS AND DISPUTES
INDEX
(Numbers and Topics in Bold are Section Headings)

Acceptance of Nonconforming Work
9.6.6, 9.9.3, 12.3
Acceptance of Work
9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, 12.3
Access to Work
3.16, 6.2.1, 12.1
Accident Prevention
10
Acts and Omissions
3.2, 3.3.2, 3.12.8, 3.18, 4.2.3, 8.3.1, 9.5.1, 10.2.5,
10.2.8, 13.4.2, 13.7.1, 14.1, 15.2
Addenda
1.1.1, 3.1.1
Additional Costs, Claims for
3.7.4, 3.7.5, 6.1.1, 7.3.7.5, 10.3, 15.1.4
Additional Inspections and Testing
9.4.2, 9.8.3, 12.2.1, 13.5
Additional Insured
11.1.4
Additional Time, Claims for
3.2.4, 3.7.4, 3.7.5, 3.10.2, 8.3.2, 15.1.5
Administration of the Contract
3.1.3, 4.2, 9.4, 9.5
Advertisement or Invitation to Bid
1.1.1
Aesthetic Effect
4.2.13
Allowances
3.8, 7.3.8
All-risk Insurance
11.3.1, 11.3.1.1
Applications for Payment
4.2.5, 7.3.9, 9.2, 9.3, 9.4, 9.5.1, 9.6.3, 9.7.1, 9.10,
11.1.3
Approvals
2.1.1, 2.2.2, 2.4, 3.1.3, 3.10.2, 3.12.8, 3.12.9, 3.12.10,
4.2.7, 9.3.2, 13.5.1
Arbitration
8.3.1, 11.3.10, 13.1.1, 15.3.2, 15.4
ARCHITECT-DESIGNER
4
Architect-Designer, Definition of
4.1.1
Architect-Designer, Extent of Authority
2.4.1, 3.12.7, 4.1, 4.2, 5.2, 6.3.1, 7.1.2, 7.3.7, 7.4,
9.2.1, 9.3.1, 9.4, 9.5, 9.6.3, 9.8, 9.10.1, 9.10.3, 12.1,
12.2.1, 13.5.1, 15.3.2, 14.2.2, 14.2.4, 15.1.3, 15.2.1
Architect-Designer, Limitations of Authority and
Responsibility
2.1.1, 3.12.4, 3.12.8, 3.12.10, 4.1.2, 4.2.1, 4.2.2, 4.2.3,
4.2.6, 4.2.7, 4.2.10, 4.2.12, 4.2.13, 5.2.1, 7.4.1, 9.4.2,
9.5.3, 9.6.4, 15.1.3, 15.2
Architect’s-Designer’s Additional Services and
Expenses
2.4.1, 11.3.1.1, 12.2.1, 13.5.2, 13.5.3, 14.2.4
Architect’s-Designer’s Administration of the Contract
3.1.3, 4.2, 3.7.4, 15.2, 9.4.1, 9.5
Architect’s-Designer’s Approvals
2.4.1, 3.1.3, 3.5.1, 3.10.2, 4.2.7
Architect’s-Designer’s Authority to Reject Work
3.1.5, 4.2.6, 12.1.2, 12.2.1
Architect’s-Designer’s Copyright
1.1.7, 1.5
Architect’s-Designer’s Decisions
3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 4.2.14, 6.3.1,
7.3.7, 7.3.9, 8.3.1, 9.2.1, 9.4.1, 9.5, 9.8.4, 9.9.1,
13.5.2, 15.2, 15.3
Architect’s-Designer’s Inspections
3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 13.5
Architect’s-Designer’s Instructions
3.2.4, 3.3.1, 4.2.6, 4.2.7, 13.5.2
Architect’s-Designer’s Interpretations
4.2.11, 4.2.12
Architect’s-Designer’s Project Representative
4.2.10
Architect’s-Designer’s Relationship with Contractor
1.1.2, 1.5, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5.1,
3.7.4, 3.7.5, 3.9.2, 3.9.3, 3.10, 3.11, 3.12, 3.16, 3.18,
4.1.2, 4.1.3, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5,
9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3.7, 12, 13.4.2, 13.5, 15.2
Architect’s-Designer’s Relationship with
Subcontractors
1.1.2, 4.2.3, 4.2.4, 4.2.6, 9.6.3, 9.6.4, 11.3.7
Architect’s-Designer’s Representations
9.4.2, 9.5.1, 9.10.1
Architect’s-Designer’s Site Visits
3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.5
Asbestos
10.3.1
Attorneys’ Fees
3.18.1, 9.10.2, 10.3.3
Award of Separate Contracts
6.1.1, 6.1.2
Award of Subcontracts and Other Contracts for
Portions of the Work
5.2
Basic Definitions
1.1
Bidding Requirements
1.1.1, 5.2.1, 11.4.1
Binding Dispute Resolution
9.7.1, 11.3.9, 11.3.10, 13.1.1, 15.2.5, 15.2.6.1, 15.3.1,
15.3.2, 15.4.1
Boiler and Machinery Insurance
11.3.2
Bonds, Lien
7.3.7.4, 9.10.2, 9.10.3


Init. User Notes: Jan 03 O3 07 72 13

(17)7065783)
Bonds, Performance, and Payment
7.3.7.4, 9.6.7, 9.10.3, 11.3.9, 11.4

Building Permit
3.7.1

Capitalization
1.3

Certificate of Substantial Completion
9.8.3, 9.8.4, 9.8.5

Certificates for Payment
4.2.1, 4.2.5, 4.2.9, 9.3.3, 9.4, 9.5, 9.6.1, 9.6.6, 9.7.1,
9.10.1, 9.10.3, 14.1.1.3, 14.2.4, 15.1.3

Certificates of Inspection, Testing or Approval
13.5.4

Certificates of Insurance
9.10.2, 11.1.3

Change Orders
1.1.1, 2.4.1, 3.4.2, 3.7.4, 3.8.2.3, 3.11.1, 3.12.8, 4.2.8,
5.2.3, 7.1.2, 7.1.3, 7.2, 7.3.2, 7.3.6, 7.3.9, 7.3.10, 8.3.1,
9.3.1.1, 9.10.3, 10.3.2, 11.3.1.2, 11.3.4, 11.3.9, 12.1.2,
15.1.3

Change Orders, Definition of
7.2.1

CHANGES IN THE WORK
2.2.1, 3.11, 4.2.8, 7, 7.2.1, 7.3.1, 7.4, 7.4.1, 8.3.1,
9.3.1.1, 11.3.9

Claims, Definition of
15.1.1

CLAIMS AND DISPUTES
3.2.4, 6.1.1, 6.3.1, 7.3.9, 9.3.3, 9.10.4, 10.3.3, 15, 15.4

Claims and Timely Assertion of Claims
15.4.1

Claims for Additional Cost
3.2.4, 3.7.4, 6.1.1, 7.3.9, 10.3.2, 15.1.4

Claims for Additional Time
3.2.4, 3.7.4.6.1.1, 8.3.2, 10.3.2, 15.1.5

Concealed or Unknown Conditions, Claims for
3.7.4

Claims for Damages
3.2.4, 3.18, 6.1.1, 8.3.3, 9.5.1, 9.6.7, 10.3.3, 11.1.1,
11.3.5, 11.3.7, 14.1.3, 14.2.4, 15.1.6

Claims Subject to Arbitration
15.3.1, 15.4.1

Cleaning Up
3.15, 6.3

Commencement of the Work, Conditions Relating to
2.2.1, 3.2.2, 3.4.1, 3.7.1, 3.10.1, 3.12.6, 5.2.1, 5.2.3,
6.2.2, 8.1.2, 8.2.2, 8.3.1, 11.1, 11.3.1, 11.3.6, 11.4.1,
15.1.4

Commencement of the Work, Definition of
8.1.2

Communications Facilitating Contract
3.9.1, 4.2.4

Administration

Completion, Conditions Relating to
3.4.1, 3.11, 3.15, 4.2.2, 4.2.9, 8.2, 9.4.2, 9.8, 9.9.1,
9.10, 12.2, 13.7, 14.1.2

COMPLETION, PAYMENTS AND
9

Completion, Substantial
4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3, 12.2,
13.7

Compliance with Laws
1.6.1, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 4.1.1, 9.6.4, 10.2.2,
11.1, 11.3, 13.1, 13.4, 13.5.1, 13.5.2, 13.6, 14.1.1,
14.2.1.3, 15.2.8, 15.4.2, 15.4.3

Concealed or Unknown Conditions
3.7.4, 4.2.8, 8.3.1, 10.3

Conditions of the Contract
1.1.1, 6.1.1, 6.1.4

Consent, Written
3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.8.5, 9.9.1,
9.10.2, 9.10.3, 11.3.1, 13.2, 13.4.2, 15.4.4.2

Consolidation or Joiner
15.4.4

CONSTRUCTION BY OWNER OR BY
SEPARATE CONTRACTORS
1.1.4, 6

Construction Change Directive, Definition of
7.3.1

Construction Change Directives
1.1.1, 3.4.2, 3.12.8, 4.2.8, 7.1.1, 7.1.2, 7.1.3, 7.3,
9.3.1.1

Construction Schedules, Contractor's
3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.5.2

Contingent Assignment of Subcontracts
5.4, 14.2.2.2

Continuing Contract Performance
15.1.3

Contract, Definition of
1.1.2

CONTRACT, TERMINATION OR
SUSPENSION OF THE
5.4.1.1, 11.3.9, 14

Contract Administration
3.1.3, 4, 9.4, 9.5

Contract Award and Execution, Conditions Relating to
3.7.1, 3.10, 5.2, 6.1, 11.1.3, 11.3.6, 11.4.1

Contract Documents, The
1.1.1

Contract Documents, Copies Furnished and Use of
1.5.2, 2.2.5, 5.3

Contract Documents, Definition of
1.1.1

Contract Sum
3.7.4, 3.8, 5.2.3, 7.2, 7.3, 7.4, 9.1, 9.4.2, 9.5.1.4, 9.6.7,
9.7, 10.3.2, 11.3.1, 14.2.4, 14.3.2, 15.1.4, 15.2.5

Contract Sum, Definition of
9.1

Contract Time
3.7.4, 3.7.5, 3.10.2, 5.2.3, 7.2.13, 7.3.1, 7.3.5, 7.4,
8.1.1, 8.2.1, 8.3.1, 9.5.1, 9.7.1, 10.3.2, 12.1.1, 14.3.2,
15.1.5.1, 15.2.5
Contract Time, Definition of
8.1.1

CONTRACTOR
3
Contractor, Definition of
3.1, 6.1.2

Contractor’s Construction Schedules
3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.5.2

Contractor’s Employees
3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3, 11.1.1, 11.3.7, 14.1, 14.2.1.1,

Contractor’s Liability Insurance
11.1

Contractor’s Relationship with Separate Contractors and Owner’s Forces
3.12.5, 3.14.2, 4.2.4, 6, 11.3.7, 12.1.2, 12.2.4

Contractor’s Relationship with Subcontractors
1.2.2, 3.3.2, 3.18.2, 3.18.1, 5, 9.6.2, 9.6.7, 9.10.2, 11.3.1.2, 11.3.7, 11.3.8

Contractor’s Relationship with the Architect/Designer
1.2, 1.5, 3.3.6, 3.3.8, 3.2.2, 3.2.3, 3.3.9, 3.3.1, 3.3.4, 3.5.1, 3.7.4, 3.10, 3.11, 3.12, 3.16, 3.18, 4.1.3, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3.7, 12, 13.5, 15.1.2, 15.2.1

Contractor’s Representations
3.2.1, 3.2.2, 3.5.1, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.8.2

Contractor’s Responsibility for Those Performing the Work
3.3.2, 3.18, 5.3.1, 6.1.3, 6.2, 9.5.1, 10.2.8

Contractor’s Review of Contract Documents
3.2

Contractor’s Right to Stop the Work
9.7

Contractor’s Right to Terminate the Contract
14.1, 15.1.6

Contractor’s Submittals

Contractor’s Superintendent
3.9, 10.2.6

Contractor’s Supervision and Construction Procedures
1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.5, 7.3.7, 8.2, 10, 12, 14, 15.1.3

Contractual Liability Insurance
11.1.1.8, 11.2

Coordination and Correlation
1.2, 3.2.1, 3.3.1, 3.10, 3.12.6, 6.1.3, 6.2.1

Copies Furnished of Drawings and Specifications
1.5, 2.2.5, 3.11

Copyrights
1.5, 3.17

Correction of Work
2.3, 2.4, 3.7.3, 9.4.2, 9.8.2, 9.8.3, 9.9.1, 12.1.2, 12.2

Correlation and Intent of the Contract Documents
1.2

Cost, Definition of
7.3.7

Costs
2.4.1, 3.2.4, 3.7.3, 3.8.2, 3.15.2, 5.4.2, 6.1.1, 6.2.3, 7.3.3, 7.3.7, 7.3.8, 7.3.9, 9.10.2, 10.3.2, 10.3.6, 11.3, 12.1.2, 12.2.1, 12.2.4, 13.5, 14

Cutting and Patching
3.14, 6.2.5

Damage to Construction of Owner or Separate Contractors
3.14.2, 6.2.4, 10.2.1.2, 10.2.5, 10.4, 11.1.1, 11.3, 12.2.4

Damage to the Work
3.14.2, 9.9.1, 10.2.1.2, 10.2.5, 10.4.1, 11.3.1, 12.2.4

Damages, Claims for
3.2.4, 3.18, 6.1.1, 8.3.3, 9.5.1, 9.6.7, 10.3.3, 11.1.1, 11.3.5, 11.3.7, 14.1.2, 14.2.4, 15.1.6

Damages for Delay
6.1.1, 8.3.3, 9.5.1.6, 9.7, 10.3.2

Date of Commencement of the Work, Definition of
8.1.2

Date of Substantial Completion, Definition of
8.1.3

Day, Definition of
8.1.4

Decisions of the Architect/Designer
3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 15.2, 6.3, 7.3.7, 7.3.9, 8.1.3, 8.3.1, 9.2.1, 9.4, 9.5.1, 9.8.4, 9.9.1, 13.5.2, 14.2.2, 14.2.4, 15.1, 15.2

Decisions to Withhold Certification
9.4.1, 9.5, 9.7, 14.1.1.3

Defective or Nonconforming Work, Acceptance, Rejection and Correction of
2.3.1, 2.4.1, 3.5.1, 4.2.6, 6.2.5, 9.5.1, 9.5.2, 9.6.6, 9.8.2, 9.9.3, 9.10.4, 12.2.1

Defective Work, Definition of
3.5.1

Definitions
1.1, 2.1.1, 3.1.1, 3.5.1, 3.12.1, 3.12.2, 3.12.3, 4.1.1, 15.1.1, 5.1, 6.1.2, 7.2.1, 7.3.1, 8.1, 9.1, 9.8.1

Delays and Extensions of Time
3.2, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4.1, 8.3, 9.5.1, 9.7.1, 10.3.2, 10.4.1, 14.3.2, 15.1.5, 15.2.5

Disputes
6.3.1, 7.3.9, 15.1, 15.2

Documents and Samples at the Site
3.11

Drawings, Definition of
3.1.5

Drawings and Specifications, Use and Ownership of
3.11

Effective Date of Insurance
8.2.2, 11.1.2

Emergencies
10.4, 14.1.1.2, 15.1.4
Employees, Contractor’s 3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3.3, 11.1.1, 11.3.7, 14.1, 14.2.1.1
Equipment, Labor, Materials or 1.1.3, 1.1.6, 3.4, 3.5.1, 3.8.2, 3.8.3, 3.12, 3.13.1, 3.15.1, 4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.7, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2
Execution and Progress of the Work 1.1.3, 1.2.1, 1.2.2, 2.2.2, 2.2.5, 3.1, 3.3.1, 3.4.1, 3.5.1, 3.7.1, 3.10.1, 3.12, 3.14, 4.2, 6.2.2, 7.1.3, 7.3.5, 8.2, 9.5.1, 9.9.1, 10.2, 10.3, 12.2, 14.2, 14.3.1, 15.1.3
Extensions of Time 3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3, 7.4.1, 9.5.1, 9.7.1, 10.3.2, 10.4.1, 14.3, 15.1.5, 15.2.5
Failure of Payment 9.5.1.3, 9.7, 9.10.2, 13.6, 14.1.1.3, 14.2.1.2
Faulty Work (See Defective or Nonconforming Work)
Final Completion and Final Payment 4.2.1, 4.2.9, 9.8.3, 9.10, 11.1.2, 11.1.3, 11.3.1, 11.3.5, 12.3.1, 14.2.4, 14.4.3
Financial Arrangements, Owner’s 2.2.1, 13.2.2, 14.1.1.4
Fire and Extended Coverage Insurance 11.3.1.1
GENERAL PROVISIONS 1
Governing Law 13.1
Guarantees (See Warranty)
Hazardous Materials 10.2.4, 10.3
Identification of Subcontractors and Suppliers 5.2.1
Indemnification 3.1.7.1, 3.18.9, 9.10.2, 10.3.3, 10.3.5, 10.3.6, 11.3.1.2, 11.3.7
Initial Decision 15.2
Initial Decision Maker, Definition of 1.1.8
Initial Decision Maker, Decisions 14.2.2, 14.2.4, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5
Initial Decision Maker, Extent of Authority 14.2.2, 14.2.4, 15.1.3, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5
Injury or Damage to Person or Property 10.2.8, 10.4.1
Inspections 3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 4.9.2, 9.8.3, 9.9.2, 9.10.1, 12.2.1, 13.5
Instructions to Bidders 1.1.1
Instructions to the Contractor 3.2.4, 3.3.1, 3.8.1, 5.2.1, 7, 8.2.2, 12, 13.5.2
Instruments of Service, Definition of 1.1.7
Insurance 3.18.1, 6.1.1, 7.3.7, 9.3.2, 9.8.4, 9.9.1, 9.10.2, 11
Insurance, Boiler and Machinery 11.3.2
Insurance, Contractor’s Liability 11.1
Insurance, Effective Date of 8.2.2, 11.1.2
Insurance, Loss of Use 11.3.3
Insurance, Owner’s Liability 11.2
Insurance, Property 10.2.5, 11.3
Insurance, Stored Materials 9.3.2, 11.4.1.4
INsurance AND BONDS 11
Insurance Companies, Consent to Partial Occupancy 9.9.1, 11.4.1.5
Insurance Companies, Settlement with 11.4.10
Intent of the Contract Documents 1.2.1, 4.2.7, 4.2.12, 4.2.13, 7.4
Interest 13.6
Interpretation 1.2.3, 1.4, 4.1.1, 5.1, 6.1.2, 15.1.1
Interpretations, Written 4.2.11, 4.2.12, 15.1.4
Judgment on Final Award 15.4.2
Labor Disputes 8.3.1
 Laws and Regulations 1.5, 3.2.3, 3.6, 3.7, 3.12.10, 3.13.1, 4.1.1, 9.6.4, 9.9.1, 10.2.2, 11.1.1, 11.3, 13.1.1, 13.4, 13.5.1, 13.5.2, 13.6.1, 14, 15.2.8, 15.4
Licenses 2.1.2, 9.3.3, 9.10.2, 9.10.4, 15.2.8
Limitations, Statutes of 12.2.5, 13.7, 15.4.1.1
Limitations of Liability 2.3.1, 3.2.2, 3.5.1, 3.12.10, 3.17.1, 3.18.1, 4.2.6, 4.2.7, 4.2.12, 6.2.2, 9.4.2, 9.6.4, 9.6.7, 10.2.5, 10.3.3, 11.1.2, 11.2, 11.3.7, 12.2.5, 13.4.2
Limitations of Time 2.1.2, 2.2, 2.4, 3.2.2, 3.10, 3.11, 3.12.3, 3.15.1, 4.2.7, 5.2, 5.3.1, 5.4.1, 6.2.4, 7.3, 7.4, 8.2, 9.2.1, 9.3.1, 9.3.3,
Loss of Use Insurance
11.3.3
Material Suppliers
1.5, 3.12.1, 4.2.4, 4.2.6, 5.2.1, 9.3, 9.4.2, 9.6, 9.10.5
Materials, Hazardous
10.2.4, 10.3
Materials, Labor, Equipment and
1.1.3, 1.1.6, 1.5.1, 3.4.1, 3.5.1, 3.8.2, 3.8.3, 3.12,
3.13.1, 3.15.1, 4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.7, 9.3.2,
9.3.3, 9.5.1.3, 9.10.2, 10.2.1.2, 10.2.4, 14.2.1.1,
14.2.1.2
Means, Methods, Techniques, Sequences and
Procedures of Construction
3.3.1, 3.12.10, 4.2.2, 4.2.7, 9.4.2
Mechanic’s Lien
2.1.2, 15.2.8
Mediation
8.3.1, 10.3.5, 10.3.6, 15.2.1, 15.2.5, 15.2.6, 15.3,
15.4.1
Minor Changes in the Work
1.1.1, 3.12.8, 4.2.8, 7.1, 7.4
MISCELLANEOUS PROVISIONS
13
Modifications, Definition of
1.1.1
Modifications to the Contract
1.1.1, 1.1.2, 3.11, 4.1.2, 4.2.1, 5.2.3, 7, 8.3.1, 9.7.1,
10.3.2, 11.3.1
Mutual Responsibility
6.2
Nonconforming Work, Acceptance of
9.6.6, 9.9.3, 12.3
Nonconforming Work, Rejection and Correction of
2.3.1, 2.4.1, 3.5.1, 4.2.6, 6.2.4, 9.5.1, 9.8.2, 9.9.3,
9.10.4, 12.2.1
Notice
2.2.1, 2.3.1, 2.4.1, 3.2.4, 3.3.1, 3.7.2, 3.12.9, 5.2.1,
9.7.1, 9.10.2, 10.2.2, 11.1.2, 11.4.6, 12.2.2.1, 13.3,
13.5.1, 13.5.2, 14.1, 14.2, 15.2.8, 15.4.1
Notice, Written
2.3.1, 2.4.1, 3.3.1, 3.9.2, 3.12.9, 3.12.10, 5.2.1, 9.7.1,
9.10, 10.2.2, 10.3, 11.1.3, 11.3.6, 12.2.2.1, 13.3, 14,
15.2.8, 15.4.1
Notice of Claims
3.7.4, 4.5, 10.2.8, 15.1, 15.4
Notice of Testing and Inspections
13.5.1, 13.5.2
Observations, Contractor’s
3.2, 3.7.4
Occupancy
2.2.2, 9.6.6, 9.8, 11.3.1.5
Orders, Written
1.1.1, 2.3, 3.9.2, 7, 8.2.2, 11.3.9, 12.1, 12.2.2.1, 13.5.2,
14.3.1
OWNER
2
Owner, Definition of
2.1.1
Owner, Information and Services Required of the
2.1.2, 2.2, 3.2.2, 3.12.10, 6.1.3, 6.1.4, 6.2.5, 9.3.2,
9.6.1, 9.6.4, 9.9.2, 9.10.3, 10.3.3, 11.2, 11.3, 13.5.1,
13.5.2, 14.1.1.4, 14.1.4.1, 15.1.3
Owner’s Authority
1.5, 2.1.1, 2.3.1, 4.1.2, 4.3.1, 4.2.4, 4.2.9, 5.2.1, 5.2.4,
5.4.1, 6.1, 6.3.1, 7.2.1, 7.3.1, 8.2.2, 8.3.1, 9.3.1, 9.3.2,
9.5.1, 9.5.2, 10.2.2, 10.2.3, 11.1.3, 11.3.3, 11.3.10, 12.2.2,
12.3.1, 13.2.2, 14.3, 14.4, 15.2.7
Owner’s Financial Capability
2.2.1, 13.2.2, 15.2.1.4
Owner’s Liability Insurance
11.2
Owner’s Loss of Use Insurance
11.3.3
Owner’s Relationship with Subcontractors
1.1.2, 3.2, 5.3, 5.4, 9.6.4, 9.10.2, 14.2.2
Owner’s Right to Carry Out the Work
2.4, 14.2.2
Owner’s Right to Clean Up
6.3
Owner’s Right to Perform Construction and to
Award Separate Contracts
6.1
Owner’s Right to Stop the Work
2.3
Owner’s Right to Suspend the Work
14.3
Owner’s Right to Terminate the Contract
14.2
Ownership and Use of Drawings, Specifications
and Other Instruments of Service
1.1.1, 1.1.6, 1.1.7, 1.5, 2.2.5, 3.2.2, 3.11.1, 3.17.1,
4.2.12, 5.3.1
Partial Occupancy or Use
9.6.6, 9.9, 11.3.1.5
Patch, Chewing and
3.14, 6.2.5
Patents
3.17
Payment, Applications for
4.2.5, 7.3.9, 9.2.1, 9.3, 9.4, 9.5, 9.5.3, 9.7.1, 9.8.5,
9.10.1, 14.2.3, 14.2.4, 14.4.3
Payment, Certificates for
4.2.5, 4.2.9, 9.3.3, 9.4, 9.5, 9.6.1, 9.6.6, 9.7.1, 9.10.1,
9.10.3, 13.7, 14.1.1.3, 14.2.4
Payment, Failure of
9.5.1.3, 9.7, 9.10.2, 13.6, 14.1.1.3, 14.2.1.2
Payment, Final
4.2.1, 4.2.9, 9.8.2, 9.10, 11.1.2, 11.1.3, 11.4.1, 11.4.5,
12.3.1, 13.7, 14.2.4, 14.4.3

AIA Document A301**-2007. Copyright © 2011, 1915, '916, '925, '927, '951, '954, '961, '981, '982, 1986, 1970, 1976, 1987, 1927 and 2007 by The American Institute of Architects. All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law. This document was produced by AIA software at 11:18:39 on 07/06/2009 under Order No. 1235487850_1 which expires on 08/29/2010, and is not for resale.

User Notes: Jun 60 SPD 09 72 13

(7171020763)
Payment Bond, Performance Bond and Payments, Progress
7.3, 7.4, 9.6.7, 9.10.3, 11.4.9, 11.4
PAYMENTS AND COMPLETION
9
Payments to Subcontractors
5.4.2, 9.5.1.3, 9.6.7, 9.6.3, 9.6.4, 9.6.7, 11.4.8, 14.2, 1.2
PCB
10.3.1
Performance Bond and Payment Bond
7.3.7.4, 9.6.7, 9.10.3, 11.4.9, 11.4
Permits, Fees, Notices and Compliance with Laws
2.2.2, 3.7, 3.13, 7.3.7.4, 10.2.2
PERSONS AND PROPERTY, PROTECTION OF
10
Polychlorinated Biphenyl
10.3.1
Product Data, Definition of
3.12.2
Product Data and Samples, Shop Drawings
3.11, 3.12, 4.2.7
Progress and Completion
4.2.2, 8.2, 9.8, 9.9.1, 14.1.4, 15.1.3
Progress Payments
9.3, 9.6, 9.8.5, 9.10.3, 13.6, 14.2, 15.1.3
Project, Definition of the
1.4.4
Project Representatives
4.2.10
Property Insurance
10.2.5, 11.3
PROTECTION OF PERSONS AND PROPERTY
10
Regulations and Laws
1.5, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 4.1.1, 9.6.4, 9.9.1, 10.2.2, 11.1, 11.4, 13.1, 13.4, 13.5.1, 13.5.2, 13.6, 14, 15.2.8, 15.4
Rejection of Work
3.5.1, 4.2.6, 12.2.1
Releases and Waivers of Liens
9.10.2
Representations
3.2.1, 3.5.1, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.4.2, 9.5.1, 9.8.2, 9.10.1
Representatives
2.1.1, 3.1.1, 3.9, 4.1.1, 4.2.1, 4.2.2, 4.2.10, 5.1.1, 5.1.2, 13.2.1
Responsibility for Those Performing the Work
3.3.2, 3.18, 4.2.3, 5.3.1, 6.1.3, 6.2, 6.3, 9.5.1, 10
Retainage
9.3.1, 9.6.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3
Review of Contract Documents and Field Conditions by Contractor
3.2, 3.12.7, 6.1.3
Review of Contractor's Submittals by Owner and Architect/Engineer
3.10.1, 3.10.2, 3.11, 3.12, 4.2, 5.2, 6.1.3, 9.2, 9.8.2
Review of Shop Drawings, Product Data and Samples by Contractor
3.12
Rights and Remedies
1.1.2, 2.3, 2.4, 3.5.1, 3.7.4, 3.15.2, 4.2.6, 4.5, 5.3.5, 5.4, 6.1, 6.3, 7.3.1, 8.3, 9.5.1, 9.7, 10.2.5, 10.3, 12.2.2, 12.2.4, 13.4, 14, 15.4
Royalties, Patents and Copyrights
3.17
Rules and Notices for Arbitration
15.4.1
Safety of Persons and Property
10.2, 10.4
Safety Precautions and Programs
3.3.1, 4.2.2, 4.2.7, 5.3.1, 10.1, 10.2, 10.4
Samples, Definition of
3.12.3
Samples, Shop Drawings, Product Data and
3.11, 3.12, 4.2.7
Samples at the Site, Documents and
3.11
Schedule of Values
9.2, 9.3.1
Schedules, Construction
3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.5.2
Separate Contracts and Contractors
1.1.4, 3.12.5, 3.14.2, 4.2.4, 4.2.7, 6, 8.3.1, 11.4.7, 12.1.2
Shop Drawings, Definition of
3.12.1
Shop Drawings, Product Data and Samples
3.11, 3.12, 4.2.7
Site, Use of
3.13, 6.1.1, 6.2.1
Site Inspections
3.2.2, 3.3.3, 3.7.1, 3.7.4, 4.2, 9.4.2, 9.10.1, 13.5
Site Visits, Architect’s/Engineers
3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.5
Special Inspections and Testing
4.2.6, 12.2.1, 13.5
Specifications, Definition of
1.1.6
Specifications, The
1.1.1, 1.1.6, 1.2.2, 1.5, 3.11, 3.12.10, 3.17, 4.2.14
Statute of Limitations
13.7, 15.4.1
Stopping the Work
2.3, 9.7, 10.3, 14.1
Storage Materials
6.2.1, 9.3.2, 10.2.1.2, 10.2.4, 11.4.1.4
Subcontractor, Definition of
5.1.1
SUBCONTRACTORS
5


User Notes: Jun 09 CF0 03 72 13

(1717065783)
Subcontractors, Work by
1.2.2, 3.3, 3.12.1, 4.2.3, 5.2.3, 5.3, 5.4, 9.3.1.2, 9.6.7
Subcontractual Relations
5.3, 5.4, 9.3.1.2, 9.6, 9.10, 10.2.1, 11.4.7, 11.4.8, 14.1, 14.2.1
Submittals
3.1, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 7.3.7, 9.2, 9.3, 9.8, 9.9.1, 9.10.2, 9.10.3, 11.1.3
Submittal Schedule
3.10.2, 3.12.5, 4.2.7
Subrogation, Waivers of
6.1.1, 11.4.5, 11.3.7
Substantial Completion
4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3, 12.2, 13.7
Substantial Completion, Definition of
9.8.1
Substitution of Subcontractors
5.2.3, 5.2.4
Substitution of Architect/Designer
4.1.3
Substitutions of Materials
3.4.2, 3.5.1, 7.3.8
Sub-subcontractor, Definition of
5.1.2
Subsurface Conditions
3.7.4
Successors and Assigns
13.2
Superintendent
3.9, 10.2.6
Supervision and Construction Procedures
1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.7, 8.2, 8.3.1, 9.4.2, 10, 12, 14, 15.1.3
Surety
5.4.1.2, 9.8.5, 9.10.2, 9.10.3, 14.2.2, 15.2.7
Surety, Consent of
9.10.2, 9.10.3
Surveys
2.2.3
Suspension by the Owner for Convenience
14.3
Suspension of the Work
5.4.2.1, 14.3
Suspension or Termination of the Contract
5.4.1.1, 11.4.9, 14
Taxes
3.6, 3.8.2.1, 7.3.7.4
Termination by the Contractor
14.1, 15.1.6
Termination by the Owner for Cause
5.4.1.1, 14.2.1, 15.1.6
Termination by the Owner for Convenience
14.4
Termination of the Architect/Designer
4.1.3
Termination of the Contractor
14.2.2
TERMINATION OR SUSPENSION OF THE CONTRACT
14
Tests and Inspections
3.1.3, 3.3, 4.2.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 10.3.2.1, 11.4.1.1, 12.2.1, 13.5
TIME
8
Time, Delays and Extensions of
3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4.1, 8.3, 9.5.1, 9.7.1, 10.3.2, 10.4.1, 14.3.2, 15.1.5, 15.2.5
Time Limits
2.1.2, 2.2, 2.4, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2, 4.4, 4.5, 5.2, 5.3, 5.4, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3, 9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 9.11.3, 9.11.4.1.5, 9.11.4.6, 9.11.4.10, 12.2, 13.5, 13.7, 14, 15.1.2, 15.4
Time Limits on Claims
3.7.4, 10.2.8, 13.7, 15.1.2
Title to Work
9.3.2, 9.3.3
Transmission of Data in Digital Form
1.6
UNCOVERING AND CORRECTION OF WORK
12
Uncovering of Work
12.1
Unforeseen Conditions, Concelled or Unknown
3.7.4, 8.3.1, 10.3
Unit Prices
7.3.3.2, 7.3.4
Use of Documents
1.1.1, 1.5, 2.2.5, 3.12.6, 5.3
Use of Site
3.13, 6.1.1, 6.2.1
Values, Schedule of
9.2, 9.3.1
Waiver of Claims by the Architect/Designer
13.4.2
Waiver of Claims by the Contractor
9.10.5, 11.4.7, 13.4.2, 15.1.6
Waiver of Claims by the Owner
9.9.3, 9.10.3, 9.10.4, 11.4.3, 11.4.5, 11.4.7, 12.2.2.1, 13.4.2, 14.2.4, 15.1.6
Waiver of Consequential Damages
14.2.4, 15.1.6
Waiver of Liens
9.10.2, 9.10.4
Waivers of Subrogation
6.1.1, 11.4.5, 11.3.7
Warranty
3.5, 4.2.9, 9.3.3, 9.8.4, 9.9.1, 9.10.4, 12.2.2, 13.7.1
Weather Delays
15.1.5.2
Work: Definition of
1.1.3 Written Consent
1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.8.5,
9.9.1, 9.10.2, 9.10.3, 11.4.1, 13.2, 13.4.2, 15.4.4.2
Written Interpretations
4.2.11, 4.2.12
Written Notice
2.3, 2.4, 3.3.1, 3.9, 3.12.9, 3.12.10, 5.2.1, 8.2.2, 9.7,
9.10, 10.2.2, 10.3, 11.1.3, 11.4.6, 12.2.2, 12.2.4, 13.3,
14, 15.4.1
Written Orders
1.1.1, 2.3, 3.9, 7, 8.2.2, 11.4.9, 12.1, 12.2, 13.5.2,
14.3.1, 15.1.2
ARTICLE 1 GENERAL PROVISIONS

§ 1.1.1 BASIC DEFINITIONS

§ 1.1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect-Designer. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor’s bid or proposal, or portions of Addenda relating to bidding requirements.

§ 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect-Designer or the Architect-Designer’s consultants, (2) between the Owner and a Subcontractor, (3) between the Owner and the Architect-Designer or the Architect-Designer’s consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect-Designer shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect-Designer’s duties.

§ 1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor’s obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

§ 1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

§ 1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 INSTRUMENTS OF SERVICE

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect-Designer and the Architect-Designer’s consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 INITIAL DECISION MAKER

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2-Designer.

§ 1.1.9 PROJECT MANUAL

The Project Manual is a volume or set that may include portions of the Contract Documents and other documents.

§ 1.1.10 PROVIDE OR PROVIDED

"Provide" or "Provided" as used in Contract Documents includes furnishing and installing a thing, product, system or the like.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all, performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably foreseeable from them as being necessary to produce the indicated results.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.2.4 Within the Specifications, the sections of Division One (01) are General Requirements, and apply to all sections of the Specifications.

§ 1.3 CAPITALIZATION

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 INTERPRETATION

In the interest of brevity, the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

§ 1.5.1 The Architect-Designer and the Architect's Designers' consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, except the design and the Contract Documents, and will retain all common law, statutory and other reserved rights, including copyrights. The Design and the Contract Documents are property of the State of Tennessee, and may be used only for the benefit of the State and on authority of the State Building Commission (SBC). The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own nor claim a copyright in the Instruments of Service. The design, or the Contract Documents, submitted or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service, the design, or the Contract Documents provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service, the design, or the Contract Documents, on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants. Owner with respect to the design and the Contract Documents, and the Designer and the Designer's consultants with respect to the Instruments of Service other than the design and the Contract Documents.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they—Contractor intends to transmit Instruments of Service in digital form, it shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

ARTICLE 2 OWNER

§ 2.1 GENERAL

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization.
Except as otherwise provided in Section 4.2.1, the Architect-Designer does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative, in accordance with SBC Policy.

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic’s lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner’s interest therein. Public construction projects are not subject to mechanic’s liens in Tennessee. The remedy afforded to laborers and furnishers of material or State projects is referenced in Section 15.2.8.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner’s obligations under the Contract. Therefore, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner’s ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the portion of the Work affected by the material change. After the Owner furnishes the evidence, the Owner shall not materially vary any such financial arrangements without prior notice to the Contractor. The SBC project number constitutes verification that funding has been established as a matter of public record.

§ 2.2.2 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner’s control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 15.2. The Contractor will be furnished, free of charge, such copies of Contract Documents as are reasonably necessary for execution of the Work.

§ 2.3 OWNER’S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2, or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, if the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.4 OWNER’S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within ten days after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued directing payments to the Contractor in the amount of labor and materials incurred in making such correction, and may include the Architect’s reasonable cost of correcting such deficiencies, including Owner’s expenses and compensation for the Architect’s additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect.
payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

§ 2.4.1 If Contractor defaults or neglects to carry out the Work in accordance with Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies.

§ 2.4.2 If the Contractor fails to complete the Work in accordance with the time limit stipulated in the Certificate of Substantial Completion, then Owner may take over the completion of Work without advance notice to Contractor and without prejudice to any other remedy that Owner may have.

§ 2.4.3 In such cases as described in Sections 2.4.1 and 2.4.2, an appropriate modification will be issued deducting from the Contract Sum the reasonable cost of correcting such deficiencies or completing such Work, regardless of whether Owner actually undertakes completing such Work, in which case the deduction shall be based on the Designer’s estimate in accordance with Section 7.3.6, including Owner’s expenses and compensation for the Designer’s additional services made necessary by such default, neglect, or failure. Such action by the Owner and amounts charged to Contractor are both subject to prior approval of the Owner. If the unpaid balance of the Contract Sum is not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

§ 2.4.4 In the case of a Contract Sum based upon a Guaranteed Maximum Price that includes a GMP Contingency, the unused GMP Contingency shall not be included in the calculation required by Section 2.4.3 of unpaid balance of the Contract Sum, and the reduction in the Contract Sum shall not be applied to the GMP Contingency.

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor’s term "Contractor" means the Contractor or the Contractor’s authorized representative. When the Agreement is a Construction Services Agreement between the Owner and a Construction Manager / General Contractor, the term "Contractor" means Construction Manager / General Contractor or its authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect-Designer or the Architect-Designer’s administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.1.4 At the time of bid and award, Contractor shall not be currently disqualified from participating in State construction projects under the supervision of the SBC. Such disqualification extends to succeeding or related corporations, partnerships, joint ventures, and other business organizations having substantial factual or legal connections, continuity, or identity with those that have been disqualified.

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor...
shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor shall be promptly reported by the Contractor to the Designer as a request for information in such form as the Architect-Designer may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents. Contractor shall not perform construction activity when Contractor knows, or should know in exercise of reasonable diligence, that the activity involves error, inconsistency, or omission in Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor shall be promptly reported by the Contractor to the Designer as a request for information in such form as the Architect-Designer may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect-Designer issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, with reasonable diligence, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations with reasonable diligence. If the Contractor performs those obligations, obligations with reasonable diligence, the Contractor shall not be liable to the Owner or Architect-Designer for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES
§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. The Contractor shall determine that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice and a proposal of corrective changes to the Owner and Architect-Designer and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner required means, methods, techniques, sequences or procedures. The Contractor that are accepted by the Contractor.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 LABOR AND MATERIALS
§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. Contractor shall receive neither material, equipment, labor, nor services from one who submitted a competing general bid for the same Contract and subsequently withdrew, retracted, or otherwise failed to enter into the contract.

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Architect-Designer in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect-Designer and in accordance with a Change Order or Construction Change Directive. 

[Signature]
materials, equipment, and systems are essential elements of the Contract. If Contractor desires to use another material, equipment, or system in lieu thereof, Contractor shall request approval in writing and shall submit samples and data, including an estimate of difference in cost, as required for Designer's consideration. Designer and Owner will be final judge of acceptability of substitution. No substitution shall be made without authority in writing from Designer. Not later than 21 days after award of contract, Contractor shall provide a list showing names of manufacturers proposed for each specified product, and applicable name of installer, whether Contractor or subcontractor. Designer will within 14 days reply to Contractor stating whether Owner or Designer, after due investigation, has reasonable objection to any such manufacturer or installer. If adequate data on proposed manufacturer or installer is not available, Designer may state that action will be deferred until Contractor provides further data. Contractor shall not make use of a manufacturer, or installer to which Owner or Designer has reasonably objected. Contractor shall receive appropriate adjustment in Contract Sum, Contract Time, or both, for making such change unless objection was based on failure of manufacturer or installer to meet requirements of Contract Documents, in which case neither Contract Sum nor Contract Time shall be adjusted. Failure to object to a manufacturer shall not constitute waiver of requirements of Contract Documents. Products furnished by listed Contractor's manufacturers must conform to requirement of Contract Documents.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.4.4 Contractor shall disclose existence and extent of financial interests, whether direct or indirect, which Contractor has in proposed subcontractors and material suppliers.

§ 3.4.5 PROHIBITION OF ILLEGAL IMMIGRANTS

§ 3.4.5.1 The requirements of Public Acts of 2006, Chapter Number 878, of the State of Tennessee, addressing the use of illegal immigrants in the performance of any contract to supply goods or services to the State of Tennessee, shall be material to the performance of this Contract, a breach of which shall be grounds for monetary and other penalties, including termination of this Contract.

§ 3.4.5.2 The Contractor by entering into this contract attests, certifies, warrants, and assures that the Contractor shall not knowingly utilize or obtain the services of an illegal immigrant in the performance of this Contract and shall not knowingly utilize or obtain the services of any subcontractor or consultant who will utilize the services of any illegal immigrant in the performance of this Contract.

§ 3.4.5.3 The Contractor understands and agrees that failure to comply with this section will be subject to the sanctions of Public Chapter 878 of 2006 for acts or omissions occurring after its effective date. This law provides for the prohibition of a Contractor from contracting with, or submitting an offer, proposal, or bid to contract with the State of Tennessee to supply goods or services for a period of one year after a Contractor is discovered to have knowingly used the services of illegal immigrants during the performance of this Contract.

§ 3.4.5.4 For purposes of this Contract, "illegal immigrant" shall be defined as any person who is not either a United States citizen, a lawful permanent resident, or a person whose physical presence in the United States is authorized or allowed by the Department of Homeland Security and who, under Federal immigration laws and/or regulations, is authorized to be employed in the U.S. or is otherwise authorized to provide services under the Contract.

§ 3.4.6 NON-DISCRIMINATION IN EMPLOYMENT

§ 3.4.6.1 Contractor shall not discriminate against any employee or applicant for employment because of race, creed, color, religion, sex, age, or national origin as defined in Tennessee Code Annotated (TCA) § 4-21-401 et seq., nor because of handicap, in accordance with TCA § 8-50-103.

§ 3.4.6.2 Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to handicap, race, creed, color, religion, sex, age, or national origin, including but not limited to practices in recruitment, recruitment advertising, employment, selection for training or apprenticeship, rates of pay or other forms of compensation, upgrading, demotion, transfer, layoff, or termination.

§ 3.4.6.3 Contractor shall post in conspicuous places, available to employees and applicants for employment, notices setting forth these policies of non-discrimination.
§ 3.4.6.4 Solicitations or advertisements for employees placed by or in behalf of Contractor shall state that qualified applicants shall receive consideration for employment without regard to handicap, race, creed, color, religion, sex, age, or national origin.

§ 3.4.7 PREVAILING WAGE SCALE
§ 3.4.7.1 Contractor is required to comply with policies, conditions and rules of the Tennessee Department of Labor and Workforce Development pursuant to TCA § 12-4-401, et seq, which include that if the Contract Sum exceeds $50,000, Contractor is required to pay Prevailing Wage Scale current in the area of the Project to laborers and mechanics employed on the Work, as set forth in said rules, policies, and statutes, and to furnish weekly payrolls with the decision number noted on each to the Tennessee Department of Labor and Workforce Development.

§ 3.4.7.2 When a Federal Wage Scale applies to the Project, it will be included in Contract Documents, and Contractor shall pay not less than rates set forth. If both Federal and State wage rates apply to project, Contractor shall pay the higher of the two wage scales for each craft or trade.

§ 3.4.7.3 Current Prevailing Wage Scale Determination(s) for this project will be included in Contract Documents as part of the Conditions of the Contract, if Owner’s estimate of the value of Work indicates that it is required. Failure of Owner or Designer to provide current wage scale decision prior to bidding does not relieve Contractor of obligations set forth above.

§ 3.4.7.4 If Prevailing Wage Rates applicable to the Project change during the course of the Contract, or differ from those provided in Contract Documents, equitable adjustment in Contract Sum shall be made.

§ 3.4.8 REPORTING OF SUBCONTRACTORS
If the total Contract Sum equals or exceeds $100,000 (whether under the terms of the initial contract or by Modification), and the time of the Work is more than six (6) months, Contractor shall include with its obligations under TCA § 50-7-404(a) including but not limited to the subcontractor reporting requirements of subsection (d)(1).

§ 3.5 WARRANTY
The Contractor warrants to the Owner and Architect-Designer that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor’s warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect-Designer, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 TAXES
The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, as described in § 50-7-404(a) of the Code, unless the Contractor has a contract with the State of Tennessee exempting the Contractor from such taxes, and the Contractor shall be entitled to a refund of any taxes paid. If the State of Tennessee collects, after bids are received or negotiations concluded, a change in a sales, consumer, use, or similar state tax for the Work or a portion thereof provided by the Contractor, the Contract Sum shall be accordingly adjusted by appropriate modification of the Owner may make other lawful provision to mitigate the change.

§ 3.6.3 Neither Contract Sum nor Contract Time shall be adjusted for changes resulting from a change in a tax by a governmental body other than the State of Tennessee, regardless of when the tax is enacted or goes into effect.
§ 3.7 PERMITS, FEES, NOTICES, AND COMPLIANCE WITH LAWS
§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor, except as provided in Section 3.7.3, shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor, except as provided in this section, performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents taking into account that unless otherwise stipulated in Contract Documents, excavations and other subsurface construction activity shall be considered unclassified down to design depth, regardless of substrate and abandoned or inactive infrastructure or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect—before conditions are disturbed—Designer in accordance with Section 15.1.4 before continuing activities that could lead to a claim for additional cost and in no event later than 21 days after first observation of the conditions. The Architect—Designer will promptly investigate such conditions and, if the Architect—Designer determines that they differ materially and cause an increase or decrease in the Contractor’s cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect—Designer’s adjustment in the Work, Contract Sum and/or Contract Time, if the Designer determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect—Designer shall promptly notify the Owner and Contractor in writing stating the reasons. If either party disputes the Architect—Designer’s determination or recommendation, that party may proceed as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect—Designer. Upon receipt of such notice, the Owner shall promptly taking any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 ALLOWANCES
§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.2 Contractor’s costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order Modification. The amount of the Change Order Modification shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.3.8.2.2.

Contractor shall monitor the costs included in allowances, and shall not incur excess costs without first-obtaining a Modification adjusting the allowance sufficient for the excess.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ and designate a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. Work through final inspection. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect Designee has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect-Designer's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect-Designer's approval. The Architect-Designer's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect-Designer reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect-Designer.

§ 3.10.4 SCHEDULING ASSISTANCE

Owner may provide the Scheduling Assistance. If provided, such services will be set forth in the specification of Progress Schedules. If provided, the purpose of such services is to assist in producing a progress schedule for the Work; however, no express or implied guarantee or warranty is provided by the Owner regarding the suitability of the derived schedules, and the Contractor retains full responsibility for the suitability of the schedules and for conforming to them. Contractor shall fully cooperate in developing a schedule, and shall require the necessary forces- assisting the Contractor to likewise cooperate fully.

§ 3.10.5 COMMISSIONING CONSULTANT

Owner may provide the services of a Commissioning Consultant, either as a consultant engaged by the Owner, or as Subcontractor under a specified allowance and selected by the Owner. If provided, such services will be set forth in the Specifications. The Contractor retains full responsibility for compliance with the Contract Documents. Contractor shall fully cooperate in commissioning, and shall require the necessary forces assisting the Contractor to
likewise cooperate fully. If commissioning activities are included in the Work, they shall not be a cause for delay or cost claims.

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concepts expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect-Designer is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect-Designer is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect-Designer without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect-Designer Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect-Designer or, in the absence of an approved schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect-Designer that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so prior to providing that which is the subject of the submittal, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents. If a portion of Work demonstrated by a submittal deviates from the requirements of the Contract Documents, the Contractor shall specifically identify the deviation and its differences in cost as a part of the submittal.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect-Designer.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect-Designer's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect-Designer in writing of such deviation and its difference in cost at the time of submittal and (1) the Architect-Designer has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect-Designer's approval thereof.
§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect-Designer on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect-Designer will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall be prepared or certified by such professional's written approval when submitted to the Architect-Designer. The Owner and the Architect-Designer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect-Designer have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.13 USE OF SITE
The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 CUTTING AND PATCHING
§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 CLEANING UP
§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 ACCESS TO WORK
The Contractor shall provide the Owner and Architect-Designer access to the Work in preparation and progress wherever located.
§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall, subject to approval by the Attorney-General of the State of Tennessee with respect to suits or claims against Owner, defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect-Designer harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturer is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect-Designer. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect-Designer.

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect-Designer's consultants, and agents and employees of any of them the Owner from and against claims, damages, losses and expenses, including, but not limited to attorneys’ fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property, including loss of use resulting therefrom, (other than the Work itself), but only to the extent caused by the willful or negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 3.18. Contractor agrees to indemnify the Architect and Architect-Designer’s consultants based on the willful or negligent acts or omissions of the Contractor, except that Contractor shall not indemnify the Architect and Architect-Designer’s consultants based on design mistakes and errors or omissions.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers’ compensation acts, disability benefit acts or other employee benefit acts.

§ 3.19 RELATIONS WITH OWNER’S REPRESENTATIVES

§ 3.19.1 Contractor, subcontractors, material suppliers, and sub-subcontractors shall neither offer nor give a product-service, payment, negotiable instrument, gift, gratuity, or other compensation in connection with this project to a representative or employee of the State of Tennessee, the Architect, or the Architect-Designer’s consultants without Owner’s consent. Evidence of a violation of this requirement may be cause for termination of this Contract.

§ 3.20 PARTICIPATION OF MINORITY-OWNED BUSINESSES:

§ 3.20.1 To the extent that the Contractor or a subcontractor is a Minority-owned Business, the Contractor shall report to the State the status of this regard and the names and amounts of contracts entered into with Minority-owned Businesses on State projects in order for the State to collect data on such participation.

§ 3.20.2 "Minority-owned Business" means a business which is solely owned, or at least 5 percent of the assets of outstanding stock of which is owned, by an individual who personally manages and controls the daily operations of such business, and who is approved for normal entry into the economic mainstream because of past practices of discrimination based on race, religion, ethnic background, sex or disability.

§ 3.20.3 To be a "Minority-owned Business" for the purposes of this contract, a business must be certified as a "Minority-owned Business" by an agency of the federal government or the government of the State of Tennessee which is normally engaged in the practice of providing such certification.

ARTICLE 4 DESIGNER
ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

§ 4.1.1 The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the
Agreement and is referred to throughout the Contract Documents as if singular in number. "Designer" is the licensed professional firm lawfully practicing architecture, landscape architecture, or engineering, identified in the Bid Document and Agreement form for project, or the Authorized representative thereof.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Architect-Designer as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect-Designer. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect-Designer is terminated, the Owner shall employ a successor architect to whom the Contractor has no reasonable objection and Designer whose status under the Contract Documents shall be that of the Architect-Designer.

§ 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Architect-Designer will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect (1) during construction, (2) until final payment is due and (3) at the Owner's request during the one-year period for correction of Work described in Section 12.2. The Designer will have authority to set on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect-Designer will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, (1) to become generally familiar with the progress and quality of the portion of the Work completed, (2) to identify any defects and deficiencies in the Work, and (3) to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect-Designer will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect-Designer will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 On the basis of the site visits, the Architect-Designer will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect-Designer will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect-Designer will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 COMMUNICATIONS Facilitating CONTRACT Administration

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect-Designer about matters arising out of or relating to the Contract. Communications by and with the Architect-Designer's consultants shall be through the Architect-Designer's Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner-Owner or the Owner's Designer.

§ 4.2.5 Based on the Architect's Designer's evaluations of the Contractor's Applications for Payment, the Architect Designer will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect-Designer has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect-Designer considers it necessary or advisable, the Architect-Designer will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect-Designer nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect-Designer to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.
§ 4.2.7 The Architect-Designer will review and approve, or take other appropriate action upon, the Contractor’s submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect’s checking for compliance with the requirements and conformance with the intent of the Contract Documents. The Architect’s design shall be in accordance with the submittal schedule approved by the Architect-Designer or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect-Designer’s professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect-Designer’s review of the Contractor’s submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect-Designer’s review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect-Designer, of any construction means, methods, techniques, sequences or procedures. The Architect-Designer’s approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect-Designer will assist the Owner in preparing Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Architect-Designer will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect-Designer will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner’s review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect-Designer agree, the Architect-Designer will provide one or more project representatives to assist in carrying out the Architect’s responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents if requested by the Contractor.

§ 4.2.11 The Architect-Designer will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect-Designer’s response to such requests will be in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect-Designer will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect-Designer will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith according to the reasonable and professional standard of care.

§ 4.2.13 The Architect-Designer’s decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect-Designer will review and respond to requests for information about the Contract Documents. The Architect-Designer’s response to such requests will be in writing within any time limits agreed upon or otherwise with reasonable promptness, within 15 days. If appropriate, the Architect-Designer will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS
§ 5.1 DEFINITIONS
§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term “Subcontractor” is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term “Subcontractor” does not include a separate contractor or subcontractors of a separate contractor.
§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK
§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable within 21 days after award of the Contract, shall furnish in writing to the Owner through the Architect-Designer the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect-Designer may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect-Designer has reasonable objection to any such proposed person or entity or (2) that the Architect-Designer requires additional time for review. Failure of the Owner or Architect-Designer to reply within the 14 day period shall constitute notice of no reasonable objection. No construction activity shall be commenced by a person or entity in question until all objections have been resolved. If required, Contractor shall furnish evidence satisfactory to Designer, showing each proposed Subcontractor is competent to execute work covered by the subcontract. Subcontractors identified as part of Contractor’s bid for this project shall be used in this capacity listed, unless otherwise approved by the Owner in accordance with State Building Commission policy.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect-Designer has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect-Designer has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect-Designer has no reasonable objection. If the proposed but rejected Subcontractor was able to meet requirements of Contract Documents and reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor’s Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsibly in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect-Designer makes reasonable objection to such substitution.

§ 5.2.5 Contractor shall not award subcontract to one who submitted a competing general bid for the same Contract and subsequently withdrew, reneged, or otherwise failed to enter into contract.

§ 5.2.6 Contractor shall not allow work under the Contract to be performed contrary to the requirements of Section 3.4.5 nor by a Contractor or Subcontractor that has been disqualified from participating in State construction projects under the supervision of the State Building Commission. Such disqualification extends to succeeding or related corporations, partnerships, joint ventures, and other business organizations having substantial factual or legal connections, continuity, or identity with those that have been disqualified. If such a participant is discovered, Contractor shall immediately discontinue the participation and provide a suitable substitute at no additional cost to the Owner, and provide documentation to the Owner of the action taken to comply with this requirement.

§ 3.3 SUBCONTRACTUAL RELATIONS
By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor’s Work, which the Contractor, by these Documents, assumes toward the Owner and Architect-Designer. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect-Designer under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights; and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents.


User Notes: Jun 09 OPD 09 72 13

(177805793)
§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS
§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
§ 5.4.2 Assignment is at the option of Owner, and creates no duty or obligation upon Owner to exercise this option, nor is any right created for any subcontractor to expect or rely upon such assignment. When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor’s rights and obligations under the subcontract.

§ 5.4.3 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor’s compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.4 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor’s obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
§ 6.1 OWNER’S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS
§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner’s own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to those including those portions related to insurance and waiver of subcontractor’s insurance. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner’s own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner’s own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

§ 6.2 MUTUAL RESPONSIBILITY
§ 6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor’s construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor’s Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Designer all apparent discrepancies or defects in such other construction that would render it
unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an
acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and
proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor
because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be
responsible to the Contractor for costs the Contractor incurs because of a separate contractor's delays, improperly
timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially
completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are
described for the Contractor in Section 3.14.

§ 6.3 OWNER'S RIGHT TO CLEAN UP

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their
respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the
Owner may clean up and the Architect-Designer will allocate the cost among those responsible.

ARTICLE 7       CHANGES IN THE WORK

§ 7.1 GENERAL

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the
Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the
limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Architect-Designer; a
Construction Change Directive requires agreement by the Owner and Architect-Designer and may or may not be
agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect-Designer alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the
Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or
order for a minor change in the Work.

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and
Architect-Designer stating their agreement upon all of the following:

1. The change in the Work;
2. The amount of the adjustment, if any, in the Contract Sum; and that the price includes all eligible
overhead and profit, and represents all direct and indirect costs associated with the change; and
3. The extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 Unless otherwise agreed to in writing by Owner and Contractor, the method of determining adjustments in
Contract Sum shall be by one or more of the methods set forth in Section 7.3.3, and shall be based on reasonable
expenditures and savings as set forth in Section 7.3.7.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and
Architect-Designer, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or
Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order
changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the
Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change
Order.
§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

.2 Unit prices stated in the Contract Documents or subsequently agreed upon;

.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted subject to limitation and requirements contained in the Contract Documents.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect-Designer of the Contractor’s agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor’s agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect-Designer shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount in accordance with Section 7.3.11. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect-Designer may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

§ 7.3.7.1 Costs for the purpose of this Section 7.3.7 shall be limited to the following:

.1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers’ compensation insurance; Payroll Expense of labor;

.2 Costs of materials, supplies and equipment, including cost of transportation, thereof, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor, or otherwise equipment rented from others, and not more than 30 percent of the Associated Equipment Distributors Nationally Averaged Rental Rates for Construction Equipment for machinery and equipment belonging to the Contractor;

.4 Costs of premiums for all bonds and insurance bonds and insurance to the extent required by Contract Documents, permit fees, and sales, use or other similar taxes related to the Work; and

.5 Additional costs of supervision and field office personnel directly attributable to the change; Direct Payroll Expense of supervision directly attributable to authorized overtime; and

.6 reasonable Direct Payroll Expense of project manager and clerical workers directly attributable to estimating and coordinating the change.

.7 The following items are "Class 1 Time-Related Expenses", and shall be considered as costs when Contract Time is extended due to additional work or a Class 1 cause defined in Section 8.3, and solely to the extent directly attributable to extension of time: field offices, sheds, phones, sanitary facilities, on-site utilities, drinking fountains, cleaning, safety programs, and other construction facilities and temporary controls not specifically required for additional work; costs of superintendent’s vehicle; and other general use vehicles, being those requiring a Class 1, 2, or M license, and excluding those requiring a Class A, B, or C license, as set forth in the Tennessee Driver Handbook or comparable, current successor publication of the Tennessee Department of Safety.
§ 7.3.7.2 DIRECT PERSONNEL EXPENSE (DPE)

§ 7.3.7.2.1 Direct payroll expense (DPE) costs delineated in Sections 7.3.7.1.1, 7.3.7.1.5, 7.3.7.1.6, and 7.3.7.1.7 shall be limited to base salary or hourly wage plus a maximum of 39 percent of base salary or hourly wage, and further limited to a maximum of $155 per hour, excluding all labor burden.

§ 7.3.7.2.2 If the Contract Sum is a Guaranteed Maximum Price between the Owner and a Construction Manager / General Contractor, the costs for project manager, clerical work, and Class 1 Time-Related Expenses included by Sections 7.3.7.1.6 and 7.3.7.1.7 and the extra 5 percent for the Contractor in Section 7.3.11.1 shall not apply. In such cases, the CM/GC Fee and General Conditions costs shall apply in accordance with the Master Contract provisions for Modifications and Change in GMP.

§ 7.3.7.3 Specifically excluded from costs and included in overhead or general requirements are: corporate, home office, and branch office overhead, rent, mortgage, off-site utilities, project management, and personal, not otherwise mentioned, capital expenses and interest on capital, hand tools; and the items listed in Section 7.3.7.1.7 when Contract Time is not extended due to additional work or a Class 1 clause.

§ 7.3.7.4 To facilitate checking for increases or decreases in the Contract Sum, proposals shall be accompanied by Contractor’s complete itemization of costs of work including labor, materials and equipment, plus an amount for overhead and profit.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additional and credits covering related Work or substitutions are involved in a change, the allowance amount for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for these costs and certify for payment the amount that the Architect determines, in the Architect’s professional judgment, to be reasonably justified. The Architect’s interim determination of cost shall adjust the Contract Sum on the same basis as in Change Order subject to the right of either party to disagree and assert a claim in accordance with Article 15; amounts included in the Contract Sum by the Construction Change Directive for such changes shall be included in the Schedule of Values.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a report for determination and execution of an appropriate Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.3.11 OVERHEAD AND PROFIT

§ 7.3.11.1 The amount for overhead and profit on costs as stipulated in Section 7.3.7 shall be: 10 percent overhead added to the itemized cost; plus 5 percent profit added to the itemized cost and overhead; plus 5 percent for the Contractor added to the itemized cost, overhead, and profit, when the itemized cost is for work performed by a subcontractor or sub-subcontractor.

§ 7.3.11.2 When the Contract Sum is a Guaranteed Maximum Price between the Owner and a Construction Manager / General Contractor, the extra 5 percent for the Contractor in Section 7.3.11.1 shall not apply. In such cases, the CM/GC Fee shall apply in accordance with the Master Contract provisions for Modifications and Change in GMP.
§ 7.4 MINOR CHANGES IN THE WORK
The Architect-Designer has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect-Designer and shall be binding on the Owner and Contractor.

ARTICLE 8 TIME
§ 8.1 DEFINITIONS
§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect-Designer in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 PROGRESS AND COMPLETION
§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time in accordance with the Agreement.

§ 8.3 DELAYS AND EXTENSIONS OF TIME AND FORCED ACCELERATION
§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control, or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine. The basis exists for an extension of time if Contractor is delayed in performing Work but solely to the extent that delays are unforeseeable, unavoidable, and beyond the control and without fault or negligence, in whole or in part, of Contractor, subcontractors, sub-subcontractors, and suppliers at every time, and said delays directly impact the Contractor's ability to achieve Substantial Completion in accordance with the Contract Time requirements, and said delays cannot be made up by reasonable efforts otherwise, and said delays stem from the following causes:

§ 8.3.1.1 Class 1 causes: an act or failure to act that is contrary to the Contract Documents on the part of Owner or Architect or an employee of either, or of a separate Contractor employed by Owner, or an injunction against Owner or Owner's representatives.

§ 8.3.1.2 Class 2 causes: abnormal weather, acts of God, riots, civil commotion, acts of War, fire, unavoidable casualties, epidemics, quarantine restrictions, labor disputes, unusual delay in transportation, freight embargoes, or insolvency of subcontractors, sub-subcontractors, or suppliers.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15. If the basis exists for an extension of time under Section 8.3.1, Owner may, either:

AIA Document A201™ — 2007. Copyright © 1911, 1916, 1919, 1926, 1937, 1941, 1951, 1961, 1967, 1970, 1976, 1987, 1997 and 2007 by The American Institute of Architects. All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law. This document was produced by AIA software at 13:19:39 on 07/09/2006 under Order No. 1234567890_1 which expires on 05/26/2010, and is not for resale.

User Notes: Jun 09 OFO 00 72 19 (1717065783)
§ 8.3.2.1 in the case of additional work or a Class 1 cause, assign the Class 1 Time-Related Expenses, defined in Section 7.3.7.1.7, plus the overhead and profit allowed in Section 7.3.11, to a special allowance that can be earned based upon the extent of actual use of the related Time Extension in completion of the Work.

§ 8.3.2.2 accept the reasonable and appropriate time extension as determined by Designer to cover such delay, and in the case of a Class 2 cause, there will be no corresponding adjustment in Contract Sum, and the sole recourse of Contractor will be entitlement to time extension as provided by Designer regardless of actual source or cause of delay.

§ 8.3.2.3 order Contractor to accelerate construction activity by working overtime and by adding extra forces in order to overcome such delays, and adjusting the Contract Sum in accordance with Article 7 to compensate Contractor for such directed acceleration; however, direct costs used in determining such compensation shall be limited to properly substantiated and documented premium or overtime labor costs; or,

§ 8.3.2.4 employ a combination of the above remedies.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents. Neither Owner nor Designer will be obligated to either Owner or Contractor, and Contractor hereby expressly waives claims against Owner and Designer on account of damages, costs, expenses, or related impacts which Contractor, subcontractors, sub-subcontractors, suppliers, or other persons may incur as a result of a Class 2 cause enumerated in Section 8.3.1. Contractor’s sole and exclusive remedy and full compensation in such event shall be extension of Contract Time in accordance with provisions of the Contract Documents. Contractor likewise waives claims of damages, costs, or expenses due to a delay resulting from a Class 1 cause except and solely to the extent of costs allowed under Section 7.3.7.

§ 8.3.4 Claims relating to time shall be made in accordance with applicable provisions of Article 15 or shall receive no consideration. If monthly Weather Delay Reports are required by the specifications, then claims for time extension based upon weather delays will be denied if a submitted report does not corroborate the claim or if no report was submitted when it was required, and Contractor waives the right to such claims.

§ 8.3.5 Extensions of time shall be implemented in accordance with Article 7.

ARTICLE 9 PAYMENTS AND COMPLETION
§ 9.1 CONTRACT SUM
The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents. The Contract Sum is not subject to change due to commodity, equipment, or labor cost fluctuations.

§ 9.2 SCHEDULE OF VALUES
Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect-Designer before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect-Designer may require. This schedule, unless objected to by the Architect-Designer, shall be used as a basis for reviewing the Contractor’s Applications for Payment. If during construction the Schedule of Values cease to accurately represent the allocation of the Contract Sum, the Contractor shall submit a revised Schedule of Values.

§ 9.3 APPLICATIONS FOR PAYMENT
§ 9.3.1 At least ten days before, or prior to the date established for each progress payment, the Contractor shall submit to the Architect-Designer an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. Such application shall be notarized, if required. The total completed value in the continuation sheet of the application for payment cannot exceed the scheduled value. Such application shall be notarized and supported by such data substantiating the Contractor’s right to payment as the Owner or Architect-Designer may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainerage if provided for in the Contract Documents.
§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site; extent those costs have been included in the Contract Sum and actually incurred. Additional costs which may be attendant to the off-site storage are the responsibility of the Contractor, and cannot be claimed by Contractor against Owner.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment, if payment is received by the Contractor. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.3.4 Applications for Payment, the amount represented as total completed and stored to date shall reflect the portion of the Contract Sum properly allocable to labor, materials, and equipment incorporated in the Work and materials and equipment suitably stored in accordance with Section 9.3.2, and not exceed the Contract Sum less the value of incomplete Work and corrections required. This total completed and stored to date shall not be construed to define completion as determined by substantial completion or final completion of the Work according to Sections 9.9.9 or 9.10.

§ 9.3.5 Applications for Payment shall indicate retainage withheld from the total completed and stored to date as follows: 5 percent until acceptance of a Certificate of Substantial Completion; and, thereafter 2 percent until final payment. The retaining amount shall be indicated as the total earned less retainage. Applications that reduce retainage shall be accompanied by Consent or Surety if a bond was required according to Section 11.4.

§ 9.3.6 Applications for Payment shall indicate the total earned less retainage, and the aggregate of previous payments made subtracted therefrom, and an amount requested.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect-Designer will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect-Designer determines is properly due, or notify the Contractor and Owner in writing of the Architect-Designer's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect-Designer to the Owner, based on the Architect-Designer's evaluation of the Work and the data comprising the Application for Payment, that, to the best of the Architect-Designer's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect-Designer. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect-Designer has (1) made exhaustive or continuous off-site inspections to check the quality or quantity of the

User Notes: Jun 06 OPD 00 72 13

(1717067673)
Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Architect-Designer may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect-Designer's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect-Designer is unable to certify payment in the amount of the Application, the Architect-Designer will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect-Designer cannot agree on a revised amount, the Architect-Designer will promptly issue a Certificate for Payment for the amount for which the Architect-Designer is able to make such representations to the Owner. The Architect-Designer may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect-Designer's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of:

1. defective Work not remedied;
2. third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
3. failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
4. reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
5. damage to the Owner or a separate contractor;
6. reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
7. potential liquidated damages and other unsettled claims.

§ 9.5.2 When any of the above reasons for withholding certification are removed, certification will be made for respective amounts previously withheld.

§ 9.5.3 If the Architect-Designer withholds certification for payment under Section 9.5.1, the Owner, at its option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect-Designer and the Architect-Designer will reflect such payment on the next Certificate for Payment.

§ 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect-Designer has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall notify the Architect-Designer with TCA § 12-4-701 et seq. as may from time to time be amended.

1. Payment is due not later than 45 days after an undisputed Certificate for Payment has been received by the Owner. Owner will endeavor to make payment within 21 days, but shall not be obligated to do so.

2. Based upon Certificates for Payment issued by the Designer correcting the Application for Payment as appropriate, the Owner shall make progress payments to the Contractor as provided in the Contract Documents.

§ 9.6.2 The Contractor shall pay each Subcontractor no later than seven days after receipt of payment from the Owner or the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of entitlement for the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect-Designer and Owner will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and as taken therefrom by the Architect-Designer and Owner on account of portions of the Work done by such Subcontractor.
§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect-Designer shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision. When Contract Sum meets the statutory threshold, the Contractor shall comply with the procedures established by the Tennessee State Treasurer and Department of Finance and Administration for establishment of an interest-bearing retainage escrow account.

§ 9.7 FAILURE OF PAYMENT
If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor’s Application for Payment, or if the Owner does not pay the Contractor within seven days after the date payment is due as established in the Contract Documents the amount certified by the Architect er awarded by binding dispute resolution, currently due as of that date pursuant to the terms of the Contract Documents (including certification by the Designer), then the Contractor may, upon seven additional days’ written notice to the Owner and Architect-Designer, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor’s reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 SUBSTANTIAL COMPLETION
§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. In order to occupy or utilize the Work for its intended use, Owner must have received complete Product Data, Operating and Maintenance Data, orientation, and training, as may be required by specifications, and use and occupancy permits.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect-Designer a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor’s list, the Architect-Designer will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect-Designer’s inspection discloses any item, whether or not included on the Contractor’s list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect-Designer. In such case, the Contractor shall then submit a request for another inspection by the Architect-Designer to determine Substantial Completion.
§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect-Designer will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate; the Certificate, subject to the provisions of Section 9.12.2. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect-Designer as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect-Designer.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect-Designer shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor’s written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect-Designer will promptly make such inspection and, when the Architect-Designer finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect-Designer will promptly issue a final Certificate for Payment stating that the best of the Architect-Designer’s knowledge, information and belief, and on the basis of the Architect-Designer’s on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect-Designer’s final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor’s being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect-Designer: (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner’s property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days’ prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, waivers, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish bond and shall furnish acknowledgement of the matter to the Surety satisfactory to the Owner to indemnify the Owner against such loss. If such loss such matter in lieu of such a release or waiver. If such
remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such Item, including all costs and reasonable attorneys’ fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect-Designer so confirms, the Owner shall, upon application by the Contractor and certification by the Architect-Designer and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retaiage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect-Designer prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4 The making of final payment shall not constitute a waiver of claims by the Owner except those arising from the following:

.1 Items, Claims, security interests or encumbrances arising out of the Contract and unsettled;

.2 failure of the Work to comply with the requirements of the Contract Documents, irrespective of when such failure is discovered; or

.3 terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that party except those previously made in writing and identified by that party as unsettled at the time of final Application for Payment.

§ 9.10.6 Final payment constituting the entire unpaid balance of Contract Sum shall be paid by Owner to Contractor when Work has been completed, the Contract fully performed, and a final Certificate for Payment issued by Designer.

§ 9.11 METHOD OF PAYMENT

§ 9.11.1 Payments to Contractor shall be made through Owner’s automated clearing house wire transfer system. Contractor shall have completed an Authorization Agreement for Automatic Deposits ACH Credits Form prior to commencing Work and prior to submitting a first application for payment.

§ 9.11.2 Debit entries to correct errors authorized by the Authorization Agreement for Automatic Deposits ACH Credits Form shall be limited to those errors detected prior to the effective date of the credit entry. The remittance advice shall note that a correcting entry was made. Corrections shall be made within two banking days of the effective date of the original transaction. Other errors detected at a later date shall take the form of a refund, or in some instances, a credit memo if additional payments are to be made.

§ 9.11.3 The Owner reserves the right to deduct from payments which are or shall become due and payable to Contractor under this or any contract between the parties any amounts which are or shall become due and payable to the State by the Contractor.

§ 9.12 LIQUIDATED DAMAGES

§ 9.12.1 Time being of the essence, Contractor further agrees to accept conditions for liquidated damages in the amount set forth in Contract Documents for each calendar day in excess of allotted time for Substantial Completion, or approved extension thereof, parties agreeing that the amount of damages resulting from delay would be uncertain and difficult to prove, and further agreeing that such liquidated damages set forth in the Owner-Contractor Agreement are a reasonable estimate of those damages which could result from delay.

§ 9.12.2 If a portion of the Work is certified Substantially Complete, the amount of Liquidated Damages applicable to the remaining Work may be reduced by written mutual agreement.

§ 9.12.3 Secondary Liquidated Damages shall be 25 percent of that originally required by the Contract Documents, and shall accrue until such time that Work has been completed and the Contract fully performed if the time for completion stipulated in the Certificate of Substantial Completion has passed; or, if no such time was stipulated, then 30 calendar days have passed following the certified date of Substantial Completion and:
the Contract Time, including approved extensions, plus 30 calendar days, has passed.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 SAFETY OF PERSONS AND PROPERTY

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

1. employees on the Work and other persons who may be affected thereby;

2. the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor’s Subcontractors or Sub-subcontractors, and

3. other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The Owner reserves the right to effect repairs to damaged property and deduct all costs from the Contract Sum. The foregoing obligations of the Contractor are in addition to the Contractor’s obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate responsible member of the Contractor’s organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor’s superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 HAZARDOUS MATERIALS

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to
persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect-Designer in writing.

§ 10.3.2 Upon receipt of the Contractor's written notice, pursuant to circumstances described in Section 10.3.1, Owner will have the option to either terminate the contract as provided in Article 14, proceed with Contractor in a mutually agreed plan of action, or as follows: the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect-Designer the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect-Designer will promptly reply to the Owner in writing stating whether or not either has reasonable objection to persons or entities proposed by the Owner. If either the Contractor or Architect-Designer has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect-Designer have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, Following claim and modification processes in accordance with Articles 15 and 7, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

§ 10.4 EMERGENCIES
In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS
§ 11.1 CONTRACTOR'S LIABILITY INSURANCE
§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance required by the Contract Documents as will protect the Contractor and the Owner from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable.
1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;

2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

4 Claims for damages caused by usual personal injury liability coverage;

5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property or property on or away from the site, including loss of use resulting therefrom;

6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;

7 Claims for bodily injury or property damage arising out of completed operations; and

8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverage, whether written on an occurrence- or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents, one year after final payment. Specific limits of coverage and limits of liability provided by the Contractor shall be written in a comprehensive form satisfactory to the Owner in the following minimum requirements:

1 Comprehensive General Liability, with combined single limits for bodily injury and property damage of Each Occurrence: $1,000,000
   Aggregate: $2,000,000
   and including:
   premises & operations;
   underground, explosion, & collapse;
   products & completed operations;
   contractual;
   independent contractors;
   Owner / Contractor protective;
   broad form property damage; and,
   personal injury (employment exclusion deleted).

2 Asbestos abatement insurance:
   Non-friable asbestos: If removal or abatement of non-friable asbestos is included in the Work, and Contractor's General Liability Insurance coverage excludes risks associated with asbestos, Contractor shall provide evidence of a Special Endorsement.
   Friable asbestos: If removal or abatement of friable asbestos is included in the Work, Contractor shall provide evidence of a special endorsement.
   Special Endorsement: Evidence of a Special Endorsement shall be in the form of a Certificate of Insurance certifying a special endorsement for asbestos abatement insurance with a minimum $500,000 limit of liability. If Contractor is performing no portion of the asbestos removal or abatement with its own forces, Contractor, in lieu of its own such endorsement, may substitute a Certificate showing such special endorsement covering the subcontractor's or sub-subcontractor which is actually performing the asbestos removal or abatement.

3 Comprehensive Automobile Liability, with combined single limits for bodily injury and property damage of Each Occurrence: $500,000
   and including owned, hired, and non-owned vehicles; or, if there are no owned vehicles, Contractor may provide written certification of such and provide coverage limited to hired and non-owned vehicles.

4 Workers Compensation and Employer's Liability (without restriction as to whether covered by Workmen's Compensation law), with Workers Compensation according to statute, and Employer's Liability: $100,000.

5 If an exposure exists, Aircraft and Watercraft Liability (owned & non-owned), with limits approved by Owner shall be provided.
§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. Certificate(s) of insurance provided to attest to coverage shall specifically cite each element of coverage and not less than limits set forth in Section 11.1.2, as confirmation of complete coverage, and shall identify Contractor, Producer, Insurance Carrier, Project, and certificate holder, and state the Producer's notice requirements as set forth in Section 11.1.4. The term "Commercial General Liability" shall mean all of the coverage listed in Section 11.1.2.1.a unless specifically noted otherwise in the certificate. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the 10-year period required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include-(1) the Owner, the Architect/Designer and the Architect/Designer's Consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.1.5 Contractor shall notify Owner in writing of changes in coverage or carrier not later than ten days after notification of Contractor by Producer, or ten days before Contractor makes a change, whichever occurs first. Contractor shall require that if policies are cancelled or modified before expiration date thereof, Producer shall endeavor to mail ten days prior written notice to certificate holder named therein.

§ 11.2 OWNER'S LIABILITY INSURANCE
The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 11.3 PROPERTY INSURANCE
§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire for the covered Project at the site on a replacement cost basis with optional deductibles basis. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project specified in the Owner as named insured, and the Contractor, Subcontractors and Sub-subcontractors as additional insured under the policy.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, hail, flood, testing and startup, temporary buildings and debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect/Designer's services and Contractor's services and expenses for work required as a result of such insured loss. Such insurance carried by Owner will include a $10,000 deductible clause. The deductible is the responsibility of the Contractor.

§ 11.3.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Owner as named insured. Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order if not included in the Contract Sum the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable therefor.
§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 The Owner's property insurance shall cover all or exclude portions of the Work stored off the site, and also portions of the Work in transit or in transit and, Contractor shall provide insurance upon such portions to protect the Owner's Interest.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 BOILER AND MACHINERY INSURANCE
The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 LOSS OF USE INSURANCE
The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor; the Contractor shall endeavor to provide ten days written notice to the Contractor should the policy be canceled prior to the expiration date. Failure to mail such notice shall impose no obligation or liability of any kind upon the Owner or issuing company.

§ 11.3.7 WAIVERS OF SUBROGATION
The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate subcontractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or otherwise property insurance applicable to the Work, except such rights as they have to proceed of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate subcontractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers in favor of other parties cumbered herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance.
§ 11.3.8 A loss insured under the Owner’s property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgage clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If, required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner’s duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit a separate account proceeds as received, which the Owner shall distribute in accordance with such agreement as the parties in interest may make, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If, after such an insured loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.7; however, this shall not preclude Owner’s emergency repairs under Section 10.2.5.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest object in writing within five days after occurrence of loss to the Owner’s exercise of this power. If such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution selected in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators-insurers.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents or the date of execution of the Contract. If the initial Contract Sum as awarded exceeds $100,000, Contractor shall provide Contract Bond, in the amount of 100 percent of Contract Sum covering faithful performance of contract and payment of obligations arising thereunder. If a Contract Bond is required, and a Three-Year Roof Bond is also stipulated in the Bidding Documents, then the Three-Year Roof Bond shall be provided as stipulated. Bond(s) shall be executed on Tennessee State Building Commission Standard Form(s) exhibited in Bidding Documents for project, and subject to provisions of Section 11.4.3.

§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor and Owner shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.4.3 Surety is the person or entity identified as such in a bond and is referred to throughout the Contract Documents as 'singular in number. The term "Surety" means the Surety or the Surety’s authorized representative. Surety Company issuing bond shall be licensed to transact business in Tennessee by Department of Commerce and Insurance. Bonds shall have certified and current Power-Of-Attorney for the Surety’s Attorney-in-Fact attached. Attorney-in-Fact who executes bond on behalf of Surety shall be one who is licensed by Tennessee as a resident agent, and shall affix license number to bond; or, countersignature by and license number of a licensed resident agent shall be affixed to the bond in addition to the signature of the Attorney-in-Fact.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Architect-Designer’s written request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect-Designer, be uncovered for the Architect-Designer’s examination and be replaced at the Contractor’s expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect-Designer has not specifically requested in writing to examine prior to its being covered, the Architect-Designer may request in writing to see such Work and it
shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of uncovering, correction and recovering shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK
§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION
The Contractor shall promptly correct Work rejected by the Architect-Designer or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect-Designer's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION
§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor of known noncomplying Work and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct noncomplying Work within a reasonable time during that period after receipt of notice from the Owner or Architect-Designer, the Owner may correct it in accordance with Section 2.4. If Three Year Roof Bond has been provided, then with regard to the total roofing system, its installation, and materials, the one year time period hereunder is extended for two additional years for a total period of three years. Until such time as the three years hereunder have expired, Contractor's obligations hereunder shall be joint and several with Company as defined and set forth in the Roofing System Warranty. For the purpose of Section 12.2.2, all of Company's actions, whether of omission or commission, pursuant to the Roofing System Warranty are likewise actions of Contractor hereunder and shall in no way negate or reduce the responsibilities of Contractor hereunder.

§ 12.2.2.2 The one year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 and time period of applicable special warranties relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.
§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its completion or removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4 located.

§ 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a person providing construction financing for the Project, if the person assumes the Owner’s rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, to or on an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Architect-Designer or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

§ 13.4.3 If normal procedures within the Contract fail to satisfy a Claim against the Owner, further action is to be taken up with the Tennessee Claims Commission pursuant to TCA § 9-8-101 et seq. Damages recoverable against the State shall be limited expressly to claims awarded by the Commission.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect-Designer timely notice of when and where tests and inspections are to be made so that the Architect-Designer may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Architect-Designer, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect-Designer will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the...
Architect-Designer of when and where tests and inspections are to be made so that the Architect-Designer may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveals a failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect-Designer's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect-Designer.

§ 13.5.5 If the Architect-Designer is to observe tests, inspections or approval required by the Contract Documents, the Architect-Designer will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 INTEREST
Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time in the place where the Project is located, past due as stated in Section 9.6.1 in accordance with TCA § 12-4-704 as may from time to time be amended.

§ 13.7 TIME LIMITS ON CLAIMS
The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other Owner arising out of or related to the Contract in accordance with the requirements of the final-dispute resolution method selected in the Agreement-Contract Documents and Section 13.4.3 within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive Contractor waives all claims and causes of action not commenced in accordance with this Section 13.7.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT
§ 14.1 TERMINATION BY THE CONTRACTOR
§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

1. Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
2. An act of government, such as a declaration of national emergency that requires all Work to be stopped; or
3. Because the Architect-Designer has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents;
4. The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1 Documents.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect-Designer, terminate the Contract and recover from the Owner payment for-
Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages—eligible overhead, profit, and costs as defined in Section 7.3.7 incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, Designer, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE
§ 14.2.1 The Owner may terminate the Contract if the Contractor
  1. repeatedly refuses or repeatedly fails to supply enough properly skilled workers or proper materials;
  2. fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
  3. repeatedly disregards or repeatedly fails to comply with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
  4. otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Initial Decision—Maker—Designer that sufficient cause exists to justify such action, may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:
  1. Exclude the Contractor from the site and take possession of all Work, the site, and all materials, equipment, tools, and construction equipment and machinery thereto owned by the Contractor;
  2. Accept assignment of Subcontracts pursuant to Section 5.4; and
  3. Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect—Designer's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision—Maker—Designer upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE
§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent
  1. that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
  2. that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE
§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall
  1. cease operations as directed by the Owner in the notice;
take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; including materials for which Owner has paid and which are stored off-site, and except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs the completed portion of the Work, eligible costs as defined in Section 7.3.7 incurred by reason of such termination, along with reasonable overhead and profit on the Work not completed plus a fraction of 5 percent of the remaining balance of the Contract Sum, which fraction shall be equal to the value of Work completed divided by the Contract Sum.

ARTICLE 15 CLAIMS AND DISPUTES
§ 15.1 CLAIMS
§ 15.1.1 DEFINITION
A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 NOTICE OF CLAIMS
Claims by either the Owner or Contractor except claims of liquidated damages, must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Architect; if the Architect is not serving as the Initial Decision Maker, Designee. Claims by either party must be initiated within twenty-one (21) days after occurrence of the event giving rise to such Claim or within twenty-one (21) days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. If the effect of the condition giving rise to the Claim cannot be fully evaluated, a preliminary notice of pending claim shall be made within the stated time limit subject to further action in a timely manner.

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE
Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker, Designee, will issue recommendations for change orders and certificates for payment in accordance with its decisions issued pursuant to Section 15.2.5.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST
If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work required by the Contract Documents shall be given to the Owner by the Contractor, and written notice received by the Contractor from Owner acknowledging the claim and authorizing construction activity to proceed, before the Contractor shall proceed to execute the construction activity giving rise to the Claim; hence, the claim shall be addressed under provisions of Section 15.2. Documentation of claims shall conform to the requirements of Article 7. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME
§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the To make Claim for an increase in Contract Time, Contractor shall give written notice as provided herein, and include an estimate of cost, which shall be limited to that allowed by Section 8.3.3, and an explanation of the cause and probable effect on progress of Work. In the case of a continuing delay, only one Claim is necessary, necessary, and Contractor shall subsequently detail the full scope of the delay.

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.
§ 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES
The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes:

1. damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of their persons; and

2. damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work. The Contractor waives Claims against the Owner for consequential damages arising out of or relating to this Contract including but not limited to either party's termination in accordance with Article 14, principal office expenses, including the compensation of personnel stationed at the principal office, and any damages for losses of financing, business, and reputation, and for loss of profit.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 INITIAL DECISION
§ 15.2.1 Claims, excluding those arising under Sections 10.2, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Respect for those Claims excluded by this Section 15.2.1, an initial decision shall be referred to the Designer for initial decision. An initial decision or other action by the Designer in accordance with Section 15.2.2 shall be required as a condition precedent to prosecution of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner Claims for action pursuant to remedies provided by law for Claims between Owner and Contractor, unless the Designer fails to timely comply with Section 15.2.2.

§ 15.2.2 The Initial Decision Maker/Designer will review Claims and within ten days of the receipt of a Claim or information preliminary or pursuant to a Claim or modification to a Claim and, take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker/Designer is unable to resolve the Claim if the Initial Decision Maker/Designer lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker/Designer concludes that, in the Initial Decision Maker/Designer's sole discretion, it would be inappropriate for the Initial Decision Maker/Designer to resolve the Claim, the Initial Decision Maker/Designer may, upon ten days to request reconsideration based upon additional information, or the decision shall be final. If Designer suggests compromise, parties have ten days to respond. If the Designer declines to resolve the claim, the Owner may, but is not obligated to, take the lead in resolving the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker/Designer may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker/Designer in rendering a decision. The Initial Decision Maker/Designer may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker/Designer requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker/Designer when the response or supporting data will be furnished or (3) advise the Initial Decision Maker/Designer that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker/Designer will either reject or approve the Claim in whole or in part.
§ 15.2.5 The Initial Decision Maker/Designer will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution to the provisions in Section 15.2.2, and thereafter to mediation if consented to by both parties, and to remedies as otherwise provided by law.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor’s default, the Owner may, but is not obligated to, notify the surety and request the surety’s assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic’s lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines. As a matter of law, the State of Tennessee and its property are not subject to mechanic’s and material suppliers liens. Subcontractors, suppliers, and other claimants are protected through the Contract Bond as required by TCA § 12-4-201 et seq., the policies of the State Building Commission, and Section 11.4 of these Conditions. Specific requirements for notice of Claims on the bond are set forth in the TCA § 12-4-205.

§ 15.3 MEDIATION
The State of Tennessee is not subject to mandatory mediation.

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.2.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 The parties shall share the mediator’s fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereon.

§ 15.4 ARBITRATION
The State of Tennessee is not subject to mandatory arbitration.

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration, which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. A demand for arbitration shall be made in writing delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party

AIA Document A201™—2007. Copyright © 1911, 1915, 1925, 1937, 1951, 1963, 1965, 1968, 1970, 1976, 1977 and 2007 by The American Institute of Architects. All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under law. This document was produced by AIA software at 13:10:38 on 07/05/09 under Order No. 1234567890_1 which expires on 08/02/2010, and is not for resale.

User Notes: Jun 09 O'DO 67 72 13

(1717066783)
§ 15.4.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for
mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based
on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a
written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of
legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in
accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity
comy consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court
having jurisdiction thereof.

§ 15.4.4 CONSOLIDATION OR JOINER

§ 15.4.4.1 Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any-
other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration
permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact;
and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a
common question of law or fact whose presence is required to assure complete relief in arbitration provided that the
party sought to be joined consents in writing to such joinder. Consent to arbitration involving an
additional person or entity shall not constitute consent to arbitration of any claim, dispute, or other matter in question
not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this-
Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as the Owner and
Contractor under this Agreement.
Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, Dick Tracy, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with this certification at 13:18:38 on 07/09/2009 under Order No. 1234567890_1 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A201™ – 2007 - General Conditions of the Contract for Construction, as published by the AIA in its software, other than changes shown in the attached final document by underscoring added text and striking over deleted text.

(Signed)

(Title)

(Dated)
SUPPLEMENTARY CONDITIONS
REGARDING ALL CONTRACTS USING OFD CONDITIONS FOR GENERAL WORK.

MODIFICATIONS TO
OFD s007213 for General Work
(a modified AIA Document A201-1997)

GENERAL CONDITIONS
OF THE CONTRACT FOR CONSTRUCTION

The following supplements modify, change, delete from or add to "General Conditions of the Contract for Construction", and any other Conditions preceding these by section number for this Contract. Where a portion of Conditions is altered by these Conditions, the unaltered portion shall remain in effect.

--------------------------- ARTICLE 1 ---------------------------
GENERAL PROVISIONS

Add the following section:

1.1.4 The Project

Add to this section:
The Project is identified in the first page of the Agreement with an Owner’s project number in the format of 999/999-99-9999XX. This project number may differ from the number as used on other Contract Documents. This Owner’s project number is to be shown in all correspondence related to the project.

--------------------------- ARTICLE 3 ---------------------------
CONTRACTOR

3.4.7 Prevailing Wage Scale:
Delete this section in its entirety.

Add the following section:

3.22 Financial Records:

3.22.1 The Contractor shall maintain documentation for all charges under this Contract. The books, records, and documents of the Contractor, insofar as they relate to work performed or money received under this contract, shall be maintained for a period of three (3) full years from the date of the final payment and shall be subject to audit at any reasonable time and upon reasonable notice by the State, the Comptroller of the Treasury, or their duly appointed representatives. The financial statements shall be prepared in accordance with generally accepted accounting principles.

--------------------------- ARTICLE 9 ---------------------------
PAYMENTS and COMPLETION

9.10.6 Add: “If there is no Contract Bond, the final Certificate may be withheld until the prospect of final payment is advertised 30 days for the benefit of those to whom the Contractor may be indebted.”

-------------------------- ARTICLE 11 --------------------------
INSURANCE and BONDS

11.1.1.5 Delete “other than to the Work itself”.

Add the following section:

11.1.2.6 Builder’s Risk Insurance (BRI) for the full amount of the Contract Sum, unless the Work consists entirely of hazardous materials abatement or other demolition with no constructive patching or renovating, in which case there will be no BRI.

11.3.1 Delete first sentence and substitute:
“The Contractor shall purchase from and maintain, with a company or companies licensed to do business in Tennessee by the Department of Commerce and Insurance, property insurance written on a builder’s risk “all risk” or equivalent policy form in the amount of the initial Contract Sum plus value of subsequent Contract modifications for the covered project at the site on a replacement cost basis.”

11.3.1.1 Delete the last two sentences and substitute, “Any deductibles shall be the responsibility of the Contractor.”

11.3.1.2 Delete this section.

11.3.1.4 Delete the clause in its entirety and substitute: This property insurance shall cover portions of the work stored off the site and also portions of the work in transit. The Contractor shall present a certificate of insurance demonstrating coverage of the property stored off the site or in transit at the time payment for that portion of the work is presented.

11.3.2 At beginning of first sentence delete “The Owner shall purchase...” and substitute “The Contractor shall purchase...”.

11.3.6 Substitute all references to “Owner” with “Contractor”, and substitute all references to “Contractor” with “Owner”.

11.3.8 Delete clause.

11.3.9 At the end of the section delete all after “shall be performed by the Contractor”.

END OF SECTION
PART 1 GENERAL

1.01 PROJECT
A. Project Name: Fine Arts Classroom Building
B. Owner's Name: Tennessee Board of Regents.
C. Architect's Name: McCarty Holsaple McCarty Architects, Inc.
D. The Project consists of the construction of Fine Arts performance building including but not limited to classrooms, musical practice spaces, performing and supporting spaces. This fourth design release package Work includes, but is not limited to finish carpentry, architectural wood casework, plastering, mirrors, tiling, ceilings, wood grilles, floorings, wall finishes, interior painting, information specialties, interior specialties, furnishings items, elevator, lifts and coordination with work in previous design releases and other work as indicated in the Specifications and as shown on the Drawings

1.02 SPECIAL REQUIREMENTS - NOISE CRITICAL SPACES
A. Many areas of the building require special acoustical provisions and restrictions in order to meet allowed background and intrusive noise levels. These areas are designated as “Noise Critical Spaces.” Noise Critical Spaces include spaces that must be quiet, and spaces that contain noise-generating equipment.
   The following areas have been designated as Noise Critical Spaces:
   1. Multipurpose Auditorium / Concert Hall
   2. Studio Theatre
   3. Recital Hall
   4. Control/Sound Booths (to support the 3 spaces above)
   5. Large Instrumental Rehearsal
   6. Choir Rehearsal Room
   7. Percussion Rehearsal Rooms (Large and Small)
   8. Percussion Offices
   9. Music Offices
   10. Piano Storage Room
   11. Green Rooms
   12. Scene Shop
   13. Mechanical Rooms
   14. Electrical/IT/Telecom Rooms
B. All penetrations in partitions and slabs enclosing Noise Critical Spaces shall be sleeved, packed, and sealed airtight with non-hardening sealant as shown on the Drawings and Details and as described elsewhere in the Specification.

1.03 CONTRACT DESCRIPTION
A. Contract Type: A Construction Manager At Risk contract.

1.04 WORK BY OWNER
A. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Substantial Completion. Some items include:
   1. Furnishings.
   2. Small equipment.
B. Owner will supply and install the following:
   1. To be determined.
C. Owner will supply the following for installation by Contractor:
   1. Indicated toilet accessories.
   2. Other items to be determined.

1.05 OWNER OCCUPANCY
   A. Owner intends to occupy the Project upon Substantial Completion.
   B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
   C. Schedule the Work to accommodate Owner occupancy.

1.06 CONTRACTOR USE OF SITE
   A. Provide access to and from site as required by law and by Owner:
      1. Emergency Building Exits During Construction: Keep all exits required by code open during
         construction period; provide temporary exit signs if exit routes are temporarily altered.
      2. Do not obstruct roadways, sidewalks, or other public ways without permit.
   B. Utility Outages and Shutdown:
      1. Prevent accidental disruption of utility services to other facilities.
      2. Schedule shutdown of utility services as coordinated with the Owner, arranged at least 24 hours in
         advance.

1.07 WORK SEQUENCE
   A. Construct Work in stages during the construction period:
      1. Stage 1: Sitework and foundations.
      2. Stage 2: Structural Steel.
      4. Stage 4: Complete Building
   B. Coordinate construction schedule and operations with Owner.

1.08 SPECIFICATION SECTIONS APPLICABLE TO ALL CONTRACTS
   A. Unless otherwise noted, all provisions of the sections listed below apply to all contracts. Specific items
      of work listed under individual contract descriptions constitute exceptions.
   B. Section 01.23.11 - Design Options
   C. Section 01.30.00 - Administrative Requirements.
   D. Section 01.40.00 - Quality Requirements.
   E. Section 01.41.15 - Basic Regulatory Requirements
   F. Section 01.45.33 - Code-Required Special Inspections
   G. Section 01.50.00 - Temporary Facilities and Controls.
   H. Section 01.60.00 - Product Requirements.
   I. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.
   J. Section 01.70.00 - Execution and Closeout Requirements.
   K. Section 01.77.70 - Closeout Procedures
   L. Section 01.78.21 - Closeout Submittals
   M. Section 01.78.50 - HPBr Reporting
   N. Section 01.78.51 - HPBr Checklist / Tracking Form
PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01.10.00
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Option 1 Parking at Northwest Corner of the Site (In Design Release Package 1):
   2. Design Option (Add): Include additional 25 parking spaces as dashed in on Site Layout Plan C101.

B. Option 2 Fixed Seating: (per Section 12.60.00 - Multiple Seating)
   1. Base costs: Provide base fixed audience seats.
   2. Option 2 Seating (Add) Alternate 1 for Auditorium 102 and Auditorium Balcony 207.
   3. Option 2 Seating (Add) Alternate 2 for Recital Hall 104.
   4. Option 2 Seating (Add) Alternate 3 for Recital Hall 104.
   5. Option 2 Seating (Add) Alternate 4 for Auditorium 102, Auditorium Balcony 207 & Recital Hall 104.

C. Option 3 - Motorized window shades in Lobby and Rehearsal Spaces.
   2. Design Option 3 (Add): Add motorized operation and wireless controls on window shades in Lobby and Rehearsal Spaces.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION 01.23.11
SECTION 01 25 13
PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SUBSTITUTIONS:

A. Substitute products should not be ordered and shall not be installed without written approval or acceptance from Designer. Contractor assumes all risks associated with premature ordering and installation of substitute products.

B. The specifically named manufacturers, products, and systems, and descriptive characteristics used in the Contract Documents normally serve only to establish a level of quality and a performance standard. Unless specific restriction is placed upon an item in the specifications, Contractor may submit proposals for substitutions. The Owner reserves the right to disallow substitutions. Contractor assumes risks associated with possible rejection of proposals for substitution submitted during the life of the contract.

C. Delays caused by tardiness of Contractor in preparing and forwarding submittals do not constitute an acceptable basis for consideration of substitute products. Delays due to factors which were in effect prior to project bidding do not constitute an acceptable basis for consideration of substitute products.

1.02 SUBSTITUTION REQUEST FORM:

A. Requests for substitutions shall be submitted to Designer on the form exhibited as Section 01 25 33, or in a similar format which provides the same or more information.

B. When making requests for substitutions, Contractor assumes the following responsibilities:

1. To have personally investigated the proposed substitute product and determined it is equal or superior in all respects to that specified;

2. To provide the same warranty for substitute that Contractor would for that specified;

3. To provide complete cost data, and waive all claims for additional costs related to substitution which subsequently become apparent; and

4. To coordinate installation of the accepted substitute, making such changes as may be required for Work to be complete in all respects.

END OF SECTION
**SECTION 01 25 33**  
**PRODUCT SUBSTITUTION REQUEST FORM**

<table>
<thead>
<tr>
<th>To:</th>
<th>Project:</th>
</tr>
</thead>
</table>
| McCarty Holsaple McCarty, Architects, Inc. | 166/005-08-2013 CM  
Fine Arts Classroom for East Tennessee State University |

<table>
<thead>
<tr>
<th>Attn:</th>
<th>Specified Item:</th>
<th>Proposed Substitute:</th>
</tr>
</thead>
</table>

1. The following are attached (Mark all that apply):
   - [ ] Complete Description
   - [ ] Laboratory Tests
   - [ ] | Catalog
   - [ ] Spec Data
   - [ ] Information on the availability of maintenance services and replacement materials for proposed substitute(s)
   - [ ] Names, addresses, and phone numbers of fabricators and suppliers for proposed substitute(s)

2. This substitution will have the following effects on dimensions, gauges, weights, etc.:  

3. This substitution will have the following effects on wiring, piping, ductwork, etc.:  

4. This substitution will have the following effects on other trades:  

5. This substitution will have the following effect on construction Schedules:  

6. The proposed substitute(s) differs from the specified product(s) in quality and performance as follows:  

7. Manufacturers guarantees for the substitute(s) and the specified product(s) are (check one):  
   - [ ] the same  
   - [ ] different (if different, explain below)
8. If the proposed substitution is accepted, it will result in:
   [ ] no cost impact  [ ] a cost increase of
   [ ] a cost decrease of
   (If change in cost is indicated, itemization on specified Cost Itemization Form is attached)

9. License fees or royalties are pending on the proposed substitute.
   [ ] No  [ ] Yes (if yes, explain below)

10. The undersigned or the firm represented shall pay for additional studies, investigations, submittals, redesign, and analysis by the Designer necessitated by this substitution request.

   Substitutions must be requested in accordance with applicable Contract requirements. After bidding, substitutions are to be submitted only by Contractor. Substitute products should not be ordered or installed without written acceptance.

   Submitted by:
   Sign here: __________________________  Date: __________________________
   Name: ____________________________  Telephone: __________________________
   type or print: __________________________
   for: ____________________________
   Name of firm: __________________________
   Address: ____________________________
   Street address: __________________________
   and mailing address: __________________________
   if different: __________________________
   City, State, and Zip Code: __________________________

   Designer's Review Comments:
   [ ] Accepted  [ ] Rejected
   [ ] Accepted as noted  [ ] Rejected (received too late)
   [ ] Rejected (submittal incomplete)

   Additional comments:

   For the Designer:
   Signature here: __________________________  Date: __________________________
SECTION 01 26 00
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 SUPPORTING DOCUMENTATION for PROPOSALS or CLAIMS


B. For a change in the Work, specifically describe proposed change, or briefly describe the proposed change with specific reference to a completely descriptive attachment, such as a Request for Proposal from the Designer.

C. For a change in Contract Sum, state briefly the reason for change, state the amount, and provide itemization of values on the following forms, or similar forms providing the same information:
   1. Section 01 26 54 Form for Price Summary: listing the itemizations of work by subcontractors and the Contractor that together apply to an entire related change in work.
   2. Section 01 26 55 Form for Price of Work: detailing the quantities, units, costs, and extensions for materials, equipment, and labor, subtotaled, plus overhead, and profit related to a specific proposed change in the Work.
   3. Section 01 26 56 Form for Price of Time: if applicable, deriving an average cost per day.

D. For a change in Contract Time:
   1. Fully describe the extent of and reasons for the change and effect of the change on the construction schedule, and attach a revised Progress Schedule. Take into account weekends, holidays, and the specified standard baseline for weather delays during the period of the requested extension.
   2. For a change based on weather-related delay, provide and attach:
      a. applicable specified Weather Delay Reports, or, if none is specified, daily work logs that describe actual local weather conditions and their impact on progress.
      b. National Oceanic and Atmospheric Administration (NOAA) weather data, for corroboration.
      c. NOAA comparative data on normals, means, and extremes if such data or another weather baseline is not already provided in Contract Documents.

1.02 SIGNATURES for Change Order:

A. Form shall be similar in format and content to Section 01 26 40, and signed by authorized representatives of each of the entities required by Conditions of the Contract.

B. Normal procedure shall be that:
   1. Designer prepares and submits supporting documents to Owner.
   2. Owner produces and signs three (3) counterparts of form; transmits by fax, e-mail, or other means, informational copies to its Construction Representative, Designer, and Contractor; and forwards.
   3. Owner’s Construction Representative receives counterparts, and brings them to next Progress Meeting, unless urgency and opportunity make for a more timely execution.
   4. Designer and Contractor both sign all three (3) counterparts at Progress Meeting. Each retains a counterpart, and the Owner’s Construction Representative retains the third for the Owner.

END OF SECTION
PART 1 - GENERAL

1.01 EXTENSIONS OF CONTRACT TIME

A. If the basis exists for an extension of time in accordance with paragraph 8.3 of the Conditions, an extension of time on the basis of weather may be granted only for the number of Weather Delay Days in excess of the number of days listed as the Standard Baseline for that month.

1.02 STANDARD BASELINE FOR AVERAGE CLIMATIC RANGE

A. The Owner has reviewed weather data available from the National Oceanic and Atmospheric Administration and determined a Standard Baseline of average climatic range for the State of Tennessee.

B. Standard Baseline shall be regarded as the normal and anticipatable number of calendar days for each month during which construction activity shall be expected to be prevented and suspended by cause of adverse weather. Suspension of construction activity for the number of days each month as listed in the Standard Baseline is included in the Work and is not eligible for extension of Contract Time.

C. Standard Baseline is as follows:

<table>
<thead>
<tr>
<th>Month</th>
<th>Standard Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>12</td>
</tr>
<tr>
<td>Feb</td>
<td>11</td>
</tr>
<tr>
<td>Mar</td>
<td>8</td>
</tr>
<tr>
<td>Apr</td>
<td>7</td>
</tr>
<tr>
<td>May</td>
<td>7</td>
</tr>
<tr>
<td>Jun</td>
<td>6</td>
</tr>
<tr>
<td>Jul</td>
<td>7</td>
</tr>
<tr>
<td>Aug</td>
<td>5</td>
</tr>
<tr>
<td>Sep</td>
<td>4</td>
</tr>
<tr>
<td>Oct</td>
<td>5</td>
</tr>
<tr>
<td>Nov</td>
<td>6</td>
</tr>
<tr>
<td>Dec</td>
<td>11</td>
</tr>
</tbody>
</table>

1.03 ADVERSE WEATHER and WEATHER DELAY DAYS

A. Adverse Weather is defined as the occurrence of one or more of the following conditions which prevents exterior construction activity or access to the site within twenty-four (24) hours:

1. precipitation (rain, snow, or ice) in excess of one-tenth inch (0.10") liquid measure
2. temperatures which do not rise above 32 degrees F by 10:00 a.m.
3. temperatures which do not rise above that specified for the day’s construction activity by 10:00 a.m., if any is specified
4. sustained wind in excess of twenty-five (25) m.p.h.
5. standing snow in excess of one inch (1.00")

B. Adverse Weather may include, if appropriate, "dry-out" or "mud" days:

1. for rain days above the standard baseline;
2. only if there is a hindrance to site access or sitework, such as excavation, backfill, and footings; and,
3. at a rate no greater than 1 make-up day for each day or consecutive days of rain beyond the standard baseline that total 1.0 inch or more, liquid measure, unless specifically recommended otherwise by the Designer.

C. A Weather Delay Day may be counted if adverse weather prevents work on the project for fifty percent (50%) or more of the contractor's scheduled work day, including a weekend day or holiday if Contractor has scheduled construction activity that day.
1.04 DOCUMENTATION and SUBMITTALS

A. WEATHER DELAY REPORT:

1. Use a copy of Section 01 26 25 as a Weather Delay Report, indicating for each calendar month the days on which construction activity affecting the critical path of the Work was prevented by weather conditions.

2. In the column for the cause, indicate measurement of precipitation, temperature, wind, or other influencing factors.

3. Describe the construction activity that was scheduled, on the critical path, and delayed.

4. At the end of the month, add up the number of days delay, subtract the baseline number given in this Section, and show the resulting claimable days in excess of baseline.

5. Submit a copy of the completed report with the next application for payment. Reports submitted with applications for payment do not constitute a claim or preliminary claim for extension of time.

B. When making a claim for a time extension based on weather delay(s):

1. Submit a copy of all reports completed since the last month for which a time extension was previously claim, or the commencement of Work if no previous claim, through the last month for which delay is being claimed. Claims for time extension based upon weather delays are unjustified if a submitted report does not corroborate the claim or if no report was submitted when it was required with an application for payment.

2. Submit daily jobsite work logs showing which and to what extent construction activities have been affected by weather on a monthly basis.

3. Submit actual weather data to support claim for time extension obtained from nearest NOAA weather station or other independently verified source approved by Designer at beginning of project.

4. Organize claim and documentation to facilitate evaluation on a basis of calendar month periods, and submit in accordance with the procedures for Claims established in Article 15 of the Conditions, and the applicable General Requirements.

5. If an extension of the Contract Time is appropriate, it shall be implemented in accordance with the provisions of Article 7 of the Conditions, and the applicable General Requirements.

END OF SECTION
# SECTION 01 26 25
WEATHER DELAY REPORT

<table>
<thead>
<tr>
<th>Date</th>
<th>Weather condition causing delay</th>
<th>Work scheduled on critical path for this day that was delayed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total number of days this month with delay due to weather

Baseline number from Section 01 26 20

Total – Baseline = claimable days
SECTION 01 26 40
FORM FOR AMENDMENT, CHANGE ORDER, OR DIRECTIVE

[ ] Amendment  Modification  Number:
[ ] Change Order
[ ] Construction Change Directive  PROJECT: Fine Arts Classroom for East Tennessee State University

Original Contract Date:
This Change initiated:  Project Number  166/005-08-2013

The following changes in the Contract are hereby directed:

<table>
<thead>
<tr>
<th>Item</th>
<th>Reference</th>
<th>Work</th>
<th>Contract-Sum</th>
<th>Contract-Time</th>
</tr>
</thead>
</table>

The original Contract Sum ............................................................................................................ $
Net Change previously authorized .................................................................................................. $
The Contract Sum prior to this Modification .................................................................................... $
This modification ( increases / does not change / decreases ) the Contract Sum…… $
The new Contract sum, including this modification ................................................................. $
This modification ( increases / does not change / decreases ) the Contract Time……
The new Contract Time, including this modification ........................................................................
The last day of the Contract Time, including this modification ....................................................

CONTRACTOR  DESIGNER  OWNER
Signed  Signed  Signed

Name & Date  Name & Date  Name & Date

For  For  For

01 26 40  Form for Amendment, Change Order, or Directive
Jun 05 OFD 012640 Page 1 of 1
**SECTION 01 26 54**  
**FORM FOR PRICE SUMMARY**

<table>
<thead>
<tr>
<th>Work by Subcontractors</th>
<th>Name of Subcontractor</th>
<th>Costs and Allowances</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Subtotal:  
General Contractor mark-up on Subtotal: \( \% = \)  0.00
Subtotal for General Contractor for work by subcontractors:  0.00

<table>
<thead>
<tr>
<th>Work by General Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Subtotal (including Subcontractors and the General Contractor):  0.00

Bond Premium: \( \% = \)  0.00

Total:  0.00

Rounding off is permitted if rounding up for decreases and rounding down for increases. Math functions in XLS show rounded to nearest penny, but carry exact value for calculations. Let embedded math do its work.

This XLS spreadsheet is available on Owner's website, Designers' Manual, Bidding Documents, listed by its Section number and title.
### SECTION 01 26 55
#### FORM FOR PRICE OF WORK

<table>
<thead>
<tr>
<th>Description</th>
<th>Material</th>
<th>Equipment</th>
<th>Labor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quantity</td>
<td>Unit</td>
<td>Cost</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

**Materials Subtotal:** 0.00
**Equipment Subtotal:** 0.00
**Labor Subtotal:** 0.00

**Cost:** 0.00
**Cost:** 0.00
**Cost:** 0.00

Subtotal of Costs of Materials + Equipment + Labor = $0.00
10% Overhead allowed on costs = $0.00
Subtotal of Costs + Overhead = $0.00
5% Profit allowed on Costs + Overhead = $0.00

**Total for this change =** $0.00
<table>
<thead>
<tr>
<th>Description</th>
<th>Period Cost</th>
<th>Period (Year, Month, Week, Day)</th>
<th>Cost Per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superintendent Salary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superintendent Vehicle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Use Vehicles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Office</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Office Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fax Machine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copier</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typewriter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Office Utilities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Gas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinking Water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telephone Service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-Site Storage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trailer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety Program</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site Toilet(s)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Subtotal of Costs: ____________________________

10% for Overhead:

Subtotal with Overhead: _______________________

5% for Profit:

Total per day: _______________________

Cells with red underline (if viewed in color) are for you to fill in. Other cells are protected. Math functions show rounded to penny, but carry exact value for calculations. Let embedded math do its work. Use "Year", "Month", "Week", or "Day" for period. This XLS spreadsheet is available on the Owner's website, Designers' Manual, Bidding Documents, listed by its Section number and Title.
SECTION 01 29 16
CM/GC-GMP CONTINGENCY AND RESERVE

PART 1 - GENERAL

1.01 DEFINITION

A. The CM/GC-GMP Contingency and the Reserve Fund are defined in the CM/GC Master Contract Attachment 1 Scope of Services and Deliverables.

B. The CM/GC-GMP Reserve Fund is an accumulation from trades that were estimated at the time that the GMP was agreed upon and are later bid to complete the trade bidding. Trades that bid less than estimated add the difference to Reserve. Trades that bid more than estimated deduct the difference from Reserve. Once all estimated trades are bid and awarded, if there is a net negative Reserve, the amount is charged to the GMP Contingency, regardless whether the GMP Contingency has sufficient balance to cover the charge. The Reserve does not accumulate from savings through substitutions, reductions in Work, nor unused remainders of allowances; rather, such savings are to be returned to the Owner through an appropriate modification as soon as they occur.

1.02 CM/GC-GMP CONTINGENCY LOG

A. Maintain a Contingency Log on the specified form, showing for each item a sequence number, brief caption description, individual cost, the portion of that cost currently incurred for Total Completed and Stored to Date of applications for payment, and whether the item needs or has received concurrence required by 1.02.C. If there are Phases, make sequence numbering subordinate to each Phase, grouping the items by Phase, and provide a subtotal for each Phase.

B. Providing a copy of Log to Owner and Designer constitutes written advisement for items clearly fitting definition.

C. When providing an updated Log that contains items not clearly fitting Contingency definitions that have not been given written concurrence by Owner and Designer accepting the inclusion in the Contingency, identify such items and obtain written concurrence from Designer and Owner in the form of their initials upon a copy of the Log next to each such item.

1.03 RESERVE FUND LOG

A. Maintain a Reserve Fund Log on the specified form, showing for each estimated trade:
   1. the Name of the successfully bidding subcontractor engaged for the trade, once trade bidding is actually completed. Until then, while trade bidding is pending, leave the subcontractor blank;
   2. the Date for trade bidding, whether pending a future occurrence, or actually having occurred; or, when an exception to trade bidding has been authorized by the Owner, the date of authorization;
   3. the Description of the trade, and, if the amount of the trade is split between multiple line items in the schedule of values, the line items of the Schedule of Values that together account for the full amount of the trade;
   4. the Estimated Value of the trade as agreed;
   5. the Actual Price of the trade, once trade bidding has actually occurred and subcontracts awarded based upon bidding; and,
   6. the Effect on Reserve, which is the Estimated Value minus the Actual Price.

B. The Reserve Log spreadsheet calculates the Effect on Reserve once a Name is filled in. This formula is filled in for enough rows to fill most or all of the first page. If the Log requires further rows, copy the formula into the additional rows.

C. List the estimated trades in the order they are listed in the agreement and amendments, if any.

D. As trade bidding is completed for each trade, report the results, identifying the trade(s) procured, and providing an updated copy of the Reserve Log, bid tabulation, and a copy of the bids received.
E. Except as may be allowed according to paragraph F immediately below, if an estimated trade is not procured by bidding, it loses its status as an estimated trade and instead becomes a scope gap to be paid from the GMP Contingency. In this case, enter this in the Reserve Log with “scope gap” as the Subcontractor, the effective date as the Date, the Description unchanged, the Estimated Value unchanged, zero as the Actual Price, and the resulting increase Effect on Reserve.

F. Owner may authorize an exception to the requirement of bidding a trade when: the trade is a relatively small add to an existing subcontracted trade; or, if the trade is relatively small and impractical to procure through bidding; or, if the trade has been specified as proprietary or sole-source; or, if the trade is work that can only be provided by a local utility or government. In such exceptional cases, the CM/GC will provide an itemized cost for that trade using specification section 01 26 55; or, if a local utility or government, then whatever is their customary means of presenting their costs.

G. If Owner authorizes a transfer of Reserve into Contingency, enter this in the Reserve Log with the name of the Owner employee authorizing the transfer as the Subcontractor, the authorization date as the Date, “Owner authorized transfer” as the Description, zero as the Estimated Value, the amount of authorized transfer as the Actual Price, and the resulting decrease Effect on Reserve.

H. Attach current copy of Reserve Log to each counterpart of each Application for Payment.

1.04 Effect on the Schedule of Values

A. Include only values consistent with the current Contingency Log and Reserve Log. To the extent that 1.02.C requires concurrence for items, include only values consistent with concurrences received.

B. Include a single line item in the Schedule of Values for the Reserve Fund. If there are no phases in the Schedule of Values, include a single line item in the Schedule of Values for the CM/GC-GMP Contingency, and represent values as for other line items.

C. If there are Phases in the Schedule of Values:
   1. include an overall line item for the portion of the CM/GC-GMP contingency not included in a Phase;
   2. include also a line item in each Phase for its portion of the CM/GC-GMP contingency;
   3. initially, set CM/GC-GMP contingency values at full value for overall, and zero for each phase;
   4. as costs are assigned to CM/GC-GMP Contingency, to the extent costs are applicable within phases, increase scheduled value of applicable Phase, and reduce scheduled value of overall CM/GC-GMP contingency, so their sum remains constant; and,
   5. represent values for each CM/GC-GMP contingency line item as for other line items.

D. Include estimated trades as distinct line items in the Schedule of Values, initially showing these at their Estimated Value, later adjusting them to their Actual Price as the trade bidding is completed.

1.05 Effect on Applications for Payment:

A total completed and stored to date for an estimated trade cannot be included in an application for payment until the procurement has been completed and the effect on Reserve shown in the Reserve Log.

1.06 Effect on Progress Schedule and Public Advertisement:

A. In the Progress Schedule, show the bid dates for each estimated trade as also shown in the Reserve Log. In the Progress Schedule, include the period during which the trade will be released for solicitation of its trade bids.

B. Inform the Owner’s bidding coordinator specifically when each trade enters solicitation, and ensure that the bidding coordinator has posted the public advertisement for the suitable period approved by the Owner’s project manager.

END OF SECTION
### Form for CM/GC GMP Contingency Log

**CM/GC name:** Denark Construction, Inc  
**Owner’s project number:** 166/005-08-2013  
**Project Name:** Fine Arts Classroom for East Tennessee State U

<table>
<thead>
<tr>
<th>Date</th>
<th>Credit</th>
<th>Charge</th>
<th>Remaining Contingency</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Date</td>
<td>Description</td>
<td>Estimated Value</td>
<td>Actual Price</td>
</tr>
<tr>
<td>--------</td>
<td>------</td>
<td>-------------</td>
<td>-----------------</td>
<td>--------------</td>
</tr>
</tbody>
</table>

Current Reserve: 0.00
PART 1 - GENERAL

1.01 Basic Requirements

A. Retainage escrow requirements are mandated by Chapter No. 340 House Bill No. 966 Public Acts of 1985 which was passed by the Tennessee General Assembly.

B. Conditions of Contract, in accordance with State law, require retainage to be deposited into an interest-bearing escrow account if the Contract Sum $500,000 or greater. Compliance is mandatory and cannot be waived.

C. Failure to have the escrow account operational by the time of the contractor's second application for payment can result in delay of payment or inability of the Owner to make payment. Any such delay or inability to pay will not be grounds for relief under the prompt payment statutes.

1.02 The banking institution handling the retainage escrow account must be in an appropriate custodial care agreement with the State Treasurer. If not already in such an agreement, a banking institution can request such an agreement from the State Treasurer, subject to meeting eligibility requirements of TCA section 12-4-108(c).

1.03 Getting Started

A. Shortly after award of Contract, the Tennessee Department of Finance and Administration (F&A) will send the Contractor its latest information for starting the account. This information typically includes:

1. procedural guide
2. forms, including the basic application, colloquially referred to as "Form A".
3. list of banks that currently have agreements with the State to host retainage escrow accounts

B. Getting help

1. The instructions from F&A will include a name and phone number to call for help:
   a. If the Contractor needs help completing Form A.
   b. If the Contractor plans to use a lending institution that does not have a current agreement with the State for hosting retainage escrow.

2. At the time this standard specification is written (see bottom left of page) the contact person for help in setting up new escrow accounts and completing Form A is Mary Mansour at (615)741-1317.

C. To avoid delays in setting up the escrow, and possible delays in payment, do not wait to be contacted by F&A as described above. Instead, if the Contract Sum is $500,000 or greater, as soon as the Contract is awarded, take the Form A that is page 2 of this Section, get it filled out and executed with the escrow bank, and have the bank send the original wet-signature Form to

   ATTN: Mary Mansour
   Tennessee Department of Finance and Administration
   Office of Business and Finance
   Suite 2000 William R. Snodgrass Tennessee Tower
   312 Rosa L. Parks Avenue
   Nashville TN 37243-0294

1.04 A sample of Form A is provided on page 2 of this Section. Otherwise, this is the …
FORM A

APPLICATION FOR THE SUBSTITUTION OF SECURITIES FOR ALL AMOUNTS RETAINED ON STATE BUILDING COMMISSION CONSTRUCTION CONTRACTS

Date: ____________________________

RE: Contract Number: ____________________________
     Project No.: ____________________________
     Location: ____________________________

Dear State Building Commission:

Pursuant to the provisions of Tennessee Code Annotated, Sections 12-4-108, Contractor's name and address as appearing on construction Contract:

hereby requests that whenever payment for which certain amounts are retained by the State Building Commission as determined by the subject construction contract, the amount so retained be substituted for approved securities, as designated by the Tennessee State Treasurer.

The undersigned Contractor hereby appoints __________________________________________________________ (Name of Banking Institution) located at __________________________________________________________ (Complete Address of Banking Institution) to be its agent and attorney-in-fact to receive all amounts retained by the State Building Commission under the provisions of the subject construction Contract and to purchase Retainage Securities of the following type: __________________________________________________________ (Description & Account Number)

The appointed Banking Institution, as indicated by the acceptance signature shown below, agrees to enter or has already entered into a Trust Agreement with the Tennessee State Treasurer to act as custodian and servicing agent of Retainage Securities and to perform all assigned duties and responsibilities with respect thereto as set forth in the Trust Agreement, which is herein incorporated by reference.

Very truly yours,

(Signature of Authorized Representative of Contractor) (Title)

ACCEPTED:

(Signature of Authorized Officer of Banking Institution) (Title)

CONTACT PERSON (BANK) __________________________________________________________ PLEASE PRINT

PHONE NUMBER __________________________________________________________
PART 1 - GENERAL

1.01 RELATED SECTIONS

A. Phases are normally set forth in the Agreement and in the Summary of Work specification, normally from 01 10 00 to 01 10 19, but may differ in this Project Manual.

B. Applications for Payment and the final statement of accounting are normally specified in sections from 01 29 00 to 01 29 99, such as OFD standard Section 01 29 76, but may differ in this Project Manual.

C. Allowances are normally specified in sections from 01 21 00 to 01 21 99, such as OFD standard sections 01 21 13 and 01 21 15. Allowances associated with Unit Prices are normally in sections from 01 22 00 to 01 22 99, such as OFD standard sections 01 22 13 and 01 22 15. The arrangement of sections may differ in this Project Manual.

1.02 FORM and APPROVAL

A. The form for schedule of values shall be AIA Document G703 Continuation Sheet.

B. If objected to by Designer, revise and resubmit to Designer's satisfaction prior to submitting application for payment. If during construction, a line item's total completed and stored to date for payment purposes exceeds or is anticipated to exceed allocations, revise and resubmit a schedule of values such that no values of completed work exceed their allocations.

1.03 ALLOCATION OF VALUES

A. If the Work is divided into defined portions ("Phases"), intended to have distinct commencement, duration, or completion requirements, divide the allocation to correspond to the Phases, providing a sub-total for each Phase; then within each Phase, subdivide the allocations as specified in the following paragraphs.

B. Provide at least these three line items to account for General Requirements:
   1. Mobilization, staging, and general start-up costs.
   2. Construction administration and temporary facilities, prorated over the course of the project.
   3. Maintenance of Record Documents, prorated over the course of the project.

C. If sitework is included, other than minor sitework incidental to a building or major structure, include sitework in single line item or group of line items. Within the group, categorize site utilities, roads and parking, and appurtenances according to general type and physical separation. If allowances are stipulated in the Work relating to sitework, provide a line item for each such allowance, including quantity allowances associated with Unit Prices.

D. For each involved building or major structure:
   1. If allowances are stipulated in the Work, provide a line item in the Schedule of Values for each allowance, including quantity allowances associated with Unit Prices.
   2. If the Contract is a CM/GC contract based on a Guaranteed Maximum Price (GMP) with estimated trades identified as a part of the GMP, provide a distinct line item for each estimated trade.
   3. Categorize by major trades or units of work corresponding to the current Progress Schedule, and relate to the Divisions and Sections of the Specifications.
   4. Further subdivide as desired, but maintain a distinct and identifiable correspondence to this allocation.

E. Account for Modifications by incorporating them into the appropriate allocations, or with a line item for each, until incorporating each into the appropriate allocations for the final statement of accounting.

END OF SECTION
### PART 1 - GENERAL

#### 1.01 SUBMITTAL:

A. In each application for payment, according to its context, provide:

<table>
<thead>
<tr>
<th>Counterpart or Copy</th>
<th>Progress Payment</th>
<th>Reducing Retainage upon SC</th>
<th>Final Payment</th>
<th>Document</th>
</tr>
</thead>
<tbody>
<tr>
<td>counterpart</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>G702 Application</td>
</tr>
<tr>
<td>copy</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>G703 Continuation</td>
</tr>
<tr>
<td>copy</td>
<td>no</td>
<td>no</td>
<td>YES</td>
<td>Final Accounting</td>
</tr>
<tr>
<td>copy</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>Contingency &amp; Reserve Logs (if CM/GC)</td>
</tr>
<tr>
<td>copy</td>
<td>if any</td>
<td>if any</td>
<td>no</td>
<td>Off-Site Stored Materials documents</td>
</tr>
<tr>
<td>counterpart</td>
<td>no</td>
<td>no</td>
<td>YES</td>
<td>Affidavit of Payment</td>
</tr>
<tr>
<td>counterpart</td>
<td>no</td>
<td>no</td>
<td>YES</td>
<td>Consent of Surety with Power of Attorney</td>
</tr>
<tr>
<td>copy</td>
<td>no</td>
<td>no</td>
<td>YES</td>
<td>Insurance Certificate</td>
</tr>
<tr>
<td>copy</td>
<td>no</td>
<td>no</td>
<td>YES</td>
<td>Statement of continuing insurability</td>
</tr>
<tr>
<td>copy</td>
<td>no</td>
<td>if any</td>
<td>if any</td>
<td>U&amp;O permit</td>
</tr>
<tr>
<td>copy</td>
<td>no</td>
<td>YES</td>
<td>YES</td>
<td>Data Binder Receipt(s)</td>
</tr>
<tr>
<td>copy</td>
<td>no</td>
<td>no</td>
<td>YES</td>
<td>Roof Warranty or warranties</td>
</tr>
<tr>
<td>copy</td>
<td>no</td>
<td>no</td>
<td>YES</td>
<td>Report of Subcontractors and Suppliers</td>
</tr>
<tr>
<td>copy</td>
<td>YES</td>
<td>if any</td>
<td>if any</td>
<td>Visitor Log</td>
</tr>
<tr>
<td>copy</td>
<td>YES</td>
<td>if any</td>
<td>if any</td>
<td>Weather Delay Report</td>
</tr>
<tr>
<td>copy</td>
<td>YES</td>
<td>no</td>
<td>YES</td>
<td>Progress Schedule</td>
</tr>
<tr>
<td>copy</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>Submittal Log</td>
</tr>
</tbody>
</table>

B. Provide application documents assembled in order listed above, on 8½" x 11" pages, except 11" x 17" pages can be used for Progress Schedules and Submittal Logs if folded to fit an 8½" x 11" size. Orient all pages as shown below. Provide application sets bound with a single clip (no staple) affixed to the upper left of the G702 first page (according to its orientation).  

```
Binding Edge  8 ½ x 11 Landscape
Binding Edge  8 ½ x 11 Portrait
Binding Edge  11 x 17 Landscape
Binding Edge  11 x 17 Portrait
```

C. Counterpart documents shall be original instruments with wet signatures and embossed or wet-stamped seals, in each set of application documents.

D. Provide a draft submission, including attachments, as a PDF attached to an email, to Designer and to the Owner’s construction representative three (3) days prior to actual submittal.

E. Provide actual submission of five (5) sets of the application documents to the Designer at Progress Meeting, Substantial Completion inspection meeting, or final inspection meeting. If submitted outside of these meetings, provide conveyance of application to Designer, from Designer to Owner’s construction representative, and from Owner’s construction representative to Owner’s central office.
1.02 INCLUSIONS AND CALCULATIONS:

A. Accurately represent all values with two decimal places, calculated to the penny.

B. STORED MATERIALS: those suitably stored on-site but not yet incorporated into the Work can be included; and, those suitably stored off-site can be included if documented in accordance with later provisions of this Section.

C. On CM/GC contracts, the total completed and stored to date for estimated trades can only be included once bids have been taken, subcontracts awarded, and the actual price reconciled to the Reserve Log.

D. Calculation of Retainage and amounts withheld:
   1. Credit for completed work and stored materials, and deductions for incomplete work, comprise the “Total Completed and Stored to Date”. The “Total Completed and Stored to Date” shall not include the value of Punch List items that remain incomplete after Substantial Completion.
   2. Retainage is calculated as a percentage of “Total Completed and Stored to Date”: 5% prior to Substantial Completion; 2% after Substantial Completion; then, none at final payment. In the continuation sheets, showing retainage at individual line items is not required and is discouraged, as it promotes rounding errors. Retainage should only be shown at Phase sub-totals, if Phases exist, and when retainage rates vary between phases.
   3. Other amounts withheld (i.e., potential liquidated damages or in response to subcontractor claims of non-payment) can be added to the continuation sheet and deducted from the Total Completed and Stored to Date, or can be deducted from the resulting Current Payment Due after retainage and prior payments are accounted.

E. If a billing period would cross a State fiscal year (ending June 30, starting July 1), provide separate pay requests for the portion of work performed in each fiscal year.

1.03 FORMS, FORMAT, and CONTENT:

A. G702 Application: Use AIA Document G702 Application and Certificate for Payment
   1. For Project identification, include the Owner’s project number featured prominently, institution name, and work name, which is normally the Project title shown in the Agreement.
   2. Provide a unique, sequential application number.
   3. Include the Contractor’s address exactly as provided in the ACH Form.
   4. Show the County where the Work is located, normally where AIA captions “Contract for”.

B. G703 Continuation: Use AIA Document G703 Continuation Sheet itemized with the line items and values of the Schedule of Values accepted by Designer, and values and percentages for each line item. If there are Phases, include a sub-total for each Phase as well as a grand total.

C. Final Accounting: Allocate final Contract Sum as if modifications had been fully incorporated in Contract Sum at award of Contract, and shall follow the same format as the Schedule of Values.

D. GMP Contingency Log and Reserve Log, only if a CM/GC contract.

E. Off-Site Stored Materials: If any, provide:
   1. Statement identifying where materials are stored, and assuring that materials are tagged to identify them for use in the project.
   2. Bill(s) of sale for materials claimed that list(s) all items.
   3. Certificate of insurance covering materials claimed, recognizing Owner's right to make claims.

F. Affidavit of Payment of Debts and Claims: Provide counterpart using AIA Document G706, when requesting final payment for the Work or reduction of retainage to zero for any portion of the Work.
G. Consent of Surety:
   1. If seeking reduction in retainage prior to Final Payment for the entire Work, or final payment on only
      a portion of the Work, provide counterpart using AIA Document G707A Consent of Surety to
      Reduction in Retainage, or a similarly formed letter.
   2. If seeking Final Payment, provide counterpart using AIA Document G707 Consent of Surety
      Company to Final Payment, or a similarly formed letter.
   3. If Contractor has listed exceptions in the Affidavit of Payment, Surety’s consent shall acknowledge
      such exceptions.
   4. If Contract is not bonded, Consent of Surety is not required, and Owner will instead advertise a public
      notice of settlement, and wait 30 days for responses, before accepting the application.
   5. Provide counterpart of Power of Attorney with Consent of Surety.

H. Insurance Certificate: If seeking final payment, provide certificate of insurance for products and completed
   operations as required by Conditions of the Contract sections 9.10.2(2) and 11.1.2.1.c.

I. Statement of continuing insurability: if seeking final payment, a letter written to the effect required by
   Conditions of the Contract section 9.10.2(3).

J. Use & Occupancy Permit (some jurisdictions have a different name): provide copy with first application
   following substantial completion.

K. Data Binder Receipt:
   1. with first application following substantial completion, provide copy of document identifying to whom
      Contractor delivered the Operating and Maintenance Data Binders.
   2. with application for final payment, provide copy of document identifying to whom Contractor delivered
      Project Data Binders

L. Roof Warranty or warranties, if any required on the Owner’s Section 07 50 35 standard form.

M. Report of Subcontractors and Suppliers, on the standard form.

N. Visitor Log for the period covered by application. After substantial completion, provide Log(s) for periods
   prior to substantial completion that have not been provided in a prior application.

O. Weather Delay Report for all calendar months completed, up to the date of substantial completion, and
   not previously submitted.

P. Progress Schedule, updated and current, indicating progress through the period covered by application
   and scheduled progress through completion of Work. This is not required with the request for final
   payment.

Q. Shop Drawing Log for entire project through the period covered by application. If there has been no shop
   drawing log activity since a previous copy was submitted with a previous application, a single page can
   be substituted saying so and identifying which pay request had the latest up-to-date log. If a log is long
   and has many of its early pages unchanged since a previous copy was submitted with a previous
   application, a single page can be substituted for the earlier unchanged pages saying so and identifying
   which pay request had the latest copy of those pages.

1.04 CERTIFICATION

   A. Designer, if in disagreement with the amounts claimed in an application, may either return application to
      Contractor for revision and resubmittal, or revise application by hand to indicate corrections Designer
      considers appropriate.

   B. Designer, finding an application complete and correct, will certify the application and return one of the
      sets to Contractor to indicate the action taken.

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES
   A. Electronic document submittal service.
   B. Preconstruction meeting.
   C. Progress meetings.
   D. Progress photographs.
   E. Coordination drawings.
   F. Submittals for review, information, and project closeout.
   G. Number of copies of submittals.
   H. Submittal procedures.

1.02  RELATED REQUIREMENTS
   A. Document 00.72.13 - General Conditions: Dates for applications for payment.
   B. Document 00.72.13 - General Conditions: Duties of the Construction Manager.
   C. Document 00.73.16 - Supplementary Conditions: Duties of the Construction Manager
   D. Section 01.91.13 - Commissioning : Additional procedures for submittals relating to commissioning.

1.03  PROJECT COORDINATOR
   A. Project Coordinator: Construction Manager.
   B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for on site access, traffic, and parking facilities.
   C. During construction, coordinate use of site and facilities through the Project Coordinator.
   D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
   E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01.10.00 - Summary.
   F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
   G. Coordinate that penetrating members in all walls and slabs common to Noise Critical Spaces shall be sleeved or framed to ensure a flexible joint of 1” surrounding the penetrating element.
   H. Make the following types of submittals to Architect through the Project Coordinator:
      1. Requests for Interpretation.
      2. Requests for substitution.
      3. Shop drawings, product data, and samples.
      4. Test and inspection reports.
      5. Design data.
      6. Manufacturer's instructions and field reports.
      7. Applications for payment and change order requests.
      8. Progress schedules.
      9. Coordination drawings.
      10. Correction Punch List and Final Correction Punch List for Substantial Completion.
11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL

A. See Section 01.78.50 - HPBr Reporting for electronic submittal service for sustainable design documentation.

B. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format and transmitted via an Internet.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g., supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. It is Contractor's responsibility to submit documents in allowable format.
   3. Users need an email address, Internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com).
   4. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

3.02 PRECONSTRUCTION MEETING

A. Project Coordinator will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   3. Contractor.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contract, ________ and Architect.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

A. Project Coordinator will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

B. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Contractor's superintendent.
   5. Major subcontractors.
C. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Maintenance of progress schedule.
   7. Corrective measures to regain projected schedules.
   8. Planned progress during succeeding work period.
  10. Effect of proposed changes on progress schedule and coordination.
  11. Other business relating to work.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PROGRESS PHOTOGRAPHS

A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
B. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.
C. Photography Type: Digital; electronic files.
D. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.
E. In addition to periodic, recurring views, take photographs of each of the following events:
   1. Completion of site clearing.
   2. Excavations in progress.
   3. Foundations in progress and upon completion.
   4. Structural framing in progress and upon completion.
   5. Enclosure of building, upon completion.
F. Views:
   1. Provide aerial photographs from four cardinal views at each specified time, until structure is enclosed.
   2. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
   3. Consult with Architect for instructions on views required.
   4. Provide factual presentation.
   5. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

G. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
   1. Delivery Medium: Via email.
   2. File Naming: Include project identification, date and time of view, and view identification.
   3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
   4. Photo CD(s): Provide 1 copy including all photos cumulative to date and PDF file(s), with files organized in separate folders by submittal date.

3.05 COORDINATION DRAWINGS

A. Provide information required by Project Coordinator for preparation of coordination drawings.
B. Review drawings prior to submission to Architect.

3.06 SUBMITTALS FOR REVIEW
A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.
B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
C. Samples will be reviewed for aesthetic, color, or finish selection.
D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01.78.21 - Closeout Submittals.

3.07 SUBMITTALS FOR INFORMATION
A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. HPBr Design Guidelines submittals and reports.
   3. Certificates.
   4. Test reports.
   5. Inspection reports.
   6. Manufacturer's instructions.
   7. Manufacturer's field reports.
   8. Other types indicated.
B. Submit for Architect's knowledge as contract administrator or for Owner.

3.08 SUBMITTALS FOR PROJECT CLOSEOUT
A. Submit Correction Punch List for Substantial Completion.
B. Submit Final Correction Punch List for Substantial Completion.
C. When the following are specified in individual sections, submit them at project closeout in conformance to requirements of Section 01.78.00 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   5. Other types as indicated.
D. Submit for Owner's benefit during and after project completion.

3.09 NUMBER OF COPIES OF SUBMITTALS
A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.10 SUBMITTAL PROCEDURES
A. General Requirements:
B. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
   2. Do not reproduce the Contract Documents to create shop drawings.
   3. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.
C. Transmit each submittal with a copy of approved submittal form.
D. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
E. Identify Project, SBC Number, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
F. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
G. Schedule submittals to expedite the Project, and coordinate submission of related items.
H. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
I. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
J. Provide space for Contractor and Architect review stamps.
K. When revised for resubmission, identify all changes made since previous submission.
L. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
M. Submittals not requested will not be recognized or processed.

END OF SECTION 01.30.00
PART 1 - GENERAL

1.01 SCHEDULING AND ATTENDANCE

A. The Designer, in cooperation with the Owner and the Contractor, will schedule and administer a Pre-Construction Conference, periodic Progress Meetings, and other specially called or required meetings.

B. Representatives of the Owner and the Designer will attend.

C. Representatives of the Contractor, subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents. In the case of the Contractor, the representative shall be one who is authorized to sign change orders.

1.02 PRE-CONSTRUCTION CONFERENCE

A. A Pre-Construction Conference will be scheduled and conducted at the project site prior to the issuance of the Notice to Proceed.

B. The Pre-Construction Conference shall be attended by the Contractor's:
   1. (Office) Job Manager
   2. (Field) Job Superintendent
   3. Major subcontractors' representatives
   4. Major suppliers' representatives
   5. Others, as desired.

C. The Pre-Construction Conference is intended to be an opportunity for the Contractor to review administrative, procedural, and temporary facilities requirements of the Contract Documents, and to ask questions concerning the Work.

1.03 PROGRESS MEETINGS

A. Progress Meetings will be scheduled and conducted at the project site, typically twice-monthly, or when deemed advisable by the Designer.

B. Progress Meetings shall be attended by the Contractor's:
   1. (Office) Job Manager
   2. (Field) Job Superintendent
   3. Subcontractors' representatives, as befits the agenda
   4. Suppliers' representatives, as befits the agenda
   5. Others, as appropriate.

C. Progress Meetings are intended to include a monthly opportunity for the Contractor to submit applications for payment, signing of change orders by Designer and Contractor, a general review of the progress of the Work, and identifying and mitigating impediments to timely completion.

D. Progress Meetings will be scheduled and conducted until final completion.

END OF SECTION
SECTION 01 31 90
ADMINISTRATIVE LOGS

PART 1 - GENERAL

1.01 SUBMITTALS LOG

A. If any shop drawings, product data, or sample submittals are required by the Contract Documents, maintain a submittals log to record the status of submittals made to the Designer.

1. Submit three (3) copies with each application for payment.
2. Clearly identify the Project.
3. Record activities with respect to shop drawings, product data, samples, and such other submittals which are required by the Contract Documents.
4. Indicate for each submittal made to date:
   a. Title or name, and type of submittal.
   b. Date submitted to the Designer.
   c. Date returned by the Designer.
   d. General nature of the Designer’s response.

1.02 VISITOR LOG

A. Maintain visitor log in the field office (or with the Project Superintendent when no field office is required) to record visits by all persons not a part of the Contractor’s forces, materials suppliers, or subcontractors’ forces, until substantial completion of the entire Work.

1. Submit a copy with each counterpart of each application for payment, covering the period since the last log(s) submitted.
2. Clearly identify the Project.
3. Use the form of specification Section 01 31 93, and indicate:
   a. Visitor name and affiliation.
   b. Date and time of visit.
   c. Length of time on site.

END OF SECTION
Please print information below if you represent the Owner, institution, Designer or a consultant, a testing agency engaged by the Owner or Designer, a regulatory authority, or yourself as a private individual. Please estimate how long you will be on site, rather than logging out when you leave.

Persons who are employed by the Contractor, a subcontractor, a sub-subcontractor, a supplier, or a testing agency engaged by any of these, are NOT VISITORS, and should not log in on this Log.

<table>
<thead>
<tr>
<th>Name</th>
<th>Representing</th>
<th>Arrival Date &amp; Time</th>
<th>how long on site</th>
<th>phone number while on site</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PART 1 - GENERAL

1.01 INITIAL PROGRESS SCHEDULE

A. Submit within 21 days of award of the Contract, and not later than the date of submission of the first application for payment. Clearly identify the Project on the schedule.

B. Outline the orderly progress of the Work as planned from the Notice to Proceed through Substantial Completion on the contractually required date. Categorize the Work by Phase (if Phases are specified), major work area, and distinct trade or team, and divide into individual activities of one month or less duration each. Provide an identifiable relationship to the schedule of values. Identify projected monthly progress, points of 50% completion, Substantial Completion, and final completion, and other major milestones. If included in the Work, Commissioning activities and Storm Water Pollution protection Plan (SWPPP) activities shall be among those major milestones. If planting or landscaping that is seasonally sensitive is included in the Work, show that portion of Work distinctly during a seasonally appropriate time.

C. A bar chart or critical path method is acceptable, or other method which is approved by the Designer. Since requests and claims for extension of time require demonstrating effect upon the critical path of Work, a critical path method schedule is recommended, and may be required as supporting documentation to prove validity of a requested or claimed time extensions.

1.02 SUBMITTALS SCHEDULE

A. Submit with the initial Progress Schedule. Clearly identify the Project, and format in a manner similar to the initial progress schedule, utilizing the same method, or make a part of the initial Progress Schedule.

B. Identify submittals to be made. Show date for submission and date by which Designer should respond, allowing sufficient time for review.

C. Designer may require revision of schedule if times allotted for review are insufficient.

1.03 UPDATED PROGRESS SCHEDULE

A. Submit a copy attached to each counterpart of applications for payment.

B. Clearly identify the Project. Format in a manner similar to the initial progress schedule, utilizing the same method.

C. Indicate:
   1. Work as initially scheduled.
   2. Actual progress through the period covered by the current application for payment.
   3. Planned progress through Substantial Completion, including extensions of time made by change order or construction change directive.

D. If actual progress falls behind projections, show how the backlog is to be made up so that the Work will be completed on time.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. References and standards.
   B. Control of installation.
   C. Mock-ups.
   D. Tolerances.
   E. Defect Assessment.

1.02 REFERENCES AND STANDARDS
   A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
   B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
   C. Obtain copies of standards where required by product specification sections.
   D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
   E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
   F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

PART 3 EXECUTION

2.01 CONTROL OF INSTALLATION
   A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
   B. Comply with manufacturers' instructions, including each step in sequence.
   C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
   D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
   E. Have Work performed by persons qualified to produce required and specified quality.
   F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
   G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.
2.02 MOCK-UPS
   A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
   B. Integrated Exterior Mock-ups: construct integrated exterior mock-up as indicated on Drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
   C. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
   D. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
   E. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
   F. Accepted mock-ups shall be a comparison standard for the remaining Work.
   G. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

2.03 TOLERANCES
   A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
   B. Comply with manufacturers’ tolerances. Should manufacturers’ tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
   C. Adjust products to appropriate dimensions; position before securing products in place.

2.04 DEFECT ASSESSMENT
   A. Replace Work or portions of the Work not conforming to specified requirement
# PART 1 - GENERAL

## 1.01 CODES AND REGULATIONS

**A.** The Regulatory Requirements used for Tennessee Board of Regents projects are listed below as a convenience and may not be inclusive of all that apply. Others may also apply. Comply with all pertinent codes, standards, regulations and laws.

<table>
<thead>
<tr>
<th>Document</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. NFPA 101 Life Safety Code, 2012 No provision of the preceding cited publications shall be adopted that conflicts: The installation and service standards of portable fire extinguishers and fixed fire extinguisher systems in Tenn. Comp. R. &amp; Regs. 0780-02-14-.02; and, The standards for engaging in the liquefied petroleum gas business in Tenn. Comp. R. &amp; Regs. 0780-02-17-.02. Paragraph (1) of this rule shall not be construed as adopting any provision of the cited publications which establishes: and optional or recommended, rather than mandatory, standard or practice; or, any agency, procedure, fees or penalties for administration or enforcement purposes inconsistent with the statute or rules. 2008 National Electrical Code</td>
<td>National Fire Protection Association 1 Batterymarch Park Quincy, Massachusetts 02169-7471 (800) 344-3555</td>
</tr>
<tr>
<td>3. 2007 Tennessee Elevator Safety Board Rules Chapter 0800-3-4 Elevators, Dumbwaiters, Escalators, and other Lifts 2007 Board of Boiler Rules Chapter 0800-3-3 Boiler Inspections</td>
<td>Tn. Dept. of Labor and Workforce Development Div. of Boiler, Elevator &amp; Amusement Device Inspection 220 French Landing Drive Nashville, TN 37243-1006 (615) 741-2123</td>
</tr>
<tr>
<td>4. ASHRAE standard 62.1-2013 Ventilation for Acceptable Indoor Air Quality</td>
<td>American Society of Heating, Refrigerating &amp; Air Conditioning Engineers 1791 Tullie Circle NE Atlanta, Georgia 30329 (404) 636-8400</td>
</tr>
<tr>
<td>5. Tennessee Chapters 0780-2-1, Electrical Installations 0780-2-2, Codes &amp; Standards 0780-2-3, Plan &amp; Spec Review 0780-2-18, Equitable Restrooms</td>
<td>Department of Commerce and Insurance Fire Prevention Division Codes Enforcement Section 500 James Robertson Parkway Nashville, Tennessee 37243-1162 (615) 741-2981</td>
</tr>
</tbody>
</table>
### Basic Regulatory Requirements

#### 6. ADA Title II, State and local government facilities must follow the requirements of the 2010 standards, including both the Title II regulations at 28 CFR 35.151 and the 2004 ADAAG at 36 CFR part 1191, appendices B and D. In the few places where requirements between the two differ, the requirements of 28 CFR 35.151 prevail. The compliance date is March 15, 2012, for all newly constructed or altered State and local government facilities permitted after this date.

ADA Title III, Public accommodations and commercial facilities must follow the requirements of the 2010 standards, including both the Title III regulations at 28 CFR part 36, subpart D: and the 2004 ADAAG at 36 CFR part1191, appendices B and D. In the few places where requirements between the two differ, the requirements of 28 CFR part 36, subpart D prevail. The compliance date is March 15, 2012, for all newly constructed or altered facilities permitted after this date.

#### 7. TDEC Division of Water Pollution Control  Tennessee water quality control act of 1977 (TCA 69-3-101)
SECTION 01 43 25
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 CONTRACTOR'S RESPONSIBILITIES

A. Employ and pay for the services of an independent testing laboratory, approved by the Designer, to perform specified services and testing. Employment of laboratory does not relieve Contractor's obligations to perform the Work of the Contract.

B. Coordinate and pay for inspections and testing required by law, ordinance, rules, regulations, orders, or approvals of public authorities as required by the Contract Documents.
   1. Furnish copies of Products Test reports as required.
   2. Furnish incidental labor and facilities to facilitate inspections and tests and for storage and curing of test samples.
   3. Notify the lab sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.
   4. Make arrangements with lab and pay for additional samples and tests required for Contractor's convenience.

1.02 TESTING LABORATORY

A. Qualifications:
   1. Meet "Recommended Requirements for Independent Laboratory Qualification", published by the American Council of Independent Laboratories, and Basic requirements of ASTM E 329 "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction".
   2. Be authorized to operate in the State of Tennessee.
   3. Submit copies to the Designer of the report of inspection of facilities made by Materials Reference Laboratory of National Bureau of Standards during the most recent tour of inspection with the memorandum of remedies of any deficiencies reported by the inspection.

B. Duties and limitations of authority:
   1. Perform specified inspections, sampling, and testing of materials and methods of construction and promptly submit five copies of the written report of each test and inspection to the Designer.
   2. Laboratory is not authorized to release, revoke, alter or enlarge on requirements of the Contract Documents, approve or accept portions of the Work, or perform duties of the Contractor.

END OF SECTION
SECTION 01.45.33
CODE-REQUIRED SPECIAL INSPECTIONS

PART 1  GENERAL

1.01  SECTION INCLUDES

A. Code-required special inspections.
B. Testing services incidental to special inspections.
C. Submittals.

1.02  RELATED REQUIREMENTS

A. Section 01.30.00 - Administrative Requirements: Submittal procedures.
B. Section 01/43.25 - Testing Laboratory Services.

1.03  DEFINITIONS

B. Authority Having Jurisdiction (AHJ):  Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
C. International Accreditation Service, Inc. (IAS).
D. National Institute of Standards and Technology (NIST).
E. Special Inspection:
   1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved contract documents and the referenced standards.
   2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.04  REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
I. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops; 2014.
O. IAS AC291 - Accreditation Criteria for Special Inspection Agencies; 2012.

1.05 SUBMITTALS
A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency shall:
   1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Submit certification that Special Inspection Agency is acceptable to AHJ.
   4. Submit documentation that Special Inspection Agency is accredited by IAS according to IAS AC291.
C. Special Inspection Reports: After each special inspection, Special Inspector shall promptly submit two copies of report; one to Architect and one to the AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of Special Inspector.
      d. Date and time of special inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of special inspection.
      h. Date of special inspection.
      i. Results of special inspection.
      j. Conformance with Contract Documents.

1.06 SPECIAL INSPECTION AGENCY
A. Construction Manager will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.
B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.07 TESTING AND INSPECTION AGENCIES

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL
A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
   1. Continuous Special Inspection: Special Inspection Agency shall be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspection: Special Inspection Agency shall be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

3.02 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

A. High-Strength Bolt, Nut and Washer Material:
   1. Verify identification markings conform to ASTM standards specified in the approved contract and to AISC 360, Section A3.3; periodic.
   2. Submit manufacturer's certificates of compliance; periodic.

B. High-Strength Bolting Installation: Verify items listed below comply with AISC 360, Section M2.5.
   1. Snug tight joints; periodic.
   2. Pretensioned and slip-critical joints with matchmarking, twist-off bolt or direct tension indicator method of installation; periodic.

C. Structural Steel and Cold Formed Steel Deck Material:
   1. Structural Steel: Verify identification markings conform to AISC 360, Section M3.5; periodic.
   2. Other Steel: Verify identification markings conform to ASTM standards specified in the approved contract documents; periodic.
   3. Submit manufacturer's certificates of compliance and test reports; periodic.

D. Weld Filler Material:
   1. Verify identification markings conform to AWS standards specified in the approved contract documents and to AISC 360, Section A3.5; periodic.
   2. Submit manufacturer's certificates of compliance; periodic.

E. Welding:
   1. Structural Steel and Cold Formed Steel Deck:
      c. Single Pass Fillet Welds 5/16 inch or Greater: Verify compliance with AWS D1.1/D1.1M; continuous.
      d. Floor and Roof Deck Welds: Verify compliance with AWS D1.3/D1.3M; continuous.
      e. Reinforcing Steel: Verify items listed below comply with AWS D1.4/D1.4M and ACI 318, Section 3.5.2.
         a. Verification of weldability; periodic.
         b. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames as well as boundary elements of special structural walls of concrete and shear reinforcement; continuous.
         c. Shear reinforcement; continuous.
         d. Other reinforcing steel; periodic.

F. Steel Frame Joint Details: Verify compliance with approved contract documents.
   1. Details, bracing and stiffening; periodic.
   2. Member locations; periodic.
   3. Application of joint details at each connection; periodic.

3.03 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

A. Reinforcing Steel, Including Prestressing of Tendons and Placement: Verify compliance with approved contract documents and ACI 318, Sections 3.5 and 7.1 through 7.7; periodic.

B. Reinforcing Steel Welding: Verify compliance with AWS D1.4/D1.4M and ACI 318, Section 3.5.2; periodic.
C. Bolts Installed in Concrete: Where allowable loads have been increased or where strength design is used, verify compliance with approved contract documents and ACI 318, Sections 8.1.3 and 21.2.8 prior to and during placement of concrete; continuous.

D. Anchors Installed in Hardened Concrete: Verify compliance with ACI 318, Sections 3.8.6, 8.1.3, and 21.2.8; periodic.

E. Design Mix: Verify plastic concrete complies with the design mix in approved contract documents and with ACI 318, Chapter 4 and 5.2; periodic.

F. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172/C172M, ASTM C31/C31M and ACI 318, Sections 5.6 and 5.8 and record the following, continuous:
   1. Slump.
   2. Air content.
   3. Temperature of concrete.

G. Specified Curing Temperature and Techniques: Verify compliance with approved contract documents and ACI 318, Sections 5.11 through 5.13; periodic.

3.04 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION

A. Masonry Structures Subject to Special Inspection:
   1. Engineered masonry in structures classified as "low hazard..." and "substantial hazard to human life in the event of failure".

B. Verify each item below complies with approved contract documents and the applicable articles of ACI 530/530.1/ERTA.
   1. Inspections and Approvals:
      a. Verify compliance with the required inspection provisions of the approved contract documents; periodic.
      b. Verify approval of submittals required by contract documents; periodic.
   2. Compressive Strength of Masonry: Verify compressive strength of masonry units prior to start of construction unless specifically exempted by code; periodic.
   4. Joints and Accessories: When masonry construction begins, verify:
      a. Proportions of site prepared mortar; periodic.
      b. Construction of mortar joints; periodic.
      c. Location of reinforcement, connectors, prestressing tendons, anchorages, etc; periodic.
   5. Structural Elements, Joints, Anchors, Protection: During masonry construction, verify:
      a. Size and location of structural elements; periodic.
      b. Type, size and location of anchors, including anchorage of masonry to structural members, frames or other construction; periodic.
      c. Size, grade and type of reinforcement, anchor bolts and prestressing tendons and anchorages; periodic.
      d. Welding of reinforcing bars; continuous.
   6. Grouting Preparation: Prior to grouting, verify:
      a. Grout space is clean; periodic.
      b. Correct placement of reinforcing, connectors, prestressing tendons and anchorages; periodic.
      c. Correctly proportioned site prepared grouts and prestressing grout for bonded tendons; periodic.
      d. Correctly constructed mortar joints; periodic.
3.05 SPECIAL INSPECTIONS FOR SOILS

A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
   1. Design bearing capacity of material below shallow foundations; periodic.
   2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
   3. Materials, densities, lift thicknesses; placement and compaction of backfill; continuous.
   4. Subgrade, prior to placement of compacted fill; periodic.

B. Testing: Classify and test excavated material; periodic.

3.06 SPECIAL INSPECTIONS FOR MICROPILES FOUNDATIONS

A. Materials, Equipment and Final Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
   1. Element length; continuous.
   2. Element diameters and materials; continuous.
   3. Embedment into bedrock; continuous.
   4. End bearing strata capacity; continuous.
   5. Placement locations and plumbness; continuous.
   6. Capacities of test elements and additional tests, as required.

B. Drilling Operations: Observe and maintain complete and accurate records for each element; continuous.

C. Material Volume: Record concrete and grout volumes.

D. Concrete Elements Associated with Deep Foundations: Perform additional inspections as required by the Special Inspections for Concrete Construction article of this section.

3.07 SPECIAL INSPECTIONS FOR SPRAYED FIRE RESISTANT MATERIALS

A. Sprayed Fire Resistant Materials, General:
   1. Verify compliance of sprayed-fire resistant materials with specific fire-rated assemblies indicated in approved contract documents, and with applicable requirements of the building code.
   2. Perform special inspections after rough installation of electrical, mechanical, plumbing, automatic fire sprinkler and suspension systems for ceilings.

B. Physical and visual tests: Verify compliance with fire resistance rating.
   1. Condition of substrates; periodic.
   2. Thickness of sprayed fire resistant material; periodic.
   3. Density of sprayed fire resistant material in pounds per cubic foot; periodic.
   4. Bond strength (adhesion and cohesion); periodic.
   5. Condition of finished application; periodic.

C. Structural member surface conditions:
   1. Inspect structural member surfaces before application of sprayed fire resistant materials; periodic.
   2. Verify preparation of structural member surfaces complies with approved contract documents and manufacturer's written instructions; periodic.

D. Application:
   1. Ensure minimum ambient temperature before and after application complies with the manufacturer's written instructions; periodic.
   2. Verify area where sprayed fire resistant material is applied is ventilated as required by the manufacturer's written instructions during and after application; periodic.

E. Thickness: Verify that no more than 10 percent of thickness measurements taken from sprayed fire resistant material are less than thickness required by fire resistance design in approved contract documents. In no case shall the thickness of the sprayed fire resistant material be less than the minimum below.
   1. Minimum Allowable Thickness: Tested according to ASTM E605, periodic.
      a. Design thickness 1 inch or greater: Design thickness minus 1/4 inch.
b. Design thickness greater than 1 inch: Design thickness minus 25 percent.

F. Density: Verify density of sprayed fire resistant material is no less than density required by the fire resistance design in the approved contract documents.

G. Bond Strength: Verify adhesive and cohesive bond strength of sprayed fire resistant materials is no less than 150 pounds per square foot when in-place samples of the cured material are tested according to ASTM E736 and as described below.

3.08 SPECIAL INSPECTIONS FOR MASTIC AND INTUMESCENT FIRE RESISTANT COATINGS
A. Verify mastic and intumescent fire resistant coatings comply with AWCI 117 and the fire resistance rating indicated on approved contract documents.

3.09 SPECIAL INSPECTIONS FOR FIRE RESISTANT PENETRATIONS AND JOINTS
A. Verify penetration firestops in accordance with ASTM E2174.
B. Verify fire resistant joints in accordance with ASTM E2393.

3.10 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES
A. Special Inspection Agency shall:
   2. Perform specified sampling and testing of products in accordance with specified reference standards.
   3. Ascertain compliance of materials and products with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests or inspections specified.
B. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.
C. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.11 TESTING AGENCY DUTIES AND RESPONSIBILITIES
A. Testing Agency Duties:
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests or inspections specified.
B. Limits on Testing or Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the work.
C. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.
D. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.
3.12 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. Contractor Responsibilities, General:
   1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
   2. Cooperate with agency and laboratory personnel; provide access to the work, to manufacturers' facilities, and to fabricators' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to work to be tested or inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
      c. To facilitate tests or inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
   5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

   END OF SECTION 01.45.33
Mccarty Holsaple McCarty, Inc. East Tennessee State University
Fine Arts Classroom Building
SBC No. 166/005-08-2013 CM

CODE-REQUIRED SPECIAL INSPECTIONS

DESIGN RELEASE PACKAGE 3
ISSUED: 10/16/2017
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Utility Outage and Shutdown
   B. Temporary utilities.
   C. Temporary telecommunications services.
   D. Temporary sanitary facilities.
   E. Temporary Controls: Barriers and fencing.
   F. Security requirements.
   G. Decorum
   H. Vehicular access and parking.
   I. Staging
   J. Waste removal facilities and services.
   K. Project identification sign.
   L. Field offices.

1.02 UTILITY OUTAGE AND SHUTDOWN
   A. Prevent accidental disruption of utility services to other facilities.
   B. Schedule shutdown of utility services as coordinated with the Owner, arranged at least 24 hours in advance.
   C. Owner's point of contact for utilities is Eddie Harkleroad at 423-439-7749.

1.03 TEMPORARY UTILITIES
   A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
   B. New permanent facilities may be used.
   C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.04 TELECOMMUNICATIONS SERVICES
   A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
   B. Telecommunications services shall include:
      1. Telephone Land Lines: One line, minimum; one handset per line.
      2. Internet Connections: Minimum of one; DSL modem or faster.
      3. Facsimile Service: Minimum of one dedicated fax machine/printer, with dedicated phone line.

1.05 TEMPORARY SANITARY FACILITIES
   A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
   B. Maintain daily in clean and sanitary condition.

1.06 BARRIERS
   A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
C. Provide protection for plants designated to remain. Replace damaged plants.
D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING
A. Construction: Commercial grade chain link fence.
B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.08 SECURITY
A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
B. Coordinate with Owner's security program.

1.09 DECORUM
A. Employees and other workers shall at all times exhibit appropriate behaviour with students and faculty.
B. Employees on site shall have passed a Tennessee Criminal History Records Check and be in conformance with the Drug-Free Workplace Requirements of Tennessee Law
C. Employees shall comply with Owner's regulations regarding alcohol, tobacco, identification, etc..

1.10 VEHICULAR ACCESS AND PARKING
A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
B. Coordinate access and haul routes with governing authorities and Owner.
C. Provide and maintain access to fire hydrants, free of obstructions.
D. Provide means of removing mud from vehicle wheels before entering streets.
E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, coordinate additional parking with Owner.
F. Do not allow vehicle parking on existing pavement.

1.11 STAGING
A. Contractor shall coordinate all staging area requirements.
B. Should site space not be adequate, Contractor shall arrange for off-site staging or warehouse facilities.

1.12 WASTE REMOVAL
A. See Section 01.74.19 - Construction Waste Management and Disposal, for additional requirements.
B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
C. Provide containers with lids. Remove trash from site periodically.
D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.13 PROJECT IDENTIFICATION
A. Provide project identification sign of design and construction as approved.
B. Erect on site at location established by Architect.
C. No other signs are allowed without Owner permission except those required by law.

1.14 FIELD OFFICES
A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack and drawing display table.
B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
C. Locate offices a minimum distance of 30 feet from existing and new structures.

1.15 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS
A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
C. Clean and repair damage caused by installation or use of temporary work.
D. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01.50.00
SECTION 01 57 23
TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

1.01 JURISDICTION

This project is under the jurisdiction of the Tennessee Department of Environment and Conservation (TDEC) and a Storm Water Pollution Prevention Plan (SWPPP) has been filed. TDEC has provided a Construction General Permit (CGP) Notice of Coverage (CGP-NOC or just NOC). Under a NOC, the Owner is primary permittee, and the Contractor is considered a secondary permittee and may be referred to as a Construction Site Operator, by virtue of having day-to-day operational control of those activities at a project which are necessary to ensure compliance with a SWPPP for the site or other permit conditions.

1.02 RELATED SECTIONS

A. Copies of the NOC and SWPPP are normally included in the specifications but formatted without a specification section number. They may follow this Section or may be added by addendum or modification, and are to be considered a part of this Section. A copy of each, not bound into larger volumes of the Contract Documents, may be obtained from the Designer for ease of carrying out the requirements below.

B. Other technical aspects of the SWPPP are described in the Contract Documents where appropriate.

1.03 BASIC COORDINATION AND MONITORING

A. NOC: Post a copy of the NOC in a prominent, public location, such as a general notices board where building permit, employment regulations, and prevailing wage rates are posted. Protect the NOC from weather without obstructing its visibility. Repair or replace the NOC if it becomes damaged or missing.

B. SWPPP:

1. Maintain a copy of the SWPPP on site at all times. If a construction office/trailer is on site, keep the SWPPP documents inside it in a designated location. If there is no office/trailer, construct a SWPPP box and store the SWPPP documents therein. If the site is inactive, or does not have an on-site location adequate to store and protect the SWPPP, post a notice alongside the NOC telling where the SWPPP is stored, with a contact name and phone number. If the SWPPP is located off-site, provide reasonable local access to it during normal working hours.

2. Make updated plans and inspection reports available upon request to the operator of the local MS4, inspectors, and local agencies approving EPSC plans, grading plans, or storm water management plans.

C. RAINFALL MONITORING:

1. Maintain a rain gage on site, or determine a reliable local reference resource for rainfall monitoring. Some TBR campuses have such a resource. A resource off of the immediate campus where the project is located is not adequately local for normal daily readings. On days when Contractor's forces are not on site, if an on-campus local resource is unavailable, a rainfall reading can be obtained from a reliable nearby resource.

2. Take 24-hour rainfall depth measurement readings at a consistent time of day each day. When a rain event occurs, record the approximate beginning and ending time. Record the daily readings on the Weather Delay Report, Section 01 26 25, even if Work is not delayed.

3. Keep a copy of rainfall records with the SWPPP.
D. **EPSC FIELD PLANS:** A set of Erosion Prevention and Sediment Control (EPSC) plans shall be designated “field plans” and used to show modifications and updates and the date of each change, which can be hand-written on the sheets. Maintain these field plans nearby the overall project record documents.

E. **SITE ASSESSMENT:** As soon as SWPPP Site Assessment features are in place, notify the Designer that the Work is ready for the SWPPP Site Assessment.

F. **TWICE-WEEKLY INSPECTIONS:**

1. Conduct inspections of the storm water control measures twice-weekly and at least seventy-two (72) hours apart. Where sites or portion(s) of sites have been temporarily stabilized, or runoff is unlikely due to extreme drought, or winter conditions such as freezing or snow or ice covering, written notification may be submitted to the local environmental field office that inspections are being curtailed; and, if not objected to by that office, then such inspection may be conducted only once per month until construction activity resumes or thaw or precipitation results in runoff. Inspection requirements do not apply after Work has achieved final stabilization.

2. The person making the inspections must have active certification, having completed the TDEC “Fundamentals of Erosion Prevention and Sediment Control Level 1” course.

3. A “Construction Stormwater Inspection Certification (Twice-Weekly Inspections)” form must be filled out by the inspector for each inspection. Keep copies of completed forms with the SWPPP. Blanks of this form can be found in the Tennessee Erosion and Sediment Control Handbook, Fourth Edition, August 2012, appendix C, as issued by the Tennessee Department of Environment and Conservation.

G. **FINAL STABILIZATION:** Submit statement of final stabilization to the Designer when permanent site work is in place and temporary storm water control measures have been removed, typically when requesting substantial completion inspection, at the substantial completion inspection, or when requesting final inspection. Final stabilization is defined as seventy percent (70%) density of a permanent groundcover over all previously disturbed area(s).

H. **RECORD DOCUMENTS:** In addition to keeping the Project Record Documents complete with as-built conditions, at Final Stabilization assemble all twice-weekly inspection reports and site audit reports, and include these in the Project Data Binders.

**PART 2 – PRODUCTS**

**PART 3 – EXECUTION**

**END OF SECTION**
SECTION 01.60.00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data Submittals: Submit manufacturer’s standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. DO NOT USE products having any of the following characteristics:

C. Where all other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions, as defined in Section 01.61.16.
   2. If wet-applied, have lower VOC content, as defined in Section 01.61.16.
   3. Have a published GreenScreen Chemical Hazard Analysis.

2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01.25.00 - Substitution Procedures.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

C. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
3.02 TRANSPORTATION AND HANDLING
A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
D. Transport and handle products in accordance with manufacturer's instructions.
E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION
A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
B. Store and protect products in accordance with manufacturers' instructions.
C. Store with seals and labels intact and legible.
D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
E. For exterior storage of fabricated products, place on sloped supports above ground.
F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
G. Comply with manufacturer's warranty conditions, if any.
H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
I. Prevent contact with material that may cause corrosion, discoloration, or staining.
J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 01.60.00
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Requirements for Indoor-Emissions-Restricted products.
B. Requirements for VOC-Content-Restricted products.
C. Requirement for installer certification that they did not use any non-compliant products.

1.02 RELATED REQUIREMENTS
A. Section 01.30.00 - Administrative Requirements: Submittal procedures.
B. Section 01.62.25 - Product Options: Requirements related to product substitutions.
C. Section 07.92.00 - Joint Sealants: Emissions-compliant sealants.

1.03 DEFINITIONS
A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
1. Interior paints and coatings.
2. Interior adhesives and sealants, including flooring adhesives.
3. Flooring.
4. Products making up wall and ceiling assemblies.
5. Thermal and acoustical insulation.
B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
1. Interior paints and coatings.
2. Interior adhesives and sealants, including flooring adhesives.
C. Interior of Building: Anywhere inside the exterior weather barrier.
D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
1. Concrete.
2. Clay brick.
3. Metals that are plated, anodized, or powder-coated.
4. Glass.
5. Ceramics.
6. Solid wood flooring that is unfinished and untreated.

1.04 REFERENCE STANDARDS

D. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2007.


F. SCAQMD 1113 - South Coast Air Quality Management District Rule No.1113; current edition.

G. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

H. SCS (CPD) - SCS Certified Products; current listings at www.scscertified.com.


1.05 SUBMITTALS

A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.

B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

C. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of his products, or 2) that such products used comply with these requirements.

1.06 QUALITY ASSURANCE

A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
   1. Wet-Applied Products: State amount applied in mass per surface area.
   2. Paints and Coatings: Test tinted products, not just tinting bases.
   3. Evidence of Compliance: Acceptable types of evidence are the following:
      a. Current UL (GGG) certification.
      b. Current SCS (CPD) Floorscore certification.
      c. Current SCS (CPD) Indoor Advantage Gold certification.
      d. Current listing in CHPS (HPPD) as a low-emitting product.
      e. Current CRI (GLP) certification.
      f. Test report showing compliance and stating exposure scenario used.
   4. Product data submittal showing VOC content is NOT acceptable evidence.
   5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.

B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed in accordance with requirements.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
   1. Inherently Non-Emitting Materials.

C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
   3. Paints and Coatings: Each color; most stringent of the following:
      a. 40 CFR 59, Subpart D.
      b. SCAQMD 1113 Rule.
      c. CARB (SCM).

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION 01.61.16
PART 1 - GENERAL

1.01 ENVIRONMENTAL HAZARDOUS PRODUCTS, MATERIALS, OR WASTES

A. Do not incorporate in the Work hazardous materials or products as currently defined in the Resource Conservation and Recovery Act of 1976 (RCRA), the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), or Environmental Protection Agency (EPA) regulations, rules, or requirements, as amended, unless the Contract Documents give no other option than to provide a material or product which contains a hazardous material, component, constituent, waste, or leachate. In studying the Contract Documents and carrying out the Work, report at once to the Designer the discovery of a product or material which contains hazardous materials, components, constituents, waste, or leachate.

B. Do not incorporate in the Work a product or material which contains concentrations of a constituent, component, or material above the threshold levels which would require adherence to hazardous waste disposal regulations as currently defined, or could cause a release or threat of release of a hazardous substance at a level that would require a remedial response or removal action as currently defined by RCRA, CERCLA, or the EPA.

C. Select materials and products meeting specified requirements which comply with EPA requirements as regards hazardous materials content. In making requests for substitutions, determine that materials and products proposed for substitution comply with RCRA, CERCLA, and EPA requirements.

END OF SECTION
SECTION 01.70.00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Examination, preparation, and general installation procedures.
B. Cutting and patching.
C. Cleaning and protection.

1.02 RELATED REQUIREMENTS
A. Section 07.84.00 - Firestopping.

1.03 QUALIFICATIONS
A. For survey work, employ a land surveyor registered in Tennessee and acceptable to Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

1.04 PROJECT CONDITIONS
A. Use of explosives is not permitted.
B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
D. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

1.05 COORDINATION
A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
B. Notify affected utility companies and comply with their requirements.
C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
F. Contractor shall ensure that cutting and patching in Noise Critical construction does not compromise the acoustical performance of those constructions.
G. Coordinate completion and clean-up of work of separate sections.
H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.
PART 2 PRODUCTS

2.01 PATCHING MATERIALS
   A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
   B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
   C. Examine and verify specific conditions described in individual specification sections.
   D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
   E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
   F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION
   A. Clean substrate surfaces prior to applying next material or substance.
   B. Seal cracks or openings of substrate prior to applying next material or substance.
   C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 LAYING OUT THE WORK
   A. Verify locations of survey control points prior to starting work.
   B. Promptly notify Architect of any discrepancies discovered.
   C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
   D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
   E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
   F. Utilize recognized engineering survey practices.
   G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
      1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
      2. Grid or axis for structures.
      3. Building foundation, column locations, ground floor elevations.
   H. Periodically verify layouts by same means.
   I. Maintain a complete and accurate log of control and survey work as it progresses.
3.04 GENERAL INSTALLATION REQUIREMENTS
A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 CUTTING AND PATCHING
A. Whenever possible, execute the work by methods that avoid cutting or patching.
B. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-conforming work.
C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
F. Restore work with new products in accordance with requirements of Contract Documents.
G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07.84.00, to full thickness of the penetrated element.
I. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.06 PROGRESS CLEANING
A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.07 PROTECTION OF INSTALLED WORK
A. Protect installed work from damage by construction operations.
B. Provide special protection where specified in individual specification sections.
C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

END OF SECTION 01.70.00
PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS
   A. Owner requires that this project generate the least amount of trash and waste possible.
   B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
   C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
   D. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
   E. Methods of trash/waste disposal that are not acceptable are:
      1. Burning on the project site.
      2. Burying on the project site.
      3. Dumping or burying on other property, public or private.
      4. Other illegal dumping or burying.
   F. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 DEFINITIONS
   A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
   B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
   C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
   D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
   E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
   F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
   G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
   H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
   I. Return: To give back reusable items or unused products to vendors for credit.
   J. Reuse: To reuse a construction waste material in some manner on the project site.
   K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
   L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
   M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.03 SUBMITTALS
A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
B. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
   1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
   2. Submit Report on a form acceptable to Owner.
   3. Landfill Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
      c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   4. Incinerator Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards, of trash/waste material from the project delivered to incinerators.
      c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   5. Recycled and Salvaged Materials: Include the following information for each:
      a. Identification of material, including those retrieved by installer for use on other projects.
      b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
      c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
      e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
   6. Material Reused on Project: Include the following information for each:
      a. Identification of material and how it was used in the project.
      b. Amount, in tons or cubic yards.
      c. Include weight tickets as evidence of quantity.
   7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 3 EXECUTION

2.01 WASTE MANAGEMENT PROCEDURES
A. See Section 01.30.00 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
B. See Section 01.50.00 for additional requirements related to trash/waste collection and removal facilities and services.
C. See Section 01.60.00 for waste prevention requirements related to delivery, storage, and handling.
D. See Section 01.70.00 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

2.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Pre-bid meeting.
   2. Pre-construction meeting.
   3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. Provide containers as required.
   2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION 01.74.19
McCarty Holsaple McCarty, Inc.
MANAGEMENT & DISPOSAL

East Tennessee State University
FINE ARTS CLASSROOM BUILDING
SBC No. 166/005-08-2013 CM

CONSTRUCTION WASTE

DESIGN RELEASE PACKAGE 4
ISSUED: 12/01/2017
SECTION 01 77 70
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 PRE-CLOSEOUT SUBMITTALS

A. Submit required tabulations when Work reaches seventy-five percent completion; however, regardless of percent completion, submit not later than 30 days prior to the scheduled date on which Substantial Completion is required.

B. Submit tabulations of:
   1. Equipment and systems for which the specifications require demonstrations or training, indicating relevant specification sections, scheduled time and place for demonstration and training sessions, and intended audience. Adjust schedule if instructed by Designer to do so.
   2. Equipment and systems for which operating and maintenance data are required in the Operating and Maintenance Data Binders and related documents are required in the Project Data Binders.
   3. Spare parts and extra materials required, indicating the relevant specification sections, and the appropriate party to whom the items are to be delivered.

1.02 REQUEST FOR CLOSEOUT INSPECTION

A. SUBSTANTIAL COMPLETION:
When Contractor considers Work substantially complete, Contractor shall submit to Designer:
   1. written assertion that Work is Substantially Complete;
   2. a list of items to be completed or corrected and dates scheduled for completion or correction of each item;
   3. certification that orientation and training for facility maintenance personnel is complete or written assertion that such orientation and training will be certified prior to inspection;
   4. written assertion that Operating & Maintenance Data Binders are complete and available or will be prior to inspection;
   5. when a Use and Occupancy Permit applies, a copy of the final approval(s), or written assertion that they will be complete and available prior to inspection;
   6. a draft of the application for payment corresponding to the substantial completion, with written assertion that an application for payment will be ready and submitted at the inspection;
   7. when there is Commissioning, written assertion that Commissioning requirements have been completed or will be prior to inspection.
   8. when there is a storm water permit, written statement of the status of final stabilization required under the Storm Water Pollution Prevention Plan (SWPPP) for the TDEC Construction General Permit (CGP) Notice of Termination (NOT).

B. FINAL INSPECTION:
When Contractor considers Work complete, Contractor shall submit to Designer:
   1. certification that a qualified person authorized by Contractor has reviewed the Contract Documents and inspected the Work;
   2. written assertion that the Work is complete and in accordance with Contract Documents and ready for Final Inspection;
   3. written assertion that additional materials necessary to augment the Operating & Maintenance Data Binders with instructions for adding these to the Binders, or full replacement Binders, are complete and available or will be prior to inspection;
   4. written assertion that Project Data Binders and Construction Record Documents are complete and available or will be prior to inspection; and,
   5. an application for final payment
C. Upon receipt of an appropriate request for inspection, Designer will schedule an inspection meeting with Contractor, and Owner's representatives to determine the status of completion.

1.03 RESULTS OF CLOSEOUT INSPECTIONS

A. Should the Designer determine that Work is not complete to the degree asserted by Contractor, Designer will promptly notify Contractor in writing stating the deficiencies. Contractor shall take immediate steps to remedy deficiencies and make a request for Re-Inspection.

B. SUBSTANTIAL COMPLETION: Designer will prepare a Certificate of Substantial Completion accompanied by a list of items to be completed or corrected, and will submit Certificate to Contractor and to Owner for signature with an accounting of Liquidated Damages due, when Designer verifies that:

1. Work is Substantially Complete based on an inspection conducted pursuant to an appropriate request for Closeout inspection;
2. orientation and training for facility maintenance personnel is complete; and,
3. Operating & Maintenance Data Binders are complete and have been delivered to the Owner.

C. FINAL INSPECTION: Designer will certify that the Work is Complete, and will initiate Final Adjustments, when Designer verifies that:

1. Work is complete in accordance with Contract Documents based on an inspection conducted pursuant to an appropriate request for Closeout inspection;
2. orientation and training for facility maintenance personnel is complete; and,
3. additional materials necessary to augment the Operating & Maintenance Data Binders with instructions for adding these to the Binders, or full replacement Binders, are complete and have been delivered to the Owner.
4. Project Data Binders and Construction Record Documents are complete and have been delivered to the Designer.

1.04 RE-INSPECTION FEES: If the Work fails a Closeout inspection, and a subsequent inspection is requested and conducted based on Contractor assertion of the same stage of completion, Owner will compensate Designer for performing such Re-Inspection as additional services, and deduct the amount of such compensation from the Contract Sum by appropriate modification.

1.05 FINAL ADJUSTMENTS

A. When Designer has certified that the Work is complete, Designer will determine whether modification is needed to reflect appropriate adjustments to Contract Sum which were not previously effected. If such modification is needed, Designer shall assist the Owner in its preparation and deliver it to Contractor, who in the case of a change order, shall sign and return it to Designer.

B. When Designer has certified that the Work and needed modifications to the Contract are complete, and if necessary, Designer will instruct Contractor to submit a revised final application for payment.

1.06 ONE-YEAR CORRECTIVE INSPECTION

A. An inspection will be scheduled and conducted at project site prior to one year from date Substantial Completion was achieved, but as close to the end of that year as is reasonably possible.

B. The inspection will be attended by at least one representative each of Owner, Designer, and Contractor.

C. The inspection will confirm non-conforming items previously identified for correction by the Owner, and whether corrections have been completed or are still outstanding, and is intended to be an opportunity for Contractor to become aware of any outstanding corrections needed.

END OF SECTION
SECTION 01 78 21  
CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.01 DATA BINDERS GENERALLY

A. Provide two complete sets. Provide commercial quality three ring binders with durable plastic covers. Identify project and type of data on face and side of binder. If multiple binders are required, identify as consecutively numbered volumes, identifying original documents as set number one. Provide information required by Contract Documents organized as outlined below. Include related documents under the heading to which each is most closely related.

B. Provide introductory information:

1. Cover sheet giving complete project title and number, Contractor's name, address, phone number, name of project superintendent, and related general information.

2. Table of Contents identifying material in Binder, and identifying missing materials to be added later or certifying completeness of Binder. Reference and bind separately any over-size documents that cannot be neatly folded and included in this binder.

1.02 OPERATING & MAINTENANCE DATA BINDERS

A. Provide Product Data as outlined below

1. Detailed Table of Contents for this part

2. For each system or product: names, addresses, and telephone numbers of supplier, installer, and maintenance service company; drawing and specification reference; building location; manufacturer and model number

3. Description of unit and component parts, clearly identifying the specific product or part installed. When manufacturer's cut sheets are used for product identification, plainly mark specific items included in Work and mark out items not included in Work.

4. related information required by Contract Documents, or furnished with items included in Project, that Owner may use for maintenance, operation, repair, renovation, or additions to Work.

B. Provide Operating and Maintenance Data as outlined below for mechanical and electrical systems, equipment, and products:

1. Detailed Table of Contents for this part

2. Manufacturer's printed operating and maintenance instructions supplemented with drawings and text to clearly illustrate proper operation and a logical sequence of maintenance procedures.

3. Servicing and lubrication schedule with list of lubricants.

4. Manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

5. As-installed control diagrams by controls manufacturer.

6. Installers' coordination drawings with as-installed color coded piping diagrams and wiring diagrams.

7. Charts of valve tag numbers with the location and function of each valve.

8. Circuit directories of panel boards.

9. Instructions for care, with a list of manufacturer's recommended types of cleaning agents and methods.

10. List materials and parts furnished for the Owner's use.

11. Copy of the list of persons who received demonstration and training.
C. If Commissioning applies, provide a section for the Commissioning functional performance test certifications and data. If separate binders of this information have been submitted already, include a copy of their content in this section. If separate binders of this information have not been submitted already, provide a third copy in a separate binder.

D. If a SWPPP applies, provide a section into which the Designer can add the Storm Water Operation & Maintenance Plan.

1.03 PROJECT DATA BINDERS

A. Add to introductory information a complete listing of subcontractors and material suppliers, including dollar amount, company name, address, phone number, local representative, and information regarding minority-owned business status. This information shall be submitted to Designer on the form exhibited as Section 01 78 88.

B. Provide certificates and acceptance information:
   1. Detailed Table of Contents for this part
   2. Certificate of Substantial Completion
   3. A copy of the State Fire Marshal’s Certificate of Occupancy, if applicable
   4. Other Certificate(s) of Inspection, Use & Occupancy permit, or letter(s) of acceptance from:
      a. Local building authorities
      b. Department of Labor for boilers, pressure vessels, or elevators
      c. Public Health Authorities
      d. other governing authorities as apply

C. Guarantees, warranties, bonds, certifications, maintenance agreements, and related documents
   1. Detailed Table of Contents for this part
   2. Guarantees, warranties, and bonds, executed by the respective vendors, manufacturers, suppliers and subcontractors
   3. Certifications
   4. Maintenance Agreements and service contracts
   5. Complete information for each item:
      a. Product or work item, and scope of installation
      b. Name of provider, with name of responsible principal, address and telephone number
      c. Beginning date and duration
      d. Information about instances which might affect validity, and proper procedure in case of failure

D. If a SWPPP applies, provide the twice-weekly inspection reports and site audit reports.

1.04 CONSTRUCTION RECORD DOCUMENTS: The record copy of Contract Documents required by paragraph 3.11 of the Conditions shall be kept in good condition for submittal to Designer upon completion of construction activity. In the course of the Work, Contractor shall legibly mark these documents to record actual conditions of Work, including: location, depth, and identification of new and existing underground items, location by dimension and identification of utilities, valves, tap points, equipment, service access, test points, and related features, field changes in dimensions and detail, changes by addenda, change orders, and construction change directives, description and details of features for maintenance, service, replacement, or expansion of the Work.

END OF SECTION
SECTION 01 78 25
DATA BINDER RECEIPT

PART 1 - GENERAL

1.01 RELATED SECTIONS
Section 01 29 76 Payment Procedures
Section 01 77 70 Close-Out Procedures
Section 01 78 21 Close-Out Submittals

1.02 CONTRACTOR PREPARATION AND USE OF THIS FORM

A. Use this form or a reasonable facsimile to verify delivery of Data Binders. Fill in the identifying information following this paragraph, then use the prepared form as a receipt, for signature by the person to whom Data Binders are delivered. Provide a copy of the receipt with the application for payment.

1. For the Application for Payment commensurate with Substantial Completion, provide a copy indicating delivery of Operating and Maintenance Data Binders.

2. For the Application for Payment commensurate with Final Completion, provide a copy indicating delivery of Project Data Binders.

B. Identifying Information:

1. For the Work:
   Project Title: (SBC project number, institutional location, and work name)

2. For the Data Binder(s), mark only one of the boxes below:
   - ONLY Operating & Maintenance Data Binder (due at substantial completion inspection)
   - ONLY Project Data Binder (due at final inspection)
   - BOTH data binders

1.03 RECIPIENT SIGNATURE

A. By signature below, recipient acknowledges receipt of the Data Binder identified above, but does not certify the completeness or correctness of the Data Binder.

Recipient Signature:
Legibly indicate recipient’s name and title or affiliation with Owner or Designer

END OF SECTION
PART 1 GENERAL

1.01 PROJECT GOALS
A. The project has been designed to achieve the Tennessee High Performance Building Requirements (HPBr) minimum of 43 Targeted Points or Credits, as defined in High Performance Building Requirements Manual Version 1.01 and tracked by the accompanying HPBr CHECKLIST/TRACKING FORM. The HPBr Manual is available for download at https://www.tn.gov/assets/entities/osa/attachments/HPBr_Manual_v1.01.pdf
B. Contractor is not responsible for the application for certification, nor for determination of methods of achieving HPBr credits unless specifically so indicated.
C. Many of the HPBr credits can be achieved only through intelligent design of the project and are beyond the control of the Contractor. However, certain credits relate to the products and procedures used for construction. Therefore, the full cooperation of the Contractor and subcontractors is essential to achieving final certification.
D. Contractor shall familiarize himself with the relevant HPBr requirements and provide the necessary information and instruction to all subcontractors and installers.

1.02 RELATED REQUIREMENTS
A. ETSU Fine Arts Classroom Building High Performance Building HPBr CHECKLIST/TRACKING FORM following this section.

1.03 SUBMITTALS
A. HPBr Documentation: The scope of required documentation is specified in some individual specification sections; other scope is specified in this section and its related forms only.
B. New Product Documentation: For each new product in the Product Reporting Scope, submit the Material Content Form, with evidence of compliance attached.
C. Product Cost Statement: Submit the total cost of all products defined as in the Product Reporting Scope, above, including purchase price, taxes, and delivery to site, but not labor, tools, or equipment for installation; submit prior to or along with initial application for payment; update and re-submit whenever the total cost changes due to contract modifications.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01.78.50
# CHECKLIST / TRACKING FORM

**High Performance Building Requirements v1.01**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Targetted Points</th>
<th>Applicable Credit Attempted</th>
<th>Applicable Credit Not Attempted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable</td>
<td>80</td>
<td>24</td>
<td>Programming 46</td>
</tr>
<tr>
<td>Minimum</td>
<td>50</td>
<td>40</td>
<td>SD 44</td>
</tr>
<tr>
<td>Not Applicable</td>
<td></td>
<td></td>
<td>Closeout 0</td>
</tr>
</tbody>
</table>

**Project Team Representatives**

- **O** - Owner
- **C** - Contractor
- **ME** - Mechanical Engineer
- **EE** - Electrical Engineer
- **CE** - Civil Engineer
- **A** - Architect
- **LA** - Other

**Landscape Architect**

**CHECKLIST Total**

<table>
<thead>
<tr>
<th>Programming</th>
<th>SD</th>
<th>DO</th>
<th>CO</th>
<th>Closeout</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
<td>49</td>
<td>45</td>
<td>18</td>
<td>48</td>
</tr>
</tbody>
</table>

**Primary Credit Responsibility**

<table>
<thead>
<tr>
<th>Possible Points</th>
<th>Credit ID</th>
<th>Applicable to Building Scope?</th>
<th>Description</th>
<th>Level</th>
<th>LM Total:</th>
<th>Comment</th>
<th>Role</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. **Site Selection** - Preserve existing buildings

- **LM1.1** - Yes

- **LM1.2** - Yes

- **LM1.3** - Yes

- **LM1.4** - Yes

- **LM1.5** - Yes

- **LM1.6** - Yes

- **LM1.7** - Yes

2. **Transportation** - Plan for access to public transportation

- **LM2.1** - Yes

- **LM2.2** - Yes

- **LM2.3** - Yes

- **LM2.4** - Yes

3. **Landscape Design** - Maximize vegetated open space

- **LM3.1** - Yes

4. **Stormwater Design** - Design stormwater management systems

- **LM4.1** - Yes

5. **Exterior Site Lighting** - Provide visual access to site and property

- **LM5.1** - Yes

- **LM5.2** - Yes

6. **Heat Island Reduction** - Non roof surface reflectivity and shading

- **LM6.1** - Yes

- **LM6.2** - Yes

7. **Stromwater Design** - Reduce discharge rate and volume 25% on previously developed sites.

- **LM7.1** - Yes

- **LM7.2** - Yes

8. **Exterior Site Lighting** - Locate fixtures to minimize illumination above the horizontal plane

- **LM8.1** - Yes

9. **Exterior Site Lighting** - Locate fixtures to minimize light trespass at property lines. Document foot-candle levels at site boundary

- **LM9.1** - Yes

- **LM9.2** - Yes

**State of Tennessee HPBr v1.01 12/18/2015 Page 1 of 6**

Print Date: 12/3/2017 8:32 PM
### Checklist / Tracking Form

#### Categories
- **Applicable**
- **Not Applicable**
- **Applicable Credit Attempted**
- **Applicable Credit Not Attempted**
- **Not Applicable Credit**

#### Project Details
- **SBC Number**: 166/005-08-2013
- **Applicable Credit Attempted**: 0
- **Applicable Credit Not Attempted**: 24
- **Category from Applicability Tree**: Category A
- **Applicable to Building/Site Scope?**: Yes

#### Water Efficiency

<table>
<thead>
<tr>
<th>Credit ID</th>
<th>Description</th>
<th>Level</th>
<th>Required</th>
<th>Priority</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>WE1.1</td>
<td>Water Efficient Landscaping, Utilize efficient irrigation technologies and planning</td>
<td>Yes</td>
<td>Yes</td>
<td>1</td>
<td>Required: Fee increase dependent on documentation requirements.</td>
</tr>
<tr>
<td>WE1.2</td>
<td>Water Efficient Landscaping, Non potable sources or no irrigation</td>
<td>Yes</td>
<td>Yes</td>
<td>1</td>
<td>Required: Irrigation desirable during period of drought, pumping water from Brush Creek not recommended due to high cost of maintenance and negative environmental impact. System cost $12k-$18k FSC: Non-potable system cost $15k-$20k</td>
</tr>
<tr>
<td>WE2.1</td>
<td>Wastewater Treatment &amp; Conveyance: On site treatment</td>
<td>No</td>
<td>No</td>
<td>1</td>
<td>BLS: Scope not included in this project - verify</td>
</tr>
<tr>
<td>WE2.2</td>
<td>Wastewater Treatment &amp; Conveyance: Utilize non potable water</td>
<td>No</td>
<td>No</td>
<td>1</td>
<td>BLS: - Not currently in project scope</td>
</tr>
<tr>
<td>WE3.1</td>
<td>Water Use Reduction - Fixture flow and flush rates</td>
<td>Yes</td>
<td>Yes</td>
<td>1</td>
<td>BLS: Does not meet ETSU Campus Standards. Cost increase of $50-$100 per fixture.</td>
</tr>
<tr>
<td>WE3.2</td>
<td>Water Use Reduction - Utilize auto-flush / auto-flush valves</td>
<td>Yes</td>
<td>Yes</td>
<td>1</td>
<td>BLS: - Not currently in project scope</td>
</tr>
</tbody>
</table>

#### Checklist Total

<table>
<thead>
<tr>
<th>Category</th>
<th>Points</th>
<th>Applicable</th>
<th>Not Applicable</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming</td>
<td>46</td>
<td>0</td>
<td>2</td>
<td>48</td>
</tr>
<tr>
<td>SD</td>
<td>45</td>
<td>0</td>
<td>1</td>
<td>44</td>
</tr>
<tr>
<td>DO</td>
<td>44</td>
<td>0</td>
<td>1</td>
<td>43</td>
</tr>
<tr>
<td>CD</td>
<td>44</td>
<td>0</td>
<td>1</td>
<td>43</td>
</tr>
<tr>
<td>Closeout</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Checklist Total Checklists:
- **Programming**: 46
- **SD**: 45
- **DO**: 44
- **CD**: 44
- **Closeout**: 0

#### Targeted Points
- **Total**: 104

---

**Note**: For each pursued credit, if credits are not pursued, provide justification.
### Checklist / Tracking Form

#### High Performance Building Requirements v1.01

**Project Type:** New Construction  
**Minimum Applicable Credit:** 40  
**Not Applicable Credit:** EE

#### Phase | Target Points | Applicable Credit Attempted | Not Applicable Credit
---|---|---|---
Programming | 46 | | |
SD | 46 | | |
DD | 44 | | |
Closeout | 0 | | |

<table>
<thead>
<tr>
<th>Category from Applicability Tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category A</td>
</tr>
</tbody>
</table>

#### Program Team Representatives

<table>
<thead>
<tr>
<th>Role</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>Owner</td>
</tr>
<tr>
<td>EW</td>
<td>Contractor</td>
</tr>
<tr>
<td>ME</td>
<td>Mechanical Engineer</td>
</tr>
<tr>
<td>EE</td>
<td>Electrical Engineer</td>
</tr>
<tr>
<td>C</td>
<td>Civil Engineer</td>
</tr>
<tr>
<td>A</td>
<td>Architect</td>
</tr>
<tr>
<td>LA</td>
<td>Other</td>
</tr>
</tbody>
</table>

#### Checklist Total

<table>
<thead>
<tr>
<th>EE Total:</th>
<th>12</th>
<th>25</th>
<th>13</th>
<th>24</th>
<th>13</th>
<th>24</th>
<th>0</th>
<th>0</th>
<th>37</th>
</tr>
</thead>
</table>

#### Possible Points | Credit ID | Applicable to Building Site Scope? | Description |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Energy Efficiency

<table>
<thead>
<tr>
<th>Energy Efficiency</th>
<th>Level:</th>
<th>Role</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commissioning - Basic commissioning process</td>
<td>Required</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>Commissioning - Advanced commissioning process</td>
<td>Required</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>Energy Efficient Purchasing Policy - Energy Star qualified appliances &amp; equipment</td>
<td>Required</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>Energy Efficiency - Schematic Design energy modeling</td>
<td>Required</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>Minimum Energy Performance - all projects to demonstrate compliance with ASHRAE 90.1-2010, according to project scope</td>
<td>Required</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>Improved Energy Performance - energy model is used during design, and final design demonstrates energy cost savings that exceed those required by the Minimum Energy Performance credit (EE3.3)</td>
<td>Priority 1</td>
<td>ME</td>
<td></td>
</tr>
<tr>
<td>Energy Efficiency in Existing Buildings - Lighting Power Reduction</td>
<td>Priority 1</td>
<td>ME</td>
<td></td>
</tr>
<tr>
<td>Energy Efficiency in Existing Buildings - Daylight Harvesting Controls</td>
<td>Priority 1</td>
<td>ME</td>
<td></td>
</tr>
<tr>
<td>Energy Efficiency in Existing Buildings - High efficiency HVAC Equipment</td>
<td>Priority 1</td>
<td>ME</td>
<td></td>
</tr>
<tr>
<td>Energy Monitoring, Monitoring and Reporting: Building Level Monitoring</td>
<td>Required</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>Energy Monitoring, Monitoring and Reporting: System level energy monitoring with measurement and verification - New Construction</td>
<td>Priority 1</td>
<td>EE</td>
<td></td>
</tr>
<tr>
<td>Energy Monitoring, Monitoring and Reporting: System level energy monitoring with measurement and verification - Existing Buildings</td>
<td>Priority 1</td>
<td>EE</td>
<td></td>
</tr>
<tr>
<td>Long-Term Energy Reporting - Maintain energy and water consumption data in Energy Star Portfolio Manager</td>
<td>Required</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>Renewable Energy - Investigate life-cycle cost effectiveness of on-site renewable energy</td>
<td>Required</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>Renewable Energy - Provide Renewable Energy Credits (REC) equal to 10% of annual site electricity by remote display</td>
<td>Required</td>
<td>O</td>
<td></td>
</tr>
</tbody>
</table>

#### Comment:

Describe implementation approach for each pursued credit. If credits are not pursued, provide justification.
**CHECKLIST / TRACKING FORM**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Targeted Points</th>
<th>Applicable</th>
<th>Not Applicable</th>
<th>Applicable Credit Attempted</th>
<th>Applicable Credit Not Attempted</th>
<th>Role</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming</td>
<td>46</td>
<td>49</td>
<td>45</td>
<td>9</td>
<td>9</td>
<td>A</td>
<td>DM</td>
</tr>
<tr>
<td>SD</td>
<td>46</td>
<td>46</td>
<td>18</td>
<td>9</td>
<td>9</td>
<td>C</td>
<td>SL</td>
</tr>
<tr>
<td>DD</td>
<td>44</td>
<td>44</td>
<td>44</td>
<td>9</td>
<td>9</td>
<td>ME</td>
<td>JK</td>
</tr>
<tr>
<td>CD</td>
<td>44</td>
<td>44</td>
<td>44</td>
<td>9</td>
<td>9</td>
<td>EE</td>
<td>NB</td>
</tr>
<tr>
<td>Closeout</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>CE</td>
<td>CK</td>
</tr>
</tbody>
</table>

**Checklist Total:**

- **MR 1.1**: Yes - Recycling Collection and Storage
  - Required: Yes
  - Level: Yes
  - Comment: Description implement approach for each pursued credit. If credits are not pursued, provide justification.

  - Role: A
  - Initials: DM

- **MR 3.3**: Yes - Sustainable Materials: Recycled content (non-wood) - Harvested AND manufactured in state - 10% of total cost. Harvested OR manufactured in TN, 50% of product cost contributes to credit
  - Required: Yes
  - Level: Yes

  - Role: A
  - Initials: DM/SL

- **MR 3.4**: Yes - Sustainable Materials: Tennessee Produced Wood Products: Wood materials harvested AND manufactured in state - 50% of wood products. When harvested OR manufactured in state, 50% of material cost contributes to credit
  - Required: Yes
  - Level: Yes

  - Role: A
  - Initials: DM/SL

- **MR 3.5**: Yes - Sustainable Materials: Regional materials - 20%
  - Required: Yes
  - Level: Yes

  - Role: A
  - Initials: DM/SL

- **MR 3.6**: Yes - Sustainable Materials: Material reuse
  - Required: Yes
  - Level: Yes

  - Role: A
  - Initials: DM/SL

- **MR 3.7**: Yes - Sustainable Materials: Rapidly renewable
  - Required: Yes
  - Level: Yes

  - Role: A
  - Initials: DM/SL

**SBC Number:** 166/005-08-2013
**Applicable Credit Attempted:**
**Applicable Credit Not Attempted:**
**SL:** Project Name: ETSU Fine Arts Classroom Building
**Construction Documentation:**
**Date:** 12/17/2017
**Minimum:** 40
**Project Type:** New Construction
**Category from Applicability Tree:** Category A

**Applicable Credit ID**

- **Recycling Collection and Storage**: MR 1.1
- **Construction Waste Management**: MR 2.1
- **Sustainable Materials**: MR 3.1 - MR 3.7

**Primary Credit Responsibility**

- **A**: Architect
- **DM**: Denark Verify Percentage
- **SL**: SL
- **CK**: Civil Engineer
- **JK**: JE
- **NB**: Electrical Engineer
- **SL**: SL
- **DM**: Denark Verify Percentage
- **DM/SL**: DM/SL
- **A**: Architect
## High Performance Building Requirements v1.01

### CHECKLIST / TRACKING FORM

<table>
<thead>
<tr>
<th>Phase</th>
<th>Targeted Points</th>
<th>Applicable Credit Attempted</th>
<th>Project Team Representatives</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>O - Owner</td>
<td>EN/BR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C - Contractor</td>
<td>SL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ME - Mechanical Engineer</td>
<td>JK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EE - Electrical Engineer</td>
<td>NB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CE - Civil Engineer</td>
<td>CR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A - Architect</td>
<td>DM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LA - Other</td>
<td>BP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Not Applicable</th>
<th>24</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Category from Applicability Tree</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor Environmental Quality</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible Points</th>
<th>Credit ID</th>
<th>Applicable to Building/Scope?</th>
<th>Description</th>
<th>Level</th>
<th>Priority</th>
<th>Role</th>
<th>Responsibility</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>EQ 1-1</td>
<td>Yes</td>
<td>Tobacco Smoke Control</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>BR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ 1-2</td>
<td>Yes</td>
<td>Minimum Ventilation: Design to meet ASHRAE 62.1-2007 or 2012 IMC</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ 1-3</td>
<td>Yes</td>
<td>Outdoor Air Delivery Monitoring: Provide a direct outdoor airflow measurement device</td>
<td>Priority 2</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>JK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ 1-4</td>
<td>Yes</td>
<td>Air Quality Management: During construction</td>
<td>Priority 1</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>J</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ 1-5</td>
<td>Yes</td>
<td>Air Quality Management: Before occupancy</td>
<td>Priority 2</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>JE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ 1-6</td>
<td>Yes</td>
<td>Material VOC Limits: Adhesives and sealants</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ 1-7</td>
<td>Yes</td>
<td>Material VOC Limits: Paints</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>JE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ 1-8</td>
<td>Yes</td>
<td>Material VOC Limits: Coatings and anti-corrosive paints</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ 1-9</td>
<td>Yes</td>
<td>Material VOC Limits: Flooring systems</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ 1-10</td>
<td>Yes</td>
<td>Material VOC Limits: Composite wood and agri-fiber</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ 1-11</td>
<td>Yes</td>
<td>Pollutant Control: Entryway systems</td>
<td>Priority 1</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>J</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ 1-12</td>
<td>Yes</td>
<td>Pollutant Control: Hazardous material storage</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ 1-13</td>
<td>Yes</td>
<td>Pollutant Control: Filtiration media</td>
<td>Priority 1</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ 1-14</td>
<td>Yes</td>
<td>Thermal Comfort: Design to meet ASHRAE Standard 55-2004</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ 1-15</td>
<td>Yes</td>
<td>Individual Occupant System Controls: Lighting controls</td>
<td>Priority 1</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ 1-16</td>
<td>Yes</td>
<td>Individual Occupant System Controls: Thermal comfort</td>
<td>Priority 2</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ 1-17</td>
<td>No</td>
<td>Views from Occupied spaces</td>
<td>Priority 1</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
</tr>
</tbody>
</table>

### Checklist Total

<table>
<thead>
<tr>
<th>Programming</th>
<th>SD</th>
<th>DD</th>
<th>CD</th>
<th>Closeout</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
<td>49</td>
<td>45</td>
<td>18</td>
<td>2017</td>
</tr>
<tr>
<td>48</td>
<td>44</td>
<td>9</td>
<td>41</td>
<td>2013</td>
</tr>
<tr>
<td>44</td>
<td>9</td>
<td>51</td>
<td>4</td>
<td>2015</td>
</tr>
<tr>
<td>44</td>
<td>9</td>
<td>51</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>19</td>
<td></td>
</tr>
</tbody>
</table>

### Priority Credit

<table>
<thead>
<tr>
<th>Credit ID</th>
<th>Possible Points</th>
<th>Applicable to Building/Scope?</th>
<th>Description</th>
<th>Level</th>
<th>Priority</th>
<th>Role</th>
<th>Responsibility</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQ 1-1</td>
<td>Yes</td>
<td>Tobacco Smoke Control</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>BR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ 1-2</td>
<td>Yes</td>
<td>Minimum Ventilation: Design to meet ASHRAE 62.1-2007 or 2012 IMC</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ 1-3</td>
<td>Yes</td>
<td>Outdoor Air Delivery Monitoring: Provide a direct outdoor airflow measurement device</td>
<td>Priority 2</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>JK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ 1-4</td>
<td>Yes</td>
<td>Air Quality Management: During construction</td>
<td>Priority 1</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>J</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ 1-5</td>
<td>Yes</td>
<td>Air Quality Management: Before occupancy</td>
<td>Priority 2</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>JE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ 1-6</td>
<td>Yes</td>
<td>Material VOC Limits: Adhesives and sealants</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ 1-7</td>
<td>Yes</td>
<td>Material VOC Limits: Paints</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>JE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ 1-8</td>
<td>Yes</td>
<td>Material VOC Limits: Coatings and anti-corrosive paints</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ 1-9</td>
<td>Yes</td>
<td>Material VOC Limits: Flooring systems</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ 1-10</td>
<td>Yes</td>
<td>Material VOC Limits: Composite wood and agri-fiber</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ 1-11</td>
<td>Yes</td>
<td>Pollutant Control: Entryway systems</td>
<td>Priority 1</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>J</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ 1-12</td>
<td>Yes</td>
<td>Pollutant Control: Hazardous material storage</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ 1-13</td>
<td>Yes</td>
<td>Pollutant Control: Filtiration media</td>
<td>Priority 1</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ 1-14</td>
<td>Yes</td>
<td>Thermal Comfort: Design to meet ASHRAE Standard 55-2004</td>
<td>Required</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ 1-15</td>
<td>Yes</td>
<td>Individual Occupant System Controls: Lighting controls</td>
<td>Priority 1</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ 1-16</td>
<td>Yes</td>
<td>Individual Occupant System Controls: Thermal comfort</td>
<td>Priority 2</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQ 1-17</td>
<td>No</td>
<td>Views from Occupied spaces</td>
<td>Priority 1</td>
<td>1 0 1 0 1 0 1 0 1 0 1</td>
<td>O</td>
<td>ME</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Comment

Describe implementation approach for each pursued credit. If credits are not pursued, provide justification.

---

Print Date: 12/3/2017 8:32 PM | State of Tennessee HPBr v1.01 12/18/2015 | Page 5 of 6
## CHECKLIST / TRACKING FORM

### High Performance Building Requirements v1.01

**Project Team Representatives**

- O - Owner: EW/BR
- C - Contractor: SL
- ME - Mechanical Engineer: JK
- EE - Electrical Engineer: NB
- CE - Civil Engineer: CK
- A - Architect: DM
- LA - Landscape Architect: BP

### Applicable 80 Minimum 40

<table>
<thead>
<tr>
<th>Category from Applicability Tree</th>
<th>Role</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming</td>
<td>O</td>
<td>EW/BR</td>
</tr>
<tr>
<td>SD</td>
<td>C</td>
<td>SL</td>
</tr>
<tr>
<td>DD</td>
<td>ME</td>
<td>JK</td>
</tr>
<tr>
<td>CD</td>
<td>EE</td>
<td>NB</td>
</tr>
<tr>
<td>Closeout</td>
<td>CE</td>
<td>CK</td>
</tr>
<tr>
<td>Other</td>
<td>A</td>
<td>DM, JK, NB, CK, BP</td>
</tr>
<tr>
<td>Landscape Architect</td>
<td>LA</td>
<td>BP</td>
</tr>
</tbody>
</table>

### Checklist Total:

<table>
<thead>
<tr>
<th>Points</th>
<th>Innovation in Design and Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1 ID Total: 46 9 49 45 10 49 51 44 9 51 0 0 104</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible Points</th>
<th>Credit ID</th>
<th>Applicable to Building/Site Scope?</th>
<th>Description</th>
<th>Level:</th>
<th>Prior</th>
<th>Comment:</th>
<th>Role</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ID1.1</td>
<td>No</td>
<td>Innovation in Design: Provide specific title</td>
<td>Yes</td>
<td>1</td>
<td>General Design Team</td>
<td>O</td>
<td>EW/BR</td>
</tr>
<tr>
<td>1</td>
<td>ID1.2</td>
<td>No</td>
<td>Innovation in Design: Provide specific title</td>
<td>Yes</td>
<td>1</td>
<td>General Design Team</td>
<td>O</td>
<td>EW/BR</td>
</tr>
<tr>
<td>1</td>
<td>ID1.3</td>
<td>No</td>
<td>Innovation in Design: Provide specific title</td>
<td>Yes</td>
<td>1</td>
<td>General Design Team</td>
<td>O</td>
<td>EW/BR</td>
</tr>
<tr>
<td>1</td>
<td>ID1.4</td>
<td>Yes</td>
<td>Environmentally Accredited Design Team</td>
<td>Yes</td>
<td>1</td>
<td>Several Design Team Leaders</td>
<td>O</td>
<td>EW/BR</td>
</tr>
</tbody>
</table>

### Primary Credit Responsibility:

- O - Owner
- C - Contractor
- ME - Mechanical Engineer
- EE - Electrical Engineer
- CE - Civil Engineer
- A - Architect
- LA - Landscape Architect

Print Date: 12/3/2017 8:32 PM

State of Tennessee HPBr v1.01 12/18/2015 Page 6 of 6
<table>
<thead>
<tr>
<th>Work performed or Material Supplied, and Dollar Value</th>
<th>Firm name and address</th>
<th>Principal Contact and Phone</th>
<th>If a Minority-Owned Business, classification and certifying agency. If not, “NO”.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PART 1 - GENERAL: not used

PART 2 - PRODUCTS: not used

PART 3 - EXECUTION

3.01 Equipment Start-up / Commissioning

A. Conduct demonstration and instruction as soon as practicable upon installations, and prior to Substantial Completion inspection. Substantial Completion shall not be certified, nor shall Owner be required to assume responsibility for operating, maintaining, or insuring system, prior to complete demonstration and instruction.

B. Demonstrate operation of newly provided equipment and systems to Designer and to Owner's representative. Instruct Owner's personnel in operation, adjustment, and maintenance of equipment and systems, using the operating and maintenance data as the basis of instruction.

C. Make lists of persons witnessing equipment and systems demonstration, and persons receiving operating instruction, using a format similar to the form included in Section 01 79 25 with project, subject, trainer, session information, and attendees identified. Include copy of lists in the Operating and Maintenance Data Binders.

END OF SECTION
PART 1 – GENERAL

1.01 Use a copy of this page as a planning form for demonstrations and training. Fill in the basic identifying information below:

SBC Project Number: 166/005-08-2013

Institution/Location: East Tennessee State University, Johnson City, TN

Project Name: Fine Arts Classroom for East Tennessee State University

Owner’s Facility Coordinator: __________________________ Phone: __________________________

Owner’s Maintenance Contact: __________________________ Phone: __________________________

Contractor Contact: __________________________ Phone: __________________________

1.02 If a list of required demonstrations and training has been specified in Division 1, use that list as a starting point, review the project manual for other specifications that require training of the Owner’s operators, and complete the list below. Check the box on left if Demonstration and Training is required on the standard listed subjects; add subjects as identified by review of the specifications and check the box to the left of each; and, schedule and indicate an target date for each. If the number of training subjects exceeds the available space provided here, replace or continue the list on a similarly formatted separate page. Submit the list with the initial Progress Schedule, and update as necessary during the Work to ensure that advance notice of the demonstration and training schedule is acceptable to the Designer.

<table>
<thead>
<tr>
<th>Spec Reference</th>
<th>Subject</th>
<th>Target Date</th>
<th>Actual Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Accessibility</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boiler</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chiller</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data Transmission</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electrical</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elevator / Conveying</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fire Alarm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Irrigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mechanical</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plumbing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Telecommunications</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PART 2 – PRODUCTS: not used.

PART 3 – EXECUTION

3.01 For each session conducted, use this page as a Training Verification Report.

A. Fill in the information below prior to the session ("End Time" may be filled in after):

- SBC Project Number: 166/005-085-2013
- Institution/Location: East Tennessee State University, Johnson City, TN
- Project Name: Fine Arts Classroom for East Tennessee State University

<table>
<thead>
<tr>
<th>Subject Equipment / System:</th>
<th>Spec Reference</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrator Name:</td>
<td>Company:</td>
<td>Phone:</td>
</tr>
<tr>
<td>Place:</td>
<td>Date:</td>
<td>Start Time:</td>
</tr>
<tr>
<td></td>
<td>End Time:</td>
<td></td>
</tr>
</tbody>
</table>

B. Minimum Agenda Requirements:

☐ System Walk-through
☐ Operation
☐ Trouble-shooting
☐ Maintenance
☐ Safety

C. Attendance: Each person receiving the demonstration and training shall sign in below, or on a similarly formatted continuation page:

<table>
<thead>
<tr>
<th>Initials</th>
<th>Legibly print your name</th>
<th>Unit and title or function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 01 91 13
COMMISSIONING

PART 1 – GENERAL

1.01 Complete the processes of commissioning selected equipment and systems as specified. These should be listed in a companion section following this section. The absence of such a section does not negate the commissioning responsibilities. In the absence of such a section, review the specifications for commissioning requirements and provide a summary list as a submittal to the Designer for approval prior to performing the required commissioning.

1.02 SUBMITTALS

A. Functional Performance Testing:
Prepare and submit to the Designer Functional Performance Testing Procedures for approval of equipment and systems. Contractor will use forms provided in this section of the specifications. Testing procedures will be detailed step-by-step and specific to each system. The approved procedures will be used to conduct the Functional Performance Testing. Functional Performance Testing will be completed prior to Substantial Completion.

B. Commissioning Data:
Upon completion of the Functional Performance Testing, the Contractor will submit to the Designer the Commissioning section of the Operation and Maintenance Binder. The binder will be divided into sections. The binder will contain copies of the manufacturer’s installation and start-up procedures utilized by the installer and/or contractor, completed Functional Performance Testing Procedures and associated forms from Sections 23 08 xx and 26 08 xx, signed Functional Performance Test Certificates, and equipment and maintenance records for equipment and systems operated prior to Owner acceptance.

1.03 ROLES:

A. Designer, using its Consultants will:
1. Review and approve the contractors Functional Performance Testing Procedures.
2. Report on field observations and report deficiencies to the contractor.
3. Observe the contractors Functional Performance Testing.
5. Review final Commissioning Data.

B. Contractor:
1. Prepare and provide Functional Performance Testing Procedures for Designer approval.
2. Provide installation and start-up of all equipment and systems as prescribed by the manufacturer’s procedures.
3. Perform and maintain a maintenance and service log for equipment and systems that are being operated prior to Owner acceptance.
4. Provide manpower, supplies, testing instruments, etc. required to perform Functional Performance Testing.
6. Prepare three (3) sets of Commissioning Data for Designer review and approval.
1.04 SYSTEMS TO BE COMMISSIONED:

A. The following Mechanical systems and associated equipment are to be Commissioned as specified in Sections 23 08 xx.
   1. Mechanical (HVAC) Air and Water
   2. Associated Controls and Building Automation
   3. Domestic Hot Water

B. The following Electrical systems and associated equipment are to be Commissioned as specified in Sections 26 08 xx.
   1. Electrical panel boards.
   2. Power Circuits.
   3. Lighting levels.
   4. Generator and/or Back-up Power sources.

PART 2 – PRODUCTS: NOT USED

PART 3 – EXECUTION

3.01 Commissioning Construction Phase:
Complete the following Commissioning activities during the Construction Phase of the project. Submit for review and provide notification of activities.

A. Manufacturer’s system/equipment start-up procedures.

B. Specified manufacturer’s and/or independent testing agency reports.

C. Project schedule that included dates for start-up of equipment and systems, and Functional Performance Testing.

D. Minimum seven (7) day notification of code required testing and specified cleaning of systems.

E. Minimum seven (7) day notification of system and equipment start-up.

F. Control submittal on systems and equipment including drawings, sequences and programming.

G. Prepare detailed Functional Performance Testing Procedures for systems and equipment. Utilize the forms provided in this section of the specifications. Procedures will be detailed, step-by-step, and include description of expected results for verification. Modify test procedures as required by the Designers’ comments. Coordinate and schedule tests so that all parties involved will be present for final testing and acceptance.

H. Correct all deficiencies prior to final acceptance.

I. Prepare a list of all system and equipment warranties specified in the contract documents. Provide the warranty item and the contract document section number. Provide the Designer with an update list throughout the project.

J. Prepare a list of all deliverables specified in the contract documents. Provide the deliverable item and the contract document section number. Provide the Designer with an updated list throughout the project.
K. Prepare a list of all Training and Demonstrations specified in the contract documents. Provide the type of Training and/or Demonstration and the contract document section number. Provide the Designer with an updated list throughout the project.

L. Prepare a list of all tests, reports, services, etc. whether required by codes, independent authorities, or manufacturers as specified in the contract documents. Provide the type of test, report, services, etc. and the contract document section number. In the case that the test is required by state or local codes, update the list as soon as the information is available. Provide the Designer with an updated list throughout the project.

M. Systems and/or equipment will not be used for temporary purposes of any kind until authorized by the Designer in writing to ensure that required maintenance and warranties remain in force. The Contractor will be responsible for maintenance of all systems and equipment until final acceptance and will maintain on site a binder containing schedules of maintenance activities, items checked, repairs or replacements made and documents to verify that the work was performed. The documentation contained in this binder will become part of the Commissioning Binder.

3.02 Commissioning Acceptance Phase:
Complete the following Commissioning activities during the Acceptance Phase of the project. The activities described in this section must be completed prior to substantial completion.

A. Perform Functional Performance Tests of Mechanical and Electrical systems and equipment as specified utilizing the testing procedure prepared by the Contractor and approved by the Designer to verify proper calibration, operation and performance. The Contractor is responsible for providing all manpower, equipment and/or testing instruments required to perform tests. Functional Performance Testing will be performed in the presence of the Designer/Consultant and the Owner. Tests that fail to perform as required, will be retested upon correction. If retesting has to be rescheduled, the Contractor will be responsible for any additional charges.

B. All deliverables prescribed in the contract documents will be delivered to the Owner at the location designated by the Owner.

C. Perform all Training and Demonstrations prescribed in the contract documents.

D. Provide three (3) Final Commissioning Binders to the Designer for review and approval. Ensure that all forms are completely filled out and all testing results documented. If missing or incomplete information and/or data is identified by the Designer, reassemble replacement manuals with complete information prior to project final payment.

END OF SECTION
SECTION 01.91.14
GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY
A. Commissioning is a quality-focused process for enhancing the delivery of a project. The process focuses on verifying and documenting that the facility and all its systems and assemblies are planned, designed, installed, tested, operated and maintained to meet the Owner’s Operational Performance Requirements as defined in the Contract Documents.
B. The purpose of commissioning is to provide a systematic process of assuring by verification and documentation, from the design phase to a minimum of one year after construction, that all facility systems perform interactively in accordance with the Contract Documents and their intent.

1.02 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Commissioning Plan, dated December 1st, 2017

1.03 INCLUDED SYSTEMS
A. The following systems, equipment and their components are included in the scope of the commissioning activities and are considered to be commissioned systems and equipment.
   1. Heating, Ventilating and Air Conditioning (HVAC) Systems
   2. Plumbing Systems
   3. Building Automation and Control System (BACS)
   4. Lighting (Interior and Exterior) Systems
   5. Electrical Power Systems
   6. Fire Alarm

1.04 ROLES AND RESPONSIBILITIES
A. Commissioning Authority (CxA): The Commissioning Authority is an individual who leads, reviews and oversees the completion of the commissioning process activities.
B. General Contractor (hereafter referred to as “Contractor”)
   1. The Contractor shall be responsible for adhering to applicable code required procedures, standards and industry practices to ensure personal safety, the safety of others, and facility safety. If there are procedures in the checklists or the functional performance tests which conflict with safety, the Contractor shall not proceed and shall notify the CxA immediately.
   2. The Contractor shall be responsible for the quality of construction.
   3. The Contractor shall be responsible for communicating to the CxA the construction schedule, milestones, completion schedules, planned testing, etc., including updates in the same fashion, timeliness and level of detail as is provided to the Owner.
   4. The Contractor shall incorporate commissioning-related activities into the overall project schedule.
   5. The Contractor shall make record drawings readily available for review and use by the CxA at any time during normal business hours.
C. Subcontractors
   1. The HVAC Subcontractor shall be responsible for the scheduling, supervising and performing start-up, testing and commissioning activities as necessary to demonstrate to the Owner successful operation of the HVAC systems.
   2. The Plumbing Subcontractor shall be responsible for the scheduling, supervising and performing start-up, testing and commissioning activities as necessary to demonstrate to the Owner successful operation of the plumbing systems.
3. The BACS Subcontractor shall be responsible for the scheduling, supervising and performing start-up, testing and commissioning activities as necessary to demonstrate to the Owner successful operation of the BACS.

4. The Electrical Subcontractor shall be responsible for the scheduling, supervising and performing start-up, testing and commissioning activities as necessary to demonstrate to the Owner successful operation of the electrical systems.

PART 2 PRODUCTS

2.01 MEANS OF ACCESS

A. The Contractor and/or Subcontractors shall provide means for the CxA to access, observe and visually confirm proper operation of all equipment and systems. These means shall be in compliance with all OSHA and job-site safety regulations.

2.02 TEST EQUIPMENT

A. The Contractor and/or Subcontractors shall provide the necessary equipment to fully test the commissioned systems as defined in the functional performance test procedures to be provided by the CxA.

B. The test equipment shall meet the following minimum requirements.

1. All test equipment shall be in good mechanical and electrical condition.
2. Field test metering used to check power system meter calibration will be more accurate than the instrument being tested.
3. Accuracy of metering in test equipment shall be appropriate for the test being performed.
4. Waveshape and frequency of test equipment output waveforms shall be appropriate for the test and the tested equipment.

C. Calibration

1. Calibration of all test equipment shall be current.
2. Calibration accuracy shall be traceable to National Institute of Standards and Technology (NIST).
3. Test equipment shall be calibrated in accordance with the following schedule.
   a. Field instruments
      1) Analog – At least every 6 months
      2) Digital – At least every 12 months
   b. Leased Specialty Equipment – At least every 12 months
4. Dated calibration labels shall be visible on all test equipment.
5. Calibration records shall be provided for all test equipment used in the project.

PART 3 EXECUTION

3.01 COMMISSIONING TEAM

A. The Contractor and each Subcontractor shall designate an individual to be responsible for coordinating commissioning activities with the CxA. This requirement is intended to facilitate effective communication during the commissioning process.

B. The commissioning team consists, at a minimum of the following:

1. Owner
2. Developer
3. Commissioning Authority
4. Architect
5. Design Engineers (Mechanical, Plumbing, Electrical, Specialty)
6. General Contractor
7. Mechanical Subcontractor(s) and its Subcontractors
8. Plumbing Subcontractor(s) and its Subcontractors
9. BACS Subcontractor(s) and its Subcontractors
10. Electrical Subcontractor(s) and its Subcontractors
11. TAB Subcontractor

3.02 COMMUNICATION PROTOCOLS
A. Formal reports including Site Observation Reports will be distributed to the Owner, Developer, Architect and General Contractor.
B. Informal comments and observations from the commissioning work will be relayed directly to the responsible party whenever possible, with copies to the Owner, Developer, Architect and General Contractor. This includes field observations and functional performance test results. The direct communication approach will avoid delays from traditional remote paper exchanges, will encourage dialogue and discussion of options and alternatives, and generally maintain an atmosphere of cooperation and quality.
C. Response Times
   1. Timeliness in delivering information or providing responses to the CxA is essential to providing the construction product to the Owner on time, as well as facilitating the commissioning process.
   2. The Contractor shall adhere to the following to meet this objective:
      a. Delivery of proposed training material to CxA: Thirty (30) days prior to the scheduled training
      b. Written response to a site observation comment to CxA: Five (5) days or less from receipt of comment, if possible.
      c. Time to correct discrepancies noted in Record Drawings during construction phase: Two (2) weeks from the date the discrepancy was noted
   3. The CxA shall respond, in writing, to questions from the Contractor within five (5) working days.

3.03 COMMISSIONING MEETINGS
A. Commissioning issues will be handled during project meetings which will be scheduled bi-weekly or less, unless agreed to by both the CxA and Contractor. If specific topics require additional discussion, the appropriate parties shall meet immediately after the project meeting or at another time mutually agreed to by those parties.

3.04 SUBMITTAL REVIEW PROCEDURES
A. The Contractor shall provide a copy of each submittal defined for the systems to be commissioned to the CxA at the same time as providing the submittal to the Architect.
B. The CxA will review the submittals for information only (approval not required) parallel to the Engineer’s review.

3.05 FIELD OBSERVATIONS AND VERIFICATIONS
A. The CxA will make field observations from time-to-time. The CxA field observation reports may include construction issues, access and maintenance issues, safety issues, or other issues.
B. The Contractor shall respond, in writing to the CxA and/or the Owner, to each contractor-responsible issue within five (5) calendar days of receipt of the field observation report. The response shall state at a minimum the following:
   1. Concurrence or not on whether this is an issue
   2. Planned corrective action
   3. Date on when correction will be completed
C. The Contractor shall respond in writing when the corrective action has been completed and in its opinion the issue is resolved.
3.06 EQUIPMENT CHECKLISTS

A. The Commissioning Authority will provide the Contractor the following types of equipment checklists (alternatively, the Contractor may submit its own checklists to the CxA for review and approval in lieu of using those provided by the CxA):

1. Equipment Pre-functional Checklist

B. Intent

1. The Equipment Pre-functional Checklist will be used to communicate the readiness for a particular equipment or system for functional performance testing.
2. The checklists do not contain all of the requirements of the Contract Documents. The completion of the checklist does not eliminate the Contractor’s responsibility for meeting other requirements in the Contract Documents.

C. Use and Process

1. Equipment checklists will be provided to the Contractor by the CxA for all equipment to be commissioned.
2. The Contractor shall refer to CxAlloy to obtain the checklists.
3. The Contractor shall complete each checklist on CxAlloy. The Contractor shall document and explain any negative responses to any line item of the checklist at the end of the checklist.
4. The Contractor shall provide each completed checklist to the CxA according to the following schedule:
   a. Equipment Pre-functional Checklist: Minimum of five (5) working days prior to scheduling of any functional performance tests related to that equipment
5. The CxA shall have a minimum of five (5) working days to verify at his discretion whether the checklists have been completed satisfactorily before scheduling of any functional performance tests related to that equipment.

3.07 FUNCTIONAL PERFORMANCE TESTING

A. General

1. The Contractor and appropriate Subcontractors shall demonstrate that the commissioned equipment and systems operate properly in all modes of operation.
2. Testing shall begin at the component level and progress upwards in complexity to the equipment and system level.
3. When all systems have passed their functional performance tests, the Contractor and appropriate Subcontractors shall demonstrate that the systems operate correctly as a whole in a System Integration Test.

B. Functional Performance Test (FPT) Procedures

1. The Contractor shall provide all documentation as requested to the CxA for development of functional performance testing procedures. This documentation shall include, at a minimum, manufacturer installation, start-up, operation and maintenance procedures. The CxA may request further documentation as necessary for the development of functional performance tests.
2. The FPT procedures will be provided to the Contractor by the CxA prior to testing for review.
3. The Contractor shall refer to the Commissioning Plan for draft FPT procedures.
4. The Contractor and Subcontractors shall review the FPT procedures and reply, in writing, whether the tests as written are acceptable, meet the installed conditions, and will not void any warranties. The Contractor shall provide any requested modifications to the test procedures in writing to the CxA for consideration. No reply from the Contractor within four (4) weeks of its receipt of the FPT procedures signifies the Contractor’s and Subcontractors’ concurrence that the procedures are acceptable.
5. The FPT procedures will provide step-by-step instructions in a pass/fail format.

C. When the equipment and systems are ready to test, the FPT will be scheduled for a time in accordance with the project completion schedule.

1. Functional performance testing is intended to begin upon completion of a system.
2. Functional testing may proceed prior to the completion of the system at the discretion of the CxA and the Contractor.

D. The Contractor shall place equipment and systems into operation and continue the operation as required during each working day of the testing activities.

E. The Contractor shall accomplish the functional performance testing of equipment based on procedures developed by the CxA and as reviewed by the Contractor.
   1. The Contractor shall provide skilled technicians to operate the systems during functional performance testing. At a minimum, the contractor shall provide one trade technician familiar with the system being tested.
   2. The Contractor shall provide means of access to the CxA to visually verify all aspects of the specified test.
   3. The Contractor shall correct any deficiencies identified during testing and retest equipment as required.

F. If the total time required to correct minor problems during testing is greater than forty-five (45) minutes (unless extenuating circumstances exist), the test shall be considered failed and must be repeated in its entirety.

G. If a major problem is discovered during the test, the Contractor shall correct the problem. Prior to retesting, the Contractor shall submit to the CxA the required data indicating that the deficient items have been corrected. After review of this information by the CxA, a retest will be scheduled. During the course of the retest, if at any point a major deficiency is discovered, the test will be stopped. If more than two functional performance tests (one initial test and one retest) for any type of equipment due to Contractor’s failure of problems or issues that the Contractor had direct or indirect control over are required, the costs for the CxA to witness retesting of similar types of equipment until satisfactory results are obtained shall be the responsibility of the Contractor.
   1. A major problem is any problem or group of problems that require more than forty-five minutes to correct.
   2. A type of equipment is equipment that belongs to a common category, for example, air handling unit or panelboard.

H. Re-testing: During the course of the retest, if at any point a major deficiency is discovered, the test will be stopped. Repeat tests until acceptable results are achieved.

I. Deferred Testing: The Contractor shall provide labor, equipment, and materials to perform any functional testing that must be deferred past the date of final completion in order to properly perform the test. Acceptable reasons for deferring a test shall include the following:
   1. Specific climatic conditions are necessary to properly demonstrate the functionality of the equipment or system.
   2. Work to be conducted under a subsequent phase of the Project is not complete per the contractual Detailed CPM Project Schedule.

3.08 TEST AND BALANCE VERIFICATION

A. The Contractor shall provide the labor and test equipment necessary to demonstrate to the CxA that the HVAC air and water systems have been properly balanced.

B. The CxA will randomly select devices, equipment, and systems for verification purposes.
   1. The Contractor shall be prepared to demonstrate proper balance of at least 10% of non-critical systems. Non-critical systems are those whose sole purpose is to maintain thermal comfort conditions.
   2. The Contractor shall be prepared to demonstrate proper balance of 100% of critical systems. Critical systems are those whose primary purpose is to maintain conditions necessary for life-safety or other regulatory conditions, i.e., pressure relationships in laboratories.

C. The Contractor shall regard this verification process as a functional performance test for purposes of time allowed to correct deficiencies and requirements regarding retesting if major problems are discovered.
3.09 TRAINING VERIFICATION

A. The Contractor shall submit proposed training material to the CxA for review and comment.

B. The Contractor for the respective system shall be responsible for the development and implementation of the training material for that system.

C. The Contractor shall upload final Operation and Maintenance (O&M) manuals, approved submittals, warranty document and TAB report to CxAAlloy prior to training.

D. At a minimum, the Contractor shall provided the following material at the time of training:
   1. Detailed agenda
   2. Contractor contact information sheet
   3. Detailed training material (divided by sections where appropriate)
   4. Log sheets and maintenance checklists
   5. Training may be recorded for future reference if requested by the Owner.

E. The Contractor shall develop a proposed training schedule and submit that to the Owner for review, comment and approval.

F. The Contractor shall schedule and coordinate all training sessions through the Owner.

G. At a minimum, training topics shall include the following:
   1. Description of equipment and systems
   2. Warranties and guarantees
   3. Equipment start-up and shutdown
   4. Normal and emergency operation
   5. Seasonal changeover
   6. Maintenance schedules
   7. Health and safety issues
   8. Special tools and spare parts
   9. Emergency procedures
   10. Hands-on operation
   11. Troubleshooting
   12. O&M manuals
   13. Facilities control system and sequences of operation

END OF SECTION 01 91 14
Section 1 - Overview
The Building Commissioning Plan for Construction is a source of information on the key steps that must be completed throughout the construction, acceptance, and operation of the new facility to assure the Owner’s Performance Requirements are met. The Owner has adopted commissioning as their process for quality assurance in the building design and construction process. Commissioning is a systematic process for constructing and operating a building/system using lessons and tools from industrial quality programs. During the construction phase, commissioning focus is placed on key systems. This includes verification of the installation, operation, training, and system documentation.

This Building Commissioning Plan for Construction has been specifically developed for this project to aid the building design, construction, and operation team in ensuring the quality of the project. It is important to understand that the Building Commissioning Plan for Construction provides a framework for the commissioning and quality assurance process. It may be modified and adapted to meet unforeseen quality control issues and opportunities throughout the project.

The commissioning process has many benefits to the entire commissioning team. Construction commissioning benefits the owners by providing a nonbiased, third party system expert, who can help identify issues early and reduce first year operation costs. This is accomplished by verification and documentation that systems function as designed and meet the intent of the OPR. Construction commissioning benefits the contractors by providing coordination between trades and identifying potential rework issues, warranty calls, and service callbacks.

Definitions
The following are definitions of key terms used in this document.

Commissioning – A quality process beginning during the planning phase and continuing through the life of the building. The basic purpose of building commissioning is to provide documented confirmation that building systems function in compliance with criteria set forth in the Project Documents to satisfy the Owner’s operational needs. The process is based on the structure developed and presented in ASHRAE Guideline 0 – The Commissioning Process.

Basis of Design – A document developed by the design team that details all assumptions made during the creation of the construction documents in order to meet the Owner’s requirements.

Commissioning Plan – A plan that details how the various commissioning activities will be accomplished for the project. It is used by all members of the commissioning team as a reference for the commissioning activities that will be taking place.

Pre-Functional Checklist – The on-site verification of the existence and installation of equipment, materials, and/or systems as required in the contract documents.

Construction Testing and Start-up – The original checking by the contractor and/or manufacturer’s representative of the installation and operation of a component or a system often with the aid of checklists provided by the installing contractor or manufacturer, including model verification.

Functional Performance Testing – The checking and testing of a fully installed system for operation both individually and in conjunction with other systems, which affect their operation as defined by the contract documents.

Sampling Rate – The percentage or quantity of components, equipment, or systems that will be witnessed by the Owner and/or Commissioning Authority to ensure compliance with the Owner’s requirements and the contract
documents.

Owner – The Owner is Tennessee Board of Regents/East Tennessee State University.
Section 2 - Commissioned Systems and Equipment

The following systems, equipment, and their components are included in the scope of the commissioning activities.

<table>
<thead>
<tr>
<th>Table 2-1: Commissioned Systems and Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System and Equipment</strong></td>
</tr>
<tr>
<td><strong>Mechanical</strong></td>
</tr>
<tr>
<td>Building Automation System</td>
</tr>
<tr>
<td>Pumps</td>
</tr>
<tr>
<td>Air-Cooled Chillers</td>
</tr>
<tr>
<td>Hot Water Boilers</td>
</tr>
<tr>
<td>Air Handling Units</td>
</tr>
<tr>
<td>Fan Coil Units</td>
</tr>
<tr>
<td>Split Systems</td>
</tr>
<tr>
<td>Exhaust Fans</td>
</tr>
<tr>
<td>Terminal Units</td>
</tr>
<tr>
<td><strong>Plumbing</strong></td>
</tr>
<tr>
<td>Domestic Hot Water Heater</td>
</tr>
<tr>
<td>Domestic Water Booster Pumps</td>
</tr>
<tr>
<td>Mixing Valve</td>
</tr>
<tr>
<td>Circulating Pumps</td>
</tr>
<tr>
<td>Sump Pump</td>
</tr>
<tr>
<td>Air Compressor</td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
</tr>
<tr>
<td>Transformers</td>
</tr>
<tr>
<td>Panelboards</td>
</tr>
<tr>
<td>Switchboard</td>
</tr>
<tr>
<td>Lighting Controls (Floor Level)</td>
</tr>
<tr>
<td>Emergency Lighting (Floor Level)</td>
</tr>
<tr>
<td>Occupancy Sensors</td>
</tr>
<tr>
<td>Global Power Failure/Recovery Test</td>
</tr>
<tr>
<td>Fire Alarm Control Panel (FACP)</td>
</tr>
<tr>
<td>Field Devices (Floor Level)</td>
</tr>
</tbody>
</table>
Section 3 - Communication Protocol and Organization Chart
The key to an effective project is to ensure that there are well-defined lines of communication between all parties involved in the project. Communication is maintained throughout the project by a conscious effort of the various commissioning team members. The specific communication structures developed for this project ensure efficient identification and resolution to issues through the use of clear and concise procedures.

See Figure 3-1 for a graphical demonstration of the commissioning team communication flow path.

![Figure 3-1 Commissioning Team Communication](image)

**Overview of Responsibilities**

Owner Rep/Owner: Coordinates staff involvement, responds to facility operational questions and communicates facility requirements.

A/E: Provides written narratives of system operation, attends commissioning meetings as required, reviews test procedures, provides punch-lists, resolves design (field) issues and provides input on issues that arise during the functional tests.

GC: The General Contractor manages Sub-contractor schedule and assures Sub Contractors execute commissioning tasks in accordance with the Commissioning Plan.

CA: The Commissioning Authority coordinates the overall Cx process and acts as Owner’s advocate in regards to Cx activities. Core activities include: design reviews, development of inspections and test plans and manages the Cx issues database and training plan. The CA develops, executes and documents testing protocols to assure
commissioned systems are functioning in accordance with the CxP and specifications. The CA conducts Commissioning Meetings, issues periodic status reports and updates the Master Issue List.

**Major Trade Sub-Contractors:** The Sub-Contractor directly participates and supports all inspections and tests developed by CA. Sub-Contractors provide the CA with skilled personnel and test equipment appropriate to each trade to successfully complete all phases of the work.

**TAB Sub-Contractor:** The TAB Sub-Contractor performs the tests and balances functions to HVAC systems. Provides reports on system and equipment performance. Responsible for integrating commissioning into the TAB Validation process and works closely with other team members with specific emphasis to the BAS Contractor. The TAB subcontractor shall notify the GC if problems arise or if work performed will not meet the design intent, plans and / or specifications. The GC will forward the information to CA and Owner to enable resolution of problems if they occur.

**Building Automation System Contractor:** The BAS Contractor provides information and services to enable functional and performance testing to the building HVAC and other integrated systems. The Controls Contractor shall execute and submit the pre-commissioning checkout, startup and test reports as specified in the contract documents. Works closely with the TAB Contractor to assure sensors and controls are coordinated to regulate equipment and systems operations.
Section 4 – Construction Phase Commissioning Activities

Table 4-1 lists the formal written work products related to commissioning that will be developed over the course of the project.

<table>
<thead>
<tr>
<th>Product</th>
<th>Responsible Party</th>
<th>Product Description and Form</th>
<th>Expected by Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cx Plan</td>
<td>CxA</td>
<td>Final Cx plan for construction phase</td>
<td>Construction phase Cx kick-off meeting</td>
</tr>
<tr>
<td>Field Observation Reports (FOR)</td>
<td>CxA</td>
<td>Report of observations made during site visit</td>
<td>1 day after site visit</td>
</tr>
<tr>
<td>Response to FOR issues</td>
<td>All Contractors</td>
<td>Written response to issues identified in FORs</td>
<td>7 business days after receipt of report</td>
</tr>
<tr>
<td>Issues Log</td>
<td>CxA</td>
<td>List of deficiencies and non-compliance with Contract Documents identified during Cx</td>
<td>Issued with Cx meeting agendas or as needed</td>
</tr>
<tr>
<td>Cx Progress Reports</td>
<td>CxA</td>
<td>Gives scheduling needs and update, deficiency report, Cx progress</td>
<td>Weekly to Monthly as needed/requested</td>
</tr>
<tr>
<td>Completed Pre-functional Checklists</td>
<td>All Contractors</td>
<td>Checklists to be used by the contractors to formally communicate readiness for functional testing.</td>
<td>Minimum 5 days before scheduled date of FPT</td>
</tr>
<tr>
<td>Final TAB report</td>
<td>TAB Contractor</td>
<td>Final TAB report with method and results.</td>
<td>Within 3 weeks after TAB completion</td>
</tr>
<tr>
<td>Functional Performance Test Report</td>
<td>CxA</td>
<td>Documentation of deficiency discovered during testing.</td>
<td>3 days after test</td>
</tr>
<tr>
<td>Training Plan</td>
<td>Contractors</td>
<td>Submit training agendas</td>
<td>30 days before training</td>
</tr>
<tr>
<td>Training Completion Documentation</td>
<td>CxA</td>
<td>List of trainees, completed hrs and topics and approvals</td>
<td>Within 2 weeks after training completion</td>
</tr>
<tr>
<td>Deferred Testing Reports</td>
<td>CxA</td>
<td>Documentation of seasonal and deferred tests</td>
<td>Within 2 weeks of test</td>
</tr>
</tbody>
</table>
Issue Log Description
All issues identified during the course of the project shall be tracked using the Issues Log. The purpose of the Issues Log is to communicate issues identified during the course of the project to the commissioning team and track those issues to resolution. All issues shall have responses within two weeks from identification.

The Issues Log shall contain detailed descriptions of problems identified during the construction phase, along with recommended corrective actions. Each issue is tracked in a database with the following information:

- Unique identifier
- Date of issue identification
- Applicable test number
- Applicable system or equipment number
- Location of issue
- Description of issue
- Recommended corrective action
- Responsible party
- Expected date of response

Issues can be sorted by any of the above information and provided to the commissioning team in customized reports.
Section 5 - Construction Phase

Commissioning Meetings
The CxA shall conduct a commissioning kick-off meeting early in the construction phase to discuss specific roles and responsibilities of the contractors. During this meeting the CxA shall review the OPR, Basis of Design, and unique contract document requirements.

Throughout construction, most commissioning issues shall be handled during regularly scheduled project meetings. If specific topics require additional discussion, the commissioning team shall meet immediately after the project meeting.

Other commissioning meetings may occur at other times mutually agreed to by the commissioning team.

Submittal Reviews
The Contractor shall forward a copy of each related equipment submittal to the CxA for review. The submittals shall be used to assist with developing FPT procedures and to verify that the correct equipment is installed. If the CxA finds any discrepancy or deficiency with the submittal, the CxA shall forward the information to the A/E for resolution. Approval, review, and comment upon submittals are solely the responsibility of the A/E.

Site Visits
Site visits are the primary method used during the Construction Phase to verify that installed systems and equipment comply with the OPR. The site visit procedures use a statistical approach to verify compliance. This includes performing general inspections, verifying installed equipment complies with the contract documents, and verifying pre-functional checklists have been accurately completed.

Initially, the CxA shall perform site visits on a monthly basis, with increasing frequency. As construction progresses and systems and equipment installations are completed, Site Visits may be as often as weekly or daily.

Upon arrival, the CxA shall notify the General Contractor before entering the jobsite. The CxA shall follow all safety policies and regulations implemented by the General Contractor. After completing the site visit, the CxA shall meet with the General Contractor to discuss any potential issues observed or to note any safety concerns. A Field Observation Report shall be distributed to the General Contractor in electronic format the next day. This report shall outline any observed issues and provide recommendations for resolution. The FOR may include construction issues, access and maintenance issues, safety issues, or other issues. The General Contractor shall respond to the issues within five days.

Pre-functional Checklists
The Pre-functional Checklist is a document that communicates the completion of installation and startup and the readiness for functional performance testing.

- Divisions 22, 23, 26, and 28 Pre-functional Checklists are founded on CxAlloy under Checklists.
- The contractor shall complete the checklists and return them to the CxA as soon as possible. Note, a minimum of five (5) days must be provided between receipt of the completed pre-functional checklist by the CxA and functional testing of the applicable equipment or system.
- Pre-functional checklists must be returned to the CxA before commencement of functional performance testing of that equipment or system.

Functional Performance Tests
Functional Performance Tests (FPT) demonstrate that the commissioned systems and equipment operate properly in all modes of operation. Testing shall begin at the component level and progress upwards in complexity to the equipment and system level. When all systems have passed their functional performance tests, the systems shall be tested together to verify operation as a whole in a Global System Integration Test.

Each FPT is written in a pass/fail format, with yes being the correct response and no being a failed response.
The contractor shall complete and submit all applicable equipment pre-functional checklists prior to scheduling of testing. When the equipment and systems are ready to test, the FPT shall be scheduled for a time mutually convenient to the contractors and the CxA. The contractor should contact the owner and the CxA via phone or e-mail to initiate the FPT scheduling. The CxA shall orchestrate the Functional Performance Test and document the test results on the appropriate forms. The contractor shall be responsible to provide personnel and equipment to perform the testing and to correct problems found during the testing.

If the total time required to correct minor problems during testing is greater than forty-five (45) minutes, the test shall be considered failed and must be repeated in its entirety. If a major problem is discovered during the test, the contractor shall correct the problem. Prior to retesting, the contractor shall submit to the CxA the required data indicating that the deficient items have been corrected. After review of this information by the CxA, a retest shall be scheduled. During the course of the retest, if at any point a major deficiency is discovered, the test shall be stopped.

The CxA developed draft functional performance test procedures based on the Issued for Construction documents. These procedures are subject to modification based on input of the contractors, the design team and the owner. Upon receiving input or agreement from each of these parties on the procedures, the CxA shall issue final functional performance test procedures.

- Divisions 22, 23, 26, and 28 Draft Functional Performance Test procedures are founded on CxAloy under Test Templates.
Section 6 - Final Commissioning Report
The Final Commissioning Report shall be provided to the owner after functional performance testing is completed, issues that have been addressed or resolved, and the CxA has received project documentation. The following is an outline of the Final Commissioning Report:

Section 1   Executive Summary
Section 2   Commissioning Plan
Section 3   Commissioning Specifications
Section 4   Issues Log
Section 5   Design Review Reports
Section 6   Submittal Review Reports
Section 7   O&M Review Reports
Section 8   Site Observations
Section 9   MEP Equipment & Systems
Appendix A   System Schematics
Appendix B   Controls Strategies, Sequences of Operation, and Setpoints
Appendix C   TAB Report
**SECTION 01 91 23**  
**PERFORMANCE TESTING IDENTIFICATION FORM**

**Owner's Project Number:** 166/ 005-08-2013 CM  
**Institution or Campus:** East Tennessee State University  
**Building:** Fine Arts Building for East Tennessee State University  
**Installer:**

<table>
<thead>
<tr>
<th>System/Unit Identifier:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
<td></td>
</tr>
</tbody>
</table>

List Each Piece of Equipment Associated with This System and/or Unit by Tag #

<table>
<thead>
<tr>
<th>Piece of Equipment</th>
<th>Tag Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>

*Performance Testing Identification Form 01 91 23 - 1*
**SECTION 01 91 26**  
**PERFORMANCE TESTING PROCEDURES FORM**

**Owner's Project Number:** 166/005-08-2013

**Institution or Campus:** East Tennessee State University

**Building:** Fine Arts Classroom for East Tennessee State University

**Installer:**

<table>
<thead>
<tr>
<th>Step by Step Detailed Procedure</th>
<th>Expected Result</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**System/Unit Identifier:**

**Location:**

**Date:**

**Tests run by:**
SECTION 01 91 29
FUNCTIONAL PERFORMANCE TEST CERTIFICATION

Owner's Project #: 166/005-08-2013 CM  Project Name: Fine Arts Building for East Tennessee State University

Identification of Equipment or System: _____________________________________________

Location of Equipment or System: _______________________________________________

Manufacturer / Supplier: ________________________________________________________

This date: ____________________________________________________________________

Functional Performance Test Procedure No: _________________________________________

Components Included: __________________________________________________________

The above systems and components integral to this equipment are complete and have undergone Functional Performance Tests. All Functional Performance Test procedures are complete and have been checked off only by parties having direct knowledge of the event, as indicted below, respective to each responsible contractor. This Functional Performance Test is submitted for approval and is subject to the attached list of outstanding items not completed successfully. Contractor shall submit a Deficiency Form upon completion of any outstanding or deficient items. None of the outstanding items preclude safe and reliable functional tests being performed.

CHECK ONE:  ☐ Deficiency listing attached; or, ☐ No Deficiencies Found.

All Designer and Contractor punch list items for this system and related equipment have been addressed and corrected prior to Functional Performance Testing.

The Functional Performance Test procedures were reviewed and approved by the installer and applicable subcontractors prior to testing.

CONTRACTOR'S CERTIFICATION OF PERFORMANCE:

I hereby certify that the above described equipment or system, has been energized, operated, adjusted, and balanced in accordance with requirements of the Contract Documents and the manufacturer's recommendations for a sufficient period to confirm that operation complies in all respects with the Contract Requirements.

Signature ____________________________  Print Name ____________________________  Date ________________

Installer: ____________________________________________  ____________________________  ________________

General Contractor: ________________________________  ____________________________  ________________

Designer / Consultant: ________________________________  ____________________________  ________________
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Manufactured architectural precast concrete pavers on portions of the roof, as indicated on the Drawings. The pavers are not on normally accessible areas.
   B. Supports.
   C. Section does not include precast stair tread & risers on metal stairs. See Section 05.51.00 - Metal Stairs

1.02 RELATED REQUIREMENTS
   A. Section 07.53.23 - EPDM Thermoset Single-Ply Roofing

1.03 REFERENCE STANDARDS

1.04 ADMINISTRATIVE REQUIREMENTS
   A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.05 SUBMITTALS
   A. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.
   B. Shop Drawings: Indicate layout, unit locations, configuration, reinforcement, connection details, support items, dimensions, openings, and relationship to adjacent materials.
      1. Include details of mix designs.
      2. Include structural design calculations.
   C. Fabricator's Qualification Statement: Provide documentation showing precast concrete fabricator is accredited under IAS AC157.
   D. Maintenance Data: Indicate surface cleaning instructions.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction wast diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
      1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.07 QUALITY ASSURANCE
   A. Fabricator Qualifications:
      1. Firm having at least 2 years of documented experience in production of precast concrete of the type required.
B. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that describes execution requirements.

1.08 DELIVERY, STORAGE, AND HANDLING
   A. Handling: Lift and support precast units only as recommended by the manufacturer.
   B. Protect units to prevent staining, chipping, or spalling of concrete.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Architectural Precast Concrete:
      4. Substitutions: See Section 01.60.00 - Product Requirements.

2.02 PRECAST ROOF PAVERS
   A. Manufactured precast concrete pavers, for use as roof pavers where indicated.
      1. Materials: High density, hydraulically pressed concrete units, manufactured to 1/8" tolerances and produced by subjecting the concrete mix to a minimum pressure of 1,000 pounds per square inch over the entire surface area.
         a. Size: Typical 23.5" x 23.5" x 2", with other sizes as needed to fit layouts.
         b. Compressive Strength: 8,000 min. psi @ 28 days
         c. Flexural Strength: 1,100 psi
         d. Density: 155 lbs/cu ft.
         e. Absorbtion: less than 4%.
         f. Fabricated of Coplay Cement, Type 1, Buff.
         g. Aggregates should be a blend from 200 mesh to 5/8" with a light gray color. The aggregates should be washed with no deleterious substances, with no thin or elongated pieces. The aggregates should have an L.A. abrasion test of 21 and L.A. rattles loss test of 21.8% (at 500 revolutions).
         h. The pavers shall be integrally colored with shade from manufacturer's standard colors, as selected by the architect

2.03 SUPPORT DEVICES
   A. Pedestal and flexible leveling shims, loose laid on additional pads of roof membrane.
      1. Tab pedestal system; designed to secure each concrete paver in its proper location. Pedestals may be stacked to desired height.
      2. Leveling shims; flexible rubber-like shims in 1/16" and 1/8" thicknesses to eliminate paver movement.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that roof system is ready to receive work of this section.

END OF SECTION 03.45.00
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Mortar for masonry.
   B. Grout for masonry.

1.02 RELATED REQUIREMENTS
   A. Section 04.16.00 - Masonry Accessories
   B. Section 04.20.00 - Unit Masonry: Installation of mortar and grout.

1.03 REFERENCE STANDARDS
   J. ASTM C595 - Blended Hydraulic Cements
   L. Brick Institute of America
   M. Mortar to meet requirements of the 2012 International Building Code
      1. Field Tests for Grout and Mortar

1.04 SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.
   C. Samples: Submit multiple samples of mortar, illustrating mortar color and color range for selection and matching.
   D. Reports: Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.
   E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE
A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.
B. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, structural backup and flashings (with lap joint, corner and end dam) in mockup.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.
B. Deliver and store manufactured products in original unopened containers.
C. Stockpile and handle aggregates to prevent contamination from foreign materials.
D. Store admixtures to prevent contamination or damage from excessive temperature changes.
E. Keep water free of harmful materials.

1.08 FIELD CONDITIONS
A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.
B. Heat mixing water when air temperature is below 40 degrees F (4 degrees C) and heat aggregates when air temperature is below 32 degrees F (0 degrees C) to assure mortar temperatures between 40 degrees F (4 degrees C) and 120 degrees F (50 degrees C) until used.
C. Produce subsequent mortar batches within +/- 10 degrees F (+/- 6 degrees C) of first batch.
D. Do not heat water or sand above 120 degrees F (50 degrees C).

PART 2 PRODUCTS
2.01 MORTAR AND GROUT APPLICATIONS
A. Mortar Color: Mortar for brick is to be colored. The intent is for the mortar to match that on the Millennium Center. Contractor to use $18.00/Bag for colored mortar pricing. Final selection of colored mortar shall be approved and selected by Designer. There may be two colors of mortar for brick.
B. Mortar Mix Designs: ASTM C270, Property Specification, Type S.
C. Cultured Stone Units "only": ASTM C270, Type N.
D. Maximum air content 12%.
2.02 MATERIALS
A. Mortar Aggregate: ASTM C144. Except for joints less than 1/4", use aggregate graded with 100% passing the No. 16 sieve.
B. Water: Clean and potable.

2.03 MORTAR MIXING
A. Mix mortar materials to produce mortar cubes having 1800 psi compressive strength when tested in accordance with compressive strength test, ASTM C270. Minimum water retention, 75%. Maximum air content, 18%.
B. Proportions: Determine by laboratory design mixes to produce a compressive strength of 1800 psi.
C. Mixing Procedures:
   1. Measure materials by volume or equivalent weight.
   2. Do not measure by shovel.
   3. Mix ingredients in clean mechanical batch for 3 - 5 minutes.
   4. Use maximum amount of water to produce workable consistency.
   5. Retemper stiffened mortar only within 2-1/2 hours after initial mixing.

2.04 GROUT MIXING
A. Grout: ASTM C476, Coarse grout having 2,500 minimum psi strength at 28 days.
B. Grout Mixing:
   1. Control batching procedure to ensure proper volume proportions of grout materials and achieve grout slump between 8" and 10".
   2. Measure grout materials mixed at job site by volume and mix all ingredients in mechanical mixer for minimum of five minutes.
   3. Mix grout in accordance with ASTM C94/C94M.

PART 3 EXECUTION

3.01 PREPARATION
A. Debris: Spaces to be grouted shall be free of mortar droppings, debris, loose aggregates and any material deleterious to masonry grout.
B. Cleanouts: When grout pour exceeds 5’ in height, cleanouts shall be provided in the bottom course of masonry in each grout pour.
C. Plug clean-out holes for grouted masonry with block masonry units. Brace masonry to resist wet grout pressure.

3.02 INSTALLATION
A. Install mortar and grout to requirements of Section 04.20.00 in which masonry is specified.

3.03 FIELD QUALITY CONTROL
A. Field Compressive Test Specimen for Mortar: ASTM C270. Make and test one compressive test specimen for each 5,000 square feet of wall.
B. Field Compressive Test Specimen for Grout: ASTM C1019-89a. Make and test one compressive test specimen for each 5,000 square feet of wall.
C. Refer to Specification Section 03.30.00 - Case-in-Place Concrete, Paragraph 3.09.
D. The Contractor shall pay for all tests. These tests should be included in the Contractor's Bid.

END OF SECTION 04.05.11
SECTION 04.16.00
MASONRY ACCESSORIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: The extent of the masonry work is shown on the drawings.
   1. Related Work Described Elsewhere:
      2. Section 04.05.11 - Mortar and Masonry Grout
      3. Section 04.20.00 - Unit Masonry

1.02 SUBMITTALS

A. Manufacturer’s Data: Submit manufacturer's specifications and installation instructions for each masonry
   accessory required. Include data substantiating that materials comply with specified requirements. Send a
   copy of manufacturer's instructions to the installer.

B. For cavity spaces over 4 1/2", provide the design of the ladder eye-wire reinforcement by an engineer
   licensed in the State of Tennessee or provide additional masonry to reduce cavity space. The solution
   must meet the requirements of the masonry code “Building Code Requirements and Specification for
   Masonry Structures.”

PART 2 - PRODUCTS

2.01 GENERAL

A. Fire Rated Masonry: Wherever a Fire Resistance Classification is shown or scheduled for unit masonry
   construction (1-Hour, 2-Hour and similar designation), provide accessories which have been tested and
   listed for the construction shown.

2.02 REINFORCEMENT

A. Continuous Wire Reinforcing and Ties for Masonry:
   1. General: Provide welded wire units prefabricated in straight lengths of not less than 10' feet (3m)
      with matching corner and tee units. Fabricate from cold drawn steel wire complying with ASTM
      A82, with deformed continuous side rods and plain cross rods and a unit width of 1-1/2" to 2"
      (38mm to 51mm) less than thickness of wall or partition. Corner and tee units to be provided at all
      wall intersections.

B. For Single Wythe Masonry Provide Units Fabricated As Follows:
   1. Truss type fabricated with single pair of side rods and continuous diagonal cross rods.

C. Wire Size: Fabricate with 9 gauge side and cross rods, unless otherwise shown or specified. Refer
   Paragraph E. below.
   1. For use in interior partition walls fabricate from mill galvanized wire.
   2. For use in exterior walls fabricate from hot dipped galvanized wire with 1.5 oz. zinc coating
      complying with ASTM A153, Class B-2.

D. Manufacturers: The following manufacturers offer products which comply with the requirements of this
   specification:
   1. Wire-Bond.
   2. Dur-O-Wal.
   3. Hohmann and Barnard.
   4. Lox-All, Cumberland Corporation.
   5. Southern Wire Mesh Company.

E. For exterior walls with block back up and brick veneer provide masonry reinforcing as follows:
   "Tab-Tie" prefabricated continuous reinforcing spaced as shown on drawings; Durowal “Dur-O-Tab” or
equal. Side wires 3/16” diameter deformed and all galvanized. Refer to drawings for different wall thickness.
F. Bending of "Tabs" will not be permitted for any reason.

2.03 ANCHORING DEVICES FOR MASONRY
A. General: Provide straps, bars, bolts and rods of the type and size shown, but fabricated from not less than 16 gauge sheet metal or 3/8” (9mm) diameter rod stock, unless otherwise shown.
B. Stud to CMU Ties: Hohmann & Barnard (or equal), Model No. DW-10HS with "Tri-Tie" triangular 3/16” diameter anchor. Space 16” o.c. each way.
C. Brick Ties to Exterior Wall Metal Studs: Hohmann & Barnard, Inc. (or equal), Thermal 2-Seal Tie Veneer Anchors, with continuous wire for seismic conditions, all Type 304 stainless steel. Coordinate sizes of anchors with thicknesses of wall assemblies.
1. Metal brick tie straps shall be anchored by stainless steel barrel with screw through sheathing material and firmly into metal exterior wall stud. Do not anchor to sheathing alone. Maximum anchorage spacing at 16” X 16” o.c.
D. Brick Ties to Exterior Wall Masonry: Hohmann & Barnard (or equal), Model 170-2S-SH Adjustable Truss Eye-Wire with Seismic Hook. Ladder type masonry joint reinforcing with protruding eye-wires to receive seismic hooks. All Type 304 stainless steel.
1. See note for submittals for conditions where veneer cavity exceeds 4 1/2”.
E. Column Ties: Hohmann & Barnard (or equal), Model No's.359-391W triangular anchors 1/4” diameter; trapezoidal ties 302W and 301W; rectangular ties 1/4” diameter. Spacings as per manufacturers recommendations and maximum of 16” o.c. vertically.
F. Debonded Shear Anchors: Hohmann & Barnard (or equal) Slip-Set Stabilizer, joint stabilizing anchor, Standard Type, allowable load transfer capacity of 305 pounds per anchor, maximum vertical spacing of 8” inches.

2.04 FLASHING FOR MASONRY
A. General: Provide concealed flashings shown to be built into masonry.
2. Stainless Steel Flashing: ASTM A666, Type 304, soft temper, 26 gauge, 0.0187 inch thick, finish 2B to 2D.
3. Sealant joints at shelf angles: Horizontal sealant joints as shelf angles shall match color of adjacent mortar.
B. Manufacturers offering products to comply with the requirements include the following:
1. York.
2. Polytite.
3. Cheney.
4. Sandou.
5. Advanced.

2.05 MASONRY ACCESSORIES
A. Reinforcing Bars: Deformed steel reinforcing bars complying with ASTM A615 Grade 60 of the sizes shown.
B. Preformed Control Joint: Factory-extruded solid section of rubber conforming to ASTM C2000 2AA 805 with a durometer hardness of approximately 80 when tested in conformance with ASTM D2240.
1. Control joint section shall be capable of resisting a uniform load of 294 lb. per foot for wide flange section and 338 lb. per foot for regular section.
2. Provide with corner and tee accessories, fused joints.
C. Control Joint in Face Veneer: 3/8" thick X 3" wide, closed cell neoprene material conforming to ASTM D1056, Class RE41, compression up to 35%, manufactured with an adhesive surface.
   1. Manufacturers offering products to comply with the requirements include the following:
      a. AA Wire Products Company.
      b. Dur-O-Wal.
      c. Ty-Wal.

D. Grout Stop: "Durowal" D/A 1010-1013, Fil Stop fiber glass mesh, 10 x 10 white resin coated glass mesh, conforming to ASTM D1668, Type 207.

E. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and to allow proper cavity drainage.
   1. Full-Height Airspace Maintenance and Drainage Material: Mesh panels, fitted between masonry ties, where indicated on Drawings.
   2. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.

F. Termination Bars: Stainless steel; compatible with membrane and adhesives.

G. Weeps:
   1. Type: Polyester mesh, vertical head joint type, matching color of mortar. Typical.
   2. Type: Tube type plastic weeps only where indicated on Drawings.

H. Cavity Vents:
   1. Type: Polyester mesh, vertical head joint type, matching color of mortar. Typical.

I. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 - EXECUTION

3.01 INSPECTION
   A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION
   A. See Section 04.20.00 - Unit Masonry and other applicable sections.

3.03 COORDINATION
   A. Carefully coordinate with all other trades to ensure proper and adequate interface of the work of other trades with the work of this section.

END OF SECTION 04.16.00
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Concrete Block.
B. Concrete Brick.
C. Common Brick (brick to be furnished by others and installed by contractor).
D. Hollow Brick and Uncored Brick (brick to be furnished by others and installed by contractor).
E. Special shaped bricks (brick to be furnished by others and installed by contractor).
F. Lipped brick at heads to be field cut from uncored brick (brick to be furnished by others and to be cut and installed by contractor).
G. Reinforcement and Anchorage, See 04.16.00 - Masonry Accessories.
H. Flashings, See 04.16.00 - Masonry Accessories.
I. Lintel Installation.
J. Accessories, See 04.16.00 - Masonry Accessories.

1.02 RELATED REQUIREMENTS
A. Section 04.05.11 - Mortar and Masonry Grout.
B. Section 04.16.00 - Masonry Accessories.
C. Section 05.50.00 - Miscellaneous Metal: Loose steel lintels.

1.03 REFERENCE STANDARDS
D. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale); 2013.
E. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2014.
F. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale); 2014.
I. BIA TECHNICAL NOTES No. 28B - Brick Veneer/Steel Stud Walls; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.
1.05 SUBMITTALS
A. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
B. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
C. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.
D. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.07 QUALITY ASSURANCE
A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.
B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.08 MOCK-UP
A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, structural backup, and flashings (with lap joint, corner, and end dam) in mock-up. Multiple brick color options in color ranges and face typ may be necessary to match the Millennium Center.
B. Locate where directed near the Millennium Center, in full sunlight orientation, with both colors exhibited.

1.09 DELIVERY, STORAGE, AND HANDLING
A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS
2.01 CONCRETE MASONRY UNITS
A. Concrete Block (CMU): Provide manufacturer's standard lightweight aggregate units, with nominal face dimensions of 16" long x 8" high, unless otherwise shown. Concrete masonry units shall conform to the requirements of ASTM C90, open end, Type 1 and with compressive strength of 1700 psi minimum on
net area for any one unit, and not less than 1900 psi for average of 3 units. Aggregate for units shall meet ASTM C331 for lightweight aggregate F'm = 1900 psi for **all units**.

1. Provide special shapes where shown and where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions. Provide bullnose block where indicated. Moulded block will be required for 45 degree outside corners or other angled corners.

2. Shrinkage of standard blocks shall not exceed the amount recommended in ASTM C426.

3. Water content: At the time of delivery to the job site, concrete masonry units shall have a value in weight of contained water of not more than 35% of the fully saturated content for the unit tested.

4. Ship units from the factory and store at the job site with necessary protection to prevent increase of water content from rain and other sources.

5. Certification required under Submittals shall show results of tests made not more than 12 months prior to delivery of concrete masonry units to the job site, that shows compliance with the specified values and shall certify that the mix design, yield per batch and curing procedures for the units delivered to the job site will be equal to those submitted for test.

6. Curing: Cure units in a moisture controlled atmosphere or in an autoclave at normal pressure and temperature to comply with ASTM C90, Type 1 requirements.

**B. Concrete Brick (if occurs):**

1. For architectural and paver use, ASTM C1634 (or ASTM C55, Grade N), non-cored (solid), normal weight.

2. For below grade use, ASTM C1634 (or ASTM C55, Grade N), normal weight.

3. For other uses, ASTM C55, normal weight.

**2.02 BRICK UNITS**

**A. Manufacturers:**

1. General Shale Brick: www.generalshale.com. All bricks and special shapes will be furnished by this company and installed by the Contractor.

**B. Facing Brick:** ASTM C216, Type FBX, Grade SW.

1. Color and texture: Two colors to match existing Millennium Center building and hollow facing brick.
   - "Main Brick Veneer Color 1" - Red brick to match the Millennium Center. Appears to be General Shale Red Range Charleston Lighweight Modular 6035006347.
   - "Accent Brick Veneer Color 2" - Yellow brick to match the Millennium Center. Appears to be General Shale Centennial Velour 6044000084.

2. Nominal size: As indicated on drawings.

3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
   - At Lintels and Shelf Angles: Provide lipped brick or cut brick to indicated shape.
   - At Sills: Provide sloped sill brick where indicated.
   - At Recessed Brick Areas: Provide uncored brick.

**C. Building (Common) Brick:** ASTM C62, Grade SW; solid units.

1. Nominal size: As indicated on drawings.

**D. Hollow Facing and Building Brick:** ASTM C652, Grade SW; Type HBX; Class H40V.

1. Color and texture: Two colors to match existing Millennium Center building and solid facing brick.
   - "Main Brick Veneer Color 1" - Red brick to match the Millennium Center. Appears to be General Shale Red Range Charleston Lighweight Modular 6035006347.
   - "Accent Brick Veneer Color 2" - Yellow brick to match the Millennium Center. Appears to be General Shale Centennial Velour 6044000084.

2. Nominal size: As indicated on drawings.

**2.03 MORTAR AND GROUT MATERIALS**

**A. Mortar and Grout:** As specified in Section 04.05.11.

**DESIGN RELEASE PACKAGE 4**

**ISSUED: 12/01/2017**
2.04 REINFORCEMENT AND ANCHORAGE
   A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; as specified in Section 03.30.00 and sizes as indicated on drawings.
   B. Joint Reinforcement, as specified in Section 04.16.00: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

2.05 FLASHINGS
   A. Flashing Materials, as specified in Section 04.16.00 - Masonry Accessories.

2.06 ACCESSORIES
   A. Masonry Accessories are specified in Section 04.16.00 - Masonry Accessories

2.07 LINTELS
   A. Construct lintels where shown as follows:
      1. Install loose lintels of steel and other materials as shown. Galvanized lintels at exterior walls.
      2. Provide minimum bearing at each jamb of 4" for openings less than 4'-0" wide and 8" for wider openings.
      3. Grout masonry minimum 8" wide by thickness of wall at all lintel bearings from bottom of lintel to floor or footing below.

2.08 MORTAR AND GROUT MIXES
   A. Mortar and Grout for Unit Masonry: As specified in Section 04.05.11.
   B. Colored Mortar: As specified in Section 04.05.11. Proportion selected pigments and other ingredients to match the brick on the Millennium Center and Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that field conditions are acceptable and are ready to receive masonry.
   B. Verify that related items provided under other sections are properly sized and located.
   C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION
   A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
   B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
   C. Debris: Spaces to be grouted shall be free of mortar droppings, debris, loose aggregates and any material deleterious to masonry grout.
   D. Cleanouts: When grout pour exceeds 5' in height, cleanouts shall be provided in the bottom course of masonry in each grout pour.
   E. Plug clean-out holes for grouted masonry with block masonry units. Brace masonry to resist wet grout pressure.

3.03 COLD AND HOT WEATHER REQUIREMENTS
   A. Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.
3.04 COURSING
A. Establish lines, levels, and coursing indicated. Protect from displacement.
B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
D. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches.
   3. Mortar Joints: Match the Millennium Center joint profile(s).

3.05 PLACING AND BONDING
A. Lay solid masonry units in full 3/8” bed of mortar, with full head joints, uniformly jointed with other work.
B. Lay hollow masonry units with face shell bedding on head and bed joints, fully mortared.
C. Vertical cells to be grouted are to be aligned and provide unobstructed openings for grout, in accordance with the Project Drawings.
D. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
E. Remove excess mortar and mortar smears as work progresses.
F. Interlock intersections and external corners, except for units laid in stack bond.
G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
I. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
J. Wall Ties: Fabricate and place ties and other reinforcement accessories in conformance with the provisions of Section 3.
K. Embedded Items and Accessories: Install embedded items and accessories where shown in the Project Drawings and in accordance with the Contract Documents.
   1. Construct chases as masonry units are laid.
   2. When required, place pipes and conduits passing horizontally through masonry beams or masonry walls in steel sleeves or cored holes.
   3. Install and secure connectors, flashing, weep holes, weep vents, nailing blocks and other accessories.
L. Bracing of Masonry: Design, provide and install bracing that will assure stability of masonry during construction.

3.06 WEEPS/CAVITY VENTS
A. Install weeps in veneer and cavity walls at 16 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.
B. Install cavity vents in veneer and cavity walls at 32 inches on center horizontally below shelf angles and lintels and near top of walls.

3.07 CAVITY MORTAR CONTROL
A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
B. Where indicated, install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions. Verify that airspace width is no more than 3/8 inch greater than panel thickness. Install horizontally between joint reinforcement. Stagger end joints in adjacent rows. Fit to perimeter construction and penetrations without voids.

C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.

F. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

3.09 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

1. Extend flashings full width at interruptions to form watertight pan at non-masonry construction.

2. Provide end dams at ends of flashings in accordance with manufacturer's recommendations and where indicated.

3. Remove or cover protrusions or sharp edges that could puncture flashings.

4. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive and double-stick joint tape.

3.10 LINTELS

3.11 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

3.12 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

3.13 CLEANING

A. Remove excess mortar and mortar droppings.
B. Replace defective mortar. Match adjacent work.
C. Clean soiled surfaces with cleaning solution.

3.14 PROTECTION
A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.
B. Cover the tops of masonry walls to protect from the weather.

END OF SECTION 04.20.00
SECTION 05.40.00
COLD FORMED STEEL FRAMING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: All axially or wind loaded light gauge steel studs, track, joists, trusses, bridging, purlins, and related accessories as indicated on the Contract Drawings and specified herein.

B. Related Work Described Elsewhere:

1. Lumber and Rough Carpentry: Section 06.10.00
2. Metal Framing: Section 09.22.16

1.02 QUALITY ASSURANCE

A. Inspection and Quality Control:

1. Contractor shall provide effective full time quality control over all fabrication and erection activities.

2. As directed by Designer, Owner's Testing Agency may inspect the maintenance of a Quality Control Program including spot checking weldments and welding procedures in accordance with A.W.S. Standards.

3. Steel framing manufacturer shall provide a qualified representative for periodic on site review of fabrication and installation in accordance with Manufacturer's Recommendations.

4. Inspection by Owner's Testing Agency is not intended to comprehensive or complete. Full responsibility for Quality Control shall remain with the General Contractor.

B. Standards:

1. Work shall meet the Requirements of the following Standards:


   e. All pertinent Federal, State and Local Codes.
2. The most stringent requirements shall govern in conflicts between specified Codes and Standards.

1.03 SUBMITTALS

A. Shop Drawings:

1. Prior to framing fabrication, submit formal fabrication and erection shop drawings for Designer approval.

2. Shop Drawings Shall Indicate:

   a. Framing with individual panel drawings for each wall and each differing condition including configuration, dimensions, materials, attachments, and panel locations. Sections of each load bearing wall and associated detailed connections shall be provided.

   b. All member gauges, spacings and sizes.

   c. Shop and field assembly details including cut and connections.

   d. Type and location of welds, screws, clips, bolts and fastening devices.

B. Structural Calculations:

1. Submit recommended structural design with supporting calculations as prepared by manufacturer for approval by Engineer of Record, Designer or both. Calculations and drawings to be stamped by a Engineer of Record licensed in the State of the Project.

1.04 PRODUCT HANDLING

A. Protection: Upon delivery, material shall be protected from rain and snow by impervious covering or shelter.

B. Keep steel members off the ground, using pallets, platforms or other supports. Protect steel members and package materials from corrosion and deterioration.

PART 2 - PRODUCTS

2.01 GENERAL

A. All framing members shall be manufactured and supplied by and be of the type and size as shown on the plans, manufacturer shall be a member of SSMA.

B. Sizes are based on the Steel Stud Manufacturers Association (SSMA), “Product Technical Information” guide.
2.02 MATERIALS

A. Hot-Dipped Galvanized Materials (unless otherwise noted on Drawings):

1. All galvanized studs and joists 12 (97 mil), 14 (68 mil) and 16 (54 mil) gauge, shall be formed from steel that corresponds to the minimum requirements of ASTM A446, Grade D with a minimum yield of 50,000 psi, unless otherwise noted on drawings. All exterior wall studs to be 600S200-54 (50ksi) unless otherwise noted.

2. All galvanized 18 (43 mil) and 20 (33 mil) gauge studs and joists, all galvanized track, bridging, end closures and accessories shall be formed from steel that corresponds to the requirements of ASTM A446, Grade A with a minimum yield of 33,000 psi, unless otherwise noted on drawings.

3. All galvanized studs, joists, track, bridging and accessories shall be formed from steel having a G60 galvanized coating meeting the requirements of ASTM A525 or A924.

C. Properties: The physical and structural properties shall be considered the minimum permitted for all framing members, calculated in accordance with the latest AISI Specification shall be provided.

D. Substitutions: Any substitutions must be approved in writing by the Designer or the Engineer of Record.

2.03 FABRICATION

A. Framing components may be preassembled into panels prior to erecting. Prefabricated panels shall be square, with components attached in a manner as to prevent racking.

B. All framing components shall be cut squarely for attachment to perpendicular members, or as required for angular fit against abutting members. All cutting of framing components shall be done by sawing or shearing, torch cutting is NOT acceptable. Members shall be held positively in place until properly fastened.

C. Provide insulation equal to that specified elsewhere in all double jamb studs and double header members which will not be accessible to the Insulation Contractor.

D. Axially Loaded Studs:

1. Studs shall have full bearing against inside track web, prior to stud and track attachment.

2. Splices in axially loaded studs is not permitted.

3. No notching or coping of studs is allowed.

4. Framing fabricator is to ensure punch out alignment when assembling lateral bracing and field cutting studs to length. Lateral bracing must be installed at the time the wall is erected. Failure to install bracing at this time may compromise the structural integrity of the building.

5. Use minimum of three studs at the corner of all exterior walls.
6. Use minimum of three studs at the intersection of all load bearing walls (exterior or interior).

7. Joist or roof member must bear directly over stud. If not, a structural member is required on top of runner track for proper bearing and anchorage.

8. Studs from floor above must bear directly over joists. If not, a structural member is required on top of joist for proper bearing.

D. Joist and Rafter:
   1. Joist or rafter member must bear directly over stud. If not, a structural member is required on top of runner track for proper bearing and anchorage.
   2. All splice requirements for joists and rafters must be determined through engineering analysis.
   3. All field holes must be reinforced. No notching or coping of joists or rafters is allowed unless stated in the shop drawing package.
   4. Joist or rafter bridging must be installed at the time the floor or roof is erected. Failure to install bracing at this time may compromise the structural integrity of the building.

E. Headers:
   1. All headers/built-up beams are to be constructed with UNPUNCHED material only.
   2. Splicing of headers is not allowed.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection: Prior to installation inspect work of all other trades. Verify that all such work is complete and accurate to the point where this installation may properly commence in strict accordance with framing shop drawings.

B. Discrepancies:
   1. Immediately notify Designer of all discrepancies.
   2. Do not proceed with installation in areas of discrepancies until such discrepancy has been fully resolved.

3.02 ERECTION

A. Walls:
   1. Erect framing and panels plumb, level and square in strict accordance with the approved shop drawings.
2. Handling and lifting of prefabricated panels shall be done in a manner as to not cause distortion in any member.

3. Track shall be securely anchored to the supporting structure as shown on the fabrication and erection drawings.

4. At track butt joints, abutting pieces of track shall be securely anchored to a common structural element, or they shall be butt welded or spliced together.

5. Studs shall be plumbed, aligned and securely attached to the flange or webs of both upper and lower tracks.

6. Jack studs or cripples shall be installed below window sills, above window and door heads, at free standing stair rails and elsewhere to furnish support, and shall be securely attached to supporting members.

7. Wall studs bridging shall be attached in a manner to prevent stud rotation. Bridging rows shall be spaced according to the manufacturer’s recommendation. Without supportive data, the minimum bridging shall be 5'-0" on center for wind loaded walls and 3'-4" on center for axial loaded walls.

8. Framed wall openings shall include headers and supporting studs as shown on the plans.

9. Temporary bracing shall be provided until erection is completed.

10. Provision for structural vertical movement shall be provided where indicated on the plans using a vertical slide clip or other means in accordance with Manufacturers recommendations or as indicated on the drawings.

B. Cold Formed Steel Lintel:

1. Lintel shall be located directly over bearing studs or a load distribution member shall be provided at the top track.

2. Provide web stiffeners at lintels.

END OF SECTION 05.40.00
PART 1  GENERAL

1.01  SECTION INCLUDES
A.  Stairs with precast concrete treads.
B.  Stairs with concrete treads.
C.  Stairs with metal treads.
D.  Ships Ladders with grating treads.
E.  Structural steel stair framing and supports.
F.  Handrails and guards, except where noted.

1.02  RELATED REQUIREMENTS
A.  Section 05.12.00 - Structural Steel
B.  Section 05.50.00 - Miscellaneous Metal
C.  Section 05.70.00 Decorative Metal: Railings and guardrails for Stair 1, Lobby Mezzanine and Balcony

1.03  REFERENCE STANDARDS
H.  ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
N. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.
O. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
R. NAAMM MBG 531 - Metal Bar Grating Manual; 2009.
T. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
V. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

1.04 SUBMITTALS
A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include the design engineer's stamp or seal on each sheet of shop drawings.
C. Delegated Design Data: As required by authorities having jurisdiction.
D. Welders' Certificates.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   3. Compliance with Credit EQ6.2: Material VOC Limits - Paints
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE
A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Tennessee, or personnel under direct supervision of such an engineer.
B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.
C. Fabricator Qualifications:
   1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.
PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.

1. Regulatory Requirements: Provide stairs and railings complying with the most stringent requirements of local, state, and federal regulations; where requirements of the contract documents exceed those of regulations, comply with the contract documents.

2. Handrails: Comply with applicable accessibility requirements of ADA Standards.


4. Dimensions: As indicated on drawings.

5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.

6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.

7. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:

1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
   a. Welded Joints: Continuously welded and ground smooth and flush.
   b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
   c. Exposed Edges and Corners: Square edge corners and edges.
   d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

2. Commercial: Exposed joints as inconspicuous as possible, whether welded or mechanical; underside of stair not covered by soffit IS considered exposed to view.
   a. Welded Joints: Intermittently welded on back side, filled with body putty, and sanded smooth and flush.
   b. Welds Exposed to View: Ground smooth and flush.
   c. Mechanical Joints: Butted tight, flush, and hairline.
   d. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts.
   e. Exposed Edges and Corners: Eased to small uniform radius.
   f. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for satin or matte finish.

3. Service: Exposed joints tight with face surfaces aligned; underside of stair not covered by soffit is not considered exposed to view.
   a. Welded Joints: Welded on back side wherever possible.
   b. Welds Exposed to View: Ground smooth; not required to be flush.
   c. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts or screw threads.
   d. Metal Surfaces to be Painted: Sanded smooth, suitable for satin or matte finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH STRUCTURAL REINFORCED PRECAST CONCRETE TREADS (STAIR 1)

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed, integral precast with treads.

C. Treads: Metal pan with precast concrete treads & risers.
1. Precast Concrete Treads and Risers:
   b. Other Manufacturer: Precast Terrazzo Enterprises, Inc., 1107 N New Hope Road, Raleigh, NC 27610, 800-849-8849, www.precastterrazzo.com info@precastterrazzo.com
   c. Other Manufacturer: Romoco Precast Terrazzo Products, Roman Mosaic & Tile Co., 2039 Mountain Road, Manheim, PA 17545, 717-665-2739 www.romanmosaic.com
   d. Cement Color: As selected by Architect from manufacturer's standard cementitious samples.
   e. Aggregate Color: As selected by Architect's from manufacturer's standard cementitious samples.
   f. Abrasive Strips: Three strips with contrasting color, embedded into surface 1/2 inch back of point of nosing.
   g. Anchorage to Tread Pan: Epoxy adhesive.

2. Tread Support: Steel angles at stringers.

3. Anchorage to Stringers: Continuously welded, from top, to be exposed to view from bottom.

D. Railings: See Section 05.73.13 - Glazed Decorative Metal Railings.

2.03 METAL STAIRS WITH CONCRETE TREADS (STAIR 2)

A. Jointing and Finish Quality Level: Commercial, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.
   1. Concrete Depth: 1-1/2 inches, minimum.
   2. Tread Pan Material: Steel sheet.
   3. Tread Pan Thickness: As required by design; 14 gage, 0.075 inch minimum.
   4. Pan Anchorage to Stringers: Continuously welded, from top or bottom.
   5. Concrete Reinforcement: None.
   6. Concrete Finish: For resilient floor covering.

D. Risers: Same material and thickness as tread pans.
   1. Nosing Depth: Not more than 1-1/2 inch overhang.
   2. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.

E. Stringers: Rolled steel channels.
   1. Stringer Depth: 12 inches.
   2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

G. Railings: Steel pipe railings.

H. Finish: Shop- or factory-prime painted.

I. Under Side of Stair: Exposed to view, to be finished same as specified for other exposed to view surfaces.

2.04 METAL STAIRS WITH METAL TREADS

A. Jointing and Finish Quality Level: Service, as defined above.

B. Risers: Closed.

C. Treads: Checkered steel plate.
   1. Tread Thickness: 1/4 inch, minimum.
   2. Anchorage to Stringers: Welded or bolted to carrier angles welded or bolted to stringers.

D. Risers: Steel sheet.
   1. Riser Thickness: As required by design; 14 gage, 0.075 inch minimum.
2. Riser/Nosing Profile: Sloped riser with rounded nosing of minimum radius.

E. Stringers: Rolled steel channels.
   1. Stringer Depth: 10 inches.
   2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

G. Railings: Steel pipe railings.

H. Finish: Shop- or factory-prime painted.

2.05 METAL STAIRS WITH GRATING TREADS (SHIPS LADDERS)

A. Jointing and Finish Quality Level: Service, as defined above.

B. Risers: Open.

C. Treads: Steel bar grating.
   1. Grating Type: Welded.
   2. Bearing Bar Depth: 3/4 inch, minimum.
   3. Top Surface: Standard.
   6. Anchorage to Stringers: End plates welded to grating, bolted to stringers.

D. Stringers: Rolled steel channels.
   1. Stringer Depth: 10 inches.
   2. End Closure: Sheet steel of same thickness as risers welded across ends.

E. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity. Toe kicks required.

F. Railings: Steel pipe railings.

G. Finish: Shop- or factory-prime painted.

2.06 HANDRAILS AND GUARDS

A. General: Galvanized at exterior locations, painted.

B. Hand Rails: Round pipe rails, unless otherwise indicated.
   1. Outside Diameter: 1-1/4” inch minimum, to 1-1/2 inches maximum.

C. Guards:
   1. Top Rails: Round pipe or tube rails unless otherwise indicated.
      a. Outside Diameter: 1.9 inch, Inside Diameter 1-1/2 inches.
   2. Infill at Picket Railings: Vertical pickets.
      a. Horizontal Spacing: Maximum 4 inches on center.
      b. Material: Solid steel bar.
      c. Shape: Square.
      d. Size: 1/2 inch square.
      e. Top Mounting: Welded to underside of top rail.
      f. Bottom Mounting: Welded to topside of bottom rail.
   3. End and Intermediate Posts: Same material and size as top rails.
      a. Horizontal Spacing: As indicated on drawings.
      b. Mounting: Welded to top surface of stringer.
   4. Configuration and Material: As indicated on Drawings.
   5. Construction: Welded unless otherwise noted.
   6. Joining and finish quality level per that specified for the type of stair.
2.07 MATERIALS

A. Steel Sections: ASTM A36/A36M.
B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.
C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.
D. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black and galvanized finish, as indicated.
E. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
   1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
   2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).
F. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230 with G40/Z120 coating.
G. Checkered Plate: ASTM A786/A786M, rolled steel floor plate; manufacturer's standard pattern.
H. Gratings: Bar gratings complying with NAAMM MBG 531 or NAAMM MBG 532, whichever applies based on bar sizes.
I. Concrete Fill: Portland cement Type I, 3000 psi 28 day strength, 2 to 3 inch slump.
J. Concrete Reinforcement: Mesh type, galvanized.

2.08 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.
B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.09 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
B. Do not prime surfaces in direct contact with concrete or where field welding is required.
C. Prime Painting: Use specified shop- and touch-up primer.
   1. Preparation of Steel: In accordance with SSPC-SP 2, Hand Tool Cleaning.
   2. Number of Coats: One.
D. Galvanizing: Hot-dip galvanize to minimum requirements of ASTM A123/A123M.
   1. Touch up abraded areas after fabrication using specified touch-up primer for galvanized surfaces.

PART 3 EXECUTION

3.01 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

3.02 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.
B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
C. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

D. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

E. Obtain approval prior to site cutting or creating adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

END OF SECTION 05.51.00
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Formed metal floor, mezzanine, and stair tread gratings.
   B. Perimeter closure.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS
   E. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric); 2012.
   F. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

1.04 SUBMITTALS
   A. Product Data: Provide span and deflection tables.
   B. Shop Drawings: Indicate details of component supports, openings, perimeter construction details, and tolerances.
      1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.
   D. Manufacturer's Installation Instructions: Indicate special requirements for opening and perimeter framing.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction waste diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
      1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
      2. Compliance with Credit EQ6.2: Material VOC Limits - Paints
   D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.
1.06 QUALITY ASSURANCE
   A. Designer Qualifications: Design gratings and plates under direct supervision of a licensed Professional Engineer experienced in design of this type of work.
   B. Designer Qualifications: Design gratings and plates under direct supervision of a Professional Structural Engineer experienced in design of this type of work and licensed in Tennessee.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS
   A. Conform to applicable code for loading requirements.
   B. Maximum Allowable Deflection Under Live Load: 1/240 of span; size components by single support design.
   C. Maximum Spacing Between Bars: To restrict pedestrian shoe heels.

2.02 MATERIALS
   A. Steel Framing: ASTM A36/A36M shapes, galvanized per ASTM A123/A123M.
   B. Cross Bars: ASTM B211 (ASTM B211M) solid bars.
   C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.03 ACCESSORIES
   A. Fasteners and Saddle Clips: Galvanized steel:
   B. Perimeter Closure: Of same material as grating.

2.04 FABRICATION

2.05 FINISHES
   A. Galvanizing for Steel Shapes: ASTM A123/A123M.
   B. Galvanizing for Steel Hardware: ASTM A153/A153M.
   C. Non-Slip Surfacing: Aluminum oxide.

PART 3 EXECUTION -- NOT USED

END OF SECTION 05.53.05
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Railings for Balconies.
   B. Horizontal Torm Light Rails at Balconies.
   C. Vertical Torm Light Rails at Proscenium
   D. Cable railings at Studio Theater

1.02 RELATED REQUIREMENTS
   A. Section 05.50.00 - Metal Fabrications: Supports.

1.03 REFERENCE STANDARDS
   H. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

1.04 ADMINISTRATIVE REQUIREMENTS
   A. Pre-Installation Meeting: Schedule and conduct a preinstallation meeting one week before starting work of this section. Attendees shall include, but not be limited to:
      1. Contractor.
      2. Manufacturer's representative.
      3. Architect.
      4. Owner's representative.
      5. Other subcontractors of adjacent work.

1.05 SUBMITTALS
   A. Product Data: Submit manufacturer's product data including description of materials, components, finishes, fabrication details, glass, anchors, and accessories.
   B. Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.
C. Test Reports: Submit test reports from an independent testing agency showing compliance with specified design and performance requirements.

D. Manufacturer's Installation Instructions.

E. Maintenance Data: Manufacturer's instructions for care and cleaning.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION

A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.

B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   3. Compliance with Credit EQ6.2: Material VOC Limits - Paints

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing decorative stairs and railing systems and acceptable to manufacturer.

B. Templates: Supply installation templates, reinforcing and required anchorage devices.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect materials against damage during transit, delivery, storage, and installation at site.

B. Inspect materials upon delivery for damage. Repair damage to be indistinguishable from undamaged areas; if damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.

C. Prior to installation, store materials and components under cover, in a dry location.

1.09 FIELD CONDITIONS

A. Do not install railings until project is enclosed and ambient temperature of space is minimum 65 degrees F and maximum 95 degrees F.

B. Maintain ambient temperature of space at minimum 65 degrees F and maximum 95 degrees F for 24 hours before, during, and after railing installation.

1.10 WARRANTY

A. Warranty: Manufacturer's standard one year warranty against defects in materials, fabrication, finishes, and installation commencing on Date of Substantial Completion.
PART 2 PRODUCTS

2.01 RAILING SYSTEMS

A. Railing Systems - General: Factory- or shop-fabricated in design indicated, to suit specific project conditions, and for proper connection to building structure, and in largest practical sizes for delivery to site.

1. Design Criteria: Design and fabricate railings and anchorages to resist the following loads without failure, damage, or permanent set; loads do not need to be applied simultaneously.

   a. Lateral Force: 75 lb minimum, at any point, when tested in accordance with ASTM E935.
   b. Distributed Load: 50 lb/ft minimum, applied in any direction at the top of the handrail, when tested in accordance with ASTM E935.
   d. Concentrated Load: 200 lbs minimum, applied in any direction at any point along the handrail system, when tested in accordance with ASTM E935.
   e. Rails for Torm lights shall be designed to carry the loads of the lights.

2. Assembly: Join lengths, seal open ends, and conceal exposed mounting bolts and nuts using slip-on non-weld mechanical fittings, flanges, escutcheons, and wall brackets.


4. Field Connections: Provide sleeves to accommodate site assembly and installation.

5. Welded and Brazed Joints: Make exposed joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.

   a. Ease exposed edges to small uniform radius.
   b. Welded Joints:
      1) Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.

B. Metal Tube Railing: Engineered for Torm lights.

1. Rails: 1-1/2 inch IPS / 1.9 inch OD diameter pipe or tube, Schedule 40.
2. Decorative Flanges for Embedded Posts: Circular, collared cover plate without screw holes.
3. Wall Mounted Components: Components necessary to support railing with 1-1/2 inch clearance from wall, and as follows:
4. Fasteners: Concealed.
5. Finish: Painted

C. Cable Railing System:

1. Description: Post and cable railing system.
2. Configuration: Guardrail only.
3. Post and Top Rail: Steel Bar as shown on drawings.
4. Cable: ASTM A555/555M.
   a. Fabricate from ASTM A666 stainless steel, Type 304 or Type 316.
   b. Size: 3/16 inch diameter.
5. Fittings: Type 304 or Type 316 stainless steel, non-swedge.
7. Finishes:
   a. Exposed Steel Pipe and Tubing: Painted.
   b. Exposed, Stainless Steel Cable and Fittings: Manufacturer's standard.
8. Fabrication:
   a. Corners: Mitered and welded; grind smooth to match adjacent finish.
   b. Exposed Joints: Butt tight and flush.
   c. Splices: Provide interior sleeves; fasteners allowed at splice connections

D. Metal Balcony Railings

2. Configuration: As shown on the Drawings.
3. Finish: Painted

2.02 MATERIALS
A. Steel Components:
   1. Sections, Shapes, Plate and Bar: ASTM A36/A36M.
   4. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

2.03 ACCESSORIES
A. Welding Fittings: Factory- or shop-welded from matching pipe or tube; joints and seams ground smooth.
B. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete for bolting anchors.
   2. For anchorage to masonry, provide brackets to be embedded in masonry for bolting anchors.
   3. For anchorage to stud walls, provide backing plates for bolting anchors.
   4. Exposed Fasteners: No exposed bolts or screws.
C. Sealant: Silicone; clear.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that substrate and site conditions are acceptable and ready to receive work.
B. Verify field dimensions of locations and areas to receive work.
C. Notify Architect immediately of conditions that would prevent satisfactory installation.
D. Do not proceed with work until detrimental conditions have been corrected.
E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates and supports for attachment of anchors.

3.02 PREPARATION
A. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions and directions for installation of anchorages and fasteners.
B. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.

3.03 INSTALLATION
A. Comply with manufacturer's drawings and written instructions.
B. Install components plumb and level, accurately fitted, free from distortion or defects and with tight joints, except where necessary for expansion.
C. Anchor securely to structure.
D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
E. Isolate dissimilar materials with bituminous coating, bushings, grommets or washers to prevent electrolytic corrosion.
3.04 TOLERANCES
   A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
   B. Maximum Offset From True Alignment: 1/4 inch.

3.05 FIELD QUALITY CONTROL
   A. Field Services: Provide the services of the manufacturer for field observation of installation of railings.

3.06 CLEANING
   A. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents or other substances that may damage the material or finish.

3.07 PROTECTION
   A. Protect installed components and finishes from damage after installation.
   B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.
      1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION 05.70.00
SECTION 05.71.13
FABRICATED SPIRAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Preassembled spiral stairways.

1.02 RELATED SECTIONS

1.03 SYSTEM DESCRIPTION
A. Performance Requirements: Stair manufacturer shall engineer and fabricate stairs and railings to comply with applicable code requirements for live and dead loads, stair widths, and other sizes and configurations applicable to Work of this Section.
B. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials for handrails, railing systems, anchors, and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems.
1. Stair treads and structure shall be capable of withstanding a uniform load of 100 lbf/sq. ft. (4.8 kPa) and a concentrated load of 300 lbf (136 kf) applied to an area of 4 sq. in. (26 sq. cm). Uniform and concentrated loads need not be assumed to act concurrently.
   a. Deflection: L/480.
2. Top Rail of Guardrail Systems: Capable of withstanding the following loads applied as indicated:
   a. Concentrated load of 200 pounds (90.6 kg) applied at any point and in any direction.
   b. Uniform load of 50 pounds per linear foot (74.3 kg/m) applied horizontally and concurrently with uniform load of 100 pounds per linear foot (148.6 kg/m) applied vertically downward.
   c. Concentrated load need not be assumed to act concurrently with uniform loads.
3. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:
   a. Concentrated load of 200 pounds (90.6 kg) applied at any point and in any direction.
   b. Uniform load of 50 pounds per linear foot (74.3 kg/m) applied in any direction.
   c. Concentrated and uniform loads need not be assumed to act concurrently.
4. Infill Area of Guardrail Systems: Capable of withstanding a horizontal concentrated load of 200 pounds (90.6 kg) applied to 1 ft2 (0.1 m2) at any point in the system.
5. Above load need not be assumed to act concurrently with loads on top rails of railing systems in determining stress on guard.

1.04 REFERENCES
A. NAAMM "Metal Stairs Manual."
C. AWS D1.1 "Structural Welding Code - Steel."
D. AWS D1.3 "Structural Welding Code - Sheet Steel."
E. AWS "Welding Procedure and Performance Qualification."

1.05 SUBMITTALS
A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings:
   1. Submit shop drawings for stairs and railings.
   2. Include plans, elevations and details.
   3. Indicate floor opening details, including floor opening and stair height tolerances.
   4. Show connection and accessory items and locations for anchor and bolt installation.
   5. Indicate field welds.
   6. Include design loads, structural calculations and material properties.
   7. Shop drawings shall be signed and sealed by a Structural Engineer licensed in State in which Project is located.

D. Selection Samples:
   1. For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples:
   1. Full size, minimum 12 inches (305 mm) in length, samples for verification of tread, handrail and baluster profile and finish.
   2. For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION

A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.

B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   3. Compliance with Credit EQ6.2: Material VOC Limits - Paints

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall have produced types of stair and railing systems required for not less than ten years, with not less than five similar projects that have been in successful use for not less than five years.

B. Installer Qualifications: Minimum five years' experience in successful installation of stair and railing systems of type specified for Project.

1.08 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to starting work of this section.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Handling: Handle materials to avoid damage.
1.10 PROJECT CONDITIONS
A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.11 SEQUENCING
A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.12 WARRANTY
A. Provide stair and railing system manufacturer's written warranty that its products are free from defects in material and workmanship for life of building and that it agrees to repair or replace items proven to be defective or refund purchase price of item.

PART 2 PRODUCTS

2.01 SPIRAL STAIRS WELDED UNIT
A. Style/Design: As indicated on Drawings.

2.02 COMPONENTS
A. Column: Pipe; diameter as required for design loading or as indicated on Drawings.
B. Column Cap: Match material and finish of column.
C. Metal Landing Platforms:
   1. Material: Steel.
   2. Metal Landing Platforms: 3/16 inch (4.8 mm) checker plate.
D. Well Rail: Match stair balusters and handrails.
E. Metal Treads:
   1. Metal Treads: 3/16 inch (4.8 mm) steel checker plate.
F. Metal Handrails:
   1. Material: Steel.
   2. 1-1/2 inches round.
G. Metal Balusters:
   1. Material: Steel.
H. Metal Stringers: Plates, tubing, or channels as required for compliance with performance requirements.
   1. Material: Steel.
I. Provide landing framing, connections, and other components necessary for support and installation of stairs and other components.

2.03 ACCESSORIES
A. Fasteners and Anchorage Devices: Type as recommended by stair and railing system manufacturer.
B. Welding Materials: Type required for materials being welded.
C. Galvanizing Repair Paint: High-zinc-dust content paint for re-galvanizing welds in steel, complying with SSPC Paint 20.
D. Grout: Non-metallic shrinkage-resistant grout, premixed, noncorrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents.
E. Adhesive: Type as recommended by stair manufacturer for adhering [carpet] [rubber] to tread.

2.04 MATERIALS
A. Steel:
1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or Grade D.
5. Steel Tubing: ASTM A 500/A 500M (cold formed) or ASTM A 513.
6. Hot Rolled Sheet: ASTM A 569, commercial quality, or ASTM A570, Grade 30, structural quality, unless another grade is required for design loading.
7. Cold Rolled Sheet: ASTM A 366, commercial quality, or ASTM A 611, Grade A, structural quality, unless another grade is required for design loading.
8. Checker Plate: Raised pattern floor plate; thickness as required by tread model specified.
9. Tubing: Cold- or hot-formed steel tubing complying with ASTM A 500 or A 501 respectively, or as required for design loading.

2.05 FABRICATION
A. Design Rotation: Fabricate stair and railing system and well rail and platform for counterclockwise rotation in the ascending direction and to shapes and configurations indicated in Contract Documents in largest practical sizes for handling through building openings. Mark units for reassembly and coordinated installation.
B. Fabricate stair and railing system and well rail and platform to permit site assembly and installation.
C. Weld step to center column. No hubs on fully assembled stair.
D. Mill balusters to fit angle of handrail.
E. Form continuous handrails with no joints or bolts. Form elbow bends and wall returns to uniform radius, free from buckles and twists, and with smooth finished surfaces free from blemishes.
   1. Fabricate metal handrail and railing exposed ends with prefabricated end fittings.
F. Join components with concealed fasteners and concealed welds. Countersink fasteners that cannot be concealed.
G. Welded Connections: Cope and weld or use welded-in fittings. Weld connections continuously. Grind exposed welds smooth, flush, and hairline. Remove sharp or rough edges on exposed surfaces.
H. Fabricate platforms with integral nosings matching tread nosings.

2.06 FINISHES
A. Steel: Stair and railing system manufacturer's standard prime paint finish, for field finish painting.

PART 3 EXECUTION

3.01 EXAMINATION
A. Site Verification of Conditions: Verify installation conditions previously established under other sections are acceptable for product installation in accordance with manufacturer's instructions.
B. Verify that field measurements are acceptable to suit stair assembly tolerances.
C. Verify supports and anchors are correctly and securely positioned.
D. Scheduling of installation implies that substrate and conditions are prepared and ready for product installation. Proceeding with installation implies installer's acceptance of substrate and conditions.
E. Do not begin installation until substrates have been properly prepared.
F. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION
A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION
A. Install stair assembly in accordance with manufacturer's instructions and approved shop drawings and in compliance with specified performance requirements.
B. Anchor components rigidly and securely to building structure, plumb and level, accurately fitted, and free from distortion or defects.
C. Fit exposed connections to form tight hairline joints.
D. Weld connections which cannot be shop welded because of size limitations.
   1. Perform field welding of steel in accordance with AWS D1.1.
   2. Field bolt and weld to match shop bolting and welding. Grind exposed joints smooth.
E. Clean field welds, bolted connections and abraded areas.
   1. Touch up with shop primer.
F. Fastening to In-Place Construction: Provide anchorage devices and fasteners where needed for securing fabricated spiral stairs to in-place construction; include threaded fasteners for concrete and masonry inserts, through bolts, lag bolts, wood screws, and other connectors as required.
G. Assemble fabricated spiral stair components, with each component aligned and in correct relation to the designed position.

3.04 FIELD QUALITY CONTROL
A. Maximum Variation from Plumb: 1/4 inch for full height of stair.
B. Maximum Variation from Level: 1/8 inch.
C. Maximum Angular Variation of Tread from True Position: 3 degrees.
D. Comply with NAAMM Metal Stairs Manual.

3.05 PROTECTION
A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 05.71.13
PART 1 -- GENERAL

1.01 SUMMARY
A. Provide decorative illuminated railing system with posts designed to mount with base plate and anchors.

1.02 DESIGN REQUIREMENTS
A. Railing assembly shall withstand a minimum concentrated load of 200 pounds at any point and in any direction, and a uniform load of 50 pounds per foot applied horizontally and vertically downward but not concurrently.
B. All plastic and metal infill panel shall withstand a concentrated load of 200 pounds applied horizontally on an area of 1 sq. ft. and a uniform load of 25 pounds per square foot applied horizontally but not concurrently with other loads.
C. The strength of aluminum shall be the lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95 and the strength of Stainless Steel shall be 60 percent of minimum yield strength.

1.03 SUBMITTALS
A. Product Datacenter
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for hooks and or open slat shelving units.
B. Shop Drawings
   1. Include typical dimensioned cross-section(s) and plan view of each differing sized unit, indicating
      a. Dimensions as shown on the drawings.
      b. Finishes.
      c. Samples: For each exposed product and for each color and texture specified.
         1) Size: 12 inches
      d. Provide Qualification of Installers

1.04 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants.
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.05 QUALITY ASSURANCE
A. Fabricator Qualifications shall furnish references listing projects of similar size and scope.
B. Installer Qualifications shall have five (5) years of relevant experience of installing ornamental iron and railing systems.
C. Regulatory Requirements.
1. Components and installation are to be in accordance with all local, state and federal codes and jurisdictions having authority.

2. Components and installation are to follow current ADA Section 36, ICC/ANSI A117.1, International Building Code guidelines or any local or state codes or amendments, whichever is most restrictive.

D. Furnish certification that all components and fittings are furnished by the same manufacturer or approved by the primary component manufacturer.
   1. Furnish certification that components were installed in accordance to the manufacturer’s installation requirements and engineering data to meet the specified design loads.

E. Arrange a pre-installation meeting based on the following requirements:
   1. Prior to the beginning of work, conduct a pre-job conference at the job site with seven calendar days advance written notice ensuring the attendance by competent authorized representatives of the fabricator, building owner’s representative, architect and all subcontractors whose work interfaces with the work of this section.
   2. Review the specifications to determine any potential coordination issues, changes in scope and/or design, installation scheduling and requirements, job site conditions and procedures and/or any other information pertinent to the installation.
   3. Record the results of the conference and furnish copies to all participants.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.

B. Store material on site in a location and in a manner to avoid damage. Stacking shall be done in a way, which will prevent bending.
   1. Store material in a clean, dry location away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin, or polyethylene sheeting in a manner that will permit circulation of air inside the covering.
   2. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of material.

1.07 WARRANTY
A. Five-year limited warranty includes factory labor and material costs for repairing or replacing defective LED lighting parts and power supply.

B. Warranty coverage based on the date of Certificate of Substantial Completion. The warranty does not cover replacement parts unless the original part was defective.

PART 2 -- PRODUCTS

2.01 ACCEPTABLE MANUFACTURER
A. Basis of Design is based upon products manufactured or supplied by Intense Lighting; 3340 E. La Palma Avenue, Anaheim, CA. Phone: 800-961-5321. Fax: 800-961-5322. Web site: www.intenselighting.com. E-Mail: info@intenselighting.com

B. Lumenrail by Wagner Companies, 10600 W Brown Deer Road, Milwaukee, WI 53224, Phone 414-214-0444, www.wagnercompanies.com

C. liniLED Illuminated Handrail by Organic Lighting Systems, 205 W Blueridge Avenue, Orange, CA 92865, 626-969-6140, www.organiclighting.com, sales@organiclighting.com

D. Subject to meeting the requirements specified, other manufacturers requesting approval to bid their products shall submit a request for substitution 10 days prior to bid date in accordance with Section 01.25.13 - Product Substitution Procedures.
2.02 MATERIALS AND FINISHES
A. Aluminum stock shall meet the following requirements:
   1. Extruded Bars, Shapes and Moldings: Alloy 6061-T6 meeting ASTM B 221/F 221M.
   2. Finish (refer to NAAMM/NOMMA Metal Finishes Manual):
      a. Anodized finish shall be Clear Anodized and shall meet requirements of AAMA 2607.1.
   3. Stainless Steel: Type 304, No. 4 finish.

2.03 RAILING SYSTEM
A. Material shall conform to 2.02 and be finished in accordance with 2.02
B. Internal Rails: Fabricate rails from aluminum.
C. External Rail Jackets: Fabricate jackets from stainless steel.
D. Mounting: floor base plate.
E. Attach post to underside of railing by use of top post bracket.
   1. V-Rail LED Lighting Rail Fixture and Lamp:
      a. Source: standard brightness LED.
      b. Life (70% brightness): 50,000 hours.
      d. Beam Angle: 60° Symmetric at mid conditions, 30° Asymmetric at end conditions
      e. Housing: Extruded Aluminum.
      f. Mounting: Mastic tape.
      g. Listings: U.L. Listed for wet or dry locations.
      h. Length: 42” increments.
      i. Power Requirement: 24V output
      j. Power Consumption: 4.2 w/ft.
      l. Input Voltage to Power Supply: 120v.
      m. Temperature Range: -25° C through +55° C

2.04 FASTENERS
A. All mechanical fasteners used in the assembly of stainless steel or aluminum railings shall be manufactured from stainless steel.
B. 3M Scotch-Weld Epoxy Adhesive DP 190 Translucent (long term cure)
C. Cement: Hydraulic, ASTM C 595, factory prepared with accelerator [Rockite®].

2.05 HANDRAIL BRACKETS
A. Brackets shall be made of cast aluminum.

2.06 FIELD COORDINATION AND FABRICATION
A. Form rail-to-end post connections and all changes in rail direction by radius elbows; field verify all conditions with dimensions shown on submittals and shop drawings.
B. Cut material square and remove burrs from all exposed edges, with no chamfer.
C. Make exposed joints butt tight and flush.
D. Close exposed ends of handrail by use of end caps.
E. For posts set in concrete, furnish matching sleeves or inserts not less than 5 inches long.
F. Locate intermediate rails equally spaced between top rail and finished floor or center line of tread.
G. Verify dimensions on site prior to shop fabrication.

PART 3 --EXECUTION

3.01 PREPARATION
A. Supply items to be cast in concrete.
B. Examine areas to receive railing system. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.02 DISSIMILAR METALS
A. When aluminum components come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with 3M Scotch-Weld Epoxy Adhesive DP 190 Translucent or other approved product.
   1. When aluminum components come into contact with cement or lime mortar, exposed aluminum surfaces shall be painted with zinc chromate.

3.03 GENERAL INSTALLATION
A. Install in accordance with shop drawings and manufacturer’s instructions at locations indicated on the drawings.
B. Erect work horizontal or parallel to rake of steps or ramp, rigid, and free from distortion or defects detrimental to appearance or performance.
C. Use mechanical or adhesive joints per manufacturer’s instructions for permanently connecting railing components at nonwelded connections. Seal all recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
D. Use fully welded joints for permanently connecting railing components at welded connections. Comply with requirements for welded connections.

3.04 INSTALLATION
A. For railing posts with base mounted attachment, attach posts as indicated using fittings provided by manufacturer’s.
   1. Drill holes for anchors (supplied by others) and install post (with anchors supplied by others) spaced horizontal distance between posts at 4’0” minimum to 6’0” maximum on-center.
   2. Position post with electrical driver over the electrical conduit stub-out. Plumb and level post as required with base level to surface.
   3. Install top rail and secure in place with factory fittings.
   4. Continue installing posts, tubes and cut as required to fit field conditions.
   5. Epoxy weld extension and swivel coupling with posts in place. Repeat above procedures for remaining assemblies.
   6. Field connect electrical drivers per manufacturer’s instructions.

3.05 PROTECTION
A. Protect railing system and finish from damage during construction.
B. Provide wood blocks and padding to prevent damage to railing members and fittings during field installation.
C. Provide temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.
3.06 CLEANING

A. As installation is completed, wash thoroughly using clean water and soap; rinse with clean water.
B. Do not use acid solution, steel wool or other harsh abrasives.
C. If stain remains after washing, remove finish and restore in accordance with NAAMM/NOMMA Metal Finishes Manual.
D. For stainless steel, clean all metal work with Q-Rail "Q-Ultra-Clean" or similar product to prevent "tea staining" of stainless steel.
E. For anodized aluminum, anodized finish must not be removed from anodized aluminum. Re-anodizing can only be done by removing railing and returning it to the anodizer.

END OF SECTION 05.73.00
PART 1 - GENERAL

1.01 SUMMARY
A. Provide decorative railing system with posts designed to mount with base plate anchors.

1.02 DESIGN REQUIREMENTS
A. Railings, guards and handrails used for protection of pedestrians at open-sided stairs, ramps and floor areas used for guidance and support.
B. Railing assembly shall withstand a minimum concentrated load of 200 pounds at any point and in any direction, and a uniform load of 50 pounds per foot applied horizontally and vertically downward but not concurrently.
C. All plastic and metal infill panel shall withstand a concentrated load of 200 pounds applied horizontally on an area of 1 sq. ft. and a uniform load of 25 pounds per square foot applied horizontally but not concurrently with other loads.
D. The strength of aluminum shall be the lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95 and the strength of Stainless Steel shall be 60 percent of minimum yield strength.

1.03 SUBMITTALS
A. Product Datacenter
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for hooks and or open slat shelving units.
B. Shop Drawings
   1. Include typical dimensioned cross-section(s) and plan view of each differing sized unit, indicating:
      a. Dimensions as shown on the drawings.
      b. Finishes.
      c. Samples: For each exposed product and for each color and texture specified.
         1) Size: 12 inches
      d. Provide Qualification of Installers

1.04 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBr) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.05 QUALITY ASSURANCE
A. Fabricator Qualifications shall furnish references listing projects of similar size and scope.
B. Installer Qualifications shall have five (5) years of relevant experience of installing ornamental iron and railing systems.

C. Regulatory Requirements
   1. Components and installation are to be in accordance with all local, state and federal codes and jurisdictions having authority.
   2. Components and installation are to follow current ADA Section 36, ICC/ANSI A117.1, International Building Code guidelines or any local or state codes or amendments, whichever is most restrictive.

D. Furnish documentation that all components and fittings are furnished by the same manufacturer or approved by the primary component manufacturer.
   1. Furnish documentation that components were installed in accordance to the manufacturer’s installation requirements and engineering data to meet the specified design loads.

E. Arrange a pre-installation meeting based on the following requirements:
   1. Prior to the beginning of work, conduct a pre-job conference at the job site with seven calendar days advance written notice ensuring the attendance by competent authorized representatives of the fabricator, building owner’s representative, architect and all subcontractors whose work interfaces with the work of this section.
   2. Review the specifications to determine any potential coordination issues, changes in scope and/or design, installation scheduling and requirements, job site conditions and procedures and/or any other information pertinent to the installation.
   3. Record the results of the conference and furnish copies to all participants.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.

B. Store material on site in a location and in a manner to avoid damage. Stacking shall be done in a way, which will prevent bending.
   1. Store material in a clean, dry location away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin, or polyethylene sheeting in a manner that will permit circulation of air inside the covering.
   2. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of material.

PART 2 - PRODUCTS

2.01 MANUFACTURERS


B. Wagner Companies, 10600 W Brown Deer Road, Milwaukee, WI 53224, Phone 414-214-0444, www.wagnercompanies.com

C. Organic Lighting Systems, 205 W Blueridge Avenue, Orange, CA 92865, 626-969-6140, www.organiclighting.com, sales @organiclighting.com

D. Subject to meeting the requirements specified, other manufacturers requesting approval to bid their products shall submit a request for substitution 10 days prior to bid date in accordance with Sectoin 01.25.13 - Product Substitution Procedures.

2.02 MATERIALS

A. Aluminum stock shall meet the following requirements:
1. Extruded Bars, Shapes and Moldings: Alloy 6061-T6 meeting ASTM B 221/F 221M.
2. Finish (refer to NAAMM/NOMMA Metal Finishes Manual):
   a. Anodized finish shall be Clear Anodized and shall meet requirements of AAMA 2607.1.
B. Stainless Steel: Type 304; No. 4 finish.

2.03 RAILING SYSTEM
A. Material shall conform to 2.02 and be finished in accordance with 2.02
B. Internal Rails: Fabricate rails from aluminum.
C. External Rail Jackets: Fabricate jackets from stainless steel.
D. Fabricate posts from aluminum tube.
   1. Mounting: floor base plate.
   2. Attach post to underside of railing by use of top post bracket

2.04 FASTENERS
A. All mechanical fasteners used in the assembly of stainless steel or aluminum railings shall be manufactured from stainless steel.
B. 3M Scotch-Weld Epoxy Adhesive DP 190 Translucent (long term cure)

2.05 HANDRAIL BRACKETS
A. Brackets shall be made of aluminum.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Contractor to examine existing surfaces for squareness and plumb prior to installation.
B. Contractor to verify that all necessary wood blocking is in place prior to installation.

3.02 PREPARATION
A. Protect surrounding and adjacent work as required preventing damage to preceding work during execution of this work.
B. Perform all preparation necessary for a successful installation of products as specified in manufacturer’s installation instructions.

3.03 INSTALLATION
A. Obtain Manufacturer’s instructions for successful installation of work to be performed and become knowledgeable with all material handling and installation recommendations.
B. Ensure full compliance with Manufacturer’s instructions in all aspects of tasks required by this work. Install products in accordance with manufacturer’s instructions at locations indicated on the drawings.
C. Coordinate all work with other project trades to assure proper installation and provide proper accommodations for following work by other trades.
D. For railing posts with base mounted attachment, attach posts as indicated using fittings provided by manufacturer.
   1. Drill holes for anchors (supplied by others) and install post (with anchors supplied by others) spaced horizontal distance between posts at 4’0” minimum to 6’0” maximum on-center.
   2. Position post with electrical driver over the electrical conduit stub-out. Plumb and level post as required with base level to surface.
   3. Install top rail and secure in place with factory fittings.
4. Continue installing posts, tubes and cut as required to fit field conditions.
5. Epoxy weld extension and swivel coupling with posts in place. Repeat above procedures for remaining assemblies.
6. Field connect electrical drivers per manufacturer’s instructions.

3.04 FIELD QUALITY CONTROL
A. After installation, check all work for flaws and defects.
B. Form rail-to-end post connections and all changes in rail direction by radius elbows; field verify all conditions with dimensions shown on submittals and shop drawings.
C. Cut material square and remove burrs from all exposed edges, with no chamfer.
D. Make exposed joints butt tight and flush.
E. Close exposed ends of handrail by use of end caps or support brackets as required.
F. For posts set in concrete, furnish matching sleeves or inserts not less than 5 inches long.
G. Locate intermediate rails equally spaced between top rail and finished floor or center line of tread.
H. Verify dimensions on site prior to shop fabrication.
I. Repair all defective work.
J. Remove and replace all damaged components that cannot be successfully repaired as determined by Project Architect

3.05 PROTECTION
A. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged components that cannot be repaired to architect’s satisfaction.
B. Fabricator/Installer to provide a Maintenance kit and shall review maintenance procedures and the product warranty with the Owner’s maintenance personnel upon completion of project.

3.06 CLEANING
A. Remove all protection materials.
B. Clean all surfaces following manufacturer’s recommendations prior to final project completion. Do not use harsh cleaning materials or methods that would damage finish.
C. Dispose properly of all debris generated by this work, protection materials and cleaning materials.

END OF SECTION 05.73.01
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Sheathing.
   B. Roof-mounted curbs.
   C. Roofing nailers.
   D. Roofing cant strips.
   E. Preservative treated wood materials.
   F. Fire retardant treated wood materials.
   G. Communications and electrical room mounting boards.
   H. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS
   A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS
   E. ICC (IBC) - International Building Code; 2012
   F. PS 1 - Structural Plywood; 2009.
   G. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.

1.04 SUBMITTALS
   A. Product Data: Provide technical data on wood preservative materials, application instructions, and wood.
   B. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.
   C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction waste diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
      1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
3. Compliance with Credit EQ6.5: Material VOC Limits - Composite wood and agrifiber
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 DELIVERY, STORAGE, AND HANDLING
A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

1.07 WARRANTY
A. See Section 01.78.21 - Closeout Submittals, for additional warranty requirements.
B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS
A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS
A. Sizes: Nominal sizes as indicated on drawings, S4S.
B. Moisture Content: S-dry or MC19.
C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS
A. Roof Sheathing, for MCM canopies and where indicated: Any PS 1 type, rated Structural I Sheathing.
   2. Span Rating: 24
   3. Performance Category: 3/4 PERF CAT.
B. Wall Sheathing, For backside of parapets and where indicated: Plywood, PS 1, Grade C-C, Exterior Exposure.
C. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
D. Other Applications:
   1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
   2. Other Locations: PS 1, C-D Plugged or better.
2.04 ACCESSORIES
A. Fasteners and Anchors:
   1. Metal and Finish: Stainless steel for high humidity and preservative-treated wood locations, galvanized or unfinished steel elsewhere.
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
   3. Anchors: Toggle bolt type for anchorage to hollow masonry.
B. Building Paper: Water resistant felt paper to separate pressure treated wood from metal deck and studs.

2.05 FACTORY WOOD TREATMENT
A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
B. Fire Retardant Treatment:
   1. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Treat rough carpentry items as indicated.
      c. Do not use treated wood in applications exposed to weather or where the wood may become wet.
C. Preservative Treatment:
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
      b. Treat lumber exposed to weather.
      c. Treat lumber in contact with roofing, flashing, or waterproofing.
      d. Treat lumber in contact with masonry or concrete.

PART 3 EXECUTION
3.01 PREPARATION
A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL
A. Select material sizes to minimize waste.
B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.
3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim. Blocking to withstand 200 plf applied in any direction.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous treated blocking around exterior door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at all roof openings except where pre-fabricated curbs are specifically indicated otherwise. Form corners by alternating lapping side members.

C. All roof wood blocking attachments shall meet ES-1 and FM 1-49 criteria.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing, where occurs: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
   1. Screw panels to framing; staples are not permitted.

B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.

3.06 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01.74.19 - Construction Waste Management & Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 06.10.00
PART 1  GENERAL

1.01  SECTION INCLUDES
A. Finish carpentry items.
B. Hardwood stain grade running trim, wall caps and base.
C. Hardware and attachment accessories.

1.02  RELATED REQUIREMENTS
A. Section 06.10.00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
B. Section 06.42.16 - Wood-Veneer Paneling: Shop fabricated custom paneling.
C. Section 08.43.13 - Aluminum Storefront: Synthetic Marble sills.
D. Section 09.72.00 - Wood Veneer Wall Covering

1.03  REFERENCE STANDARDS
A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.
D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
G. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.
I. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
J. PS 1 - Structural Plywood; 2009.

1.04  SUBMITTALS
A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
B. Product Data:
   1. Provide data on fire retardant treatment materials and application instructions.
   2. Provide instructions for attachment hardware and finish hardware.
C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Provide the information required by AWI/AWMAC/WI (AWS).
D. Samples: Submit two samples of finish plywood, 12 by 12 inch in size illustrating wood grain and specified finish.

1.05  TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction wast diverted from landfills:
1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   3. Compliance with Credit EQ6.5: Material VOC Limits - Composite wood and agrifiber
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE
A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Company with at least one project within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.
   2. Single Source Responsibility: Provide and install this work from single fabricator.
B. Provide mockup of finish carpentry assembly indicated on the Drawings, including balcony railing caps at sidewalk condition, stained and finished.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS
A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
B. Interior Woodwork Items:
   1. Moldings, Bases, Casings, and Miscellaneous Trim: Walnut, quarter sawn, stain finish.
   2. Loose Shelving: Birch plywood with hardwood edge; prepare for paint finish.

2.02 WOOD-BASED COMPONENTS
A. Wood fabricated from old growth timber is not permitted.
B. Wood fabricated from timber recovered from riverbeds or otherwise abandoned is permitted, unless indicated otherwise, and provided it is clean and free of contamination, identify source; provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc. (ALSC).

2.03 LUMBER MATERIALS
A. Hardwood Lumber: Walnut species, quarter sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

2.04 SHEET MATERIALS
A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B; glue type as recommended for application.
B. Softwood Plywood Exposed to View: Face species as indicated, rotary cut, medium density fiberboard core; PS 1 Grade A-B; glue type as recommended for application.
C. Hardwood Plywood: Face species as indicated, quarter cut, book matched, medium density fiberboard core; HPVA HP-1, Front Face Grade AA, Back Face Grade 1; glue type as recommended for application.
D. Particleboard: ANSI A208.1; Composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.
E. Hardboard: ANSI A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth one side (S1S).

2.05 PLASTIC LAMINATE MATERIALS
A. Plastic Laminate: NEMA LD 3, HGS; color as selected; textured, low gloss finish where indicated, such as at shelving that is not in Section 06.41.00 Architectural Wood Casework.
B. Low Pressure Laminate: Melamine; selected color, and furniture surface texture.

2.06 FASTENINGS
A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
B. Concealed Joint Fasteners: Threaded steel.

2.07 ACCESSORIES
A. Lumber for Shimming and Blocking: Softwood lumber of Douglas Fir species.
B. Cellular PVC Trim: Extruded, expanded PVC; UV-resistant, heat-stabilized, and rigid material.
   1. Density: 31 pounds per cubic foot, minimum.
   2. Flame Spread: ASTM E84, 75, maximum.
C. Wood Filler: Solvent base, tinted to match surface finish color.

2.08 HARDWARE
A. Hardware: Comply with BHMA A156.9.

2.09 WOOD TREATMENT
A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.
B. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
C. Wood Preservative by Pressure Treatment (PT Type): Provide AWPA U1 treatment using waterborne preservative with 0.25 percent retainage.
D. Shop pressure treat wood materials requiring fire rating to concealed wood blocking.
E. Provide identification on fire retardant treated material.
F. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.
G. Redry wood after pressure treatment to maximum 15 percent moisture content.

2.10 FABRICATION
A. Shop assemble work for delivery to site, permitting passage through building openings.
B. Cap exposed plastic laminate finish edges with material of same finish and pattern.
C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
D. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
2.11 SHOP FINISHING
A. Sand work smooth and set exposed nails and screws.
B. Apply wood filler in exposed nail and screw indentations.
C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.
D. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 12, Polyurethane, Water-based.
      b. Stain: As selected by Architect.
      c. Sheen: Satin.
   2. Opaque:
      a. System - 12, Polyurethane, Water-based.
      b. Color: As selected by Architect.
      c. Sheen: Satin.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify adequacy of backing and support framing.
B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION
A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
B. Set and secure materials and components in place, plumb and level.
C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.03 SITE APPLIED WOOD TREATMENT
A. No site finishing on any stained items will be allowed.

3.04 TOLERANCES
A. Maximum Variation from True Position: 1/16 inch.
B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION 06.20.00
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Specially fabricated cabinet units.
   B. Cabinet hardware.
   C. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS
   A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.
   B. Section 06.10.00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
   C. Section 12.36.00 - Countertops.

1.03 REFERENCE STANDARDS
   A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
   C. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.
   D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
   E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
   F. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).
   G. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS
   A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS
   A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   B. Product Data: Provide data for hardware accessories.
   C. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet and shelf unit substrate and finish.
   D. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.
   E. Provide laminated plastic color samples from manufacturer's standard lines.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction wast diverted from landfills.
1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   3. Compliance with Credit EQ6.5: Material VOC Limits - Composite wood and agrifiber

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.07 QUALITY ASSURANCE
A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
   2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

1.08 MOCK-UP
A. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware, finishes, and plumbing accessories.
B. Locate where directed.
C. Mock-up may remain as part of the Work.

1.09 DELIVERY, STORAGE, AND HANDLING
A. Protect units from moisture damage.

1.10 FIELD CONDITIONS
A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS
A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
B. Plastic Laminate Cabinets: Custom grade.
   2. Finish - Exposed Interior Surfaces: Decorative laminate.
   3. Finish - Concealed Surfaces: Manufacturer's option.
   4. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
   5. Door and Drawer Front Retention Profiles: Fixed panel.
   6. Cabinet Design Series: As indicated on drawings.

2.02 WOOD-BASED COMPONENTS
A. Wood fabricated from old growth timber is not permitted.

2.03 LAMINATE MATERIALS
A. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels for interiors.
B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
2.04 COUNTERTOPS
   A. Countertops are specified in Section 12.36.00.

2.05 ACCESSORIES
   A. Adhesive: Type recommended by fabricator to suit application.
   B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of
      width to match component thickness.
      1. Color: As selected by Architect from manufacturer's standard range.
      2. Use at all exposed plywood edges.
      3. Use at all exposed shelf edges.
   C. Fasteners: Size and type to suit application.
   D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or
      chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed
      locations.
   E. Concealed Joint Fasteners: Threaded steel.
   F. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent
      surface.

2.06 HARDWARE
   A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
   B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or
      multiple holes for pin supports and coordinated self rests, satin chrome finish, for nominal 1 inch spacing
      adjustments.
   C. Drawer and Door Pulls: "U" shaped wire pull, stainless steel with satin finish, 4 inch centers.
   D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
   E. Drawer Slides:
      1. Static Load Capacity: Commercial grade.
   F. Hinges: European style concealed self-closing type, stainless, steel with satin finish.

2.07 FABRICATION
   A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage
      through building openings.
   B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for
      any single length.
   C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting.
      Provide matching trim for scribing and site cutting.
   D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured
      sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate
      counter butt joints minimum 2 feet from sink cut-outs.
      1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
      2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
   E. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches
      on center.
F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.
G. All wood grained laminates will have grain pattern to run vertical on cabinets, doors & drawer faces.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify adequacy of backing and support framing.
   B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION
   A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
   B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
   C. Use fixture attachments in concealed locations for wall mounted components.
   D. Use concealed joint fasteners to align and secure adjoining cabinet units.
   E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
   F. Secure cabinets to floor using appropriate angles and anchorages.
   G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
   H. Site glaze glass materials using the Interior Dry method specified in Section 08.80.00.

3.03 ADJUSTING
   A. Adjust installed work.
   B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING
   A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION 06.41.00
1.01 SECTION INCLUDES
   A. Bituminous dampproofing.

1.02 RELATED REQUIREMENTS
   A. Section 07.21.00 - Thermal Insulation: Rigid insulation board used as protection board.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
   A. Product Data: Provide properties of primer, bitumen, and mastics.
   B. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction wast diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
      1. Compliance with Credit MR1.1: Recycling Collection and Storage
      2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
      3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 FIELD CONDITIONS
   A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.
PART 2 PRODUCTS

2.01 BITUMINOUS DAMPROOFING
   A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
      1. Composition - Vertical Application: ASTM D1227 Type III or ASTM D1187/D1187M Type I.
      2. Composition - Horizontal and Low-Slope Application: ASTM D1227 Type II or III.
      3. VOC Content: Not more than permitted by local, State, and federal regulations.
   B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.02 COLD ASPHALTIC MATERIALS
   A. Asphalt Primer: 1, compatible with substrate.
   B. Sealing Mastic: Asphalt roof cement, ASTM D2822, Type I.

2.03 ACCESSORIES
   A. Protection Board: 1” Rigid insulation specified in Section 07.21.00.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify existing conditions are acceptable prior to starting this work.
   B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
   C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.02 PREPARATION
   A. Protect adjacent surfaces not designated to receive dampproofing.
   B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
   C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
   D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.03 APPLICATION
   A. Foundation Walls: Apply two coats of asphalt dampproofing.
   B. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
   C. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
   D. Apply bitumen with mop.
   E. Apply bitumen at a temperature limited by equiviscous temperature (EVT) plus or minus 25 degrees F; do not exceed finish blowing temperature for four hours.
   F. Apply bitumen in two coats, continuous and uniform, at a rate of 25 sq ft/gal per coat.
   G. Apply from 2 inches below finish grade elevation down to top of footings.
   H. Seal items watertight with mastic, that project through dampproofing surface.
   I. Place drainage panel directly over dampproofing, butt joints, place to encourage drainage downward.
J. Place protection board over drainage panel, butt joints, and adhere with mastic.

K. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION 07.11.13
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Board insulation and integral vapor retarder at cavity wall construction, perimeter foundation wall, underside of floor slabs, and exterior walls.
   B. Spray foam insulation at back side of rigid insulation in exterior walls.
   C. Batt insulation in exterior wall, ceiling, and roof construction.
   D. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS
   A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.
   B. Section 07.21.19 - Foamed-In-Place Insulation: Plastic foam insulation other than boards.
   C. Section 07.53.23 - EPDM Thermoset Single-Ply Roofing System: Insulation specified as part of roofing system.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
   A. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
   B. Manufacturer’s Certificate: Certify that products meet or exceed specified requirements.
   C. Manufacturer’s Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction waste diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
      1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
      2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 FIELD CONDITIONS
A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

2.02 FOAM BOARD INSULATION MATERIALS
A. Extruded Polystyrene Board Insulation at perimeter foundation walls: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
   1. Type: ASTM C578.
   2. Flame Spread Index (FSI): Class B - 26 to 75, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. R-value: 1 inch of material at 72 degrees F: 5, minimum.
   5. Complies with fire resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
   7. Water Absorption, Maximum: 0.3 percent, by volume.
B. Polyisocyanurate Board Insulation with Facers Both Sides, at exterior walls: Rigid cellular foam, complying with ASTM C1289; Type I, aluminum foil both faces; Class 2, glass fiber-reinforced core.
   1. Flame Spread Index (FSI): Class B - 26 to 75, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   3. Complies with fire resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
   4. Compressive Strength: 16 psi
   5. Board Size: 48 by 96 inch.
   7. Thermal Resistance: R-value of 6.5 per inch.

2.03 BATT INSULATION MATERIALS
A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option.
B. Glass Fiber Batt Insulation: Unfaced flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   5. Facing: Unfaced.
C. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced; flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
2.04 ACCESSORIES

A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide, at faced board insulation.

B. Insulation Fasteners: Lengths of unfinished, 13 gage (0.072 inch) high carbon spring steel with chisel or mitered tips, held in place by tension, length to suit insulation thickness and substrate, capable of securely supporting insulation in place.

C. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

D. Nails: Steel wire; electroplated or galvanized; type and size to suit application.

E. Wire Mesh: Galvanized steel, hexagonal wire mesh.

F. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Install boards horizontally on foundation perimeter.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

B. Extend boards over expansion joints, unbonded to foundation on one side of joint.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

D. Immediately following application of board insulation, place protective boards over exposed insulation surfaces.
   1. Install boards horizontally from base of foundation to top of insulation.
   2. Butt boards tightly, with joints staggered from insulation joints.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

A. Adhere a 6 inch wide strip of flashing sheet over expansion joints with double beads of adhesive each side of joint.
   1. Tape seal joints between sheets.
   2. Extend sheet full height of joint.

B. Install rigid insulation directly to steel studs or exterior grade sheathing at 16 inches on center with manufacturer recommended mechanical fasteners, and tape joints with manufacturer's minimum 4 inch wide sealant tape; comply with ASTM E2357.

C. Install boards horizontally on walls.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

D. Extend boards over expansion joints, unbonded to wall on one side of joint.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
F. Place 6 inch wide flashing sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames, and tape seal in place to ensure continuity of vapor retarder and air seal.

G. Tape insulation board joints.

### 3.04 BOARD INSTALLATION AT CAVITY WALLS

A. Install boards to fit snugly between wall ties.
   1. Place membrane surface against adhesive.
   2. Place membrane surface facing out, and tape seal board joints.

B. Install boards horizontally on walls.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.
   4. Place impale fastener locking discs.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

D. Place 6 inch wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames, and tape seal in place to ensure continuity of vapor retarder and air seal.

### 3.05 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

### 3.06 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

A. Installation of board insulation over low slope roof deck as specified in Section 07.53.23 EPDM Thermoset Single-Ply Roofing.

### 3.07 BATT INSTALLATION

A. Install insulation in accordance with manufacturer’s instructions.

B. Install in exterior envelope spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

### 3.08 FIELD QUALITY CONTROL

A. See Section 01.40.00 - Quality Requirements, for additional requirements.

### 3.09 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION 07.21.00
SECTION 07.21.19
FOAMED-IN-PLACE INSULATION

PART 1 GENERAL -- NOT USED

1.01 SECTION INCLUDES
A. Foamed-in-place insulation.
   1. In exterior framed walls.
   2. In exterior wall crevices.
   3. At junctions of dissimilar wall and roof materials.
B. Protective intumescent coating.

1.02 REFERENCE STANDARDS

1.03 ADMINISTRATIVE REQUIREMENTS
A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.04 SUBMITTALS
A. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.
B. Certificates: Certify that products of this section meet or exceed specified requirements.
C. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1 - Material VOC Limits - Adhesive and sealants
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.
1.06 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.
   B. Applicator Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience.

1.07 FIELD CONDITIONS
   A. Do not install insulation when ambient temperature is lower than 70 degrees F.
   B. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
   C. Do not apply foam when temperature is within 5 degrees F of dew point.

PART 2 PRODUCTS

2.01 MATERIALS
   A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
      1. Regulatory Requirements: Conform to applicable code for flame and smoke limitations.
      2. Thermal Resistance: R-value of 5.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.
      3. Water Vapor Permeance: Vapor retarder; 2 perm, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
      4. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
      5. Air Permeance: 0.004 cfm/sq ft, maximum, when tested at intended thickness in accordance with ASTM E2178 or ASTM E283 at 1.5 psf.
      6. Closed Cell Content: At least 90 percent.
      7. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

2.02 ACCESSORIES
   A. Primer: As required by insulation manufacturer.
   B. Protective Coating: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify work within construction spaces or crevices is complete prior to insulation application.
   B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.02 PREPARATION
   A. Mask and protect adjacent surfaces from over spray or dusting.
   B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION
   A. Apply insulation in accordance with manufacturer's instructions.
   B. Apply insulation by spray method, to a uniform monolithic density without voids.
C. Apply overcoat monolithically, without voids to fully cover foam insulation, to achieve fire rating required.
D. Patch damaged areas.
E. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.
F. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.04 FIELD QUALITY CONTROL

3.05 PROTECTION
   A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION 07.21.19
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Manufactured pre-finished metal panels for siding on the mechanical screen walls, with accessory components.

1.02 RELATED REQUIREMENTS
   Section 05.10.00 Structural Metal Framing

1.03 REFERENCE STANDARDS
   F. AAMA 2605 - Standard for Resin-based Coatings

1.04 SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Shop Drawings: Indicate dimensions, layout, joints, construction details, and methods of anchorage.
   C. Samples: Submit two samples of wall panel, 12 inch by 12 inch in size illustrating finish color, sheen, and texture.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction wast diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
      1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
      2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
      3. Compliance with Credit EQ6.2: Material VOC Limits - Paints
      4. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints
   D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
B. Installer Qualifications: Company specializing in installing products of the type specified in this section with minimum three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
C. Prevent contact with materials that may cause discoloration or staining of products.

1.08 WARRANTY
A. See Section 01.78.21 - Closeout Submittals, for additional warranty requirements.
B. Provide 20-year paint-finish warranty for cracking, chipping, peeling, fading and chalking.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Metal Wall Panels - Exposed Fasteners:
   1. Fabral, Inc., Hefti-Rib 7.2" ribs: www.fabral.com
   3. Englert, Inc; Uniline C-36, 7.2 Rib: www.englertinc.com/#sle.

2.02 MANUFACTURED METAL PANELS
A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
   1. Provide exterior panels.
   2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
   3. Design Pressure: In accordance with applicable codes.
   5. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
   6. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
   7. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
   8. Corners: Factory-fabricated in one continuous piece with minimum 2 inch returns.
B. Exterior Panels:
   1. Profile: Horizontal; 1.5" deep, 7.2" rib spacing.
   2. Side Seams: Double-interlocked, tight-fitting, sealed with continuous gaskets.
   3. Material: Precoated steel sheet, 20 gage, 0.0359 inch minimum thickness.
   5. Color: As selected by Architect from manufacturer's standard line.
C. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.
D. Expansion Joints: Same material, thickness and finish as exterior sheets; 22 gage, 1.5 inch thick; manufacturer's standard brake formed type, of profile to suit system.
E. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
F. Anchors: Galvanized steel.
2.03 MATERIALS
A. Precoated Steel Sheet: Aluminum-zinc alloy-coated steel sheet, ASTM A792/A792M, Commercial Steel (CS) or Forming Steel (FS), with AZ50/AZM150 coating; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating. Grade 40.

2.04 FINISHES
A. Panel Backside Finish: Backsides will be exposed to weather and will need PVDF coating.
B. Custom Fluoropolymer Coating System: Polyvinylidene fluoride (PVDF) multi-coat thermoplastic fluoropolymer coating system, including minimum 70 percent PVDF color topcoat and minimum total dry film thickness (DFT) of 0.9 mil; color and gloss as indicated on drawings.

2.05 ACCESSORIES
A. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
B. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.
C. Field Touch-up Paint: As recommended by panel manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that building framing members are ready to receive panels.

3.02 PREPARATION
A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane. Space at intervals indicated.

3.03 INSTALLATION
A. Install panels on steel framing system in accordance with manufacturer's instructions.
B. Fasten panels to structural supports; aligned, level, and plumb.
C. Locate joints over supports.
D. Lap panel ends minimum 2 inches.
E. Provide expansion joints where indicated.
F. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.04 CLEANING
A. Remove site cuttings from finish surfaces.
B. Remove protective material from wall panel surfaces.
C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION 07.42.13
PART 1  GENERAL

1.01  SECTION INCLUDES
   A. Wall panels, canopies & column covers of formed metal composite material (MCM) sheet, framing,
      secondary supports and anchors to structure.
   B. Exterior cladding consisting of formed metal composite material (MCM) sheet, secondary supports, and
      anchors to structure, attached to solid backup.
   C. Underlayment under horizontal formed metal composite material (MCM) sheet., over solid backup.
   D. Matching flashing and trim.

1.02  RELATED REQUIREMENTS
   A. Section 04.20.00 - Unit Masonry: Installation of anchors.
   B. Section 05.40.00 - Cold-Formed Metal Framing: Panel support framing.
   C. Section 06.10.00 - Rough Carpentry
   D. Section 07.92.00 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

1.03  REFERENCE STANDARDS
   B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel
      Products; 2015.
   C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware;
      2009.
   E. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and
      Heat-Resisting Steel Plate, Sheet, and Strip; 2015.
   F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron
      Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
   G. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet,
      Strip, Plate, and Flat Bar; 2015.
   H. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the
      Hot-Dip Process; 2010 (Reapproved 2015).
   L. ASTM D2244 - Standard Practice for Calculation of Color Differences from Instrumentally Measured
      Color Coordinates; 2011.
   N. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films;
      2007.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Pre-Installation Meeting: Convene one week before starting work of this section to verify project requirements, co-ordinate with installers of other work, establish condition and completeness of building substrate, and review manufacturers’ installation instructions and warranty requirements.
   1. Require attendance by the installer and relevant sub-contractors.
   2. Include MCM sheet manufacturer’s representative and wall system manufacturer’s representative to review storage and handling procedures.
   3. Review in detail truck transportation, parking, vertical transportation, schedule, personnel, installation of adjacent materials and substrate.
   4. Review procedures for protection of work and other construction.
   5. Review safety precautions.

1.05 SUBMITTALS
A. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
   1. Finish manufacturer's data sheet showing physical and performance characteristics.
   2. Storage and handling requirements and recommendations.
   3. Fabrication instructions and recommendations.
   4. Specimen warranty for finish, as specified herein.
B. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
   1. Physical characteristics of components shown on shop drawings.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions and recommendations.
   4. Specimen warranty for wall system, as specified herein.
C. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
   1. Indicate panel numbering system.
   2. Differentiate between shop and field fabrication.
   3. Indicate substrates and adjacent work with which the wall system must be coordinated.
   4. Include large-scale details of anchorages and connecting elements.
   5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches.
   6. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
D. Selection Samples: For each finish product specified, submit color chips representing manufacturer's standard range of available colors and patterns.
E. Certificate: Certify that the work results of this section meet or exceed specified requirements.
F. Design Data: Submit structural calculations stamped by design engineer, for Architect's information and project record.

G. Test Report: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.


I. Manufacturer's Field Reports: Provide within 48 hours of field review. State what was observed and what changes, if any, were requested or required.

J. Manufacturer's Qualification Statement.

K. Installer's Qualification Statement.


M. Maintenance Data: Care of finishes and warranty requirements.

N. Executed Warranty: Submit warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION

A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.

B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   3. Compliance with Credit EQ6.2: Material VOC Limits - Paints
   4. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.07 QUALITY ASSURANCE

A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.

B. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of Work and licensed in Tennessee.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.
   1. With not less than three years of documented experience.
   2. Approved by MCM sheet manufacturer.
   3. Submit contact names and phone numbers for at least three references connected with successful past projects.

D. Installer Qualifications: Company specializing in performing work of the type specified in this section.
   1. With minimum three years of documented experience.
   2. Approved by wall system manufacturer.
   3. Submit contact names and phone numbers for at least three references connected with successful past projects.
E.  Testing Agency Qualifications:  Independent agency experienced in testing assemblies of the type required for this project and having the necessary facilities for full-size mock-up testing of the type specified.

1.08 DELIVERY, STORAGE, AND HANDLING
A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
   1. Protect finishes by applying heavy duty removable plastic film during production.
   2. Package for protection against transportation damage.
   3. Provide markings to identify components consistently with drawings.
   4. Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.
B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Store in well ventilated space out of direct sunlight.
   2. Protect from moisture and condensation with tarpaulins or other suitable weather tight covering installed to provide ventilation.
   3. Store at a slope to ensure positive drainage of any accumulated water.
   4. Do not store in any enclosed space where ambient temperature can exceed 120 degrees F.
   5. Avoid contact with any other materials that might cause staining, denting, or other surface damage.

1.09 WARRANTY
A. Wall System Warranty:  Provide joint written warranty by manufacturer and installer, agreeing to correct defects in manufacturing or installation within a two year period after Date of Substantial Completion.
B. MCM Sheet Manufacturer’s Finish Warranty:  Provide manufacturer’s written warranty stating that the finish will perform as follows for minimum of 20 years minimum:
   1. Chalking:  No more than that represented by a No. 8 rating based on ASTM D4214.
   2. Color Retention:  No fading or color change in excess of 5 Hunter color difference units, calculated in accordance with ASTM D2244.
   3. Gloss Retention:  Minimum of 30 percent gloss retention, when tested in accordance with ASTM D523.

PART 2 PRODUCTS
2.01 WALL PANEL SYSTEM
A. Wall Panel System:  Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage or failure.
   1. Provide structural design by or under direct supervision of a Structural Engineer licensed in Tennessee.
   2. Provide panel jointing and weatherseal using a "wet", sealant-sealed system.
   3. Anchor panels to supporting framing without exposed fasteners.
B. Performance Requirements:
   1. Provide tests on full-size mock-ups; tests performed previously for other projects are acceptable provided tested assemblies are truly equivalent to those to be used on this project, unless otherwise indicated.
   2. Thermal Movement:  Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F to 180 degrees F without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.
3. Wind Performance: Provide system tested in accordance with ASTM E330/E330M without permanent deformation or failures of structural members under the following conditions:
   b. Maximum deflection of perimeter framing member of L/175 normal to plane of the wall; maximum deflection of individual panels of L/60.
   c. Maximum anchor deflection in any direction of 1/16 inch at connection points of framing members to anchors.

4. Air Infiltration: 0.06 cfm/sq ft of wall area, maximum, when tested at 1.57 psf in accordance with ASTM E283.

5. Water Penetration: No water penetration under static pressure when tested in accordance with ASTM E331 at a differential of 10 percent of inward acting design load, 6.24 psf minimum, after 15 minutes.
   a. Water penetration is defined as the appearance of uncontrolled water on the interior face of the wall.
   b. Design to drain leakage and condensation to the exterior face of the wall.

6. Fire Performance: Tested in accordance with, and complying with the acceptance criteria of, NFPA 285; testing must be performed specifically for this project.

C. Panels: One inch deep pans formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.
   1. Reinforce corners with riveted aluminum angles.
   2. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.
   3. Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
   4. Secure members to back face of panels using structural silicone sealant approved by MCM sheet manufacturer.
   5. Fabricate panels under controlled shop conditions.
   6. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.
   7. Fabricate as indicated on drawings and as recommended by MCM sheet manufacturer.
      a. Make panel lines, breaks, curves and angles sharp and true.
      b. Keep plane surfaces free from warp or buckle.
      c. Keep panel surfaces free of scratches or marks caused during fabrication.
   8. Provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.

2.02 MATERIALS

A. Metal Composite Material (MCM) Sheet: Two sheets of aluminum sandwiching a core of extruded thermoplastic material; no foamed insulation material content.
   1. Overall Sheet Thickness: 3 mm, minimum.
   2. Face Sheet Thickness: 0.019 inches, minimum.
   3. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F.
   4. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
5. Flammability: Self-ignition temperature of 650 degrees F or greater, when tested in accordance with ASTM D1929.

6. Factory Finish: Two coats fluoropolymer resin coating, approved by the coating manufacturer for the length of warranty specified for the project, and applied by coil manufacturing facility that specializes in coil applied finishes.
   b. Long-Term Performance: Not less than that specified under WARRANTY in PART 1.

B. Metal Framing Members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.
   1. Provide material strength, dimensions, configuration as required to meet the applied loads applied and in compliance with applicable building code.
   2. Sheet Steel Components: ASTM A653/A653M galvanized to G90/Z275 or zinc-iron alloy-coated to A60/ZF180; or ASTM A792/A792M aluminum-zinc coated to AZ60/AZM180.
   3. Stainless Steel Sheet Components: ASTM A480/A480M.

C. Flashing: Sheet aluminum; 0.040 inch thick, minimum; finish and color to match MCM sheet.

D. Anchors, Clips and Accessories: Use one of the following:
   1. Stainless steel where exposed to weather or joining dis-similar materials, complying with ASTM A276/A276M, ASTM A480/A480M, or ASTM A666.
   2. Steel complying with ASTM A36/A36M and hot-dipped galvanized to ASTM A153/A153M.

E. Fasteners:
   1. Exposed Fasteners: Stainless steel; permitted only where absolutely unavoidable and subject to prior approval of the Architect.
   2. Screws: Self-drilling or self-tapping Type 410 stainless steel or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
   4. Fasteners for Flashing and Trim: Blind fasteners of high-strength aluminum or stainless steel.

F. Provide approved coating or gaskets to separate dis-similar materials.

G. Provide panel system manufacturer's and installer's standard corrosion resistant accessories, including fasteners, clips, anchorage devices and attachments.

H. Underlayment: Provide self-adhered roofing unterlayment under horizontal MCM on solid substrate.
   1. Product with rubberized asphalt adhesive backed by a layer of slip resistant coated high density cross laminated polyethylene film, equal to Grace Ice & Water Shield.
   2. Thickness: 40 mil, tested per ASTM D3767
   3. Tensile strength: 250 psi, tested per ASSTM D412
   4. Elongation: 250%, tested per ASTM D412
   5. Permeance: 0.05 Perms, tested per ASTM E96

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and interfaces with other work.

B. Verify substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturers written instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
D. Notify Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION
A. Protect adjacent work areas and finish surfaces from damage during installation.
B. Deliver anchorage items to be cast into concrete or built into masonry to appropriate installer(s) together with setting templates.

3.03 INSTALLATION
A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.
B. Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.
C. Install underlayment on solid substrate beneath horizontal MCM system.
D. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.
E. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.
F. Do not form panels in field unless required by wall system manufacturer and approved by the Architect; comply with MCM sheet manufacturer's instructions and recommendations for field forming.
G. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.
H. Where joints are designed for field applied sealant, seal joints completely with specified sealant.
I. Install flashings as indicated on shop drawings. At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.
J. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
   1. Variation From Plane or Location: 1/2 inch in 30 feet of length and up to 3/4 inch in 300 feet, maximum.
   2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet run, maximum.
   3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet run, maximum.
   4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch, maximum.
K. Replace damaged products.
   1. Exception: Field repairs of minor damage to finishes are permitted only when approved in writing by Architect, panel manufacturer, and fabricator.
   2. Field Repairs to Finishes: Using materials and methods sufficient that repairs are not discernible when viewed at distance of 10 feet under all typical light conditions experienced at the project.

3.04 FIELD QUALITY CONTROL
A. Site Visits: Schedule two site visits during execution of installation.

3.05 CLEANING
A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.
B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.
C. Remove temporary coverings and protection of adjacent work areas.
D. Clean installed products in accordance with manufacturer's instructions.

### 3.06 PROTECTION

A. Protect installed panel system from damage until Date of Substantial Completion.

**END OF SECTION 07.42.13.23**
SECTION 07 50 35
TOTAL ROOFING SYSTEM WARRANTY INSTRUCTIONS

PART 1 – GENERAL: not used

PART 2 – PRODUCTS

2.01 The Total Roofing System Warranty shall be provided on the form of Section 07 50 36. No other warranty form is acceptable, and no other warranty, stipulations, or qualifications may be incorporated or attached. If more than one building, roof, or type of membrane is provided in the Contract, provide a separate warranty for each, even if they are alike. All informational blanks on the warranty form shall be filled in prior to execution.

PART 3 – EXECUTION

3.01 Prior to the Manufacturer’s final inspection, which is a distinct and different inspection from the Designer’s final inspection of the Work of the Contract, and prior to the Manufacturer’s execution of the Total Roofing System Warranty, submit a mock-up of the Total Roofing System Warranty to the Designer, completely filled out with all information except, if not yet certain, the warranty number and individual persons names, titles, signatures, dates of signature, and contact information. Obtain Designer’s approval of this mock-up, and use this for the executed warranty. Execute the Warranty in two (2) counterparts for inclusion in the two (2) sets of Project data Binders (See specification section 01 78 21). All signatures on counterparts shall be “wet” (blue ink on paper, affixed by hand) signatures. Provide copies attached to final pay requests (See specification 01 29 76).

3.02 Filling in the upper portion of page 1:

A. SBC Project Number: fill in the “the Project” identification shown on page 1 of the construction Agreement in the format of 000/000-00-000XX, in which characters might or might not have been included for the Xs.

B. Warranty Period: fill in “thirty (30) years”.

C. Warranty Number: fill in a unique number provided by the Manufacturer for its own tracking purposes. Fill this is identically in the blanks near the upper right of each page of the form.

D. Building, Campus and Address: fill in:
   1. the name of the institution;
   2. “main campus” or the name of the campus if not the main campus;
   3. the name of the building and address or the campus ID number;
   4. if only a portion of a building, indicate which portion using conventions of the institution;

E. Roofing System Manufacturer & Address: fill in completely.

F. Roofing System Manufacturer Contact, Phone, and Email: fill in the name of the appropriate person to provide warranty service response on behalf of the Manufacturer, and their commonly used phone number and email address.

G. Manufacturer Authorized Roofing Applicator: fill in name and address of the “Roofing Contractor” (or subcontractor) that installed the System covered by this warranty.

H. Designer: fill in name of Designer shown on page 1 of the construction Agreement.

I. Contractor: fill in name of the general Contractor shown on page 1 of the construction Agreement, if different from the Applicator identified above. If the same, fill in “same”.

3.03 Filling in THE TOTAL ROOFING SYSTEM COMPONENTS on page 1

Refer to the roofing system specifications for the list of components to be included in the Total Roofing System Warranty. The components already named in the form shall be included if they occur in this system. Strike out components already named in the form that are not included in this roofing system and add components not already named in the form that are specified for inclusion.
3.04 Filling in where THE ROOFING CONTRACTOR CERTIFIES on page 1:
A. Roofing Contractor: fill in the name of the Roofing Contractor, same as the Authorized Roofing Applicator above (per 3.02.G in this section).
B. Authorized Signature: a suitably authorized representative of the Roofing Contractor with authority to bind the Roofing Contractor to the terms of this certification shall sign here.
C. Fill in the name of the person providing the Authorized Signature, their title within the Roofing Contractor organization, and the date on which the signature is affixed.

3.05 Filling in where THE MANUFACTURER WARRANTS on page 1:
A. Manufacturer: fill in the name of the Manufacturer, same as the Roofing System Manufacturer above (per 3.02.E in this section).
B. Authorized Signature: a suitably authorized representative of the Manufacturer with authority to bind the Manufacturer to the terms of this Warranty shall sign here.
C. Fill in the name of the person providing the Authorized Signature, their title within the Manufacturer organization, and the date on which the signature is affixed.

3.06 Filling in the ROOFING SYSTEM INFORMATION on page 2:
A. Fill in an “X” or similarly in one of the provided boxes to indicate that the roof is a “New Roof” over new construction or is a “Reroof” over existing construction.
B. Warranty Number: fill in same as in upper right of page 1.
C. Area of Roof Installed: fill in the total square feet (SF) of the roof installed.
D. Date of Substantial Completion: Fill in the date certified by the Designer.
E. Date of Warranty Expiration: Fill in the date equal to the Date of Substantial Completion (per 3.06.D this section) plus the Warranty Period filled in at the top of page 1 (per 3.02.B this section).
F. ROOFING SYSTEM COMPONENTS:
Complete all information for each item listed. Provide complete description of each component in the system. When different components or systems are present, describe each condition and location. If the particular component is not used in this system, fill in “n/a” in the space.
G. MANUFACTURER’S MEMBRANE INFORMATION:
Provide Manufacturer unique roll identification number for each roll used in this project.
H. MANUFACTURER FINAL INSPECTION:
1. The Manufacturer’s final inspection is limited in scope to the Roofing System, and is a distinct and different inspection from the Designer’s final inspection of the Work of the Contract.
2. Fill in name and title of the Manufacturer’s representative making the inspection. Fill in the date of the inspection. Provide signature by that representative.
3. Fill in the name and title of the Designer representative that was present at inspection.
4. Fill in the name and title of the Owner’s representative (other than the Designer) that was present at inspection.

3.07 Executing the Warranty by the TOTAL ROOFING SYSTEM MANUFACTURER at the bottom of page 4:
A. Fill in Roofing System Manufacturer’s name, same as on page 1 (per 3.02.E and 3.05.A this section).
B. Once the roof work is acceptable to the Roofing System Manufacturer, affix signature of Roofing System Manufacturer’s authorized and binding representative. Fill in date of signature.
C. Fill in the name and title of the Roof System Manufacturer’s signatory.

END OF SECTION
## SECTION 07 50 36  
TOTAL ROOFING SYSTEM WARRANTY  
State of Tennessee

<table>
<thead>
<tr>
<th>SBC Project Number</th>
<th>Warranty Period (Years)</th>
<th>Warranty Number</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Building, campus, and address</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Roofing System Manufacturer (<em>Manufacturer</em>) and address</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Roofing System Manufacturer Contact</th>
<th>Phone</th>
<th>email</th>
</tr>
</thead>
</table>

| Manufacturer Authorized Roofing Applicator (*Roofing Contractor*) | and address |
|-------------------------------------------------------------------|

<table>
<thead>
<tr>
<th>Designer</th>
<th>General Contractor (if different from applicator above)</th>
</tr>
</thead>
</table>

The Roofing System Manufacturer, (Manufacturer) warrants to the Tennessee Board of Regents (Owner) of the above building, that subject to the Terms, Conditions, and Limitations stated in this no dollar limit (NDL) warranty, the Manufacturer will repair any leak in the Total Roofing System installed by a Manufacturer authorized roofing applicator (Roofing Contractor) for a period stated above commencing with the date of Substantial Completion. The Manufacturer will repair or replace system defects or failures.

THE TOTAL ROOFING SYSTEM COMPONENTS are defined as the following; all materials as manufactured or authorized by the Manufacturer: including, but not limited to: membrane, flashings, counterflashings, adhesives and sealants, insulation, cover boards, fasteners, fastener plates, fastening bars, metal work, insulation adhesives, and any other products utilized in this installation. (Strike out materials not included in this system and add other materials included as required):

---

**THE ROOFING CONTRACTOR CERTIFIES** that the Total Roofing System was installed in strict accordance with the Manufacturer’s recommendations utilizing only the Manufacturer’s authorized products to install the Total Roofing System and that all products were protected while in their possession prior to installation and had no moisture or water trapped in the Total Roofing System. The Roofing Contractor certifies that all necessary steps were taken to ensure that all conditions were met for the issuance of The Total Roofing System Warranty by the Manufacturer.

<table>
<thead>
<tr>
<th>Roofing Contractor</th>
<th>Authorized Signature</th>
</tr>
</thead>
</table>

**Print or Type Name** | **Title** | **Date**

THE MANUFACTURER WARRANTS that if it cannot supply a specified product for inclusion in a Total Roofing System Warranty, the Roofing Contractor must obtain prior written approval from the Manufacturer for all products not supplied by the Manufacturer to be incorporated in the Total Roofing System Warranty. The Manufacturer will issue a Total Roofing System Warranty. In addition to a final inspection of the completed installation by the Manufacturer, the Manufacturer is also entitled to supplement their final field inspection with the Roofing Contractors above certification. There will be NO exceptions or exclusions to the Total Roofing System Warranty based upon products used or installation issues by the authorized Roofing Contractor, provided all materials installed are provided or authorized by the Roofing System Manufacturer.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Authorized Signature</th>
</tr>
</thead>
</table>

**Print or Type Name** | **Title** | **Date**
# ROOFING SYSTEM INFORMATION

<table>
<thead>
<tr>
<th>New Roof</th>
<th>Reroof</th>
<th>Warranty Number</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Area of Roof Installed (SF)</th>
<th>Date of Substantial Completion</th>
<th>Date of Warranty Expiration</th>
</tr>
</thead>
</table>

## TOTAL ROOFING SYSTEM COMPONENTS – list all that apply:

- **Type of Roof deck(s)**

- **Type of metal flashing / trim / coping, etc.**

- **Type of vapor barrier**

- **Type of air barrier**

- **Type and thickness of flat insulation**

- **Type and slope of tapered insulation**

- **Type of recovery board**

- **Type of flashing**

- **Membrane type and color**

## MANUFACTURER’S MEMBRANE INFORMATION

List manufacturer’s roll identification for ALL rolls of used:  If additional space is needed, attach additional sheet

<table>
<thead>
<tr>
<th>Manufacturer’s Roll Identification</th>
<th>Date</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## MANUFACTURER FINAL INSPECTION

performed by:

<table>
<thead>
<tr>
<th>Print or type name and title</th>
<th>Date</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Designer Representative present for Final Inspection:

<table>
<thead>
<tr>
<th>Print or type name and title</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

Owner Representative present for Final Inspection: (when practical)

<table>
<thead>
<tr>
<th>Print or type name and title</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
1. Owner shall provide the Manufacturer with written notice within thirty (30) days of the discovery of any leak(s) in the roof system.

2. The Manufacturer shall within fourteen (14) calendar days, commencing with receipt of written notice from the Owner, inspect the roofing system in the presence of the Owner’s representative (when practical) and if the cause(s) of the leak(s) is found the responsibility of the Manufacturer under this warranty, promptly make or cause to be made, the repair(s) or replacements(s) necessary to return the roofing system to the condition which is watertight and remediate moisture. All repair expenses incurred in connection herewith will be the responsibility of and borne by the Manufacturer.

3. If upon joint inspection by the Manufacturer and the Owner’s representative of the roofing system as provided in Paragraph 2, the cause(s) of any leak(s) is found not the responsibility of the Manufacturer under this warranty, the Manufacturer will immediately advise the Owner of the type and extent of repair(s) required to be made at the Owner's expense and if such repair(s) be promptly and reasonably made by the Manufacturer, this warranty will remain in effect for the unexpired portion of the warranty period; otherwise, this warranty will become null and void with respect to the area(s) or item(s) affected.

4. In the event the Manufacturer and Owner disagree as to the cause(s) and responsibility of the leak(s), then the Owner, without prejudice to any other remedy Owner may have, may make repair(s) of any leak(s) in accordance with Manufacturer recommendations if timely made available. Such action by the Owner shall not constitute a violation of this warranty. The Owner reserves the right to pursue reimbursement from the Manufacturer for all cost(s) and expense(s) of such repair(s), subject to the Manufacturer's responsibility under this warranty. If it is determined that the Manufacturer has no responsibility for the leak(s) under this warranty, the Owner will reimburse the Manufacturer for direct expenses encountered for trips requested by the Owner after the initial inspection.

5. In the event an emergency condition arises where, in the reasonable opinion of the Owner immediate reasonable repair(s) are necessary to avoid substantial damage to the building or its contents and the Manufacturer advises the Owner in writing of its inability, for reasons beyond its control, to inspect and repair the roof system as necessary within fourteen (14) days of written notification from the Owner, then the Owner may make such temporary repair(s) as in the opinion of the Owner are essential and necessary and such action by the Owner shall not constitute a violation of this warranty. In these circumstances, the Manufacturer shall reimburse the Owner for all reasonable costs and expenses of such temporary repair(s) subject to the Manufacturer's responsibility under this warranty.

6. In the event the Manufacturer fails to respond to written notification of known or suspected leak(s) as provided in Paragraph 2, the Owner may, after fourteen (14) days following receipt by the Manufacturer of an additional written notice and without prejudice to any other remedy he may have, make permanent repair(s) of any leak(s) and recover all reasonable costs and expenses of such repair(s) from the Manufacturer. The Manufacturer will, upon demand by the Owner, promptly reimburse the Owner these reasonable repair costs and expenses. Such action by the Owner shall in no way negate the responsibilities of the Manufacturer under this warranty for the unexpired portion of the warranty period.

7. Except as provided in Paragraphs 4, 5 & 6, any alterations of the roofing system after completion and acceptance including the placement of fixtures, utilities and equipment on or through the roof or additions thereto, will render this warranty null and void with respect to the area(s) or item(s) affected unless prior written authorization of such alterations of the roof system or additions thereto is given by the Manufacturer. Such authorization will not be unreasonably withheld.

8. This warranty shall not be applicable to the extent the roofing system sustains damage(s) by any of the following:
   (a) Acts of God and natural disasters, including but not limited to lightning, hurricanes, tornadoes, and earthquakes, winds of (3 second) peak gust speeds of 72 MPH or higher (determined by the nearest US Weather Station measured at 10 meters above ground or at the given address if reliable pinpoint wind data is available for the address), hail with a diameter greater than two inches;
   (b) Acts of negligence (whether of omission or commission), fire, accidents, or misuse, including but not limited to vandalism, civil disobedience, or acts of war, provided same are not caused by the Manufacturer and/or the Contractor.
   (c) Failure by the Owner to use reasonable care in maintaining the roof and appurtenances, provided same caused the leak(s) or item(s) affected; or,
   (d) For built-up and modified bitumen roofs: A roof design or specification authorized by the Owner with less than 1/8” per foot slope for drainage.
   (e) Building design issues that affect the performance of the Total Roofing System.

9. When the roof system has been damaged by any of the foregoing causes, repair(s) shall be at the Owner's expense and such repair(s) shall be made as provided in Paragraph 3; otherwise, this warranty will become null and void with respect to the area(s) or item(s) affected.
10. Until such time as the third year of this warranty has expired, the Manufacturer's obligations hereunder shall be joint and several with the Contractor. For the purpose of this paragraph, all of the Contractor's actions, whether of omission or commission, that are subject to this warranty are likewise the actions of the Manufacturer hereunder and shall in no way negate or reduce the responsibilities of the Manufacturer under this warranty.

11. As part of the repair of leaks, the Manufacturer shall replace roof insulation included in the this warranty that become damaged as a result of a roof leak, provided the roof leak is not excluded under the Terms, Conditions, and Limitations set forth in this warranty. The replacement of damaged roof insulation shall be limited to those boards that have lost the structural integrity necessary to support and restrain the System when it is subjected to dynamic loads such as typical roof service traffic, winds up to 72 mph, hail up to two inches in diameter, and periodic accumulations of water, snow, or ice. In the event that roof insulation is damaged as a result of a roof leak excluded under the Terms, Conditions and Limitations set forth in this warranty, the Manufacturer will advise the Owner of the type and extent of insulation and recovery board replacement to be made at the Owner's expense. Failure by the Owner to properly make these repairs in a reasonable manner using a Manufacturer licensed applicator and within a reasonable period of time shall render this Warranty null and void in the area of the damage. Neither the Manufacturer nor the Owner shall have any obligation to replace roof insulation and recovery board if the area affected by the leak is less than fifty (50) square feet.

12. The Manufacturer certifies that it:
   (a) Manufactures or purchases products for the purpose of designing, developing, and marketing a roof system;
   (b) Provides recommendations, specifications, and details for the roofing system materials and installation;
   (c) Trains and authorizes Roofing Contractors;
   (d) Provides technical assistance to Roofing Contractors;
   (e) Approves or prepares shop drawings; and,
   (f) Provides a technical representative employed by the Manufacturer for the final inspection, and to all inspections required by this warranty.

13. During the period of this warranty, the Manufacturer, its agents or employees, will have free access to the roof during regular business hours of the Owner.

14. Owner shall be responsible for the costs associated with the removal and replacement, as well as any damage caused by the removal and replacement of any overburden, super strata, or overlays, either permanent or temporary, excluding accepted stone ballast or pavers, as necessary to expose the system for inspection and/or repair.

15. Alterations or repairs to the System that are not completed in accordance with Manufacturer's published specifications, not completed by an authorized contractor, and/or where current notification procedures were not followed are excluded and this warranty will become null and void with respect to the area(s) or item(s) affected.

16. For a 30 year single ply membrane roof system, the Total Roofing System Warranty shall cover the proper repair of leaks caused by unintentional, accidental and occasional puncture damage to the membrane as a result of normal rooftop inspection, maintenance or service; however, it does not cover damage caused by snow removal or damage caused by other trades during construction. There shall be no man hour limitation per year on accidental puncture repairs covered by this provision of the warranty. Resulting wet insulation shall be treated as set forth in Paragraph 11 above.

TOTAL ROOFING SYSTEM MANUFACTURER

Roofing System Manufacturer name

Authorized Signature & Date

Print or Type Name & Title
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Adhered roof system with ethylene propylene diene terpolymer (EPDM) roofing membrane.
   B. Vapor retarder over concrete deck.
   C. Roofing stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS
   A. Section 03.45.00 - Precast Architectural Concrete: Roof pavers where indicated
   B. Section 06.10.00 - Rough Carpentry: Wood nailers and curbs.
   C. Section 07.62.00 - Sheet Metal Flashing and Trim: Flashings, Counterflashings, reglets and Copings.
   D. Section 07.71.00 - Roof Specialties: Prefabricated roofing expansion joint flashing.

1.03 REFERENCE STANDARDS
   F. FM DS 1-29 - Roof Deck Securement and Above-Deck Roof Components; Factory Mutual System; 2006.

1.04 ADMINISTRATIVE REQUIREMENTS
   A. Preinstallation Meeting: Convene one week before starting work of this section.
      1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.05 SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide manufacturer's written information listed below.
      1. Product data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
      2. Preparation instructions and recommendations.
      3. Storage and handling requirements.
   C. Manufacturer's Qualification Statement.
   D. Installer's Qualification Statement.
   E. Specimen Warranty: Mock-up of the Total Roofing System Warranty for the State of Tennessee, as provided on the form of Section 07.50.36, as per the instructions in Section 07.50.35.
F. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.

G. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

H. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

I. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.

J. Installer's Qualification Statement.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION

A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.

B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.07 QUALITY ASSURANCE

A. Perform work in accordance with 1.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum twenty (20) years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section:
   1. With minimum five (5) years documented experience.
   2. Approved by membrane manufacturer.
   3. Extend manufacturer's labor and materials guarantee.
   4. Extend manufacturer's No Dollar Limit guarantee.

D. Single Source Responsibility: Provide and install products from single source.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

B. Store products in weather protected environment, clear of ground and moisture.

C. Protect foam insulation from direct exposure to sunlight.

D. Keep Material Safety Data Sheets (MSDS) at the project site at all times during transportation, storage, and installation of materials.

E. Comply with all requirements of Owner to prevent overloading or disturbance of the structure when loading materials onto the roof.

1.09 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather. Refer to manufacturer's written instructions.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above ____ degrees F.
C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
E. Proceed with work so new roofing materials are not subject to construction traffic as work progresses.
F. Do not allow grease, oil, fats, or other contaminants to come into direct contact with membrane.

1.10 WARRANTY
A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
B. Total Roofing System Warranty: All roofing materials and installation shall be included in the Total Roofing System Warranty for the State of Tennessee, as provided on the form of Section 07.50.36, as per the instructions in Section 07.50.35.
   1. Warranty Term: 20 years.
   2. For repair and replacement include costs of both material and labor in warranty.
   3. Exceptions NOT Permitted:
      a. Damage due to roof traffic.
      b. Damage due to wind of speed greater than 56 mph but less than 90 mph.

PART 2 PRODUCTS

2.01 ROOFING APPLICATIONS
A. EPDM Membrane Roofing: 60 mil non-reinforced single ply membrane, fully adhered, over insulation.
B. Roofing Assembly Performance Requirements and Design Criteria:
   1. Wind Uplift:
      a. Designed to withstand wind uplift forces calculated with ASCE 7.
      b. Design Wind Speed: 90 miles per hour.
   2. Thermal Performance: Roof system insulation thermal value (R), minimum: R-25; provide insulation of thickness required.
   3. Drainage: No standing water within 48 hours after precipitation.

2.02 ROOFING MEMBRANE AND ASSOCIATED MATERIALS
A. Air & Vapor Barrier Base Sheet, over concrete decks: Self-adhering, rubberized asphalt membrane laminated to spun-bonded polyester fabric; 40 mils (0.040 inch) thick, minimum.
   1. Tensile Strength: 250 psi, when tested per ASTM D412.
   2. Elongation: 250%, when tested per ASTM D412.
   3. Puncture Resistance: 60 lbs, when tested per ASTM E154.
   4. Permeability: 0.015 perms, when tested per ASTM D1970.
   5. Air Permeance: 0.000 L*Sq M @ 75 Pa, when tested per ASTM E2178.
B. Membrane:
   1. Material: Ethylene propylene diene terpolymer (EPDM); ASTM D4637/D4637M, Type I (non-reinforced).
   2. Thickness: 60 mils (0.060 inch), minimum.
   3. Tensile Strength: 1600 psi min, when tested by ASTM D412
   4. Elongation: 465%, when tested per ASTM D412.
   5. Tear Strength: 200 lb/ln, when tested per ASTM D624.
   6. Factory Seam Strength: Membrane rupture, when tested per ASTM D816.
   7. Sheet Width: Factory fabricated into largest sheets possible.
C. Seaming and Splicing Materials: As recommended by membrane manufacturer.
D. Membrane Fasteners: As recommended and approved by membrane manufacturer.
E. Flexible Flashing Material: Same material as membrane.
F. Base Flashing: Provide waterproof, fully adhered base flashing system at all penetrations, plane transitions, and terminations.

2.03 INSULATION
A. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, fiber reinforced felt both faces; Grade 2 and with the following characteristics:
1. Compressive Strength: 20 pounds per square inch.
2. Tapered Board: Slope as indicated; minimum thickness 1/4 inch; fabricate of fewest layers possible.

2.04 BALLAST MATERIALS
A. Pavers: See Section 03.45.00 - Precast Architectural Concrete. Used for appearance purposes in the few indicated areas.

2.05 ACCESSORIES
A. Prefabricated Flashing Accessories:
1. Corners and Seams: Same material as membrane, in manufacturer's standard thicknesses.
2. Penetrations: Same material as membrane, with manufacturer's standard cut-outs, rigid inserts, clamping rings, and flanges.
3. Sealant Pockets: Same material as membrane, with manufacturer's standard accessories, in manufacturer's standard configuration.
4. Manufacturer's Pressure-Sensitive Reinforced Universal Securement Strip:
   a. 9 inch wide, 45 mils (0.045 inch) thick, reinforced EPDM membrane with 3 inch wide, 30 mils (0.030 inch) thick cured synthetic rubber with pressure-sensitive adhesive laminated to both edges.
B. Insulation Adhesive: Two component polyurethane, expanding foam.
C. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.
D. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
1. Length as required for thickness of insulation material and penetration of deck substrate or as required for attachment to walls, with metal washers 3” diameter.
E. Membrane Adhesive: As recommended by membrane manufacturer.
F. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.
G. Strip Reglet Devices: Extruded plastic, maximum possible lengths per location, with attachment flanges.
H. Sealants: As recommended by membrane manufacturer.
I. Cleaner: Manufacturer's standard, clear, solvent-based cleaner.
J. Primer: Manufacturer's recommended product.
K. Edgings and Terminations: Manufacturer's approved edge and termination accessories. Also see Section 07.62.00.
1. Edge System: As indicated.
2. Anchor Bar Fascia System: As indicated.
3. Drip Edge: As indicated.
4. Coping: As indicated.
5. Termination Bar.
L. Walkway Pads: Pressure-Sensitive Molded EPDM Walkway Pads
   1. Provide at all locations indicated on the Drawings and at all traffic concentration points.
   2. Size: 30" x 30" typical. Trim to fit where needed. Beaded surface.
   3. Thickness: 0.375" +/- 10%.
   4. Tensile Strength: 500 psi when tested per ASTM D412.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL
   A. Perform work in accordance with manufacturer's instructions.
   B. Do not apply roofing membrane during unsuitable weather.
   C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
   D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
   E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
   F. Coordinate the work with installation of associated counterflashings installed by other sections as the work of this section proceeds.
   G. When substrate preparation is responsibility of another installer, notify Architect of unsatisfactory conditions before proceeding.

3.02 EXAMINATION
   A. Verify that surfaces and site conditions are ready to receive work.
   B. Verify deck is supported and secure.
   C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
   D. Verify deck surfaces are dry and free of snow or ice.
   E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.03 PREPARATION, GENERAL
   A. Clean substrate thoroughly prior to roof application.
   B. Do not begin work until other work that requires foot or equipment traffic on roof is complete.
   C. Apply manufacturer's recommended vapor retarder or temporary roof before roof installation.

3.04 CONCRETE DECK PREPARATION
   A. Fill surface honeycomb and variations with latex filler.
   B. Confirm dry deck by moisture meter with 12 percent moisture maximum when tested per ASTM D4263.

3.05 INSULATION APPLICATION
   A. Apply vapor retarder to concrete deck surfaces with adhesive in accordance with manufacturer's instructions.
      1. Extend vapor retarder under cant strips and blocking to deck edge.
      2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.
   B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.
C. Attachment of Insulation over Metal Deck:
   1. Mechanically fasten first layer of insulation to deck in accordance with roofing manufacturer's instructions and Factory Mutual requirements.
   2. Embed second layer of insulation into full bed of adhesive in accordance with roofing and insulation manufacturers' instructions.
D. Attachment of Insulation over Concrete Deck Vapor Barrier: Embed insulation in adhesive in full contact, in accordance with roofing and insulation manufacturers' instructions.
E. Do not install wet, damaged, or warped insulation boards.
F. Lay subsequent layers of insulation with joints staggered minimum 6 inch from joints of preceding layer.
G. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
H. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.
I. Lay boards with edges in moderate contact without forcing, and gap between boards no greater than 1/4 inch. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
J. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches.
K. Do not apply more insulation than can be completely waterproofed in the same day.

3.06 MEMBRANE APPLICATION
A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
B. Shingle joints on sloped substrate in direction of drainage.
C. Fully Adhered Application: Apply adhesive at manufacturer's recommended rate. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof.
E. At intersections with vertical surfaces:
   1. Extend membrane to vertical surfaces and up a minimum of 4 inches onto vertical surfaces.
   2. Fully adhere flexible flashing over membrane and up to nailing strips.
   3. Secure flashing to nailing strips at 4 inches on center.
   4. Insert flashing into reglets and secure.
F. At edge metal, extend membrane under the edge metal to the outside face of the wall.
G. At copings, extend membrane under the copings to the outside face of the wall.
H. Install roofing expansion joints where indicated. Make joints watertight.
I. Install prefabricated joint components in accordance with manufacturer's instructions.
J. Coordinate installation of roof drains and sumps and related flashings. Locate all field splices away from low areas and roof drains. Lap upslope sheet over downslope sheet.
K. Install walkway pads at areas of concentrated traffic and as shown on Drawings. Space pad joints to permit drainage.
L. Lay concrete pavers pedestals and shims over manufacturer approved protection sheet and according to manufacturer's instructions.
M. Daily Seal: Install daily seal per manufacturers instructions at the end of each work day. Prevent infiltration of water at incomplete flashings, terminations, and at unfinished membrane edges.

3.07 FIELD QUALITY CONTROL
A. Require site attendance of roofing and insulation material manufacturers daily during installation of the Work.
3.08 CLEANING
   A. Remove wrappings, empty containers, paper, and other debris from the roof daily. Dispose of debris in compliance with local, State, and Federal regulations.
   B. Remove bituminous markings from finished surfaces.
   C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.
   D. Repair or replace defaced or damaged finishes caused by work of this section.

3.09 PROTECTION
   A. Protect installed roofing and flashings from construction operations.
   B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION 07.53.23
McCarty Holsaple McCarty, Inc.
ROOFING

East Tennessee State University

Fine Arts Classroom Building
SBC No. 166/005-08-2013 CM

DESIGN RELEASE PACKAGE 4
ISSUED: 12/01/2017
SECTION 07.62.00
SHEET METAL FLASHING AND TRIM

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Fabricated sheet metal items, including copings, fascias, flashings, counterflashings, and other indicated items.
B. Sealants for joints within sheet metal fabrications.
C. Reglets and accessories.

1.02  RELATED REQUIREMENTS
A. Section 04.20.00 - Unit Masonry: Coordinate metal flashings embedded in masonry.
B. Section 07.53.23 - EPDM Thermoset Single-Ply Roofing
C. Section 07.72.00 - Roof Accessories: Manufactured metal roof curbs.

1.03  REFERENCE STANDARDS
D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

1.04  SUBMITTALS
A. Product Data: Provide data on materials, finishes, anchor types and locations.
B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
C. Installation Instructions: Indicate special procedures, fasteners, supporting members and perimeter conditions requiring special attention.
D. Warranty: Materials and Installation shall be included in the Total Roofing System Warranty provided on the form of Section 07.50.36, per instructions in Section 07.50.35.
1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION

A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.

B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   3. Compliance with Credit EQ6.2: Material VOC Limits - Paints
   4. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with SPRI ES-1 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with ten years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; anodized finish of color as selected.
   1. Clear Anodized Finish at window sills and otherwise noted: AAMA 611 AA-M12C22A41 Class I clear anodic coating not less than 0.7 mils thick.

B. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 16 gage, .050” inch thick, unless otherwise indicated; plain texture, shop pre-coated with fluoropolymer coating.
   1. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As selected by Architect from manufacturer’s standard colors.

C. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gage, (0.0156 inch) thick; smooth No. 4 - Brushed finish.

2.02 COMPONENTS

A. Roof Edge Flashings: Fabricated to sizes required; mitered, concealed fasteners.
   2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable local building code.

B. Copings: Factory fabricated to sizes required; mitered, concealed fasteners.
1. Configuration: Concealed continuous hold-down cleat at both legs; internal splice piece at joints of same material, thickness and finish as cap; concealed stainless steel fasteners.
2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI ES-1 using test methods RE-3 to positive and negative design wind pressure as defined by applicable local building code.
3. Material: Formed aluminum sheet, 0.050 inch thick, of watertight construction, with roof membrane flashing continuous below copings.

2.03 ACCESSORIES
A. Fasteners: Stainless steel, with soft neoprene washers where indicated.
B. Spring-Type Two-Piece Flashing: Metal reglet piece designed for encasing in brick mortar joint and at other indicated conditions, with inserted interlocking metal flashing and wind clips.
C. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.
D. Sealant to be Exposed in Completed Work: 1; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; color as selected.
E. Plastic Cement: 1, Type I. Insure that plastic cement does not come in contact with EPDM.

2.04 FABRICATION
A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
B. Fabricate cleats of same material as sheet, minimum 3 inches high, interlocking with sheet.
C. Form pieces in longest possible lengths.
D. Hem exposed edges on underside 1/2 inch; miter and seam corners.
E. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
F. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION
A. Install starter and edge strips, and cleats before starting installation.
B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION
A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
B. Apply plastic cement compound between metal flashings and felt flashings.
C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
D. Seal metal joints watertight.
3.04 FIELD QUALITY CONTROL

A. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION 07.62.00
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Manufactured curbs, equipment rails, and pedestals.
   B. Roof hatches. See separate section for smoke vents.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS
   D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

1.04 SUBMITTALS
   A. Product Data: Manufacturer's data sheets on each product to be used.
      1. Preparation instructions and recommendations.
      2. Storage and handling requirements and recommendations.
      3. Installation methods.
      4. Maintenance requirements.
      5. For smoke hatches, submit evidence of approval by evaluation agency specified.
   B. Shop Drawings: Submit detailed layout developed for this project. Show dimensioned location and number for each type of roof accessory.
      1. Non-penetrating Rooftop Supports: Submit design calculations for loadings and spacings.
      2. Submit shop drawings sealed and signed by a Professional Engineer experienced in design of this type of work and licensed in Tennessee.
   C. Certificate: For smoke hatches, provide certificate of approval from authority having jurisdiction.
   D. Warranty Documentation:
      1. Submit manufacturer warranty.
      2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
      3. Submit documentation that roof accessories accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction wast diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   3. Compliance with Credit EQ6.2: Material VOC Limits - Paints
   4. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Store products in manufacturer's unopened packaging until ready for installation.
   B. Store products under cover and elevated above grade.

1.07 WARRANTY
   A. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURED CURBS
   A. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies:
   B. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counterflashing, internal reinforcing, and top side and edges formed to shed water.
   1. Sheet Metal: Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33; G60 coating designation; 18 gage, 0.048 inch thick.
   2. Roofing Cants: Provide integral sheet metal roofing cants dimensioned to begin slope at top of roofing insulation; 1:1 slope; minimum cant height 4 inches.
   3. Manufacture curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.
   4. Provide the layouts and configurations indicated on the drawings.
   C. Curbs Adjacent to Roof Openings: Provide curb on all sides of opening, with top of curb horizontal for equipment mounting.
   1. Provide preservative treated wood nailers along top of curb.
   2. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.
   3. Height Above Finished Roof Surface: 6 inches, minimum.
   4. Height Above Roof Deck: 14 inches, minimum.

D. Equipment Rails: Two-sided curbs in straight lengths, with top horizontal for equipment mounting.
   1. Provide preservative treated wood nailers along top of rails.
   2. Height Above Finished Roof Surface: 6 inches, minimum.
   3. Height Above Roof Deck: 14 inches, minimum.

E. Pipe, Duct, and Conduit Mounting Pedestals: Vertical posts, minimum 8 inches square unless otherwise indicated.
   1. Provide sliding channel welded along top edge with adjustable height steel bracket, manufactured to fit item supported.
   2. Height Above Finished Roof Surface: 6 inches, minimum.
   3. Height Above Roof Deck: 14 inches, minimum.

2.02 ROOF HATCHES
   A. Manufacturers - Roof Hatches:
   B. Manufacturers - Roof Hatches:
1. Acudor Products Inc; RHA Series, ladder access: www.acudor.com/#sle.
2. Bilco Company; Thermally Broken Series, ladder access: www.bilco.com/#sle.

C. Roof Hatches, General: Factory-assembled steel frame and cover, complete with operating and release hardware.
   1. Style: Provide flat metal covers unless otherwise indicated.
   2. Mounting: Provide frames and curbs suitable for mounting on flat roof deck.
   3. Thermally Broken Hatches: Added insulation to frame and cover; available in all manufacturer's standard, single leaf sizes; special sizes available upon request

D. Frames/Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
   1. Material: Mill finished aluminum, 11 gage, 0.0907 inch thick.
   2. Insulation: Manufacturer's standard; 1 inch rigid glass fiber, located on outside face of curb.
   3. Curb Height: 12 inches from finished surface of roof, minimum.

E. Metal Covers: Flush, insulated, hollow metal construction.
   1. Capable of supporting 40 psf live load.
   2. Material: Mill finished aluminum; outer cover 11 gage, 0.0907 inch thick, liner 0.04 inch thick.
   3. Insulation: Manufacturer's standard 1 inch rigid glass fiber.
   4. Gasket: EPDM, continuous around cover perimeter.

F. Safety Railing System: Manufacturer's standard accessory safety rail system mounted directly to curb.
   3. Gate: Same material as railing; automatic closing with latch.

G. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
   1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
   2. Hinges: Heavy duty pintle type.
   3. Hold open arm with vinyl-coated handle for manual release.

2.03 Non-Penetrating Rooftop Assemblies

A. Non-Penetrating Rooftop Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly.
   1. Design Loadings and Configurations: As required by applicable codes.
   2. Height: Provide minimum clearance of 6 inches under supported items to top of roofing.
   3. Support Spacing and Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
   4. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
   5. Hardware, Bolts, Nuts, and Washers: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.

B. Pipe Supports: Provide attachment fixtures complying with MSS SP-58 and as indicated.

C. Duct Supports:

D. Non-Penetrating Pedestals: Steel pedestals with square, round, or rectangular bases.
2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Do not begin installation until substrates have been properly prepared.
   B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION
   A. Clean surfaces thoroughly prior to installation.
   B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION
   A. Install in accordance with manufacturer's instructions, in manner that maintains roofing weather integrity.

3.04 CLEANING
   A. Clean installed work to like-new condition.

3.05 PROTECTION
   A. Protect installed products until completion of project.
   B. Touch-up, repair or replace damaged products before Date of Substantial Completion.
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All provisions of the Contract Documents apply to this Section.

1.2 SCOPE
A. This Section describes the extent of the Stage House Roof Smoke and Fire Vents.

1.3 WORK SPECIFIED ELSEWHERE
A. Consult all other Sections to determine the extent of work specified elsewhere but related to this Section. This work shall be properly coordinated to produce an installation satisfactory to the Owner.

1.4 QUALITY ASSURANCE
A. Performance of Roof Smoke and Fire Vents relies on the air- and water-tight installation of the vent, including all operable panels, curb, and associated construction. Installer shall exercise extreme care in ensuring that all operable components seat tightly and securely, with continuous compression of door panels at stops and seals.

1.5 SUBMITTALS
A. Samples of all materials specified shall be submitted to Architect for approval if requested. No substitutions are to be made without approval. Any non-approved materials that have been installed shall be removed and replaced with approved materials at no expense to the Owner.

B. The supplier of the Fire Vents shall provide certified test data from an accredited independent Acoustical Laboratory giving Airborne Sound Transmission Loss of a 5’x8’ consisting of 2 pairs of doors operating in tandem. The tests shall be conducted in accordance with ASTM E90-75 or later. The data shall be reported in 1/3 octave band transmission loss from 125 Hz to 4000 Hz. The data shall include the Sound Transmission Class determined in accordance with ASTM E413-73. In addition, the sound transmission loss values in dB shall not be less than the following:

<table>
<thead>
<tr>
<th>1/3 Octave Band Center Frequency, Hz</th>
<th>Sound Transmission Loss, dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>29</td>
</tr>
<tr>
<td>160</td>
<td>34</td>
</tr>
<tr>
<td>200</td>
<td>37</td>
</tr>
<tr>
<td>250</td>
<td>40</td>
</tr>
<tr>
<td>315</td>
<td>42</td>
</tr>
<tr>
<td>400</td>
<td>42</td>
</tr>
<tr>
<td>500</td>
<td>42</td>
</tr>
<tr>
<td>630</td>
<td>44</td>
</tr>
<tr>
<td>800</td>
<td>43</td>
</tr>
<tr>
<td>1000</td>
<td>43</td>
</tr>
<tr>
<td>1250</td>
<td>43</td>
</tr>
<tr>
<td>1600</td>
<td>44</td>
</tr>
<tr>
<td>2000</td>
<td>47</td>
</tr>
<tr>
<td>2500</td>
<td>51</td>
</tr>
<tr>
<td>3150</td>
<td>53</td>
</tr>
<tr>
<td>4000</td>
<td>51</td>
</tr>
</tbody>
</table>
1.6 SHOP DRAWINGS
A. Submit Shop Drawings showing complete details of mounting conditions, including clearances from Stage House structure and rigging.

1.7 APPLICABLE STANDARDS
A. All fabrications and constructions shall be labeled as being FM approved. The Fire Vents shall be fabricated and installed in accordance with the requirements of all applicable life safety, building, and other codes.

PART 2 - PRODUCTS
2.1 ACCEPTABLE MANUFACTURERS
A. MILCOR Model STC-50 rated Heat and Smoke Vent, as manufactured by MILCOR, Inc. 1150 North Gable Road Lima, OH 45801; Phone (800) 441-6899, Fax (800) 441-6899

2.2 ROOF VENTS
A. Automatic fire vents shall be of double leaf construction in sizes as shown on the drawings, and shall be labeled as FM approved.

B. Covers shall be 14 gauge paint bond G-90 galvanized steel prime painted with 3" beaded flange and formed channel reinforcing members welded to the underside. Aluminum construction is not acceptable. All hardware shall be secured to the reinforcing members. Covers shall be reinforced to support a minimum live load of 40 psf. Insulation in covers shall be glass fiber 2" thick fully covered and protected by 22 gauge paint bond G-90 galvanized steel liner prime painted.

C. Each upper cover shall be equipped with a positive automatic hold-open arm with red vinyl grip release, and a heavy extruded thermoplastic rubber gasket fitted into a retainer that is mechanically fastened to the interior of the cover to assure a continuous seal when compressed to the top surface of the curb.

D. Each lower cover shall be continuously hinged and shall be 14 gauge paint bond G-90 galvanized steel prime painted. Insulation in the lower covers shall be glass fiber 2" thick fully covered and protected by a 22 gauge paint bond G-90 galvanized steel liner prime painted.

E. Curb shall be 14 gauge paint bond G-90 galvanized steel prime painted 16" high at hinge sides, pitched 5 degrees to a fixed center channel. Curb shall be equipped with an integral metal capflashings of the same gauge and material as the curb, with external reinforcing gussets at spring mounts. Capflashings shall be equipped with stamped tabs, 6" on center, to be bent inward when installed to hold single ply membrane securely in place. Backer rod shall be provided with curb to assist in the termination of the membrane. Insulation on exterior of curb shall be rigid fiberboard 3" thick. Factory finish shall be red oxide prime paint.

F. Fire vents shall be completely assembled with upper covers hinged to the curb through heavy pintle hinges fastened to the covers with tamperproof lock bolts. Lifting mechanisms shall be compression springs fully enclosed in telescopic tubes. The lifting mechanisms shall be capable of fully opening covers against a superimposed load on the cover surface of 10 psf and shall lock automatically in vertical opposition.

G. Upper compression spring tube shall overlap the lower tube to prevent moisture and debris from entering and being trapped between the inner and outer tubes. Springs shall be lubricated at the factory and the lower tube locked into a supporting shoe that is welded to the curb. Heavy duty shock absorbers shall be provided to assure controlled opening of upper and lower covers. All hardware shall be zinc plated and chromate sealed.

H. The covers shall be remotely operated by means of a wall mounted hand winch. Cover mounted rigging release device, with 165 degree fusible links, shall secure the rigging to the underside of each cover. These devices and the winch shall be designed to securely hold the covers in the closed position against wind uplift forces without overstressing the fusible links. When heat parts the
fusible links, the cover mounted rigging release devices shall release, instantaneously dropping the rigging and allowing the covers to open. The rigging release devices shall be designed for easy resetting after a fire or a test and so that the covers cannot be closed unless the mechanisms have been reset.

PART 3 - EXECUTION

3.1 General

A. All components and materials shall be delivered to the job in their original unopened containers or bundles. All materials delivered prior to use shall be stored within a completely enclosed structure, providing protection from damage and exposure to the elements.

B. Installation shall be in accordance with the manufacturer’s instruction. The curb shall be enclosed with 3” thick rigid fiberboard insulation, faced with 1” thick exterior grade plywood and waterproof roofing system, flashed to the roof as required to maintain a watertight and airtight seal.

C. At the direction of the owner, contractor shall test vents for proper operation after installation by fusing the links. Contractor shall replace fused links after test at his expense.

D. Contractor shall guarantee to repair or replace any vent or vents which fail to open when tested following installation.

E. Contractor shall guarantee against defects in material and workmanship for a period of 5 years.

F. Vent manufacturer shall certify that it has manufactured and sold its automatic fire vents for more than 25 years with no knowledge of failure of such vents to open in a fire or in a test, or of inadvertent opening due to wind conditions or vibrations with the buildings.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fireproofing of interior structural steel not exposed to damage or moisture.
B. Fireproofing of structural steel exposed to damage or moisture and exposed in performance spaces.
C. Fireproofing of structural steel with indicated fire rating and indicated NRC value.
D. Fireproofing types and applications:
   1. Provide cementitious exposed fireproofing for all roof structural steel at Stage, Main Auditorium, Recital Hall and Studio Theater.
   2. Do not apply fireproofing to the roof deck at the following spaces (the roof fire rating is provided by concrete): Stage, Main Auditorium, Recital Hall, Studio Theater, Percussion Rehearsal, Choral Rehearsal and Instrument Rehearsal.
   3. Fireproofing in the Main Auditorium and the Recital Hall to be troweled onto trusses and painted, to create a smooth finish.
   4. Provide fireproofing with a minimum NRC value of .85 and indicated fire rating for all exposed roof structural steel at the Scene Shop.

1.02 RELATED REQUIREMENTS

A. Section 05.12.00 - Structural Steel Framing.
B. Section 05.21.00 - Steel Joist Framing.
C. Section 05.31.00 - Steel Decking.
D. Section 07.84.00 - Firestopping.
E. Section 09.21.16 - Gypsum Board Assemblies: Gypsum board fireproofing.

1.03 REFERENCE STANDARDS


1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with placement of ceiling hanger tabs, mechanical component hangers, and electrical components.
B. Preinstallation Meeting: Convene one week before starting work of this section.
1.05 SUBMITTALS

A. See Section 01.30.00 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data indicating product characteristics. Indicate products satisfy the requirements of the International Building Code.

C. Test Reports: Reports from reputable independent testing agencies for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, for:
   1. Bond strength.
   2. Bond impact.
   3. Compressive strength.
   4. Fire tests using substrate materials similar those on project.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Manufacturer's Certificate: Certify that sprayed-on fireproofing products meet or exceed requirements of contract documents.

F. Manufacturer's Field Reports: Indicate environmental conditions under which fireproofing materials were installed.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION

A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.

B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   3. Compliance with Credit EQ6.2: Material VOC Limits - Paints
   4. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, and:
   1. Having minimum five years of documented experience.
   2. Approved by manufacturer.

1.08 MOCK-UP

A. Construct mock-up, 100 square feet in size.

B. Conform to project requirements for fire ratings.

C. Locate where directed.

D. Examine installation within one hour of application to determine variances from specified requirements due to shrinkage, temperature, and humidity.

E. Where shrinkage and cracking are evident, adjust mixture and method of application as necessary. Remove materials and re-construct mock-up.

F. Mock-up may remain as part of the Work.
1.09 FIELD CONDITIONS
A. Do not apply spray fireproofing when temperature of substrate material and surrounding air is below 40 degrees F or when temperature is predicted to be below said temperature for 24 hours after application.
B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.
C. Provide temporary enclosure to prevent spray from contaminating air.
D. Do not allow roof traffic during installation of roof fireproofing and drying period.

1.10 WARRANTY
A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
B. Correct defective Work within a five year period after Date of Substantial Completion.
   1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
   2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Sprayed-On Fireproofing:
   5. Substitutions: See Section 01.60.00 - Product Requirements.

2.02 FIREPROOFING ASSEMBLIES
A. Provide assemblies as indicated on the drawings.

2.03 MATERIALS
A. Sprayed Fire-Resistive Material for Interior Applications, Concealed: Manufacturer's standard factory mixed material, which when combined with water is capable of providing the indicated fire resistance, and conforming to the following requirements:
   1. Bond Strength: 150 pounds per square foot, minimum, when tested in accordance with ASTM E736 when set and dry.
   2. Dry Density: As required by fire resistance design.
   3. Compressive Strength: 8.33 pounds per square inch, minimum.
   4. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760.
   5. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937.
   6. Surface Burning Characteristics: Maximum flame spread index of 0 (zero) and maximum smoke developed index of 0 (zero), when tested in accordance with ASTM E84.
   7. Fungal Resistance: No growth after 28 days when tested according to ASTM G21.
B. Sprayed Fire-Resistive Material Exposed to Damage or Moisture: Manufacturer's standard factory mixed material, which when combined with water is capable of providing the indicated fire resistance, and conforming to the following requirements:
   2. Bond Strength: 1000 pounds per square foot, minimum, when tested in accordance with ASTM E736 when set and dry.
   3. Dry Density: As required by fire resistance design.
4. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760.
5. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937.
6. Air Erosion Resistance: Weight loss of 0.025 g/sq ft, maximum, when tested in accordance with ASTM E859 after 24 hours.
7. Surface Burning Characteristics: Maximum flame spread index of 0 (zero) and maximum smoke developed index of 0 (zero), when tested in accordance with ASTM E84.

C. Sprayed Fire-Resistive Material with Acoustical Performance: Inorganic Portland cement based, medium density spray-applied fire resistive material (SFRM) designed to provide fire protection for structural steel. Tested and classified by UL as "investigated for exterior use". Formulated to withstand indirect weather exposure conditions and limited physical abuse. In addition to fire resistance, material also provides thermal and acoustical benefits.
   2. Bond Strength/Adhesion: 1,525 psf when tested in accordance with ASTM E736 when set and dry.
   3. Density: 24 - 26pcf when tested in accordance with ASTM E605.
   5. Effect of Impact on Bonding: No cracking or delamination when tested in accordance with ASTM E760.
   6. Compressive Strength: 7,920 psf when tested in accordance with ASTM E761.
   7. Corrosivity: Does not promote corrosion of steel when tested in accordance with ASTM E937.
   8. Air Erosion Resistance: 0.00 g/sf when tested in accordance with ASTM E859.
   9. Fungal Resistant: No growth after 28 days when tested in accordance with ASTM G21.
  10. Thermal Performance: 0.41 BTU in/hr per sq ft as 75 degrees F, when tested in accordance with ASTM C518.
  11. Acoustic Performance: NRC 0.85 per 1/2 inch thickness, when tested in accordance with ASTM C423.

2.04 ACCESSORIES
   A. Primer Adhesive: Of type recommended by fireproofing manufacturer.
   B. Overcoat: As recommended by manufacturer of fireproofing material.
   C. Metal Lath: Expanded metal lath; minimum 1.7 pounds per square foot, galvanized finish.
   D. Water: Clean, potable.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that surfaces are ready to receive fireproofing.
   B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.
   C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.
   D. Verify that voids and cracks in substrate have been filled. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

3.02 PREPARATION
   A. Perform tests as recommended by fireproofing manufacturer in situations where adhesion of fireproofing to substrate is in question.
   B. Remove incompatible materials that could affect bond by scraping, brushing, scrubbing, or sandblasting.
C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.
D. Apply fireproofing manufacturer's recommended bonding agent on primed steel.
E. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.
F. Close off and seal duct work in areas where fireproofing is being applied.

3.03 APPLICATION

A. Install metal lath over structural members as indicated or as required by UL Assembly Design Numbers.
B. Apply primer adhesive in accordance with manufacturer's instructions.
C. Apply fireproofing in thickness and density necessary to achieve required ratings, with uniform density and texture.
D. In exposed locations, trowel surface smooth and form square edges, using tools and procedures recommended by fireproofing manufacturer.
E. In the Main Auditorium and Recital Hall, the fireproofing is to be troweled onto trusses and painted, to create a smooth finish.

3.04 FIELD QUALITY CONTROL

A. Inspect the installed fireproofing after application and curing for integrity, prior to its concealment. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings and requirements of the Authority Having Jurisdiction.
B. Remove and replace installed fireproofing that does not comply with specified requirements, as directed by Architect.
C. Re-inspect the installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.05 CLEANING

A. Remove excess material, overspray, droppings, and debris.
B. Remove fireproofing from materials and surfaces not required to be fireproofed.
C. At exposed fireproofing, clean surfaces that have become soiled or stained, using manufacturer's recommended procedures.

END OF SECTION 07.81.00
SECTION 07.84.00
FIRESTOPPING

PART 1 GENERAL -- NOT USED

1.01 SECTION INCLUDES
A. Firestopping systems.
B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS
A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.
B. Section 07.81.00 - Applied Fireproofing.
C. Section 09.21.16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS
D. ITS (DIR) - Directory of Listed Products; current edition.

1.04 SUBMITTALS
A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
D. HPBr Report: Submit VOC content documentation for all non-preformed materials.
E. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
G. Installer Qualification: Submit qualification statements for installing mechanics.
H. Copies of each firestopping assembly used on site shall be kept on site for AHU review field verification.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   3. Compliance with Credit EQ6.2: Material VOC Limits - Paints
   4. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
   3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Trained by manufacturer.
   2. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
      3. Verification of minimum three years documented experience installing work of this type.
      4. Verification of at least five satisfactorily completed projects of comparable size and type.
      5. Licensed by local authorities having jurisdiction (AHJ).

1.07 MOCK-UP

A. Install one firestopping assembly representative of each fire rating design required on project.
   1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
   2. Where firestopping is intended to fill a linear opening, install minimum of 1 linear ft.
B. Obtain approval of authorities having jurisdiction (AHJ) before proceeding.
C. If accepted, mock-up will represent minimum standard for the Work.
D. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups not accepted.

1.08 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.
B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.
C. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.

D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.02 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: Use any system listed by UL that has F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and that meets all other specified requirements.

B. Firestopping Between Edge of Floor Slab and Curtain Wall (without Penetrations): Fiber firestopping with smoke seal coating; UL Design No. TBD.

C. Firestopping Between Top of Partition Wall and Roof Slab: Fiber firestopping with smoke seal coating; UL Design No. TBD, F Rating TBD.

D. Temporary Firestopping: Reusable intumescent shapes; UL Design No. TBD, F Rating 1-1/2 hour.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to arrest liquid material leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by Owner's Independent Testing Agency.

C. Do not cover installed firestopping until inspected by authorities having jurisdiction.

D. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174, and ASTM E2393.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 07.84.00
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Nonsag gunnable joint sealants.
   B. Self-leveling pourable joint sealants.
   C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS
   A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.

1.03 REFERENCE STANDARDS
   L. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

1.04 SUBMITTALS
   A. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
      1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
      2. List of backing materials approved for use with the specific product.
      3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
      4. Substrates the product should not be used on.
      5. Substrates for which use of primer is required.
      6. Substrates for which laboratory adhesion and/or compatibility testing is required.
      7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
      8. Sample product warranty.
      9. Certification by manufacturer indicating that product complies with specification requirements.
B. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

C. Color Cards for Selection: Submit manufacturer's color cards showing standard colors available for selection. The intent is to match the exterior color(s) of sealants on the Millennium Center; custom exterior colors may be required.

D. Sustainable Design Documentation: For sealants and primers, submit VOC content and emissions documentation as specified in Section 01.61.16.

E. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

F. Installation Plan: Submit at least four weeks prior to start of installation.

G. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

H. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

I. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

J. Installation Log: Submit filled out log for each length or instance of sealant installed.

K. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION

A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.

B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   3. Compliance with Credit EQ6.2: Material VOC Limits - Paints
   4. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

D. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
   3. Stain Testing: In accordance with ASTM C1248; required only for stone substrates.
   4. Allow sufficient time for testing to avoid delaying the work.
   5. Deliver to manufacturer sufficient samples for testing.
6. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

7. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

E. Installation Plan: Include schedule of sealed joints, including the following.

1. Joint width indicated in contract documents.

2. Joint depth indicated in contract documents; to face of backing material at centerline of joint.

3. Method to be used to protect adjacent surfaces from sealant droppings and smears, with acknowledgement that some surfaces cannot be cleaned to like-new condition and therefore prevention is imperative.

4. Approximate date of installation, for evaluation of thermal movement influence.

5. Installation Log Form: Include the following data fields, with known information filled out.
   a. Unique identification of each length or instance of sealant installed.
   b. Location on project.
   c. Substrates.
   d. Sealant used.
   e. Stated movement capability of sealant.
   f. Primer to be used, or indicate as "No primer" used.
   g. Size and actual backing material used.
   h. Date of installation.
   i. Name of installer.
   j. Actual joint width; provide space to indicate maximum and minimum width.
   k. Actual joint depth to face of backing material at centerline of joint.
   l. Air temperature.

F. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.

1. Identification of testing agency.

2. Name(s) of sealant manufacturers' field representatives who will be observing.

3. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
   a. Test date.
   b. Copy of test method documents.
   c. Age of sealant upon date of testing.
   d. Test results, modeled after the sample form in the test method document.
   e. Indicate use of photographic record of test.

G. Field Quality Control Plan:

1. Visual inspection of entire length of sealant joints.

2. Non-destructive field adhesion testing of sealant joints, except interior acrylic latex sealants.

3. Destructive field adhesion testing of sealant joints, except interior acrylic latex sealant.
   a. For each different sealant and substrate combination, allow for one test every 100 feet in the first 1000 linear feet, and one test per 1000 linear feet thereafter, or once per floor on each elevation.
   b. If any failures occur in the first 1000 linear feet, continue testing at frequency of one test per 500 linear feet at no extra cost to Owner.

4. Field testing agency's qualifications.

5. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.

H. Field Adhesion Test Procedures:
1. Allow sealants to fully cure as recommended by manufacturer before testing.  
2. Have a copy of the test method document available during tests.  
3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.  
4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.  
5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.  
6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect. 

I. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.

J. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.  
1. Sample: At least 18 inch long.  
2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.  
3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.  
4. Record results on Field Quality Control Log.  
5. Repair failed portions of joints. 

K. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or other applicable method as recommended by manufacturer. 

1.07 WARRANTY 
A. See Section 01.78.21 - Closeout Submittals, for additional warranty requirements. 
B. Correct defective work within a five year period after Date of Substantial Completion.  
C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS 
A. Scope:  
1. Exterior Joints: Seal open joints, whether or not the joint is indicated on the drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.  
   a. Wall expansion and control joints.  
   b. Joints between door, window, and other frames and adjacent construction.  
   c. Joints between different exposed materials.  
   d. Openings below ledge angles in masonry.  
   e. Other joints indicated below.  
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.  
   a. Joints between door, window, and other frames and adjacent construction.  
   b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.  
   c. Other joints indicated below.
3. Do not seal the following types of joints.
   a. Intentional weepholes in masonry.
   b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
   c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
   d. Joints where installation of sealant is specified in another section.
   e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use nonsag non-staining silicone sealant, unless otherwise indicated.
   1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
   2. Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
   3. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.

C. Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
   2. Wall, Ceiling, and Floor Joints Where Tamper-Resistance is Required: Nonsag tamper-resistant polyurethane sealant.
   3. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
   4. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.

D. Interior Wet Areas: Bathrooms and restrooms; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.

E. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.02 JOINT SEALANTS - GENERAL
A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.03 NONSAG JOINT SEALANTS
A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
   2. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.

B. Conventional Silicone Sealant, Parking Structure and Highway

C. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Cure Type: Single-component, neutral moisture curing
   5. Service Temperature Range: Minus 65 to 180 degrees F.

D. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.

E. Silyl-Terminated Polyether (STPE) and Polyurethane (STPU) Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 35 percent, minimum.
2. Hardness Range: 20 to 40, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's standard range.
4. Service Temperature Range: Minus 40 to 180 degrees F.

F. Tamper-Resistant, Silyl-Terminated Polyurethane (STPU) Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 12-1/2 percent, minimum
2. Hardness Range: 25 to 30, Shore A, when tested in accordance with ASTM C661.

G. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multicomponent; not expected to withstand continuous water immersion or traffic.

H. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multicomponent; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.

I. Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
2. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's standard range.

J. Tamper-Resistant Polyurethane Sealant: ASTM C920, Grade NS, Uses M, G, and A; single or multicomponent; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 12-1/2 percent, minimum.
2. Hardness Range: 50 to 60, Shore A, when tested in accordance with ASTM C661.

K. Epoxy Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Hardness Range: 65 to 75, Shore A, when tested in accordance with ASTM C661.
2. Color: To be selected by Architect from manufacturer's standard range.
3. Service Temperature Range: Minus 40 to 180 degrees F.

L. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.

M. Non-Curing Butyl Sealant: Solvent-based; ASTM C1311; single component, nonsag, non-skimming, non-hardening, non-bleeding; vapor-impermeable; intended for fully concealed applications.

2.04 SELF-LEVELING SEALANTS

A. Self-Leveling Silicone Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.

B. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion.

C. Sealant Tape: Pre-formed expanding tape seal with modified liquid acrylic adhesive infused into cellular foam base material, with hydrophobic/hydrophilic chemistry.
2. Substitutions: See Section 01.60.00 - Product Requirements.
2.05 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
   1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
   2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
   3. Open Cell: 40 to 50 percent larger in diameter than joint width.
   4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.
B. Verify that backing materials are compatible with sealants.
C. Verify that backer rods are of the correct size.
D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
   1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
   2. Notify Architect of date and time that tests will be performed, at least 7 days in advance.
   3. Arrange for sealant manufacturer's technical representative to be present during tests.
   4. Record each test on Preinstallation Adhesion Test Log as indicated.
   5. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
   6. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.
B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
B. Perform installation in accordance with ASTM C1193.
C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

### 3.04 FIELD QUALITY CONTROL

A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.

C. Destructive Adhesion Testing: If there are any failures in first 1000 linear feet, notify Architect immediately.

D. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

E. Repair destructive test location damage immediately after evaluation and recording of results.

### 3.05 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at the low temperature in the thermal cycle. Report failures immediately and repair.

END OF SECTION 07.92.00
PART 1  GENERAL

SECTION 08.11.13
HOLLOW METAL DOORS AND FRAMES

1.01  SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.
B. Hollow metal frames for wood doors.
C. Fire-rated hollow metal doors and frames.
D. Thermally insulated hollow metal doors with frames.
E. Hollow metal borrowed lites glazing frames.
F. Accessories, including glazing, louvers, and matching panels.

1.02  RELATED REQUIREMENTS

A. Section 08.34.73 - Sound Control Door Assemblies
B. Section 08.71.00 - Door Hardware
C. Section 08.80.00 - Glazing: Glass for doors and borrowed lites
D. Section 09.91.13 - Exterior Painting: Field painting

1.03  ABBREVIATIONS AND ACRONYMS

A. ANSI - American National Standards Institute
B. ASCE - American Society of Civil Engineers
C. HMMA - Hollow Metal Manufacturers Association
D. NAAMM - National Association of Architectural Metal Manufacturers
E. NFPA - National Fire Protection Association
F. SDI - Steel Door Institute
G. UL - Underwriters Laboratories

1.04  REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010
B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011
C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014
D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011
E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015
F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015
H. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014
J. ITS (DIR) - Directory of Listed Products; current edition.
L. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
P. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.05 SUBMITTALS
   A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
   B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
   C. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
   D. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction waste diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
      1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
      2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
      3. Compliance with Credit EQ6.2: Material VOC Limits - Paints
      4. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints
   D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.07 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING
   A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
   B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.
PART 2 PRODUCTS

2.01 DESIGN CRITERIA

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Typical Door Face Sheets: Flush.
   4. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
   5. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
      a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. Hollow Metal Panels: Same construction, performance, and finish as doors.

C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.02 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 2 - Heavy-duty.
      b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
      e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
   2. Core Material: Polyurethane, 1.8 lbs/cu ft minimum density.
   3. Door Thermal Resistance: R-Value of 8.7, minimum, for installed thickness of polyurethane.
   5. Door Face Sheets: Flush.
   6. Weatherstripping: Integral, recessed into door edge or frame.
   7. Door Finish: Factory primed and field finished.

B. Interior Doors, Non-Fire Rated:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 2 - Heavy-duty.
      b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
      e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
   2. Core Material: Manufacturers standard core material/construction and in compliance with requirements.

C. Fire-Rated Doors:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 2 - Heavy-duty.
      b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
      e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
   2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
   3. Provide units listed and labeled by UL (DIR) or ITS (DIR).
      a. Attach fire rating label to each fire rated unit.
   4. Core Material: Manufacturers standard core material/construction in compliance with requirements.

2.03 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Same as hollow metal door.

C. Exterior Door Frames: Full profile/continuously welded type.
   1. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
   2. Weatherstripping: Separate, see Section 08.71.00.

D. Interior Door Frames, Non-Fire Rated: Slip-on type at gypsum board walls, and knock-down type at masonry walls.
   1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.

E. Door Frames, Fire-Rated: Slip-on type at gypsum board walls, and knock-down type at masonry walls.
   1. Fire Rating: Same as door, labeled.
   2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.

F. Sound-Rated Door Frames: Slip-on type at gypsum board walls, and knock-down type at masonry walls.
   1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.

G. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

H. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

2.04 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.05 ACCESSORIES

A. Louvers: Roll formed steel with overlapping frame; finish same as door components; factory-installed.
   1. In Fire-Rated Doors: UL (DIR) or ITS (DIR) listed fusible link louver, same rating as door.
   2. Style: Standard straight slat blade.

B. Glazing: As specified in Section 08.80.00, factory installed.

C. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.

D. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.
2.06 FINISHES
   A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
   B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify existing conditions before starting work.
   B. Verify that opening sizes and tolerances are acceptable.
   C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION
   A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.
   B. Coat inside of other frames with bituminous coating to a thickness of 1/16 inch.

3.03 INSTALLATION
   A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
   B. Install prefinished frames after painting and wall finishes are complete.
   C. Install fire rated units in accordance with NFPA 80.
   D. Coordinate frame anchor placement with wall construction.
   E. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
   F. Install door hardware as specified in Section 08.71.00.
   G. Comply with glazing installation requirements of Section 08.80.00.
   H. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES
   A. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING
   A. Adjust for smooth and balanced door movement.
   B. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

END OF SECTION 08.11.13
SECTION 08.11.73  
ACCORDION FIRE & SMOKE RATED DOORS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Provide all materials, labor, equipment and services necessary to furnish, deliver and install all work under this section as shown on the contract documents, specified herein, and as specified by the job conditions.

1.02 DESCRIPTION

A. Related work specified elsewhere:
   1. 1. Metal Fabrication. Section 05 50 00
   2. 2. Rough Carpentry. Section 06 10 00
   3. 3. Access Panels & Doors: Section 08 31 00
   4. 4. Painting: Section 09 91 00
   5. 5. Electrical: Division 26

1.03 SUBMITTALS

A. Procedures: Furnish submittals in accordance with the general requirements specified.

B. Shop Drawing: Furnish shop drawings for architect's approval. Include elevations, sections, and details indicating dimensions, materials, finishes, conditions for anchorage and support of each door.

C. Certifications:
   1. Submit manufacturer’s Underwriters Laboratories (UL), Warnock Hersey (WH) or Factory Mutual Research (FM) laboratory test report verifying product compliance in accordance with the required fire and smoke ratings.
   2. Submit manufacturer’s Code Compliance Research Report published by an independent third-party testing agency that is certified by the International Accreditation Service confirming compliance of the fire door assembly in accordance with the International Building Code.

D. Product Literature: Submit manufacturer's technical literature describing the product to be used under this section.

E. Maintenance and Operating Manuals: Furnish complete manuals describing the materials, devices and procedures to be followed in operating and maintaining all doors under this section. Include manufacturer's brochures and parts lists describing the actual materials used in the product.

1.04 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION

A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.

B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   4. Compliance with Credit EQ6.2: Material VOC Limits - Paints
   5. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.05 QUALITY ASSURANCE

A. Fire & Smoke Rated Assemblies: Provide all doors with fire and smoke resistance rating required to comply with governing regulations which are inspected, tested, listed and labeled by UL, WH or FM and complying with NFPA 80 for class of opening. Provide units tested in accordance with the requirements of UL 10B, UL 1784, NFPA 252, ASTM E-152. Provide testing laboratory label permanently fastened to each fire and smoke door assembly.

B. Regulatory Requirements:
   1. Comply with applicable requirements of the laws, codes, ordinances and regulations of federal, state and municipal authorities having jurisdiction.
   2. Listed under a certified Code Compliance Research Report in accordance with the applicable sections of the International Building Code.

C. Testing: Provide documentation from a certified testing agency that the fire door’s self-closing governor mechanism and fire door operator have been tested for a minimum of 50,000 cycles and 500 self closing trip tests.

D. Manufacturer Requirements: Door manufacturer shall have been in the business of and have experience in manufacturing the type of product covered under this specification section as well as giving credible service for a minimum of five (5) years. Provide list of at least ten (10) completed projects which include the products covered under this section.

1.06 DELIVERY, STORAGE AND HANDLING

A. General: Deliver and store materials in manufacturer's original packaging, labeled to show name, brand and type. Store materials in a protected dry location off the ground in accordance with manufacturer's instructions.

1.07 WARRANTY

A. Door Warranty: Provide Two (2) Year Warranty signed by the manufacturer and installer agreeing to repair or replace work which has failed as a result of defects in materials or workmanship. Upon notification within the warranty period, such defects shall be repaired at no cost to the owner.

PART 2 PRODUCTS

2.01 ACCORDION FIRE & SMOKE RATED DOORS

A. Manufacturers:

B. Substitutions: See Section 01.60.00 - Product Requirements.

2.02 MATERIALS

A. General: Each unit shall consist of an interlocking single folding panel curtain suspended from a steel head track system. Curtain shall be designed to travel in a horizontal plane, smoothly and without binding. Curtain shall be driven to the open and close position by a positive action sprocket and integral endless drive chain system.
   1. Curtain: Shall be fabricated of galvanized, interlocking, 18 gauge minimum steel panels with an approximate cross section not greater than 7” wide.
B. Leading Edge: Curtain shall be furnished with a structural steel member of tubular design to provide stiffness, limit deflection and provide for a tight fitting closure.

C. Receiving Edge: Shall be fabricated of a steel member with sufficient depth, designed to accept the leading edge and form a tight fitting closure when the door is the fully closed position.

D. Head Track: Shall be of not less than a 1/8" thick steel formed shape with removable pans that conceal and protect the integral positive action endless drive chain system. The overall track width shall not be greater than 9".

E. Floor Track (Optional): Shall be no greater than 1½" deep and include integral removable stainless steel protective cover plates to allow for easy cleaning and proper maintenance.

F. Perimeter Smoke Seals: Provided UL classified perimeter smoke seals and sweeps at both the top and bottom ends of the curtain panels.

G. Counterbalance Unit: The fire door shall be counterbalanced by means of adjustable steel counterweight system that is to be located in an area as indicated in the construction drawings.

H. Electric Motor Operator: Fire door shall be provided with a compact power unit designed and built by the door manufacturer. Operator shall be equipped with an adjustable screw-type limit switch to break the circuit at termination of travel. High efficiency planetary gearing running in an oil bath, shall be furnished together with a centrifugal governor, magnetic operated brake and a fail-safe magnetic release device, completely housed to protect against damage, dust and moisture. An efficient overload protection device, which will break the power circuit and protect against damage to the motor windings shall be integral with the unit. Operator is to be housed in a NEMA type 1 enclosure.

1. Motor: Shall be intermediate duty, thermally protected, ball bearing type with a class A or better insulation. Horsepower of motor is to be 1/3hp minimum or of manufacturer's recommended size, which ever is greater.

2. Starter: Shall be size "0" magnetic reversing starter, across the line type with mechanical and electrical interlocks, with 10 amp continuous rating and 24 volt control circuit.

3. Reducer: Planetary gear type, 80% efficiency minimum.

4. Brake: Magnetically activated, integral within the operator's housing.

5. Control Station: Provide flush mount key switch control station marked open, close and stop.

I. Self-Closing Mechanism: The fire door is to be designed with a centrifugal governor as an integral part of the operator's construction. The automatic release mechanism shall be activated by smoke detector or fire alarm. When activated the door is released and begins to close due to the captured counterweight force. The speed of the door shall be governed by a centrifugal governor, designed to match the normal operating speed of the door, at a rate of not greater than 9" per second or less than 6" per second. The fire door shall self-close under its own power. Battery back-up systems to achieve self-closing are not acceptable.

J. Magnetic Release with 10 Second Time Delay: A fail-safe magnetic release device shall be built into the operator as an integral part of the release mechanism. When power is interrupted to the release mechanism by the smoke detector or fire alarm, the door shall begin to self-close. In the event of power failure the time delay shall prevent the fire door from closing for a period of 10 seconds. Once the 10 seconds have lapsed, the fire door shall self-close without the aid of electricity or battery back-up systems. Once power has been restored the automatic reset time delay as well as the fire door shall reset themselves.

K. Obstruction Sensing Device: The fire door shall be designed with a radio activated obstruction sensing safety edge. In the event that the safety edge meets an obstruction during the normal closing operation, the door shall stop, reverse and return to the open position. In the event the safety edge meets an obstruction during the self-closing operation, the door shall reverse and attempt to close three times. In the event that the obstruction has not been removed during the third attempt, the door shall come to rest on the obstruction and once the obstruction has been removed the fire door shall continue to the fully closed position.
L. Easy Trip Test Feature: The fire door shall be designed so that it may be trip tested simply by cutting power to the operator. By turning the power switch off, the door shall self-close. Once the fire door has satisfactorily closed, it shall be reset simply by turning the power back on. No ladders or tools shall be needed to reset the door or the time delay unit.

M. Finish: After completion of fabrication, clean all metal surfaces to remove dirt and chemically treat to provide for paint adhesion. Panels are to receive a prime coat of .2 mils of epoxy primer and .8 mils of polyester paint of McKeon Sterling Gray finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces and field conditions to which this work is to be performed and notify architect if conditions of surfaces exist which are detrimental to proper installation and timely completion of work.

B. Verify all dimensions taken at job site affecting the work. Notify the architect in any instance where dimensions vary.

C. Coordinate and schedule work under this section with work of other sections so as not to delay job progress.

3.02 INSTALLATION

A. Perform installation using only factory approved and certified representatives of the door manufacturer.

B. Install door assemblies at locations shown in perfect alignment and elevation, plumb, level, straight and true.

C. Adjust door installation to provide uniform clearances and smooth non-binding operation.

D. Install wiring in accordance with applicable local codes and the National Electrical Code Standard. Materials shall be UL listed.

E. Test door closing sequence when activated by the building's fire alarm system. Reset door after successful test.

3.03 PROTECTION AND CLEANING

A. Protect installed work using adequate and suitable means during and after installation until accepted by owner.

B. Remove, repair or replace materials which have been damaged in any way.

C. Clean surfaces of grime and dirt using acceptable and recommended means and methods.

END OF SECTION 08.11.73
**PART 1  GENERAL**

**1.01 SECTION INCLUDES**
A. Flush wood doors; flush and flush glazed configuration; fire rated, non-rated, and special function.

**1.02 RELATED REQUIREMENTS**
A. Section 08.11.13 - Hollow Metal Doors and Frames.
B. Section 08.34.73 - Sound Control Door Assemblies
C. Section 08.71.00 - Door Hardware.
D. Section 08.80.00 - Glazing.
E. Section 09.91.23 - Interior Painting: Field finishing of indicated doors.

**1.03 REFERENCE STANDARDS**
A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
D. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.
E. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

**1.04 SUBMITTALS**
A. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
B. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
   1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
   2. Include certification program label.
C. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
D. Specimen warranty.
E. Test Reports: Show compliance with specified requirements for the following:
   1. Fire resistance rating.
F. Manufacturer's Installation Instructions: Indicate special installation instructions.
G. Warranty, executed in Owner's name.

**1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION**
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants.
3. Compliance with Credit EQ6.2: Material VOC Limits - Paints
4. Compliance with Credit EQ6.5: Material VOC Limits - Composite wood and agrifiber
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE
A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
D. Quality Certification:
   1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) requirements for grade or grades specified.
   2. Provide designated labels on shop drawings as required by certification program.
   3. Provide designated labels on installed products as required by certification program.
   4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
E. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire-rating as indicated.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Package, deliver and store doors in accordance with specified quality standard.
B. Accept doors on site in manufacturer's packaging. Inspect for damage.
C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.08 WARRANTY
A. See Section 01.78.21 - Closeout Submittals, for additional warranty requirements.
B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 DOORS
A. Doors: Refer to drawings for locations and additional requirements.
   1. Quality Level: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS).
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at all locations.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
   3. Wood veneer facing for field transparent finish as indicated on drawings.
4. Wood veneer facing for field opaque finish as indicated on drawings.

2.02 DOOR AND PANEL CORES
   A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
   B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.03 DOOR FACINGS
   A. Veneer Facing for Transparent Finish: Walnut, veneer grade in accordance with quality standard indicated, quarter cut, with book match between leaves of veneer, balance match of spliced veneer leaves assembled on door or panel face.
   B. Veneer Facing for Opaque Finish: Medium density overlay (MDO), in compliance with indicated quality standard.

2.04 DOOR CONSTRUCTION
   A. Fabricate doors in accordance with door quality standard specified.
   B. Cores Constructed with stiles and rails:
      1. Provide solid blocks at lock edge for hardware reinforcement.
      2. Provide solid blocking for other throughbolted hardware.
   C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
   D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
      1. Exception: Doors to be field finished.
   E. Provide edge clearances in accordance with the quality standard specified.

2.05 FACTORY FINISHING - WOOD VENEER DOORS
   A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
      1. Transparent:
         a. System - 12, Polyurethane, Water-based.
         b. Sheen: Satin.

2.06 ACCESSORIES
   A. Hollow Metal Door Frames: As specified in Section 08.11.13.
   B. Glazing: As specified in Section 08.80.00.
   C. Glazing Stops: Wood with metal clips for rated doors, butted corners; prepared for countersink style tamper proof screws.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify existing conditions before starting work.
   B. Verify that opening sizes and tolerances are acceptable.
   C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.
3.02 INSTALLATION
   A. Install doors in accordance with manufacturer's instructions and specified quality standard.
      1. Install fire-rated doors in accordance with NFPA 80 requirements.
      2. Install smoke and draft control doors in accordance with NFPA 105 requirements.
   B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
   C. Field-Finished Doors: Trimming to fit is acceptable.
      1. Adjust width of non-rated doors by cutting equally on both jamb edges.
      2. Trim maximum of 3/4 inch off bottom edges.
      3. Trim fire-rated doors in strict compliance with fire rating limitations.
   D. Use machine tools to cut or drill for hardware.
   E. Coordinate installation of doors with installation of frames and hardware.
   F. Coordinate installation of glazing.
   G. Install door louvers plumb and level.

3.03 TOLERANCES
   A. Conform to specified quality standard for fit and clearance tolerances.
   B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING
   A. Adjust doors for smooth and balanced door movement.
   B. Adjust closers for full closure.

END OF SECTION 08.14.16
SECTION 08.31.00
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Wall access door and frame units.
B. Ceiling access door and frame units.

1.02 RELATED REQUIREMENTS
A. Section 08.71.00 - Door Hardware: Mortise cylinder and core hardware.
B. Section 09.91.13 - Exterior Painting: Field paint finish.
C. Section 09.91.23 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS
B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

1.04 SUBMITTALS
A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
D. Manufacturer's Installation Instructions: Indicate installation requirements.
E. Project Record Documents: Record actual locations of each access unit.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall-Mounted Units:
1. Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
2. Size: 12 inch by 12 inch.
3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
4. Tool-operated spring or cam lock; no handle.
5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

B. Wall-Mounted Units in Wet Areas:
2. Size: 12 inch by 12 inch.
3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
4. Tool-operated spring or cam lock; no handle.
5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

C. Fire-Rated Wall-Mounted Units:
1. Wall Fire-Rating: As indicated on drawings.
4. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.
5. Tool-operated spring or cam lock; no handle.

D. Ceilings, Unless Otherwise Indicated: Same type as for walls. Where a gypsum board ceiling greater than 120 square feet is not accessible provide a 24" x 24" access panel whether shown or not. Coordinate location with Mechanical.
1. Material: Steel.
2. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
3. Size - Other Ceilings: 12 inch by 12 inch.
4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
5. Tool-operated spring or cam lock; no handle.

E. Fire-Rated Ceiling-Mounted Units:
4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
5. Tool-operated spring or cam lock; no handle.

2.02 WALL AND CEILING MOUNTED UNITS

A. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
1. Style: Frame concealed by door panel.
2. Door Style: Single thickness with rolled or turned in edges.
3. Frames: 16 gage, 0.0598 inch, minimum thickness.
4. Heavy Duty Frames: 14 gage, 0.0747 inch, minimum thickness.
5. Single Steel Sheet Door Panels: 1/16 inch, minimum thickness.
6. Heavy Duty Single Steel Sheet Door Panels: 14 gage, 0.0747 inch, minimum thickness.
7. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
9. Primed and Factory Finish: Polyester powder coat; color as selected by Architect from manufacturer's standard colors.
10. Hardware:
    a. Hardware for Fire-Rated Units: As required for listing.
    b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that rough openings are correctly sized and located.
   B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION
   A. Clean surfaces thoroughly prior to proceeding with this work.
   B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION
   A. Install units in accordance with manufacturer's instructions.
   B. Install frames plumb and level in openings, and secure units rigidly in place.
   C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION 08.31.00
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Overhead coiling doors, operating hardware, fire-rated, non-fire-rated, and exterior, electric operation.
B. Wiring from electric circuit disconnect to operator to control station.

1.02 RELATED REQUIREMENTS
A. Section 07.92.00 - Joint Sealants: Sealing joints between frames and adjacent construction.
B. Section 09.91.23 - Interior Painting: Field paint finish.
C. Section 26.05.83 - Wiring Connections: Power to disconnect.

1.03 REFERENCE STANDARDS
C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
D. ITS (DIR) - Directory of Listed Products; current edition.
E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
I. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS
A. Product Data: Provide general construction, electrical equipment, and component connections and details.
B. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
C. Samples: Submit samples of available colors and finish textures.
D. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.
E. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.
F. Engineering: Provide engineering of the framed openings for the doors. The design shall be by an engineer licensed in the State of Tennessee.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   3. Compliance with Credit EQ6.2: Material VOC Limits - Paints
   4. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 COILING DOORS

A. Exterior Coiling Doors: Steel slat curtain.
   1. Capable of withstanding positive and negative wind loads of 20 psf, without undue deflection or damage to components.
   2. Sandwich slat construction with insulated core of foamed-in-place polyurethane insulation; minimum R-value of 7.5 or greater.
   3. Nominal Slat Size: 2 inches wide x required length.
   5. Hood Enclosure: Manufacturer's standard; primed steel.

B. Fire-Rated Coiling Doors: Steel slat curtain; conform to NFPA 80.
   1. 1-1/2 hour fire rating.
   2. Provide products listed and labeled by ITS (DIR) or UL (DIR) as suitable for the purpose specified and indicated.
   3. Oversized Openings: Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated units and operating hardware assembly.
   5. Nominal Slat Size: 2 inches wide by required length.
   8. Hood Enclosure: Manufacturer's standard; primed steel.
   10. Electric operation.

2.02 MATERIALS

A. Curtain Construction: Interlocking slats.
   1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
   2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
   3. Weatherstripping: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.

B. Steel Slats: Minimum thickness, 22 gage, 2 inch ASTM A653/A653M galvanized steel sheet.

C. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.

D. Steel Guides: ASTM A36/A36M steel angles, size as required for wind loading, hot-dip galvanized per ASTM A 123/A 123M.

E. Hood Enclosure: Internally reinforced to maintain rigidity and shape.

F. Lock Hardware:
   1. For motor operated units, additional lock or latching mechanisms are not required.

G. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

2.03 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
   1. Provide interlock switches on motor operated units.

B. Electric Operators:
   1. Mounting: Side mounted.
   3. Motor Voltage: 208 volt, three phase, 60 Hz.
   5. Controller Enclosure: NEMA 250, Type 1.
   6. Opening Speed: 12 inches per second.

C. Control Station: Standard three button (OPEN-STOP-CLOSE) momentary control for each operator.
   1. 24 volt circuit.

D. Safety Edge: Located at bottom of curtain, full width, electro-mechanical sensitized type, wired to stop operator upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install fire-rated doors in accordance with NFPA 80.

C. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

D. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

E. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

F. Coordinate installation of electrical service with Section 26.05.83.

G. Complete wiring from disconnect to unit components.

H. Complete wiring from fire alarm system.

I. Install perimeter trim and closures.
3.03 TOLERANCES
   A. Maintain dimensional tolerances and alignment with adjacent work.
   B. Maximum Variation From Plumb: 1/16 inch.
   C. Maximum Variation From Level: 1/16 inch.
   D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.04 ADJUSTING
   A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING
   A. Clean installed components.
   B. Remove labels and visible markings.

END OF SECTION 08.33.23
SECTION 08.34.73
SOUND CONTROL DOOR ASSEMBLIES

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS
   A. Work of this section, as shown or specified, shall be in accordance with the requirements of the Contract documents.

1.02 WORK INCLUDED
   A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the furnishing and installation of Sound Control Door Assemblies as shown on the drawings and specified herein

1.03 RELATED WORK
   A. Consult all other Sections to determine the extent of work specified elsewhere but related to this Section. This work shall be properly coordinated to produce an installation satisfactory to the Owner.

1.04 SUBMITTALS
   A. Submit certified copies of 1/3 Octave Band Transmission Loss test data and STC rating as issued by an accredited independent acoustical laboratory.
   B. Submit Shop Drawings for fabrication and installation of door panels, door frames, hardware, and acoustical seals. Shop drawings shall include detail assembly drawings, showing the complete installation, a listing of materials, surface finishes, fabricating assembly and installation tolerances. No Shop Drawing shall be submitted which shows details or components that deviate from those shown or described on Construction Documents. A request for deviations must be submitted in writing to Architect for review and approval.
   C. Provide a Schedule of door assemblies using the same reference numbers for details and openings as those shown on Construction Documents.
   D. Submit with proposal a Schedule indicating a comparison of the Acoustical Performance and hardware requirements of these Specifications with the Acoustical Performance and hardware offered in the proposal.

1.05 PRODUCT HANDLING
   A. Deliver hollow metal work crated to provide protection during job storage. Use all means necessary to project the material of this Section before, during and after installation and to protect the installed work and materials of all other trades. Inspect for damage prior to installation. Minor damage may be repaired on jobsite on approval; otherwise, replace damaged item.

1.06 QUALITY ASSURANCE
   A. The manufacturer of Sound Control Door Assemblies shall have a minimum 5 years experience in the fabrication and installation of acoustically-rated door assemblies similar to those of this Section.
   B. Laboratory Certification: Acoustical testing of submitted door assemblies shall be conducted in an accredited independent acoustical laboratory. Sound transmission loss values shall be determined in accordance with ASTM E90-90. Sound Transmission Class (STC) shall be determined in accordance with ASTM E413-87.
   C. Certification of acoustical tests must be submitted by Contractor for approval prior to installation.
   D. The Contractor shall employ an organization and personnel who are trained and skilled mechanics with previous experience in the installation of similar precision fabricated assemblies.
E. Fabrication shall not proceed until written approval of Submittal has been issued.

F. The force in pounds required to open and operate each door panel shall be in accordance with the requirements of the Americans with Disabilities Act.

G. Sound Control Door assemblies shall be manufactured by one of the following:
   1. IAC Acoustics
   2. Noise Barriers, LLC
   3. Overly Manufacturing Company

1.07 FIELD CERTIFICATION

A. Contractor shall guarantee acoustical performance in the field of the Sound Control Door Assemblies. The acoustical performance rating in the field shall not be less than a Noise Isolation Class (NIC) 0 dB lower than the laboratory STC rating of the door assembly when tested in the field in accordance with the noise reduction test procedure ASTM 336-75.

B. The field test will be conducted by the Architect's acoustical consultant. The manufacturer's representatives should be present to observe testing procedures and conditions. Approval of test data to be given by Architect or representative of Architect.

C. The requirement that the Contractor, at the time of submittal, submit certification of STC rating as obtained in an accredited acoustical laboratory, is mandatory. The guarantee of the achievement of acoustical performance of the NIC rating in the field will not be accepted as a substitute for the laboratory test certification. Complete compliance with the acoustical performance specifications, both laboratory and field, is required of the Contractor to be eligible as a bidder on the furnishing and installation of the Sound Control Door Assemblies.

PART 2 PRODUCTS

2.01 GENERAL

A. Fabricate units to be rigid, neat in appearance and free from defects, warp or buckle. Accurately form metal to required sizes and profiles. Wherever practical, fit and assemble units in the manufacturer's plant. Identify work that is not permanently factory-assembled before shipment to ensure proper assembly at the Project site. Weld exposed joints continuously: grind, fill dress and make smooth flush and invisible.


C. Supports and anchors: Fabricate not less than 14-gauge sheet metal of shapes and sizes required to secure frames to partitions and concrete floor. Provide jamb anchors as determined by wall construction. Anchors are to be spaced at 12” on center (max) and are to be of a corrosion resistant material.

D. Frames: Frames shall be slip-in configuration, continuously reinforced, fabricated from 14 gauge cold rolled, galvannealed steel with an A60 coating weight and furnished “split” in two (2) pieces, inside and outside, that are mitered and welded together allowing for easy installation into either existing or new construction openings.

E. Shop applied paint: For all steel surfaces use rust-inhibitive type primer paint suitable for finish coat of paint applied in the field.

F. Fire Rating: As specified below or as shown on Drawings.

G. Fabrication: Steel units to be rigid and free of defects, warp or buckle.

H. Veneers: Wood veneers applied to the faces of the doors. Walnut veneer, quarter cut, with book match between leaves of veneer, balance match of spliced veneer leaves assembled on door face.
2.02 HARDWARE
A. Hinges: Cam-lift, butt-type, hinges, US26D finish by door manufacturer. Hinge manufacturer to furnish laboratory test data on request certifying that hinges of identical design have been cycled a minimum of 125,000 times while supporting a door leaf weighing a minimum of 350 lbs.
   1. Quantity of hinges as follows:
   2. For door leaf thickness less than or equal to 2 1/2”:
      a. Two (2) hinges required per leaf for openings up to and including 96” high.
      b. Three (3) hinges required per leaf for openings up to and including 120” high
   3. Closers: “LCN” or “Norton”
   4. Pull Handles: 1” diameter x 9” overall length, 3” projection, US28 finish
   5. Push Plates: 4” wide x 16” high x .050” thick, US32D finish
   6. Latchsets/Locksets: Provided by door manufacturer. Refer to finish hardware schedule for cylinders.
   7. Flushbolts: “Glynn-Johnson”, surface mounted to inactive leaf, top & bottom (used on double leaf doors)
   8. Coordinators: “Dorma” (used on double leaf doors when both leaves need to be active)
   9. Thresholds: Thresholds shall be ungrooved solid metal or wood. Thickness shall match finish floor height. Finish to be selected by architect.
B. Finish hardware preparation: Prepare hollow metal units to receive mortised and concealed finish hardware, including cutouts, reinforcing plates, and drilling and tapping as required. Provide reinforcing plates for surface mounted items. Weight of door panels to be considered.

2.03 PRE-HUNG
A. Assembly and adjustment of door leaf, frame, acoustic seals, hinges and associated finish hardware shall take place at the factory to insure ease of installation, reliable operation and acoustic performance. The entire manufactured assembly shall be shipped to the job site ready to install and operate.

2.04 REINFORCEMENT
A. Reinforce door panels for required hardware as follows:
B. Hinges: 3/8” steel plate x 6” longer than hinge. Secure with not less than 6 spot-welds.
C. Mortised Latchsets with Lever Handles: 14-gauge steel sheet with not less than 2 spot-welds.
D. Surface Mounted Closers: 12-gauge steel sheet secured with not less than 6 spot-welds.

2.05 TYPE STC-51 SOUND CONTROL DOOR ASSEMBLY:
A. Acoustical Performance: The acoustical performance requirements are that the door assembly (door frame, panel and acoustical seals) shall have not less than an STC 51 and include expanded specifications concerning sound transmission loss (TL) values in dB for each 1/3-octave band from 100 Hz to 5000 Hz, including TL at the 125 Hz 1/3-octave band which shall be a minimum 28 dB.
B. Fabrication: The steel frame shall be 14-gauge cold rolled steel, reinforced continuously at jambs and head. The frame shall be of a “slip-in” configuration, and abut and terminate to specific partition construction as shown on Drawings. The sound insulating door panel shall be 2 1/2” thick, having cold rolled 14-gauge steel panel facings and continuously welded edges. The door shall be provided with a mortised astragal where scheduled on the drawings. The weight of door panel shall not exceed 9 psf. Vision ports to be installed in door panels where shown on Drawings and in Schedule. Provide integral double magnetic acoustical seals equal to those installed for certification tests. Wood veneer applied to door faces.
C. Door shall be IAC Acoustics Type “Noise Lock 51” or approved equal.
2.06 TYPE STC-54 SOUND INSULATING DOOR ASSEMBLY:
A. Acoustical Performance: The acoustical performance requirements are that the door assembly (door frame, panel and acoustical seals, including astragal where scheduled) shall have not less than an STC 54 and include expanded specifications concerning sound transmission loss (TL) values in dB for each 1/3 octave band from 100 Hz to 5000 Hz, including a TL at the 125 Hz 1/3 octave band which shall be a minimum 35 dB.

B. Fabrication: The steel frame shall be 14-gauge cold rolled steel, reinforced continuously at jambs and head. The frame shall be of a “slip-in” configuration, and abut and terminate to specific partition construction as shown on Drawings. The sound insulating door panel shall be 3 1/2” thick, having cold rolled 14 gauge steel panel facings and continuously welded edges. The door shall be provided with a mortised astragal where scheduled on the drawings. The weight of door panel shall not exceed 13 psf. Vision ports to be installed in door panels where shown on Drawings and in Schedule. Provide integral double magnetic acoustical seals equal to those installed for certification tests. Wood veneer applied to door faces.

C. Door shall be IAC Acoustics Type “Noise Lock 54” or approved equal.

2.07 GLASS AND GLAZING
A. Laminated Acoustical Glass
1. Glass shall meet minimum requirements as specified in ASTM C1036-85.
2. Interlayer shall be clear Saflex by Monsanto.
3. Acoustical Performance: Laminated acoustical glass shall have not less than the STC values shown below, and include expanded specifications concerning sound transmission loss (TL) values in dB for each 1/3 octave band from 100 Hz to 5000 Hz, including a TL at the 125 Hz 1/3 octave band which shall be no less than the values indicated below:
   a. Glazing Thickness  STC  TL at 125 Hz
   b.  36   27
   c.  38   29
   d.  41   30

B. Glazing in Doors shall consist of the number of lites of glass type, thickness and treatment as required to achieve the specified acoustical performance of the door assembly, but shall in no case consist of fewer than two lites, each 1/4” thick laminated acoustical glass.

C. Glazing channel shall be closed cell sponge EPDM glazing channel. Extruded U-channels by Atlantic India Rubber (219-534-1531), or approved equal.

D. Non-Fire Rated Doors: Provide factory-installed, aluminum extruded stops and moldings with true mitered corners for double, glazed assemblies. Size of vision lite is to be determined from the door schedule. Safety glass or fire-resistive glazing product meeting doors’ sound control and labeling requirements is acceptable.

E. Fire Rated Doors: Provide factory-installed, formed steel stops and moldings with true mitered corners for double, glazed assemblies. Size of vision lite is to be determined from the door schedule in conjunction with any UL requirements. Wire mesh, glass clad laminate or fire-resistive glazing product meeting doors’ sound control and labeling requirements is acceptable.

PART 3 EXECUTION

3.01 GENERAL
A. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all is complete to the point where this installation may properly commence. Verify that Door Assemblies may be installed in complete accordance with the original design and the approved Shop Drawings. In the event of discrepancy, immediately notify the Architect immediately in writing.
B. Shop prefabricate all doors and frames into complete units, verifying all measurements at the site prior to fabrication. Knock-down frames shall not be approved.

C. Fabricate in strict accordance with approved Shop Drawings. Accurately miter and fit all members to hairline joints. Weld or mechanically fasten along entire line of contact on the unexposed side.

D. Install units in accordance with manufacturer's recommendations. The manufacturer shall provide a factory-trained engineer or mechanic at the jobsite to supervise the unloading, erection, final adjustments, and final check out of the Door Assemblies, including door panels, frames, hardware, and accessories.

E. Back of steel frame shall be packed solid with minimum 6 pcf mineral wool batt insulation prior to installation when installed in drywall partition, or filled with grout prior to installation when installed in block partition.

F. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set.

G. Tightly caulk openings between steel frame and adjoining partition with clear silicone sealant.

H. Door frames shall be delivered to jobsite with a steel spreader connecting the bottom legs of the frame to ensure non-racking. Spreader does not determine the opening width.

I. Fit doors accurately in frames with clearances recommended by the manufacturer.

J. Apply clear silicone sealant to all jamb and head seals prior to application of seals to frame.

K. Check and readjust the operating finish hardware items just prior to final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames that are warped, bowed or otherwise unacceptable.

END OF SECTION 08.34.73
PART 1  GENERAL

1.01  SECTION INCLUDES
   A. Packaged power-operated door assemblies of following types:
   B. Operators for doors provided in other sections.
   C. Controllers, actuators and safety devices.
   D. Handrails adjacent to doors.
   E. Maintenance.

1.02  RELATED REQUIREMENTS

1.03  REFERENCE STANDARDS
   B. BHMA A156.19 - American National Standard for Power Assist and Low Energy Power Operated
      Doors; 2013.

1.04  SUBMITTALS
   A. Shop Drawings:
      1. Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage,
         recesses, materials, and finishes, electrical characteristics and connection requirements.
      2. Identify installation tolerances required, assembly conditions, routing of service lines and conduit,
         and locations of operating components and boxes.
   B. Product Data: Provide data on system components, sizes, features, and finishes.
   C. Samples: Submit two samples of exposed to view hardware, carpet with frame, and attachment hardware.
   D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring
      special attention, and manufacturer's hardware and component templates.
   E. Maintenance Contract.
   F. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
   G. Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of
      hardware and operating component.
   H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name
      and registered with manufacturer.
   I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
      1. Wrenches and other tools required for maintenance of equipment.

1.05  TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE
       DOCUMENTATION
      1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr
      CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction wast diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE
   A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

1.07 WARRANTY

PART 2 PRODUCTS

2.01 POWER OPERATED DOORS
   A. Power Operated Doors: Provide products that comply with NFPA 101 and requirements of authorities having jurisdiction; provide equipment selected for actual door weight and for light pedestrian traffic, unless otherwise indicated.
      1. Swinging Door Operators: Fully adjustable for opening and closing speeds, checking speeds, and hold-open time; in the event of power failure, disengage operator allowing door to function as a door with a spring closer.
      2. Packaged Door Assemblies: Provide components by single manufacturer, factory-assembled, including doors, frames, operators, actuators, and safeties.
   B. Swinging Doors with Low-Energy Power Operators: Comply with BHMA A156.19; operator activated by pushing or pulling the door or by a manual actuator, not a sensor; safeties not required.
      1. Kinetic Energy of Door in Motion: 1.25 pound-force foot, maximum.
      2. Force Required to Prevent Stopped Door From Opening or Closing: 15 pound-force, maximum, measured at 1 inch from the latch edge of the door at any point in the swing cycle.
      3. Force Required to Release Latch, When Unpowered: 15 pound-force, maximum, measured at 1 inch from the latch edge of the door at any point in the swing cycle.
      4. Force Required to Set Door in Motion When Unpowered: 30 pound-force, maximum, measured at 1 inch from the latch edge of the door at any point in the closing cycle.
      5. Force Required to Fully Open Door When Unpowered: 15 pound-force, maximum, measured at 1 inch from the latch edge of the door at any point in the closing cycle.
   C. Operators:
      2. Pneumatic/Hydraulic Operators: Low voltage control system, pneumatic activation to hydraulic device for opening and closing.

2.02 AUTOMATIC ENTRANCE DOOR ASSEMBLIES
   A. Swinging Automatic Door: Single-acting hinged, electric operation, extruded aluminum glazed door, with extruded tubular frame, and operator concealed overhead.
      1. Operation: Low-energy power open, spring close operation.
      5. Provide handrails on both sides of each door leaf.
      6. Door and Frame Finish: Same as adjacent framing system.
2.03 OPERATORS FOR SWINGING DOORS PROVIDED BY OTHERS

A. Door Operator: Electric, surface mounted overhead.
   1. Operation: Low-energy power open, spring close operation.
   2. Variable speed control for opening and closing cycles.

2.04 CONTROLLERS, ACTUATORS, AND SAFETIES

A. Controller: Provide microprocessor operated controller for each door.
B. Comply with BHMA A156.10 for actuator and safety types and zones.
C. Push Button Actuator: Standard momentary contact type, wall mounted, surface; stainless steel escutcheon plate.
D. Swinging Door Safety Device: Door-mounted proximity detector device arranged to prevent operation of door when persons or obstructions are in the swing zone.

2.05 ACCESSORIES

A. Steel Clips, Supports, and Steel Anchors: Galvanized to 1.25 oz/sq ft.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work and dimensions are as indicated on shop drawings.
B. Verify that electric power is available and is of the correct characteristics.

3.02 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.
B. Provide for thermal expansion and contraction of door and frame units and live and dead loads that may be transmitted to operating equipment.
C. Provide for dimensional distortion of components during operation.
D. Install pneumatic lines and door power units in a manner to prevent condensation or freezing.
E. Coordinate installation of components with related and adjacent work; level and plumb.

3.03 ADJUSTING

A. Adjust door equipment for correct function and smooth operation.

3.04 CLEANING

A. Remove temporary protection, clean exposed surfaces.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.06 MAINTENANCE

A. Provide a separate maintenance contract for specified maintenance service.
B. Provide service and maintenance of operating equipment for one year from Date of Substantial Completion, at no extra charge to Owner.

END OF SECTION 08.42.29
SECTION 08.43.13
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Aluminum-framed storefront.
B. Aluminum doors and frames.
C. Weatherstripping.
D. Synthetic Marble Sills
E. Door hardware.

1.02 RELATED REQUIREMENTS
A. Section 05.50.00 - Metal Fabrications: Steel attachment devices.
B. Section 07.21.00 - Thermal Insulation: Sealing framing to thermal insulation weather barrier system.
C. Section 07.92.00 - Joint Sealants: Sealing joints between frames and adjacent construction.
D. Section 08.42.29 - Automatic Entrances.
E. Section 08.71.00 - Door Hardware: Hardware items other than specified in this section.
F. Section 08.80.00 - Glazing: Glass and glazing accessories.
G. Section 12.24.00 - Window Shades: Attachments to framing members.

1.03 REFERENCE STANDARDS
A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordinate with installation of other components that comprise the exterior enclosure.
B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS
A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.
C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
D. Manufacturer’s Certificate: Certify that the products supplied meet or exceed the specified requirements.
E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
G. Report of field testing for water leakage.
H. Designer Qualifications Statement.
I. Manufacturer Qualifications Statement.
J. Installer Qualifications Statement.
K. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.07 QUALITY ASSURANCE
A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Tennessee.
B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING
A. Handle products of this section in accordance with AAMA CW-10.
B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.
1.09 FIELD CONDITIONS
A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY
A. Correct defective Work within a five year period after Date of Substantial Completion.
B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 STOREFRONT
A. Aluminum-Framed Storefront: Factory fabricated, factory finished, front-glazed aluminum framing members with infill, and related flashings, anchorage and attachment devices. Exterior frames shall be thermally broken.
   1. Glazing Rabbet: For 1 inch insulating glazing.
   3. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
   4. Finish: Class I natural anodized.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
   5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
  10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Performance Requirements:
   1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
      a. Design Wind Loads: Comply with requirements of ASCE 7.
      b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
   2. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
   3. Air Leakage: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.
   4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
2.02 COMPONENTS
A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
B. Glazing: As specified in Section 08.80.00.
C. Swing Doors: Aluminum.
   2. Top Rail: 6 inches wide.
   5. Glazing Stops: Square.
   6. Finish: Same as storefront.

2.03 MATERIALS
B. Fasteners: Stainless steel.
C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.04 SYNTHETIC MARBLE SILLS
A. Provide sill material made from crystal marble stone that are bound by a natural acrylic resin. Sills shall be resistant to UV rays, acids, leaches and salts. The sills shall not absorb liquids. Material shall be suitable for exterior and interior use.
B. Composition shall be 95% marble and 5% polyester acrylic resin.
C. Color to be selected from manufacturer's standard color selections.

2.05 HARDWARE
A. For each door, include weatherstripping, sill sweep strip, and threshold.
B. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
C. Sill Sweep Strips: Resilient seal type, of neoprene; provide on all exterior doors.
D. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify dimensions, tolerances, and method of attachment with other work.
B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION
A. Install wall system in accordance with manufacturer's instructions.
B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
C. Provide alignment attachments and shims to permanently fasten system to building structure.
D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
E. Provide thermal isolation where components penetrate or disrupt building insulation.
F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam. Provide shims as required for proper weeping. If sill flashings cannot be one-piece, insure sill flashing joints are lapped a minimum of 6" with double-sided tape of peel & stick EPDM.

G. Avoid fastening through sill flashings on horizontal surface. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Set thresholds in bed of sealant and secure.

J. Install hardware using templates provided.

K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL

A. See Section 01.40.00 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.

B. Test installed storefront for water leakage in accordance with AAMA 501.2 hose test.

3.05 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 08.43.13
SECTION 08.44.13
GLAZED ALUMINUM CURTAIN WALLS

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Aluminum-framed curtain wall, with vision glazing and glass, stone, and spandrel infill panels.
B. Firestopping between curtain wall and edge of floor slab.

1.02  RELATED REQUIREMENTS
A. Section 05.12.00 - Structural Steel Framing: Steel attachment members.
B. Section 05.50.00 - Metal Fabrications: Steel attachment devices.
C. Section 07.21.00 - Thermal Insulation; Sealing framing to thermal insulation weather barrier system.
D. Section 07.84.00 - Firestopping: Firestop at system junction with structure.
E. Section 07.92.00 - Joint Sealants: Sealing joints between frames and adjacent construction.
F. Section 08.42.29 - Automatic Entrances.
G. Section 08.43.13 - Aluminum-Framed Storefronts: Entrance framing and doors.
H. Section 08.80.00 - Glazing.

1.03  REFERENCE STANDARDS
A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; 2009.

1.04  ADMINISTRATIVE REQUIREMENTS
A. Coordinate with installation of other components that comprise the exterior enclosure.
B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05  SUBMITTALS
A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.

C. Shop Drawings: Provide engineer stamped shop drawings indicating system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and any field welding required.

D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

E. Design Data: Provide engineering of curtainwall system by an engineer registered in the State of Tennessee. Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.

F. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.

G. Field Quality Control Submittals: Report of field testing for water leakage.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION

A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.

B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.07 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at Tennessee.

B. Full-Size Mock-up Testing: Have a specimen representative of project conditions tested by an independent testing agency for compliance with specified thermal, structural, air infiltration, water penetration, and sound attenuation criteria.

C. Verify that each component is appropriate for use in structural sealant glazing (SSG) application in regards to at least the following properties; size, shape, dimensions, material, self-life, storage conditions, and color.

D. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.

E. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.08 MOCK-UP

A. Locate on-site where directed by Architect. Mock-up may remain as part of the Work.

B. Locate off-site where directed. Remove when directed.
1.09 DELIVERY, STORAGE, AND HANDLING
A. Handle products of this section in accordance with AAMA CW-10.
B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.10 FIELD CONDITIONS
A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.11 WARRANTY
A. Correct defective Work within a five year period after Date of Substantial Completion.
B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 CURTAIN WALL
A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Outside glazed, with pressure plate and mullion cover.
   2. Fabrication Method: Either shop/factory or field fabricated system.
   4. Vertical Mullion Face Width: 2-1/2 inches.
   5. Vertical Mullion Depth From Face of Glazing Cap to Back of Frame: 10.5 inches.
   6. Intermediate Vertical Mullion Additional Cap: Provide 2" additional cap on face of mullion, as shown on Drawings.
   7. Finish: Class I natural anodized.
      a. Factory finish surfaces that will be exposed in completed assemblies.
      b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   8. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   10. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
   1. Design Wind Loads: Comply with the applicable code.
   2. Seismic Loads: Design and size components to withstand seismic loads and sway displacement in accordance with requirements of ASCE 7.
   3. Movement: Accommodate the following movement without damage to components or deterioration of seals:
      a. Expansion and contraction caused by 180 degrees F surface temperature.
      b. Expansion and contraction caused by cycling temperature range of 170 degrees F over a 12 hour period.

DESIGN RELEASE PACKAGE 4
ISSUED: 12/01/2017
c. Movement of curtain wall relative to perimeter framing.
d. Deflection of structural support framing, under permanent and dynamic loads.

C. Water Penetration Resistance: No uncontrolled water on indoor face when tested as follows:
   1. Test Pressure Differential: 10 psf.

D. Air Leakage: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.

E. Thermal Performance Requirements:
   1. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.

2.02 COMPONENTS
   A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   B. Glazing: As specified in Section 08.80.00.

2.03 MATERIALS
   B. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.
   C. Firestopping: As specified in Section 07.84.00.
   D. Weatherseal Sealant: Silicone, with adhesion in compliance with ASTM C794; compatible with glazing accessories.
   E. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
   F. Glazing Accessories: As specified in Section 08.80.00.

2.04 FINISHES
   A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify dimensions, tolerances, and method of attachment with other related work.
   B. Verify that curtain wall openings and adjoining air and vapor seal materials are ready to receive work of this section.
   C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION
   A. Install curtain wall system in accordance with manufacturer's instructions.
   B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
   C. Provide alignment attachments and shims to permanently fasten system to building structure.
   D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
   E. Provide thermal isolation where components penetrate or disrupt building insulation.
   F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam. Provide shims as required for proper weeping. If sill flashings cannot be one-piece, insure sill flashing joints are
lapped a minimum of 6" with double-sided tape of peel & stick EPDM. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

G. Install firestopping at each floor slab edge.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Pressure Plate Framing: Install glazing and infill panels in accordance with Section 08.80.00, using glazing method required to achieve performance criteria.

J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

### 3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

### 3.04 FIELD QUALITY CONTROL

A. Provide services of manufacturer's field representative to observe installation and submit report.

B. Test installed curtain wall for water leakage in accordance with AAMA 501.2.

C. Replace curtain wall components that have failed field testing and retest until performance is satisfactory.

### 3.05 ADJUSTING

A. Adjust operating sash for smooth operation.

### 3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

### 3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 08.44.13

END OF SECTION 08.44.13
PART 1  GENERAL

1.01  SECTION INCLUDES
   A. Service and teller window units with pass-through device.

1.02  REFERENCE STANDARDS

1.03  ADMINISTRATIVE REQUIREMENTS
   A. Coordinate work with adjacent materials specified in other sections and as indicated on drawings and approved shop drawings.
   B. Preinstallation Meeting: Prior to start of installation arrange a meeting on site to familiarize installer and installers of related work with requirements relating to this work.

1.04  SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Submit manufacturer's product data for specified products indicating materials, operation, glazing, finishes, and installation instructions.
   C. Shop Drawings: Indicate configuration, sizes, rough-in, mounting, anchors and fasteners, and installation clearances.
   D. Manufacturer Qualification Statement.
   E. Installer Qualification Statement.
   F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05  QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least ten years documented experience, and with ability to provide test reports showing that their standard manufactured products meet the specified requirements.
   B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06  DELIVERY, STORAGE, AND HANDLING
   A. Deliver units in manufacturer's original packaging and unopened containers with identification labels intact.
   B. Store units in area protected from exposure to weather and vandalism.

1.07  WARRANTY
   A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
   B. Provide manufacturer's warranty agreeing to repair or replace units and their components that fail in materials or workmanship within two years from Date of Substantial Completion.
PART 2  PRODUCTS

2.01  SERVICE AND TELLER WINDOW UNITS
  A.  Manufacturers:
      4.  Substitutions: See Section 01.60.00 - Product Requirements.
  B.  Location: Built within interior wall, as indicated on drawings.
  C.  Window Type: Fixed.
      1.  Mounting: Projected from the wall surface.
      2.  Window Size: 24 inch wide by 36 inch high.
  D.  Glazing: Single (monolithic), clear.
      1.  Tempered safety glazing.
  E.  Communication: Standard talk-through portal.
  F.  Products:

2.02  COMPONENTS
  A.  Windows: Factory-fabricated, finished, and glazed, with extruded aluminum frame and glazing stops; complete with hardware and anchors.
      1.  Provide window units that are re-glazable from the secure side without dismantling the non-secure side of framing.
      2.  Rigidly fit and secure joints and corners with internal reinforcement. Make joints and connections flush, hairline, and weatherproof. Fully weld corners.
      3.  Apply factory finish to all exposed surfaces.
  B.  Deal Tray: Integral with window sill.
      1.  Material: One piece stainless steel tray construction, 18 gage, 0.0500 inch minimum thickness.

2.03  MATERIALS
  A.  Aluminum Extrusions: Minimum 1/8 inch thick frame and sash material complying with ASTM B221 and ASTM B221M.

2.04  FINISHES

PART 3  EXECUTION

3.01  EXAMINATION
  A.  Verify that window openings are ready for installation of windows.
  B.  Verify that correct embedded anchors are in place and in proper location; repair or replace anchors as required to achieve satisfactory installation.
  C.  Notify Architect if conditions are not suitable for installation of units; do not proceed until conditions are satisfactory.

3.02  INSTALLATION
  A.  Install in accordance with manufacturer's instructions.
B. Install units in correct orientation (inside/outside or secure/non-secure).
C. Anchor units securely in manner so as to achieve performance specified.

3.03 ADJUSTING
   A. Adjust operating components for smooth operation while also maintaining a secure, weather-tight enclosure and a tight fit at the contact points; lubricate operating hardware.

3.04 CLEANING
   A. Remove protective material from factory finished surfaces.
   B. Clean exposed surfaces promptly after installation without damaging finishes.

3.05 PROTECTION
   A. Provide temporary protection to ensure that service and teller windows are without damage upon Date of Substantial Completion.

END OF SECTION 08.56.59
SECTION 08 56 76
OPERABLE SOUND CONTROL WINDOWS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS
   A. Work of this section, as shown or specified, shall be in accordance with the requirements of the Contract documents.

1.2 SCOPE
   A. Provide all labor, material and equipment necessary to furnish and install operable and fixed double aluminum frame windows as shown on drawings and specified herein. Window shapes and accessories as specified and detailed establish the type of units and materials to be used to provide the functional performance and aesthetic requirements desired. Details indicate the required depth and profile.

1.3 RELATED WORK
   A. Consult all other sections to determine the extent of work specified elsewhere but related to this section. Such work shall be properly coordinated to produce a satisfactory installation.

1.4 SYSTEM DESCRIPTION
   A. Thermal break aluminum double-double horizontal rolling conforming to or exceeding HS-DW-C25.

1.5 QUALITY ASSURANCE
   A. Air Infiltration: With the primary sash in a closed and locked position, and the secondary sash in the open position, window is tested in accordance with ASTM-E283-84 and meets the following performance requirements.
      1. Air infiltration on windows with less than 18 feet of operable track perimeter cannot exceed 2.8 cfm total when tested at a static pressure drop of 1.56 psf (equivalent to 25 mph wind velocity) or 6.3 cfm total when tested at 6.24 psf (equivalent to 50 mph wind velocity).
      2. Air infiltration on windows with 18 or more feet of operable sash track perimeter cannot exceed .15 cfm per foot of operable sash crack perimeter under a static pressure drop of 1.56 psf or .35 cfm at 6.24 psf.

   B. Uniform Load Structural Test
      1. With primary set of sash in the closed and locked position, and the secondary set of sash in the full open position, test unit in accordance with ASTM-E-330 at a static air pressure difference of 37.5 pounds per square foot with high pressure applied first on one side of the unit and then on the other side.
      2. At conclusion of test, there is no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, nor any other damage which would cause the window to be inoperable. Permanent deformation of any frame, sash or ventilator member cannot exceed 0.4% of its span.

   C. Condensation Resistance Factor (CRF): When tested in accordance with AAMA-1502.7-81 on an exact size window of 6’0” x 4’0”, the CRF cannot be less than 60.

   D. Sound Transmission Loss Test: The window is tested for sound transmission loss, and a sound transmission class computed using all facilities and procedures in explicit conformity with ASTM designations E90-75 and E413-73. The sound transmission class (STC), no less than 42 when glazed with 3/8” laminated glass on the exterior and 1/4” glass on the interior.
1.6 REFERENCE
A. Aluminum windows conforming to or exceeding the ANSI/AAMA 101-88 "Voluntary Specifications for Aluminum Prime Windows and Sliding Glass Doors."

1.7 SUBMITTALS
A. Before proceeding with the manufacturing of the windows, the window contractor shall submit complete shop drawings showing installation details for Architect's approval. These drawings also show elevations of windows, full-sized details of all sections of windows, collateral materials, details of anchorage and hardware. Supplemental data contains calculations of moments of inertia on frames and mullion connections plus instructions for storage, handling and erection of windows.

B. Submit a list of at least (5) completed projects of similar nature and scope to the Architect listing name, location and Architect.

C. Submit current certified test reports to verify performance as described elsewhere in this specification.

1.8 WARRANTY
A. The manufacturer guarantees his work against material defects in manufacture for a period of ten (10) years. If a defect is found and brought to the attention of the manufacturer, the defect will be corrected at no cost to the owner for a period of (10) years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. All aluminum thermal barrier horizontal rolling windows:
   1. Milco Series W-27TR, as manufactured by MILCO a division of Apogee Wausau Group, 7555 Stewart Avenue; Wausau, Wisconsin 54401; Phone 715.842.0581
   2. DeVac 600 series, manufactured by Mon-Ray Inc. (Manufacturer of DeVac windows), 801 Boone Ave N.; Minneapolis, Minnesota 55427; Phone 800.544.3646.

2.2 MATERIALS
A. All principle frame, sash or ventilator window sections are special extruded aluminum shapes produced from Architectural Grade homogenized aluminum primary billet.

B. Material: Frame, sash and screen members are aluminum alloy 6063-T6 per job requirements. All extrusions have a nominal wall thickness of .062", except frame sills which have a nominal wall thickness of .093" in the primary walls and track.

C. Thermal Barrier: The thermal barrier is not a structural part of the frame assembly but provides complete metal separation of the frame members. The thermal barrier is tongue and groove fit with each part of the frame securely locking them though not inhibiting the expansion and contraction of either part. The frame thermal barrier is no less than 1/4" wide. A bead of sealant compatible with the thermo-barrier material is applied to the complete frame perimeter to insure that water does not enter the wall cavity. No screws, connections or fittings span the thermal barrier.

D. Weather-stripping: Sash are double weather-stripped at head, jamb and sill using silicoated woven pile with mylar side fins or center fins. Vinyl weather-stripping will not be accepted.
E. Hardware: The interior and exterior sash meeting rails have a spring loaded stainless steel plunger lock mounted in the meeting rail only, that engages automatically with a stainless steel strike plate as window is closed. The lock handle is applied to the interior face of the meeting rail. All interior meeting rails to have continuous grip rails.

F. Operable sash shall be factory glazed with the following:
   1. Operable sections: 3/8” laminated glass (STC 36) plus 1/4” plate glass (STC 31) separated by the air space shown on the drawings.
   2. Fixed sections: 1/2” thick monolithic projection quality glass as specified.

G. Fixed sash shall be factory glazed with the following:
   1. STC 57 Rating: ½” (13 mm) interior, ⅛” (6 mm) exterior – double pane.
      a. Glass type shall be ¼” low iron float optical glass and ½” low iron float optical glass, PPG Starphire or equal.

2.3 FABRICATION

A. Construction-Frames: The frame is a minimum of 6” deep. Frames are constructed of continuous extrusions, square cut at corners and precision machined. Window frame consists of three separate units having a continuous non-conductive rigid vinyl thermal barrier between which is tongue and groove fit with each section securely locking the units together. Center frame jambs have two aluminum legs to guide venetian blind as interior sash is opened. Overall frame depth is 6” minimum. Corners fastened with minimum of four stainless steel screws. Sill is tubular and weeped to prevent the accumulation of moisture or debris. The weepage system allows drainage of all water from all cavities in sill and is clear through from the outside to inside. Sill section also has provisions for anchorage without bridging the thermal barrier.

B. Construction Sash: All sash members are hollow tubular extrusions to resist twist and deflection. Inner and outer sash have the same section modulus. Sash members are square cut and milled to allow telescoped joints at each corner for maximum strength and weather tightness. All sash operate on rollers. All screws, axles and pins are stainless steel. All sash are removable from inside, without tools, for cleaning.

2.4 FINISH

A. Exposed surfaces of all aluminum windows and trim shall have an Architectural Class I (0.7 mil minimum thickness) electrolytically-deposited anodic finish. All parts shall receive a medium matte etch prior to anodizing. Flat matte Dark or Extra-Dark Bronze or Black color as selected by Architect. Finish shall be in accordance with AA-M10C22A44.

PART 3 - EXECUTION

3.1 GENERAL

A. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all is complete to the point where this installation may properly commence. Verify that Window Assemblies may be installed in complete accordance with the original design and the approved Shop Drawings. In the event of discrepancy, immediately notify the Architect immediately in writing.

B. Shop prefabricate all windows and frames into complete units, verifying all measurements at the site prior to fabrication.

C. Fabricate in strict accordance with approved Shop Drawings. Accurately miter and fit all members to hairline joints. Weld or mechanically fasten along entire line of contact on the unexposed side.

D. Windows, mullions and trim are installed by experienced workmen in exact accordance with the manufacturer’s instructions and approved shop drawings.
E. Back of frame shall be lined with dry grouting prior to installation.
F. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. Fill frames in masonry walls with mortar as the wall is laid up.

3.2 SEALANTS
A. Seal joints between windows and surrounding construction.
B. Joints and surfaces to receive sealants are clean, free from loose material, free of efflorescence or mortar leaking and dry. Sealants are not applied when temperature is below manufacturer's recommendations.
C. Clean joints and surfaces before sealing or priming in conformance with manufacturer's instructions.
D. Prime joints in conformance with material manufacturer's instructions.
E. Provide joint backing in all joints where a suitable backstop to receive sealant is otherwise not available.
F. Pack joints with joint backing to provide depth equal to 1/2 of width. Caulk joint width cannot be less than 1/4” nor more than 1/2” unless recommended otherwise by the manufacturer.

3.3 PROTECTION AND FINISHING
A. Prior to installation, metal surfaces of windows and trim shall be cleaned of all mortar, plaster, paint and other contaminants.
B. The general contractor is responsible for protection of the work from damage by other trades and final cleaning.

END OF SECTION
SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Installation of all electrified and mechanical door hardware items is described and required to be provided in other related Sections of these Specifications.

Door hardware items specified to be furnished by the contract door hardware supplier, under this section. Door hardware items specified for installation on aluminum door openings shall be shipped from the contract door hardware supplier directly to the manufacturer / supplier of the aluminum door openings for hardware preparations and installation. Shipment(s) shall take place in a manner to avoid any delays in the work.

Hardware supplier must be an authorized, direct factory distributor of all door hardware and access control products specified herein to insure compliance and service of these products.

C. Unless otherwise approved by the Architect / Engineer, furnish all door hardware items as described in the door hardware schedule.

1.02 SUMMARY

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. This Section includes the following:

. Butt Hinges
. Continuous Geared Hinges
. Cylinders and Keys
. Cylindrical Latchsets and Locksets
. Mortise Latchsets and Locksets
. Deadbolts with Accessories
. Exit Devices
. Door Closers
. Overhead Door Stops / Holders
. Wall and Floor Stops
. Electromagnetic Door Holders
. Push and Pull Bars
. Mop and Kick Plates
. Lock Guards
. Thresholds
. Door Sweeps
. Self-Adhesive Gasketing
. Perimeter Gasketing
. Drip Strips
. Door Silencers
. Security Equipment
C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 05 50 00 - Metal Fabrications
2. Section 06 20 00 - Finish Carpentry
3. Section 07 92 00 - Joint Sealants
4. Section 08 11 13 - Hollow Metal Doors and Frames
5. Section 08 14 16 - Flush Wood Doors
6. Section 08 34 73 - Sound Control Door Assemblies
7. Section 08 41 13 - Aluminum-Framed Storefronts
8. Section 08 33 23 - Overhead Coiling Doors
9. Division 26 - Electrical
10. Division 27 - Communications
11. Division 28 - Electronic Safety and Security
12. Hardware specified under other Sections is excluded from this Section.

1.03 REFERENCES

A. Standards of the following as referenced:

1. 2010 ADA Standards for Accessible Design
2. American National Standards Institute, Inc. (ANSI)
3. Door and Hardware Institute (DHI)
5. Intertek Testing Services - Warnock Hersey (ITS-WH)
10. Underwriter’s Laboratories, Inc. (UL)

B. Regulatory standards of the following as referenced:

1. Department of Justice, Office of the Attorney General, Americans with Disabilities Act, Public Law 101-336 (ADA)

1.04 SYSTEM DESCRIPTION

A. Refer to applicable headings for system description for electric hardware products.

1.05 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification, Section 01 33 00 - Submittal Procedures; for submittal procedures.

B. Product data including manufacturers’ technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements. Clearly highlight each submitted item and data applicable to this project on manufacturer’s cut sheets. Arrange cut sheets in an order in which each item appears in the hardware sets.

C. Final hardware / access control systems schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into vertical format “hardware sets” indicating complete designations of every item required for each door or opening. Use specification Set Numbers with any variations suffixed with A, B, etc. Include the following information:
a. Type, style, function, size, and finish of each hardware item.
b. Name and manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of each hardware set cross referenced to indications on drawings both on floor plans and in door and frame schedule.
e. Explanation of all abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for hardware.
g. Door and frame sizes and materials.
h. Keying information.
i. Provide a complete and detailed system of operating and elevation diagrams specifically developed for each opening requiring electrified hardware, except openings where only electromagnetic door holders and/or door position switches are specified. Provide these diagrams with the hardware schedule submittals, for approval. The following shall be included:

(1) Point-To-Point wiring diagram.
(2) Elevation of each door.
(3) Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.

j. Cross reference numbers used within schedule deviating from those specified.

(1) Column 1: State specified item and manufacturer.
(2) Column 2: State prior approved substituted item and its manufacturer.

2. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g.: hollow metal frames) which is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of hardware schedule.

3. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner’s final instructions on keying of locks has been fulfilled.

D. Samples of each type of exposed hardware unit in finish indicated and tagged with full description for coordination with schedule. Submit samples prior to submission of final hardware schedule.

1. Samples will be returned to the supplier. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated in the work, within limitations of keying coordination requirements.

E. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

This is a requirement of the door hardware supplier to furnish all templates of each required door hardware item to the suppliers of the hollow metal doors and frames. No templates shall be sent until all door hardware items have been approved.

F. Electronic Hardware Systems:

1. Wiring Diagrams: Coordinate the installation of all required electronic hardware items with the Project Electrical Engineer and provide all necessary installation and technical data, including wiring diagram drawings, to the Project Electrical Engineer and Electrical Sub-Contractor. Provide a copy of all wiring diagram drawings with each door hardware schedule submitted after approval.
2. Provide complete operational descriptions of electronic components listed by each door opening in the door hardware submittals. Operational descriptions are to detail how each electrical component functions within the door opening, incorporating all conditions of ingress and egress. Provide this information with each door hardware schedule submitted for approval.

3. Provide elevation drawings of electronic hardware items and systems identifying locations of the system’s components with respect to their placement in the door opening. Provide a copy of all elevation drawings with each door hardware schedule submitted for approval.

4. The electrical products contained within this specification represents a complete engineered system. If alternate electrical products are submitted, it is the responsibility of the distributor to bear any and all costs of providing a complete and operational system including re-engineering of electrical diagrams and system layout, as well as power supplies, power transfers, and all other required electrical components. Coordinate with the Project Electrical Engineer and Electrical Sub-Contractor to ensure that line voltage and low voltage wiring requirements are coordinated to provide a complete and operational system.

5. Upon completion of the electrical hardware installation, the door hardware supplier shall verify that all electrical components are functioning properly and state in the required guarantee that this inspection has been performed.

G. Contract closeout submittals: At the completion of this Project, furnish to the Owner two (2) copies of an Owner’s Operation and Maintenance Manual. This manual shall consist of a labeled, hardcover, three-ring binder with the following technical information.

1. Maintenance instructions for each door hardware item.

2. Manufacturers’ catalog cut-sheets for each of their respective products.

3. Parts list for each of the manufacturers’ respective products.

4. Final “Approved” Door Hardware Schedule.

5. Final “Approved” Keying Schedule.

6. Warranty: Completed and executed warranty forms.

1.06 QUALITY ASSURANCE

A. Deleted.

B. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, security equipment, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.

C. Qualifications of Supplier: A recognized architectural door hardware supplier, with warehousing facilities, who has been furnishing hardware and installation in the Project’s vicinity for a period of not less than 5 years. The supplier shall be, or shall employ, a certified Architectural Hardware Consultant (AHC) and Security Consultant who is available, at reasonable times during the course of the work, for consultation about the Project’s hardware requirements, to the Owner, Architect, and Contractor.

A certified Architectural Hardware Consultant (AHC) and Security Consultant shall prepare all hardware and access control schedules. Supplier shall be responsible for proper coordination of all door hardware items and access control items with related sections, to insure compatibility of products.
1. Hardware supplier must be an authorized, direct factory distributor of all door hardware and access control products specified herein to insure compliance and service of these products.

2. Require supplier to meet with Owner to finalize keying requirements and to obtain final instructions in writing.

D. Qualifications of Installer: The hardware installer shall have no less than five (5) years of documented experience in the installation of hardware of similar quantities and types as required for this project. The installer's qualifications shall be submitted to the architect, in writing, for approval by the architect before any work shall commence.

E. Fire-Rated Openings: Furnish door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of the Authorities Having Jurisdiction. Furnish only items, of door hardware, that are listed and are identical to products tested by UL, ITS-WH, FM, or other testing and inspecting organization acceptable to the Authorities Having Jurisdiction, for use on types and sizes of doors indicated, in compliance with the requirements of fire-rated door and door frame labels.

Project requires door assemblies and components that are compliant with positive pressure and S Label requirements. Specifications must be cross-referenced and coordinated with door and frame manufacturers to ensure that total door opening engineering is compatible with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies.

F. Product Qualifications: Manufacturers names and numbers are used to indicate the standards of design and quality. Submittals should include a sheet listing grade of item, duty rating (if applicable) and finish.

G. Substitutions: All substitution requests are required to be submitted prior to the bid date and complying with the procedures and time frame as outlined in Section 00 21 13 - Instructions To Bidders. Approval of submitted products is at the discretion of the Architect and the Hardware Consultant.

H. General Contractor, hardware distributor, access control supplier, and installers shall count, coordinate, and store all door hardware and access control items herein, verifying complete counts of all items scheduled and furnished. The manufacturers’ and Owner’s representatives will inspect the installation of the door hardware and access control items during that phase of construction. Any deficiencies in installation of all materials included herein shall be corrected before installation continues.

I. At the Project’s Completion, the Owner’s Representative shall accompany the Architect and General Contractor during the door hardware and Access Control items punch list phase of the project close-out, insuring the Owner’s Representative is familiar with all applications and systems, as installed. Refer to additional requirements under 3. - EXECUTION.

J. Pre-Installation Meeting: Prior to door hardware installation, the General Contractor / Construction Manager shall request a hardware installation meeting to be held at the project’s location. This meeting shall convene no later than one month prior to the hardware’s installation. The types of hardware this meeting shall include are: locksets, exit devices, and door closers. The manufacturer’s representatives of the above listed products, in conjunction with the hardware supplier for this project, shall conduct the installation training. All hardware installers shall be required to attend this meeting to receive certificate of authorized training. This meeting shall serve as door openings coordination and review of all shop drawings from related trades prior to the hardware installation.

The hardware supplier shall include any related meeting costs in their proposal.

K. Electrified Hardware and Security Hardware Systems: Prior to ordering the electrified hardware, the General Contractor shall request a coordination meeting. This meeting shall convene prior to or after the Door Hardware Schedule and the wiring diagrams have been submitted to the General Contractor. All related trades shall be represented at this meeting, which shall also include the architect, the Owner’s representative, and the hardware supplier. This meeting shall serve as a review and coordination of all
electrified hardware, wiring, connections, location for power supplies, and remote switches, and door functions. All related trades shall make any required changes, and resubmit schedules, diagrams, and any other required data, no later than one (1) week following this meeting.

1.07 PRODUCT HANDLING

A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Packaging of door hardware is the responsibility of the supplier. As material is received by the hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set numbers to match the set numbers of the approved hardware schedule. Two or more identical sets may be packed in the same container.

C. Door hardware supplier shall deliver all individually packaged hardware items promptly to the place of installation (Shop or Project Site); direct factory shipments are not acceptable unless agreed upon beforehand. Hardware supplier shall coordinate delivery times and schedules with the Contractor.

D. Inventory door hardware jointly with the General Contractor, representatives of the hardware supplier, and the hardware installer, until each is satisfied that the count is correct.

E. At the time of the hardware delivery, the door hardware supplier in conjunction with the Contractor shall verify and check in all hardware items. The Contractor must report all shortages (discrepancies with shipping documents) within five (5) working days.

F. General Contractor shall provide a secure lock-up for the door hardware and security equipment delivered to the Project, but not yet installed. Control handling and installation of the hardware items that are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

1.08 WARRANTY

A. All materials must be warranted against defects in workmanship and materials for a period of one (1) year from date of acceptance of this project, unless otherwise noted. Any evidence of misuse or abuse voids all warranties. These warranties shall be each manufacturer’s standard written warranty.

B. Special Warranties:

   . Continuous Geared Hinges: Limited Lifetime.
   . Cylindrical Latchesets and Locksets: Seven (7) Year Period.
   . Mortise Latchesets and Locksets: Ten (10) Year Period.
   . Exit Devices: Five (5) Year Period.
   . Door Closers: Twenty-Five (25) Year Period.
   . Electromagnetic Door Holders: Two (2) Year Period.
   . Thresholds, Door Sweeps, Self-Adhesive Gasketing, Perimeter Gasketing, and Drip Strips: Three (3) Year Period.

C. Any manufacturer whose standard written warranty does not equal or exceed the requirements listed above must provide a letter stating that they will extend their warranty to comply with the requirements of this specification.

D. Refer to Section 01 77 70 - Contract Closeout; for additional warranty requirements.

1.09 MAINTENANCE
A. Maintenance Tools and Instructions: The General Contractor shall furnish a complete set of specialized tools and maintenance instructions as needed for the Owner’s continued adjustment, maintenance, and removal and replacement of door hardware.

B. Parts Kits: Furnish manufacturers’ standard parts kits for locksets, exit devices, and door closers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Substitutions: Where specific manufacturers and their products are listed as “acceptable manufacturers”, provide those products from specified manufacturers; subject to compliance with specified requirements stated herein.

Any request for substitutions shall be submitted prior to the bid date and complying with the procedures and time frame as outlined in Section 01.25.13 – Product Substitution Procedure. Approved substitutions will be provided by addendum only.

Substitutions will not be allowed where only one manufacturer and their products are listed.

BUTT HINGES

1. Acceptable Manufacturers:
   b. IVES; Division of Allegion, PLC (IVE) - 5BB1 / 5BB1HW (IVE).
   c. Stanley Hardware; A Division of Stanley Security Solutions, Inc. - FBB168 / FBB179 / FBB191 / FBB199 (STA).

2. Characteristics:
   a. Tested to be in accordance with ANSI / BHMA A156.1.
   b. Type: Five (5) knuckle, full mortise, ball bearing.
   c. Templates: Furnish only template-produced units.
   d. Fasteners: Furnish Phillips flat-head screws complying with the following requirements.
      (1) For metal doors and frames, install machine screws into drilled and tapped holes.
      (2) For wood doors and frames, install threaded-to-the-head wood screws.
      (3) For fire-rated wood doors, install #12 x 1-1/4 inch, threaded-to-the-head steel wood screws.
      (4) Finish screw heads to match surface of hinges or pivots.
   e. Hinge Pins: Except as otherwise indicated, furnish hinge pins as follows:
      (1) Out-Swing Exterior Doors: Non-removable pins.
      (2) Out-Swing Interior Doors: Non-rising pins and Non-removable pins; as indicated in DoorHardware Sets.
      (3) In-Swing Exterior / Interior Doors: Non-rising pins.
      (4) Tips: Flat button and matching plug. Finished to match leaves.
   f. Size: Provide hinges 4.5” x 4.5” for doors up to 36” in width. Provide hinges 5” x 4.5” for doors over 36” in width. Hinge width shall be sufficient to allow door to swing to its maximum degree of opening.
   g. Quantity: Furnish one pair of hinges for all doors up to 5’-0” high. Furnish one additional hinge for each additional 2 feet or fraction thereof.

CONTINUOUS GEARED HINGES

1. Acceptable Manufacturers:
   a. Hager Hinge Co. – 780-112-HD (HAG)
b. Select Products Limited - SL24 HD (SEL).
c. IVES; Division of Allegion, PLC (IVE) - 224HD.

2. Characteristics:
   a. Tested to be in accordance with ANSI / BHMA A156.26, Grade 1.
   b. Templates: Furnish only template-produced units.
   c. All hinges are to be “Full Mortise”.
   d. Hinges to be manufactured of extruded 6063-T6 aluminum alloy with an anodized finish.
   e. All hinge profiles to be manufactured to template bearing locations at 2 9/16” spacing.
   f. All hinges are to be furnished factory cut for each door size.
   g. Vertical door loads shall be carried on chemically lubricated polyacetal thrust bearings.
   h. The door and frame leaves shall be continuously geared together for the entire hinge length and this relationship secured with a full-length cover channel so that the hinge will operate through a full swing of 180 degrees.
   i. All rotating areas of the gear cap and geared leaves shall have a permanent lubricant which is factory applied along the full length of the hinge, and the lubricant shall last the life of the hinge without any additional maintenance required.
   j. Fasteners: Furnish manufacturer’s standard fasteners based upon recommendations for each installation.

CYLINDERS AND KEYS

1. Acceptable Manufacturers:
   a. Corbin Russwin, Inc.; An ASSA ABLOY Group company (COR).

2. Characteristics:
   a. Tested to be in accordance with ANSI / BHMA A156.28.
   b. Existing Key System: Furnish all cylinders keyed into East Tennessee State University’s existing “Corbin Russwin” interchangeable core key system, for this project.
   c. Equip all cylinders and locksets with the manufacturer’s standard 6-pin interchangeable core tumbler cylinders, 8000 Series.
   d. Furnish cylinders and locksets with temporary, brass / keyed, “Construction” interchangeable cores for the duration of the time of construction. Construction cores, master keys, and control keys shall not be part of the Owner’s permanent key system or furnished on the same keyway (or key section) as the Owner’s permanent key system. Construction cores, master keys, and control keys are the property of the manufacturer and shall be returned when the permanent cores and keys are installed. Remove these “Construction” interchangeable cores Only when directed by the Architect and / or Owner.
   e. Furnish final “Permanent” interchangeable cores and keys, for installation by the Owner.
   f. Metals: Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.
   g. Comply with the Owner’s instructions for keying requirements and, except as otherwise indicated, furnish individual change keys for each lock that is not designated to be keyed alike with a group of related locks.

(1) Permanently inscribe each key with number of lock that identifies the cylinder manufacturer’s key symbol, and notation, “DO NOT DUPLICATE”.

h. A keying meeting between the Owner and a representative of the successful door hardware distributor shall be arranged subsequent to the return of the approved Door Hardware Schedule. A keying schedule will be established by the door hardware distributor’s representative and submitted to the Owner, for approval. After the Owner’s review, the keying schedule shall be returned to the distributor’s representative such that the permanent cores and keys can be prepared on a timely basis.
Permanent cores and keys will be transmitted directly to the Owner by the Door Hardware Distributor. The Owner shall be responsible for the installation of the permanent cores and the return of the construction cores and keys.

Key Material: Furnish keys of nickel silver only.

Key Quantities: Furnish the following quantities of keys for the entire project.

1. Ten (10) Each - Construction Master Keys
2. Two (2) Each - Construction Control Keys
3. Five (5) Each - Permanent Master Keys
4. Two (2) Each - Permanent Control Keys
5. Four (4) Each - Permanent Change Keys

(For Each Keyed Door Opening)

Deliver all construction interchangeable cores and keys to the General Contractor.
Deliver all permanent interchangeable cores and keys to the Owner, via Registered Mail.

CYLINDRICAL LATCHSETS AND LOCKSETS

1. Acceptable Manufacturers:
   a. Corbin Russwin, Inc.; An ASSA ABLOY Group company (COR) - CL3300 Series x “Newport (NZD)” Trim Design.

2. Characteristics:
   a. Tested to be in accordance with or exceed ANSI / BHMA A156.2, Series 4000, Grade 1 Strength and Operational requirements.
   b. U.L. Listed for 3-hour doors.
   c. Locksets shall be non-handed.
   d. Chassis: Cylindrical housing design, heavy gauge, cold rolled steel mechanisms, corrosion treated for normal atmosphere conditions.
   e. Locksets shall have separate anti-rotational through-bolts for positive mounting / interlocking to the door, without any exposed mounting screws.
   f. Locksets shall have solid cast levers, plated to match the specified finish symbols. Levers shall operate independently, and shall have separate, heavy duty, lever return springs or spring cages, allowing for a smooth operation of the lockset, for effective lever support, which shall prevent lever sag. Outside lever handles shall be a minimum of 4-5/8” in length and shall provide a minimum of 2” clearance from the surface of the door to the inside of the lever, at the midpoint. Outside lever handles shall return to within, a maximum, of 1/2” of the door surface.
   g. Outside lever handles, on keyed locksets, shall be removable only when the designated key is in the cylinder.
   h. When the outside lever handle is locked, the lever shall rotate freely and shall return to its horizontal position when released. The locked outside lever handle shall freely rotate up and down while remaining securely locked.
   i. Roses: Wrought brass, bronze or stainless steel, plated to match the specified finish symbols. Roses shall be a minimum 3-7/16” in diameter, for coverage of the ANSI / DHI A115.18 - 1994 door preparation.
   j. All locksets shall be furnished with a 1/2” throw latchbolt and shall be listed by Underwriter’s Laboratories, Inc. for A label and lesser class 4’-0” x 10’-0” single doors.
   k. Backsets: 2-3/4”.
   l. Strike: Brass, bronze or stainless steel, plated to match the specified finish symbols. Conform to ANSI A115.2 (4-7/8” x 1-1/4”), with lips of a sufficient length to clear trim and protect clothing.

MORTISE LATCHSETS AND LOCKSETS

1. Acceptable Manufacturers:
a. Corbin Russwin, Inc.; An ASSA ABLOY Group company (COR) - ML2000 Series x “Newport (NSR)” Trim Design or “110 Salvador” as scheduled.

2. Characteristics:
   a. Conforms to and/or exceeds all ANSI / BHMA A156.13, Series 1000, Grade 1 Operational, Grade 2 Security. ANSI / ASTM F476-84 Grade 30, U.L. Listed. Conform to and/or exceed 800,000 cycle ANSI Grade 1 requirements.
   b. Latchsets and locksets shall have all functions available in a one size case, fabricated from heavy wrought steel, zinc dichromate plated for corrosion resistance and lubricity of internal parts. Cases shall be closed on all sides to protect internal parts.
   c. The handing of all latchsets and locksets shall be reversible without the disassembly of the lockcase.
   d. Latchsets and locksets shall have adjustable, beveled and armored fronts, with standard 2-3/4” (70mm) backsets, with full 3/4” (19mm) throw two or three-piece mechanical stainless steel anti-friction latchbolts, one-piece stainless steel 1” throw deadbolts, and stainless steel auxiliary bolts.
   e. All latchsets and locksets with latchbolts, regardless of trim design, shall be listed by Underwriters Laboratories for 3-hour fire rated and lesser classified doors.
   f. Lock trim (knobs, levers, sectional or escutcheon) shall be throughbolted through the lockcase to assure correct alignment and proper operation.
   g. Latchsets and locksets shall be furnished with replaceable breakaway spindles, designed to resist excessive force from vandalism, preventing damage to lever trim and internal lock case components.
   h. Where indicated in Door Hardware Sets, when the outside lever handle is locked, the lever shall rotate freely and shall return to its horizontal position when released. The locked outside lever handle shall freely rotate up and down while remaining securely locked.
   i. Lever handles shall be one-piece, solid, brass, bronze, or stainless steel.
   j. Armor fronts, escutcheons, and roses shall be fabricated from brass, bronze, or stainless steel.
   k. Strikes shall be 16 gauge, curved, brass, bronze or stainless steel, with 1” deep strike boxes, and furnished with lips of sufficient lengths to clear trim and protect clothing.
   l. Furnish “Knurled” outside levers; as indicated in Door Hardware Sets. “Abrasive” outside levers shall not be acceptable.

EXIT DEVICES

1. Acceptable Manufacturers:

2. Characteristics:
   a. Tested to be in accordance with ANSI A156.3, 1994, Grade 1. All exit devices to be heavy duty, with one-piece removable covers. The housing shall be manufactured from extruded aluminum without exposed screws or rivets.
   b. Exit devices shall be “UL” listed for Life Safety. All exit devices for fire-rated door openings shall have “UL” labels for “Fire Exit Hardware”. All exit devices shall conform to NFPA 80 and NFPA 101 requirements.
   c. All series exit devices shall be “touchpad” (modern) types, incorporating a hydraulic fluid damper, which decelerates the touchpad on its return stroke and eliminates noise associated with the exit device operation. All exit devices shall be non-handed. The touchpad shall extend a minimum of 1/2 of the door width and shall be a minimum of 2-3/16” in height.
   d. Exit devices shall incorporate a deadlatching feature for security and / or for future addition of alarm kits and / or other electrical requirements.
   e. All latchbolts to be the deadlocking type. Latchbolts shall have a self-lubricating coating to reduce wear.
   f. Flush metal end caps shall be standard with all exit devices.
g. Exit device strikes, where surface applied, shall be a roller type and have an anti-slip mounting plate.

h. All outside exit device trim shall be forged brass, full escutcheon. The lever trim shall be a “breakaway type” with substantial resistance to rotation when locked but allowing the vandalized lever to drop to a vertical, 90 degrees, position when more than 35 pounds of torque is applied.

i. The exit device end caps shall be secured with three (3) screws to a truss bracket.

j. The “touchpad” exit devices shall be patterned punched to designate code requirements; where required.

k. Where detailed, provide electric latch retraction. Retraction shall be provided by motor driven retraction of latch. Where scheduled, provide coordinated power supplies, Von Duprin Series 900 with proper modules as listed.

l. All exit devices shall be fabricated of aluminum material, anodized to the standard architectural finishes to match the balance of the door hardware.

m. Provide standard “06” lever trim at all openings except where special “M52” trim is noted in the schedule of hardware.

. DOOR CLOSERS

1. Acceptable Manufacturers:
   a. Corbin Russwin, Inc.; An ASSA ABLOY Group company (COR) - DC6000 Series.

2. Characteristics:
   a. Door closers shall have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder; which have been tested and certified under ANSI Standard A156.4, Grade 1.
   b. Hydraulic fluid shall be of an all weather type, requiring no seasonal closer adjustment.
   c. Spring power shall be continuously adjustable over the full range of closer sizes, and allowing for reduced opening force for the physically handicapped. Hydraulic regulations shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed and back check.
   d. All closers shall have solid forged steel main arms (and forearms for parallel arm closers) and where specified shall have a spring loaded stop in the soffit shoe; as indicated in Door Hardware Sets. Where door travel on out-swing doors must be limited, use spring loaded stop in the soffit shoe type closers. Auxiliary stops are not required when spring loaded stop in the soffit shoe type closers are used.
   e. Closers shall have non-metallic full, plastic, covers, which provides complete enclosure.
   f. All closers shall be of one manufacturer and shall maintain the manufacturer’s thirty (30) year warranty.
   g. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ADA and ANSI A117.1 provisions for door opening force.
   h. Closers shall be attached utilizing through bolts with wood and machine screws.
   i. Closers to be installed to allow door swing as shown on plans. Doors swinging into exit corridors shall provide for corridor clear width as required by code. Where possible, mount closers inside rooms.
   j. Powder coating finish to be certified to exceed 100 hours salt spray testing by ETL, an independent testing laboratory used by BHMA for ANSI certification. Lacquer or painted finish on metal components shall not be acceptable.

. OVERHEAD DOOR STOPS / HOLDERS

1. Acceptable Manufacturers:
   a. Glynn-Johnson Door Controls; Division of Allegion, PLC - 90 / 100 / 450 Series (GJ).
   b. Rixson Specialty Door Controls; An ASSA ABLOY Group company - 1 / 9 / 10 Series (RIX).
c. Sargent Manufacturing Company; An ASSA ABLOY Group company - 590 / 690 / 1540 Series (SAR).

2. Characteristics:
   a. Tested to be in accordance with ANSI / BHMA A156.8, Grade 1.
   b. Furnish medium / heavy duty door stops, non-handed / reversible, of a, where detailed, carbon steel base substrate material or 300 Series stainless steel substrate material.
   c. Furnish units with a shock absorbing mechanism for added durability.
   d. All units are to be installed with the jamb bracket mounted on the stop, unless as indicated in the Door Hardware Sets, “Angle Jamb Brackets” are specified to be utilized. Overhead door stops specified with “Angle Jamb Brackets” are used to convert the installation of the units to hinge side mounting.

WALL AND FLOOR STOPS

1. Acceptable Manufacturers:
   b. IVES; Division of Allegion, PLC - WS401CCV / FS439 (IVS).

2. Characteristics:
   a. Tested to be in accordance with ANSI / BHMA A156.16, Grade 1.
   b. Wall stops shall have a solid forged brass housing with a concealed, in the concave bumper, attachment. Furnish with wood screw and plastic anchors.
   c. Floor stops shall be fabricated from solid cast brass or bronze. Furnish with wood screws and plastic anchors / machine screws and lead expansion shield anchors.
   d. Install floor stops in such a position that they permit maximum door swing, but do not present a hazard or obstruction.

ELECTROMAGNETIC DOOR HOLDERS

1. Acceptable Manufacturers:
   a. Rixson Specialty Door Controls; An ASSA ABLOY Group company - Model 998.
   b. LCN; Division of Allegion, PLC (LCN) - SEM7850 Series.

2. Characteristics:
   a. Tested to be in accordance with ANSI / BHMA A156.15, Grade 1.
   b. Furnish electromagnetic door holders designed to hold designated doors in an open position when energized by an electrical current. Electromagnetic door holders shall be designed to operate in conjunction with U.L. Listed fire detectors and manual door closers. When electrical current is interrupted, holder shall become de-energized, releasing door and allowing manual door closer to perform its closing function.
   c. Door holders shall be a low profile, recessed, wall mount, for concealed wiring, and designed to be installed in a single outlet box. The outlet box shall be reinforced to withstand the shock of a door opening, preventing the box anchors from working loose. Electrical Sub-Contractor shall be responsible for furnishing outlet boxes, electrical wiring, conduit, and all other related components.
   d. Furnish door holders which can also be released by a simple manual pull on the door.
   e. Door holders shall be furnished with a Fail-Safe operation. When electrical power failure occurs, doors shall release to close automatically.
   f. Door holders shall be U.L. Listed for installation on smoke barrier 3-hour doors.
   g. Magnets shall be protected against transients and surges up to 600 volts.
   h. Voltage and Current: 120V AC, 50-60 Hz., @ .020 amp. maximum.
   i. Door armature assembly shall be through bolt mounted and furnished with a door reinforcing plate.
   j. For installations where 120V AC input voltage is required, 120V / 24V transformers are required to be furnished to reduce line voltage for 24V holding solenoids.
k. Electrical wiring of these units shall be in accordance with the National Electrical Code (ANSI / NFPA 70) for the appropriate class of circuit.
l. Final installation of these units shall be handled by and coordinated with General Contractor’s Electrical Sub-Contractor.

PUSH AND PULL BARS

1. Acceptable Manufacturers:
   b. Rockwood Manufacturing an ASSA ABLOY Group company – RM4110 Hickory; RM2110-8” (ROC).
   c. H. B. Ives, Division of Allegion PLC – 9190 Series at aluminum entrances (IVE).

2. Characteristics:
   a. Tested to be in accordance with ANSI / BHMA A156.6, Grade 1.
   b. Push and pull bars shall be fabricated of 1” diameter solid bar stock. Push bars shall have a 2-1/2” projection with a 1-1/2” clearance. Pull bars shall have a minimum, 10” center-to-center length, 2-3/4” projection, 1-3/4” clearance, and shall comply with the recommendations of the Americans with Disabilities Act (A.D.A.).
   c. Fasteners: Furnish with one (1) 3/8-16 x 3” steel cone head machine screw with two (2) set screws, and (1) zinc plated, steel screw sleeve, for concealed, thru-bolt, back-to-back, mounting of the Common Ends. Furnish with two (2) 3/8-16 x 2-1/4” machine screws with blind thru-bolts, for mounting of the Free Ends.

KICK PLATES

1. Acceptable Manufacturers:
   a. Hager Hinge Co. – 193S Series
   b. IVES; Division of Allegion, PLC (IVE) - 8400 Series.

2. Characteristics:
   a. Tested to be in accordance with ANSI / BHMA A156.6, Grade 1.
   b. All mop and kick plates shall be US18 gauge (.050”) thick of stainless steel material.
   c. Fabricate mop plates not more than 1 inch less than door widths, on the “Pull” sides, and kick plates not more than 1 inch or 1-1/2 inches less than door widths, on the “Push” sides; or as indicated in Door Hardware Sets.
   d. Heights:
      (1) Kick Plates shall be 8 inches in height.
   e. Bevel three (3) edges.
   f. Fabricate kick plates with countersunk screw holes.
   g. Furnish kick plates with #6 x 5/8” truss head, stainless steel, sheet metal screws.

THRESHOLDS

1. Acceptable Manufacturers:
   a. National Guard Products, Inc. (NGP)
   b. Reese Enterprises, Inc. (RES)
   c. Zero International, Inc.; Division of Allegion, PLC (ZER).

2. Characteristics:
   a. Thresholds shall be certified by an independent testing laboratory to meet the requirements of ANSI / BHMA A156.21 and in accordance with the requirements of A.D.A.A.G. and ICC / ANSI A117.1.
   b. Thresholds shall be no less than a total thickness of .187” and furnished in an aluminum extrusion that is of alloy 6063 hardness T-5.
c. Furnish thresholds with a rugged abrasive “non-skid” finish of a nickel-aluminum composite, which is bonded by a heat-fusion process to the metal surface, by an exothermic reaction, at high temperatures.

d. Thresholds shall be furnished with 1/4”-20 x 3” stainless steel sleeve anchors.

. DOOR SWEEPS

1. Acceptable Manufacturers:
   a. National Guard Products, Inc. (NGP).
   b. Reese Enterprises, Inc. (RES).
   c. Zero International, Inc.; Division of Allegion, PLC (ZER).

2. Characteristics:
   a. Tested to be in accordance with ANSI / BHMA A156.22.
   b. Door sweeps shall be furnished encased in a high quality aluminum extrusion that is of alloy 6063 hardness T-5.
   c. Furnish door sweeps with neoprene seals, rain drip strips, and #6 x 1/2” stainless steel, truss head, sheet metal screw fasteners.

. SELF-ADHESIVE GASKETING

1. Acceptable Manufacturers:
   a. National Guard Products, Inc. (NGP).
   b. Reese Enterprises, Inc. (RES).
   c. Zero International, Inc.; Division of Allegion, PLC (ZER).

2. Characteristics:
   b. Gasketing shall be furnished extruded from high grade silicone, with pressure sensitive, double backed, self-adhesive.
   c. Gasketing shall be classified by UL.

. PERIMETER GASKETING

1. Acceptable Manufacturers:
   a. National Guard Products, Inc. (NGP).
   b. Reese Enterprises, Inc. (RES).
   c. Zero International, Inc.; Division of Allegion, PLC (ZER).

2. Characteristics:
   a. Tested to be in accordance with ANSI / BHMA A156.22.
   b. Gasketing shall be furnished encased in a high quality aluminum extrusion that is of alloy 6063 hardness T-5.
   c. Furnish gasketing with solid neoprene seals and #6 x 3/4” stainless steel, truss head, sheet metal screw fasteners.

. DRIP STRIPS

1. Acceptable Manufacturers:
   a. National Guard Products, Inc. (NGP).
   b. Reese Enterprises, Inc. (RES).
   c. Zero International, Inc.; Division of Allegion, PLC (ZER).
2. Characteristics:
   a. Drip strips shall be furnished in an aluminum extrusion that is of alloy 6063 hardness T-
      5.
   b. Furnish all drip strips #6 x 1/2” stainless steel, truss head, sheet metal screw fasteners.

   HARDWARE AT SOUND SEAL EQUIPPED DOORS

1. Acceptable Manufacturers:
   c. Zero International, Inc.; Division of Allegion, PLC (ZER).
   b. Reese Enterprises, Inc. (RES)
   c. Penko; An ASSA ABLOY Group company (PEM)

2. Adjustable Head and Jamb Seals:
   a. Head and jamb seal housing shall have extruded metal housings with a minimum overall
      thickness of 0.93 inches.
   b. Head and jamb housing shall allow for a minimum of 0.31 inches of adjustability after
      installation.
   c. Seals shall be continuous closed cell sponge neoprene with a minimum width of 0.75
      inches.
   d. Zero Model 770.

3. Automatic Door Bottoms:
   a. Door bottom housing shall have extruded metal housings with a minimum overall
      thickness of 0.83 inches.
   b. Door bottom shall have a minimum vertical travel of 1 inch.
   c. Seal shall be continuous closed cell sponge neoprene with a minimum width of 0.75
      inches.
   d. Zero Model 369 (Mortised).

4. Astragals:
   a. Astragals shall have a minimum depth of 0.50 inches.
   b. Astragals shall allow for a minimum of 0.188 inches of adjustability after installation.
   c. Zero Model 55 & 155 (Surface Mounted)

5. Thresholds:
   a. Thresholds shall be extruded solid metal, ¼” minimum thickness.
   b. Threshold shall be flat without grooves.
   c. Zero Model 164A.

6. Door Closer, Door Holder, and Exit Device Strike Brackets:
   a. Door closer / holder brackets shall be solid steel with a minimum thickness of 0.157
      inches.
   b. Door closer height shall be coordinated with the specified perimeter gasketing to allow
      for complete adjustability of the seals after installation.
   c. Provide brackets as required where top strikes of exit devices would be required to be
      mounted through the perimeter gasketing.
   d. All brackets used on fire doors must be listed by a recognized testing laboratory for that
      use.

DOOR SILENCERS

1. Acceptable Manufacturers:
   a. IVES; Division of Allegion, PLC (IVE) – SR64.
   c. Triangle Brass Manufacturing Company, Inc. (TRI) - 1229A.
2. Characteristics:
   a. Tested to be in accordance with ANSI / BHMA A156.16, Grade 1.
   b. Silencers shall be fabricated from a gray, opaque, rubber material, and featuring a pneumatic design that, once installed, forms an air pocket to absorb shock, reduce noise of door closing, eliminate door rattle, and provide constant tension for door latches or locks.
   c. Silencers shall be installed into pre-drilled hollow metal door frames, which if installed properly, shall become Tamper-Proof.
   d. Silencers shall be installed into pre-drilled wood door frames. To prevent removal, a small brad shall be driven into the stop strips of the wood frames and through the stems of the silencers.
   e. Furnish three (3) for each single door, four (4) for each single “Dutch” door, and two (2) for each pair of doors.

SECURITY EQUIPMENT

1. Acceptable Manufacturers:
   a. Electric Latch Retraction:
      1. Von Duprin; Division of Allegion, PLC – QEL Series (VON)
   b. Power Supplies:
      1. Schlage Lock Company, LLC; Division of Allegion, PLC - PS900 Series (SCH).
      2. Von Duprin, Inc.; Division of Allegion, PLC - PS900 Series (VON).
   c. Key Switches:
      1. Schlage Lock Company, LLC; Division of Allegion, PLC – 653-04-L2 (SCH).

2. Characteristics:
   a. Furnish all items as indicated in Door Hardware Sets.

3. Coordinate all required security equipment items with Division 26 - Electrical, Division 27 - Communications, Division 28 - Electronic Safety and Security, Project Electrical Engineer, Electrical Sub-Contractor, Alarm System’s Engineers, and Access Control System’s Integrators.

CREMONOE BOLTS

1. Acceptable Manufacturers:
   a. Richards Wilcox:
      1. Heavy Duty Cremone Bolt 1028.00310 Series (RW)
      2. Finish – Zinc Plated Steel

2.02 MATERIALS AND FABRICATION

A. Manufacturer’s Name Plate: Do not use manufacturers’ products that have manufacturer’s name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise acceptable to Architect.

1. Manufacturer’s identification will be permitted on rim of lock cylinders only.

B. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer’s standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI / BHMA A156 series standards for each type of hardware item and with ANSI / BHMA A156.18 for finish designations indicated. Do not furnish “optional” materials or forming methods for those indicated, except as otherwise specified.
C. Fasteners: Furnish hardware manufactured to conform to published templates, generally prepared for machine screw installation.

1. Do not furnish hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.

2. Furnish screws for installation with each hardware item. Furnish Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible, including “prepared for paint” surfaces to receive painted finish.

3. Furnish concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of adequately fastening the hardware. Coordinate with wood doors and metal doors and frames where thru-bolts are used as a means of reinforcing the work, furnish sleeves for each thru-bolt or use sex screw fasteners.

2.03 HARDWARE FINISHES

A. Match items to the manufacturer’s standard color and texture finish for the latch and lock sets (or push-pull units if no latch of lock sets).

B. Furnish finishes that match those established by ANSI or, if none established, match the Architect’s sample.

C. Furnish quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with the manufacturer’s standards, but in no case less than specified by the referenced standards, for the applicable units of hardware.

D. The designations used to indicate hardware finishes are those listed in ANSI / BHMA A156.18, “Materials and Finishes”, including coordination with the traditional U.S. finishes, shown by certain manufacturers for their products.

  . Butt Hinges US26D (652) Satin Chromium
    US32D (630) Satin Stainless Steel
  . Continuous Geared Hinges US28 (628) Satin Aluminum, Clear Anodized
  . Mortise Cylinders and Mortise Thumbturn Cylinders US26D (626) Satin Chromium
  . “Construction” Interchangeable Cores US19 (622) Flat Black Coated
  . “Permanent” Interchangeable Cores US26D (626) Satin Chromium
  . Cylindrical Latchsets and Locksets US26D (626) Satin Chromium
  . Mortise Latchsets and Locksets US26D (626) Satin Chromium
  . Exit Devices US26D (626) Satin Chromium
  . Door Closers and Mounting Plates US28 (689) Silver Aluminum Painted
  . Overhead Door Stops / Holders 652 Chrome-Like Coating on Steel
    US32D (630) Satin Stainless Steel
. Wall and Floor Stops US26D (626) Satin Chromium
. Electromagnetic Door Holders AL (689) Powder Coated Aluminum
. Push / Pull Bars US32D (630) Satin Stainless Steel
. Kick Plates US32D (630) Satin Stainless Steel
. Lock Guards US32D (630) Satin Stainless Steel
. Thresholds 719 (US27) Mill Finish Aluminum, Uncoated
. Sound Seal Threshold 719 (US27) Mill Finish Aluminum, Uncoated
. Door Sweeps 628 (US28) Satin Aluminum, Clear Anodized
. Self-Adhesive Gasketing BLACK (Silicone)
. Perimeter Gasketing 628 (US28) Satin Aluminum, Clear Anodized
. Drip Strips 628 (US28) Satin Aluminum, Clear Anodized
. Door Silencers GREY (Rubber)
. Rapid Entry Key Boxes BLACK
. Power Supplies LGR Baked On Light Grey Enamel

PART 3 - EXECUTION

3.01 INSTALLATION

A. Mount hardware units at heights indicated in the following applicable publications, except as specifically indicated or required to comply with governing regulations and, except as otherwise indicated, by the Architect.

1. “Recommended Locations for Builders Hardware for Standard Steel Doors and Frames” by the Door and Hardware Institute.

B. Install each hardware item in compliance with the manufacturer’s instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

C. Sets units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Where scheduled, Door Pulls shall be through-bolted with bolt heads concealed behind Push Plates.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

F. Set thresholds, for exterior and interior doors, in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7, Section 07 92 00 - Joint Sealants.
G. Sound Seals: Comply with manufacturer’s instructions and recommendations to the extent installation requirements are not otherwise indicated.
   1. Silencers shall not be installed on doors equipped with sound seals.
   2. Sound seals shall be installed in coordination with all other scheduled hardware.
   3. Contractor shall adjust all sound seals to provide a light tight seal at the entire perimeter of the door leaf.
   4. All door closers shall operate silently under normal operation.
   5. Apply a continuous bead of non-hardening, paintable sealant between the seal housing and door frame. Do not paint acoustical seals.
   6. Acoustical seals shall be continuous when installed. Do not cut or otherwise modify seals or seal housings for any reason.

H. The hardware installer shall be responsible for installation of all mechanical and electromechanical hardware items contained within this specification, in accordance with the manufacturer’s technical installation guidance, and in addition to all applicable code requirements.

I. The Electrical Sub-Contractor, under Division 26 - Electrical, shall be responsible for providing and installing all (120 VAC) power source wiring as required for the electrified locking and access control hardware, equipment, accessories, and power supplies. This includes quad outlets as required on a dedicated circuit in designated IT / Telecommunication Room(s) and the related conduit, stud-ins, junction boxes, and connectors required for the power source delivery and connections. Provide cabling, conduit, stud-ins, patch cords, fire stop systems, data connectors, junction boxes, and back boxes for both the electrified locking hardware and access control equipment at each of the access controlled or monitored openings per plan drawings and specifications. Provide and install conduit between each of the aforementioned devices and between junction boxes, power supplies, and access control equipment located on or above each door opening.

   Installation of power supplies and interfacing of security system with fire alarm system as required, and coordination of complete security system shall be provided by the Electrical Sub-Contractor, under Division 26 - Electrical. Electrical Sub-Contractor shall be responsible for providing and installing all 120 VAC cabling connections and terminations from the electrical junction boxes to these electrical devices.

J. The Access Control System’s supplier shall be responsible for providing all low-voltage (12 / 24 VDC) wiring and communication cabling (RS-232 / RS-485) installation from network control processors to reader controllers, I / O monitor / control interface panels, electrified and integrated locking hardware, remote card readers, keypads, or display terminals, monitoring and signaling switches, and power supplies, identification, and termination in accordance with the manufacturer’s technical installation guidance, in addition to all applicable code requirements. Installation of all card readers, controllers, software packages, door position switches, and run low voltage wiring from the power supplies / controllers to the electrified hardware items at each opening where specified. The Access Control System’s installer shall also be responsible for connectors, final wire terminations, final hook-ups, testing, system set-up, warranty, and Owner Turnover. Owner Training shall be provided under this Section.

K. Upon completion of the final installation of the Door Hardware and Access Control System, and burn in of the Security System, the Contract Hardware Distributor and the Access Control System’s Supplier shall jointly make final adjustments to the electrified hardware and Access Control System’s openings to insure proper adjustment and function of the opening is in compliance with the system’s functionality requirements.

3.02 ADJUSTING, CLEANING, AND DEMONSTRATING

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, the hardware installers shall return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

B. Clean adjacent surfaces soiled by hardware installation.

C. Door Hardware Supplier’s Field Service:
   1. Instruct Owner’s Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

D. Architect’s Hardware Consultant’s Field Service:
   1. Inspect door hardware items for correct installation and adjustment after complete installation of the door hardware.
   2. File a written report of this inspection directly to the Architect.

E. Continued Maintenance Service: Approximately six (6) months after the acceptance of hardware in each area, the Installer shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner’s personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of any current or predictable problems (of substantial nature) in the performance of the hardware and furnish copy to the Owner’s Agent / Representative.

### HARDWARE SCHEDULE

#### Set No. A-1
Each to have:
- 2 Continuous Hinges 780-112-HD HAG 628
- 2 Sets Push / Pull Bars 159V – BTB Mounted HAG 630
- 2 Door Closers DC6210-A11 x Drop Plate as Required COR 689

#### Set No. A-2
Each to have:
- 2 Continuous Hinges 780-112-HD HAG 628
- 2 Exit Devices CD9847DT VON 626
- 2 Cylinders Corbin / Russwin as Required CT6 COR 626
- 2 Door Closers DC6210-A11 x Drop Plate as Required COR 689

Weatherstrip, thresholds, sweeps complete with aluminum doors.

#### Set No. A-3
Each to have:
- 2 Continuous Hinges 780-112-HD HAG 628
- 1 Exit Device CD9847DT VON 626
- 1 Exit Device CD9847NL VON 626
- 3 Cylinders Corbin / Russwin as Required CT6 COR 626
2 Door Closers DC6210-A11 x Drop Plate as Required 
Weatherstrip, thresholds, sweeps complete with aluminum doors.

<table>
<thead>
<tr>
<th>Set No. A-4</th>
<th>Each to have:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Continuous Hinge</td>
<td>780-112-HD</td>
<td>HAG</td>
<td>628</td>
</tr>
<tr>
<td>1 Continuous Hinge</td>
<td>780-112-HD w/EPT Prep</td>
<td>HAG</td>
<td>628</td>
</tr>
<tr>
<td>1 Power Transfer</td>
<td>EPT-10</td>
<td>VON</td>
<td>689</td>
</tr>
<tr>
<td>1 Exit Device</td>
<td>CD9847DT</td>
<td>VON</td>
<td>626</td>
</tr>
<tr>
<td>1 Exit Device</td>
<td>SD-QEL 9847NL</td>
<td>VON</td>
<td>626</td>
</tr>
<tr>
<td>3 Cylinders</td>
<td>Corbin / Russwin as Required CT6</td>
<td>COR</td>
<td>626</td>
</tr>
<tr>
<td>2 Door Closers</td>
<td>DC6210-A11 x Drop Plate as Required</td>
<td>COR</td>
<td>689</td>
</tr>
<tr>
<td>1 Power Supply</td>
<td>PS902 – 900-2RS – 900-8F</td>
<td>VON</td>
<td>-</td>
</tr>
<tr>
<td>1 Card Reader</td>
<td>By Owner</td>
<td>Weatherstrip, thresholds, sweeps complete with aluminum doors. Card reader, card reader power supply, controller, logic, wire and wiring by others.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set No. A-5</th>
<th>Each to have:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Continuous Hinge</td>
<td>780-112-HD</td>
<td>HAG</td>
<td>628</td>
</tr>
<tr>
<td>1 Continuous Hinge</td>
<td>780-112-HD w/EPT Prep</td>
<td>HAG</td>
<td>628</td>
</tr>
<tr>
<td>1 Power Transfer</td>
<td>EPT-10</td>
<td>VON</td>
<td>689</td>
</tr>
<tr>
<td>1 Exit Device</td>
<td>CD9847DT</td>
<td>VON</td>
<td>626</td>
</tr>
<tr>
<td>1 Exit Device</td>
<td>SD-QEL 9847NL</td>
<td>VON</td>
<td>626</td>
</tr>
<tr>
<td>3 Cylinders</td>
<td>Corbin / Russwin as Required CT6</td>
<td>COR</td>
<td>626</td>
</tr>
<tr>
<td>2 Door Closers</td>
<td>DC6210-A11 x Drop Plate as Required</td>
<td>COR</td>
<td>689</td>
</tr>
<tr>
<td>1 Power Supply</td>
<td>PS902 – 900-2RS – 900-8F</td>
<td>VON</td>
<td>-</td>
</tr>
<tr>
<td>Weatherstrip, thresholds, sweeps complete with aluminum doors. Rough in for future card reader.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set No. E-1</th>
<th>Each to have:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Ea. Butts</td>
<td>BB1191 – NRP</td>
<td>HAG</td>
<td>626</td>
</tr>
<tr>
<td>1 Exit Device</td>
<td>9875NL</td>
<td>VON</td>
<td>626</td>
</tr>
<tr>
<td>1 Cylinder</td>
<td>Corbin / Russwin as Required CT6</td>
<td>COR</td>
<td>626</td>
</tr>
<tr>
<td>1 Door Closer</td>
<td>DC6210 – A12</td>
<td>COR</td>
<td>689</td>
</tr>
<tr>
<td>1 Kick Plate</td>
<td>193S</td>
<td>HAG</td>
<td>630</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>425</td>
<td>NGP</td>
<td>719</td>
</tr>
<tr>
<td>1 Door Sweep</td>
<td>200SA</td>
<td>NGP</td>
<td>628</td>
</tr>
<tr>
<td>1 Set Weatherstrip</td>
<td>700SA – Head &amp; Jambs</td>
<td>NGP</td>
<td>628</td>
</tr>
<tr>
<td>1 Drip Cap</td>
<td>16A x M. O. Width</td>
<td>NGP</td>
<td>628</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set No. E-2</th>
<th>Each to have:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Ea. Butts</td>
<td>BB1191 – NRP</td>
<td>HAG</td>
<td>626</td>
</tr>
<tr>
<td>2 Flush Bolts</td>
<td>282D</td>
<td>HAG</td>
<td>626</td>
</tr>
<tr>
<td>1 Lever Entrance</td>
<td>ML2065 – NSA – CT6</td>
<td>COR</td>
<td>626</td>
</tr>
<tr>
<td>2 Door Closers</td>
<td>DC6210 – A12</td>
<td>COR</td>
<td>689</td>
</tr>
</tbody>
</table>
2 Kick Plates 193S HAG 630
1 Threshold 425HD (0.244 Inches Thick) NGP 719
2 Door Sweeps 200SA NGP 628
1 Set Weatherstrip 700SA – Head & Jambs NGP 628
1 Set Astragals 9600A – 2 Pcs. NGP 628
1 Drip Cap 16A x M. O. Width NGP 628

Set No. E-3
Each to have:
Acoustical doors complete with all required hardware except:
1 or 2 Cylinders Corbin / Russwin as Required CT6 COR 626

Set No. E-4
Each to have:
3 Ea. Butts BB1191 – NRP HAG 626
1 Lever Communicating ML2022 – NSA – CT6 COR 626
1 Door Closer DC6210 – A12 COR 689
1 Set Weatherstrip 700SA – Head, Jambs and Sill NGP 628
1 Drip Cap 16A x M. O. Width NGP 628

Set No. E-5
Each to have:
3 Ea. Butts BB1199 – NRP HAG 626
1 Power Transfer EPT-10 VON 689
1 Exit Device QEL9875NL VON 626
1 Cylinder Corbin / Russwin as Required CT6 COR 626
1 Door Closer DC6210 – A11 COR 689
1 Kick Plate 193S HAG 630
1 Threshold 425HD (0.244 Inches Thick) NGP 719
1 Door Sweep 200SA NGP 628
1 Set Weatherstrip 700SA – Head & Jambs NGP 628
1 Drip Cap 16A x M. O. Width NGP 628
1 Card Reader By Owner
Card reader, card reader power supply, controller, logic, wire and wiring by others.

Set No. E-6
Each to have:
3 Ea. Butts BB1199 – NRP HAG 626
1 Power Transfer EPT-10 VON 689
1 Exit Device QEL9875NL VON 626
1 Cylinder Corbin / Russwin as Required CT6 COR 626
1 Door Closer DC6210 – A11 COR 689
1 Kick Plate 193S HAG 630
1 Threshold 425HD (0.244 Inches Thick) NGP 719
1 Door Sweep 200SA NGP 628
1 Set Weatherstrip 700SA – Head & Jambs NGP 628
1 Drip Cap 16A x M. O. Width NGP 628

Rough in for future card reader.

Set No. E-7
Each to have:
Rolling steel service doors complete with all required hardware.

Set No. 1
Each to have:
<table>
<thead>
<tr>
<th>Set No. 2</th>
<th>Each to have:</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Ea. Butts</td>
<td>BB1279</td>
</tr>
<tr>
<td>1 Lever Passage</td>
<td>CL3310 – NZD</td>
</tr>
<tr>
<td>1 Door Closer</td>
<td>DC6200</td>
</tr>
<tr>
<td>1 Kick Plate</td>
<td>193S</td>
</tr>
<tr>
<td>1 Door Stop</td>
<td>236W</td>
</tr>
<tr>
<td>3 Silencers</td>
<td>SR64</td>
</tr>
</tbody>
</table>

Lift interlock with this door complete with lift system.

<table>
<thead>
<tr>
<th>Set No. 3</th>
<th>Each to have:</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Ea. Butts</td>
<td>BB1168 – (5&quot; High @ Drs. &gt; 3'0&quot;)</td>
</tr>
<tr>
<td>1 Exit Device</td>
<td>9875L-F</td>
</tr>
<tr>
<td>1 Cylinder</td>
<td>Corbin / Russwin as Required CT6</td>
</tr>
<tr>
<td>1 Door Closer</td>
<td>DC6210</td>
</tr>
<tr>
<td>1 Door Closer Mounting Bracket</td>
<td>770SPB</td>
</tr>
<tr>
<td>1 Kick Plate</td>
<td>193S</td>
</tr>
<tr>
<td>1 Door Stop</td>
<td>236W</td>
</tr>
<tr>
<td>1 Set Sound Seal</td>
<td>770SP – Head &amp; Jambs</td>
</tr>
<tr>
<td>1 Auto Door Bottom</td>
<td>369 w/ End Caps</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>164A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set No. 4</th>
<th>Each to have:</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Ea. Butts</td>
<td>BB1279</td>
</tr>
<tr>
<td>2 Flush Bolts</td>
<td>282D</td>
</tr>
<tr>
<td>1 Dust Proof Strike</td>
<td>280X</td>
</tr>
<tr>
<td>1 Lever Office</td>
<td>CL3351 – NZD – CT6</td>
</tr>
<tr>
<td>2 Door Closers</td>
<td>DC6210/DC6200</td>
</tr>
<tr>
<td>2 Kick Plates</td>
<td>193S</td>
</tr>
<tr>
<td>2 Door Stops</td>
<td>236W</td>
</tr>
<tr>
<td>2 Silencers</td>
<td>SR64</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set No. 5</th>
<th>Each to have:</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Ea. Butts</td>
<td>BB1279</td>
</tr>
<tr>
<td>1 Lever Office</td>
<td>CL3351 – NZD – CT6</td>
</tr>
<tr>
<td>1 Door Closer</td>
<td>DC6200</td>
</tr>
<tr>
<td>1 Kick Plate</td>
<td>193S</td>
</tr>
<tr>
<td>1 Door Stop</td>
<td>236W/241F</td>
</tr>
<tr>
<td>3 Silencers</td>
<td>SR64</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set No. 6</th>
<th>Each to have:</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Ea. Butts</td>
<td>BB1279</td>
</tr>
<tr>
<td>1 Lever Office</td>
<td>CL3351 – NZD – CT6</td>
</tr>
<tr>
<td>1 Door Closer</td>
<td>DC6210 – A11</td>
</tr>
<tr>
<td>1 Door Closer Mounting Bracket</td>
<td>770SPB</td>
</tr>
</tbody>
</table>
1 Kick Plate 193S HAG 630
1 Door Stop 241F HAG 626
1 Set Sound Seal 770SP – Head & Jambs ZER 628
1 Auto Door Bottom 369 w/ End Caps ZER 628
1 Threshold 164A ZER 719

Set No. 7
Each to have:
6 Ea. Butts BB1279 HAG 652
2 Flush Bolts 282D HAG 626
1 Lever Office CL3351 – NZD – CT6 COR 626
2 Door Closers DC6200 COR 689
2 Kick Plates 193S HAG 630
2 Door Stops 236W HAG 626
1 Set Sound Seal 770SP – Head & Jambs ZER 628
1 Set Astragals 55AA & 155AA ZER 628
2 Auto Door Bottoms 369 w/ End Caps ZER 628
1 Threshold 164A ZER 719

Set No. 8
Each to have:
3 Ea. Butts BB1279 HAG 652
1 Lever Office CL3351 – NZD – CT6 COR 626
1 Door Closer DC6200 COR 626
1 Kick Plate 193S HAG 630
1 Door Stop 236W HAG 626
1 Set Sound Seal 770SP – Head & Jambs ZER 628
1 Auto Door Bottom 369 w/ End Caps ZER 628
1 Threshold 164A ZER 719

Set No. 9
Each to have:
3 Ea. Butts BB1168 HAG 652
1 Power Transfer EPT-10 VON 689
1 Exit Device QEL9875L-F VON 626
2 Cylinders Corbin / Russwin as Required CT6 COR 626
1 Door Closer / Holder 4040SE Pull Side Mounted LCN 689
1 Overhead Stop GJ90S series GI 630
1 Door Stop Mounting Bracket 770SPB ZER 689
1 Kick Plate 193S HAG 630
1 Set Sound Seal 770SP – Head & Jambs ZER 628
1 Auto Door Bottom 369 w/ End Caps ZER 628
1 Key Switch 653-04-L2 SCH -
1 Power Supply PS902 – 9002RS – 900FA VON -
1 Threshold Expansion Joint Flush By Others
Fire alarm power, relay, wire and wiring by others.
Building electrical power, wire and wiring by others.

Set No. 10
Each to have:
6 Ea. Butts BB1168 HAG 652
2 Power Transfers EPT-10 VON 689
2 Exit Devices QEL9827L-F-LBR VON 626
2 Exit Dev. Strike Mtg. Brackets 770SPB ZER 689
### Design Release Package 4

**Issued:** 12/01/2017

**1. SET NO. 11**
- **Each to have:**
  - **3** Ea. Butts: BB1168 (4 Ea. @ Doors > 7'0"")
  - **1** Power Transfer: EPT-10
  - **1** Exit Device: QEL9875L-F x M52 Trim @ Doors 207C-C & 207C-B; 06 Trim @ All Other Doors.
  - **2** Cylinders: Corbin / Russwin as Required CT6
  - **1** Door Closer: DC6200-A11
  - **1** Door Closer Mounting Bracket: 770SPB
  - **1** Kick Plate: 193S
  - **1** Set Sound Seal: 770SP – Head & Jambs
  - **1** Auto Door Bottom: 369 w/ End Caps
  - **1** Threshold: 164A
  - **1** Key Switch: 653-04-L2
  - **1** Power Supply: PS902 – 9002RS – 900FA

**Fire alarm power, relay, wire and wiring by others.**

**Building electrical power, wire and wiring by others.**

### Design Release Package 4

**Issued:** 12/01/2017

**1. SET NO. 12**
- **Each to have:**
  - **3** Ea. Butts: BB1168 – 5” High
  - **1** Lever Office: CL3351 – NZD – CT6
  - **1** Door Closer: DC6200
  - **1** Kick Plate: 193S
  - **1** Set Sound Seal: 770SP – Head & Jambs
  - **1** Auto Door Bottom: 369 w/ End Caps
  - **1** Threshold: 164A
  - **1** Key Switch: 653-04-L2
  - **1** Power Supply: PS902 – 9002RS – 900FA

**Fire alarm power, relay, wire and wiring by others.**

**Building electrical power, wire and wiring by others.**

### Design Release Package 4

**Issued:** 12/01/2017

**1. SET NO. 13**
- **Each to have:**
  - **3** Ea. Butts: BB1279 (4 Ea. @ Doors > 7'0"")
  - **1** Lever Storeroom: CL3357 – NZD – CT6
  - **1** Door Closer: DC6200
  - **1** Kick Plate: 193S
  - **1** Door Stop: 241F
  - **3** Silencers: SR64

**Set No. 14**
- **Each to have:**
  - **3** Ea. Butts: BB1279
  - **1** Lever Storeroom: CL3357 – NZD – CT6
  - **1** Door Closer: DC6210-A11
  - **3** Silencers: SR64
Lift interlock with this door complete with lift system.

<table>
<thead>
<tr>
<th>Set No. 15</th>
<th>Each to have:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Ea. Butts</td>
<td>282D</td>
<td>HAG 652</td>
</tr>
<tr>
<td>2</td>
<td>Flush Bolts</td>
<td>193S</td>
<td>HAG 626</td>
</tr>
<tr>
<td>1</td>
<td>Lever Office</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td>2</td>
<td>Door Closers</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td>2</td>
<td>Kick Plates</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td>2</td>
<td>Door Stops</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td>2</td>
<td>Silencers</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td>1</td>
<td>Threshold</td>
<td>BB1279</td>
<td>HAG 652</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set No. 16</th>
<th>Each to have:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Ea. Butts</td>
<td>282D</td>
<td>HAG 652</td>
</tr>
<tr>
<td>2</td>
<td>Flush Bolts</td>
<td>193S</td>
<td>HAG 626</td>
</tr>
<tr>
<td>1</td>
<td>Lever Office</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td>2</td>
<td>Door Closers</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td>1</td>
<td>Set Sound Seal</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td>1</td>
<td>Set Astragals</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td>2</td>
<td>Auto Door Bottoms</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td>1</td>
<td>Threshold</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set No. 17</th>
<th>Each to have:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Ea. Butts</td>
<td>BB1279</td>
<td>HAG 652</td>
</tr>
<tr>
<td>1</td>
<td>Lever Office</td>
<td>DC6200-A11</td>
<td>COR 689</td>
</tr>
<tr>
<td>1</td>
<td>Door Closer</td>
<td>DC6210</td>
<td>COR 689</td>
</tr>
<tr>
<td>1</td>
<td>Kick Plate</td>
<td>193S</td>
<td>HAG 630</td>
</tr>
<tr>
<td>3</td>
<td>Silencers</td>
<td>SR64</td>
<td>IVE - -</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set No. 18</th>
<th>Each to have:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Ea. Butts</td>
<td>BB1168</td>
<td>HAG 652</td>
</tr>
<tr>
<td>2</td>
<td>Flush Bolts</td>
<td>282D – 1/24” 1/12”</td>
<td>HAG 652</td>
</tr>
<tr>
<td>1</td>
<td>Lever Office</td>
<td>DC6210</td>
<td>COR 689</td>
</tr>
<tr>
<td>2</td>
<td>Door Closers</td>
<td>DC6210</td>
<td>COR 689</td>
</tr>
<tr>
<td>2</td>
<td>Door Closer Mounting Brackets</td>
<td>770SPB</td>
<td>ZER 689</td>
</tr>
<tr>
<td>2</td>
<td>Kick Plates</td>
<td>193S</td>
<td>HAG 630</td>
</tr>
<tr>
<td>2</td>
<td>Door Stops</td>
<td>236W</td>
<td>HAG 630</td>
</tr>
<tr>
<td>1</td>
<td>Set Sound Seal</td>
<td>770SP – Head &amp; Jambs</td>
<td>ZER 689</td>
</tr>
<tr>
<td>1</td>
<td>Set Astragals</td>
<td>55AA &amp; 155AA</td>
<td>ZER 689</td>
</tr>
<tr>
<td>2</td>
<td>Auto Door Bottoms</td>
<td>369 w/ End Caps</td>
<td>ZER 689</td>
</tr>
<tr>
<td>1</td>
<td>Threshold</td>
<td>369 w/ End Caps</td>
<td>ZER 689</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set No. 19</th>
<th>Each to have:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Ea. Butts</td>
<td>BB1168</td>
<td>HAG 652</td>
</tr>
<tr>
<td>2</td>
<td>Exit Devices</td>
<td>9827L-F-LBR</td>
<td>VON 626</td>
</tr>
<tr>
<td>2</td>
<td>Cylinders</td>
<td>Corbin / Russwin as Required CT6</td>
<td>COR 626</td>
</tr>
<tr>
<td>2</td>
<td>Door Closers</td>
<td>DC6200</td>
<td>COR 689</td>
</tr>
<tr>
<td>Set No.</td>
<td>Each to have:</td>
<td>Identity</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>---------------</td>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td>20</td>
<td>3 Ea. Butts</td>
<td>BB1168 – 5” High</td>
<td>HAG 652</td>
</tr>
<tr>
<td></td>
<td>1 Exit Device</td>
<td>9875L-F</td>
<td>VON 626</td>
</tr>
<tr>
<td></td>
<td>1 Cylinder</td>
<td>Corbin / Russwin as Required CT6</td>
<td>COR 626</td>
</tr>
<tr>
<td></td>
<td>1 Door Closer</td>
<td>DC6210</td>
<td>COR 689</td>
</tr>
<tr>
<td></td>
<td>1 Kick Plate</td>
<td>193S</td>
<td>HAG 630</td>
</tr>
<tr>
<td></td>
<td>1 Door Stop</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td></td>
<td>3 Silencers</td>
<td>SR64</td>
<td>IVE - -</td>
</tr>
<tr>
<td>21</td>
<td>3 Ea. Butts</td>
<td>BB1279</td>
<td>HAG 652</td>
</tr>
<tr>
<td></td>
<td>1 Lever Classroom</td>
<td>CL3355 – NZD – CT6</td>
<td>COR 626</td>
</tr>
<tr>
<td></td>
<td>1 Door Closer</td>
<td>DC6210-A11</td>
<td>COR 689</td>
</tr>
<tr>
<td></td>
<td>1 Kick Plate</td>
<td>193S</td>
<td>HAG 630</td>
</tr>
<tr>
<td></td>
<td>3 Silencers</td>
<td>SR64</td>
<td>IVE - -</td>
</tr>
<tr>
<td>22</td>
<td>4 Ea. Butts</td>
<td>BB1168</td>
<td>HAG 652</td>
</tr>
<tr>
<td></td>
<td>1 Exit Device</td>
<td>9875L-F</td>
<td>VON 626</td>
</tr>
<tr>
<td></td>
<td>1 Cylinder</td>
<td>Corbin / Russwin as Required CT6</td>
<td>COR 626</td>
</tr>
<tr>
<td></td>
<td>1 Door Closer</td>
<td>DC6200</td>
<td>COR 689</td>
</tr>
<tr>
<td></td>
<td>1 Kick Plate</td>
<td>193S</td>
<td>HAG 630</td>
</tr>
<tr>
<td></td>
<td>1 Door Stop</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td></td>
<td>3 Silencers</td>
<td>SR64</td>
<td>IVE - -</td>
</tr>
<tr>
<td>23</td>
<td>3 Ea. Butts</td>
<td>BB1279</td>
<td>HAG 652</td>
</tr>
<tr>
<td></td>
<td>1 Lever Office</td>
<td>CL3351 – NZD – CT6</td>
<td>COR 626</td>
</tr>
<tr>
<td></td>
<td>1 Door Closer</td>
<td>DC6200</td>
<td>COR 689</td>
</tr>
<tr>
<td></td>
<td>1 Kick Plate</td>
<td>193S</td>
<td>HAG 630</td>
</tr>
<tr>
<td></td>
<td>1 Magnetic Holder</td>
<td>FM998</td>
<td>RIX 689</td>
</tr>
<tr>
<td></td>
<td>3 Silencers</td>
<td>SR64</td>
<td>IVE - -</td>
</tr>
</tbody>
</table>

Fire alarm power, relays, wire and wiring by others.

Set No. 24
dEach to have:

<table>
<thead>
<tr>
<th>Set No.</th>
<th>Each to have:</th>
<th>Identity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>3 Ea. Butts</td>
<td>BB1279</td>
<td>HAG 652</td>
</tr>
<tr>
<td></td>
<td>1 Lever Passage</td>
<td>CL3310 – NZD</td>
<td>COR 626</td>
</tr>
<tr>
<td></td>
<td>1 Door Closer</td>
<td>DC6200</td>
<td>COR 689</td>
</tr>
<tr>
<td></td>
<td>1 Kick Plate</td>
<td>193S</td>
<td>HAG 630</td>
</tr>
<tr>
<td>Set No.</td>
<td>Description</td>
<td>Model</td>
<td>Brand</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>25</td>
<td>Each to have:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Ea. Butts</td>
<td>BB1168</td>
<td>HAG 652</td>
</tr>
<tr>
<td>1</td>
<td>Exit Device</td>
<td>9875L</td>
<td>VON 626</td>
</tr>
<tr>
<td>1</td>
<td>Cylinder</td>
<td>Corbin / Russwin as Required CT6</td>
<td>COR 626</td>
</tr>
<tr>
<td>1</td>
<td>Door Closer</td>
<td>DC6210-A11</td>
<td>COR 689</td>
</tr>
<tr>
<td>1</td>
<td>Door Closer Mounting Bracket</td>
<td>770SPB</td>
<td>ZER 689</td>
</tr>
<tr>
<td>1</td>
<td>Kick Plate</td>
<td>193S</td>
<td>HAG 630</td>
</tr>
<tr>
<td>1</td>
<td>Set Sound Seal</td>
<td>770SP – Head &amp; Jambs</td>
<td>ZER 628</td>
</tr>
<tr>
<td>1</td>
<td>Auto Door Bottom</td>
<td>369 w/ End Caps</td>
<td>ZER 628</td>
</tr>
<tr>
<td>1</td>
<td>Threshold</td>
<td>164A</td>
<td>ZER 719</td>
</tr>
<tr>
<td>26</td>
<td>Each to have:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Ea. Butts</td>
<td>BB1168</td>
<td>HAG 652</td>
</tr>
<tr>
<td>1</td>
<td>Exit Device</td>
<td>9875L</td>
<td>VON 626</td>
</tr>
<tr>
<td>1</td>
<td>Cylinder</td>
<td>Corbin / Russwin as Required CT6</td>
<td>COR 626</td>
</tr>
<tr>
<td>1</td>
<td>Door Closer</td>
<td>DC6210-A11</td>
<td>COR 689</td>
</tr>
<tr>
<td>1</td>
<td>Door Closer Mounting Bracket</td>
<td>770SPB</td>
<td>ZER 689</td>
</tr>
<tr>
<td>1</td>
<td>Kick Plate</td>
<td>193S</td>
<td>HAG 630</td>
</tr>
<tr>
<td>1</td>
<td>Set Sound Seal</td>
<td>770SP – Head &amp; Jambs</td>
<td>ZER 628</td>
</tr>
<tr>
<td>1</td>
<td>Auto Door Bottom</td>
<td>369 w/ End Caps</td>
<td>ZER 628</td>
</tr>
<tr>
<td>1</td>
<td>Threshold</td>
<td>164A</td>
<td>ZER 719</td>
</tr>
<tr>
<td>27</td>
<td>Each to have:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Ea. Butts</td>
<td>BB1168</td>
<td>HAG 652</td>
</tr>
<tr>
<td>1</td>
<td>Lever Passage</td>
<td>ML2010 – 110 Salvador</td>
<td>COR 626</td>
</tr>
<tr>
<td>1</td>
<td>Door Closer</td>
<td>DC6210</td>
<td>COR 689</td>
</tr>
<tr>
<td>1</td>
<td>Kick Plate</td>
<td>193S</td>
<td>HAG 630</td>
</tr>
<tr>
<td>1</td>
<td>Door Stop</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td>3</td>
<td>Silencers</td>
<td>SR64</td>
<td>IVE</td>
</tr>
<tr>
<td>28</td>
<td>Each to have:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Ea. Butts</td>
<td>BB1168 (4 Ea. @ Doors &gt; 7'0&quot;)</td>
<td>HAG 652</td>
</tr>
<tr>
<td>1</td>
<td>Exit Device</td>
<td>9875L</td>
<td>VON 626</td>
</tr>
<tr>
<td>1</td>
<td>Cylinder</td>
<td>Corbin / Russwin as Required CT6</td>
<td>COR 626</td>
</tr>
<tr>
<td>1</td>
<td>Door Closer</td>
<td>DC6210</td>
<td>COR 689</td>
</tr>
<tr>
<td>1</td>
<td>Kick Plate</td>
<td>193S</td>
<td>HAG 630</td>
</tr>
<tr>
<td>1</td>
<td>Door Stop</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td>3</td>
<td>Silencers</td>
<td>SR64</td>
<td>IVE</td>
</tr>
<tr>
<td>29</td>
<td>Each to have:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Ea. Butts</td>
<td>BB1168</td>
<td>HAG 652</td>
</tr>
<tr>
<td>2</td>
<td>Exit Devices</td>
<td>9827L x M52 Trim x LBR</td>
<td>VON 626</td>
</tr>
<tr>
<td>2</td>
<td>Cylinders</td>
<td>Corbin / Russwin as Required CT6</td>
<td>COR 626</td>
</tr>
<tr>
<td>2</td>
<td>Door Closer</td>
<td>DC6210</td>
<td>COR 689</td>
</tr>
<tr>
<td>Item</td>
<td>Set No.</td>
<td>Qty</td>
<td>Item</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------</td>
<td>-----</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Kick Plates</td>
<td>193S</td>
<td>2</td>
<td>Door Stops</td>
</tr>
<tr>
<td>Silencers</td>
<td>SR64</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td><strong>Set No. 30</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Each to have:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Ea. Butts</td>
<td>BB1168</td>
<td>8</td>
<td>Exit Devices</td>
</tr>
<tr>
<td>2 Exit Device Stk. Mtg. Brackets</td>
<td>770SPB</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2 Cylinders</td>
<td>Corbin / Russwin as Required CT6</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2 Door Closers</td>
<td>DC6210</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2 Door Closer Mounting Brackets</td>
<td>770SPB</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Kick Plates</td>
<td>193S</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Door Stops</td>
<td>236W</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1 Set Sound Seal</td>
<td>770SP – Head &amp; Jambs</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1 Set Astragals</td>
<td>55AA &amp; 155AA</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2 Auto Door Bottoms</td>
<td>369 w/ End Caps</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1 Threshold</td>
<td>164A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Set No. 31</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Each to have:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Ea. Butts</td>
<td>BB1279</td>
<td>4</td>
<td>Lever Storeroom</td>
</tr>
<tr>
<td>1 Door Closser</td>
<td>DC6210</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1 Door Closer Mounting Bracket</td>
<td>770SPB</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Kick Plate</td>
<td>193S</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Door Stop</td>
<td>236W</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1 Set Sound Seal</td>
<td>770SP – Head &amp; Jambs</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1 Auto Door Bottom</td>
<td>369 w/ End Caps</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1 Threshold</td>
<td>164A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Set No. 32</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Each to have:</td>
<td></td>
<td></td>
<td>Acoustical doors complete with hardware except:</td>
</tr>
<tr>
<td>1 or 2 Cylinders</td>
<td>Corbin / Russwin as Required CT6</td>
<td>1 or 2</td>
<td></td>
</tr>
<tr>
<td>Where required, expansion joint flush threshold by others.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Set No. 33</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Each to have:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Ea. Butts</td>
<td>BB1168</td>
<td>3</td>
<td>Push Plate</td>
</tr>
<tr>
<td>1 Pull Plate</td>
<td>H33G – 4” x 16”</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1 Door Closser</td>
<td>DC6210- A11</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1 Door Closer Mounting Bracket</td>
<td>770SPB</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Kick Plate</td>
<td>193S</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1 Set Sound Seal</td>
<td>770SP – Head &amp; Jambs</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1 Auto Door Bottom</td>
<td>369 w/ End Caps</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1 Threshold</td>
<td>164A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Set No. 34</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Each to have:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Ea. Butts</td>
<td>BB1168 (5” High @ Doors &gt; 3’0” Width)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>1 Push Plate</td>
<td>30S – 8” x 16”</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1 Pull</td>
<td>RM2110 – 8”</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1 Door Closser</td>
<td>DC6210- A11</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Set No.</td>
<td>Item Description</td>
<td>Part No.</td>
<td>Manufacturer</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------------------------------------</td>
<td>----------</td>
<td>--------------</td>
</tr>
<tr>
<td>35</td>
<td>Door Closer Mounting Bracket</td>
<td>770SPB</td>
<td>ZER 689</td>
</tr>
<tr>
<td>35</td>
<td>Kick Plate</td>
<td>193S</td>
<td>HAG 630</td>
</tr>
<tr>
<td>35</td>
<td>Set Sound Seal</td>
<td>770SP – Head &amp; Jambs</td>
<td>ZER 628</td>
</tr>
<tr>
<td>35</td>
<td>Auto Door Bottom</td>
<td>369 w/ End Caps</td>
<td>ZER 628</td>
</tr>
<tr>
<td>35</td>
<td>Threshold</td>
<td>164A</td>
<td>ZER 719</td>
</tr>
<tr>
<td>36</td>
<td>Door Closer Mounting Bracket</td>
<td>770SPB</td>
<td>ZER 689</td>
</tr>
<tr>
<td>36</td>
<td>Kick Plate</td>
<td>193S</td>
<td>HAG 630</td>
</tr>
<tr>
<td>36</td>
<td>Door Stop</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td>36</td>
<td>Set Sound Seal</td>
<td>770SP – Head &amp; Jambs</td>
<td>ZER 628</td>
</tr>
<tr>
<td>36</td>
<td>Auto Door Bottom</td>
<td>369 w/ End Caps</td>
<td>ZER 628</td>
</tr>
<tr>
<td>36</td>
<td>Threshold</td>
<td>164A</td>
<td>ZER 719</td>
</tr>
<tr>
<td>37</td>
<td>Door Closer Mounting Bracket</td>
<td>770SPB</td>
<td>ZER 689</td>
</tr>
<tr>
<td>37</td>
<td>Kick Plate</td>
<td>193S</td>
<td>HAG 630</td>
</tr>
<tr>
<td>37</td>
<td>Door Stop</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td>37</td>
<td>Set Sound Seal</td>
<td>770SP – Head &amp; Jambs</td>
<td>ZER 628</td>
</tr>
<tr>
<td>37</td>
<td>Auto Door Bottom</td>
<td>369 w/ End Caps</td>
<td>ZER 628</td>
</tr>
<tr>
<td>37</td>
<td>Threshold</td>
<td>164A</td>
<td>ZER 719</td>
</tr>
<tr>
<td>38</td>
<td>Door Closer Mounting Bracket</td>
<td>770SPB</td>
<td>ZER 689</td>
</tr>
<tr>
<td>38</td>
<td>Kick Plate</td>
<td>193S</td>
<td>HAG 630</td>
</tr>
<tr>
<td>38</td>
<td>Door Stop</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td>38</td>
<td>Set Sound Seal</td>
<td>770SP – Head &amp; Jambs</td>
<td>ZER 628</td>
</tr>
<tr>
<td>38</td>
<td>Auto Door Bottom</td>
<td>369 w/ End Caps</td>
<td>ZER 628</td>
</tr>
<tr>
<td>38</td>
<td>Threshold</td>
<td>164A</td>
<td>ZER 719</td>
</tr>
<tr>
<td>39</td>
<td>Door Closer Mounting Bracket</td>
<td>770SPB</td>
<td>ZER 689</td>
</tr>
<tr>
<td>39</td>
<td>Kick Plate</td>
<td>193S</td>
<td>HAG 630</td>
</tr>
<tr>
<td>39</td>
<td>Door Stop</td>
<td>236W</td>
<td>HAG 626</td>
</tr>
<tr>
<td>39</td>
<td>Set Sound Seal</td>
<td>770SP – Head &amp; Jambs</td>
<td>ZER 628</td>
</tr>
<tr>
<td>39</td>
<td>Auto Door Bottom</td>
<td>369 w/ End Caps</td>
<td>ZER 628</td>
</tr>
<tr>
<td>39</td>
<td>Threshold</td>
<td>164A</td>
<td>ZER 719</td>
</tr>
</tbody>
</table>

**Set No. 35**

<table>
<thead>
<tr>
<th>Each to have:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Ea. Butts</td>
<td>BB1279</td>
</tr>
<tr>
<td>2 Flush Bolts</td>
<td>282D</td>
</tr>
<tr>
<td>1 Dust Proof Strike</td>
<td>280X</td>
</tr>
<tr>
<td>1 Lever Office</td>
<td>CL3351 – NZD – CT6</td>
</tr>
<tr>
<td>2 Kick Plates</td>
<td>193S</td>
</tr>
<tr>
<td>2 Door Stops</td>
<td>236W</td>
</tr>
<tr>
<td>2 Silencers</td>
<td>SR64</td>
</tr>
</tbody>
</table>

**Set No. 36**

<table>
<thead>
<tr>
<th>Each to have:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Ea. Butts</td>
<td>BB1279</td>
</tr>
<tr>
<td>1 Lever Office</td>
<td>CL3351 – NZD – CT6</td>
</tr>
<tr>
<td>1 Door Stop</td>
<td>236W</td>
</tr>
<tr>
<td>1 Set Sound Seal</td>
<td>770SP – Head &amp; Jambs</td>
</tr>
<tr>
<td>1 Auto Door Bottom</td>
<td>369 w/ End Caps</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>164A</td>
</tr>
</tbody>
</table>

**Set No. 37**

<table>
<thead>
<tr>
<th>Each to have:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Ea. Butts</td>
<td>BB1279</td>
</tr>
<tr>
<td>1 Lever Office</td>
<td>CL3351 – NZD – CT6</td>
</tr>
<tr>
<td>1 Door Closer</td>
<td>DC6200</td>
</tr>
<tr>
<td>1 Door Stop</td>
<td>236W</td>
</tr>
<tr>
<td>1 Set Sound Seal</td>
<td>770SP – Head &amp; Jambs</td>
</tr>
<tr>
<td>1 Auto Door Bottom</td>
<td>369 w/ End Caps</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>164A</td>
</tr>
</tbody>
</table>

**Set No. 38**

<table>
<thead>
<tr>
<th>Each to have:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Ea. Butts</td>
<td>BB1168 (8 Ea. @ Doors &gt; 7’0”)</td>
</tr>
<tr>
<td>2 Exit Devices</td>
<td>9827L x M52 Trim @ Door 104F x LBR</td>
</tr>
<tr>
<td>2 Exit Device Stk. Mtg. Brackets</td>
<td>770SPB</td>
</tr>
<tr>
<td>2 Cylinders</td>
<td>Corbin / Russwin as Required CT6</td>
</tr>
<tr>
<td>2 Door Closers</td>
<td>DC6210-A12</td>
</tr>
<tr>
<td>2 Door Closers</td>
<td>DC6210-A12</td>
</tr>
<tr>
<td>2 Kick Plates</td>
<td>193S</td>
</tr>
<tr>
<td>1 Set Sound Seal</td>
<td>770SP – Head &amp; Jambs</td>
</tr>
<tr>
<td>1 Set Astragals</td>
<td>55AA &amp; 155AA</td>
</tr>
<tr>
<td>2 Auto Door Bottoms</td>
<td>369 w/ End Caps</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>Expansion Joint Flush Threshold By Others</td>
</tr>
</tbody>
</table>

**Set No. 39**

<table>
<thead>
<tr>
<th>Each to have:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Ea. Invisible Hinges</td>
<td>218</td>
</tr>
<tr>
<td>4 Push / Pulls</td>
<td>RM4110 Wood, Hickory, 24” BTB</td>
</tr>
<tr>
<td>2 Door Closers</td>
<td>DC6210-A12</td>
</tr>
<tr>
<td>2 Kick Plates</td>
<td>193S</td>
</tr>
</tbody>
</table>

**DESIGN RELEASE PACKAGE 4**

**ISSUED:** 12/01/2017
2 Silencers SR64 IVE - -
1 Threshold Expansion Joint Flush Threshold By Others

Set No. 40
Each to have:
6 Ea. Butts BB1168 (8 Ea. @ Doors > 7'0'') HAG 652
2 Push Plate 30S – 8’’ x 16’’ HAG 630
2 Pull Plates H33G – 4’’ x 16’’ (Omit @ Door 104G-B) HAG 630
2 Pulls RM2110 – 8’’ @ Door 104G-B ROC 626
2 Door Closers DC6210-A12 COR 689
2 Door Closer Mounting Brackets 770SPB ZER 689
2 Kick Plates 193S HAG 630
1 Set Sound Seal 770SP – Head & Jambs ZER 628
1 Set Astragals 55AA & 155AA ZER 628
2 Auto Door Bottoms 369 w/ End Caps ZER 628
1 Threshold Expansion Joint Flush Threshold By Others

Set No. 41
Each to have:
8 Ea. Invisible Hinges 218 SOS 626
4 Push / Pulls RM4110 Wood, Hickory, 24” BTB ROC 630
2 Door Closers DC6210-A12 COR 689
2 Kick Plates 193S HAG 630
2 Silencers SR64 IVE - -
1 Threshold Expansion Joint Flush Threshold By Others

Set No. 42
Each to have:
3 Ea. Butts BB1279 (4 Ea. @ Doors > 7’0’’) HAG 652
1 Lever Office CL3351 – NZD – CT6 COR 626
1 Door Stop 236W HAG 626
3 Silencers SR64 IVE - -

Set No. 43
Each to have:
3 Ea. Butts BB1279 (4 Ea. @ Doors > 7’0’’) HAG 652
1 Lever Storeroom CL3357 – NZD – CT6 COR 626
1 Door Stop 236W HAG 626
1 Set Sound Seal 770SP – Head & Jambs ZER 628
1 Auto Door Bottom 369 w/ End Caps ZER 628
1 Threshold 164A ZER 719

Set No. 44
Each to have:
3 Ea. Butts BB1279 HAG 652
1 Lever Storeroom CL3357 – NZD – CT6 COR 626
1 Door Stop 236W HAG 626
3 Silencers SR64 IVE - -
### Set No. 45
Each to have:
- **3 Ea. Butts**: BB1279  
  HAG  652
- **1 Lever Privacy**: CL3320 – NZD  
  COR  626
- **1 Kick Plate**: 193S  
  HAG  630
- **1 Door Stop**: 236W / 241F  
  HAG  626
- **3 Silencers**: SR64  
  IVE  - -

### Set No. 46
Each to have:
- **18 Ea. Butts**: BB1168 – 5”  
  HAG  652
- **2 Cremone Bolt**
  1028.00320.020  
  RW  US2C
- **2 Cremone Bolt Handles**
  1028.00330  
  RW  US2C
- **1 Cremone Bolt Hasp**
  1028.00360  
  RW  US2C
- **1 Padlock**
  PL5270 w/8000 IC – CT6  
  COR  - -
- **2 Door Closers**
  DC8210-12  
  COR  689
- **2 Cremone Bolt Hasp**
  770SPB  
  ZER  689
- **2 Kick Plates**
  193S – 36” High  
  HAG  630
- **1 Set Sound Seal**
  770SP – head & Jambs  
  ZER  628
- **1 Set Astragals**
  55AA & 155AA  
  ZER  628
- **2 Auto Door Bottoms**
  369 w/ End Caps  
  ZER  628
- **1 Threshold**
  Expansion Joint Flush Threshold By Others

### Set No. 47
Each to have:
- **3 Ea. Butts**: BB1168  
  HAG  652
- **1 Push Plate**
  30S – 8” x 16”  
  HAG  630
- **1 Pull Plate**
  H33G – 4” x 16”  
  HAG  630
- **1 Door Closer**
  DC6200  
  COR  689
- **1 Kick Plate**: 193S  
  HAG  630
- **1 Door Stop**: 236W  
  HAG  626
- **3 Silencers**
  SR64  
  IVE  - -

### Set No. 48
Each to have:
- **3 Ea. Butts**: BB1279  
  HAG  652
- **1 Exit Device**
  9875NL  
  VON  626
- **1 Cylinder**
  Corbin / Russwin as Required – CT6  
  COR  626
- **1 Door Closer**
  DC6210-A11  
  COR  689
- **1 Door Closer Mounting Bracket**
  770SPB  
  ZER  689
- **1 Kick Plate**: 193S  
  HAG  630
- **1 Set Sound Seal**
  770SP – Head & Jambs  
  ZER  628
- **1 Auto Door Bottom**
  369 w/ End Caps  
  ZER  628
- **1 Threshold**
  164A  
  ZER  719

### Set No. 49
Each to have:
- **6 Ea. Butts**: BB1279  
  HAG  652
- **2 Flush Bolts**
  282D  
  HAG  626
- **1 Lever Office**
  CL3351 – NZD – CT6  
  COR  626
- **2 Kick Plates**: 193S  
  HAG  630
2 Door Holders  
GJ90H Series  
GJ  630

2 Silencers  
SR64  
IVE  - -

1 Threshold  
Expansion Joint Flush Threshold By Others

Set No. 50
Each to have:
6 Ea. Butts  
BB1168  
HAG  652
2 Power Transfers  
EPT-10  
VON  689
2 Exit Devices  
QEL9827L-LBR  
VON  626
2 Exit Dev. Strike Mtg. Brackets  
770SPB  
ZER  689
3 Cylinders  
Corbin / Russwin as Required CT6  
COR  626
2 Door Closers  
DC6210  
COR  689
2 Door Closer Mounting Brackets  
770SPB  
ZER  689
2 Kick Plates  
193S  
HAG  630
2 Door Stops  
236W  
HAG  626
1 Set Sound Seal  
770SP – Head & Jambs  
ZER  628
1 Set Astragals  
55AA & 155AA  
ZER  628
2 Auto Door Bottoms  
369 w/ End Caps  
ZER  628
1 Key Switch  
653-04-L2  
SCH  - -
1 Power Supply  
PS902 – 9002RS – 900FA  
VON  - -
1 Threshold  
Expansion Joint Flush Threshold By Others
Building electrical power, wire and wiring by others.

Set No. 51
Each to have:
6 Ea. Butts  
BB1168  
HAG  652
2 Push Plates  
30S – 8” x 16”  
HAG  630
2 Pull Plates  
H33G – 4” x 16”  
HAG  630
2 Door Closers  
DC6200  
COR  689
2 Kick Plates  
193S  
HAG  630
2 Door Stops  
236W  
HAG  626
1 Set Sound Seal  
770SP – Head & Jambs  
ZER  628
1 Set Astragals  
55AA & 155AA  
ZER  628
2 Auto Door Bottoms  
369 w/ End Caps  
ZER  628
1 Threshold  
Expansion Joint Flush Threshold By Others

Set No. 52
Each to have:
4 Ea. Butts  
BB1279  
HAG  652
1 Lever Privacy  
CL3320 – NZD  
COR  626
1 Door Closers  
DC6200  
COR  689
1 Kick Plate  
193S  
HAG  630
1 Door Stop  
236W  
HAG  626
3 Silencers  
SR64  
IVE  - -

Set No. 53
Each to have:
1 Continuous Hinge  
780-112-HD  
HAG  628
1 Lever Office  
CL3351 – NZD – CT6  
COR  626
1 Door Closers  
DC6200  
COR  689
1 Kick Plate  
193S  
HAG  630
1 Door Stop 236W HAG 626
3 Silencers SR64 IVE - -

Set No. 54
Each to have:
6 Ea. Butts BB1168 HAG 652
2 Exit Devices 9827L - LBR VON 626
2 Cylinders Corbin / Russwin as Required CT6 COR 626
2 Door Closers DC6210 COR 689
2 Kick Plates 193S HAG 630
2 Door Stops 236W HAG 626
2 Silencers SR64 IVE - -
1 Threshold Expansion Joint Flush Threshold By Others

Set No. 55
Each to have:
6 Ea. Butts BB1168 HAG 652
2 Push / Pull Bars 159D - BTB HAG 630
2 Door Closers DC6210 COR 689
2 Kick Plates 193S HAG 630
2 Door Stops 236W HAG 626
2 Silencers SR64 IVE - -

Set No. 56
Each to have:
3 Ea. Butts BB1168 HAG 652
1 Lever Classroom CL3355 – NZD – CT6 COR 626
1 Door Closer DC6200 COR 689
1 Kick Plate 193S HAG 630
1 Door Stop 236W HAG 626
3 Silencers SR64 IVE - -

Set No. 57
Each to have:
8 Ea. Butts BB1168 HAG 652
2 Exit Devices 9827L - LBR VON 626
2 Cylinders Corbin / Russwin as Required CT6 COR 626
2 Door Closers DC6200 COR 689
2 Kick Plates 193S HAG 630
2 Door Stops & Holders 495 IVE 626
2 Silencers SR64 IVE - -

Set No. 58
Each to have:
3 Ea. Butts BB1168 (4 Ea. @ Doors > 7’0") HAG 652
1 Push Plate 30S – 8” x 16” HAG 630
1 Pull RM2110-8” @ Doors 102A-C, 102B-C, 207B-B, 207A-B, 207A-C ROC 626
<table>
<thead>
<tr>
<th>Item Description</th>
<th>Quantity</th>
<th>Specification</th>
<th>Manufacturer</th>
<th>Model/Code</th>
<th>Set Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pull Plate</td>
<td>1</td>
<td>H33G – 4” x 16” (Omit @ Doors 102A-C, 102B-C, 207B-B, 207A-B, 207A-C)</td>
<td>HAG</td>
<td>630</td>
<td></td>
</tr>
<tr>
<td>Door Closer</td>
<td>1</td>
<td>DC6200</td>
<td>COR</td>
<td>689</td>
<td></td>
</tr>
<tr>
<td>Kick Plate</td>
<td>1</td>
<td>193S</td>
<td>HAG</td>
<td>630</td>
<td></td>
</tr>
<tr>
<td>Door Stop</td>
<td>1</td>
<td>236W</td>
<td>HAG</td>
<td>626</td>
<td></td>
</tr>
<tr>
<td>Set Sound Seal</td>
<td>1</td>
<td>770SP – Head &amp; Jambs</td>
<td>ZER</td>
<td>628</td>
<td></td>
</tr>
<tr>
<td>Auto Door Bottom</td>
<td>1</td>
<td>369 w/ End Caps</td>
<td>ZER</td>
<td>628</td>
<td></td>
</tr>
<tr>
<td>Threshold</td>
<td>1</td>
<td>164A</td>
<td>ZER</td>
<td>719</td>
<td></td>
</tr>
</tbody>
</table>

**Set No. 59**

Each to have:

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Quantity</th>
<th>Specification</th>
<th>Manufacturer</th>
<th>Model/Code</th>
<th>Set Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ea. Butts</td>
<td>4</td>
<td>BB1279</td>
<td>HAG</td>
<td>652</td>
<td></td>
</tr>
<tr>
<td>Lever Office</td>
<td>1</td>
<td>CL3351 – NZD – CT6</td>
<td>COR</td>
<td>626</td>
<td></td>
</tr>
<tr>
<td>Door Closer</td>
<td>1</td>
<td>DC6200</td>
<td>COR</td>
<td>689</td>
<td></td>
</tr>
<tr>
<td>Kick Plate</td>
<td>1</td>
<td>193S</td>
<td>HAG</td>
<td>630</td>
<td></td>
</tr>
<tr>
<td>Door Stop</td>
<td>1</td>
<td>236W</td>
<td>HAG</td>
<td>626</td>
<td></td>
</tr>
<tr>
<td>Silencers</td>
<td>3</td>
<td>SR64</td>
<td>IVE</td>
<td>- -</td>
<td></td>
</tr>
</tbody>
</table>

**Set No. 60**

Each to have:

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Quantity</th>
<th>Specification</th>
<th>Manufacturer</th>
<th>Model/Code</th>
<th>Set Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ea. Butts</td>
<td>6</td>
<td>BB1279</td>
<td>HAG</td>
<td>652</td>
<td></td>
</tr>
<tr>
<td>Flush Bolts</td>
<td>2</td>
<td>282D</td>
<td>HAG</td>
<td>626</td>
<td></td>
</tr>
<tr>
<td>Lever Storeroom</td>
<td>1</td>
<td>CL3357 – NZD – CT6</td>
<td>COR</td>
<td>626</td>
<td></td>
</tr>
<tr>
<td>Door Closers</td>
<td>2</td>
<td>DC6200</td>
<td>COR</td>
<td>689</td>
<td></td>
</tr>
<tr>
<td>Kick Plates</td>
<td>2</td>
<td>193S</td>
<td>HAG</td>
<td>630</td>
<td></td>
</tr>
<tr>
<td>Door Stops</td>
<td>2</td>
<td>236W</td>
<td>HAG</td>
<td>626</td>
<td></td>
</tr>
<tr>
<td>Set Sound Seal</td>
<td>1</td>
<td>770SP – Head &amp; Jambs</td>
<td>ZER</td>
<td>628</td>
<td></td>
</tr>
<tr>
<td>Set Astragals</td>
<td>1</td>
<td>55AA &amp; 155AA</td>
<td>ZER</td>
<td>628</td>
<td></td>
</tr>
<tr>
<td>Auto Door Bottoms</td>
<td>2</td>
<td>369 w/ End Caps</td>
<td>ZER</td>
<td>628</td>
<td></td>
</tr>
<tr>
<td>Threshold</td>
<td>1</td>
<td>164A</td>
<td>ZER</td>
<td>719</td>
<td></td>
</tr>
</tbody>
</table>

**Set No. 61**

Each to have:

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Quantity</th>
<th>Specification</th>
<th>Manufacturer</th>
<th>Model/Code</th>
<th>Set Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ea. Butts</td>
<td>6</td>
<td>BB1168</td>
<td>HAG</td>
<td>652</td>
<td></td>
</tr>
<tr>
<td>Push Plates</td>
<td>2</td>
<td>30S – 8” x 16”</td>
<td>HAG</td>
<td>630</td>
<td></td>
</tr>
<tr>
<td>Pull Plates</td>
<td>2</td>
<td>H33G – 4” x 16”</td>
<td>HAG</td>
<td>630</td>
<td></td>
</tr>
<tr>
<td>Door Closers</td>
<td>2</td>
<td>DC6200</td>
<td>COR</td>
<td>689</td>
<td></td>
</tr>
<tr>
<td>Kick Plates</td>
<td>2</td>
<td>193S</td>
<td>HAG</td>
<td>630</td>
<td></td>
</tr>
<tr>
<td>Door Stops</td>
<td>2</td>
<td>236W</td>
<td>HAG</td>
<td>626</td>
<td></td>
</tr>
<tr>
<td>Set Sound Seal</td>
<td>1</td>
<td>770SP – Head &amp; Jambs</td>
<td>ZER</td>
<td>628</td>
<td></td>
</tr>
<tr>
<td>Set Astragals</td>
<td>1</td>
<td>55AA &amp; 155AA</td>
<td>ZER</td>
<td>628</td>
<td></td>
</tr>
<tr>
<td>Auto Door Bottoms</td>
<td>2</td>
<td>369 w/ End Caps</td>
<td>ZER</td>
<td>628</td>
<td></td>
</tr>
<tr>
<td>Threshold</td>
<td>1</td>
<td>164A</td>
<td>ZER</td>
<td>719</td>
<td></td>
</tr>
</tbody>
</table>

**END OF SECTION 08 71 00**

DESIGN RELEASE PACKAGE 4
ISSUED: 12/01/2017
PART 1  GENERAL

1.01  SECTION INCLUDES
   A.  Insulating glass units.
   B.  Spandrel glass units.
   C.  Glazing units.
   D.  Glazing compounds and accessories.

1.02  RELATED REQUIREMENTS
   A.  Section 08.11.13 - Hollow Metal Doors and Frames: lites in doors and borrowed lites.
   B.  Section 08.14.16 - Flush Wood Doors: Lites in doors.
   C.  Section 08.43.13 - Aluminum-Framed Storefronts
   D.  Section 08.44.13 - Glazed Aluminum Curtain Walls

1.03  REFERENCE STANDARDS
   M.  GANA (GM) - GANA Glazing Manual; 2009.
1.04 ADMINISTRATIVE REQUIREMENTS
   A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS
   A. Product Data on Insulating Glass Unit, Glazing Unit, Plastic Sheet Glazing Unit, and Plastic Film Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
   B. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
   C. Certificate: Certify that products of this section meet or exceed specified requirements.
   D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction wast diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
      1. Compliance with Credit MR1.1: Recycling Collection and Storage
      2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%
      3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.07 QUALITY ASSURANCE
   A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.
   B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
   C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
   D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.08 FIELD CONDITIONS
   A. Do not install glazing when ambient temperature is less than 40 degrees F.
   B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.09 WARRANTY
   A. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

DESIGN RELEASE PACKAGE 4
ISSUED: 12/01/2017
PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Design Pressure: Calculated in accordance with ASCE 7.
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   4. Glass thicknesses listed are minimum.

B. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including replacement of failed units.

C. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
   1. In conjunction with vapor retarder and joint sealer materials described in other sections.

D. Thermal and Optical Performance: Provide glass products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.

D. All southern exterior exposed glass performance shall be equal to Solarban 70XL Solar Control Low-e glass. All other exterior exposed glass performance shall be equal to Solarban 60. All glass shall be clear in color.

2.02 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless noted otherwise.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT.
   3. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality-Q3, color and performance characteristics as indicated.
   4. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 test requirements for Category II.
   2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch thick, minimum.

2.03 INSULATING GLASS UNITS

A. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Metal Edge Spacers: Aluminum, bent and soldered corners.
5. Edge Seal:
   a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone or polyurethane sealant as secondary seal applied around perimeter.
7. Purge interpane space with dry air, hermetically sealed.

B. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior glazing unless otherwise indicated.
2. Space between lites filled with argon.
3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
   b. Coating: Low-E (passive type), on #2 surface.
4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
5. Total Thickness: 1 inch.
6. Thermal Transmittance (U-Value): 0.24, nominal.
8. Solar Heat Gain Coefficient (SHGC): 0.39 percent, minimum.
10. Light to Solar Gain Ratio: 1.79

C. Type IG-2 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Use on southern exposure of facility unless acoustic indicated.
2. Space between lites filled with argon.
3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
   b. Coating: Low-E (passive type), on #2 surface.
4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
5. Total Thickness: 1 inch.
6. Thermal Transmittance (U-Value): [0.24], nominal.
8. Solar Heat Gain Coefficient (SHGC): 0.27 percent, minimum.
10. Light to Solar Gain Ratio: 2.37

D. Type IG-3 - Vision glass, double glazed, acoustic.
1. Exterior glazing for all Music Faculty Offices, Instrumental Rehearsal, Percussion Rehearsal, and Choral Rehearsal. 1” insulating glass: 1/4” laminated glass, 1/2” space filled with argon, 1/4” laminated glass. Low-E (passive type) coating on #2 surface.
2. OITC rating: 33
3. Thermal Transmittance (U-Value): 0.24, nominal.
5. Solar Heat Gain Coefficient (SHGC): 0.27 percent, nominal.

E. Type IG-4 - Insulating Glass Units: Spandrel glazing.
1. Applications: Exterior spandrel glazing unless otherwise indicated.
2. Space between lites filled with air.
3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
b. Coating: Same as on vision units, on #2 surface.
   a. Coating: Color as selected.
5. Total Thickness: 1 inch.
6. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.35, nominal.

2.04 GLAZING UNITS
A. Monolithic Interior Vision Glazing:
   1. Applications: Interior glazing unless otherwise indicated.
   2. Glass Type: Fully tempered float glass.
   3. Tint: Clear.
   4. Thickness: 1/4 inch, nominal.

2.05 GLAZING COMPOUNDS
A. Glazing Putty: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; grey color.
B. Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.
C. Polyurethane Sealant: Single component, chemical curing, non-staining, non-bleeding; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 20 to 35; color as selected.
D. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.06 ACCESSORIES
A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Continuous x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
   1. Width: As required for application.
   2. Thickness: As required for application.
D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION
3.01 VERIFICATION OF CONDITIONS
A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
B. Verify that the minimum required face and edge clearances are being provided.
C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
D. Verify that sealing between joints of glass framing members has been completed effectively.
E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION
A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL
A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)
A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - WET/DRY GLAZING METHOD (TAPE AND SEALANT)
A. Application - Interior Glazed: Set glazing infills from the interior of the building.
B. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch above sight line.
C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
D. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
E. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch intervals, 1/4 inch below sight line.
F. Carefully trim protruding tape with knife.

3.06 FIELD QUALITY CONTROL
A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
B. Monitor and report installation procedures and unacceptable conditions.

3.07 CLEANING
A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
B. Remove non-permanent labels immediately after glazing installation is complete.
C. Clean glass and adjacent surfaces after sealants are fully cured.
D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer’s written recommendations.

3.08 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION 08.80.00
PART 1  GENERAL

1.01  SECTION INCLUDES
   A. Glass mirrors.
      1. Annealed float glass.
      2. Tempered safety glass.

1.02  RELATED REQUIREMENTS
   A. Section 10.28.00 - Toilet, Bath, and Laundry Accessories: Metal mirror frames.

1.03  REFERENCE STANDARDS
   E. GANA (GM) - GANA Glazing Manual; 2009.
   G. GANA (TIPS) - Mirrors: Handle with Extreme Care (Tips for the Professional on the Care and Handling of Mirrors); 2011.

1.04  SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
   C. Product Data on Glazing Compounds: Submit chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
   D. Manufacturer's Certificate: Certify that mirrors, meets or exceeds specified requirements.
   E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
   F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.05  TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction wast diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
      1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
      2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.
1.06 QUALITY ASSURANCE
   A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.  
   B. Fabricate, store, transport, receive, install, and clean mirrors in accordance with recommendations of GANA (TIPS).

1.07 FIELD CONDITIONS
   A. Do not install mirrors when ambient temperature is less than 50 degrees F.  
   B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY
   A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
   B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.01 MATERIALS
   A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.  
   B. Mirror Glass; Type 1: Clear, tempered safety glass; ASTM C1048, with copper and silver coatings, and protective overcoating, at locations where required by code.
      1. Thickness: 1/4 inch.
   C. Mirror Glass: ASTM C1036, Type 2 - Transparent Flat, Class 1 - Clear, Quality - Q1 (high-quality mirrors); silvering, protective coating, and quality requirements in compliance with ASTM C1503. Provide with polished edges.
      1. Thickness: 1/4 inch.
      2. Size: As noted on drawings.

2.02 ACCESSORIES
   A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness.  
   B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness.  
   C. Glazing Tape: Preformed butyl compound; 10 to 15 Shore A durometer hardness; on release paper.  
   D. Glazing Clips: Manufacturer's standard type.  
   E. Mirror Attachment Accessories: Stainless steel clips.  
   F. Mirror Adhesive: Chemically compatible with mirror coating and wall substrate.  
   G. Channel Frame, when indicated: One piece, channel frame, stainless steel, Type 430, polished finish, 1/2 inch by 1/2 inch by 3/8 inch deep with 90 degree mitered corners.

PART 3 EXECUTION -- NOT USED

3.01 EXAMINATION
   A. Verify that openings for mirrored glazing are correctly sized and within tolerance.  
   B. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.
3.02 PREPARATION
   A. Clean contact surfaces with solvent and wipe dry.
   B. Seal porous mirror frames or recesses with substrate compatible primer or sealer. Prime surfaces scheduled to receive sealant.
   C. Prepare installation in accordance with ASTM C1193 for solvent release sealants, and install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION
   A. Install mirrors in accordance with GANA (TIPS) and manufacturers recommendations.
   B. Set mirrors plumb and level, and free of optical distortion.
   C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.
   D. Installation in Frames:
      1. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.
      2. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
      3. Rest mirrors on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
      4. Place glazing tape on free perimeter of mirrors in same manner described above.
      5. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
      6. Trim protruding tape edge.
   E. Frameless Mirrors: Set mirrors in proper place with adhesive, applied in accordance with adhesive manufacturer's instructions.

3.04 CLEANING
   A. Remove wet glazing materials from finish surfaces.
   B. Remove labels after work is complete.
   C. Clean mirrors and adjacent surfaces.

END OF SECTION 08.83.00
SECTION 09.21.16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Performance criteria for gypsum board assemblies.
B. Metal stud wall framing.
C. Metal channel ceiling framing.
D. Acoustic insulation.
E. Cementitious backing board.
F. Gypsum wallboard.
G. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS
A. Section 05.40.00 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing.
B. Section 06.10.00 - Rough Carpentry: Wood blocking product and execution requirements.
C. Section 09.22.16 - Non-Structural Metal Framing.

1.03 REFERENCE STANDARDS
A. 11
B. 11
J. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.
K. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.

DESIGN RELEASE PACKAGE 4
ISSUED: 12/01/2017
R. ASTM E413 - Classification for Rating Sound Insulation; 2010.
T. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2008.
V. ICC (IBC) - International Building Code; 2015.

1.04 SUBMITTALS
A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
E. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesives and sealants
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum three years of experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES
A. Provide completed assemblies complying with ASTM C840 and GA-216.
B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 55-59 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
2. Acoustic Attenuation: STC of 50-54 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

D. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:
1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
2. Acoustic Attenuation: STC of 50-54 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

E. Fire Rated Assemblies: Provide completed assemblies complying with applicable code.
1. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly.
2. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.
3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
1. Studs: "C" shaped with flat or formed webs with knurled faces.
2. Runners: U shaped, sized to match studs.
3. Ceiling Channels: C-shaped.

B. Exterior Non-Loadbearing Studs and Furring for Application of Gypsum Board: As specified in Section 09.22.16.

C. Loadbearing Studs for Application of Gypsum Board: As specified in Section 05.40.00.

D. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.

E. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

F. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and screwed to secondary deflection channel set inside but unattached to top track.

2.03 BOARD MATERIALS

A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Unfaced fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Thickness:

B. Impact Resistant Wallboard:
1. Application: High-traffic areas indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Type: Fire resistance rated Type X, UL or WH listed.
5. Edges: Tapered.

C. Backing Board For Wet Areas: One of the following products:
   1. Application: Surfaces behind tile in wet areas including tub and shower surrounds and shower ceilings.
   2. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with 3 or ASTM C1325.
      a. Thickness: 1/2 inch.

D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
   1. Application: Vertical surfaces behind thinset tile, except in wet areas.
   2. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.

E. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut. For all areas greater than 120 square feet and are not accessible, provide a 24" x 24" accessible panel. Coordinate location with Mechanical.
   1. Application: Ceilings, unless otherwise indicated.
   2. Thickness: 5/8 inch.

F. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
   1. Paper Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

2.04 ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3.5 inch.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Beads, Joint Accessories, and Other Trim: ASTM C1047, paintable galvanized steel or rolled zinc, unless noted otherwise.
   1. Rigid Corner Beads: Low profile, for 90 degree outside corners and archways.
   2. Heavy Duty Corner Trim: Where indicated on Drawings.
      a. Size: 1 1/4", Equal to Fry DMCT-1250.
      b. Material: Extruded aluminum, 6063 T5 alloy.
      c. Finish: As selected by Architect
      d. Application: Flanges embedded in drywall joint compound.

3. Architectural Reveal Beads:
   b. Reveal Width: 5/8 inch.
   c. Shapes: As indicated on drawings.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

E. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.
H. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION
A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
   1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.
   2. Install studs at spacing required to meet performance requirements.
B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.
   1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
   2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.03 FRAMING INSTALLATION
A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
C. Studs: Space studs at 16 inches on center.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
   1. Orientation: Horizontal.
   2. Spacing: As indicated.
F. Acoustic Furring: Install resilient channels at maximum 16 inches on center. Locate joints over framing members.
G. Furring for Fire Ratings: Install as required for fire resistance ratings indicated.
H. Blocking: Install wood blocking for support of:
   1. Framed openings.
   2. Wall mounted cabinets.
   3. Plumbing fixtures.
   4. Toilet partitions.
   5. Toilet accessories.
   6. Wall mounted door hardware.

3.04 ACOUSTIC ACCESSORIES INSTALLATION
A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
1. Place one bead continuously on substrate before installation of perimeter framing members.
2. Place continuous bead at perimeter of each layer of gypsum board.
3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.05 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
E. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
F. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.
G. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with applicable instructions.
H. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.
I. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
   2. At exterior soffits, not more than 30 feet apart in both directions.
B. Corner Beads: Install at external corners, using longest practical lengths.
C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.
D. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on the drawings. Provide vent area specified.

3.07 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
   2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   4. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.
C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
D. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION 09.21.16
PART 1 GENERAL

1.01 SECTION INCLUDES
A. Metal partition, ceiling, and sofit framing.
B. Wall vibration control components.
C. Framing accessories.

1.02 RELATED REQUIREMENTS
A. Section 05.21.00 - Steel Joists: Execution requirements for anchors for attaching work of this section.
B. Section 05.40.00 - Cold-Formed Metal Framing: Structural load bearing metal stud framing and Exterior wall stud framing.
C. Section 05.40.00 - Cold-Formed Metal Framing: Execution requirements for anchors for attaching work of this section.
D. Section 05.50.00 - Metal Fabrications: Metal fabrications attached to stud framing.
E. Section 05.50.00 - Metal Fabrications: Execution requirements for anchors for attaching work of this section.
F. Section 06.10.00 - Rough Carpentry: Wood blocking within stud framing.
G. Section 06.10.00 - Rough Carpentry: Wall sheathing.
H. Section 07.21.00 - Thermal Insulation: Acoustic insulation.
I. Section 08.31.00 - Access Doors and Panels.
J. Section 09.21.16 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.
K. Section 09.21.16 - Gypsum Board Assemblies: Execution requirements for anchors for attaching work of this section.

1.03 REFERENCE STANDARDS
A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.
H. ASTM E413 - Classification for Rating Sound Insulation; 2010.

1.04 SUBMITTALS
A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings:
   1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
   2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.

C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Sustainable Design Submittal: Documentation of recycled content and location of manufacture.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION

A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.

B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

1.07 MOCK-UP

A. Provide mock-up of stud wall, ceiling, and soffit framing including insulation, sheathing, window frame, and door frame and finish specified in other sections. Coordinate with installation of associated work specified in other sections.
   1. Mock-up Size: Full height, minimum 12 feet long, including corner.

PART 2 PRODUCTS

2.01 FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Studs: C shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.

B. Loadbearing Studs: As specified in Section 05.40.00.

C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
D. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
   3. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.

E. Tracks and Runners: Same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud.

F. Furring and Bracing Members: Of same material as studs; thickness to suit purpose; complying with applicable requirements of ASTM C754.


H. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced.

I. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

J. Vibration Control Components: Stamped L-Shaped steel brackets (single or double L as required by the load application), captured and held securely by a neoprene element with two anchoring points. The brackets are used to resiliently decouple and support partitions, head-of-wall, soffits, plumbing and fixtures in sound control ceilings and walls as shown in the Drawings. (See Section 13.48.23 for Spring Isolated Gypsum Ceilings where indicated on Drawings.)

2.02 FABRICATION
   A. Fabricate assemblies of framed sections to sizes and profiles required.
   B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify existing conditions before starting work.
   B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING
   A. Comply with requirements of ASTM C754.
   B. Extend partition framing to structure where indicated and to ceiling in other locations.
   C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   D. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
   E. Align and secure top and bottom runners at 24 inches on center.
   F. At partitions indicated with an acoustic rating:
      1. Provide components and install as required to produce STC ratings as indicated, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.
   G. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
H. Install studs vertically at spacing indicated on drawings.
I. Align stud web openings horizontally.
J. Secure studs to tracks using crimping method. Do not weld.
K. Stud splicing is not permissible.
L. Fabricate corners using a minimum of three studs.
M. Double stud at wall openings, door and window jambs, not more than 2 inches from each side of openings.
N. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
O. Blocking: Use wood blocking secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.

3.03 CEILING AND SOFFIT FRAMING
A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
B. Install furring independent of walls, columns, and above-ceiling work.
C. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.
D. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.
E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
F. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.
G. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.
H. Laterally brace suspension system.

3.04 TOLERANCES
A. Maximum Variation From True Position: 1/8 inch in 10 feet.
B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION 09.22.16
PART 1  GENERAL

1.01  SECTION INCLUDES
A. Metal lath for cement and gypsum plaster.

1.02  RELATED REQUIREMENTS
A. Section 05.40.00 - Cold-Formed Metal Framing: Water-resistive barrier under exterior plaster and stucco.
B. Section 07.25.00 - Weather Barriers: Weather barrier under exterior plaster and stucco.
C. Section 08.31.00 - Access Doors and Panels: Product requirements for metal access panels integral with metal lath.
D. Section 09.22.16 - Non-Structural Metal Framing.
E. Section 09.23.00 - Gypsum Plastering.

1.03  REFERENCE STANDARDS
C. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.
D. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.

1.04  SUBMITTALS
A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on furring and lathing components, structural characteristics, material limitations, and finish.

1.05  TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.
1.06 QUALITY ASSURANCE
A. Maintain one copy of each installation standard referenced on site throughout the duration of lathing and plastering work.
B. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

PART 2 PRODUCTS

2.01 FRAMING AND LATH ASSEMBLIES
A. Provide completed assemblies with the following characteristics:
   1. Maximum Deflection of Vertical Assemblies: 1:360 under lateral point load of 100 lbs.
B. Fire Rated Assemblies: Provide components complying with requirements for fire rated assemblies specified in the section where the plaster finish is specified.

2.02 LATH
   1. Weight: To suit application and as specified in ASTM C841 or ASTM C1063 for framing spacing.
B. Corner Mesh: Formed sheet steel, minimum 0.018 inch thick, perforated flanges shaped to permit complete embedding in plaster, minimum 2 inch size; same finish as lath.
C. Beads, Screeds, Joint Accessories, and Other Trim: Depth governed by plaster thickness, and maximum possible lengths.
   1. Material: Formed sheet steel with rust inhibitive primer, expanded metal flanges.
   5. Control Joints: Accordion profile with protective tape, 2 inch flanges.

2.03 ACCESSORIES
A. Access Panels: As specified in Section 08.31.00.
B. Anchorage: Tie wire, nails, and other metal supports, of type and size to suit application; to rigidly secure materials in place, galvanized.
C. Fasteners: Self-piercing tapping screws; ASTM C1002 or ASTM C954.
D. Tie Wire: Annealed galvanized steel.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify existing conditions before starting work.
B. Verify that substrates are ready to receive work and conditions are suitable for application.
C. For exterior plaster and stucco on stud walls, verify that water-resistive barrier has been installed over sheathing substrate completely and correctly.
D. Do not begin until unacceptable conditions have been corrected.
E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
3.02 INSTALLATION - GENERAL

A. Install interior lath and furring for gypsum plaster in accordance with ASTM C841.
B. Install metal lath and furring for Portland cement plaster in accordance with ASTM C1063.
C. Install lath and furring for fire-rated assemblies in accordance with requirements of assembly as indicated.

3.03 CONTROL AND EXPANSION JOINT INSTALLATION

A. Locate joints as indicated on drawings and comply with ASTM C1063.
   1. Area of plaster panel not to exceed 144 sq ft for vertical surfaces.
   2. Spacing between control joints not to exceed 18 ft in each direction.
   3. Area bounded by control joints not to exceed a length-to-width ratio of 2-1/2 to 1.
B. Install expansion joints where an expansion joint occurs in base exterior wall.
C. Install prefabricated joint accessories in accordance with ASTM C1063.
D. Construct expansion joints of back-to-back casing beads with a backer rod and sealant, set 1/4 inch apart.

3.04 ACCESS PANELS INSTALLATION

A. Install access panels and rigidly secure in place.
B. Install frames plumb and level in opening. Secure rigidly in place.
C. Position to provide convenient access to concealed work requiring access.

3.05 LATH INSTALLATION

A. Apply lath taut, with long dimension perpendicular to supports.
B. Lap or nest ends of metal lath in accordance with ASTM C841.
C. Secure end laps with tie wire where they occur between supports.
D. Attach metal lath to concrete and concrete masonry using wire loops. Attach anchors to backup surface; space at maximum 24 inches on center.
E. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches from corner to form the angle reinforcement; fasten at perimeter edges only.
F. Place corner bead at external wall corners; fasten at outer edges of lath only.
G. Place base screeds at termination of plaster areas; secure rigidly in place.
H. Place 4 inch wide strips of lath centered over junctions of dissimilar backing materials, and secure rigidly in place.
I. Place lath vertically above each top corner and each side of door frames to 6 inches above ceiling line.
J. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.
K. Place additional strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

3.06 TOLERANCES

A. Maximum Variation from True Lines and Levels: 1/8 inch in 10 feet.
B. Maximum Variation from True Position: 1/8 inch.

END OF SECTION 09.22.36
SECTION 09.23.00
GYPSUM PLASTERING

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Gypsum plastering.
B. Gypsum plaster over gypsum lath, metal lath, and concrete.
C. Gypsum lath.

1.02  RELATED REQUIREMENTS
A. Section 05.40.00 - Cold-Formed Metal Framing: Metal stud framing for plaster.
B. Section 06.10.00 - Rough Carpentry: Wood stud framing for plaster.
C. Section 07.84.00 - Firestopping: Sealing top-of-wall assemblies and through-wall penetrations at fire rated walls.
D. Section 07.92.00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
E. Section 08.31.00 - Access Doors and Panels: Access panels.
F. Section 09.21.16 - Gypsum Board Assemblies: Metal stud framing and furring for plaster.
G. Section 09.22.36 - Lath: Metal lath, furring, and accessories for plaster base.

1.03  REFERENCE STANDARDS

1.04  SUBMITTALS
A. Product Data: Provide data on plaster materials, characteristics, and limitations of products specified.

1.05  TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.
1.06 QUALITY ASSURANCE
   A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.07 MOCK-UP
   A. Construct mock-up of interior wall, 6 feet long by 10 feet wide, illustrating surface finish.
   B. Locate where directed.
   C. Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS
   A. Do not apply plaster when substrate or ambient air temperature is under 50 degrees F or over 80 degrees F.
   B. Maintain minimum ambient temperature of 50 degrees F during and after installation of plaster.

PART 2 PRODUCTS

2.01 PLASTER MATERIALS
   B. Ready-Mixed Gypsum Plaster: ASTM C28/C28M; mill-mixed type, requiring only the addition of water.
   C. Lime: ASTM C206, Type S; special finishing hydrated lime.

2.02 LATH AND ACCESSORIES
   A. Gypsum Lath: ASTM C1396/C1396M, standard type.
   B. Beads, Screeds, Joint Accessories, and Other Trim: Depth governed by plaster thickness, maximum possible lengths.
      1. Material: Formed sheet steel with rust inhibitive primer, expanded metal flanges.
   C. Corner Mesh: Formed sheet steel, minimum 0.018 inch thick, perforated flanges shaped to permit complete embedding in plaster, minimum 2 inch size; galvanized.
   D. Heavy Duty Corner Trim: Where indicated on Drawings.
      1. Size: 1 1/4”, equal to Fry DMCT-1250.
      3. Finish: As selected by Architect
   E. Strip Mesh: Expanded metal lath, minimum 0.018 inch thick, 2 inch wide by 24 inch long; galvanized.
   F. Fasteners: Nails, staples, or other approved metal supports, of type and size to suit application, to rigidly secure accessories in place.
   G. Reveals: 2 1/2" x 5/8" reveals, 1/2"x5/8" reveals and corner trim. Painted at painted wall conditions and clear finish aluminum at wood veneer wallcovering conditions.

2.03 PLASTER MIXES
   A. Over Other Solid Bases: Two-coat application, ready-mixed plaster, mixed and proportioned in accordance with ASTM C842 and manufacturer's instructions. Total application thickness 5/8 inch.
   B. Over Metal Lath: Three-coat application, ready-mixed plaster, mixed and proportioned in accordance with ASTM C842 and manufacturer's instructions.
   C. Ready-Mixed Plaster Materials: Mix in accordance with manufacturer's instructions.
D. Finish Coat for Troweled Finish: Lime putty with gypsum gauging plaster, mixed and proportioned in accordance with ASTM C842.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that existing conditions are satisfactory before starting work.
B. Masonry: Verify joints are cut flush and surface is ready to receive work of this section. Verify no bituminous or water repellent coatings exist on masonry surface.
C. Concrete: Verify surfaces are flat, honeycomb is filled flush, and surface is ready to receive work of this section. Verify no bituminous, water repellent, or form release agents exist on concrete surface that are detrimental to plaster or plaster bond.
D. Grounds and Blocking: Verify items within walls for other sections of work have been installed.
E. Gypsum Lath and Accessories: Verify substrate is flat and surface is ready to receive work of this section. Verify joint and surface perimeter accessories are in place.
F. Metal Lath and Accessories: Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are in place.
G. Mechanical and Electrical: Verify services within walls have been tested and approved.

3.02 PREPARATION
A. Dampen masonry surfaces to reduce excessive suction.
B. Clean concrete surfaces of foreign matter. Thoroughly dampen surfaces before using acid solutions, solvent, or detergents to perform cleaning. Wash surface with clean water.
C. Roughen smooth concrete surfaces and smooth faced masonry.
D. Apply bonding agent in accordance with manufacturer's instructions.

3.03 PLASTERING
A. Apply gypsum plaster in accordance with ASTM C842 and manufacturer's instructions.
B. Thickness of Plaster including Finish Coat:
   2. Direct to unit masonry: 5/8 inch.
   3. Finish coat applied direct to concrete: 3/16 inch, maximum.
   5. To horizontal concrete surfaces: 1/8 to 3/8 inch.
C. Finish Texture: Float to a consistent and smooth finish.
D. Perform work in panels to nearest natural break or between accessories and metal reveals.

3.04 TOLERANCES
A. Maximum Variation from True Flatness: Level 4 finish, 1/8 inch in 10 feet.

END OF SECTION 09.23.00
SECTION 09.27.00
PLASTER FABRICATIONS

PART 1  GENERAL -- NOT USED

1.01  SECTION INCLUDES
A. Glass-fiber-reinforced gypsum fabrications as indicated on drawings. for round column covers.

1.02  RELATED REQUIREMENTS

1.03  REFERENCE STANDARDS

1.04  SUBMITTALS
A. Product Data: Manufacturer's data sheets on each product to be used, including dimensions, finishes, storage and handling requirements and recommendations, and installation recommendations.
B. Shop Drawings: For custom items, provide drawings showing dimensions, layout, joints, details, fastening, and interface with adjacent work; include field measured dimensions of the spaces where items are to be installed, if critical to proper installation.
C. Samples: For each custom finish specified, two samples, minimum size 6 inches square, representing actual product, color, and patterns.

1.05  TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06  DELIVERY, STORAGE, AND HANDLING
A. Transport, lift, and handle units with care, avoiding excessive stress and preventing damage; use appropriate equipment.
B. Store products in manufacturer's unopened packaging until ready for installation, in a clean dry area protected from weather, moisture and damage; store units upright and not stacked unless permitted by manufacturer.
PART 2 PRODUCTS

2.01 GYPSUM FABRICATIONS (INTERIOR USE ONLY)
   A. Glass-Fiber-Reinforced Gypsum Fabrications: Molded glass fiber reinforced gypsum with structural
      reinforcing as required.
      1. Surface Burning Characteristics: Flame spread index of 0 (zero), smoke developed index of 10,
         maximum, when tested in accordance with ASTM E84.
      2. Surface Finish: Suitable for flat paint finish, without pinholes, voids, or roughness.
      3. Material Characteristics: Complying with ASTM C1355/C1355M.
      4. Items Too Large or Heavy to be Adhesively Installed: Provide concealed anchorage points for
         plaster type wire anchors.
      5. Glass Content: Minimum 5 percent by weight.
      7. Shell Thickness: 5/8 inch, minimum.
     10. Draft Angle: 3 degrees, minimum, on returns, setbacks, reveals, and grooves.
     11. Dimensional Tolerances of Molded Surfaces:
         a. Straightness: Maximum of Maximum of 1/8” in 10 linear feet variation from straight at any
            point along any plane, edge, or surface.
         c. Dimensions Within Overall Width and Length: Plus/minus 1/16 inch.
         d. Finish: Level 4 finish - float to a consistent smooth finish.
     12. 1/2"x5/8" and 2 1/2"x5/8" paintable reveals.
   B. Joint Cement: Type recommended by fabrication manufacturer.
   C. Joint Tape and Compound: Types recommended for gypsum wallboard work.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Do not begin installation until substrates have been properly constructed; verify that substrates are plumb
      and true.
   B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory
      preparation before proceeding.
   C. Check field dimensions before beginning installation. If dimensions vary too much from design
      dimensions for proper installation, notify Architect and wait for instructions before beginning installation.

3.02 PREPARATION
   A. Clean surfaces thoroughly prior to installation.
   B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for
      the substrate under the project conditions.
   C. Install supplementary temporary and permanent supports as required for proper installation.

3.03 INSTALLATION
   A. Install in accordance with applicable code and manufacturer’s recommendations, plumb and true to line;
      shim where necessary.
   B. Coordinate work with installation of substrates.
   C. Join pieces with cemented butt joints except at control and expansion joints.
D. Provide control joints at not more than 35 feet on center if not indicated on drawings.
E. Provide expansion joints where moving joints in substrate occur.
F. Finish joints and surfaces as required for Level 5 in ASTM C840.

3.04 PROTECTION
   A. Protect installed products until completion of project.
   B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 09.27.00
SECTION 09.30.00
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Tile for floor applications.
B. Tile for wall applications.
C. Tile for shower receptors.
D. Cementitious backer board as tile substrate.
E. Non-ceramic trim.

1.02 REFERENCE STANDARDS
E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).
K. 11
P. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).
R. 11

1.03 ADMINISTRATIVE REQUIREMENTS
A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.04 SUBMITTALS
A. Product Data: Provide manufacturers’ data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Master Grade Certificate: Submit for each type of tile, signed by the tile manufacturer and tile installer.
F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Tile: 10 square feet of each size, color, and surface finish combination.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.
1.06 QUALITY ASSURANCE
   A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.
   B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
   C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.07 MOCK-UP
   A. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
      1. Minimum size of mock-up is indicated on drawings.
      2. Approved mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING
   A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.09 FIELD CONDITIONS
   A. Do not install solvent-based products in an unventilated environment.
   B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

PART 2 PRODUCTS

2.01 TILE
   A. Manufacturers: All products by the same manufacturer.
   B. Porcelain Tile: ANSI A137.1, standard grade.
      1. Size: as scheduled in Finish Legend.
      2. Thickness: 3/8 inch.
      3. Color(s): As indicated on Finish Legend.

2.02 TRIM AND ACCESSORIES
   A. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
      1. Applications:
         a. Wall corners and outside: Schluter Deco
         b. Transition between floor finishes of different heights and at thresholds.
            1) Porcelain tile to terrazzo and carpet: Schluter Schiene
            2) Other transitions to be rubber pieces.
         c. Expansion and control joints, floor and wall.
         d. Transition from floor tile to wall tile: Schluter Dilex.
      2. Manufacturers:
         c. Substitutions: See Section 01.60.00 - Product Requirements.

2.03 SETTING MATERIALS
   A. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4 or ANSI A118.15.
   B. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.
C. Adhesive for Bonding Fleece-Backed Underlayments to Non-Cementitious Substrates: Water-based rubber resin.

2.04 GROUTS
A. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
   1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
   2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
B. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
   1. Applications: Toilet spaces.
   2. Color(s): As selected by Architect from manufacturer's full line.
C. Stain Resistant Grout Additive: Liquid admixture for sanded and unsanded cement-based grouts; mix with dry grout material in place of water.
   1. Applications: Where indicated.

2.05 MAINTENANCE MATERIALS
A. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
   1. Composition: Water-based colorless silicone.

2.06 ACCESSORY MATERIALS
A. Concrete Floor Slab Crack Isolation Membrane: Polyethylene membrane with a grid structure of square cavities, each cut back in a dovetail configuration, with an anchoring fleece laminated to the underside. Membrane designed for ceramic tile and dimension stone installations as an uncoupling layer and waterproofing membrane. Material complying with ANSI A118.12.
   1. Type: Sheet applied.
   2. Thickness: 1/8 inch.
   3. Crack Resistance: No failure at 1/16 inch gap, minimum.
B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
C. Underlayment at Floors: Specifically designed for bonding to thin-set setting mortar; not primarily a waterproofing material and having the following characteristics:
   1. Crack Resistance: No failure at 1/16 inch gap, minimum; comply with ANSI A118.12.
   3. Uncoupling Function: Allow for separation between membrane and the mortar adhering tile to the membrane when subjected to excessive substrate movement.
D. Backer Board: Cementitious type complying with 2; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.
E. Backer Board: High density polystyrene with reinforced cementitious coating on both sides; with compatible alkaline resistant joint tape; to be covered with waterproofing prior to installation of tile.
   1. Thickness: 1/2 inch.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION
A. Protect surrounding work from damage.
B. Vacuum clean surfaces and damp clean.
C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
D. Install backer board in accordance with 2 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL
A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
E. Form internal angles square and external angles bullnosed.
F. Install non-ceramic trim in accordance with manufacturer's instructions.
G. Sound tile after setting. Replace hollow sounding units.
H. Keep control and expansion joints free of mortar, grout, and adhesive.
I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS
A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
   1. Use uncoupling membrane under all tile unless other underlayment is indicated.
   2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
   3. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F131.
B. Install tile-to-tile floor movement joints in accordance with TCNA (HB) Method EJ171F.
3.05 INSTALLATION - WALL TILE
   A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.
   B. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.
   C. Over metal studs without backer install in accordance with TCNA (HB) Method W241, mortar bed, with membrane where indicated.

3.06 CLEANING
   A. Clean tile and grout surfaces.

3.07 PROTECTION
   A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION 09.30.00
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Suspended metal grid ceiling system.
   B. Acoustical units.
   C. Edge Trims.

1.02 RELATED REQUIREMENTS
   A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS
   D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

1.04 ADMINISTRATIVE REQUIREMENTS
   A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
   B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Shop Drawings: Indicate grid layout and related dimensioning.
   C. Product Data: Provide data on suspension system components and acoustical units.
   D. Engineering: Cloud ceiling framing and support system shall be engineered by an engineer licensed in the State of Tennessee.
   E. Samples: Submit two samples 4 by 4 inch in size illustrating material and finish of acoustical units.
   F. Manufacturer's Installation Instructions: Indicate special procedures.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction wast diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
      1. Compliance with Credit MR1.1: Recycling Collection and Storage
2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
4. Compliance with Credit EQ6.2: Material VOC Limits - Paints
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.07 QUALITY ASSURANCE
A. Fire-Resistive Assemblies: Complete assembly listed and classified by UL (FRD) for the fire resistance indicated.
B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.08 FIELD CONDITIONS
A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS
A. Acoustical Units - General: ASTM E1264, Class A.
   1. Units for Installation in Fire-Rated Suspension System: Listed and classified for the fire-resistive assembly as part of suspension system.
B. Acoustical Panels Type ACT-1: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
   1. VOC Content: Certified as Low Emission
   2. Size: 24 by 24 inches.
   5. Light Reflectance: 83 percent, determined in accordance with ASTM E1264.
   6. NRC: 0.50
   7. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
   9. Surface Color: To be selected by Architect from manufacturer's standard line.
   11. Suspension System: 9/16" Exposed grid Type SS-A, painted White unless noted otherwise.
   12. Warranty: 30-year manufacturer's warranty against visible sag, mold and mildew.
   13. Products:
      c. Certainteed Sand Micro #SHm-150; www.certainteed.com/commercial-ceilings/
      d. Substitutions: See Section 01.60.00 - Product Requirements.
C. Acoustical Panels, Type ACT-2: NOT USED
D. Acoustical Panels Type ACT-3: Painted mineral fiber, ASTM E1264 Type IV, with the following characteristics:
   1. Size: 24 by 24 inches.
   2. Thickness: 5/8 inches.
   3. Composition: Wet felted.
   4. Light Reflectance: 83 percent, determined in accordance with ASTM E1264.
5. NRC: 0.75
6. Ceiling Attenuation Class (CAC): 24, determined in accordance with ASTM E1264.
7. Edge: Beveled Tegular.
8. Surface Color: To be selected by Architect from manufacturer's standard line.
9. Surface Pattern: See Finish Legend for specific pattern(s).
10. Suspension System: 9/16" Exposed grid Type SS-A, painted to match tile.
11. Warranty: 30-year manufacturer's warranty against visible sag, mold and mildew.
12. Products:
   c. Certainteed Symphony #122BF-75-1; www.certainteed.com/commercial-ceilings/
   d. Substitutions: See Section 01.60.00 - Product Requirements.

E. Acoustical Panels Type ACT-4: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
1. Size: 24 by 24 inches.
2. Thickness: 7/8 inches.
3. Composition: Wet felted.
4. Light Reflectance: 83 percent, determined in accordance with ASTM E1264.
5. NRC: 0.90
6. Ceiling Attenuation Class (CAC): 30, determined in accordance with ASTM E1264.
7. Edge: Beveled Tegular.
8. Surface Color: To be selected by Architect from manufacturer's standard line.
9. Surface Pattern: See Finish Legend for specific pattern(s).
10. Suspension System: 9/16" Exposed grid Type SS-A unless noted otherwise.
11. Warranty: 30-year manufacturer's warranty against visible sag, mold and mildew.
12. Products:
   c. Certainteed Symphony F #1342-IOF-1F; www.certainteed.com/commercial-ceilings/
   d. Substitutions: See Section 01.60.00 - Product Requirements.

F. Acoustical Panels Type ACT-5: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
1. Size: 24 by 24 inches.
2. Thickness: 7/8 inches.
3. Composition: Wet felted.
4. Light Reflectance: 83 percent, determined in accordance with ASTM E1264.
5. NRC: 0.85
7. Edge: Square.
8. Surface Color: Black.
10. Suspension System: 15/16" Exposed grid Type SS-B Painted Black.
11. Warranty: 30-year manufacturer's warranty against visible sag, mold and mildew.
12. Products:
   d. Substitutions: See Section 01.60.00 - Product Requirements.

G. Acoustical Panels Type ACT-6: Ceramic faced mineral fiber, ASTM E1264 Type IV, with the following characteristics:
1. VOC Content: Certified as Low Emission.
2. Size: 24 by 24 inches.
4. Composition: Ceramic bonded mineral fiber.
5. Mold & Mildew Resistance: Totally inorganic resistant to growth of mold and mildew.
7. NRC Range: 0.50 to -, determined in accordance with ASTM E1264.
8. Ceiling Attenuation Class (CAC): 40 min., determined in accordance with ASTM E1264.
9. Fire Performance: Fire Guard
10. Edge: Square.
13. Suspension System: Exposed grid Type SS-C.
14. Warranty: 30-year manufacturer's warranty against visible sag, mold and mildew.
15. Products:
   c. Substitutions: See Section 01.60.00 - Product Requirements.

2.02 SUSPENSION SYSTEM(S)

A. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

B. Exposed Steel Suspension System Type SS-A: Formed steel, commercial quality cold rolled; intermediate-duty.
   1. Profile: Tee; 9/16 inch wide face, as noted.
   2. Construction: Double web.
   3. Finish: Painted, color as noted.
   4. Products:
      c. Certainteed 9/16" Elite Narrow Stab; www.certainteed.com
      d. Substitutions: See Section 01.60.00 - Product Requirements.

C. Exposed Steel Suspension System Type SS-B: Formed steel, commercial quality cold rolled; intermediate-duty.
   1. Profile: Tee; 15/16 inch wide face, as noted.
   2. Construction: Double web.
   4. Products:
      c. Certainteed 15/16" Classic Hook System; www.certainteed.com
      d. Substitutions: See Section 01.60.00 - Product Requirements.

D. Exposed Aluminum Suspension System Type SS-C: Extruded aluminum; intermediate-duty.
   1. Profile: Tee; 15/16 inch wide face.
   2. Finish: Painted white.
   3. Products:
      c. Certainteed 15/16" Classic Aluminum Capped Hook System; www.certainteed.com
      d. Substitutions: See Section 01.60.00 - Product Requirements.
2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified. Cloud ceiling framing and support system shall be designed and engineered by an engineer licensed in the State of Tennessee.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Edge Trim:
   1. Extruded aluminum perimeter trims for ACT cloud ceilings or fascias.
   3. Color: As selected from manufacturer’s standard colors.

D. Gypsum Board: Fire rated type; 5/8 inch thick, ends and edges square, paper faced.

E. Gasket For Perimeter Moldings: Closed cell rubber sponge tape.

F. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer’s instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

E. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

F. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Install with continuous gasket.
   2. Use longest practical lengths.
   3. Overlap and rivet corners.

L. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with fire rated assembly requirements and light fixture ventilation requirements.
3.03 INSTALLATION - ACOUSTICAL UNITS
   A. Install acoustical units in accordance with manufacturer's instructions.
   B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
   C. Fit border trim neatly against abutting surfaces.
   D. Install units after above-ceiling work is complete.
   E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
   F. Cutting Acoustical Units:
      1. Cut to fit irregular grid and perimeter edge trim.
      2. Make field cut edges of same profile as factory edges.
      3. Double cut and field paint exposed reveal edges.
   G. Where round obstructions occur, provide preformed closures to match perimeter molding.
   H. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

3.04 TOLERANCES
   A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
   B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION 09.51.00
PART 1 - GENERAL

1.01 SUMMARY
   A. Section includes:
      1. Wood Grille wall panels at mechanical returns in main auditorium. Adapted from linear wood ceilings specifications.
      2. Trim and accessories.

1.02 RELATED WORK IN OTHER SECTIONS:
   A. Division 1 - “General Conditions” for substitution requests, submittals, etc.

1.03 REFERENCES

1.04 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Manufacturers other than those listed in Paragraph 2.1 are required to submit for approval prior to bidding per Section One.
   B. Installer Qualifications: Engage an experienced Installer, approved by wood ceiling manufacturer, who has completed panel grilles similar in species, design, and extent to that indicated for this Project and with a record of successful in-service performance.
   C. Inspection: All work must pass inspection and approval of architect, as well as the local codes and regulations or authorities having jurisdiction.
   D. Single-Source Responsibility for Wood Grille System: Obtain each type of Wood Grille wall panels from a single fabricator, with in-house Shop Drawing capabilities, in-house assembly and finishing capabilities, and with resources to provide products of consistent quality in appearance and physical properties without delaying the project.
   E. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying project.
   F. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.05 SUBMITTALS
   A. General: Submit each item in this Section according to the Conditions of the Contract and Division 1 Specification Sections.
   B. Product Data: For each type of product specified.
   C. Samples: For verification of each type of exposed finish required, prepared on samples of size indicated below. Where finishes involve normal color and texture variations, include sample sets showing the range of variations expected.
      1. 12” x 18” samples of each panel type, pattern, and color.
1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   4. Compliance with Credit EQ6.5: Material VOC Limits - Composite wood and agrifiber
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.07 SHOP DRAWINGS & COORDINATION WITH OTHER TRADES
A. Shop Drawings: Provide Shop Drawings/Coordination Drawings for all grilles, which should include product details. Coordinate Wood Grille panels layout and installation of wood panels and support system components with other construction elements that penetrate grilles or is supported by them.

1.08 PROJECT CONDITIONS
A. Space Enclosure and Environmental Limitations: Do not install wood panel grilles until spaces are enclosed and weatherproof, wet-work in spaces is completed and dry, work above ceilings is complete, and ambient temperature and humidity conditions are being maintained at the levels indicated for Project when occupied for its intended use.

1.09 DELIVERY, STORAGE, AND HANDLING
A. Delivery & Unloading: Coordinate crate sizes, weights, unloading options, and delivery schedule with manufacturer prior to fabrication. Deliver wood panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other mistreatment.
B. Acclimatization: Before installing wood panels, permit them to reach room temperature and a stabilized moisture content (at least 72 hours) per AWI standards.
C. Handling: Handle Wood Grille panels carefully to avoid chipping edges or damaging units in any way.
D. Protection:
   1. Personnel: Follow good safety and industrial hygiene practices during handling and installing of all products and systems, with personnel to take necessary precautions and wear appropriate protective equipment as needed. Read related literature for important information on products before installation. Contractor to be solely responsible for all personal safety issues during and subsequent to installation; architect, specifier, owner, and manufacturer will rely on contractor’s performance in such regard.
   2. Existing completed work: Protect completed work above suspension system from damage during installation of suspension system components.

1.10 EXTRA MATERIALS/WARRANTIES
A. Extra Materials: Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.
   1. Wood Grille panels: Furnish quantity of full-size units equal to 2.0 percent of amount installed.
B. Warranties: Provide owner with a (1) year warranty for material and workmanship on all installed products.
   1. Manufacturers: All materials, wood ceiling and grid, shall be warranted for (1) one year for material and workmanship.
   2. Installer: All work shall be warranted for (1) year from final acceptance of completed work.

PART 2 - PRODUCTS

2.01 WOOD GRILLE WALL PANELS
   A. General: The following manufacturer is basis of design:
      2. Armstrong Ceilings (www.armstrongceilings.com): Woodworks Grille
      3. Decoustics Saint-Gobain (www.decoustics.com); Linear Wood Grille Ceilings
      4. Or equal, as prior approved by architect.

2.02 WOOD GRILLE WALL PANELS
   A. Basis of Design: 9Wood, Inc. Wood Grille, Series 1000 Cross Piece Grille
      1. Wood Panels: 1100 Cross Piece Backer, SKU 1112-5
         a. Species: Western Hemlock (Clear, solid, mixed grain)
         b. Member Size: 5/8” x 1 3/8”
         c. Edge Profile: Square
         d. Members/LF: 5 Members/LF”
         e. Assembly Style: Cross Piece Backer
         f. Panel Sizes: Cut to fit designated area indicated on Drawings
         g. Fire Rating: Class 1(A) Fire Rating
         h. Finish: Clear Interior Finish, stain to match trim
         i. Reveal Scrim: Black reveal scrim
         j. Removable: Panels to be removable with hidden fasteners
         k. Hardware: Any exposed hardware to be black

2.03 ACCESS DOORS IN PANELS
   A. Portions of panels shall be cut and modified to create full height access door panel at the acoustic drapery storage pocket, as per the Architectural Drawings and Details.
   B. Provide necessary hidden hardware to hinge open 180 degrees and clasp to hold closed.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. General: Examine substrates and structural framing to which ceilings attach or abut, with installer present, for compliance with requirements specified in this and other sections that affect ceiling installation and anchorage. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION
   A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other anchors whose installation is specified in other Sections.
   B. Layout: Measure each ceiling area and establish the layout of Wood Grille Panel to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and conform to the layout shown on reflected ceiling plans in accordance with wood ceiling manufacturer’s approved Shop Drawings.
3.03 INSTALLATION
   A. General: Install Wood Grille to comply with manufacturer's instructions.
   B. Attachments: Anchor to building's structural members per manufacturer’s instructions and in compliance with all local codes and regulations.
   C. Installation of Wood Grille: Install Wood Grille ceiling panels in accordance with manufacturer’s installation instructions and in compliance with all local codes and regulations. Install with undamaged edges and fitted accurately to suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit, as required.
   D. Install number and use on-center spacing per wood manufacturer’s instructions, as indicated on approved Shop Drawings and in compliance with all local codes.

3.04 CLEANING
   A. General: Clean exposed wood surfaces. Comply with manufacturer's instructions for cleaning and touchup of minor finish damage. Remove and replace wood ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09.54.26
SECTION 09.64.29
WOOD STRIP AND PLANK FLOORING

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Wood strip and plank flooring, nailed, for Recital Hall.
B. Sheet vapor retarder.

1.02  RELATED REQUIREMENTS
A. Section 09.91.23 - Interior Painting: Surface finish to flooring.

1.03  REFERENCE STANDARDS

1.04  SUBMITTALS
A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data for flooring.
C. Shop Drawings: Indicate floor joint pattern and termination details.
   1. Indicate provisions for expansion and contraction.
D. Installation Instructions: Indicate standard and special installation procedures.
E. Maintenance Data: Include maintenance procedures and recommended maintenance materials.
F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Flooring Material: 10 square yards matching installed flooring.

1.05  TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   4. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints
   5. Compliance with Credit EQ6.4: Material VOC Limits - Flooring systems
   6. Compliance with Credit EQ6.5: Material VOC Limits - Composite wood and agrifiber
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06  QUALITY ASSURANCE
A. Perform work of this section in accordance with MFMA (SPEC) and NWFA (IG).
B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 FIELD CONDITIONS
A. Do not install wood flooring until wet construction work is complete and ambient air at installation space has moisture content stabilized at maximum moisture content of 40 percent.
B. Provide heat, light, and ventilation prior to installation.
C. Store materials in area of installation for minimum period of 24 hours prior to installation.
D. Maintain minimum room temperature of 65 degrees F for a period of two days prior to delivery of materials to installation space, during installation, and after installation.

PART 2 PRODUCTS

2.01 MATERIALS
A. Wood Strip Flooring:
1. Species: White Oak.
2. Grade: First.
3. Cut: Flat grain.
5. Actual Width: 2-1/4 inches.
7. End: End matched.
8. Length: Random, minimum of 9 inches.
B. Flooring Nails: Type recommended by flooring manufacturer.
C. Sleepers and Shims: Softwood lumber, pressure treated for moisture protection, No. 2 grade or better 2 by 4 inch size sitting on 3/4" Mason Super W resilient pads. Sleepers shall be spaced at 16" on center.
D. Secondary Subflooring: 2 layers of 5/8" grade "C" or better plywood. Lap layers of secondary plywood to avoid aligned joints.
E. Fill spaces between sleepers with SAFB Mineral wool batt sound insulation.
F. Vapor Retarder: Black polyethylene sheet, 8 mil thick; 2 inch wide tape for joint sealing.
G. Provide expansion joint cover at transitions to other materials.

2.02 ACCESSORIES
A. Perimeter Springs: Flat spring steel, leaf shaped, with attachment clips, 0.093 by 1 by 9 inch size.
B. Transition Strip: Same species and finish as flooring material; profiles indicated.
C. Floor Finish: Specified in Section 09.91.23.
D. Sealer and Wax: Types recommended by flooring manufacturer.

2.03 SOURCE QUALITY CONTROL
A. Inspect and stamp species and grade on underside of each piece of wood flooring at factory.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify existing conditions before starting this work.
B. Verify that concrete subfloor surface is smooth and flat to plus or minus 1/4 inch in 10 feet.
C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Sleepers and Shims:
   1. Place vapor retarder over subfloor surface, lapping edges and ends minimum 6 inches and tape seal; staple in place.
   2. Place sleepers over vapor retarder; space sleepers at 12 inches on center.
   3. Shim underside of sleepers to achieve level line of plus or minus 1/4 inch in 10 feet.
   4. Anchor sleepers to concrete substrate with explosive driven concrete nails; place nails at 16 inches on center.

B. Secondary Subflooring: Place two layers of plywood subflooring over sleepers.
   1. Lay the first layer perpendicular to the sleepers, with end joints over sleepers, and nail at 12 inches on center.

C. Prepare substrate to receive wood flooring in accordance with manufacturer's, MFMA, and NWFA instructions.

D. Broom clean substrate.

3.03 INSTALLATION

A. Sheathing Paper: Place over wood subfloor; lap edges and ends 2 inches, staple in place.

B. Wood Flooring:
   1. Install in accordance with manufacturer's, MFMA, and NWFA instructions; predrill and blind nail to sleepers.
   2. Lay flooring parallel to length of room areas. Verify alignment as work progresses.
   3. Arrange flooring with end matched grain set flush and tight.
   4. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar; provide divider strips and transition strips in accordance with flooring manufacturer's recommendations and as indicated.
   5. Install edge strips at unprotected or exposed edges, and where flooring terminates.
   7. Install flooring tight to floor access covers.
   8. Provide 2 inch expansion space at fixed walls and other interruptions.

C. Install base at floor perimeter to cover expansion space in accordance with manufacturer's instructions. Miter inside and outside corners.

D. Install floor sockets and inserts to a depth sufficient to ensure flush top surface with floor surface.

E. Finishing:
   1. Mask off adjacent surfaces before beginning sanding.
   2. Sand flooring to smooth even finish with no evidence of sander marks. Take precautions to contain dust. Remove dust by vacuum.
   3. Apply finish in accordance with floor finish manufacturer's and MFMA instructions.
   4. Apply filler and three finish coats.
   5. Apply first coat, allow to dry, then buff lightly with steel wool to remove irregularities. Vacuum clean and wipe with damp cloth before applying succeeding coat.
   6. Lightly buff between coats with steel wool and vacuum clean before applying succeeding coat.
   7. Apply last coat of finish.

3.04 CLEANING

A. Clean and polish floor surfaces in accordance with floor finish manufacturer's instructions.
3.05 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Place protective coverings over finished floors; do not remove coverings until Date of Substantial Completion.

END OF SECTION 09.64.29
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Wood flooring with topping sheet for main auditorium platform, Studio Theater & Scene Shop.
   B. Sleepers
   C. Resilient foam underlayment
   D. Sheet vapor retarder
   E. Installation accessories.

1.02 RELATED REQUIREMENTS
   A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.
   B. Section 26.27.26 - Wiring Devices (Floor Boxes)

1.03 REFERENCE STANDARDS
   A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
   B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete
      Subfloor Using Anhydrous Calcium Chloride; 2011.

1.04 SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide data on specified products, describing physical and performance characteristics;
      including sizes, wood species and colors available; and installation instructions. Provide documentation
      that system meets applicable codes and regulations.
   C. Shop Drawings: Indicate floor joint pattern and termination details.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE
   DOCUMENTATION
      1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr
      CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction wast diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
      1. Compliance with Credit MR1.1: Recycling Collection and Storage
      2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
      3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
      4. Compliance with Credit EQ6.4: Material VOC Limits - Flooring systems
      5. Compliance with Credit EQ6.5: Material VOC Limits - Composite wood and agrifiber
   D. Submit documentation of quantity and material cost with monthly Application for Payment to the
      Contractor.

1.06 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section
      with minimum three years documented experience.
B. Installer Qualifications: Company specializing in performing the type of work specified in this section.
   1. Minimum three years of documented experience.
   2. Approved by manufacturer.

1.07 FIELD CONDITIONS
A. Do not install wood flooring until wet construction work is complete and ambient air at installation space has moisture content stabilized at maximum moisture content of 40 percent.
B. Provide heat, light, and ventilation prior to installation.
C. Store materials in area of installation for minimum period of 24 hours prior to installation.
D. Humidity control is very important for wood flooring. Maintain minimum room temperature of 65 degrees F and humidity control as recommended by the flooring manufacturer for a period of two days prior to delivery of materials to installation space, during installation, and after installation until completion of project and turn-over to Owner.

PART 2 PRODUCTS

2.01 MATERIALS
A. Topping Sheets for Main Auditorium and elsewhere as indicated on finish schedule:
   1. Composition: 4'x8'x 1/4" aerated polymer sheets of 95% recycled plastics with through black color.
   2. Installation Method: Screwed down per manufacturer's pattern.
   3. Tensile Strength: 3,540 psi when tested per ASTM D-638.
   4. Compressive Strength: 1,123 psi when tested per ASTM C-365.
   5. Shore D Hardness: 98 when tested per ASTM D-785.
   6. Flammability: U.L. 94 @ 28" 94 HB
B. Topping Sheets for Studio Theater:
   1. Composition: 4' x 8' x 1/4" thick tempered hardboard, both sides.
   2. Installation Method: Screwed down per manufacturer's pattern.
   3. Manufacturer: Masonite, Duron or approved equal.
   4. Finish:
      a. Rosco Tough Prime, Black
      b. PPG Break Through Wrought Iron Black Satin.
C. Wood Flooring, with topping sheets above or without topping sheets at Scene Shop:
   1. Construction: , 1 layer of 4'-0" x 8'-0" x 23/32" APA-Rated Sturd-I-Floor equal to GP Plytanium Plywood, Southern Yellow Pine, Exposure 1, PS 1-09.
D. Subfloor:
   1. Plywood: 2 layers of 4'-0" x 8'-0" sheets of 23/32" thick APA-Rated Sturd-I-Floor, equal to GP Plytanium Plywood, Southern Yellow Pine, Exposure 1, PS 1-09.
E. Subfloor Sleepers: Manufacturer's standard engineered wood sleeper, capable of providing consistent flex.
F. Resilient Pads: With air voids for resiliency and installed at manufacturer's required spacing.
   1. Material and Thickness: Neoprene, 3/4" thick or EPDM 7/16" thick (3/4" thick for site built), minimum Durometer of 40. Mason Super W or as part of manufacturer's system.
G. Channels: Manufacturer's standard.
   1. Channels shall be designed to hold resilient pads in an uplift condition, to provide support of floor and avoid over-compressing resilient pads in an overload condition.
   2. Channel Anchors: Manufacturer's standard, but not less than modified steel drive pins recommended by anchor manufacturer to achieve minimum 900 lbf pullout strength.
H. Alternate Sleeper Assembly:
   1. Sleeper Assembly Alternate: 2 x 4 nominal yellow pine sleepers at 16" on center with 3/4" neoprene pads at 16" on center.
I. Vapor Retarder: Polyethylene sheet, 10 mil thick; 2 inch wide polyethylene tape for sealing joints.

2.02 ACCESSORIES
A. Fasteners:
   1. Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.
   2. All sheet goods to be secured with countersunk #8 flat head, square drive screws.
      a. Screw Pattern: 6" spacing on sheet perimeter and 12" spacing on interior.
      b. All screw holes shall be pre-countersunk in a grid pattern prior to installation.
C. Base: Furnish and install 4" x 3" ventilating cove base. Provide pre-molded outside corners. Color per finish schedule.
D. Floor Threshold Transitions: Balco 1120 or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that sub-floor surfaces are smooth and flat within the tolerances required for type of substrate and ready to receive laminated wood flooring.
B. Verify that sub-floor surfaces are dust-free and free of substances that could impair installation of materials to substrate surface.
C. Verify that concrete sub-floor surfaces are ready for wood flooring installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are outside the following limits:
   1. Moisture emission rate: Not greater than 3 lb per 1000 sq ft per 24 hours, tested according to ASTM F1869.
   2. Alkalinity: pH range of 5 to 9, tested according to ASTM F710.
D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION
A. Prepare sub-floor in accordance with flooring manufacturer's installation instructions.
B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
C. Prohibit traffic until filler is fully cured.
D. Vacuum clean substrate.

3.03 INSTALLATION
A. Vapor Retarder: Install loose laid, seams overlapped 4 inches and sealed with polyethylene tape. Run material 2 inches up the wall and trim after flooring is installed.
B. Underlayment: Install in accordance with manufacturer's installation instructions.
C. Subfloor:
   1. Top layer shall be installed at a 45 degree angle to bottom layer of plywood and bottom layer shall be manufactured using exterior grade flue. Plywood shall not be attached to concrete slab.
D. Wood Flooring:
   1. Install flooring in accordance with manufacturer's installation instructions, but not less than written recommendations of MFMA applicable to flooring type indicated.
   2. Lay flooring in patterns indicated on drawings. Verify alignment as work progresses.
   3. Install edge strips at unprotected or exposed edges, and where flooring terminates.
   4. Install flooring tight to floor access covers, receptacles, jacks, etc.
   5. Provide 2 inch expansion space at fixed walls and other interruptions, or as recommended by the manufacturer.

E. Finishing: Painted Flat Black - see Finish Legend/Schedule.
   1. Inspect entire floor to be sure surface is ready to accept seal and finish. Floor should be free from dust and debris.
   2. Apply finish in accordance with floor finish manufacturer's instructions.
   3. Apply filler and three finish coats.

3.04 CLEANING
   A. Remove excess adhesive from floor, base, and wall surfaces without damaging surfaces.
   B. Clean floor surfaces in accordance with the flooring manufacturer's instructions.

3.05 PROTECTION
   A. Prohibit traffic on finished floor for 24 hours after installation.
   B. Place protective coverings over finished floors; do not remove coverings until after Date of Substantial Completion.

END OF SECTION 09.64.33
SECTION 09.65.00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Resilient stair accessories.
B. Installation accessories.

1.02 RELATED REQUIREMENTS
A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.
B. Section 09.05.61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
C. Shop Drawings: Indicate seaming plans and floor patterns.
D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
E. Concrete Testing Standard: Submit a copy of ASTM F710.
F. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.
G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.

DESIGN RELEASE PACKAGE 4
ISSUED: 12/01/2017
3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
4. Compliance with Credit EQ6.4: Material VOC Limits - Flooring systems
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
B. Store all materials off of the floor in an acclimatized, weather-tight space.
C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
D. Protect roll materials from damage by storing on end.
E. Do not double stack pallets.

1.07 FIELD CONDITIONS
A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 STAIR COVERING (BACK OF HOUSE CONCRETE FILLED METAL PAN STAIRS)
A. Stair Treads and Landings: Rubber; full width and depth of stair tread in one piece; tapered thickness.
   1. Manufacturers:
   2. Minimum Requirements: Comply with ASTM F2169, Type TP, rubber, thermoset.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
   4. Nominal Thickness: 0.1875 inch.
   7. Texture: As indicated on drawings.
   8. Color: As indicated on drawings.
B. Stair Risers: Full height and width of tread in one piece, matching treads in material and color.
   1. Thickness: 0.080 inch.
C. Stair Stringers: Full height in one piece and in maximum available lengths, matching treads in material and color.
   1. Nominal Thickness: 0.080 inch.

2.02 ACCESSORIES
A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
   1. VOC Content Limits: As specified in Section 01.61.16.
C. Moldings, Transition and Edge Strips: Same material as flooring.
D. Sealer and Wax: Types recommended by flooring manufacturer.
E. Sound Control Underlayment: Membrane consisting of cork granules and ground ethylene vinyl acetate (EVA) with polyurethane binder.
1. Thickness: 0.08 inch.
2. Roll Width: 48 inch.
3. Roll Length: 50 feet.
4. Minimum of 55 dB transmission loss when tested in accordance with ASTM E90 or ASTM E492.

PART 3  EXECUTION

3.01  EXAMINATION
A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
B. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
   1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
C. Verify that required floor-mounted utilities are in correct location.

3.02  PREPARATION
A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
B. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
C. Prohibit traffic until filler is fully cured.
D. Clean substrate.
E. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03  INSTALLATION - GENERAL
A. Starting installation constitutes acceptance of sub-floor conditions.
B. Install in accordance with manufacturer's written instructions.
C. Spread only enough adhesive to permit installation of materials before initial set.
D. Fit joints and butt seams tightly.
E. Set flooring in place, press with heavy roller to attain full adhesion.
F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
   2. Resilient Strips: Attach to substrate using adhesive.
H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
I. Install flooring in recessed floor access covers, maintaining floor pattern.
J. Install feature strips where indicated.

3.04  INSTALLATION - SOUND CONTROL UNDERLAYMENT
A. Install in accordance with underlayment manufacturer's instructions.

3.05  INSTALLATION - STAIR COVERINGS
A. Install stair coverings in one piece for full width and depth of tread.
B. Install stringers configured tightly to stair profile.
C. Adhere over entire surface. Fit accurately and securely.

3.06 CLEANING
A. Remove excess adhesive from floor, base, and wall surfaces without damage.
B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION
A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 09.65.00
PART 1 GENERAL

1.01  SECTION INCLUDES
   A. Luxury resilient plank and tile flooring.
   B. Resilient base.
   C. Installation accessories:
      1. Adhesives.
      2. Finishes and cleaners.

1.02  RELATED REQUIREMENTS
   A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions: SCS FloorScore certification documentation.
   B. Section 07.92.00 - Joint Sealants.

1.03  REFERENCE STANDARDS
   J. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
X. NSF 332 - Sustainability Assessment for Resilient Floor Coverings; 2015.
Z. NSF 332 - Sustainability Assessment for Resilient Floor Coverings; 2012.

1.04 SUBMITTALS
A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings.
C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
D. Verification Samples: Submit two samples, 4 by 4 inch in size illustrating color and pattern for each resilient flooring product specified.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   4. Compliance with Credit EQ6.4: Material VOC Limits - Flooring systems
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and that the material is of the correct style, color, quantity and run number(s).
1.07 FIELD CONDITIONS

A. Acclimate material at jobsite between 65 to 85 degrees F and 35 percent to 85 percent relative humidity for 48 hours prior to installation. Temperature and relative humidity should also be maintained at the same levels during installation, and after installation.

B. Spread unopened cartons no more than 6 cartons high and at least 4 inches apart.

C. Keep away from heating and cooling ducts and direct sunlight.

D. If permanent HVAC is not operational, temporary means should be used to maintain the recommended temperature and relative humidity levels.

E. Close areas to traffic during installation of flooring and accessories.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

B. Installer Qualifications: Aspecta® Five should only be installed by professional flooring contractors that have demonstrated successful installations of jobs in similar size and scope.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Mohawk, Select Step; www.mohawkflooring.com; 800-266-4295

B. Patcraft, Set-In-Concrete; www.patcraft.com, 800-241-4014

C. Mannington, Spacia; www.mannington.com, 800-356-6787

2.02 RESILIENT TILE FLOORING

A. Luxury Vinyl Plank and Tile:
   1. Pattern: See Finish Legend.
   3. Physical Properties:
      a. Construction: Phthalate-free solid plank and tile made from 100 percent virgin vinyl.
      b. Wear Layer Thickness: 28 mil.
      c. Total Thickness (Gauge): 0.126 inch.
   4. Manufacturing, Performance, and Safety Standards:
      a. NSF 332 Certified: Platinum level.
      b. ASTM F1700, Classification: Class III, Type B.
      c. ASTM F386, Thickness: Passes requirements.
      d. ASTM F410, Wear Layer Thickness: Passes requirements for commercial classification.
      e. ASTM F2421/F2055, Size and Squareness: Passes requirements.
      f. ASTM F1914, Residual Indentation: Surpasses requirements.
      g. ASTM F137, Flexibility: Surpasses requirements.
      h. ASTM F2199, Dimensional Stability: Surpasses requirements.
      i. ASTM F925, Chemical Resistance: Surpasses requirements.
      j. ASTM F1514, Resistance to Heat: Surpasses requirements.
      k. ASTM F1515, Resistance to Light: Surpasses requirements.
      l. ASTM E648/NFPA 253, Critical Radiant Flux: Class I.
      m. ASTM E662, Smoke Density (Flaming and Non-Flaming): Passes requirements.
n. ASTM F963, Sec. 4.3.5.2(2)(B), Heavy Metals: Passes requirements.
o. 1 and 2, Mold and Microbial Resistance: Highly resistant.
p. ASTM D2047, Coefficient of Friction (Dry): Greater than or equal to 0.6.
q. ASTM F970, Static Load Limit: Greater than or equal to 1,000 pounds (surpasses requirements).
r. ASTM D4060, Abrasion Resistance: Average of 30,000 cycles (results vary with emboss).

2.03 ACCESSORIES
A. Base, Transition and Edge Strips: Rubber. Base 4" high.
B. Adhesives:
   1. VOC Content Limits: As specified in Section 01.61.16.

PART 3 EXECUTION

3.01 EXAMINATION
A. Install flooring and accessories after other operations (including painting) have been completed.
B. Acceptance of Conditions: Carefully examine all installation areas with installer/applicator present, for compliance with requirements affecting work performance.
   1. Verify that field measurements, product, adhesives, substrates, surfaces, structural support, tolerances, levelness, temperature, humidity, moisture content level, pH, cleanliness and other conditions are as required by the manufacturer, and ready to receive work.
C. Verify that substrate is contaminant-free, including old adhesives and abatement chemicals.
D. Test substrates as required by manufacturer to verify proper conditions exist.
   1. Concrete:
      a. Check for concrete additives such as fly ash, curing compounds, hardeners, or other surface treatments that may prevent proper bonding of floor coverings.
      b. Moisture testing: Perform either the In-Situ Relative Humidity (RH) test (ASTM F2170) or Moisture Vapor Emission Rate (MVER) test (ASTM F1869). Refer to the Manufacturer's Installation Guide/Manual for the maximum allowable substrate moisture content. Substrates above the maximum allowable moisture content will require a moisture mitigation system.
      c. Perform alkalinity testing per ASTM F710 to verify pH level is between 7 to 10.
      d. Check substrate for absorbency per manufacturer's recommendations.
      e. Perform bond testing per ASTM F710 to determine compatibility of adhesive to concrete substrate.
E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION
A. Prior to installation, the flooring installer should plan and attend an on-site construction meeting with the General Contractor, Architect and Property Owner to review all requirements and inspect site conditions as outlined in the manufacturer's installation document, as well as to review the requirements of ASTM F710 and any relevant building codes, or local, state, or national regulations.
B. Flooring installation should not begin until all site conditions have been assessed, testing has been completed and subfloor conditions have been approved.
C. Prepare per manufacturer's written instructions, Section 01.70.00, and as follows:
   1. Prepare substrates to ensure proper adhesion of Luxury Vinyl Plank & Tile.
   2. Concrete Substrates: Prepare substrate per ASTM F710.
      a. Verify that subfloor is clean, flat, smooth, free of dirt, rust, paint, oil, wax or any contaminant that will interfere with adhesive bonding.
      b. Mechanically remove substrate coatings that are not compatible with adhesives, such as sealers, curing, hardening or parting compounds, soap, wax, oil, etc.
1) Do not use solvents or adhesive removers.

   c. Expansion joints, isolation joints, or other moving joints must be honored and must not be filled with underlayment products or other materials, and floor coverings must not be laid over them. Expansion joint covering systems should be detailed by the architect or engineer, and based upon intended usage and aesthetic considerations.

   d. Surface cracks, grooves, depressions, control joints or other non-moving joints, and other irregularities shall be filled or smoothed with high-quality Portland cement or calcium aluminate based patching or underlayment compound for filling or smoothing, or both.

      1) Do not skim-coat large areas with patching compound, especially slick power-troweled surfaces.

      2) Sand smooth per manufacturer's instructions.

   e. Slick surfaces such as power-troweled concrete shall be profiled as needed to allow for a mechanical bond between the adhesive and subfloor.

   f. Do not use gypsum-based underlayment products and do not skim coat concrete subfloors.

   g. Self-Leveling Underlayments: Provide a dry and smoothly-sanded underlayment substrate ready for installation of Luxury Vinyl Plank & Tile. Underlayment compound shall be moisture-resistant, mildew-resistant, and alkali-resistant and must have a minimum of 3,000 psi compressive strength per ASTM C109/C109M.

   h. Lightweight concrete shall have a compressive strength greater than 90 pounds per cubic foot with minimum compression strength of 2,500 psi or greater.

3.03 INSTALLATION

   A. Installation per manufacturer's written instructions and as follows:

      1. Layout shall be specified by Architect, Designer or End User.

      2. Follow layout and ensure installation reference lines are square.

      3. Field tiles shall be installed with directional arrows on back aligned in the same direction, or may be installed in quarter-turned fashion.

      4. Check cartons for and do not mix dye lots.

      5. Expansion Joints: Locate expansion, isolation, and other moving joints prior to installation.

         a. Do not fill expansion, isolation, and other moving joints with patching compound nor cover with resilient flooring.

         b. Install movement joint systems per manufacturer's instructions and per Section 07.92.00.

      6. Adhesives: Adhere flooring to substrate using the full spread method resulting in a completed installation without gaps, voids, raised edges, bubbles or any other surface imperfections.

         a. Select appropriate adhesive, trowel and follow manufacturer's instructions.

         b. Periodically spot-check transfer of adhesive to back of tile during installation.

         c. Roll floor with a 100 pound roller to ensure proper transfer of adhesive and bonding.

         d. Protect floor from traffic per manufacturer's instructions.

         e. Do not wet mop floor until the adhesive has properly set per written instructions.

3.04 FIELD QUALITY CONTROL

   A. Site tests and inspections:

      1. Inspect flooring installation for non-conforming work including (but not limited to) the following:

         a. Lack of adhesion.

         b. Bubbles, loose tiles or raised edges.

         c. Dirt and debris underneath flooring.

         d. Excessive gaps.

         e. Improper substrate preparation (as indicated by telegraphing).

         f. Damage to tiles, including: dents/indentations, cuts, cracks, burns or punctures.

   B. Non-conforming work per General Conditions and as follows:

      1. Repair or replace damaged material if not acceptable to the Architect.
3.05 CLEANING

A. Provide progress cleaning per manufacturer's written instructions, Section 01.70.00, and as follows:
   1. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper
      execution of the work.
      a. Clean and protect completed construction until Date of Substantial Completion.
      b. During installation, remove wet adhesive from surface of flooring per manufacturer's
         instructions.
   2. Site: Maintain project site free of waste materials and debris.

B. Provide final cleaning immediately prior to Date of Substantial Completion inspection per manufacturer's
   written instructions and Section 01.70.00.
   1. Protection: Remove manufacturer's and other installed protection immediately prior to Date of
      Substantial Completion inspection, unless required otherwise.
   2. Clean floor with a neutral 6-8 pH cleaner.

3.06 MAINTENANCE

A. Initial maintenance per flooring manufacturer's written instructions and as follows:
   1. Allow the adhesive to cure for at least 48 hours prior to wet cleaning the floor.
   2. Sweep, dust mop or vacuum the floor thoroughly to remove all loose dirt, dust, grit and debris. Do
      not use vacuums with a beater bar assembly.
   3. Remove any dried adhesive residue from the surface with mineral spirits applied to a clean, lint-free
      cloth.
   4. Damp mop the floor using a cleaner recommended by the flooring manufacturer.
   5. If necessary, scrub the floor using an auto scrubber or rotary machine (300 rpm or less) with a
      cleaner recommended by the flooring manufacturer. Maintain the proper dilution ratio and use the
      appropriate scrubbing brush or pad.
   6. Thoroughly rinse the entire floor with fresh, clean water. Remove the dirty residue with a
      wet-vacuum or clean mop and allow the floor to dry completely.

3.07 PROTECTION

A. Protect materials from construction operations until Date of Substantial Completion or Owner occupancy,
   whichever occurs first.
   1. Protect finished floor from abuse and damage by using heavy non-staining kraft paper, drop cloths
      or equivalent. Use additional, non-damaging protective materials as needed.
   2. Light foot traffic on a newly installed floor can be permitted after 24 hours.
   3. Keep heavy traffic and rolling loads off the newly installed LVT flooring for 48 hours.
   4. Protect the floor from rolling loads by covering with protective boards.

END OF SECTION 09.65.19
PART 1  GENERAL

1.01  SECTION INCLUDES
   A. Epoxy matrix terrazzo with ground and polished finish.
   B. Divider strips.

1.02  RELATED REQUIREMENTS
   A. Section 01.61.16 - Volatile Organic Compound (VOC) Restrictions.
   B. Section 03.30.00 - Cast-in-Place Concrete: Concrete subfloor with steel trowel finish.

1.03  REFERENCE STANDARDS
   B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
   E. NTMA (GRAD) - Aggregate Gradation Standards; The National Terrazzo and Mosaic Association, Inc; current edition.
   F. NTMA (EPOXY) - Epoxy Terrazzo Specifications; The National Terrazzo and Mosaic Association, Inc; Current Edition located at www.ntma.com.

1.04  SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide data for divider strips, control joint strips, expansion joints, and sealer; include printed copy of current NTMA recommendations for type of terrazzo specified.
   C. Shop Drawings: Indicate divider strip and control and expansion joint layout, and details of adjacent components. For precast units, detail profile and anchorage requirements.
   D. Samples: Submit two samples, 6 inch by 6 inch in size illustrating color, chip size and variation, chip gradation, matrix color, and typical divider strip.
   E. Cleaning and Maintenance Data: Include procedures for stain removal, stripping, and sealing.

1.05  QUALITY ASSURANCE
   A. Perform work in accordance with NTMA recommendations as posted at their web site at www.ntma.com.
   B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.
      1. Minimum five years of documented experience.
   C. Installer Qualifications: Company specializing in performing the type of work specified in this section.
      1. Minimum five years of documented experience.

1.06  MOCK-UP
   A. Construct mock-up of terrazzo illustrating appearance of finished work in each configuration required. Size mock-up to be not less than 100 square feet.
B. Locate where directed.  
C. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING  
A. Store terrazzo materials in a dry, secure area.  
B. Maintain minimum temperature of 60 degrees F.  
C. Keep products away from fire or open flame.

1.08 FIELD CONDITIONS  
A. Do not install terrazzo when temperature is below 50 degrees F or above 90 degrees F.  
B. Maintain temperature within specified range 24 hours before, during, and 72 hours after installation of flooring.  
C. During installation, provide ambient lighting level of 50 ft candles, measured at floor surface.

PART 2 PRODUCTS  

2.01 MANUFACTURERS  
B. Other Acceptable Manufacturers - Resinous Matrix Terrazzo Flooring:  

2.02 EPOXY MATRIX TERRAZZO APPLICATIONS  
A. Floors:  
   1. Thickness: 3/8 inch, nominal.  
   2. Color(s): To be selected by Architect.  
   3. Aggregate Type: Marble chips.  
   4. Aggregate Size: No. 2.

2.03 MATERIALS  
A. Epoxy Matrix Terrazzo: Aggregate and matrix mix applied to substrate, troweled flat, and ground smooth.  
   1. Mix Proportions: As required to achieve appearance specified.  
B. Matrix: Two component resin and epoxy hardener with mineral filler and color pigment, non-volatile, thermo-setting.  
C. Aggregate: Type as indicated; sized in accordance with NTMA aggregate gradation standards; color(s) as indicated, uniform in color.  
D. Finishing Grout: Epoxy, color to match terrazzo matrix.

2.04 ACCESSORIES  
A. Divider Strips: 1/8 inch thick zinc exposed top strip, zinc coated steel concealed bottom strip, with anchoring features.  
B. Divider and Control Joint Strip Height: To suit thickness of terrazzo topping, with allowance for grinding.  
C. Sealer: Colorless, non-yellowing, penetrating liquid type to completely seal matrix surface; not detrimental to terrazzo components.
D. Primer: As recommended by manufacturer for field conditions.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive terrazzo.
B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.
C. Verify that concrete sub-floor surfaces are ready for terrazzo installation by testing for moisture vapor emission, internal relative humidity, and alkalinity; obtain instructions if test results are not within the following limits:
   1. Moisture Vapor Emission: Not greater than 3 lb per 1000 sq ft per 24 hours, tested according to ASTM F1869.
   2. Internal Relative Humidity: Maximum of 80 percent, tested according to ASTM F2170.
   3. Alkalinity: pH range of 5 to 9, tested according to ASTM F710.

3.02 PREPARATION
A. Clean substrate of foreign matter, including oil, grease and curing compounds.
B. Repair any cracks in accordance with manufacturer's instructions.
C. Prepare concrete subfloor by mechanically abrading surface in accordance with manufacturer's instructions.
D. Apply primer in accordance with manufacturer's instructions.

3.03 INSTALLATION
A. Install divider and control joint strips straight and flat to locations indicated.
B. Place terrazzo mix over substrate to thickness indicated.

3.04 FINISHING
A. Finish terrazzo to NTMA requirements.
B. Grind terrazzo surfaces with power disc machine; sequence with coarse to fine grit abrasive, using a wet method or using a dry grinder with vacuum to control dust.
C. Apply grout to fill voids exposed from grinding.
D. Remove grout coat by grinding, using a fine grit abrasive.

3.05 TOLERANCES
A. Maximum Variation from Flat Surface: 1/4 inch in 10 feet.
B. Maximum Variation from Level (Except Surfaces Sloping to Drain): 1/8 inch.

3.06 CLEANING
A. Scrub and clean terrazzo surfaces with neutral pH cleaner in accordance with manufacturer's instructions. Let dry.
B. Immediately after terrazzo has dried, apply sealer in accordance with manufacturer's instructions.
C. Polish surfaces in accordance with manufacturer's instructions.
3.07 PROTECTION

A. Protect finished terrazzo from damage due to subsequent construction until Date of Substantial Completion.

END OF SECTION 09.66.23
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Carpet tile, fully adhered.
   B. Matching roll carpet for direct glue installation on base and stairs.

1.02 RELATED REQUIREMENTS
   A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.
   B. Section 03.30.00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
   C. Shop Drawings: Indicate layout of joints.
   D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
   E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
   F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
   G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
      1. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction wast diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
      1. Compliance with Credit MR1.1: Recycling Collection and Storage
      2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
      3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
      4. Compliance with Credit EQ6.4: Material VOC Limits - Flooring systems
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.
B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.07 FIELD CONDITIONS
A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Tile Carpeting:
   1. Mohawk; www.mohawk.com; 800-266-4295
   2. Lees Carpets: www.leescarpets.com

2.02 MATERIALS
A. Tile Carpeting: Tufted, manufactured in one color dye lot.

2.03 ACCESSORIES
A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.
B. Edge Strips: Embossed aluminum, color as selected by Architect.
C. Stair Nosing: Rubber type, square nose, ribbed top surface, one piece per stair tread width, Johnsonite SVCD-XX-A or equal.
D. Adhesives:
   1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.
E. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.
C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
   1. Test in accordance with ASTM F710.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
D. Verify that required floor-mounted utilities are in correct location.
3.02 PREPARATION
A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
D. Vacuum clean substrate.

3.03 INSTALLATION
A. Starting installation constitutes acceptance of sub-floor conditions.
B. Install carpet tile in accordance with manufacturer's instructions.
C. Blend carpet from different cartons to ensure minimal variation in color match.
D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
F. Locate change of color or pattern between rooms under door centerline.
G. Fully adhere carpet tile to substrate.
H. Trim carpet tile neatly at walls and around interruptions.
I. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING
A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
B. Clean and vacuum carpet surfaces.

END OF SECTION 09.68.13
DESIGN RELEASE PACKAGE 4
ISSUED: 12/01/2017
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Surface preparation and prime painting.
   B. Wood veneer wall covering.

1.02 RELATED REQUIREMENTS
   A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.
   B. Section 09.21.16 - Gypsum Board Assemblies
   C. Section 09.91.23 - Interior Painting: Preparation and priming of substrate surfaces.

1.03 REFERENCE STANDARDS
   B. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2015.

1.04 SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide data on wall covering and adhesive physivsl properties and fire hazard classification.
   C. Shop Drawings: Indicate wall elevations with seaming layout.
   D. Samples: Submit two samples of wall covering, 6 by 9 inch in size illustrating color, finish, and texture.
   E. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.
   F. Manufacturer's Installation Instructions: Indicate special procedures and recommendations for maximum permissible moisture content of substrates.
   G. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.
   H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
      1. Extra Wall Covering Materials: 3% of each species, cut and finish of wallcovering, for maintenance purposes. Furnish replacement materials from same production run as installed materials. Protect material with clearly marked packaging indicating product identification and project location.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction wast diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
      1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
      2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
      3. Compliance with Credit EQ6.5: Material VOC Limits - Composite wood and agrifiber
   D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.
1.06 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
   B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 MOCK-UP
   A. Provide panel, 3 sheets wide, full height, illustrating installed wall covering and joint seaming technique. Contact Architect for review.
   B. Locate where directed.
   C. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING
   A. Inspect roll materials at arrival on site, to verify acceptability.
   B. Protect packaged adhesive from temperature cycling and cold temperatures.
   C. Do not store roll goods on end.

1.09 FIELD CONDITIONS
   A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.
   B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.
   C. During installation, provide lighting level of 80 ft candles measured mid-height at substrate surfaces.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Basis of Design - Wall Coverings: Koroseal Arbor Series.
      1. Distributor representative: Rachel Longerier, 865-805-4182.
   B. Other Acceptable Manufacturers - Wall Coverings:
   C. Substitutions: See Section 01.60.00 - Product Requirements.

2.02 MATERIALS
   A. Requirements for Wall Coverings:
      1. Surface Burning Characteristics: Class A Fire Rating with Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
   B. Wall Covering: five-ply wood wall covering consisting of genuine wood veneer, bonded to paper, foil, flue line barrier and paper, conforming to the following:
      1. Species: Walnut
      2. Cut and Figure: Quarter cut
      3. Matching: Slip match
      4. Sheet Size: Best yield
      5. Factory Finish: Standard
   C. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.
   D. Trim: Metal reveals and termination trim, as indicated on the Drawings.
1. Type A for 1/4" outside corners: Koroseal OC 12001 Satin Aluminum
2. Type B for 1/2" reveals at wood wallcovering: Gordon Series 500, 512-5/8 with extruded inserts
3. Type C for 2 1/2" reveals at painted drywall: Gordon Series 500, 525-5/8
5. Type E for 1/2" Z-shape reveals at painted drywall: Gordon Series 300, 312-5/8
6. Type F for J-shaped trim (if required): Koroseal SMSJ00001 J-Cap, Satin Aluminum
7. Type G for mid-joint H-shaped trim (if required): Koroseal SMSH200001, Satin Aluminum

E. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that substrate surfaces are prime painted and ready to receive work, and conform to requirements of the wall covering manufacturer. Do not use oil based primers.
B. Maintain a constant temperature range of 65 degrees F to 85 degrees F, with not more than 50% relative humidity and not less than the relative humidity specified for the project area in the AWI Quality Standards Section 1700-T-19, for at least 4 days prior to and throughout the installation period, and maintained consistently thereafter.
C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.
D. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.

3.02 PREPARATION
A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.
B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.
C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
D. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION
A. Apply adhesive and wall covering in accordance with manufacturer's written instructions.
B. Provide lighting of not less than 80 foot candles per square foot during the installation process.

3.04 CLEANING
A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.
B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION
A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION 09.72.00
PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work of the Section includes all labor, materials, equipment and services necessary to complete the furnishing and installation of sound absorptive boards as shown on the drawings and specified herein, including but is not necessarily limited to the following:

1. Glass mineral wool black acoustical board insulation.
2. Surface mounted sound absorptive wall and ceiling boards. Where drawings call for “duct liner” or “duct liner board” to be applied as an exposed room finish at the wall or ceiling, provide sound absorptive boards as specified in this section.

1.2 RELATED WORK

A. Consult all other Sections to determine the extent of work specified elsewhere but related to this Section. This work shall be properly coordinated to produce an installation satisfactory to the Owner.

1.3 SUBMITTALS

A. Submit samples and product data all materials specified, including acoustical test data to Architect for approval.
B. Shop Drawings: Submit drawings sufficient to show application, attachments and locations.
C. Submit sound absorption test data measured in an independent accredited acoustical test laboratory demonstrating compliance with acoustical performance specification. Laboratory test samples shall be equal to the specified products with respect to core material, thickness, finish, and mounting.

1.4 PRODUCT HANDLING

A. Shipping: Package, handle, transport and store materials at the jobsite in a manner that will avoid damage. Materials shall be delivered in manufacturer’s original labeled, unopened cartons.
B. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
C. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.5 QUALITY ASSURANCE:

A. Insulation manufacturer shall be qualified for the work of this Section and shall have minimum 5 years’ experience with installations of similar construction.
B. Specified Products are specified to establish standards of quality, performance and design concept. The products of other manufacturers are acceptable by prior approval only.
C. The following manufacturers are approved to provide Sound Absorptive Board, provided systems are in compliance with the requirements of the Contract Documents:

1. Knauf Insulation Shelbyville, IN 46176 800-825-4434 X8485
2. Owens-Corning Toledo, OH 43659 800-438-7465
3. Acoustical Solutions Cleveland, OH 800-782-5742

1.6 COORDINATION

A. Coordinate work with all work by other Sections and Drawings.
PART 2 - PRODUCTS

2.1 GENERAL
A. All components shall be manufactured by a single established manufacturer.

2.2 SOUND ABSORPTIVE BOARD INSULATION
A. Black Surfaced, Rigid Glass Mineral Wool Board Insulation: ASTM C 1338, G 21, 22; faced on one side with black glass fiber mat finish; maximum flame spread and smoke developed indexes of 25 and 50 respectively, per UL 723.
   2. Thickness: 2 inches (51 mm).
   3. Nominal density of 3.0 lb./cu. ft. (48 kg/cu. m), thermal resistivity to 8.7 (R-SI Range 0.33 to 1.06) for 2 inch thickness.
   4. Noise Reduction Coefficient: 0.95.
   5. Corrosiveness: Does not accelerate corrosion, when tested per ASTM C665.

PART 3 - EXECUTION

3.1 PROTECTION
A. Protect treatments from damage and soiling during shipping and installation until Owner's acceptance.

3.2 INSTALLATION
A. Mounting Systems:
   1. Adhesive attachment.
   2. Impaling pin fasteners where approved.
B. Install and adjust panels to lines and levels to provide accurate alignment and reveal widths as detailed. Cut panels in field as required to match sizes shown on Drawings and fit between structural members as indicated.
C. Clean, repair or replace any panels which become soiled or damaged.

END OF SECTION
SECTION 09 84 13
SOUND ABSORPTIVE WALL PANELS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS
A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 WORK INCLUDED
A. Work of the Section includes all labor, materials, equipment and services necessary to complete the furnishing and installation of sound absorptive wall treatments as shown on the drawings and specified herein, including but is not necessarily limited to the following:
   1. Fiberglass panels with resin-hardened edges wrapped in selected fabric for walls.

1.3 RELATED WORK
A. Consult all other Sections to determine the extent of work specified elsewhere but related to this Section. This work shall be properly coordinated to produce an installation satisfactory to the Owner.

1.4 SUBMITTALS
A. Submit samples, mock-up of all materials specified, and acoustical test data to Architect for approval. No substitutions are to be made without approval. Any non-approved materials that have been installed shall be removed and replaced with approved materials at no expense to the Owner.

B. Shop Drawings: Submit complete fabrication and installation Drawings for all assemblies. Provide full size details of all major components. Submittals of panel layouts for final approval shall show field verified dimensions.

C. Submit sound absorption test data measured in an independent accredited acoustical test laboratory demonstrating compliance with acoustical performance specification. Laboratory test samples shall be equal to the specified products with respect to core material, thickness, finish, and mounting. Products shall be tested in a Type A mounting unless otherwise specified.

1.5 PRODUCT HANDLING
A. Shipping: Package, handle, transport and store materials at the jobsite in a manner that will avoid damage. Materials shall be delivered in manufacturer’s original labeled, unopened cartons.

B. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.6 QUALITY ASSURANCE:
A. Wall panel fabricator shall be qualified for the work of this Section and shall have minimum 5 years’ experience with installations of similar construction.

B. No substitutions are to be made without approval. Any non-approved materials that have been installed shall be removed and replaced with approved materials at no expense to the Owner.

C. Specified Products are specified to establish standards of quality, performance and design concept. The products of other manufacturers are acceptable by prior approval only.

D. The following manufacturers are approved to provide Acoustical Wall and Ceiling Treatments provided systems are in compliance with the requirements of the Contract Documents:
1. Corporate Acoustics  Poughkeepsie, NY  (914) 473-7738; (800) 243-3144
2. Decoustics  Getzville, NY  (716) 692-6332; (800) 387-3809
3. MBI  Cleveland, OH  (216) 431-6400
4. Whisper Walls  Aurora, CO  (303) 671-6696; (800) 527-7817

1.7 COORDINATION
   A. Coordinate acoustical wall panel work with all existing conditions.

PART 2 - PRODUCTS
   A. GENERAL
   B. Fabricate treatments to details and configurations shown on the Drawings in accordance with approved Shop Drawings and Mock-ups.
   C. All components of wall sound absorptive systems shall be manufactured by a single established manufacturer.

2.2 ACOUSTICAL WALL PANELS
   A. Acoustical Wall Panel shall be fabricated from 2” thick rigid fiberglass board, with a density of 6 pcf. Panel edges shall be as shown on the Drawings, and shall be hardened with resin. Panels are to be wrapped with a selected sound-transparent fabric, neatly wrapped around the edges and at least 3” onto back of panel. NRC 1.00 or greater per ASTM C423, Type A mounting.

PART 3 - EXECUTION
3.1 PROTECTION
   A. Protect treatments from damage and soiling during shipping and installation until Owner’s acceptance.

3.2 WALL PANEL INSTALLATION
   A. Mounting Systems:
      1. Typical mounting unless otherwise noted: Manufacturer shall provide a mechanical system using concealed continuous panel Z-clips of galvanized steel permanently bonded to the rear of the panels, and a matching Z-track leveled and attached to wall per manufacturer’s standard recommendations.
      2. Hinged Mounting: At Percussion Rehearsal 150, as shown on the Drawings.
   B. Install and adjust panels to lines and levels to provide accurate alignment and reveal widths as detailed.
   C. Clean, repair or replace any panels which become soiled or damaged.

END OF SECTION
SECTION 09 84 15
SOUND DIFFUSIVE/ABSORPTIVE PANELS

1.1 GENERAL REQUIREMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 RELATED SECTIONS
A. Section 09 23 00 – Plaster & Gypsum Board
B. Section 09 53 00 – Acoustic Tile Ceilings: Suspension Systems
C. Section 12.12.30 – Art Hanging and Display Systems

1.3 SYSTEM DESCRIPTION
A. Design Requirements: Panels shall absorb sound via a porous core that converts sound energy to heat through molecular friction. Panels shall diffuse reflected sound via a planar, variable impedance, outer surface with perforations sized and located according to an optimized binary sequence, forming a binary amplitude grating.
B. Performance Requirements
1. Random Incidence Sound Absorption Coefficients (a): Tested by independent, accredited, NVLAP facility according to ASTM C 423 and ASTM E 795 for an A mounting.

<table>
<thead>
<tr>
<th>Thickness</th>
<th>125 Hz</th>
<th>250 Hz</th>
<th>500 Hz</th>
<th>1000 Hz</th>
<th>2000 Hz</th>
<th>4000 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>0.18</td>
<td>0.35</td>
<td>0.90</td>
<td>0.99</td>
<td>0.83</td>
<td>0.60</td>
</tr>
<tr>
<td>2&quot;</td>
<td>0.45</td>
<td>0.82</td>
<td>1.09</td>
<td>0.97</td>
<td>0.83</td>
<td>0.64</td>
</tr>
<tr>
<td>3&quot;</td>
<td>0.66</td>
<td>0.96</td>
<td>0.95</td>
<td>0.92</td>
<td>0.83</td>
<td>0.62</td>
</tr>
<tr>
<td>4&quot;</td>
<td>0.90</td>
<td>0.92</td>
<td>1.00</td>
<td>0.98</td>
<td>0.83</td>
<td>0.60</td>
</tr>
</tbody>
</table>

2. Random Incidence Sound Absorption Coefficients (a): Tested by independent, accredited, NVLAP facility according to ASTM C 423 and ASTM E 795 for an E-400 mounting.

<table>
<thead>
<tr>
<th>Thickness</th>
<th>125 Hz</th>
<th>250 Hz</th>
<th>500 Hz</th>
<th>1000 Hz</th>
<th>2000 Hz</th>
<th>4000 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>0.67</td>
<td>0.77</td>
<td>0.77</td>
<td>0.94</td>
<td>0.85</td>
<td>0.70</td>
</tr>
</tbody>
</table>

3. Noise Reduction Coefficient (NRC): Tested by independent, accredited, NVLAP facility according to ASTM C 423 and ASTM E 795 for an A mounting.

4. Noise Reduction Coefficient = 0.80 (1")

5. Sound Diffusion Coefficients (sound diffusive/absorptive panel): Tested in accordance with AES-4id-2001. Average incidence diffusion coefficients shall be obtained from an average of 35 measurements of incidence angles at 5 degree intervals between +/- 85 degrees.

1/3 Octave Band Centers (Hertz) – All Panel Thicknesses

<table>
<thead>
<tr>
<th>630</th>
<th>800</th>
<th>1000</th>
<th>1250</th>
<th>1600</th>
<th>2000</th>
<th>2500</th>
<th>3150</th>
<th>4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.31</td>
<td>0.49</td>
<td>0.61</td>
<td>0.66</td>
<td>0.65</td>
<td>0.51</td>
<td>0.40</td>
<td>0.41</td>
<td>0.42</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5000</th>
<th>6300</th>
<th>8000</th>
<th>10000</th>
<th>12500</th>
<th>16000</th>
<th>20000</th>
</tr>
</thead>
</table>
6. Sound Diffusion Coefficients (reference panel): Tested in accordance with AES-4id-2001. Average incidence diffusion coefficients shall be obtained from an average of 35 measurements of incidence angles at 5 degree intervals between +/- 85 degrees.

1/3 Octave Band Centers (Hertz)

<table>
<thead>
<tr>
<th>Octave Band Center (Hertz)</th>
<th>Diffusion Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>630</td>
<td>0.40</td>
</tr>
<tr>
<td>800</td>
<td>0.55</td>
</tr>
<tr>
<td>1000</td>
<td>0.56</td>
</tr>
<tr>
<td>1250</td>
<td>0.47</td>
</tr>
<tr>
<td>1600</td>
<td>0.43</td>
</tr>
<tr>
<td>2000</td>
<td>0.37</td>
</tr>
<tr>
<td>2500</td>
<td>0.34</td>
</tr>
<tr>
<td>3150</td>
<td>0.31</td>
</tr>
<tr>
<td>4000</td>
<td>0.31</td>
</tr>
<tr>
<td>5000</td>
<td>0.25</td>
</tr>
<tr>
<td>6300</td>
<td>0.12</td>
</tr>
<tr>
<td>8000</td>
<td>0.09</td>
</tr>
<tr>
<td>10000</td>
<td>0.11</td>
</tr>
<tr>
<td>12500</td>
<td>0.00</td>
</tr>
<tr>
<td>16000</td>
<td>0.00</td>
</tr>
<tr>
<td>20000</td>
<td>0.00</td>
</tr>
</tbody>
</table>

1.4 SUBMITTALS
A. Product Data: Submit standard manufacturer product cutsheet showing product and selected options. Attach index of distinct panels indicating number of like panels, panel size and thickness, edge condition and fabric selection.
B. Design Data / Test Reports: Submit sound absorption coefficients, noise reduction coefficient and sound diffusion coefficients.
C. Shop Drawings: Submit shop drawings with dimensions for non-rectangular panels.
D. Samples: Submit 6” x 6” fabric sample for each type of fabric specified. Submit panel sample no smaller than 8” x 8” with sound diffusive binary amplitude grating partially exposed.

1.5 QUALITY ASSURANCE
A. Flame Spread / Smoke Developed Characteristics: Tested by independent, accredited NVLAP facility according to ASTM E 84 and NFPA 255.
   1. Composite Flame Spread Rating: 25 (maximum)
   2. Smoke Developed: 450 (maximum)

1.6 DELIVERY STORAGE AND HANDLING
A. Packing, Shipping, Handling and Unloading: Panels are susceptible to damage and shall be removed from packaging and handled with care. Panels greater than 16 square feet shall be carried by a minimum of 2 people. Panels shall never be set down on fabric faces, only on panel backsides.
B. Storage and Protection: Store panels in original packaging until ready to install. Store panels in temperature and humidity controlled conditions for 24 hours prior to installation and protect from moisture and infestation. Protect fabric finish from elements that would puncture, tear, snag or otherwise damage the fabric.
C. Acceptance at Site: Installation constitutes complete acceptance.

1.7 PROJECT CONDITIONS
A. Project Environmental Requirements: Installation area shall be enclosed, protected from weather and be temperature and humidity controlled prior to unpacking and installing diffusors.
PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Type B.A.D. Panel RPG Diffusor Systems Marlboro, MD 301-249-0044
B. Type T.A.D. Panel Kinetics Noise Dublin, OH 877-457-2695

2.2 MATERIALS
A. Core: Semi-rigid fiberglass, density not less than 6 pounds per cubic foot and not more than 8 pounds per cubic foot.
B. Template: 1/8” thick high density fiber board, density not less than 95 pounds per cubic foot.
C. Scrim: White, open weave, fire-rated cloth (required for light-colored fabrics).
D. Fabric: Open weave, class A, polyester, without backing such as pattern FR701-2100 by Guilford of Maine (Grand Rapids, MI). Refer to finish schedule for fabric and color selection.

2.3 MANUFACTURED UNITS
A. Acoustical wall panels (AWP-3/3A, AWP-4/4A/4B, AWP-5) shall be:
B. Thickness (nominal): 2”
C. Length (120” maximum): As shown on architectural drawings
D. Width (48” maximum): As shown on architectural drawings
E. Weight: 0.625 lbs per square foot (1” thickness)
F. Edges: Flat

2.4 ACCESSORIES
A. Fasteners: Panels to be provided with hardware and resin edges for picture rail mounting locations as shown on architectural drawings.

2.5 FABRICATION
A. Shop Assembly: Panel cores and templates will be preassembled and wrapped with scrim (if necessary) and fabric in the shop prior to arrival at project site. No field assembly is required.
B. Fabrication Tolerances – Panel sizes shall be within +/- 1/16” of specified sizes.

PART 3 - EXECUTION

3.1 INSTALLERS
A. Only qualified installers with 3 years (minimum) experience installing similar products shall install panels.

3.2 EXAMINATION
A. Site Verification of Conditions: Commencement of installation constitutes acceptance of prior work.

3.3 PREPARATION
A. Protection: Protect surrounding work so as to avoid damage during installation of Panels.
B. Surface Preparation: Inspect substrate and ensure surface is flat, clean and dry without protruding elements that would otherwise interfere with panel installation.
C. Field Measure: Prior to commencing installation, measure panels and ensure that dimensions correspond to field measured dimensions of installation area.
3.4 INSTALLATION
   A. Install panels so that fabric-covered side with template faces into occupied space. Rectangular panels have no designated top or bottom and may be installed in either direction. Refer to architectural drawings for orientation of non-rectangular panels.
   B. Removable wall panels shall be supported at back by "picture rail" track and hanger rods. All screw attachments. Scheduled Location: Music and Music Percussion Offices.

3.5 CLEANING
   A. Following installation, clean fabric on panels with high quality fabric cleaner per manufacturer’s instructions. Test for color fastness on scrap or concealed material.

3.6 PROTECTION
   A. After installation, protect panels against dirt, water and contact that would puncture, snag, tear or otherwise damage panel fabric.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints and coatings.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Exposed surfaces of steel lintels and ledge angles.
   3. Hollow metal doors & frames.
   4. Roof ladders.
   5. Mechanical and Electrical:
      a. On the roof and outdoors, paint equipment that is exposed to weather or to view, including factory-finished materials.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   7. Marble, granite, slate, and other natural stones.
   8. Floors, unless specifically indicated.
   9. Ceramic and other types of tiles.
   11. Exterior insulation and finish system (EIFS).
   13. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 01.78.50 - HPBr Reporting.

B. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.

C. Section 05.50.00 - Metal Fabrications: Shop-primed items.

D. Section 09.91.23 - Interior Painting.

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS


C. SSPC-SP 1 - Solvent Cleaning; 2015.
E. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 SUBMITTALS

A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "acrylic enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   3. Manufacturer's installation instructions.
   4. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, submit each color in each sheen available.
   3. Allow 30 days for approval process, after receipt of complete samples by Architect.
   4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   2. Label each container with color in addition to the manufacturer's label.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION

A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.

B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   4. Compliance with Credit EQ6.2: Material VOC Limits - Paints
   5. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.
1.07 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
   B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and approved by manufacturer.

1.08 MOCK-UP
   A. Provide door and frame assembly illustrating paint color, texture, and finish.
   B. Locate where directed by Architect.
   C. Mock-up may remain as part of the work.

1.09 DELIVERY, STORAGE, AND HANDLING
   A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
   B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
   C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.10 FIELD CONDITIONS
   A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
   B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
   C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
   D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
   E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for exterior, unless required otherwise by manufacturer's instructions.
   F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 PAINTS AND FINISHES - GENERAL
   A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
      1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
      2. Supply each paint material in quantity required to complete entire project's work from a single production run.
      3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
   B. Volatile Organic Compound (VOC) Content:
      1. Provide paints and finishes that comply with the most stringent requirements specified in the following:

b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
   1) Opaque, Flat: 50 g/L, maximum.
   2) Opaque, Nonflat: 150 g/L, maximum.
   3) Opaque, High Gloss: 250 g/L, maximum.
   4) Varnishes: 350 g/L, maximum.

c. Architectural coatings VOC limits of Tennessee.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Colors: To be selected from manufacturer's full range of available colors.
   1. Selection to be made by Architect after award of contract.

2.02 PAINT SYSTEMS - EXTERIOR

A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including primed metal and other indicated surfaces.
   1. Two top coats and one coat primer. Primer as recommended for the material surfaces.
   2. Top Coat(s): Exterior Satin Acrylic Enamel.

B. Ferrous Metals, Unprimed, Alkyd, 3 Coat:
   1. One coat of enamel primer.

C. Ferrous Metals, Primed, Alkyd, 2 Coat:
   1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
   2. Gloss: Two coats of acrylic enamel.

D. Galvanized Metals, Alkyd, 3 Coat:
   1. One coat galvanize primer.
   2. Gloss: Two coats of acrylic enamel.

2.03 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
   1. Anti-Corrosive Acrylic Primer for Metal.
   2. Acrylic Primer for Galvanized Metal.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

### 3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.

H. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

I. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

### 3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

F. Sand metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### 3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

### 3.05 PROTECTION

A. Protect finishes until completion of project.
B. Touch-up damaged finishes after Substantial Completion.

   END OF SECTION 09.91.13
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.
B. Field application of paints, stains, and varnishes.
C. Materials for backpriming woodwork.
D. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Elevator pit ladders.
   3. Prime surfaces to receive wall coverings.
   4. Mechanical and Electrical:
      a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
      c. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
E. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Floors, unless specifically indicated.
   7. Glass.
   8. Concrete masonry units in utility, mechanical, and electrical spaces.
   9. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 05.50.00 - Metal Fabrications: Shop-primed items.
B. Section 09.91.13 - Exterior Painting.

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 SUBMITTALS

A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
3. Manufacturer's installation instructions.
4. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, submit each color in each sheen available.
   3. Allow 30 days for approval process, after receipt of complete samples by Architect.
   4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01.60.00 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION

A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.

B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   3. Compliance with Credit EQ6.2: Material VOC Limits - Paints
   4. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and approved by manufacturer.

1.07 MOCK-UP

A. See Section 01.40.00 - Quality Requirements, for general requirements for mock-up.

B. Provide door and frame assembly illustrating paint color, texture, and finish.

C. Locate where directed by Architect.

D. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface during painting.

PART 2 PRODUCTS

2.01 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.

4. Supply each paint material in quantity required to complete entire project's work from a single production run.

5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:


   b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:

      1) Opaque, Flat: 50 g/L, maximum.
      2) Opaque, Nonflat: 150 g/L, maximum.
      3) Opaque, High Gloss: 250 g/L, maximum.
      4) Varnishes: 350 g/L, maximum.

   c. Architectural coatings VOC limits of Tennessee.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: To be selected from manufacturer's full range of available colors.
   1. Selection to be made by Architect after award of contract.
   2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
   3. Extend colors to surface edges; colors may change at any edge as directed by Architect.
   4. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.
   5. In utility areas, finish equipment, piping, conduit, and exposed duct work in colors according to the color coding scheme indicated.

2.02 PAINT SYSTEMS - INTERIOR

A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, and aluminum.
   1. Two top coats and one coat primer.
   2. Top Coat(s): High Performance Architectural Interior Latex.
   3. Primer: As recommended by top coat manufacturer for specific substrate.

B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
   1. Two top coats and one coat primer.
   2. Top Coat(s): High Performance Architectural Interior Latex.

C. Medium Duty Vertical and Overhead: Including gypsum board, plaster, concrete, concrete masonry units, uncoated steel, shop primed steel, galvanized steel, and aluminum.
   1. Two top coats and one coat primer.
   2. Top Coat(s): High Performance Architectural Interior Latex.
   3. Primer: As recommended by top coat manufacturer for specific substrate.

D. Transparent Finish on Wood.
   2. Top Coat(s): Polyurethane Varnish, Oil Modified.

E. Transparent Finish on Wood Floors:
   1. 2 top coats over stain.
   3. Top Coat(s): Polyurethane Varnish, Oil Modified.

F. Concrete/Masonry, Opaque, Latex, 3 Coat:
   1. One coat of block filler.
   2. Semi-gloss: Two coats of latex enamel.

G. Ferrous Metals, Unprimed, Alkyd, 3 Coat:
   1. One coat of alkyd primer.
   2. Gloss: Two coats of alkyd enamel.

H. Ferrous Metals, Primed, Latex, 2 Coat:
   1. Touch-up with latex primer.
   2. Gloss: Two coats of latex enamel.

I. Galvanized Metals, Alkyd, 3 Coat:
   1. One coat galvanize primer.
   2. Gloss: Two coats of alkyd enamel.

J. Gypsum Board/Plaster, Latex, 3 Coat:
   1. One coat of alkyd primer sealer.
   2. Eggshell: Two coats of latex enamel.
2.03 PRIMERS
A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
   1. Interior/Exterior Latex Block Filler.
   2. Interior Latex Primer Sealer.
   3. Interior Rust-Inhibitive Water Based Primer.
   4. Alkyd Primer for Galvanized Metal.
   5. Latex Primer for Interior Wood.

2.04 ACCESSORY MATERIALS
A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
   B. Patching Material: Latex filler.
   C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION
A. Do not begin application of paints and finishes until substrates have been properly prepared.
B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
E. Test shop-applied primer for compatibility with subsequent cover materials.
F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Plaster and Stucco: 12 percent.
   3. Masonry, Concrete, and Concrete Masonry Units : 12 percent.
   4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
   5. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION
A. Clean surfaces thoroughly and correct defects prior to application.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
D. Seal surfaces that might cause bleed through or staining of topcoat.
E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
F. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Clean concrete according to ASTM D4258. Allow to dry.
3. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

G. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.

H. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.


J. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

K. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

L. Galvanized Surfaces:

M. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

N. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

O. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
3.05 PROTECTION

A. Protect finishes until completion of project.
B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 09.91.23
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Markerboards.

1.02 RELATED REQUIREMENTS
   A. Section 06.10.00 - Rough Carpentry: Blocking and supports.
   B. Section 09.21.16 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide manufacturer's data on chalkboard, markerboard, tackboard, tackboard surface covering, trim, and accessories.
   C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.
   D. Test Reports: Show conformance to specified surface burning characteristics requirements.

1.05 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 WARRANTY
   A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
   B. Provide five year warranty for chalkboard and markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 VISUAL DISPLAY BOARDS
   A. Markerboards: Porcelain enamel on steel, laminated to core.
      2. Steel Face Sheet Thickness: 24 gage, 0.0239 inch.
      3. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
      4. Backing: Aluminum foil, laminated to core.
      5. Size: As indicated on drawings.
      8. Accessories: Provide chalk tray and map rail.
PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that field measurements are as indicated.
   B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION
   A. Install boards in accordance with manufacturer's instructions.
   B. Install with top of chalk tray at 30 inches above finished floor.
   C. Secure units level and plumb.

3.03 CLEANING
   A. Clean board surfaces in accordance with manufacturer's instructions.

END OF SECTION 10.11.01
SECTION 10.14.00
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Room and door signs.
   B. Interior directional and informational signs.
   C. Emergency evacuation maps.
   D. Building identification signs.
   E. Plaque.

1.02 RELATED REQUIREMENTS

1.03 SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. All signage, interior and exterior shall comply with ETSU's currently adopted standard signage design standards. In the event there is a discrepancy between the standard signage standards and the following specification information, the standard signage standards shall be the option used.
   C. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
   D. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
      1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
      2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
      3. Submit for approval by Owner through Architect prior to fabrication.
   E. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
   F. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
   G. Verification Samples: Submit samples showing colors specified.
   H. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.04 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction wast diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
      1. Compliance with Credit MR1.1: Recycling Collection and Storage
      2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
      3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.05 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Package signs as required to prevent damage before installation.
B. Package room and door signs in sequential order of installation, labeled by floor or building.
C. Store tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS
A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS
B. Identity Group: www.identitygroup.com, 800-772-5677
C. Take Form: www.takeform.net, 800-528-1398
D. Innerface: www.innerfacesign.com, 800-445-4796

2.02 SIGNAGE APPLICATIONS
A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Sign Type: Flat signs with applied character panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
   3. Character Height: 1 inch.
   4. Sign Height: 6 inches inches, unless otherwise indicated.
   5. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
   6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
   7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
   8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.
   9. Background color shall be Rowmark 311-504 Airforce Blue; Text color shall be White.
C. Interior Directional and Informational Signs:
   1. Sign Type: Same as room and door signs.
D. Emergency Evacuation Maps:
   1. Allow for one map per elevator lobby.
E. Building Identification Signs:
   1. Use individual dimensional metal letters.
   2. Mount on outside wall in location indicated on drawings.
F. Plaque: See Allowance for details.
G. Traffic Signs: To match campus standards; locate where indicated on drawings.

2.03 SIGN TYPES
A. Flat Signs: Signage media without frame.
   1. Edges: Square.
   2. Corners: Square.
B. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica, Arial, or other sans serif font.
   2. Character Case: Upper case only.

2.04 TACTILE SIGNAGE MEDIA
A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
   1. Total Thickness: 1/16 inch.
B. Applied Character Panels: Acrylic plastic base, with applied acrylic plastic letters and braille.
   1. Total Thickness: 1/8 inch.

2.05 PLAQUES
A. Metal Plaques:
   1. Metal: Aluminum casting.
   2. Metal Sheet Thickness: 1/8 inch, minimum.
   3. Size: Assume 24" x 36"
   4. Fonts and Verbiage: To be determined.

2.06 DIMENSIONAL LETTERS
A. Individual stainless steel reverse channel illuminated letters, 2'-0" tall x 3" wide stroke x 2" thick.
   1. Provide stainless steel back plate reflectors 2'-1" tall x 4" wide stroke x 1/2" thick. Hold channel letters off 1" to create "halo" effect.
   2. Letters on 1/2" diameter stainless steel posts.
   3. Each letter to receive power for LED lighting.

2.07 ACCESSORIES
A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that substrate surfaces are ready to receive work.
3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs where indicated:
   1. Room and Door Signs: Locate on wall at latch side of door with centerline of sign at 60 inches above finished floor.

D. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION 10.14.00
## Exterior Message List

<table>
<thead>
<tr>
<th>Loc #</th>
<th>Sign Type</th>
<th>Side A Arrow</th>
<th>Side A Message</th>
<th>Side B Arrow</th>
<th>Side B Message</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C5c</td>
<td>right</td>
<td>S3(symbol w/blue square)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>D1b</td>
<td></td>
<td>(ETSU LOGO) Copy TBD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>E1b</td>
<td></td>
<td>Faculty Staff (# TBD) Parking Parking Permit Required Available at Parking Services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>E1b</td>
<td></td>
<td>Faculty Staff (# TBD) Parking Parking Permit Required Available at Parking Services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>C5c</td>
<td>right</td>
<td>S3(symbol w/blue square)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>C5c</td>
<td>right</td>
<td>S3(symbol w/blue square)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sign Loc #</td>
<td>Floor</td>
<td>Sign Type</td>
<td>Symbol</td>
<td>Tactile/Braille</td>
<td>Flatbed Copy</td>
<td>Arrow</td>
</tr>
<tr>
<td>------------</td>
<td>-------</td>
<td>-----------</td>
<td>--------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td>1000</td>
<td>1</td>
<td>C</td>
<td>104</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000.1</td>
<td>1</td>
<td>H</td>
<td>EXIT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1001</td>
<td>1</td>
<td>C</td>
<td>104</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1002</td>
<td>1</td>
<td>H</td>
<td>EXIT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1003</td>
<td>1</td>
<td>H</td>
<td>EXIT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1004</td>
<td>1</td>
<td>C</td>
<td>104</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1005</td>
<td>1</td>
<td>C</td>
<td>104</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1006</td>
<td>1</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1007</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>104D CONTROL</td>
<td>ROOM</td>
<td></td>
</tr>
<tr>
<td>1008</td>
<td>1</td>
<td>H</td>
<td>EXIT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1008.1</td>
<td>1</td>
<td>M</td>
<td>MAXIMUM OCCUPANCY: 238 PERSONS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1009</td>
<td>1</td>
<td>B</td>
<td>S59</td>
<td>WOMEN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1009.1</td>
<td>1</td>
<td>F</td>
<td>162</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1009.2</td>
<td>1</td>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1010</td>
<td>1</td>
<td>B</td>
<td>S60</td>
<td>MEN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1011</td>
<td>1</td>
<td>D</td>
<td>FLOOR 1</td>
<td>AL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1011.1</td>
<td>1</td>
<td>H1</td>
<td>159</td>
<td>ELECTRICAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1011.2</td>
<td>1</td>
<td>H1</td>
<td>159A</td>
<td>IT/COMM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1011.3</td>
<td>1</td>
<td>H2</td>
<td>158</td>
<td>PIANO STORAGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1012</td>
<td>1</td>
<td>C</td>
<td>102</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1012.1</td>
<td>1</td>
<td>H</td>
<td>EXIT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1013</td>
<td>1</td>
<td>C</td>
<td>102</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1014</td>
<td>1</td>
<td>H</td>
<td>EXIT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1014.1</td>
<td>1</td>
<td>M</td>
<td>MAXIMUM OCCUPANCY: 853 PERSONS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1015</td>
<td>1</td>
<td>H</td>
<td>EXIT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1016</td>
<td>1</td>
<td>C</td>
<td>102</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sign Loc #</td>
<td>Floor</td>
<td>Sign Type</td>
<td>Symbol</td>
<td>Tactile/Braille</td>
<td>Flatbed Copy</td>
<td>Arrow</td>
</tr>
<tr>
<td>------------</td>
<td>-------</td>
<td>-----------</td>
<td>--------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td>1017</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>102F CONTROL BOOTH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1018</td>
<td>1</td>
<td>H1</td>
<td></td>
<td>102H STORAGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1019</td>
<td>1</td>
<td>C</td>
<td></td>
<td>102</td>
<td>Auditorium</td>
<td></td>
</tr>
<tr>
<td>1020</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>102F CONTROL BOOTH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1021</td>
<td>1</td>
<td>C</td>
<td></td>
<td>102</td>
<td>Auditorium</td>
<td></td>
</tr>
<tr>
<td>1022</td>
<td>1</td>
<td>C</td>
<td></td>
<td>102</td>
<td>Auditorium</td>
<td></td>
</tr>
<tr>
<td>1023</td>
<td>1</td>
<td>H</td>
<td></td>
<td>EXIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1023.1</td>
<td>1</td>
<td>M</td>
<td></td>
<td>MAXIMUM OCCUPANCY: 853 PERSONS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1024</td>
<td>1</td>
<td>H</td>
<td></td>
<td>EXIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1025</td>
<td>1</td>
<td>H1</td>
<td></td>
<td>EXIT ROUTE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1026</td>
<td>1</td>
<td>D</td>
<td></td>
<td>FLOOR 1</td>
<td>AL</td>
<td>To Backstage 136A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>To Lower Level Auditorium Seating 102</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>To Scene Shop 111</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>To Studio Theater 103</td>
</tr>
<tr>
<td>1027</td>
<td>1</td>
<td>C</td>
<td></td>
<td>103</td>
<td>Studio Theater</td>
<td></td>
</tr>
<tr>
<td>1028</td>
<td>1</td>
<td>C</td>
<td></td>
<td>103</td>
<td>Studio Theater</td>
<td></td>
</tr>
<tr>
<td>1029</td>
<td>1</td>
<td>H</td>
<td></td>
<td>STAIR #</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1029.1</td>
<td>1</td>
<td>H</td>
<td></td>
<td>LEVEL 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1029.2</td>
<td>1</td>
<td>EG</td>
<td></td>
<td>STAIR # ROOF ACCESS 1 LEVELS 1 - 2 EXIT DISCHARGE ON THIS LEVEL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1030</td>
<td>1</td>
<td>H</td>
<td></td>
<td>EXIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1030.1</td>
<td>1</td>
<td>M</td>
<td></td>
<td>MAXIMUM OCCUPANCY: 469 PERSONS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1031</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>103C CHAIR STORAGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1032</td>
<td>1</td>
<td>H</td>
<td></td>
<td>EXIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sign Loc #</td>
<td>Floor</td>
<td>Sign Type</td>
<td>Symbol</td>
<td>Tactile/Braille</td>
<td>Flatbed Copy</td>
<td>Arrow</td>
</tr>
<tr>
<td>------------</td>
<td>-------</td>
<td>-----------</td>
<td>--------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td>1033</td>
<td>1</td>
<td>C</td>
<td></td>
<td>103</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1034</td>
<td>1</td>
<td>C</td>
<td></td>
<td>103</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1035</td>
<td>1</td>
<td>B</td>
<td></td>
<td>S48</td>
<td>STAIR #</td>
<td></td>
</tr>
<tr>
<td>1036</td>
<td>1</td>
<td>H</td>
<td></td>
<td></td>
<td>LEVEL 1</td>
<td></td>
</tr>
<tr>
<td>1036.1</td>
<td>1</td>
<td>EG</td>
<td></td>
<td></td>
<td>STAIR # ROOF ACCESS 1 LEVELS 1 - 2 EXIT DISCHARGE ON THIS LEVEL</td>
<td></td>
</tr>
<tr>
<td>1037</td>
<td>1</td>
<td>H</td>
<td></td>
<td>EXIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1038</td>
<td>1</td>
<td>I</td>
<td></td>
<td>F7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1039</td>
<td>1</td>
<td>H</td>
<td></td>
<td>EXIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1040</td>
<td>1</td>
<td>H1</td>
<td></td>
<td>106</td>
<td>ELECTRICAL</td>
<td></td>
</tr>
<tr>
<td>1041</td>
<td>1</td>
<td>H1</td>
<td></td>
<td>106A</td>
<td>IT/COMM</td>
<td></td>
</tr>
<tr>
<td>1042</td>
<td>1</td>
<td>H1</td>
<td></td>
<td>105</td>
<td>FOH STORAGE</td>
<td></td>
</tr>
<tr>
<td>1043</td>
<td>1</td>
<td>D</td>
<td></td>
<td>FLOOR 1</td>
<td>AU</td>
<td></td>
</tr>
<tr>
<td>1044</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>107</td>
<td>DRESSING ROOM</td>
<td></td>
</tr>
<tr>
<td>1045</td>
<td>1</td>
<td>B</td>
<td></td>
<td>S58</td>
<td>RESTROOM</td>
<td></td>
</tr>
<tr>
<td>1046</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>108</td>
<td>DRESSING ROOM &amp; MAKE UP INSTRUCTION</td>
<td></td>
</tr>
<tr>
<td>1047</td>
<td>1</td>
<td>B</td>
<td></td>
<td>S58</td>
<td>RESTROOM</td>
<td></td>
</tr>
<tr>
<td>1048</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>109</td>
<td>GREEN ROOM</td>
<td></td>
</tr>
<tr>
<td>Sign Loc #</td>
<td>Floor</td>
<td>Sign Type</td>
<td>Symbol</td>
<td>Tactile/Braille</td>
<td>Flatbed Copy</td>
<td>Arrow</td>
</tr>
<tr>
<td>-----------</td>
<td>-------</td>
<td>-----------</td>
<td>--------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td>1049</td>
<td>1</td>
<td>D</td>
<td>FLOOR 1</td>
<td>AU</td>
<td>To Scene Shop 111 To Studio Theater 103 Please confirm messaging</td>
<td></td>
</tr>
<tr>
<td>1050</td>
<td>1</td>
<td>D</td>
<td>FLOOR 1</td>
<td>AU</td>
<td>To Rooms 111 - 133 To Scene Shop 111 Please confirm messaging</td>
<td></td>
</tr>
<tr>
<td>1051</td>
<td>1</td>
<td>H1</td>
<td>EXIT ROUTE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1052</td>
<td>1</td>
<td>H2</td>
<td>103 STUDIO THEATER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1053</td>
<td>1</td>
<td>H</td>
<td>EXIT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1054</td>
<td>1</td>
<td>H1</td>
<td>111 SCENE SHOP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1055</td>
<td>1</td>
<td>H2</td>
<td>103 STUDIO THEATER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1056</td>
<td>1</td>
<td>H</td>
<td>EXIT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1057</td>
<td>1</td>
<td>H</td>
<td>EXIT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1058</td>
<td>1</td>
<td>H2</td>
<td>103 STUDIO THEATER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1059</td>
<td>1</td>
<td>D</td>
<td>FLOOR 1</td>
<td>AU</td>
<td>To Scene Shop 111 To Studio Theater 103 Please confirm messaging</td>
<td></td>
</tr>
<tr>
<td>1060</td>
<td>1</td>
<td>C</td>
<td>102 Auditorium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1061</td>
<td>1</td>
<td>D</td>
<td>FLOOR 1</td>
<td>AU</td>
<td>To Back Stage 136A To Scene Shop 111 Please confirm messaging</td>
<td></td>
</tr>
<tr>
<td>1062</td>
<td>1</td>
<td>E</td>
<td></td>
<td>(Occupancy Number)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1062.1</td>
<td>1</td>
<td>H1</td>
<td>EXIT ROUTE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1063</td>
<td>1</td>
<td>H2</td>
<td>136 STAGE AND WINGS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1064</td>
<td>1</td>
<td>H2</td>
<td>136 STAGE AND WINGS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1065</td>
<td>1</td>
<td>H1</td>
<td>EXIT ROUTE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1066</td>
<td>1</td>
<td>H1</td>
<td>102 AUDITORIUM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1067</td>
<td>1</td>
<td>H2</td>
<td>136 STAGE AND WINGS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1067.1</td>
<td>1</td>
<td>H1</td>
<td>EXIT ROUTE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sign Loc #</td>
<td>Floor</td>
<td>Sign Type</td>
<td>Symbol</td>
<td>Tactile/Braille</td>
<td>Flatbed Copy</td>
<td>Arrow</td>
</tr>
<tr>
<td>------------</td>
<td>-------</td>
<td>-----------</td>
<td>--------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td>1068</td>
<td>1</td>
<td>H1</td>
<td>111</td>
<td>SCENE SHOP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1069</td>
<td>1</td>
<td>H1</td>
<td>111</td>
<td>SCENE SHOP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1070</td>
<td>1</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1071</td>
<td>1</td>
<td>H2</td>
<td>111C</td>
<td>SCENE SHOP</td>
<td>OFFICE</td>
<td></td>
</tr>
<tr>
<td>1072</td>
<td>1</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1073</td>
<td>1</td>
<td>H2</td>
<td>111A</td>
<td>SCENE SHOP</td>
<td>STORAGE</td>
<td></td>
</tr>
<tr>
<td>1074</td>
<td>1</td>
<td>H2</td>
<td>111B</td>
<td>SCENE SHOP</td>
<td>TOOLS</td>
<td></td>
</tr>
<tr>
<td>1075</td>
<td>1</td>
<td>H2</td>
<td>112</td>
<td>COSTUME SHOP</td>
<td>STORAGE</td>
<td></td>
</tr>
<tr>
<td>1076</td>
<td>1</td>
<td>H1</td>
<td>113</td>
<td>DYE ROOM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1077</td>
<td>1</td>
<td>H2</td>
<td>114</td>
<td>COSTUME SHOP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1078</td>
<td>1</td>
<td>H1</td>
<td>111</td>
<td>SCENE SHOP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1079</td>
<td>1</td>
<td>B</td>
<td>S59</td>
<td>WOMEN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1080</td>
<td>1</td>
<td>B</td>
<td>S60</td>
<td>MEN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1081</td>
<td>1</td>
<td>H2</td>
<td>114</td>
<td>COSTUME SHOP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1082</td>
<td>1</td>
<td>H1</td>
<td>114B</td>
<td>LAUNDRY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1083</td>
<td>1</td>
<td>H2</td>
<td>114A</td>
<td>COSTUME SHOP</td>
<td>OFFICE</td>
<td></td>
</tr>
<tr>
<td>1084</td>
<td>1</td>
<td>H1</td>
<td>114B</td>
<td>LAUNDRY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1085</td>
<td>1</td>
<td>H1</td>
<td></td>
<td>EXIT ROUTE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1086</td>
<td>1</td>
<td>H</td>
<td></td>
<td>EXIT ROUTE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1087</td>
<td>1</td>
<td>H1</td>
<td>131</td>
<td>KITCHENETTE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sign Loc #</td>
<td>Floor</td>
<td>Sign Type</td>
<td>Symbol</td>
<td>Tactile/Braille</td>
<td>Flatbed Copy</td>
<td>Arrow</td>
</tr>
<tr>
<td>------------</td>
<td>-------</td>
<td>-----------</td>
<td>--------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td>1088</td>
<td>F</td>
<td></td>
<td>118</td>
<td></td>
<td>Theatre Office</td>
<td></td>
</tr>
<tr>
<td>1089</td>
<td>F</td>
<td></td>
<td>119</td>
<td></td>
<td>Theatre Office</td>
<td></td>
</tr>
<tr>
<td>1090</td>
<td>F</td>
<td></td>
<td>120</td>
<td></td>
<td>Theatre Office</td>
<td></td>
</tr>
<tr>
<td>1091</td>
<td>F</td>
<td></td>
<td>121</td>
<td></td>
<td>Tech Office</td>
<td></td>
</tr>
<tr>
<td>1092</td>
<td>F</td>
<td></td>
<td>122</td>
<td></td>
<td>Tech Office</td>
<td></td>
</tr>
<tr>
<td>1093</td>
<td>F</td>
<td></td>
<td>123</td>
<td></td>
<td>Facility Manager</td>
<td></td>
</tr>
<tr>
<td>1094</td>
<td>F</td>
<td></td>
<td>124</td>
<td></td>
<td>Marketing Director</td>
<td></td>
</tr>
<tr>
<td>1095</td>
<td>F</td>
<td></td>
<td>125</td>
<td></td>
<td>Assistant Director</td>
<td></td>
</tr>
<tr>
<td>1096</td>
<td>F</td>
<td></td>
<td>126</td>
<td></td>
<td>Director’s Office</td>
<td></td>
</tr>
<tr>
<td>1097</td>
<td>H2</td>
<td></td>
<td>127</td>
<td>COPY/PRINTER</td>
<td>Music Percussion Office</td>
<td></td>
</tr>
<tr>
<td>1098</td>
<td>H2</td>
<td></td>
<td>130</td>
<td>STORAGE GENERAL</td>
<td>Music Percussion Office</td>
<td></td>
</tr>
<tr>
<td>1099</td>
<td>F</td>
<td></td>
<td>128</td>
<td></td>
<td>Music Percussion Office</td>
<td></td>
</tr>
<tr>
<td>1100</td>
<td>F</td>
<td></td>
<td>129</td>
<td></td>
<td>Music Percussion Office</td>
<td></td>
</tr>
<tr>
<td>1101</td>
<td>H1</td>
<td></td>
<td>131A</td>
<td>JANITOR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1102</td>
<td>F</td>
<td></td>
<td>132</td>
<td></td>
<td>Music Office</td>
<td></td>
</tr>
<tr>
<td>1103</td>
<td>H1</td>
<td></td>
<td>133</td>
<td>WARDROBE</td>
<td>Scene Shop Office</td>
<td></td>
</tr>
<tr>
<td>1104</td>
<td>F</td>
<td></td>
<td>111C</td>
<td></td>
<td>Scene Shop Office</td>
<td></td>
</tr>
<tr>
<td>1105</td>
<td>H1</td>
<td></td>
<td>EXIT</td>
<td>ROUTE</td>
<td>To Back Stage 136A</td>
<td></td>
</tr>
<tr>
<td>1106</td>
<td>H</td>
<td></td>
<td>EXIT</td>
<td></td>
<td>To Restrooms To Rooms 137 - 145</td>
<td></td>
</tr>
<tr>
<td>1107</td>
<td>D</td>
<td></td>
<td>FLOOR 1</td>
<td>AR</td>
<td>To Back Stage 136A To Restrooms To Rooms 137 - 145</td>
<td></td>
</tr>
<tr>
<td>Sign Loc #</td>
<td>Floor</td>
<td>Sign Type</td>
<td>Symbol</td>
<td>Tactile/Braille</td>
<td>Flatbed Copy</td>
<td>Arrow</td>
</tr>
<tr>
<td>------------</td>
<td>-------</td>
<td>-----------</td>
<td>--------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td>1108</td>
<td>1</td>
<td>H1</td>
<td></td>
<td>EXIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1109</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>137</td>
<td>ROUTE</td>
<td></td>
</tr>
<tr>
<td>1110</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>141</td>
<td>DRESSING ROOM</td>
<td></td>
</tr>
<tr>
<td>1111</td>
<td>1</td>
<td>B</td>
<td>S58</td>
<td>RESTROOM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1112</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>140</td>
<td>DRESSING ROOM</td>
<td></td>
</tr>
<tr>
<td>1113</td>
<td>1</td>
<td>B</td>
<td>S58</td>
<td>RESTROOM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1114</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>137</td>
<td>TECH STORAGE/SHOP</td>
<td></td>
</tr>
<tr>
<td>1115</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>139</td>
<td>MAIN ELECTRICAL</td>
<td></td>
</tr>
<tr>
<td>1116</td>
<td>1</td>
<td>H1</td>
<td></td>
<td>138</td>
<td>MAIN IT</td>
<td></td>
</tr>
<tr>
<td>1117</td>
<td>1</td>
<td>H</td>
<td></td>
<td>EXIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1118</td>
<td>1</td>
<td>H1</td>
<td></td>
<td>139A</td>
<td>MECHANICAL</td>
<td></td>
</tr>
<tr>
<td>1119</td>
<td>1</td>
<td>H</td>
<td></td>
<td>EXIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1120</td>
<td>1</td>
<td>H</td>
<td></td>
<td>EXIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1121</td>
<td>1</td>
<td>H1</td>
<td></td>
<td>139B</td>
<td>RISER</td>
<td></td>
</tr>
<tr>
<td>1122</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>142</td>
<td>GREEN ROOM</td>
<td></td>
</tr>
<tr>
<td>1123</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>143</td>
<td>DRESSING ROOM</td>
<td></td>
</tr>
<tr>
<td>1124</td>
<td>1</td>
<td>B</td>
<td>S58</td>
<td>RESTROOM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1125</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>144</td>
<td>DRESSING ROOM</td>
<td></td>
</tr>
<tr>
<td>Sign Loc #</td>
<td>Floor</td>
<td>Sign Type</td>
<td>Symbol</td>
<td>Tactile/Braille</td>
<td>Flatbed Copy</td>
<td>Arrow</td>
</tr>
<tr>
<td>------------</td>
<td>-------</td>
<td>-----------</td>
<td>--------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td>1126</td>
<td>1</td>
<td>B</td>
<td>S58</td>
<td>RESTROOM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1127</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>136</td>
<td>STAGE AND WINGS</td>
<td></td>
</tr>
<tr>
<td>1127.1</td>
<td>1</td>
<td>H1</td>
<td></td>
<td>EXIT</td>
<td>ROUTE</td>
<td></td>
</tr>
<tr>
<td>1128</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>145</td>
<td>STORAGE MUSIC GENERAL</td>
<td></td>
</tr>
<tr>
<td>1129</td>
<td>1</td>
<td>D</td>
<td></td>
<td>FLOOR 1</td>
<td>AL</td>
<td></td>
</tr>
<tr>
<td>1130</td>
<td>1</td>
<td>H</td>
<td></td>
<td>EXIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1131</td>
<td>1</td>
<td>H1</td>
<td></td>
<td>102</td>
<td>AUDITORIUM</td>
<td></td>
</tr>
<tr>
<td>1131.1</td>
<td>1</td>
<td>H2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1132</td>
<td>1</td>
<td>H1</td>
<td></td>
<td>EXIT</td>
<td>ROUTE</td>
<td></td>
</tr>
<tr>
<td>1133</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>136</td>
<td>STAGE AND WINGS</td>
<td></td>
</tr>
<tr>
<td>1134</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>136</td>
<td>STAGE AND WINGS</td>
<td></td>
</tr>
<tr>
<td>1135</td>
<td>1</td>
<td>H1</td>
<td></td>
<td>EXIT</td>
<td>ROUTE</td>
<td></td>
</tr>
<tr>
<td>1135.1</td>
<td>1</td>
<td>E</td>
<td></td>
<td>(Occupancy Number)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1136</td>
<td>1</td>
<td>H1</td>
<td></td>
<td>102</td>
<td>AUDITORIUM</td>
<td></td>
</tr>
<tr>
<td>1137</td>
<td>1</td>
<td>H1</td>
<td></td>
<td>102</td>
<td>AUDITORIUM</td>
<td></td>
</tr>
<tr>
<td>1138</td>
<td>1</td>
<td>D</td>
<td></td>
<td>FLOOR 1</td>
<td>AU</td>
<td>AR</td>
</tr>
<tr>
<td>1139</td>
<td>1</td>
<td>B</td>
<td>S48</td>
<td>STAIR #</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1140</td>
<td>1</td>
<td>H</td>
<td></td>
<td>LEVEL 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sign Loc #</td>
<td>Floor</td>
<td>Sign Type</td>
<td>Symbol</td>
<td>Tactile/Braille</td>
<td>Flatbed Copy</td>
<td>Arrow</td>
</tr>
<tr>
<td>-----------</td>
<td>-------</td>
<td>-----------</td>
<td>--------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td>1140.1</td>
<td>1</td>
<td>EG</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1141</td>
<td>1</td>
<td>H1</td>
<td>155</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1142</td>
<td>1</td>
<td>H2</td>
<td>154</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1143</td>
<td>1</td>
<td>B</td>
<td>S58</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1144</td>
<td>1</td>
<td>H2</td>
<td>157</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1145</td>
<td>1</td>
<td>H2</td>
<td>158</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1146</td>
<td>1</td>
<td>H2</td>
<td>104E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1147</td>
<td>1</td>
<td>H2</td>
<td>104E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1148</td>
<td>1</td>
<td>H2</td>
<td>104E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1149</td>
<td>1</td>
<td>H1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1150</td>
<td>1</td>
<td>H1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1151</td>
<td>1</td>
<td>H2</td>
<td>104H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1152</td>
<td>1</td>
<td>H2</td>
<td>152B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1153</td>
<td>1</td>
<td>H2</td>
<td>152</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sign Loc #</td>
<td>Floor</td>
<td>Sign Type</td>
<td>Symbol</td>
<td>Tactile/Braille</td>
<td>Flatbed Copy</td>
<td>Arrow</td>
</tr>
<tr>
<td>-----------</td>
<td>-------</td>
<td>-----------</td>
<td>--------</td>
<td>---------------------------------</td>
<td>-----------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>1154</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>153</td>
<td>STORAGE MUSICAL INSTRUMENT</td>
<td></td>
</tr>
<tr>
<td>1155</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>146 - 147</td>
<td>PERCUSSION REHEARSAL</td>
<td></td>
</tr>
<tr>
<td>1156</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>150</td>
<td>PERCUSSION REHEARSAL</td>
<td></td>
</tr>
<tr>
<td>1157</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>150B</td>
<td>STORAGE MUSICAL INSTRUMENT</td>
<td></td>
</tr>
<tr>
<td>1158</td>
<td>1</td>
<td>H</td>
<td>EXIT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1159</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>148 - 149</td>
<td>PERCUSSION REHEARSAL</td>
<td></td>
</tr>
<tr>
<td>1160</td>
<td>1</td>
<td>H1</td>
<td>EXIT</td>
<td></td>
<td>ROUTE</td>
<td></td>
</tr>
<tr>
<td>1161</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>151</td>
<td>CHORAL REHEARSAL</td>
<td></td>
</tr>
<tr>
<td>1162</td>
<td>1</td>
<td>H</td>
<td>EXIT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1163</td>
<td>1</td>
<td>H1</td>
<td>EXIT</td>
<td></td>
<td>ROUTE</td>
<td></td>
</tr>
<tr>
<td>1164</td>
<td>1</td>
<td>H2</td>
<td></td>
<td>152</td>
<td>INSTRUMENTAL REHEARSAL</td>
<td></td>
</tr>
<tr>
<td>1165</td>
<td>1</td>
<td>H</td>
<td>EXIT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>2</td>
<td>H</td>
<td>EXIT</td>
<td></td>
<td>LEVEL 2</td>
<td></td>
</tr>
<tr>
<td>2000.1</td>
<td>2</td>
<td>EG</td>
<td></td>
<td>STAIR #</td>
<td>ROOF ACCESS 2 LEVELS 1 - 2 DOWN FOR EXIT DISCHARGE LEVEL 1</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>2</td>
<td>B</td>
<td>S48</td>
<td>STAIR #</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>2</td>
<td>H1</td>
<td>EXIT</td>
<td>ROUTE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sign Loc #</td>
<td>Floor</td>
<td>Sign Type</td>
<td>Symbol</td>
<td>Tactile/Braille</td>
<td>Flatbed Copy</td>
<td>Arrow</td>
</tr>
<tr>
<td>------------</td>
<td>-------</td>
<td>-----------</td>
<td>--------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td>2003</td>
<td>2</td>
<td>B</td>
<td>S59</td>
<td>WOMEN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>2</td>
<td>B</td>
<td>S60</td>
<td>MEN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004.1</td>
<td>2</td>
<td>D</td>
<td></td>
<td>FLOOR 2</td>
<td>AU</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>2</td>
<td>D</td>
<td></td>
<td>FLOOR 2</td>
<td>AL</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>2</td>
<td>H1</td>
<td></td>
<td>EXIT ROUTE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>2</td>
<td>C</td>
<td>207</td>
<td></td>
<td>Auditorium Balcony</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>2</td>
<td>H</td>
<td></td>
<td>EXIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>2</td>
<td>M</td>
<td></td>
<td>MAXIMUM OCCUPANCY: 387 PERSONS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>2</td>
<td>H1</td>
<td></td>
<td>STAFF ONLY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>2</td>
<td>H1</td>
<td>208</td>
<td>MECHANICAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>2</td>
<td>H1</td>
<td>208A</td>
<td>ELECTRICAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>2</td>
<td>H1</td>
<td>212</td>
<td>JANITOR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>2</td>
<td>H</td>
<td>STAIRS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>2</td>
<td>EG</td>
<td></td>
<td>STAIR # ROOF ACCESS 2 LEVELS 1 - 2 DOWN FOR EXIT DISCHARGE LEVEL 1 AD Confirm stair number and roof access</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>2</td>
<td>H</td>
<td>LEVEL 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>2</td>
<td>H2</td>
<td></td>
<td>EXIT TO ROOF AUTHORIZED PERSONNEL ONLY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>2</td>
<td>H2</td>
<td>207</td>
<td>AUDITORIUM BALCONY Verify Message</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>2</td>
<td>H1</td>
<td></td>
<td>EXIT ROUTE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sign Loc #</td>
<td>Floor</td>
<td>Sign Type</td>
<td>Symbol</td>
<td>Tactile/Braille</td>
<td>Flatbed Copy</td>
<td>Arrow</td>
</tr>
<tr>
<td>------------</td>
<td>-------</td>
<td>-----------</td>
<td>--------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td>2020</td>
<td>2</td>
<td>H</td>
<td></td>
<td>STAIR #</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>2</td>
<td>H</td>
<td></td>
<td>LEVEL 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>2</td>
<td>H</td>
<td></td>
<td>LEVEL 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>2</td>
<td>H</td>
<td></td>
<td>STAIR #</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td>2</td>
<td>C</td>
<td></td>
<td>207</td>
<td>Auditorium Balcony</td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td>2</td>
<td>H</td>
<td></td>
<td>EXIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2026</td>
<td>2</td>
<td>C</td>
<td></td>
<td>207</td>
<td>Auditorium Balcony</td>
<td></td>
</tr>
<tr>
<td>2027</td>
<td>2</td>
<td>H</td>
<td></td>
<td>EXIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2028</td>
<td>2</td>
<td>M</td>
<td></td>
<td>MAXIMUM OCCUPANCY: 387 PERSONS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2029</td>
<td>2</td>
<td>H1</td>
<td></td>
<td>EXIT ROUTE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>2</td>
<td>D</td>
<td></td>
<td>FLOOR 2</td>
<td>AL To Auditorium Balcony</td>
<td></td>
</tr>
<tr>
<td>2031</td>
<td>2</td>
<td>H</td>
<td></td>
<td>STAIR #</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2031.1</td>
<td>2</td>
<td>D</td>
<td></td>
<td>FLOOR 2</td>
<td>AR To Auditorium Balcony To Restrooms To Elevator</td>
<td></td>
</tr>
<tr>
<td>2032</td>
<td>2</td>
<td>TBD</td>
<td></td>
<td>TBD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2032.1</td>
<td>2</td>
<td>EG</td>
<td></td>
<td>STAIR #</td>
<td>ROOF ACCESS 2 LEVELS 1 - 2 DOWN FOR EXIT DISCHARGE LEVEL 1</td>
<td></td>
</tr>
<tr>
<td>2033</td>
<td>2</td>
<td>H</td>
<td></td>
<td>LEVEL 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2034</td>
<td>2</td>
<td>H</td>
<td></td>
<td>STAIR #</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2035</td>
<td>2</td>
<td>H2</td>
<td></td>
<td>205</td>
<td>CONTROL BOOTH</td>
<td></td>
</tr>
<tr>
<td>2036</td>
<td>2</td>
<td>H2</td>
<td></td>
<td>204</td>
<td>EQUIPMENT ROOM</td>
<td></td>
</tr>
<tr>
<td>2037</td>
<td>2</td>
<td>H1</td>
<td></td>
<td>203</td>
<td>ELECTRICAL</td>
<td></td>
</tr>
<tr>
<td>Sign Loc #</td>
<td>Floor</td>
<td>Sign Type</td>
<td>Symbol</td>
<td>Tactile/Braille</td>
<td>Flatbed Copy</td>
<td>Arrow</td>
</tr>
<tr>
<td>-----------</td>
<td>-------</td>
<td>-----------</td>
<td>--------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td>2038</td>
<td>2</td>
<td>H1</td>
<td></td>
<td>203A</td>
<td>IT/COMM</td>
<td></td>
</tr>
<tr>
<td>2039</td>
<td>2</td>
<td>H1</td>
<td></td>
<td>202</td>
<td>SUPPORT</td>
<td></td>
</tr>
<tr>
<td>2040</td>
<td>2</td>
<td>I</td>
<td>F7</td>
<td>In Case of Fire Use Stairs Do Not Use Elevator</td>
<td>F7 = Fire Exit</td>
<td></td>
</tr>
<tr>
<td>2041</td>
<td>2</td>
<td>H</td>
<td>STAIR #</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2042</td>
<td>2</td>
<td>H</td>
<td>LEVEL 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2043</td>
<td>2</td>
<td>EG</td>
<td></td>
<td>STAIR # ROOF ACCESS 2 LEVELS 1 - 2 DOWN FOR EXIT DISCHARGE LEVEL 1</td>
<td>AD</td>
<td>Confirm stair number and roof access</td>
</tr>
<tr>
<td>2044</td>
<td>2</td>
<td>H</td>
<td>LEVEL 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2045</td>
<td>2</td>
<td>B</td>
<td>S48</td>
<td>STAIR #</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SIGN SPECIFICATIONS

5120 SignPanel Series
Non-Illuminated, Single Double Graphics
Mounting: Direct Burial

Support Posts:
Part Code: SPC100 (4" Circular)
Painted Color: PMS 282 C Blue

Decorative Elements:
Post Cap:
Part Code: Pediment
Painted Color: PMS 282 C Blue
Deco Rings:
Part Code: SPCDR Circular (Qty. 1 per post)
Painted Color: PMS 282 C Blue

SignPanel:
Part Code: SPA25
Size: 30"(h) x 48"(w) (visible)
Backgrd. Color: PMS 123 C Yellow

PSV Graphics:
Arrow: A110
Size: 3-3/4"
Color: 25-02 Black PSV (Gloss)
Logo: LTBD (Handicap)
Size: 3-1/4"
Color: 25-11 Cobalt Blue PSV (Gloss)
Typestyle: HelveticaNeue-Bold (HM)
Size: 3"
Color: 25-02 Black PSV (Gloss)

Over Panel:
Part Code: Aluminum
Size: 26"(h) x 44"(w) x 1/8"(d)
Backgrd. Color: PMS 282 C Blue

Intaglio Graphics:
Logo: LTBD (E)
Size: 7"
Color: PMS 123 C Yellow
Color: Grey
PSV Graphics:
Typestyle: TimesRoman-RemCap
Size: 4" & 3" (Remedial Caps)
Color: 25-01 White PSV (Gloss)

NOTE:
Logo available for Production use.

Colors depicted are a general representation of the color specified. If color selection is critical, please request sample for approval.
SIGN SPECIFICATIONS

4160.1 PolySign Series
Non-Illuminated Post Mount
Single Sided Graphics
Mounting: Direct Burial

Support Post:
Part Code: SPT50 (2” Tube)
Painted Color: PMS 282 C Blue

Aluminum Panel:
Size: 12”(h) x 8”(w) x 1/8” thick
Backgrd. Color: PMS 282 C Blue
PSV Graphics: (Sample Graphics Only)
Arrow: A110
Size: 3-1/4”
Color: 25-01 WHITE PSV (Gloss)
Intaglio Graphics: (Sample Graphics Only)
Logo: LTBD (Handicap)
Size: 4”
Color: 25-11 Cobalt Blue PSV (Gloss)

Colors depicted are a general representation of the color specified. If color selection is critical, please request sample for approval.

Scale: 1” = 1'-0”

PLAN VIEW

ACCESS DIRECTIONAL ID - SIDE A

SIDE B

27”
12”
3-1/4”
4”

ETSU Exterior Signage - Barbara Corzo Thomas

11/7/2017

Adding Background Information to help answer questions.

Addition 13, Nov. 2017 RHK

1:16 Scale - Understand the man's position in the design is not accurate.
SIGN SPECIFICATIONS

4160.1 PolySign Series
Non-Illuminated Post Mount
Double-Sided Graphics
Mounting: Direct Burial

Support Post:
Part Code: SPT100 (4" Tube)
Painted Color: PMS 282 C Blue

Aluminum Panel:
Size: 22"(h) x 24"(w) x 1/8" thick
Side A: Background Color: PMS 123 C Yellow
Side B: Background Color: PMS 282 C Blue

Over Panel: (Aluminum)
Size: 21"(h) x 22"(w) x 1/8" thick
Background Color: PMS 282 C Blue

Intaglio Graphics: (Sample Graphics Only)
Logo: LTBD (E)
Size: 3-9/16"
Color: PMS 123 C Yellow
Color: Grey

PSV Graphics: (Sample Graphics Only)
Arrow: A110
Size: 1"
Color: 25-01 White PSV (Gloss)

Text:
HelveticaNeue-Medium (HN65)
Size: 3/4"
Color: 25-01 White PSV (Gloss)

NOTE: Logos available for Production use.

Colors depicted are a general representation of the color specified. If color selection is critical, please request sample for approval.

FACULTY PARKING ID - SIDE A
SCALE: 1" = 1'-0"

PLAN VIEW

24"
22"
22"
SIGN SPECIFICATIONS

4160.1 PolySign Series
Non-Illuminated Post Mount
Double Sided Graphics
Mounting: Direct Burial
Support Post:
Part Code: SPT100 (4" Tube)
Painted Color: PMS 282 C Blue
Aluminum Panel:
Size: 30"(h) x 20"(w) x 1/8" thick
Backgrd. Color: PMS 282 C Blue
Intaglio Graphics: (Sample Graphics Only)
Typestyle: HelveticaNeue-Bold (HM)
Size: 2-5/8"
Color: PMS 123 C Yellow
Logo: LTBD (Parking Designation)
Size: 7-7/16" x 13"
Color: PMS 123 C Yellow
Color: A01 White/A02 Black
PSV Graphics: (Sample Graphics Only)
Typestyle: HelveticaNeue-Bold (HM)
Size: 15/16"
Color: 25-02 Black PSV (Gloss)
NOTE:
Logo available for Production use.

Colors depicted are a general representation of the color specified. If color selection is critical, please request sample for approval.
STAIR 1
ROOF ACCESS
LEVEL 1

↓ DOWN FOR EXIT DISCHARGE
LEVEL 1

Customer approval is required prior to production.

EVACUATION PLAN

Sign Type E / Evacuation Plan ID
FVE1117 FullView E-Series
From: FVE (Claret end) / 11" x 17"
Map Graphics: To Be Determined

Sign Type EG / Stairwell ID
FVE1117 FullView E-Series
From: FVE (Claret end) / 11" x 17"
Map Graphics: To Be Determined

Wall Mount Acrylic Plaque
341A / 18"(h) x 14"(w) x 1/8"(d) / PMS 282C Blue
Printed Graphics: Arial / 1-1/2", 1" & 5"/A01 White
Arrow: A120 / 1-1/4" (h) /A01 White

FullView Series
Interior

Design Concepts
FullView Series
Interior

1155x555

Project:
Tom Crowe
Dana DeLassus
CSR/PM:
1/4" = 1"

Draft 11, Oct. 2017 S. Egorova
Rev 1 12, Oct. 2017 S. Egorova

Colors depicted are a general representation of the color specified.
If color selection is critical, please request sample for approval.
SECTION 10.14.26.10
POST AND PANEL/PYLON SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY
A. Section includes: Non-illuminated single post exterior signs complete with components by single manufacturer at locations indicated. Provide exterior signs from same manufacturer.
B. Related sections:
   1. Section 01 62 00: Product Options and Substitutions.
   2. Section 03 30 00: Cast-in-Place Concrete.
   3. Section 04 22 00: Concrete Unit Masonry.
   4. Section 07 90 00: Joint Protection.

1.02 REFERENCES
A. Standards of the following as referenced:
   1. Aluminum Association (AA).

1.03 SYSTEM DESCRIPTION
A. Design criteria: Design to resist wind loads to 100 MPH when installed in accord with reviewed shop drawings and installation instructions.

1.04 SUBMITTALS
A. Product data:
   1. Manufacturer's signed statement regarding compliance with QUALITY ASSURANCE Article.
   2. Manufacturer's product literature indicating units and designs selected.
   3. Maintenance data and cleaning requirements for exterior surfaces.
B. Shop drawings:
   1. Indicate materials, sizes, configurations, applicable substrate mountings, and location of connections provided in other sections. Specifically indicate tolerances required from other sections for base mounted modules.
   2. Typography sample for copy.
   3. Artwork for logo graphics.
   4. Furnish templates for locations of anchors installed by others.

1.05 QUALITY ASSURANCE
A. Qualifications:
   1. Manufacturer qualifications: Work under this section from manufacturers regularly engaged in work of this magnitude and scope for minimum of ten years.
B. Pre-installation conference: Closely coordinate tolerances required in this section for installation to bases supplied in other sections.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Acceptance at site: Coordinate delivery of work to Project site under this section for immediate installation.
B. Handling materials and equipment: Handle signage in careful manner in order not to damage or mar surfaces of signs or adjacent finish surfaces as applicable.
1.07 SEQUENCING AND SCHEDULING

A. Coordinate:
   1. installation with adjacent finish materials in manner not to destroy adjacent surfaces.
   2. with other sections for cast-in or built-in anchors and mounting hardware in work accomplished in other sections.

1.08 WARRANTY

A. Special warranty: Manufacturer's standard seven year limited warranty covering coating degradation, chalking, fading, and fiberglass delaminating.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

A. Acceptable Manufacturers:
   1. APCO; PolySign; 388 Grant Street SE, Atlanta, Georgia, 30312, USA. Phone; (404) 688-9000. Fax; (404) 577-3847.
   2. Identity Group: www.identitygroup.com, 800-772-5677
   3. Take Form: www.takeform.net, 800-528-1398

B. Types:
   1. Single post and panel: Basis of Design: APCO; Model #4160.1
      a. Single post and panel

C. Sizes: 22”H x 24”W, 21”H x 22”W, 30”H x 20”W, 12”H x 8”W

D. Design units with selected components below.

2.02 COMPONENTS

A. Graphics panel module:
   1. Sign panel faces:
      a. Single and layered aluminum panels: .125” thick
   2. Finish and color:
      a. PMS 282 C Blue, PMS 123 C Yellow

B. Posts:
   1. Material: Structural extruded aluminum alloy 6063-T6, 0.09” and .125” thickness minimum.
   2. Post profile: Square
   3. Finish and color: **
      a. PMS 282 C Blue
   4. Design post for panel size; individual lengths required by manufacturer for in ground mount.

C. Graphics:
   1. Special note: Use of clear overcoat on completed graphics regardless of colors or types selected is STRICTLY PROHIBITED.
   3. Pressure sensitive graphics (PSG) colors: 25-01, and 25-02
      a. TYPE SIZE IS AVAILABLE FROM 3/4” TO 12” IN INCREMENTS. CONSULT MANUFACTURER FOR COMPLETE SIZE RANGE AVAILABLE. STANDARD TYPESTYLES ARE AS FOLLOWS. SELECT STYLE:
          1) HelveticaNeue-Bold(HM)
   4. Type:
a. Size: Vary depending on type and amount of copy required.
b. Type code: Combination

2.03 ACCESSORIES
A. Sealant for base mounted modules:
   1. Acceptable products:
      a. ChemRex Inc.; Sonneborn NP-I.
      b. Pecora Corp.; Dynatrol I.
      c. Tremco, Inc.; Dymonic.
   2. ASTM C920-86, Type S, Grade NS, Class 25.
B. Miscellaneous hardware and items for installation of in-ground and base mounted sign modules.

2.04 FABRICATION
A. Shop assembly:
   1. Fabricate units to configurations indicated on reviewed shop drawings. Internally reinforce units in accord with reviewed shop drawings.
   2. Provide copy required on reviewed shop drawings in accord with manufacturer's standard procedures.
   3. Fabricate posts to lengths required for in-ground mounting.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Verification of conditions:
   1. Examine areas to receive sign modules; verify for correct location of cast-in anchors installed under other sections.
   2. Notify Architect in writing of unacceptable substrate or improper location of anchors.
   3. Beginning work indicates acceptance of substrate. Subsequent modifications to substrate or modules becomes this section's complete responsibility.

3.02 INSTALLATION
A. Install sign modules in locations indicated in accord with reviewed shop drawings. Square, plumb, and level units.
B. Bore holes for post mounted sign modules; set and align posts; fill and compact space around post with concrete.

3.03 CLEANING
A. Clean exposed surfaces not more than 48 hours prior to Date of Substantial Completion in accord with manufacturer's written cleaning instructions.

3.04 SCHEDULES
A. See attached Schedule and Elevations.

END OF SECTION 10.14.26.10
SECTION 10.14.26.15
POST AND PANEL SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY
A. Section includes:
   1. Non-illuminated post mounted signs complete with components by single manufacturer at locations indicated.
   2. Provide exterior signs from same manufacturer.
B. Related sections:
   1. Section 01 62 00: Product Options and Substitutions.
   2. Section 03 30 00: Cast-in-Place Concrete.

1.02 REFERENCES
A. Standards of the following as referenced:
   1. Aluminum Association (AA).

1.03 SUBMITTALS
A. Product data:
   1. Manufacturer's signed statement regarding compliance with Quality Assurance Article.
   2. Manufacturer's product literature indicating units and designs selected.
   3. Maintenance data and cleaning requirements for exterior surfaces.
B. Shop drawings:
   1. Indicate materials, sizes, configurations, applicable substrate mountings, and required location of connections provided in other sections. Specifically indicate tolerances required from other sections for base mounted modules.
   2. Typography sample for copy.
   3. Artwork for ** special graphics. **
   4. Furnish templates required for anchor locations installed by others.

1.04 QUALITY ASSURANCE
A. Manufacturer qualifications: Work required under this section from manufacturers regularly engaged in work of this magnitude and scope for minimum of five years.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Acceptance at site: Coordinate delivery of work to Project site under this section for immediate installation.
B. Handling materials and equipment: Handle signage in careful manner in order not to damage or mar surfaces of signs or adjacent finish surfaces as applicable.

1.06 SEQUENCING AND SCHEDULING
A. Coordinate:
   1. installation with adjacent finish materials not destroying adjacent surfaces.
   2. with other sections for cast-in or built-in anchors and mounting hardware required in work specified in other sections.
1.07 WARRANTY
A. Special warranty: Manufacturer's standard five year limited warranty covering coating degradation, chalking, fading, and fiberglass delaminating.

PART 2 - PRODUCTS
2.01 MANUFACTURED UNITS
A. Acceptable Manufacturers:
   1. Basis of Design: APCO; SignBar; SignPanel, 388 Grant Street SE, Atlanta, Georgia, 30312, USA. Phone; (404) 688-9000. Fax; (404) 577-3847.
   2. Identity Group: www.identitygroup.com, 800-772-5677
   3. Take Form: www.takeform.net, 800-528-1398
B. Type: Post, Double post and bars.
C. Sizes: Indicated per drawings.
D. Design units with selected components below.

2.02 COMPONENTS
A. Changeable Message Panel/SignPanel Solid Plate
   1. Material: ASTM B221-90, 6063-T6 structural extruded aluminum alloy. 3003 Aluminum Plate 1/4”
   2. Type: Manufacturer's standard
      a. Normal: 25mm
   3. Sign Faces (Over Panel):
      a. Panel: Sheet aluminum, per sign type size x 1/8”D
   4. Finish and color:
      a. Center panel: PMS 123 C Yellow
      b. Over Panels: PMS 282 C Blue
      c. Custom dimensional logo shield: PMS 123 C Yellow, PMS 282 C Blue
   5. Decorative cap & pediment: PMS 282 C Blue
B. Posts:
   1. Material: ASTM B221-90, 6063-T6 structural extruded aluminum alloy, 0.093” thickness minimum.
   2. Post profile: Circular, SPC100 - 4”
   3. Finish and color: **
      a. PMS 282 C Blue
   4. Design post for panel size; individual lengths required by manufacturer for in ground mount. Post sizes 50mm and 100mm.
   5. Manufacturer's standard continuous pocket extrusion and removable security post cap for each post.
C. Graphics:
   1. Pressure sensitive vinyl (PSV) colors:
      a. Selected by Architect from manufacturer's standard: 25-02, 25-01
      TYPE SIZE IS AVAILABLE FROM 3/4” TO 12” IN INCREMENTS. CONSULT MANUFACTURER FOR COMPLETE SIZE RANGE AVAILABLE STYLE: Times Roman - RemCap, & HelveticaNeue-Bold
   3. Type code: Combination.
2.03 ACCESSORIES
   A. Miscellaneous hardware and items required for installation of in-ground mounted sign modules.

2.04 FABRICATION
   A. Shop assembly:
      1. Fabricate units to configurations indicated on reviewed shop drawings.
      2. Fabricate posts to lengths required for in-ground mounting.
      3. Furnish copy required on reviewed shop drawings in accord with manufacturer's standard procedures.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Examine areas to receive sign modules; verify for correct location of cast-in anchors installed under other sections.
   B. Notify Architect in writing of unacceptable substrate or improper location of anchors. Beginning work indicates acceptance of substrate. Subsequent modifications to substrate or modules becomes this section's complete responsibility.

3.02 INSTALLATION
   A. Install sign modules in locations indicated in accord with reviewed shop drawings. Square, plumb, and level units.
   B. Bore required holes for post mounted sign modules; set and align posts; fill and compact space around post with concrete.

3.03 CLEANING
   A. Clean exposed surfaces not more than 48 hours prior to Date of Substantial Completion in accord with manufacturer's written cleaning instructions.

3.04 SCHEDULES
   A. See attached Schedule and Elevations.

END OF SECTION 10.14.26.15
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Solid plastic toilet compartments.
   B. Urinal and vestibule screens.

1.02 RELATED REQUIREMENTS
   A. Section 05.12.00 - Structural Steel Framing: Concealed steel support members.
   B. Section 05.50.00 - Metal Fabrications: Concealed steel support members.
   C. Section 06.10.00 - Rough Carpentry: Blocking and supports.
   D. Section 10.28.00 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS
   A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

1.04 ADMINISTRATIVE REQUIREMENTS
   A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
   C. Product Data: Provide data on panel construction, hardware, and accessories.
   D. Manufacturer's Installation Instructions: Indicate special procedures.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction wast diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
      1. Compliance with Credit MR1.1: Recycling Collection and Storage
      2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
      3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.
PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments:

2.02 SOLID PLASTIC TOILET COMPARTMENTS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high
   density polyethylene (HDPE), tested in accordance with NFPA 286, floor-mounted headrail-braced.
   1. Color: To Be Determined.

B. Doors:
   1. Thickness: 1 inch.
   2. Width: 24 inch.
   4. Height: 55 inch.

C. Panels:
   1. Thickness: 1 inch.
   2. Height: 55 inch.
   3. Depth: As indicated on drawings.

D. Pilasters:
   1. Thickness: 1 inch.
   2. Width: As required to fit space; minimum 3 inch.

E. Screens: Without doors; to match compartments; mounted to wall with two panel brackets.

2.03 ACCESSORIES

A. Pilaster Shoes: Formed ASTM A666, Type 304 stainless steel with No. 4 finish, 3 in high, concealing
   floor fastenings.

B. Head Rails: Hollow stainless steel, 1 by 1-1/2 inch size, with anti-grip profile and cast socket wall
   brackets.

C. Pilaster Brackets: Polished stainless steel.

D. Wall Brackets: Continuous type, polished stainless steel.

E. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.

F. Hardware: Satin stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Door Latch: Slide type with exterior emergency access feature.
   3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   4. Coat hook with rubber bumper; one per compartment, mounted on door.
   5. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.
C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION
A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.
C. Attach panel brackets securely to walls using anchor devices.
D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES
A. Maximum Variation From True Position: 1/4 inch.
B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING
A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
C. Adjust adjacent components for consistency of line or plane.

END OF SECTION 10.21.13.19
SECTION 10.26.01
WALL AND CORNER GUARDS

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Corner guards.

1.02  RELATED REQUIREMENTS
A. Section 06.10.00 - Rough Carpentry: Blocking for wall and corner guard anchors.
B. Section 09.21.16 - Gypsum Board Assemblies, which also has heavy duty corner trim not at corner guard locations.
C. Section 09.23.00 - Gypsum Plastering, which also has heavy duty corner trim not at corner guard locations.

1.03  REFERENCE STANDARDS

1.04  SUBMITTALS
A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
B. Product Data: Indicate physical dimensions, features, anchorage details, and rough-in measurements.
C. Samples: Submit two sections of bumper rail, 24 inch long, illustrating component design, configuration, color and finish.
D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.05  TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

PART 2  PRODUCTS

2.01  COMPONENTS
A. Corner Guards - Surface Mounted: Extruded one-piece unit without splices, installed with adhesive.
   1. Material: Polyethylene terephthalate (PET or PETG); PVC-free; smooth surface.
   2. Width of Wings: 2 inches.
   3. Color: As selected from manufacturer's standard colors.
   4. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with 1.
5. Thickness: 18 gage, 0.05 inch.
6. Height: Full height from top of base to top of adjacent door frames.

2.02 FABRICATION
   A. Fabricate components with tight joints, corners and seams.
   B. Pre-drill holes for attachment.
   C. Form end trim closure by capping and finishing smooth.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
   B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION
   A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.
   B. Position corner guard 4 inches above finished floor to top of adjacent door frames.
   C. Coordinate installation of vinyl fabric wall covering with corner guard frame and cover.

3.03 TOLERANCES
   A. Maximum Variation From Required Height: 1/4 inch.
   B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Commercial toilet accessories.
   B. Accessories for toilet rooms, showers, and utility rooms.
   C. Utility room accessories.
   D. Grab bars.
   E. Accessories furnished by Owner and installed by Contractor.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

1.04 ADMINISTRATIVE REQUIREMENTS
   A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
   C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction waste diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
      1. Compliance with Credit MR1.1: Recycling Collection and Storage
      2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
      3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

PART 2 PRODUCTS

2.01 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

2.02 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

D. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

E. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

F. Back paint components where contact is made with building finishes to prevent electrolysis.

2.03 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser: Furnished by Owner; installed by Contractor.
   1. Mounting: Surface mounted. Contractor provide blocking where occurs at walls.

B. Paper Towel Dispenser: Furnished by Owner; installed by Contractor.

C. Trash Grommet for lavatory counters: 8” diameter stainless steel. Three options are:

D. Soap Dispenser: Furnished by Owner; installed by Contractor.
   1. Mounting: Surface mounted on wall. Contractor provide blocking.

E. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
   1. Size: As indicated on accessory schedule.
   2. Frame: 0.05 inchangle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
   3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.

F. Grab Bars: Stainless steel, nonslip grasping surface finish.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force, minimum. Contractor provide blocking in stud walls adequate to support loads.
b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.

c. Length and Configuration: As indicated on drawings.

G. Coat Hooks not in toilet partitions: Stainless steel heavy-duty clothes hook with concealed mounting. Products: Three options are:

H. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
1. Style: Horizontal.
4. Products: Three options are:

I. Folding Shower Seat: Wall-mounted surface; welded tubular seat frame, structural support members, hinges and mechanical fasteners of Type 304 stainless steel, L-Shaped seat.
1. Seat: Burmese teakwood slats secured to supporting frame members with stainless steel screws. Ease edges of each slat.
2. Size: 34" W x 21" D x 15" D. Hand as shown on Drawings.
3. Products: Three options are:

J. Folding Dressing Bench: Wall-mounted surface; welded tubular seat frame, structural support members, hinges and mechanical fasteners of Type 304 stainless steel, rectangular seat.
1. Seat: Burmese teakwood slats secured to supporting frame members with stainless steel screws. Ease edges of each slat.
2. Size: 42" x 20".
3. Products:
2.04 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
   1. Mop/broom holders: 3 spring-loaded rubber cam holders at shelf front.
   2. Length: 36 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify exact location of accessories for installation.
C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
D. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.
B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.
B. Install plumb and level, securely and rigidly anchored to substrate.
C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 10.28.00
PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Catwalk-mounted anchor point for fall restraint and fall arrest for worker safety.
B. Related Sections:
   1. Section 03.30.00 - Cast-In-Place Concrete
   2. Section 05100 - Structural Metal Framing

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)
B. American National Standard Institute (ANSI)
   1. ANSI Z359.1-2007 - Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components
   2. ANSI Z359.6-2009 - Specifications and Design Requirements for Active Fall Protection Systems
C. Occupational Health And Safety Administration (OSHA)
   1. OSHA 1926.502 - Fall Prevention Systems Criteria and Practices

1.03 SYSTEM DESCRIPTION

A. General: Provide structural fall restraint and fall arrest system capable of withstanding loads and stresses within limits and under conditions specified in OSHA and other applicable safety codes. Provide fall protection anchors permanently attached to roof structure.
B. Design Requirements: Anchors and accessories comprising system of following types:
   1. Guardian CB Anchors, spaced as indicated by manufacturer, for safety snap connection by individual workers capable of withstanding a 5,000 pound load or safety factor of 2 meeting the requirements of OSHA 1926.502(d)(8).
C. Performance Requirements: System and components tested for the resistance of the following loads:
   1. Fall Restraint: 1 User
   2. Fall Arrest: 1 User
   3. Design fall protection anchors to resist a 5,000 pound load applied in any direction at maximum anchor height or provide engineered system designed meeting the requirements of OSHA 1926.502(d)(8).

1.04 SUBMITTALS

A. Product Data: For each type of device specified, including manufacturer’s standard fabrication details and installation instructions.
B. Shop Drawings: Show layout, profiles, and anchorage details. Shop drawings & calculations to be stamped by a Professional Engineer registered in the State in which the project is located.
C. Maintenance Data: Written instructions for maintenance of fall prevention safety devices to be included in the operation and maintenance manual.
D. In-house Test Reports: Indicate anchor fabrication compliance with performance requirements.
E. Signage: Provide laminated sign showing system layout and usage notes, to be installed at catwalk access locations.
1.05 QUALITY ASSURANCE
A. Manufacturer Qualifications: Firm having at least 10 years continuous experience in manufacturing fall safety equipment similar to systems specified and exhibiting records of successful in-service acceptability and performance. Firm must employ personnel dedicated to provide regularly scheduled Authorized and Competent Person Training courses as mandated by OSHA 1926 and 1910 for owner’s authorized safety personnel.
B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of roof anchors that are similar to those indicated for this Project in material, design and extent.
C. OSHA Standards: Comply with Occupational Safety and Health Administration Standards for the Construction Industry 29 CFR § 1926.500 Subpart M (Fall Protection), and with applicable State Administrative Code safety standards for Fall Restraint and Fall Arrest.
D. Source Limitations: Obtain all roof anchors through one source from a single manufacturer.
E. Testing: Perform quality control tests for each system per manufacturer’s requirements.

1.06 COORDINATION
A. Contractor to coordinate installation of structural deck to meet requirements of roof anchor manufacturer.
   1. Concrete Deck: Minimum concrete strength, Fc = 2,000 psi. Minimum 6” thickness for adhesive anchor connection; minimum 4” thickness for mechanical anchor connection.
   2. Metal Deck: Minimum 18 gauge thickness, or provided with additional deck reinforcing per manufacturer's instructions.
   3. Wood Deck: Minimum 3/4” CDX plywood, or provided with additional deck reinforcing per manufacturer's instructions.
   4. Structural beam for weld-on or backer plate connection: structure must be capable of supporting a 5,000 pound ultimate load.
   5. Concrete or composite metal deck for backer plate or toggle anchor connection: Deck must be capable of supporting a 5,000 pound ultimate load.
   6. Other structural decks not listed above shall be approved by a Qualified Person.
B. Contractor to coordinate installation of structural deck reinforcements and anchorages to receive fall protection anchors.
C. Contractor to coordinate placement of roofing system, insulation and flashing to ensure water-tight integrity to roof.

1.07 WARRANTY
A. Provide manufacturer’s standard warranty to guarantee products will be free from defects for a period of 12 months. Warranty period shall become effective on date of substantial completion.

PART 2 - PRODUCTS

2.01 MANUFACTURER
A. Basis of Design: Provide fall protection system manufactured by Guardian Fall Protection Inc., 6305 South 231st Street Kent, WA, phone 800-466-6385, fax 800-670-7892, or equal.
B. Miller Fall Protection, by Honeywell, 800-873-5242; www.millerfallprotection.com

2.02 MATERIALS
A. CB Anchor base plate: galvanized steel.
2.03 MANUFACTURED ASSEMBLIES
   A. Guardian CB-1-B Anchor, or equal.

2.04 FABRICATION
   A. Fabricate work true to dimension, square, plumb, level, and free from distortions or defects detrimental to appearance and performance.
   B. Prepare, treat and coat galvanized metal to comply with manufacturer's written instructions. Prepare galvanized metal by removing grease, dirt, oil, flux, and other foreign matter.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Examine framing and substrate and verify conditions comply with structural requirements for proper system performance.
   B. Proceed with installation of roof anchors only after verifying conditions are satisfactory.

3.02 INSTALLATION
   A. General: Installation of Anchor Posts to be performed by contractor according to manufacturer’s instructions and recommendations.

3.03 FIELD QUALITY CONTROL
   A. Testing: Test on site 100% of anchors relying upon chemical adhesive fasteners using load cell test apparatus in accordance with manufacturer's written recommendations.

3.04 ADJUSTMENT AND INSPECTION
   A. Ensure all manufactured anchors have been installed in accordance with fall protection manufacturer’s engineering documentation and specifications.
   B. Provide plan drawings with any deviations in anchor locations as installed.

END OF SECTION 10.42.00
SECTION 10.44.00
FIRE PROTECTION SPECIALTIES

PART 1  GENERAL

1.01  SECTION INCLUDES
   A.  Fire extinguishers.
   B.  Fire extinguisher cabinets.
   C.  Accessories.

1.02  RELATED REQUIREMENTS
   A.  Section 06.10.00 - Rough Carpentry:  Wood blocking product and execution requirements.

1.03  REFERENCE STANDARDS

1.04  SUBMITTALS
   A.  See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B.  Product Data:  Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and installation instructions.
   C.  Shop Drawings:  Indicate locations of cabinets and cabinet physical dimensions.
   D.  Manufacturer's Installation Instructions:  Indicate special criteria and wall opening coordination requirements.
   E.  Manufacturer's Certificate:  Certify that products meet or exceed specified requirements.
   F.  Maintenance Data:  Include test, refill or recharge schedules and re-certification requirements.

1.05  FIELD CONDITIONS
   A.  Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2  PRODUCTS

2.01  FIRE EXTINGUISHERS
   A.  Fire Extinguishers - General:  Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   B.  Multipurpose Dry Chemical Type Fire Extinguishers:  Carbon steel tank, with pressure gage.
      2.  Size:  10 pound.
      3.  Temperature range:  Minus 40 degrees F to ___ degrees F.

2.02  FIRE EXTINGUISHER CABINETS
   A.  Fire Rating:  Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
   B.  Cabinet Construction:  Non-fire rated.
      1.  Formed primed steel sheet; 0.036 inch thick base metal.
   C.  Fire Rated Cabinet Construction:  One-hour fire rated.
      1.  Steel; double wall or outer and inner boxes with 5/8 inch thick fire barrier material.
D. Cabinet Configuration: Semi-recessed type.
E. Door: 0.036 inch thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon catch.
F. Door Glazing: Float glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

2.03 ACCESSORIES
A. Extinguisher Brackets: Formed steel, chrome-plated.
B. Extinguisher Theft Alarm: Battery operated alarm, 10 second delay for disarming, activated by opening cabinet door.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify existing conditions before starting work.
B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION
A. Install in accordance with manufacturer's instructions.
B. Install cabinets plumb and level in wall openings, 30 inches from finished floor to inside bottom of cabinet.
C. Place extinguishers in cabinets.

END OF SECTION 10.44.00
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Plastic laminate wood lockers

1.02 RELATED REQUIREMENTS
   A. Section 01.61.16 - Volatile Organic Compound (VOC) Content Restrictions.
   B. Section 06.10.00 - Rough Carpentry: Wood blocking and nailers.

1.03 REFERENCE STANDARDS
   A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014
   C. BHMA A156.9 - American National Standard for Cabinet Hardware, 2010
   D. NEMA LD 3 - High-Pressure Decorative Laminates, 2005.

1.04 SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Manufacturer's published data on locker construction, sizes and accessories, including locks.
   C. Shop Drawings: Indicate locker plan layout, numbering plan.
   D. Samples: Submit two samples 2” by 3” inches in size, of each color scheduled.
   E. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.05 DELIVERY, STORAGE, AND HANDLING
   A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 LOCKER APPLICATIONS
   A. Wardrobe Lockers: Three tier plastic laminate on wood lockers, free-standing with matching closed base.
      1. Width: 12 inches.
      2. Depth: 12 inches.
      3. Height: 72 inches.
      4. Fittings: Hat shelf, 2 coat hooks each locker.
      5. Locking: Built-in digital keypad locks with shared locking codes.

2.03 PLASTIC LAMINATE WOOD LOCKERS
   A. Lockers: Factory assembled, made of plastic laminate faced wood cabinets.
      1. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
      2. Wood fabricated from old growth timber is not permitted.
      3. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
4. Laminate Materials:
   a. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.
   b. High Pressure Decorative Laminate (HPDL): NEMA LD 2, types as recommended for specific applications.
   c. Exterior finish: Equal to Wilsonart “Walnut Heights” 7965K-12
7. Coat Hooks: Stainless steel
8. Number Plates: Provide rectangular shaped aluminum plates. Form numbers 1 inch high of block font style with ADA designation, in contrasting color.
9. Locks: Compact digital lock with 12-button keypad, silver grey finish, with public use code function. and master code function Equal to Kitlock Nano90.

PART 3 EXECUTION

3.01 EXAMINATION

3.02 FABRICATION
   A. Assembly: Shop assemble lockers for delivery to site in units easily handled and to permit passage through building openings.
   B. Edging: Fit shelves, doors and exposed edges with specified edging. Do not use more than one piece for any single length.
   C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.
      1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
      2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
      3. All wood grained laminates will have grain pattern to run vertical on cabinets, doors & drawer faces.

3.03 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Install lockers plumb and square.
   C. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 lb.
   D. Replace components that do not operate smoothly.

3.04 CLEANING
   A. Clean locker interiors and exterior surfaces.

END OF SECTION 10.51.00
PART 1  GENERAL

1.01  SECTION INCLUDES
   A. Metal storage shelving.

1.02  REFERENCE STANDARDS

1.03  SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Manufacturer's data sheets on each product to be used, including:
      1. Rated uniform shelf loads.
      2. Details of shelving assemblies, including reinforcement.
      3. Accessories.
      4. Installation methods.
      5. Specimen warranty.
   C. Test Reports: Provide independent agency test reports documenting compliance with specified structural requirements.
   D. Shop Drawings: Indicate location, type, and layout of shelving, including lengths, heights, and aisle layout, and relationship to adjacent construction.
      1. Indicate methods of achieving specified anchoring requirements.
   E. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and finishes.
   F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
   G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.04  QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.05  DELIVERY, STORAGE, AND HANDLING
   A. Inspect for dents, scratches, or other damage. Replace damaged units.
   B. Store in manufacturer's unopened packaging until ready for installation.
   C. Store under cover and elevated above grade.

1.06  WARRANTY
   A. See Section 01.78.00 - Closeout Submittals, for additional warranty requirements.
   B. Provide one year manufacturer warranty covering defects of manufacturing and workmanship and rust and corrosion.
PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Four Post Shelving:
      4. Substitutions:  See Section 01.60.00 - Product Requirements.

2.02 SHELVING - GENERAL
   A. See drawings for layout and sizes.
   B. Seismic Design:  Design for Seismic Zone 3, in accordance with ASCE 7, Section 9.
   C. Anchors:  Provide anchoring hardware to secure each shelving unit to floor and wall.
      1. Provide hardware of type recommended by manufacturer for substrate.

2.03 FOUR POST SHELVING
   A. Four Post Shelving:  Steel post-and-beam type with sway bracing, shelving brackets, shelving surfaces, and accessories as specified.
      1. Unit Width:  48 inches, center to center of posts.
      2. Shelf Capacity:  Uniform distributed load of 50 psf, minimum.
      3. Shelf Deflection:  1/4 inch in 36 inches, maximum, under specified uniform load.
      4. Adjustability of Shelving:  At intervals of 1 1/2 inches on center, minimum.
      5. Shelf Depth:  24 and 30 inches, minimum, as indicated on Drawings.
      6. Shelves per Unit:  As indicated on drawings.
      7. Unit Height:  120 inches, overall, maximum.
      9. Color:  As selected by Architect from manufacturer’s standard range.
     10. Number of Units:  As indicated on drawings.
   B. Posts and Beams:  Formed sheet members; perforations exposed on face of members are not acceptable.
      1. Post Shape:  Tee intermediate posts, angle end posts forming corners.
      2. Post Face Width:  2 inches, maximum.
      3. Connecting Hardware:  Manufacturer's standard.
   C. Bracing:  Formed sheet members.
      1. Back Sway Bracing:  Either strap or panel; at back of each unit.
      2. Side Sway Bracing:  Either strap or panel; at each side of each unit.
      3. Strap Sway Bracing:  One strap installed diagonally, 16 gage, 0.0598 inch; welded, riveted, or bolted to uprights.
      4. Panel Sway Bracing:  Formed sheet metal panels, 20 gage, 0.0359 inch; welded, riveted, or bolted to uprights.
   D. Shelves:  Formed sheet, finished on all surfaces, with slots for dividers.
      1. Shelf Edge Profile:  Extending 3/4 inch, maximum, below top surface of shelf.
      2. Shelf Connection to Posts:  Manufacturer's standard.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that substrate is level and that clearances are as specified.
   B. Verify that walls are suitable for shelving attachment.
C. Do not begin installation until substrates have been properly prepared.
D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

**3.02 PREPARATION**

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

**3.03 INSTALLATION**

A. Install in accordance with manufacturer's instructions.
B. Anchor and reinforce as specified, as indicated on drawings, and as recommended by manufacturer.
C. Install shelving with shelf surfaces level and vertical supports plumb; adjust feet and bases as required.
D. Out-Of-Square Tolerance - Four Post Shelving: Maximum of 1/8 inch difference in distance between bottom shelf and canopy top, measured along any post in any direction.

**3.04 CLEANING**

A. Clean shelving and surrounding area after installation.

**3.05 PROTECTION**

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION 10.56.13**
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Shelf standards, brackets, and accessories.
   B. Shelves.
   C. See drawings for locations and configurations.

1.02 RELATED REQUIREMENTS
   A. Section 06.10.00 - Rough Carpentry: Wood blocking in walls for attachment of standards.

1.03 SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Manufacturer's data sheets on each product to be used.
   C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

1.04 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING
   A. Store products under cover and elevated above grade.
   B. Store products in manufacturer's unopened packaging until ready for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Shelf Standards and Brackets:
      4. Substitutions: See Section 01.60.00 - Product Requirements.

2.02 MATERIALS
   A. Extra Heavy Duty Shelf Standards: Single-slotted channel standards for brackets adjustable in 1 inch increments along entire length of standard, drilled and countersunk for screws.
      1. Acceptable Product: KV 187LL ANO 14 or equal.
      2. Load Capacity: Recommended by manufacturer for loading of 540 to 1,060 pounds per pair of standards.
      3. Lengths: As indicated on drawings.
      5. Brackets: 12 gage, 0.1046 inch sheet steel, reinforced, locking into slots with molded nylon cam lock lever; size to suit shelves; same finish as standards.
      6. Bracket Quantity: Provide one bracket for each 12 inches of standard length.
B. Steel Shelves: 32" long x 12" deep and 16" deep galvanized steel shelves to fit the wall-mounted standards and brackets.
   1. Capacity: Shelves to accommodate the loading specified for the standards and brackets.
   2. Quantity and sizes: As indicated on the Drawings.

C. Fasteners: Screws as recommended by manufacturer for intended application or as otherwise required by project conditions.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Do not begin installation until substrates have been properly prepared and adequate blocking is provided to support the shelving.
   B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION
   A. Clean surfaces thoroughly prior to installation.
   B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Mount standards to solid backing capable of supporting intended loads.
   C. Install brackets, shelving, and accessories.

3.04 PROTECTION
   A. Protect installed products until completion of project.
   B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 10.56.17
SECTION 10.73.00
ALUMINUM WALKWAY COVERS

PART 1 GENERAL

1.01 SUMMARY
A. Section Includes: Design, fabrication, and installation of welded extruded aluminum walkway cover systems.
B. Products Furnished but not Installed Under this Section: Column sleeves (styrofoam blockouts) or anchor bolts (if required)

1.02 REFERENCES
A. The Aluminum Association (AA):
B. American Architectural Manufacturers Association (AAMA):
C. American Society of Civil Engineers (ASCE):
D. American Society for Testing and Materials (ASTM):
   1. ASTM B 209, Specification for Aluminum and Aluminum- Alloy Sheet and Plate.
E. American Welding Society (AWS):

1.03 SYSTEM DESCRIPTION
A. Design Requirements:
   2. Comply with the wind requirements of ASCE 7.
   3. Provide an all welded extruded aluminum system complete with internal drainage. Non-welded systems are not acceptable.
   4. Provide expansion joints to accommodate temperature changes of 120 degrees F. Provide expansion joints with no metal to metal contact.
B. Performance Requirements:

1.04 SUBMITTALS
A. Product Data: Manufacturer’s product information, specifications, and installation instructions for walkway cover components and accessories.
B. Shop Drawings: Include plan dimensions, elevations, and details.
C. Samples:
   1. Selection: Manufacturer’s standard range of colors for the finishes selected.
   2. Verification: 2-inch-square samples of each finish selected on the substrate specified.
D. Design Data: Design calculations bearing the seal of a Registered Professional Engineer, licensed in the state where the project is located. Design calculations shall state that the walkway cover system design complies with the wind requirements of ASCE 7, the stability criteria of applicable building code, and all other governing criteria.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION

A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.

B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   4. Compliance with Credit EQ6.2: Material VOC Limits - Paints
   5. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least ten years experience in the design, fabrication, and erection of extruded aluminum walkway cover systems.

B. Installer Qualifications: Have walkway covers installed by manufacturer, third party installation is not acceptable.

PART 2 PRODUCT

2.01 MANUFACTURERS

A. The design is based on products fabricated by: Peachtree Protective Covers, Inc., 1477 Rosedale Drive, Hiram, GA 30141, 770-439-2120, fax 770-439-2122.
   1. Comparable products by the following manufacturers also will be acceptable:
      b. Avadek Walkway Cover Systems, 12130 Galveston Road, Webster, TX 77598, 800-777-4031, www.avadek.com
      d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.02 MATERIALS

A. Aluminum Members: Extruded aluminum, ASTM B 221, 6063 alloy, T6 temper.

B. Fasteners: Aluminum, 18-8 stainless steel, or 300 series stainless steel.

C. Protective Coating for Aluminum Columns Embedded in Concrete: Clear acrylic.

D. Grout:
   1. Portland Cement: ASTM C 150, Type I.

E. Gaskets: Dry seal santoprene pressure type.

F. Aluminum Flashing: ASTM B 209, Type 3003 H14, 0.040 inch, minimum.

2.03 MIXES

A. Grout: 1 part portland cement to 3 parts sand, add water to produce a pouring consistency.

2.04 FABRICATION

A. General:
   1. Shop Assembly: Assemble components in shop to greatest extent possible to minimize field assembly.
   2. Welding: In accordance with ANSI/AWS D1.2.
   3. Bent Construction: Factory assemble beams to columns to form one-piece rigid bents. Where used make welds smooth and uniform using an inert gas shielded arc. Perform suitable edge preparation to assure 100% penetration. Grind welds only where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. Rigid mechanical joints can be used if supported by engineering calculations and/or testing.
   4. Deck Construction: Fabricate from extruded modules that interlock in a self-flashing manner. Positively fasten interlocking joints creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each. Assemble deck with sufficient camber to offset dead load deflection.

B. Columns: Provide radius-cornered tubular extrusions with cutout and internal diverter for drainage where indicated. Circular downspout opening in column not acceptable.

C. Beams: Provide open-top tubular extrusion, top edges thickened for strength and designed to receive deck members in self-flashing manner.

D. Deck: Extruded self-flashing sections interlocking into a composite unit. Provide welded plate closures at deck ends.

E. Fascia: Manufacturer’s standard shape. Provide fascia splices where continuous runs of fascia are jointed. Locate splices to be in line with bents and fasten in place on hidden or non-vertical surfaces.

F. Factory Finishing: Finish designations prefixed by AA comply with system established by the AAMA for designating aluminum finishes.
      a. Fluoropolymer Two-Coat Coating System: Manufacturer’s standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that all concrete, masonry, and roofing work in the vicinity is complete and cleaned.

3.02 ERECTION

A. Erect protective cover true to line, level, and plumb. Protect aluminum columns embedded in concrete with clear acrylic. Fill downspout columns with grout to the discharge level to prevent standing water. Install weep holes at top of concrete in non-draining columns to remove condensation.

DESIGN RELEASE PACKAGE 4
ISSUED: 12/01/2017
B. Provide hairline miters and fitted joints.

3.03 CLEANING
   A. Clean all protective cover components promptly after installation.

3.04 PROTECTION
   A. Protect materials during and after installation.

END OF SECTION 10.73.00
SECTION 10.73.01
ALUMINUM WALL HUNG CANOPY

PART 1 GENERAL

1.01 SUMMARY
A. Section Includes: Design, fabrication, and installation of welded extruded aluminum canopy systems.

1.02 REFERENCES
A. The Aluminum Association (AA):
B. American Architectural Manufacturers Association (AAMA):
C. American Society of Civil Engineers (ASCE):
D. American Society for Testing and Materials (ASTM):
   1. ASTM B 209, Specification for Aluminum and Aluminum- Alloy Sheet and Plate.
E. American Welding Society (AWS):

1.03 SYSTEM DESCRIPTION
A. Design Requirements:
   2. Comply with the wind requirements of ASCE 7.
   3. Provide an all welded extruded aluminum canopy system complete with internal drainage. Non-welded systems are not acceptable.
   4. Provide expansion joints to accommodate temperature changes of 120 degrees F. Provide expansion joints with no metal to metal contact.

1.04 SUBMITTALS
A. Product Data: Manufacturer’s product information, specifications, and installation instructions for canopy components and accessories.
B. Shop Drawings: Include plan dimensions, elevations, and details.
C. Samples:
   1. Selection: Manufacturer’s standard range of colors for the finishes selected.
   2. Verification: 2-inch-square samples of each finish selected on the substrate specified.
D. Design Data: Design calculations bearing the seal of a Registered Professional Engineer, licensed in the state where the project is located. Design calculations shall state that the canopy system design complies with the wind requirements of ASCE 7, the stability criteria of applicable building code, and all other governing criteria.
1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION

A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.

B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR1.1: Recycling Collection and Storage
   2. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   3. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   4. Compliance with Credit EQ6.2: Material VOC Limits - Paints
   5. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least ten years of experience in the design, fabrication, and erection of extruded aluminum canopy systems.

B. Installer Qualifications: Have canopy installed by manufacturer, third party installation is not acceptable.

PART 2 PRODUCT

2.01 MANUFACTURERS

A. The design is based on products fabricated by: Peachtree Protective Covers, Inc., 1477 Rosedale Drive, Hiram, GA 30141, 770-439-2120, fax 770-439-2122.
   1. Comparable products by the following manufacturers also will be acceptable:
      b. Avadek Walkway Cover Systems, 12130 Galveston Road, Webster, TX 77598, 800-777-4031, www.avadek.com
      d. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.02 MATERIALS

A. Aluminum Members: Extruded aluminum, ASTM B 221, 6063 alloy, T6 temper.
B. Fasteners: Aluminum, 18-8 stainless steel, or 300 series stainless steel.
C. Protective Coating for Aluminum Columns Embedded in Concrete: Clear acrylic.
D. Gaskets: Dry seal santoprene pressure type.
E. Aluminum Flashing: ASTM B 209, Type 3003 H14, 0.040 inch, minimum.

2.03 FABRICATION

A. General:
   1. Shop Assembly: Assemble components in shop to greatest extent possible to minimize field assembly.
   2. Welding: In accordance with ANSI/AWS D1.2.
3. Gutter Frame Construction: Factory assemble gutter fascia frames to form a one-piece welded frame. Make welds smooth and uniform using an inert gas shielded arc. Perform suitable edge preparation to assure 100% penetration. Grind welds only where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. Gutter frames constructed by mechanically fastening components together are not acceptable.

4. Deck Construction: Fabricate from extruded modules that interlock in a self-flashing manner. Positively fasten interlocking joints creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each.

B. Beams: Where applicable provide open-top tubular extrusion, top edges thickened for strength and designed to receive deck members in self-flashing manner.

C. Deck: Extruded self-flashing sections interlocking into a composite unit.

D. Gutter Fascia: Where applicable provide “j-shaped” gutter fascia capable in manufacturer’s standard sizes.

E. Fascia: Where applicable provide manufacturer’s standard fascia in standard sizes.

F. Hanger Assemblies: Provide extruded aluminum hanger rods in manufacturer’s standard shapes and sized to meet the loads seen by canopy.

G. Factory Finishing: Finish designations prefixed by AA comply with system established by the AAMA for designating aluminum finishes.
      a. Fluoropolymer Two-Coat Coating System: Manufacturer’s standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verification of Conditions: Verify that all concrete, masonry, and roofing work in the vicinity is complete and cleaned.

3.02 ERECTION
   A. Erect canopy true to line, level, and plumb.
   B. Provide hairline miters and fitted joints.

3.03 CLEANING
   A. Clean all canopy components promptly after installation.

3.04 PROTECTION
   A. Protect materials during and after installation.

END OF SECTION 10.73.01
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Prefabricated steel leveler.
   B. Operating hardware and controls.
   C. Mechanical restraint safety vehicle lock.
   D. Dock bumpers.

1.02 RELATED REQUIREMENTS
   A. Section 03.10.00 - Concrete Forming and Accessories: Placement of leveler frame and safety lock frame into concrete loading dock.
   B. Section 03.30.00 - Cast-in-Place Concrete: Concrete pit.

1.03 SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   C. Shop Drawings: Indicate required opening dimensions and tolerances, placement dimensions of safety lock device, and perimeter conditions of construction.
   D. Manufacturer's Installation Instructions: Indicate special requirements.
   E. Operation Data: Provide operating instructions, and identify unit limitations.
   F. Maintenance Data: Provide unit maintenance information, lubrication cycles, and spare parts manual.

1.04 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction wast diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
   D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Loading Dock Levelers:
      4. Substitutions: See Section 01.60.00 - Product Requirements.
2.02 COMPONENTS
A. Loading Dock Leveler:
   2. Deck Width: 85 inch.
   4. Operating Range: 12 inches above dock level, 4 inches below dock level.
   5. Capacity: 4000 lbs.
B. Vehicle Restraint: Mechanical lock, fabricated and welded steel plate construction, spring loaded to automatically latch when activated, to comply with ICC-ES (Evaluation Service) reports for semitrailer vehicle bumper requirements for dimension and placement indicated.
C. Deck: 1/4 inch steel checker plate deck, reinforced on underside, welded to fabricated steel frame; counter balanced with 16 inch long automatically operated plate lip; lip to lock in downward vertical position when leveler is at rest at dock level.
D. Pit Frame: Steel angle, 3 by 3 by 1/4 inch; welded corners, fitted with anchors ___ inch on center for concrete embedment.

2.03 ACCESSORIES
A. Loading Dock Bumpers: Equip each unit with two 12" high x 4" deep laminated dock bumpers.

2.04 FINISHES
A. Leveler Platform: Factory enameled finish.
B. Leveler Frame: Factory enameled finish.
C. Pit Frame: Hot dip galvanized to 1.25 oz/sq ft finish.
D. Vehicle Restraint: Yellow painted hook, galvanized steel operating mechanism.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that rough-in openings are acceptable.

3.02 INSTALLATION
A. Install dock leveler and mechanical safety vehicle lock unit in prepared opening in accordance with manufacturer's instructions.
B. Set square and level.
C. Anchor unit securely, flush with dock. Weld back of leveling dock to pit frame. Touch-up weld with primer.
D. Anchor safety lock securely and flush with vertical dock face.

3.03 ADJUSTING
A. Adjust installed unit and safety device for smooth and balanced operation.

END OF SECTION 11.13.19.13
SECTION  11 61 00
PERFORMANCE MACHINERY GENERAL REQUIREMENTS

PART 1 GENERAL

1.01  RELATED DOCUMENTS
A. Division 1 Specification Sections apply to this Section.
B. This section applies to the following sections:
1.   11 61 23 Performance Platforms.
2.   11 61 33 Performance Manual Rigging.
3.   11 61 37 Proscenium Fire Safety Curtain.
4.   11 61 38 Tension Wire Grid
5.   11 61 39 Performance Lifts.
6.   11 61 43 Performance and Acoustic Drapery.
7.   11 61 44 Performance Drapery Track.

1.02  DEFINITIONS
A. Manual Rigging refers to mechanical devices that are powered using human effort, power, or energy, to locate elements in horizontal or vertical planes.
B. Powered Rigging refers to mechanical devices that are operated via electro-mechanical devices to locate elements in horizontal or vertical planes.
C. Where measurements are provided, they are stated in Imperial units followed by SI units. Conversions are generally performed as soft conversions, unless a hard equivalent is readily available.

1.03  QUALIFICATIONS:
A. The Contractor shall have been an authorized representative of the manufacturer of not less than one of the specified equipment systems for a minimum of two (2) years.
B. Contractors shall have been involved in the type of work of that section for a period of five (5) years or more and shall have successfully completed at least ten (10) installations in the country in which the work is being performed of this type and scope, which have been in service successfully for not less than two (2) years. Project scope requirements include, but are not limited to, project complexity, project construction cost, and equipment contractor’s construction costs.
C. The right is reserved to inspect previous equipment or systems as furnished or installed by this Contractor. In addition, the right is reserved to reject a Contractor who has failed in any respect to comply with the provisions of previous contracts.
D. Subcontractor that will perform this work shall be listed on the bid submission. No further subcontracts are permissible, unless the sub-subcontractor is named and included as part of the bid. All terms and requirements herein apply to the subcontractor and all further subcontracts. The right is reserved to reject the proposed sub-subcontractor based on the terms stated herein.
E. Regardless of whether a Sub-Contractor is accepted and used for installation, the Contractor shall have a person under the Contractor’s Company’s direct employ supervising the installation at all times.
F. Upon request, the contractor shall submit a list of projects of similar size and scope. The Architect is the final judge of suitability of experience.
G. Where overhead rigging is part of the Work, it shall be supervised on site at all times through the entirety of installation and system commissioning by an Entertainment Technician Certification Program (ETCP) Certified Rigger – Theatre, or a licensee of authority having jurisdiction.
1.04 SUBMITTALS

A. Coordination Drawings: Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities.
   1. Show the interrelationship of components shown on separate Shop Drawings.
   2. Indicate required installation sequences.
   3. Refer to Division 1, Division 23 and Division 26 documentation for specific coordination requirements for mechanical and electrical installations.

B. Make changes in the submittals as required, consistent with the Contract Documents. When resubmitting, notify the Architect in writing of any revisions other than those required.
   1. Action indicated is subject to the requirements of the Contract Documents.
   2. Adjustments made on shop drawings are not intended to change the Contract Price. If adjustments affect the value of the Work, state such in writing prior to proceeding with the Work.

C. Shop Drawings
   1. Submit drawings depicting components, systems and assemblies, subject to static, dynamic or electrical loads affecting their safety and operational integrity, or as otherwise required by legislation, signed and sealed for the intended application, by a licensed Professional Engineer experienced in work of similar nature and scope and licensed in the State of installation.
   2. Note and maintain one of the prints returned as a "Record Document".
   3. Do not use Shop Drawings without an appropriate final stamp by the Architect indicating action taken in connection with construction.
   4. Shop Drawings shall establish the actual detail of the Work, indicate proper relation to adjoining work, amplify design details of mechanical and electrical equipment in proper relation to physical spaces in the structure, and incorporate minor changes of design or construction to suit actual conditions.
   5. Submit newly prepared information, drawn to accurate scale.
   6. Highlight, encircle, or otherwise indicate deviations from the Contract Documents.
   7. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.
   8. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings.
   9. Lettering on Shop Drawings is considered part of the Drawings.
  10. Shop Drawings include the following plates and schedules:
      a. Assembly, installation and erection plans and diagrams depicting relative locations of various members and overall dimensions with reference to the preliminary drawings including auxiliary structure.
      b. Block schematics of all equipment internal wiring and system element interconnection.
      c. Component equipment drawings from Manufacturer's approved drawings or catalog cuts showing weight, dimensions, and capacities of mechanical components.
      d. Component Equipment Drawings.
      e. Details and assembly drawings.
      f. Dimensions.
      g. Erection Plans and diagrams.
      h. Finishes.
      i. Signage and identification systems.
      j. Identification of products and materials included.
      k. Layout of control consoles, racks and other associated equipment.
      l. Mechanical Assembly Drawings.
      m. Mechanical Detail Drawings.
      n. Miscellaneous details and assembly drawings depicting lengths, widths, and sizes of all members, connection details, location, type and size of bolts, rivets, welds, and other connections together with materials to be used.
      o. Notation of coordination requirements.
p. Notation of dimensions established by field measurement.
q. Program logic and relationship to input/output points, either in logic diagrams or ladder logic diagram, or other appropriate format.
r. Riser diagrams showing quantities, coding and sizes of all interconnections between system components.
s. System assemblies, major sub assemblies, components, cabinets and enclosures, including notation of type and manufacturer of switches, relays, locks and hardware.
t. Templates and installation details.
u. Test data on materials components and systems as available for the items specified herein.
v. Wiring Diagrams showing system layout.
w. LCD Screening for motor control systems.

D. Record Document Submittals (As-Built Drawings)

1. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistant location; provide access to record documents for the Architect's reference during normal working hours.
2. On completion of Work and prior to final review, neatly transfer as-built notations to set of transparencies, stamp drawings in set "Certified As-Built Drawings" and submit record documents to the Architect.
3. Record Documents: Maintain a clean, undamaged set of Contract Documents, Shop Drawings and Product Data. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that are concealed or cannot otherwise be readily discerned later by direct observation.
4. Include details on internal setting of components.
5. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
6. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
7. Note related Change Order numbers where applicable.
8. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
9. Testing Data - Include in record submittal documentation of performance tests as required in the contract documents.
10. Upon completion of the Work, submit Record Documents to the Architect for the Owner's records.
11. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Architect and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.
12. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect for the Owner's records.

E. Maintenance Manuals

1. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder.
2. Operating and Maintenance Instructions: Provide instruction manuals describing proper operation and maintenance. Include a detailed review of the following items:
   a. Maintenance and operation manuals for individual components.
   b. Cleaning.
   c. Control sequences.
   d. Copies of warranties.
1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION

A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.

B. Provide documentation of construction waste diverted from landfills:
1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
3. Compliance with Credit EQ6.2: Material VOC Limits - Paints
4. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints
5. Compliance with Credit EQ6.5: Material VOC Limits - Composite wood and agrifiber

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.
1.06 INTERFACE WITH ADJACENT SYSTEMS

A. Systems described shall in no way damage or adversely affect architectural, mechanical, electrical or structural systems, components or construction.

B. Coordinate the system installation with the requirements of adjacent and intersecting Work.

C. Electrical Interface.
   1. Perform electrical work in accordance with governing legislation. Coordinate Work with other trades.
   2. Products furnished for installation by Division 26 contractor.
      a. Faceplate Back Boxes: Gang back boxes, as outlined in the Documents, are not included and are provided under Division 26.
      b. Devices with 100v and above terminations including receptacles, power raceways, faceplates and back boxes.
      c. Power and control raceways
      d. Motor control panels
      e. Control voltage wire and cable, including, but not limited to, specialty cable and standard wire. Control wiring is terminated by Division 11 contractor.
   3. Wire, cable and terminations for 100v and above devices are provided by Division 26.
   4. Conduit connecting control systems in this section with other systems is provided by Division 26.
   5. Power and Control Distribution
      a. See Division 26 documents for base power and control infrastructure locations.
      b. Where manufacturer’s standard system requirements differ from those in the Division 11 & Division 26 documents, coordinate those requirements with the Division 26 contractor without further cost to the project.
      c. It is incumbent on the Division 11 contractor to ensure a properly coordinated and operational system. Discrepancies in requirements should be noted prior to bid.
   6. Delivery
      a. Deliver materials within this contract to the project site.
      b. The Division 26 Contractor is responsible for equipment furnished under Division 11 at such time that the Division 26 Contractor takes possession of the equipment.
         1. At this time the Division 26 Contractor will document the exact condition, breakage or damage evident in the equipment.
         2. Exact quantities will be documented.
         3. Discrepancies in the quantities and damage or unsuitability of the product for the application will be provided in writing to the Division 11 contractor upon transfer of the equipment.
         4. Acceptance of the equipment verifies proper physical condition of the product. Electrical functionality is not implied at acceptance and is not the responsibility of the Division 26 Contractor.
         5. The Division 11 Contractor will be present at the time of transfer to coordinate and expedite this action. The Division 11 Contractor shall be given a two week minimum lead time prior to this meeting.
   7. Supervision Of Installation
      a. Provide instruction and supervision to the Division 26 Contractor as it pertains to the installation of these systems. Provide the necessary qualified personnel for coordination meetings and site visits prior to installation of systems.

D. Follow Drawings in laying out work and checking drawings of other trades to verify spaces in which work is installed. Maintain maximum headroom and space conditions at all locations. Before proceeding with the work, notify Architect where conditions appear inadequate.

E. If directed by the Architect, without extra charge, execute reasonable modifications in the layout needed to prevent conflict with work of other trades or for proper execution of the work.
1.07 SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

A. Design Requirements:
1. The Contractor's engineer shall perform detailed analysis and design of each element as required to meet the performance and safety requirement expressed by regulation, standards and in the Contract Documents.
2. Operating Mechanisms: Provide operating devices, mechanisms and hardware in connection with this Work to operate smoothly, freely and without excessive noise or friction.
3. Built-In Work: Provide anchor bolts, inserts, plates and any other anchorage devices and all other items specified herein to be built into concrete, masonry or work of other trades, with necessary templates and instructions. Provide such devices in ample time to facilitate proper placing and installation.
4. Supplementary Parts: Provide as necessary to complete each item of work, even in the event that such supplementary parts are not specifically mentioned in the Contract Documents.
5. Design and perform the mechanical installations to possess the necessary properties to withstand stresses of tension, compression, flexure, shear, and torsion which may be anticipated being imposed on one or more of the components. Conform to the following priorities of installation: 1) safety, 2) ease of operation, 3) quietness of operation and 4) service life. The standards of quality and design covering the equipment and fabrication plus the installation technique required are established on this basis. The decision of the Architect in determining the acceptability of equipment items, installation technique and workmanship is final.
6. Systems provided in the Work shall in no way damage or adversely affect architectural, mechanical, electrical or structural systems, components or construction.
7. Where dimensions and loading capacities have been omitted from the Contract Documents, determine in accordance with the requirements and intent set forth in the Contract Documents.
8. Design, fabricate and erect steel structural components and fastenings shall be in accordance with the Specifications for Design, Fabrication and Erection of Structural Steel for Buildings, latest edition, by the AISC. Perform welding in accordance with the appropriate standards of the AWS.

B. Performance Requirements:
1. Materials, components, processes and workmanship for moveable systems shall comply to the current issues or revisions of the applicable legislation, references and standards.
2. Noise and Vibration:
   a. Equipment shall operate quietly and without undue vibration. Provide isolation and damping as required to eliminate mechanical rattles, gearbox and coupling chatter and motor noise.
   b. Unless otherwise specified, noise and vibration producing equipment shall not exceed the following noise criteria at any point between the floor and 6'-0" (2m) above finished floor level.
      1. On Stage: RC 25
      3. Control Rooms: RC 25
   c. The noise produced in any area by any item shall not exceed the RC criteria referenced above, in any given octave band. Where the noise level of any 1/3 octave band is more than 3dB greater than the levels of both of its adjacent 1/3 octave bands, the criteria shall be taken to be 5 units lower. Where the noise is intermittent, the criteria shall be taken to be 5 units lower.
   d. Noise levels for critical areas are specified elsewhere in the Contract Documents. Provide sound proofing where required; ensure that acoustical treatment does not cause overheating or inhibit the operation of systems.
   e. The stiffness of all structures forming a part of the stage or acting surface shall provide a satisfactory natural frequency for setting scenery and acting. Configure such structures to prevent the vibration of moved elements. Unless specifically stated, the natural frequency shall be less than 12 HZ under full loading.

C. Provide systems designed to reflect safeguards and precautions related not only to normal use of the equipment under ideal operating and loading conditions but, additionally, to anticipate equipment
misuse, human error, and misjudgment. Design and intent parameters set forth herein in no way relieve this Contractor from responsibility or liability arising from the Work.

1.08 POWERED MACHINERY BASIC REQUIREMENTS

A. Work in related Performance Machinery sections shall be provided under the direction and design of the Contractor's professional engineer, who shall be licensed pursuant to the requirements of the Contract Documents.

B. Except where exceeded by the requirements of the Contract, provide powered hoist systems conforming to ANSI E1.6-1 (2012), and mechanical power transmission apparatus meeting at a minimum the requirements of Safety Standard for Mechanical Power Transmission Apparatus ASME B15.1-2000 as currently revised and inclusive of appendices.

C. Design Loads:
   1. Apply forces resulting from dead loads, rated loads, maximum moved loads, maximum static loads, cyclic dynamic loads, wind loads, thermal loads, impact loads, and special loads in determining the adequacy of all parts of the moveable system.
   2. Power transmission parts shall be designed so that the dynamic stresses calculated for the rated load shall not exceed the endurance limits established by the manufacturer.

D. Where multiple machines are used for moving a single load provide synchronization. Provide synchronization by either mechanical methods or appropriate controls, unless specifically described in the Contract Documents.

E. Where the failure of a single Performance Machine may create a dangerous condition or a progressive failure determine whether the individual secondary braking means is required for each Performance Machine, or if a common means may be employed for the complete system. Provide such means as determined.

F. Provide a means to stop the operation and for supporting the load, in event of failure, as required by applicable legislation and the Contract Documents.

G. Safety Devices:
   1. Provide Powered Machinery, where single point failure analysis does not show compliance with the requirements stated herein, with independent secondary means to detect overspeeds and to stop and hold the load indefinitely in the event the speed exceeds the rated design speed by 115%, unless specifically described otherwise by applicable legislation or the Contract Documents, in which instance the most stringent applies.
   2. Provide Powered Machinery Systems, as a minimum, with limit switches at terminal positions of travel, with separate and separately driven or actuated overtravel position limit switches.
   3. Where moved elements are guided, or where guided counterweights are employed, limit switches may be mounted to ensure actuation by contact or proximity of the moved element. Employment of such mounting is conditional on the locations being readily accessible for inspection and testing. Configure limit switch so as to protect them from damage in the event of overtravel.
   4. Where multiple machines are employed for moving a single object, provide a means to detect and stop the operation of all associated machines in event of malfunction of one machine. Out of synchronization operations are considered a malfunction where synchronization is required for safe operation.
   5. Employ other safety devices as necessary to detect and react to excessive variation in angle, acceleration, crushing, shearing and other similar conditions for installation where these conditions are a consideration for safe system operation.

H. Overhead Hoists
   1. Except where exceeded by the requirements of the Contract, provide overhead underhung hoists meeting at a minimum the requirement of Overhead Hoists (Underhung) ASME HST-4-1999 as currently revised and inclusive of appendices.
   2. Except where exceeded by the requirements of the Contract, provide overhead electric wire rope hoists meeting at a minimum the requirements of Performance Standard for Overhead Wire Rope Hoists ASME B-30.16-1998 as currently revised and inclusive of appendices.
3. Except where exceeded by the requirements of the Contract, provide overhead electric wire rope hoists meeting at a minimum the requirements of Performance Standard for Overhead Wire Rope Hoists ASME B-30.16-1998 as currently revised and inclusive of appendices.

1.09 PERFORMANCE EQUIPMENT BASIC ELECTRICAL REQUIREMENTS

A. This section includes general requirements for the provision of electrical wiring methods and materials for the systems described in Division 11 of these documents. Supplementary requirements are specified in specific sections relative to particular systems. Work in this section requires detailed coordination with the base building portion of the projects; particularly Division 26.

B. System Description

1. Design and Performance Requirements:
   a. Provide wiring devices complete with mounting devices and other appurtenances where required. Provide wiring devices that are the product of a single manufacturer except as specifically stated otherwise.
   b. Wiring and elementary diagrams for equipment are based on the product of the specified equipment manufacturer(s) and are shown for convenience to aid in estimating the extent of the work involved. Install the equipment actually provided in accordance with the equipment manufacturer's recommendations and details in approved wiring diagrams furnished by the equipment manufacturer. Provide equipment so connected to operate in a safe, proper and efficient manner. Note that not all control circuitry is necessarily shown on the drawings but shall be installed in conduit between the points and devices indicated on the diagrams.
   c. Wiring devices, components and electrical systems shall be in compliance with the standards promulgated by NEMA and listed by Underwriters Laboratory or similar certified testing agency.

2. Equipment Connections:
   a. Unless otherwise shown on the drawings or specified herein, the intent is to provide electrical connections required to protect, properly operate, and control motors, appliances, electrical devices, and equipment furnished and installed under the Division 11 sections of these Specifications or shown on the Drawings.
   b. Refer to other sections of these specifications and to the drawings of other trades, if necessary, to determine the extent of work included under this division of these specifications.
   c. Secure equipment, except portable equipment, firmly in place. Mount components rigidly, except where resilient isolation is required. Design and provide fastenings and supports adequate to support their loads with a safety factor of at least three.
   d. Clearly mark switches, jacks, outlets, cables, connectors, etc. logically and permanently during fabrication and installation.
   e. Where many cables are run in close proximity, color code by function in a logical manner. Detail coding in instruction and operation manuals as well as signage.
   f. Take necessary precautions to prevent and guard against electromagnetic, electrostatic and radio frequency interference.
   g. Provide control system wiring which is continuous from the faceplates to the racks. Employ no splices for entire cable length.
   h. Exercise care in wiring, so as to avoid damage to the cables and to the equipment. Between racks, cabinets, consoles or modules insure cables are well-supported, neatly laced and dressed. Make joints and connections with mechanical connectors approved by the Consultant.
   i. Group terminals by signal type.
   j. When cable is surface mounted and crossing through fire walls, use the equivalent Belden fire rated plenum cable to the specified cable type.
   k. Label terminal strips, punch blocks, wire and cables in a permanent and logical manner with a unique number on each end of cable runs.
   l. Terminate all connections with rack with mating connectors, punch blocks, or terminal strips.
m. Final location of equipment is as shown on the Drawings, located in the field by the Architect or as shown on supplementary drawings prepared by the Consultant.

1.10 IDENTIFICATION SYSTEMS

A. Design Requirements
1. Provide identification not related to the work area conforming to the Americans With Disabilities Act (ADA).
2. Based on a risk analysis performed by the Contractor’s designated qualified analyst, provide equipment and systems with appropriate markings, warnings and instructions consistent with the manufacturer’s and Contractor’s duty to warn.
   a. Where required and as otherwise feasible, provide pictorial signs in addition to text. Pictographs shall always be accompanied with appropriate explanatory text. Pictorial symbols shall conform with international standards and the ADA.
   b. Design signage to account for unfavorable viewing conditions.
   c. Where wire rope is employed, locate at operating locations and at entry to maintenance points Wire Rope Technical Board Form Number 193 warning signs.
4. Mounting Location and Height:
   a. Mount signage as required to provide effective direction and instruction.
   b. Mount signage with center of the sign no higher than 60” (1500mm) above the finished floor, unless specifically required. Mounting location shall be so that a person may approach within 3” of the sign without encountering protruding objects or standing within the swing path of a door.
   c. Mount hazard communication signage as to be plainly visible from a distance not less that 5’- 0” (1500mm).

B. Equipment Identification
1. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.
2. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.
3. Equipment Nameplates: Provide a permanent nameplate on each item of power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
   a. Name of product and manufacturer.
   b. Model and serial number.
   c. Capacity.
   d. Ratings.
4. Designate items fabricated by the system Manufacturer with the Manufacturer's name, model number and serial number on the chassis or a name plate securely attached to the item.

C. Electrical Component Identification:
1. Wiring devices, components and electrical systems shall be labeled and/or identified in compliance with the standards promulgated by NEMA and listed by Underwriters Laboratory or similar certified testing agency.

PART 2 PRODUCTS

2.01 GENERAL

A. Commodities provided by the Contractor and the manners of installation shall comply with standards required pursuant to the provisions of the Federal Occupational Safety and Health Act, as amended.
B. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.

C. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

D. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

E. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous project experience. Procedures governing product selection include the following:
   1. Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
   2. Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the most current and stringent standards, codes or regulations applicable.

F. Where no product available within the specified category matches satisfactorily and also complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category, or for noncompliance with specified requirements.

G. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern and texture from the product line selected.

H. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.

2.02 MATERIALS

A. Employ materials that are free of defects impairing strength, durability or appearance and of best commercial quality for the purpose specified. Employ materials with structural proportions to safely sustain and withstand stresses and strains to which they will be subjected. Fabricate true to detail, clean, straight with sharply defined profiles and, unless otherwise noted, with smooth finished surfaces.

B. Material Specifications:
   1. Do not employ brittle materials or materials with unknown or unproven structural behavior in critical system components.
   2. Steel items incorporated in the Work shall be produced or made in whole or substantial part in the United States, its territories or possessions.
   5. Steel pipe: A-53 Grade B (schedule as specified herein).
   8. SSPC Steel Structures Painting Manual.

C. Allowable Stresses:
   1. The following describes allowable stressed for normal design loads:
      a. In employing structural steel members and elements, do not exceed the stress values established in the Manual of Steel Construction, latest edition, as published by the AISC.
      c. In employing structural elements made of miscellaneous metals, plastics and composite materials, do not exceed the stress values established by the manufacturer's engineers for these specific materials, based on codes, standards and proven design practices for these materials.
2. Determine allowable stresses for normal design loads combined with special design loads as follows:
   a. Allowable stresses shall not exceed the values, which would cause permanent distortion of structural or machinery components. Under certain circumstances as determined by the engineer, limited plastic distortion of moved object or moved support is permissible, provided that such distortion is intentionally designed to relieve the stresses without creating a dangerous condition.

2.03 MINIMUM STANDARDS OF SAFETY:
   A. Minimum factor of safety for lifted loads: 10.
   B. Increase the factor of safety for ropes where normal operating loads include cyclic dynamic loads, as determined by the Contractor's engineer, to suit the system operational requirements for required service life.
   C. Minimum factor of safety for static loads: 8.
   D. The factor of safety may be lowered, at the discretion and responsibility of the Contractor's engineer, if the static design loads are higher than the maximum lifted load.
   E. Threaded Fasteners: ASTM Fastener Specifications as applicable to loading. Structural fasteners shall be traceable to materials, dimensions, processing and testing.
   F. Cable and Cable Connections
      1. Unless exceeded by other regulation or standard, select, inspect and employ wire rope, wire rope pulley, drums and connections in accordance with the current edition of the Wire Rope Users Manual published by the Wire Rope Technical Board.
      2. Bending ratio: As identified by the Wire Rope Users Manual, no more than one reverse bend in six wire rope lays shall be permitted.
      3. Connections shall be capable of developing at least 80 percent of the rated breaking strength of the wire rope. Compression sleeves shall comply with MS-51844
      4. Each suspension rope shall have a "Design Factor" of at least 10. The "Design Factor" is the ratio of the rated strength of the suspension wire rope to the rated working load, and shall be calculated using the following formula: F=S(N)/W. Where: F = Design factor, S = Manufacturer's rated strength of one suspension rope, N = Number of suspension ropes under load and W = Rated working load on all ropes at any point of travel.
      5. Manufacturers of wire rope, also identified as aircraft cable, employed in overhead lifting or suspension are required to be QPL certified pursuant to QPL-83420 as current. Provide preformed, galvanized unlubricated wire rope conforming to RRW-410 of the Type and Class commensurate with the diameter and construction determined appropriate by the Contractor’s engineer. Where the Contractor determines to substitute a non-QPL Certified manufacturer, the Contractor, at no additional cost to the Project, shall provide testing of each spool employed in accordance with ASTM A 931 as current. Certificates of conformance are not substitutions for certificates of testing.
      6. Maximum Fleet Angle Typical: 1.5 Degrees.
   G. Supplementary Parts: Provide as necessary to complete each item of work, even in the event that such supplementary parts are not specifically mentioned in the Contract Documents.

2.04 PERFORMANCE POWERED MACHINERY COMPONENTS
   A. Performance Powered Machines:
      1. Prime Mover:
         a. Provide performance machines with power sufficient to raise and lower 125% of the rated load. No performance machine shall be capable of exerting power sufficient to exceed three quarters of the ultimate strength of the lowest system component as installed, or one third of the ultimate strength of the support ropes.
         b. Protect electric motors used as the prime mover for a machine with a current overload device or a circuit protected by a current overload device located on the hoist. Provide each motor with the manufacturer’s nameplate listing pertinent characteristics.
B. Performance Powered Machine Bases:
   1. Provide separate load carrying paths and redundancies where possible.
   2. Provide bases of steel or aluminum as appropriate.
   4. Provide, as part of the base, the ability to retain loaded elements such as hoist drums in the event of drive shaft, connection, or bearing failures.
   5. Provide drum hoist bases in compliance with ASME B30.7 as current.

C. Motors:
   1. Provide motors as specified in the Contract Documents. Provide motors of construction appropriate for the applied environment.
   2. Provide electric motors complying with latest standards of the National Electric Manufacturers Association, the Institute of Electrical and Electronic Engineers and as herein specified.
      a. Unless otherwise specified, provide motors designed for single or three (3) phase, 60Hz alternating current operation. Prior to ordering motors ascertain the actual voltages and other current characteristics that will be available and permissible for each motor. Report the same in writing to the Architect and obtain approval before ordering motors. The designation of current characteristics in these Specifications does not relieve the responsibility for ascertaining the actual conditions of electric service available for each motor or the proper operation of all motors under actual conditions.
      b. Provide class B insulation for motors 1/2HP and larger. Provide motors rated for continuous duty and designed for temperature rises not to exceed 55o C. for fully enclosed type, and 40o C. for all other types. Provide motors capable of withstanding momentary overloads of 50% without injurious heating. Provide motors that operate without excessive heating, flashing or sparking under any conditions within the specified capacity of load and speed. Motors shall operate quietly. Motors which are in the air-stream of the air handling units shall be the totally enclosed type.
      c. Permanently identify motor leads and supply with connectors.
      d. Provide overload detection devices designed to protect the motor from damage.
      e. Provide starting overload protection device.
      f. Provide phase reversal protection and phase failure protection during starting.
      g. Provide undervoltage protection.
   3. Provide motors of adequate capacity to provide the proper acceleration characteristics and ensure movement of the maximum loads at all points of travel.
   4. The stalling load of motors shall not exceed three times the maximum lifted load.
   5. Select motors to comply with the system operational duty cycle.
   6. Provide motors of the proper type for the duty and of sufficient torque to start and run the equipment to which they are connected. Starting currents and running currents shall not exceed the limits imposed by laws, rules or regulations of the public authorities have jurisdiction or of the electrical utility company. Provide motors of sufficient horsepower, capacity and rated duty to operate the apparatus to which they are connected at the requirements set forth herein.
   7. Motors, within a system, shall all be of the same manufacturer.

D. Individual Motor Starters:
   1. For variable speed motor control, provide starters to permit ramped, variable speed, and reverse control of connected motors.
   2. For single speed motor control, provide starters to permit forward and reverse control of the connected motors, at a single speed.
   3. Provide starters with necessary attributes to permit communication with the Local Logic Control System, or mechanical logic devices.
   4. For motors 1/3 HP or smaller provide manual starters, with thermal locking overload protection and pilot light, except where interlocking or automatic control is required, provide starters with a 120 volt combination circuit breaker and magnetic starter with pilot light.
5. For motors 1/2 HP and over, provide combination circuit breaker and magnetic across-the-line starters. Provide magnetic starters with three (3) thermal overcurrent units. Provide transformers for 120 volt control circuits with fused secondary.

6. Provide motors 1/2HP or larger with ball or roller bearings with pressure grease lubrication.

7. Enclosures shall be NEMA Type I sheet steel with hinged cover, unless otherwise indicated.

8. Starters, within a system, shall all be of the same manufacturer.

E. Brakes:
1. Provide performance machines with at least two independent brakes complying with the following:
   a. Primary Brake:
      1. Provide a primary brake that automatically engages whenever power to its prime mover is interrupted
      2. Provide the primary brake rated to stop and hold not less than 125% of the rated load of the machine but in no case less than the maximum lifting capacity.
      3. The primary brake shall be directly connected to the drive train of the hoisting machine, and shall not be connected through belts, chains, clutches, shear pins, roller chains or set screw type devices. The brake shall automatically set when power to the prime mover is interrupted.
   b. Secondary Brake:
      1. The secondary brake shall be an automatic brake that, if actuated during each stopping cycle, shall not engage before the hoist is stopped by the primary brake.
      2. Provide each machine with an automatic secondary brake that will stop and hold at least 125% of the rated load under an accelerating or overspeed condition. Configure the overspeed device to shut off power to the machinery.
      3. Where employed in a traction hoist, provide the secondary brake to act directly on the wire rope. Where employed on winding drum hoists, the secondary brake shall act either on the suspension wire rope or on the drum or drum shaft. Failure of the motor drive train shall not prevent operation of the secondary brake. The actuating mechanism of the secondary brake may be separate from the brake.
      4. The secondary brake shall not be used to stop the hoist except under overspeed or abnormal conditions. It shall not be bypassed or prevented from operating by any other device during overspeed conditions.
      5. The design of the secondary braking systems shall be such that the triggering mechanism is enclosed. Configure the system so parts are readily accessible for inspection and cleaning. Appropriately protect brakes from adverse environmental conditions.
   c. Overload Protection: Provide overload protection in the system to protect against equipment raising the load in excess of the capacity of the hoist braking system.
   d. Braking Loads: Account for dynamic loads induced by activation of primary and secondary braking systems in the design and installation of the system.
   e. Braking actuation results: Actuation of the secondary brake shall not:
      1. damage the suspension rope or system;
      2. impose an overturning moment in excess of 75% of the system’s stability;
      3. impose stresses in structural members in excess of 75% of their yield strength.

F. Gearing:
1. Provide gearing in accordance with applicable legislation, the Contract Documents and the applicable standards of the AGMA.
2. The Contractor's engineer is responsible for determining the service factor classification, unless specifically required in the Contract Documents or applicable legislation. Base classification on system operational cyclic requirements, type of drive machine, starting, and stopping characteristics.
4. Suitably mount gears on bearings or drums to assure proper alignment and operation.
5. Arrange and house gears so as to provide adequate lubrication.
6. Provide gear boxes with a visual oil level indicator or means of determining that the proper amount of lubricant is contained in the gearbox.
7. Provide removable inspection plates or plugs of sufficient number and size to permit visual inspection of the operating gear faces.
8. Stamp the following data on a non-corrosive plate and attach to gearboxes:
   a. Mechanical horse-power rating.
   b. Input speed.
   c. Output speed.
   d. Gear ratio.
   e. Service factor.
   f. Thermal horse-power rating.
   g. Type of lubricant.
   h. Quantity of lubricant and lubrication requirements.

G. Speed Reducers:
1. Provide positive type speed reducers. Friction type speed reducers are not acceptable.
2. Directly connect the speed reducer to the drum or elevating mechanism of the performance machine. The use of chains, belts, clutches, shear pins or friction-type devices are not acceptable except as required for the operation of prosenium fire safety curtains.

H. Shafting:
2. Provide fillets at point of change in shaft diameters to prevent excessive stress concentrations in the shaft. Employ fitted keys or splines in connections subject to torques caused by moved loads.
4. Provide splines which safely transmit the applied torques and comply with ANSI B92.1A, Involute Splines and Inspection, Inch Version or ANSI B92.2M Involute Splines, Metric Module, current editions.
5. When line shafts are used to interconnect several independent machines or several independently mounted drums or gear reducer combinations, employ a universal joint shaft between components to compensate for shaft parallel and angular misalignments caused by installation, support structure tolerances or deflections. Flexible couplings may be employed in lieu of universal joints, provided they comply with the requirements of the Contract Documents and are designed to operate under the possible range of shaft misalignments.

I. Couplings:
1. Provide couplings which safely transmit the applied torques in compliance with the appropriate standards.
2. Provide flexible couplings where required for shaft alignment purposes.
3. Only employ couplings made of steel and with steel contact surfaces for elements subject to the torques imposed by moved elements and drive motors. Elastomer or elastomer insert couplings may be used for other purposes.

J. Bearings and Mounted Units:
1. Support shafts by anti-friction bearings or journal bearings. Provide self aligning bearings or bearing housings where possible.
2. Provide bearing types and sizes selected to comply with operational and design life requirements. Provide adequate provisions for lubrication.
3. Provide bearing mounting interface to maintain proper bearing alignment for replacement bearing installation.
4. Do not employ pillow blocks with cast iron housings for drum support bearings.

K. Drums:
1. The Contractor’s engineer is responsible for determining the drum surface and stacking configurations. Determination of drum type shall be based on the specific application and the criteria established in the Wire Rope Technical Board’s Wire Rope Users Manual and as follows:
   a. Provide winding drums with a positive means of attaching the wire rope to the drum. The drum portion of the attachment shall be capable of developing at least 4 times the rated capacity of the hoist. The wire rope portion of the attachment shall develop at least 80% of the wire rope breaking strength.
   b. Configure drums so that a minimum of three complete turns of rope remain on the drum at all times.
   c. Provide a means to prevent the rope from moving off the drum ends or causing a loose wrap on the drum. Provide a loose wrap detector which, when actuated, will shut off power to the hoist, actuate the primary brake and annunciate it’s activation. Provide a means to maintain tension in the wire rope during re-rigging.
   d. Provide hoist drums with a pitch diameter at least 18 times the diameter of the suspension rope.

2.05 PERFORMANCE MANUAL AND POWERED MACHINERY COMPONENTS

A. Clips, Wire Rope: Size "U"-bolt wire rope clips (Crosby Clips) appropriately for the cable construction, diameter and lay of the cable with which they are employed.
   1. Saddle material: Drop forged steel
   2. "U" bolt and nut material: Steel
   3. Finish: Hot dip galvanized
   4. Federal Specification: FF-C-450 Type 1 Class 1

B. Compression Sleeves: Size compression sleeves appropriately for the cable construction and diameter of the cable with which they are employed.
   1. Material: Copper
   2. Cable connection sleeves: Oval pattern
   3. Cable stop sleeves: Cylindrical pattern
   4. Military Specification MIL-51844

C. Eyebolts: Size eyebolts for the intended application. Employ dropped forged steel shoulder pattern eyebolts.

D. Shackles: Size shackles appropriately for the intended application. Execute chain connections with chain shackles; other connections may employ anchor shackles.
   1. Shackles Material: Forged Steel
   2. Pin Material: Alloy Steel
   3. Treatments: Heat Treat and Temper
   4. Pin Type: Safety type bolt type pin or safety type round pin.
   5. Federal Specification: RR-C-271D Type IV or IVB, Grade A or greater, Class 1.
   6. Size the screw pin to ensure that the threads are not included in the bearing surface of the bolt.

E. Thimbles, Wire Rope: Size wire rope thimbles appropriately for the cable construction and diameter of the cable with which they are employed.
   2. Finishing: Free of characteristics detrimental to the rope or adjacent elements.

F. Thimbles, Manila/Fibrous and Synthetic Rope: Size appropriately for the rope construction and diameter of the rope with which they are employed.
   2. Finishing: Free of characteristics detrimental to the rope or adjacent elements.

G. Turnbuckles: Size turnbuckles appropriately for the cable construction and diameter of the cable with which they are employed.
   1. Material: Drop forged carbon steel
   2. Finish: Galvanized
3. Type: Employ Jaw - jaw type unless otherwise noted.
4. Pins: Round pins and cotter keys.

H. Guide Systems:
1. Provide guide systems, as required, for guiding, stabilizing, stopping and holding the moved elements. Where guide systems are employed, provide continuous guiding throughout the entire length of travel.
2. Provide guide rails and shoes, including their supports, to support applied forces, including stabilizing forces, and braking forces if stabilizing, braking and holding functions as performed by the guide system.
3. Provide guide systems so as not to cause accidental jamming or binding.

I. Blocks:
1. Provide blocks with the appropriate sheave for the intended cable and rope.
2. Configure blocks to prevent the hoisting rope from leaving the sheave groove. Provide block design to prevent the hoisting rope to leave the housing in event of sheave shaft failure. Configure blocks to support sheave in event of sheave shaft failure. Provide blocks ensuring sheaves are centered in the housing and run plumb without rubbing or interference with the block housing. Distance between outer face of sheave and inner face of cheek plate shall be less than one cable diameter.
3. Center Pins: Unless otherwise specified, provide sheave center pins designed to transmit the sheave load to the block housing without rotating.
4. Provide side plates (cheeks) of materials and dimensions required for the anticipated load. Provide side plates enclosing the sheave sides. Secure side plates to each other with spacer assemblies to ensure parallel alignment. Arrange spacer assemblies in a configuration to permit anticipated movement of rigging while restraining running lines from escaping sheave grooves. Provide spacers with appropriate tapers and finishes to prevent damage to running lines. Arrange spacer assemblies to provide redundant support for the running lines and sheaves in the event of sheave center pin failure. Arrange side plates to result in a rigid parallel housing for the sheave. Align each sheave within the block so that the center and sides of the groove rotate in the same axis perpendicular to the axle and parallel to the side plates.
5. Provide block assembly with attachment systems designed and fabricated to transmit the block load to the mounting structure, while permitting adjustment, alignment and maintenance of the block. Unless specifically approved by the Architect, welded connections or connections employing cut side plates with draw bolts are not acceptable.
6. Configure the block so the cable is supported according to wire rope manufacturer’s recommendations.
7. Provide blocks to be suitable for anticipated loading and required mounting.

J. Sheaves:
1. Provide sheaves designed and fabricated in to meet or exceed the current edition of ANSI A10.5 American National Standard Safety Requirements for Material Hoists, Section 14.5 and the Wire Rope Technical Board’s Wire Rope User’s Manual, except where exceeded herein.
2. Configure the depth of flare of the groove so that the hoisting rope does not rub against the flange of the sheave when entering and leaving the groove.
3. Provide bearings designed to operate under the anticipated loading conditions for the lifespan of the system. Bore the hub within the close tolerances established by manufacturers engineering data for proper press fit without need of further cup clamping devices. Boring tolerances of sheaves selected at random are subject to inspection. Provide bearings rated for the load and speed derived from the calculated batten load.
4. Properly lubricate bearings according to manufacturers' recommendation.
5. Machine grooves to be smooth and free of irregularities, tool marks and imperfections. Machine hubs to assure proper bearing alignment.
6. Metal Sheaves: Provide from machined cast blanks.
7. Synthetic Sheaves: Provide from either machined extrusion or injection molded shapes. Where applicable, machine sheave grooves and hubs according to wire rope manufacturers' recommendations.

8. The minimum sheave tread diameter for wire rope head blocks is the rope diameter x 48.

9. Provide Multiple grooved blocks, including head blocks, with grooves of equal pitch diameter. Where purchase lines are employed, provide the purchase line groove at the center of the block.

10. Finish metal sheaves as required to prevent rust without wear on wire rope.

11. Acceptable Loft Block Materials (Wire Rope)
   a. Injection molded molybdenum disulphide filled nylon
   b. Machine grooved steel

12. Acceptable Loft Block Materials (Natural or Synthetic Fiber)
   a. Injection molded molybdenum disulphide filled nylon
   b. Machine grooved steel
   c. ASTM A48 Class 40 Grey Iron w/ Machined Grooves

13. Acceptable Head Block Materials
   a. Injection molded molybdenum disulphide filled nylon
   b. Machine grooved steel
   c. ASTM A48 Class 40 Grey Iron w/ Machined Grooves

14. Acceptable Floor Block Materials
   a. ASTM A48 Class 40 Grey Iron w/ Machined Grooves

K. Guards:
   2. Provide guards which do not interfere with the operation or of the machinery and which do not restrict proper ventilation. Configure guards to avoid generation or transmission of audible noise.

L. Control of hazardous energy (lockout/tagout).
   1. Provide systems and components to permit the control of hazardous energy during servicing and maintenance of machines and equipment in which the unexpected energization or start up of the machines or equipment, or release of stored energy could cause injury to employees in accordance with 29 CFR 1910.147 The control of hazardous energy (lockout/tagout). This requirement applies, but is not limited to potential energy stored in counterweights.

M. Lubrication Provisions:
   1. Provide each component with adequate means of lubrication to ensure moving parts are lubricated. Self-sealed, self-lubricating, or dry bearings of a suitable design are acceptable. Provide oil lubricated gearboxes with a means of determining that the proper quantity of lubricant is contained in the gearbox.
   2. Provide for proper lubrication of the system components. Self sealed, self lubricating and dry bearings of suitable design may be used at the discretion of the Contractor's engineer, unless specifically required otherwise.

2.06 FABRICATION

A. Shop Assembly:
   1. Workmanship: Work shall be performed by an experienced fabricator or manufacturer and installed by experienced tradesmen. Materials, methods of fabrication, fitting, assembly, bracing, supporting, fastening, operating devices and erection shall be in accordance with the Contract Documents, reviewed shop drawings and best practices of the industry, using new and clean materials specified, having structural properties sufficient to safely sustain or withstand stresses and strains to which materials and assembled work will be subjected. Assemble, fabricate and erect all work in a neat and accurate fashion.
2. Employ materials that are free of defects impairing strength, durability or appearance and of best commercial quality for the purpose specified. Employ materials with structural proportions to safely sustain and withstand stresses and strains to which they will be subjected. Fabricate true to detail, clean, straight with sharply defined profiles and, unless otherwise noted, with smooth finished surfaces.

3. Built-In Work: Provide anchor bolts, inserts, plates, other anchorage devices and other items specified herein to be built into concrete, masonry or work of other trades, with necessary templates and instructions. Provide such devices in ample time to facilitate proper placing and installation.

4. Supplementary Parts: Provide as necessary to complete each item of work, even in the event that such supplementary parts are not specifically mentioned in the Contract Documents.

5. Coordination: Accurately cut, fit, drill and tap Work herein to accommodate and fit work of other trades. Provide or obtain templates and drawings to or from applicable trades for proper coordination of this Work.

6. Connections:
   a. Make connections with tight joints, capable of developing full strength of the members and flush unless indicated otherwise. Locate joints where least conspicuous. Unless indicated otherwise, weld or bolt shop connections; bolt or screw field connections. Provide control joints as required to accommodate environmental variations.
   b. Employ fastening systems of appropriate sizes, ratings and quantities for the application. Where rated fasteners are employed, Provide domestically manufactured fasteners rated for anticipated loads and with approved markings indicating their rating. Provide fastener system's components of the same manufacture and equal ratings.
   c. Holes: Drill or cleanly punch holes, do not burn.
   d. Clean and leave unpainted the contact surfaces of bolted and welded connections. Fabricate built-ups and joints from components that are straight and close fitting, free from twists, bends or open joints in the finished assembly.
   e. Provide and assume responsibility for the location and maintenance in proper position of sleeves, inserts and anchor bolts required for the work. In the event that failure to do so requires cutting and patching of finished work, perform the work without additional cost to the Owner.
   f. Bolted connections: Drive bolts accurately into the holes without damaging the thread. Set bolt heads and nuts to rest squarely against metal. Protect bolt heads from damage during driving. Where members having sloping flange faces, provide bolted connections with appropriate beveled washers to afford square seating of heads and nuts. Do not locate holes in steel members less than 5 bolt diameters from an edge.
   g. Tighten fasteners to the torque specified by the AISC, SAE or applicable standard.
   h. Size bolts to extend not less than 1/4" (6mm) beyond the nuts. Do not employ fasteners that may interfere with the operation or safety of the Work.
   i. Employ high strength steel bolts in friction only.
   j. In addition to all other requirements, install a hardened washer between bolt heads, nuts and materials having elongated holes.
   k. Unless specifically noted, and excepting graded, rated or otherwise certified fasteners, use nylon locking type nuts in locations subject to vibration and loosening.
   l. Unless otherwise noted, exposed bolt and screw heads shall be flat and countersunk.

7. Welded Connections:
   a. Prior to welding pay particular attention to surface preparation, fit up and cleanliness of surfaces being welded.
   b. Follow the American Welding Society Standard for Welding.
   c. Perform welding in accordance with the American Welding Society's approved methods.

8. Insofar as practicable, perform fitting and assembly of the Work in the shop. Shop assemble the Work in the largest practical sizes to minimize field work. It is the responsibility of this Contractor to assure himself that shop fabricated items properly fit the field condition. In the event that shop fabricated items do not fit the field condition, return the item to the shop for correction.

9. Cutting:
a. Cut metal by sawing, shearing or blanking. Flame cutting is permitted only when edges are ground back to clean, smooth edges and no deformation or damage is caused to the metal by the process. Make cuts accurate, clean, sharp and free of burrs, without deforming adjacent surfaces or metals.

10. Where dimensions and characteristics have been omitted, furnish based on criteria set forth herein.

B. Shop / Factory Finishing:

1. Environmental Standards: Finish materials shall comply with the following:
   a. Environmental Protection Agency (EPA) requirements for less than 350 grams per liter of Volatile Organic Compounds (VOC) for finishes applied to components.

2. General:
   a. Clean and shop paint, with one coat of primer, all ferrous metals. No shop primer paint is required on galvanized materials, copper, brass, bronze or aluminum materials.
   b. Protective Coatings: Whenever dissimilar metals are in contact and aluminum metals are in contact with or imbedded in concrete, cement, mortar, plaster or masonry, separate contact surfaces by coating each contact surface, prior to assembly or installation with one coat of protective coating in addition to the shop paint prime coat described herein. Mask off those surfaces not required to receive protective coatings.

3. Preparation:
   a. Clean steel in accordance with SSPC-SP2 Hand Tool Cleaning.
   b. Protect sheave grooves, bolt threads, and moving parts prior to painting.

4. After fabrication, all steel; apply a shop coat of paint except the following:
   a. Areas within 2" of field welds.
   b. Contact surfaces of high strength bolted friction connections.
   c. Milled surfaces.
   d. Sheave Grooves.

5. Application:
   a. Apply shop prime coat immediately after cleaning metal. Apply paint in dry weather or under cover. Metal surfaces shall be free from frost or moisture when painted. Paint all metal surfaces including edges, joints, holes and corners. Prior to assembly, paint surfaces that will be concealed after such assembly. Apply paint in accordance with approved paint manufacturer's printed instructions and use thinners, adulterants or admixtures only as stated in said instructions. Paint materials uniformly to completely cover the metal surfaces.
   b. Apply paint to dry surfaces, when temperatures are above dew point, thoroughly and evenly, strict accordance with manufacturer's, to provide dry film thickness of 0.5 mils. Allow paint to dry before handling or loading steel for shipment.
   c. Apply a second coat of shop paint to surfaces inaccessible after assembly or erection.
   d. Protect machined surfaces by an accepted, neutral, rust inhibitive coating of a type not requiring removal and resistant to wear.
   e. Include painting details in the shop drawings.
   f. Sequence finishing of materials requiring anodized finishes to ensure that finished surface is not damaged during fabrication.

6. Field Touch-Up:
   a. After erection, clean all damaged areas in the shop coat, loosened scale, rust, exposed surfaces of bolts, nuts, and washers, all field welds and unpainted areas (except as mentioned) to the same standard as the shop coat and paint with the same paint used for the shop coat, at the same film thickness.
   b. Shop prime ferrous metals with fast-curing, lead and chromate free universal modified-alkyd primer complying with the performance requirements of FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish systems indicated and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
   c. Do not paint moving parts acting as bearing surfaces or subject to friction wear.

C. Factory Finishing Colors:
1. Finish ferrous metals visible from the audience chamber in flat black.
2. Finish grid or floor mounted blocks, loft blocks and headblocks yellow in accordance with OSHA 29 CFR 1910.144 and ANSI Z535.1
3. Do not paint sheave grooves, fasteners, aluminum or galvanized materials and products.
4. Treat timber products with clear penetrating stain.

2.07 SIGNAGE:

A. Provide signage in English.
B. Employ printed or stenciled characters. Handwritten characters are not acceptable.
C. Wall mount diagrams depicting the system layout and maximum load limitations (drawn not less than 1/4"=1'-0" – 1:50) in a protective transparent faced frame on the stage wall near the locking rail and near the loading gallery entrance as to be plainly visible, and as not to interfere with the operation of the system.
D. Clearly display the rated load capacity on each moved element together with restrictions for maximum load concentrations and load locations on the moved element and associated control.
E. The stroke “width-to-height” ratio shall be between 1:6 -1:8. Separate lines of by leading that is approximately 120% of the type point size. Unless specified by regulation or standard, calculate text height in inches based on unfavorable viewing conditions based on the viewing distance in feet multiplied by 0.084 (in mm based on meters x .0045).
F. Numbers and Labels: Employ UL listed, indelible adhesive backed coated polyester printed labels with adhesives designed for the surface energy of the mounting surface.
G. Manual and Powered Linesets
   1. Number each arbor with characters located on the back bar of the arbor 6" below the arbor top. Locate double digit numbers with one digit on either side of the tie rod, as to be clearly visible. Apply white characters on dark backgrounds Minimum height viewing distance: 5'-0" (1500mm).
   2. Clearly mark each lineset number on the index strip of each lockrail at the appropriate spacing with black letters on a white background. Minimum viewing distance: 4'-0" (1200mm).
   3. Mark the onstage side of each arbor tie bar at spreader plate locations with labels notifying the operator that a spreader plates are to be inserted at that position.
   4. Paint the exposed faces of counterweights constituting pipe weight for each lineset with Safety Yellow enamel as defined by ANSI Z535.1. For those pipes with connector strips, pipe weight is to include the weight for those strips and associated hardware.
   5. In locations agreed to by the Architect, provide signage at lock rail and loading gallery identifying the size and weight of each size and type of counterweight provided.
   6. Number each batten, identically to its location on the index strip, on both ends as to be read from above and below with white characters on a dark background. Minimum viewing distance: 20'-0" (6000mm).
   7. Except for linesets dedicated to potentially visually-sensitive locations, such as an orchestra shell, mark battens with a painted white stripe 1" wide running around the full circumference at the centerline of the proscenium in white and at 1'-0" (300mm) increments from the left and right of the centerline in white. Indicate the distance from the midpoint in 5'-0" (1500mm) increments. Mid line and ends excepted, increments may be marked with white indelible marker. Paint the end of each pipe and each extension with safety orange stripes 1'-0" (300mm) from the ends toward the midpoint. Mark the section of batten extension to remain in the batten with safety red stripes.
   8. Number blocks as follows with white adhesive 36pt. sans serif numerals:
      a. Head Blocks: Consecutive set numbers on each side plate 1" (25mm) from on-stage edges.
      b. Loft Blocks: Consecutive set numbers on the up-stage side plate followed by a stroke and the line number as counted from the arbor.
      c. Mule Blocks: Consecutive set numbers on the bottom side plate followed by a stroke and the line number as counted from the arbor.
   9. Number each hoist with characters viewable from the adjacent walking surface Apply white characters on dark backgrounds Minimum height viewing distance: 5'-0" (1500mm).
10. In locations agreed to by the Architect, provide signage at control locations, loading gallery, grid iron identifying all pertinent hazards, avoidance procedures and consequences. In addition to safety requirement, list on the signage the standard size of system load capacities provided and their respective weights.

H. In locations agreed to by the Architect, provide signage identifying all pertinent hazards, avoidance procedures and consequences.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Examine work prepared by others to receive work of this Section and report defects affecting installation to the Purchaser for correction. Commencement of the work shall be construed as complete acceptance of preparatory work by others. The sphere of inspection includes but is not limited to:
      a. Assurance mounting surfaces are ready to accept the Work.
      b. Verification of flatness, plumb and level of mounting conditions.
      c. Inspection of components of the Work to ensure no damage has occurred during shipping or storage.
   2. Coordinate staging, sequencing and access.
   3. Discrepancies:
      a. In the event of discrepancies, immediately notify the Architect.
      b. Do not proceed with the installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 SITE CONDITIONS

A. Sequence delivery and installation of components to protect their long term viability. Of particular concern is protecting stage and acoustical draperies from abrasive construction dust and grit and protecting drapes from the accumulation of dust which can lead to an aesthetic finish concern, premature wear, and a combustion hazard due to fine dust particles.

B. Do not deliver stage or acoustic drapery to the site where the ambient relative humidity is greater than 65% for more than a 12-hour period.

C. If stage or acoustical drapery must be installed prior to room being clean, dry, and dust free, completely wrap and protect drapery from the infiltration of dust and thoroughly clean drapery prior to final testing. Drapery that shows wear or construction dust residue will be rejected.

3.03 PREPARATION

A. Verify field measurements at the site prior to installation and modify the system accordingly.
   1. Deliver equipment to the site only after the building has been closed in. Coordinate storage at the site and ensure the materials and components are undamaged.
   2. Do not install work until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above is complete, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.
   3. Equipment and components that show wear or rusting due to excessive moisture will be rejected.
   4. Protect the surrounding environment from damage by the Work.

B. Surface Preparation:
   1. Clean surfaces as necessary prior to commencing the Work.

C. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner. Commencement of the work shall be construed as complete acceptance of preparatory work by others.
D. Manufacturer’s Instructions: Comply with manufacturer’s installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

E. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.


H. Recheck measurements and dimensions, before starting each installation.

I. Install each component during environmental conditions and Project status that will ensure the best possible results.

J. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

K. Built-In Work: Provide anchor bolts, inserts, plates and any other anchorage devices and all other items specified herein to be built into concrete, masonry or work of other trades, with necessary templates and instructions. Provide such devices in ample time to facilitate proper placing and installation.

L. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

M. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

3.04 ERECTION, INSTALLATION AND APPLICATION:

A. Workmanship:
   1. Workmanship shall be best quality; executed by workers skilled and experienced in the respective duties for which they are employed. Immediately notify the Architect if required Work is such as to make it impractical to produce required results.
   2. Decisions as to the quality or fitness of workmanship in cases of dispute rest solely with the Architect, whose decision is final.

B. Install the system with care that the components are straight, plumb, true and aligned throughout. Tightly fit connections employing appropriate safety factors and arrange in an orderly manner.

C. Perform the Work in conformance with the best trade practices, fabricate and install items in accordance with manufacturers’ recommendations and Architect's direction. Coordinate Work with trades doing adjoining work.

D. Install the system complete with all members and materials, and all bolts, nuts, washers, clips, fittings, supports, or other items required for attaching all equipment specified to the existing construction.

E. Perform required cutting, drilling, tapping and fitting to properly install and secure the Work in place. Cutting or drilling existing structural work shall have the prior review of the Architect. Perform the mechanical fabrication and workmanship in accordance with neat and mechanically acceptable practices such as clean drilled and punched holes without flash, hard smooth finish for sheared, machined, and cut edges, and proper fit of component and contiguous parts without irregularity where marching is intended. Welding shall meet qualifications of AISC manual and shall be without spatter and other evidence of poor practice. Welding of load bearing elements shall be performed by certified welders. Comply with AWS Code for procedures of manual shielded metal arc welding, appearance and quality of welds made and methods used in the correction of welding work. Moving parts shall have specified tolerances, shaft sizes, bearings, mounting, connections, and accessories coordinated into the work in a manner acceptable to the Architect. Do not incorporate wood construction or equipment into the Work except as set forth in the Specifications.

F. Erection:
1. Fastening:
   a. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Such fasteners include, but are not limited to: threaded fasteners for concrete and masonry inserts, through bolts, lag bolts, wood screws and other connectors as required.
   b. Provide metal fastenings and accessories in same texture, color and finish as adjacent materials, unless indicated otherwise.
   c. Prevent electrolytic action between dissimilar metals and materials.
   d. Space anchors within their load limit and shear capacity; ensure that they provide positive and permanent anchorage. Wood and other organic material plugs are not acceptable.
   e. Keep fastenings to a minimum, space evenly and install neatly.
   f. Fastenings which cause spalling or cracking of material to which anchorage is made are unacceptable.
   g. Where turnbuckles are employed in the suspension of overhead loads provide positive safetying in accordance with MS 33591B(AS) and as to provide equivalent resistance and strength to an equivalent locking clip system as defined under MIL-DTL-8878H Turnbuckles Positive Safetying.

2. Cutting, fitting and placement: Perform cutting, drilling and fitting required for installation of fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.

3. Connection to Building Structure:
   a. Provide supports from the structure above sized and placed to meet the loading requirements indicated herein.
   b. Provide connections to building structure through engineered clamps or mechanical connections. The use of chain or slings wrapped around structure shall not be accepted.
   c. Supports to the structure above shall fully enclose or encircle the member to which it is being attached. Clamping devices designed to pinch one side of a beam flange shall not be accepted.
   d. Hanging devices employing chain are subject to approval by the Architect and at a minimum are required to employ chain and connection devices specifically designed for overhead lifting as defined to OSHA (29 CFR 1926.251).
   e. Where required, employ wall flanges to control lateral movement.

4. Hoisting Rope Connections:
   a. Employ rope fastenings which develop not less than 100% of the manufacturer's rated breaking strength of the rope employed.
   b. Qualified personnel are responsible for installing fasteners.
   c. Equalization of Hoisting Rope Tension:
      a. Provide means to substantially equalize the tensions between ropes which are in close proximity to each other.
      b. Where suspension rope equalizers are employed, provide those of the individual compression spring or bar type. The latter type, provide the attachment by means of an entrapment bar to prevent separation of the equalizer bar from the lifted element. Extension spring type equalizers are not acceptable.
   d. Reeve typical linesets with the specified wire rope for the lift lines and 3/4" synthetic rope for the purchase lines.
   e. Employ one continuous length of cable for each lift line. The lengthening, joining or repairing of two or more sections of wire rope is prohibited. Mid-line splices are unacceptable.
   f. Cut cable and compress sleeves only by use of the appropriate tool and operation for the cable and application.
7. Wire Rope Eye Splices: Form an eye on both ends of the lift line around an appropriate thimble. Close eyes with a copper compression sleeve. Crimp the sleeve with the appropriate tool per manufacturer’s instructions. After crimping, test the sleeve for compliance with manufacturer’s requirements. In the event that the crimped sleeve does not comply with the specifications, cut the cable above the sleeve and form a new splice.

8. Secure the end of the lift line, at the appropriate trim to the batten connection device.

9. Other types of fasteners are permitted, provided that adequate tensile and fatigue tests have been made by a qualified testing agency and that the fasteners have been approved for the intended or similar use.

10. Align loads on pins via steel spacing washers to assure even loading. After closing the shackle, deform the cotter pin at the end to prevent unintentional loosening of the pin.

11. Secure the lift lines to the typical arbor tops by employing eyes and shackles. Form the eye as described herein.

H. Electrical Installation and Coordination
   1. Provide racks, furniture, consoles, etc., required for the installation and needed to provide completed systems.
   2. Furnish all low voltage cable to Division 26 contractor for installation. This includes standard and specialty cable.
   3. Terminate and install low voltage faceplates.
   4. Terminate control lines.
   5. Terminate low voltage connections in motor control panels.
   6. Interface:
      a. Coordinate work with the Division 26 Contractor in accordance with the contract documents.
      b. Contract documents are diagrammatic and indicate general arrangement of systems and work included.
      c. Follow drawings in laying out work and check drawings of other trades relating to work to verify spaces in which work is installed.
      d. Maintain headroom and space conditions at all points.

3.05 TESTING, DEMONSTRATION, AND INSTRUCTION
A. Prior to testing and certification, coordinate with the Architect the personnel required to be present during the events. Unless specifically designated by the Architect, testing, certification and operation of equipment is to be performed solely by the Contractor. Where the Architect or his designee deems it necessary to personally perform a test or operate equipment in order to determine compliance with the Contract, the Contractor shall coordinate the operation and provide the necessary approvals from authorities and organizations having jurisdiction over the Work.

B. The Contractor’s Project Manager, or a designee familiar with the engineering and installation of the system(s), will coordinate and be present at all certification and testing by the Architect and the Architect’s Consultant.

C. Clearly record the date, time, personnel, details and results of all the following tests and demonstrations and any subsequent re-tests. This will form the start of a system log book to be handed over to the user after acceptance together with operation and maintenance manuals.

D. Inspect the completely assembled hoist system including all mechanisms, fittings, control panels, etc., and make good all deficiencies before certifying that the system is complete.

E. Certify compliance with tolerances specified in the Contract Documents.

F. Certify function of braking systems.

G. Certify speed, noise and stability compliance with the Contract Documents.

H. With hoist fully loaded, perform motor current checks. Test drive unit including the effect of a loss of one or more phases, of reduced voltage and of phase reversal. Test mobile control box and all indicators. Record results of all tests.

I. Certify motion with full specified dynamic payload.
J. Provide demonstration and testing as required to obtain certification by the applicable legislative authority. This Contractor is solely responsible for obtaining such certification and all costs arising from the certification. Certification is a condition of substantial completion.

K. The completed installation of rigging equipment with draperies properly installed shall be tested and operated by the Contractor for the acceptance by the Architect by the Rigging Contractor prior to acceptance.

L. The Contractor is completely and solely responsible for any testing required by the Architect and authorities having jurisdiction to ensure compliance with the Contract Documents and applicable laws and regulations.

M. In case the need for further adjustments becomes evident during the demonstration and testing, continue the Work until the systems operate properly.

N. If more than one (1) visit is required by the Architect’s Consultant because the system does not fulfill this specification, pay for time and expenses of the Architect’s Consultant during any extensions of the acceptance testing period.

O. Demonstration and Instruction
   1. In addition to requirements in Division 1, provide the quantity of hours training indicated in the contract documents.
   2. Demonstrate the full capabilities of the system(s), demonstrating how it meets specification, and demonstrates areas in which it exceeds specification.
   3. Provide Training on this equipment system to be scheduled at times mutually agreed upon with the owner. This training time is to be divided into the following sessions as a minimum:
      a. Initial training
      b. Follow-up training.
   4. Video record the initial and subsequent training sessions. Provide the owner with five (5) copies of a DVD of that recording, in addition to other training materials.

P. Assurances:
   1. At the time of the Architect’s final review, provide a notarized affidavit stating compliance with the criteria of the Contract Documents and applicable standards, laws and regulations. Include certification that connections, including cable connections, have been made in accordance with applicable standards and manufacturer’s recommendations. Where connection methods require specific torque, pressure, periodic tool calibration or measured dimension to ensure function, provide certification that such methods have been performed and record of activities.

3.06 PROJECT CREDIT

A. In publications where this project is mentioned give credit to:
   1. The Design Architect
   2. Theatre Consultant: Theatre Consultants Collaborative, Inc.

END OF SECTION
SECTION 11.61.24
ORCHESTRA SHELL

PART 1 - GENERAL

1.10. SUMMARY

A. Provide Orchestra shell towers and ceiling as shown on the Drawings and described herein.

B. Section includes:

1. Provision of materials, components, modifications, assemblies, equipment and services as specified herein. These include:
   a. Verification of site dimensions and conditions.
   b. Submittals as required by the Contract Documents.
   c. Submission of shop drawings signed and sealed by a licensed Professional Engineer experienced in work of similar nature and scope.
   d. Engineering of equipment and systems as required by the Contract Documents.
   e. Manufacture of equipment and systems as required by the Contract Documents.
   f. Scheduling, sequencing and coordination with other trades.
   g. Site supervision of equipment and systems installation specified herein and elsewhere in the Contract Documents.
   h. Testing and demonstration of equipment and systems as specified herein and elsewhere in the Contract Documents.

C. Provide systems including:

1. Orchestra shell towers and secondary framing with architectural quality finishes.
2. Ceiling panels and secondary framing with architectural quality finishes to match existing shell ceiling units.
3. Concert lighting fixtures built into the ceiling panel with adjustable mounts, safety tilt switches and related wiring and accessories.
4. Two orchestra shell tower transporters.
5. Additional components and support structures as required to meet the intent of the Contract Documents.
6. Where dimensions and loading capacities have been omitted from this specification, they are to be determined by the Contractor in accordance with the guidelines in this section.

D. Related Sections:

1. Division 5: Metals.
2. Division 6: Wood and Plastics.
3. Division 9: Finishes.
   b. Section 116161: Performance Dimmers and Controls.
   c. Section 11961: Electrical feeder cables and cable management for ceiling panel electrical requirements are provided and installed by Section 11961.

5. Division 16: Electrical.
   a. Section 260961: Performance Dimmers and Receptacles Installation.
1.20. REFERENCES
B. National Fire Protection Association (NFPA) National Electric Code (NEC)

1.30. SYSTEM DESCRIPTION
A. Design Requirements:
   1. Construct orchestra enclosure to present decorative and functional finishes. Construction shall reflect the standard of care, dimensional, acoustic, and aesthetic requirements specified herein and indicated on the Drawings.
B. Acoustical Requirements: The following requirements are intended to assure acoustical performance:
   1. All acoustically reflective surfaces on all portions of the orchestra enclosure shall comply with mass requirements specified in this Section.
   2. All layered or composite constructions shall be void-free and 100 percent bonded throughout all surfaces.
C. Orchestra Shell Towers:
   1. Tower arrangement, quantities, and dimensions shall be as shown on the Drawings. The tower bases nest to minimize storage space.
   2. Towers consist of an aluminum extrusion and base assembly to support formed honeycomb panels with a painted finish material bonded to backing material to achieve a minimum 2.25 pounds per square foot surface weight.
   3. Tower faces consist of hinged reflection shelves constructed of 1-1/2-inch fiber honeycomb with 3/16-inch tempered hardboard on both sides.
   4. Provide tower doors as per the drawings.
D. Orchestra Ceiling Panel:
   1. Ceiling panel arrangement, quantities, and dimensions shall be as shown on the Drawings.
   2. Ceiling panels consist of a steel frame or aluminum extrusion and formed honeycomb panels with a painted finish material bonded to backing material to achieve a minimum 2.25 pounds per square foot surface weight.
   3. The ceiling panels consist of a fully welded tube aluminum extrusion, internal aluminum edge members and finish millwork as shown on the Drawings.
   4. Ceiling panels house MCM PAR fixtures provided by this Division.
   5. Ceiling panels are to be provided with a demountable performance lighting multi-pin cable to match the performance lighting system’s standard outlets, being provided under Division 16 Section “Performance Dimmers and Receptacles Installation.”

1.40. SUBMITTALS
A. All submittals shall be in accordance with Division 1 Requirements. All submittals shall be submitted in a timely manner, allowing sufficient time for adequate review and possible resubmittal without jeopardizing the project schedule.
B. Shop Drawings:
1. Shop Drawings shall be submitted within ninety (90) days of award of contract.
2. All submittals shall be complete. No partial submittals shall be allowed.
3. Submit complete Drawings of fabrication sample.
4. Drawings will show all information necessary to explain fully the design features, appearance, function, fabrication, installation and use of system components in all phases of operation.
5. Engineering studies, calculations, models and reports shall be made part of the shop drawing submittal.
6. Fabrication, installation and erection shall not commence until Shop Drawings have been reviewed and marked by the Architect.
7. All sheets in the submittal shall be of the same size.
8. Submittal shall include a title sheet listing all sheets in the submittal.
9. A professional engineer licensed in the state of fabrication.
10. Drawings shall be to an identifiable scale.

C. Product Data:
1. Submit catalog or standard data sheets for component parts as part of the shop drawing submittal. The data shall include all information that indicates compliance with the specifications herein.
2. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Clearly indicate the manufacturer of each component part.

D. Samples:
1. After approval of fabrication sample Shop Drawings, fabricate a sample to demonstrate panel construction and finishes. Sample shall be minimum 4'-0" square and shall illustrate the following:
   a. Panel construction.
   b. Panel curvature.
   c. End and edge conditions.
   d. Finish material seam.
   e. Operable concert lighting fixture with baffle, mounting and wiring.

E. Record Documents:
1. Record Documents shall be submitted in accordance with Division 1 Requirements and Supplementary General Conditions.
2. Operations and Maintenance Manuals, in quantities of five, shall include:
   a. Contact information for the Contractor and pertinent manufacturers.
   b. Safety and Operational Instructions
   c. Complete parts and subassembly list
   d. Equipment design parameters such as safe working loads and duty cycles.
   e. Wiring diagrams and termination schedules
   f. Periodic Maintenance Schedule
   g. Maintenance procedures for finishes
   h. Certificates of compliance with applicable codes
   i. Records of final testing and log
   j. Spare parts list and source information
3. Include diagrams depicting the system layout and maximum load limitations (drawn not less than 1/4 inch = 1'-0").
4. In addition to the requirements referenced above, provide record copy Shop Drawings for archival and reference usage as part of the O & M manuals:
   a. Reduced size, 11 inches by 17 inches preferred, hardcopy prints.
   b. Universal electronic format files, .pdf file type is preferred, as full size printable sheets. Submit files on standard pc format CD clearly labeled including project name, project architect, theatre consultant, contractor name, date of submittal.

1.50. **DELIVERY, STORAGE AND HANDLING**

A. Deliver all materials to the job site suitably crated, packed, and protected. Store and handle in accordance with manufacturer’s recommendations.

1.60. **PROJECT CONDITIONS**

A. Field Measurements: Verify all critical dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.70. **SPECIAL WARRANTY**

A. Warrant systems and equipment to be free of defective components, faulty workmanship and improper adjustment for a period of 2 years from the date of Owner’s acceptance. Paint and exterior finishes are excluded relative to failure due to unusual exposure. Replace items showing evidence of defective materials or workmanship (including installation workmanship) within 30 days after notification. Make replacements without cost to the Owner. Rectify conditions that might present a hazard to human life, well-being and or property within 48 hours of notification.

B. Designate warranties on manufactured equipment to the Owner to commence on the date of system acceptance.

1.80. **MAINTENANCE**

A. Maintenance Service:

   1. Provide maintenance service for a period of one year after final acceptance of the installation. This service consists of at least 2 half-yearly visits to the site for checking and adjusting of equipment. Perform the first visit 6 months after the system has been accepted. Arrange visit to be at a time mutually agreeable to the Owner.

B. Extra Materials: Provide the following material to be included in the Base Bid and turned over to the Owner at the time of system commissioning and training:

   1. Custom manufactured replaceable hardware and components, hinge assemblies, fasteners, carriers, and similar items. Provide 2 percent of total but not less than one of each component type.
   2. Lighting Fixture: Provide 2 complete with all mountings.
   3. Lamps: Provide 33 percent spare lamps.
PART 2 - PRODUCTS

2.10. MANUFACTURERS

A. The Orchestra Shell shall be manufactured by an approved manufacturer, and shall be installed under the manufacturer's supervision. The manufacturer shall have been involved in the manufacture and installation of orchestra shell systems for a period of 5 years or more, and shall have completed at least 10 installations of this type and scope. The Architect shall be the final judge of the suitability of experience.

B. Approved Orchestra Shell Manufacturers: Furnish “DIVA” by Wenger Corporation or equals by StageRight or J.R. Clancy.

2.20. MATERIALS

A. Steel:

1. Structural steel shapes and plate shall be A36.
2. Steel tube shall be A500.
3. All welding shall conform to AWS D.1.1 Structural Welding Code.

B. Wood Products:

1. Wood Moisture Content: Provide kiln dried lumber with an average moisture content range of 6 percent to 11 percent. Maintain temperature and relative humidity during fabrication, storage and finishing operations, so that moisture content values for woodwork at time of installation do not exceed given values.
2. Inspect each piece of lumber and plywood or each unit of woodwork after drying; do not use twisted, warped, bowed, or otherwise damaged or defective wood.

C. Plywood:

1. Plywood: A.P.A. Rated plywood selected for application. Plywood for the rear of the ceiling panels shall be selected to be compatible with the face plywood in all respects so as to make a lamination with equal thickness materials on both faces.
2. Construct panels using guidelines as described in PDS Supplement #4; Design and Fabrication of Plywood Sandwich Panels.

D. Face Painted Hardboard:

1. Face, Painted Panel: 3/16 inch (4.8 mm) thick hardboard stressed skin, material and finish as indicated, with no exposed fasteners. This panel assembly shall have a minimum of STC 22.
2. Back: 3/16 inch (4.8 mm) thick hardboard stressed skin, painted black.
3. Panel Edge Frame: Straight panel edges are reinforced with extruded aluminum edge frame.
4. Acclimate panel face and back materials in a temperature and humidity controlled environment for a minimum of 72 continuous hours so that they reach appropriate equilibrate condition prior to lamination to improve dimensional stability of finished laminated panels.
   a. Documentation of specified process must be available for review.
E. Honeycomb:
   1. Core material shall be resin impregnated fiber honeycomb composition with a minimum 1-1/2-inch thickness.

F. Finish Face Material:
   1. Towers: Face, Painted Hardboard with a minimum of 3/16-inch thickness. Opaque Painted Finish for Acoustical Shell Panel: 100 percent acrylic latex, 2-Coat eggshell finish
   2. Fasteners: Comply with ANSI B18.2.1&2 Specification for square and hex bolts and nuts. All bolts and fasteners shall be grade 5 or better. Fasteners shall be rated for the anticipated loads. Provide fasteners with approved markings indicating their rating.

G. Fasteners:
   2. All bolts and fasteners shall be grade 5 or better.
   3. Fasteners shall be rated for the anticipated loads.
   4. Provide fasteners with approved markings indicating their rating.

H. Concert Downlight:
   1. High Output variable white light LED Wash light. DMX-512 controlled with 5-pin connectors.
   2. Provide required connector(s) to mate with power distribution.
   3. Provide a lens set for each fixture.
   4. Provide egg crate louver for each fixture.
   5. Electronic Theatre Controls Desire 40 Studio HD.
      a. No known equal.
   6. Light Distribution: Manufacturer shall perform photometric study. The design shall meet the following minimum requirements:
      a. Minimum of 100 foot candles at 36” above the floor within the shell towers.
      b. Minimum of 50 foot candles at 36” above the floor outside the shell towers.
      c. Minimum / Maximum light distribution 1:3 measured within the area bounded within two-feet of the tower walls.
      d. Submit photometrics for review and comment.

I. Electrical and Control Components:
   1. Distribution of switched power and data distribution within the reflectors is to be provided by Orchestra Shell manufacturer and includes:
      a. Tilt safety switch and distribution.
      b. DMX-512 signal distribution meeting the requirements of Section 116161 Performance Lighting Power and Controls.
      c. Ceiling mounted junction boxes and raceways.
   2. Coordinate with feeder cables specified under Division 11 and contract documents.
   3. Comply with the requirements of the NFPA National Electric Code.

2.30. MANUFACTURED UNITS

A. ACOUSTICAL SHELL PANELS:
General: Manufacturer’s standard stressed-skin composite acoustical shell panels, with STC meeting performance requirements, designed to mix and blend sound and reflect a maximum range of audible frequencies to both audience and performers.

1. Core: 1-1/2 inch (38 mm) thick honeycomb, resin impregnated, bonded to frame and faces with permanent urethane adhesive. Contact cement adhesion does not meet the requirements of this specification.

2. Ceiling Panel Face, Painted Hardboard Face: 1/4 inch (6 mm) thick medium density fiberboard stressed skin, material and finish as indicated, with no exposed fasteners.

3. Tower Panel Face, Painted Hardboard Faced Panel: All tower panels have finished face of 1/4 inch (6 mm) thick hardboard faced medium density fiberboard stressed skin, material and finish as indicated, with no exposed fasteners. Tower panel skin construction consists of 1/4” painted hardboard on the face and 1 (one) additional 3/16” Masonite hardboard backer layer over a core of 1-1/2” thick resin-impregnated fiber honeycomb of 80-60-15 composition (15% resin minimum) with 2 (two) 3/16” layers of Masonite hardboard on the back with the rear face side painted black.

B. STAGE ACOUSTICAL SHELL SYSTEM

1. Mobile Acoustical Towers: Free-standing, self-supporting, movable towers for stage back and side walls. Towers consist of acoustical shell panels in rigid, diagonally-braced vertical aluminum frame with formed steel connection components, with center panel and two hinged wing panels, in nesting configuration minimizing required storage space. Wing panel on tower equipped with latching hardware and stage access door where indicated. Counterweighted tower base with adjustable front leveling pads concealed by removable access panel.
   a. Tower Size: 12 foot (3660 mm) wide, consisting of one 4 foot (1220 mm) center panel and two 4 foot (1220 mm) wing panels.
   b. Tower Height: 22’-0” (6.71 m)
   c. Pivoting Tower Shelf Heights: 13’-0” AFF (3.97 m) and 22’-0” AFF (6.71 m) see drawings.
   d. Pivoting Tower Shelf Depths: 2’-6” (0.762 m)._
   e. Tower Panel Radius: 20 foot (6.09 m).
   f. Paint finish, color as selected by Architect.
   g. Trim strips between Panels: Painted color as selected by Architect.
   h. Door and Wing Panel Hardware:
      i. Hinges: Aluminum, 6063T, with nylon insert and self-lubricating bearings, designed for silent operation, with no metal-on-metal contact, and requiring no replacement parts.
      j. Slide-lock mechanism and pull handle.
   k. Stage Tower Air Transporter: Electrically-operated handcart with tubular steel handbar, 2 rubber-wheeled casters, and blower unit, configured to fit mobile stage tower base and enable movement of towers through pneumatic cushion supporting most of tower’s weight. 110V 15A. Two stage tower transporters are to be provided.
   l. Pivoting Tower Shelves: Shall be single layer stressed skins. Painted hardboard faces only. Width is to match tower center section and wing doors, and depth of shelf is to be 20” (.5 m)

C. Adjustable Acoustical Shell Ceiling:

1. Acoustical shell ceiling consisting of adjustable-angle acoustical shell ceiling panels supported by integral truss, suspended from stage rigging pipe batten, and stored in fly-loft in vertical position.
   a. Ceiling Panel Size and Configuration: As indicated.
   b. Ceiling Panel Radius: 20 foot (6.09 m).
   c. Paint finish; color as selected by Architect.
d. Panel Hinges: Aluminum, with self-lubricating bearings.

D. Integrated Lighting: Manufacturer's standard UL-approved fixtures located as indicated. Integral truss incorporating electrical power raceway adequate to power integrated lighting.
   1. Specifier: Rigging and pipe battens are not furnished by Wenger. Coordinate with theater rigging consultant or with Division 05 metal fabrications section.

E. Stage Rigging and Battens: Rigging and battens supporting acoustical shell ceiling are part of the work of Division 11 Section "Stage Curtains."

F. Miscellaneous Supports: Battens, channels, and other miscellaneous supports are part of the work of Section 116133.

G. Acoustical Shell Ceiling Installation Accessories:
   a. Shackles: Rated screw pin shackles.
   b. Chain: Alloy black oxide steel chain rated for overhead lifting.

2.40. Framing:
   a. Provide the framing for the ceiling panels of a unified structural frame with intermediate braces as required.
   b. Provide supporting hardware integral to ceiling panel. Provide the hook with a safety latch and chain. Provide adjustable length hanger arms to allow for proper alignment of the panels on uneven battens. Provide interlocking hardware for adjacent panels; resulting in a continuous row with no gaps or level deviations.
   c. Provide panels to individually set each section of the ceiling panels to its performance trim, once installed. Ensure alignment by the use of overlapping tabs on panel frames.
   d. Determine dimensions and angles used to fabricate the panels from the indicated angles on the Drawings. Variations in the field are for clearance, trimming appearances and acoustical tuning and are not intended to affect the fabrication of the panels.

2.50. Transporter:
   1. Separate electrically operated air cushion type, or approved equal, device shall engage tower base and lift the majority of the tower mass for safe and stable transport by not more than two people.
   2. Provide two complete transporters.

2.60. Finishes
   A. All exposed surfaces shall have a paint finish complying with the requirements of Division 9 Section 09.91.23 – Interior Painting.
   B. Wood surfaces not visible to the audience shall be finished with alkyd undercoating and one finish coat of flat alkyd enamel, color medium gray.
   C. Prime and finish the down light fixture baffles with matte black paint.
   D. Frame and all other surfaces not exposed to the audience shall receive a painted finish. Paint on metal frames shall be satin or semi-gloss finish, color medium gray.
2.70. SOURCE QUALITY CONTROL

A. Work on the systems may be reviewed at the point of manufacture a minimum of one time during fabrication. This review will occur during the final factory checkout prior to shipping, unless the Manufacturer and Architect agree on a more advantageous inspection date.

2.80. SUPPLEMENTARY

A. Furnish equipment and hardware in addition to the items specified previously that are necessary to provide a fully working system in conformance with the intent of the Contract Documents.

2.90. SIGNAGE

A. Signage shall be legible both in construction and grammar.

B. Provide wall mounted diagrams depicting the shell system layout (drawn not less than 1/4 inch=1'-0") in a protective transparent faced frame. Placement as directed by Architect.

PART 3 - EXECUTION

3.10. EXAMINATION

A. Prior to commencing installation, inspect construction conditions at the site, and other conditions affecting the installation. Verify all pertinent dimensions and sizes and the appropriateness of all supporting structures and devices.

B. Do not proceed with equipment installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.20. INSTALLATION

A. Coordinate with Owner to ensure the scope of this section is furnished and installed as required herein.

B. Provide a competent supervisor, acceptable to the Architect, during the entire installation. Change of supervisor during the project is not acceptable without prior written approval from the Architect.

C. Equipment shall be aligned, adjusted, and trimmed for the most efficient operation, the greatest safety and for the best visual appearance.

D. All stage equipment shall be installed in accordance with the highest standards of the industry. All equipment shall be securely anchored, and installed plumb, straight, and true. All components shall function properly, safely, quietly, and without binding or rubbing.

E. Do all cutting, drilling, tapping, and approved welding required to properly install work. Obtain Architect’s prior approval for cutting and drilling of existing structural work.

F. Adjust all equipment and components for operation in accordance with the specifications, approved shop drawings, and pertinent project Drawings.
G. All finishes which are disturbed during shipping and installation shall be touched up or replaced to match the original.

H. Installation practices shall be in accordance with OSHA Safety and Health Standards and all local codes. All welding must be performed in full compliance with the latest edition of the Structural Welding Code (ANSI/AWS D1.1).

I. Provide personnel, equipment, and spare lamps as necessary to adjust and focus the concert downlights under the direction of the Architect.

3.30. CLEANING

A. The Contractor shall be responsible for clean up, including removal of packing materials etc. and the protection of surfaces or equipment provided by other contractors.

3.40. FIELD QUALITY CONTROL

A. Inspection, Testing, and Reviews:

1. During the installation of equipment, the Contractor shall arrange for safe access as necessary for inspection of equipment by the Architect.

2. Final review will be made by the Architect following written notice from the Contractor that the installation is completed.

3. At the time of inspection, the Contractor shall furnish sufficient workers to operate all equipment and to perform such adjustments and tests as may be required by the Architect. Any equipment which fails to meet with the specifications shall be repaired or replaced with suitable equipment and the inspection shall be re-scheduled under the same conditions as previously specified.

4. At the time of these inspections, no other work shall be performed in the auditorium and stage areas. All temporary bracing, scaffolding, etc. shall be removed to permit full operation of and access to all equipment.

3.50. DEMONSTRATION AND INSTRUCTION

A. The Contractor shall arrange and demonstrate to the Architect that all the Orchestra Shell elements perform per the intent of these Contract Documents prior to acceptance of the systems.

B. Demonstrate system operation for all configurations indicated in the Drawings for acceptance and turning by the Acoustician.

C. Provide a total of 8 hours of training to the Owner’s staff on use and maintenance of this equipment after the systems have been commissioned and accepted as satisfactory.

END OF SECTION 116124
SECTION 11 61 33
PERFORMANCE MANUAL RIGGING

PART 1 GENERAL

1.01 SUMMARY

A. Performance manual rigging includes manually operated equipment assemblies, systems and components required for locating scenic, acoustic, lighting and masking elements in variable vertical planes.

B. Section includes provision of materials, components, modifications, assemblies, equipment and services as specified herein. These include:
   1. Provisions as required under Division 1.
   2. Verification of site dimensions and conditions.
   3. Submission of Shop Drawings signed and sealed by a licensed Professional Engineer experienced in work of similar nature and scope and licensed in the State of installation.
   4. Engineering of equipment and systems as required by the Contract Documents.
   5. Manufacture of equipment and systems as required by the Contract Documents.
   6. Scheduling, sequencing and coordination with other trades.
   7. Site supervision of equipment and systems installation specified herein and elsewhere in the Contract Documents.
   8. Testing, demonstration, and certification of equipment and systems as specified herein and elsewhere in the Contract Documents.

C. Provide systems including:
   1. Underhung single purchase counterweight sets and pipe battens.
   2. Grid mounted diverter blocks to route cables through grid wells.
   3. Hemp spotlines rigging and sandbags.
   4. Locking rails.
   5. Complete battery of counterweight guide tracks.
   6. Outriggers with index strip lights and scenery bumpers.
   7. Cable management equipment for connector strip(s), orchestra shell, as well as any additional multicable devices.
   8. Additional support structures as required to meet the intent of the Contract Documents.
   9. Provide devices and components that are NEMA compliant and UL approved for the applications. Wiring and electrical service shall be performed by a licensed electrician and conform to applicable codes.

D. Products Installed but Not Furnished Under This Section:
   1. Draperies as furnished under Section 11 61 43 Performance and Acoustical Draperies.
   2. Performance Drapery Tracks and Motors as furnished under Section 11 61 44 Performance Drapery Tracks.
   3. Powered Adjustable Acoustic Devices as furnished under Section 11 61 55.
   4. Rigging of connector strip(s) furnished under Section 11 61 61 Performance Dimmers and Controls.
   5. Rigging of Orchestra Shell ceiling panels furnished by the Orchestra Shell contractor.

E. Related Sections:
   1. Division 1: General and Supplementary Requirements.
   2. Division 3: Concrete.
   3. Division 4: Masonry.
   4. Division 5: Metals.
   7. Division 11: Equipment.
      a. 11 61 00: Performance Machinery General Requirements.
b. 11 6124: Orchestra Shell

c. 11 61 43: Performance and Acoustic Draperies.

d. 11 61 44: Performance Drapery Track

e. 11 61 37: Proscenium Safety Curtain.

8. Division 23: Mechanical.


1.02 DEFINITIONS

A. Hemp Set: An adjustable rigging system consisting of synthetic rope, moveable, grid mounted, upright loft blocks and sandbag counterweights.

1.03 SYSTEM DESCRIPTION

A. Performance Requirements:

1. Section 11 61 00 establishes minimum requirements for the system. Where Federal, State, Local Legislation and consensus standards address these topics, the more stringent requirements take precedence. The minimum standards for construction and installation shall meet or exceed the requirements of the Applicable Project Building Code (per project) and ANSI E1.4-1 (2016) except as exceeded by these specifications. Where standards requirements conflict, the construction shall conform to the following order: Federal, State, and Local Legislation; Applicable Project Building Code; ANSI E1.4-1; these specifications.

2. Factors listed below in no way relieve this Contractor from the sole responsibility of providing safe systems.

B. Provide assemblies, cable components, connections, equipment, hardware and linkages employed in supporting, in whole or in part, overhead loads that are rated and designed for that application. Base loading for each component on the maximum percentage of the capacity of the set in which the component is employed. Base the set capacity on the batten length multiplied by a thirty pound per linear foot (30 plf) load, in addition to self weight and associated impact factors.

C. Provide mule blocks, rollers and guides as required to provide proper alignment and maintain allowable fleet angles.

1.04 SUBMITTALS

A. In addition to submittals required under Division 1 and Section 11 61 00, for items listed herein, provide manufacturer’s data and certification of compliance

1.05 WARRANTY

A. Special Warranty:

1. Warrant systems and equipment to be free of defective components, faulty workmanship and improper adjustment for a period of two years from the date of Final Acceptance. Paint and exterior finishes are excluded relative to failure due to unusual exposure. Replace items showing evidence of defective materials or workmanship (including installation workmanship) within thirty (30) days after notification. Make replacements without cost to the Owner. Rectify conditions that might present a hazard to human life, wellbeing, and or property within 48 hours of notification.

2. Designate warranties on manufactured equipment to the Owner on the date of Final Acceptance.

1.06 MAINTENANCE

A. Maintenance Service:

1. Provide maintenance service for a period of one year after final acceptance of the installation. This service consists of at least two half-yearly visits to the site for checking and adjusting of equipment.

2. Perform the first visit sixty days after the system has been accepted. Arrange visit to be at a time mutually agreeable to the Owner and Contractor.
PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide the rigging systems from components (except where otherwise stated) that are the products of one of the following manufacturers. Additional manufacturers may be used if approved in writing by the Architect, or as defined in Division 1.
   1. H&H Specialties Inc., South El Monte, CA.
   3. Thern Stage Equipment, Winona, MN
   4. Texas Scenic Company, San Antonio, TX

B. Bearings:
   1. Dodge/Reliance Electric Corp., Cleveland, OH
   2. FAG Bearings Corp., Stamford, CT.
   3. Timken Co., Canton, Ohio.

C. Cable and chain connection hardware:
   1. Chicago Hardware and Fixture Company, Chicago, IL.
   2. Columbus McKinnon Corporation, Chain Division, Amherst, NY.
   3. Cooper Industries, Campbell Chain Division, Inc., NC.
   4. The Crosby Group, Inc., Tulsa, OK.

D. Compression sleeves:
   2. National Telephone Supply Company, Cleveland, OH.

E. Synthetic ropes:
   1. All Line Inc. Naperville, IL.
   3. Atlantic Cordage Corporation, Carteret, NJ.

F. Wire Rope: Refer to Section 11 61 00, Performance Machinery Basic Requirements.

2.02 MATERIALS


B. Guide Track and Hardware
   1. Guide Tracks
      a. Provide guide tracks of steel or aluminum with brackets, fishplates and clips of compatible materials.
      b. Provide rails with a “T” section at the guide shoe connection point sized to allow adjacent guide shoes to pass each other without interference. Provide track sections with a sectional area and material properties to withstand the forces resulting from the fully loaded guided counterweight arbors.
      c. Provide tracks sufficiently true and smooth to operate properly with the guiding members.
   2. Brackets, Fastenings, Joints and Supports
      a. Provide guide track brackets, fastenings and supports capable of resisting horizontal forces imposed by anticipated loading with the total deflection at the point of support not in excess of 1/8" (3.2mm).
      b. Provide track joints so that they are equivalent to or greater strength than the track and adequately maintain the accuracy of the rail alignment.

2.03 MANUFACTURED UNITS

A. Counterweights:
1. Typical Set: Front Loading type. Provide weights from cut steel in thick nesses and quantities specified herein. Finish with hand smooth edges, free from burrs. Chamfer at 45o two diagonal corners of each weight to allow ease of loading. Slot front ends of weights with hand holds to easily extract from arbors.
2. Weight size and shape shall conform to ANSI E1.4.1.
3. Individual weights are not to exceed thirty-five (35) pounds.

B. Blocks:
1. Refer to Section 11 61 00, Performance Machinery Basic Requirements for performance criteria.
2. Single Purchase Headblocks, Upright:
   a. Provide upright headblocks with sheave aligned to permit the purchase and lift lines to operate, within the tolerances specified herein, with the arbors, loftblocks, and rope locks.
   b. Provide head blocks each with a single sheave of multiple grooves as specified herein.
3. Loft blocks, Underhung:
   a. Provide blocks that allow positioning of the cable to pass through the grid well at its center line.
   b. Provide each underhung block with idler sheaves for guiding and supporting running lines at proper elevation and quantities related to the headblocks. Equip blocks with the requisite number of idlers to prevent cable from sagging, touching and wearing against other elements. Size idlers for intended rope.
   c. For the loft blocks closest to the headblocks, in lieu of idlers, provide each with a single sheave of multiple grooves of the quantity of lift lines required for the set.
   d. Refer to Section 11 61 00, Performance Machinery Basic Requirements for additional performance criteria.
4. Temporary Rope Loft Blocks
   a. Provide blocks as required designed for electrical multi-cable management. Provide additional blocks of the quantity specified herein for temporary rigging points.
   b. Provide blocks that allow positioning of ¾” synthetic rope to pass through the gridiron at either a grid well or through openings in the grid floor.
   c. Refer to Section 11 61 00, Performance Machinery Basic Requirements for additional performance criteria.
5. Tension Blocks:
   a. Provide with appropriately sized side plates and a kick plate located at the upper on-stage corner.
   b. Provide tension blocks of sufficient weight to maintain constant tension on purchase line.
   c. Configure the block mounting to ride freely in the guide tracks on 2 sets of guide shoes of similar arrangement as the associated counterweight arbor. Ensure that the tension block properly engages track and remains in set location while purchase line is under tension.

C. Sheaves: Refer to Section 11 61 00, Performance Machinery Basic Requirements for performance criteria.

D. Counterweight Arbors:
1. Provide each set with a counterweight arbor provided at a length sufficient to contain the counterweights required for balancing the load within fifty (50) pounds the weight of the batten loaded at twenty-five pounds per linear foot (25 plf) for general purpose battens, and thirty pounds per linear foot (30plf) for stage electrics, in addition to the batten weight. Weight dimensions as specified herein. Size length to permit the loading and unloading of weights when arbor is loaded to its capacity. Provide the arbor assembly to be of sufficient strength to safely support weight on the arbor, load on cables and operating pull.
2. Support the arbor from a cable clew arrangement mounted at the arbor top with a sufficient number of shackle attachment points to accommodate the total number of cables in addition to the purchase line. Support arbor such that the load is centered between all lift lines.
3. Provide arbors constructed of formed 12-guage steel sheet, welded, with welded compartments designed for specified counterweight.
4. The arbor shall be constructed with a series of sloped shelves within individually accessible compartments at 24 inch (6100 mm) increments.

5. Each arbor compartment shall be designed to accommodate ANSI E1.4.1 compliant counterweight bricks.

6. Provide arbors designed to support counterweight widths noted on the schedule.

7. Provide arbors at nominal heights as required to support live capacity noted on the drawings.

8. Provide a counterweight latching mechanism that includes a two stage latch system designed to comply with the strength requirements of SAE J839 and FMVSS 206.

9. Arbor closing gates shall be engineered to resist counterweight loss during a free-fall event from full height. Manufacturer shall provide proof of drop testing to prove conformance.

10. Incorporate an attachment point with fiber rope thimbles to the arbor top and bottom for the connection of the purchase line.

11. Secure an additional shouldered eye lug to the on stage side of the arbor bottom for potential attachment of an additional 3/4" fiber hauling line.

12. Configure guide arrangement to maintain arbor stability throughout travel and restrain arbor from lateral movement due to impact and lateral forces.

13. Where an out of balance condition exceeds 50# between batten travel at extreme conditions, provide a compensating chain attached to the arbor designed to compensate for aircraft cable weight. Provide catch device intended to contain chain when arbor is at low position. Design chain and catch device to maintain specified noise requirements during travel.

E. Locking Rails:
   1. Provide the rail to withstand a five hundred pound per linear foot (500 plf), uplift, with a non-concurrent one thousand (1000) pound concentrated load at any location along the rail.
   2. Provide locking rail(s) extending the full depth of the stage as indicated on the Drawings and as to accommodate the complete battery of counterweight guide tracks. Configure each rail with a top angle to accommodate rope locks at the appropriate corresponding position to the guide tracks and with brackets for 3" x 5" index card holders. Incorporate a tubular steel or rolled angle reaction bar on the bottom of the rail configured to engage a portable capstan winch.
   3. Provide the complete length of the locking rail with a pair steel sections mounted so as to provide a positive top and bottom stop for arbor travel. Secure timber sections on the top of the steel stop sections to absorb impact. Cover the top of the timbers sections with 3/4" thick neoprene sheet. Secure neoprene with a synthetic adhesive. Mount the stop batten assembly in a manner that does not interfere with arbor travel or system operation.
   4. For stage level lock rail, Incorporate a 4.5" outside diameter pinrail with the top quadrant 2" below the bottom of the index strip and the offstage quadrant coplanar with the on stage edge of the index strip. Perforate through the rail 1.25" diameter holes to accommodate belaying pins. Stagger holes to center belaying pins between rope locks.

F. Rope Locks:
   1. Provide the rope lock with a 9" encapsulated steel eccentric lever and steel, ductile or malleable iron cams to provide quick action locking. When locks are fully engaged handles shall be perpendicular to the floor. Provide a thumb screw with jam-nuts for pressure adjustment. Provide locks with nylon spacers between the locking dogs, levers and casting to reduce noise.
   2. Bolt the rope locks to the locking rail with appropriate fasteners.
   3. Provide locks with elliptical slip rings to prevent movement of lever by tensioning against the purchase line. Encapsulate slip rings in plastic of the same color as the handle.
   4. Provide a synthetic rubber bumper on lock mounting angle to prevent noise from handle impact.
   5. Encapsulate identified items in red poly-vinyl chloride, 25 mils thick and testing between fifty (50) and sixty (60) on a durometer scale.
   6. Provide locks designed to comply with the control of hazardous energy plan in compliance with 29 CFR 1910.147 The control of hazardous energy (lockout/tagout).

G. Pipe Battens:
   1. Provide typical pipe battens of seamless black wrought steel pipe as specified above.
   2. Batten Splices
a. Provide splices from sleeved tubing arranged so the spliced batten equals or exceeds the strength of the continuous batten material. Secure splices using removable, appropriately rated threaded fasteners in a fashion that no part of the fastener extends beyond the batten surface by more than ½”. Arrange splices to ensure batten deflection in any span does not exceed the deflection of a continuous batten of equal span under the loading criteria specified herein.

b. Splice connections shall allow for no more than 1/8” gap between pipe section.

c. Internal batten splices shall be fabricated to tolerance such that there is no movement between batten and internal splice.

3. Provide batten length depicted for each set on the Drawings. Incorporate full pipe sections for each batten with only one partial section located on center line. Drill both ends of the battens for batten splices and extensions.

4. Provide an additional batten at each electric raceway location. Locate battens both on top of and below raceway.

5. In addition to raceway locations, provide an additional batten and pipe clamps at each location noted as “Electric.” Support additional pipe from primary batten with clamps on 5’-0” spacing, maintaining 10” clear between pipes.

H. Truss Battens

1. Provide truss battens for linesets dedicated to orchestra shell ceilings and first electric. Refer to schedule on drawings.

2. Fabricate truss battens from rolled steel sections arranged to meet the deflection and loading requirements of the Contract Documents. Provide battens with a bottom chord of 1-1/2” nominal Seamless Black Steel Pipe. Provide the top chord of a square or rectangular section no greater that 2” in width to minimize lateral deflection of the truss. Arrange webs so as to minimize interference with equipment mounting to the bottom chord.

3. Secure trusses to lift lines with formed cable eyes and compression sleeves, jaw-jaw turnbuckles and formed steel clamps bolted around the top and bottom truss chords with appropriately rated fasteners.

4. Truss Panel Splices

a. Provide truss panel connections of rated threaded fasteners and internal splice sleeves to allow field disassembly.

b. Provide splices from sleeved tubing arranged so the spliced batten equals or exceeds the strength of the continuous batten material. Secure splices using removable, appropriately rated threaded fasteners in a fashion that no part of the fastener extends beyond the batten surface by more than ½”. Arrange splices to ensure batten deflection in any span does not exceed the deflection of a continuous batten of equal span under the loading criteria specified herein.

c. Splice connections shall allow for no more than 1/8” gap between either chord section.

d. Internal batten splices shall be fabricated to tolerance such that there is no movement between batten and internal splice.

5. Provide truss length depicted for each set on the Drawings. Incorporate full pipe sections for each member with only one partial section located on center line. Drill both ends of the bottom chord for extensions.

I. Batten Extensions:

1. Provide steel pipe extensions for the off-stage ends of each batten. Extension length is determined as the amount of pipe extended from main batten, as defined in the schedule below. Provide additional length of pipe as required to remain sleeved inside for support.

2. Provide extensions which sleeve within the batten when not deployed. Size extensions to safely support a load of twenty pounds per linear foot (20 plf), and to have an outside diameter not less than 1 inch.

3. Configure the batten and extension such that the distance the extension extends beyond the batten end is infinitely adjustable by the user and so the adjustment device will sustain the position of the extension when a load equal to the extension length multiplied by 20 pounds per linear foot is applied in both longitudinal directions. Size the extensions so that not less than 12 inches remains sleeved at all times. Paint the section remaining sleeved red.
4. Weld a 1-1/4” x 3/8” diameter welded steel ring to the off-stage end of the extension so that one quadrant is partially inside the extension pipe and that the weld points are on parallel quadrants of the extension.

J. Batten Hanging Devices:
1. Provide one type of batten hanging device within the system as described below.
2. Batten Clamps:
   a. Provide connections to each lift line turnbuckles by removable steel clamps which encircle the complete circumference of the batten and allow for direct connection to the jaw of the turnbuckle. Employ appropriately rated fasteners with locking devices for connections.
   b. Configure the devices to each resist the complete loads of both adjacent spans with the additional imposed impact factors. Configure the devices to resist rotation of the batten with a load of 30 pounds per linear foot of the longest adjacent span applied at 12 inches horizontally from the section’s centroid.
   c. Configure devices so that the bottom and sides do not exceed the diameter of the batten by more than one batten diameter. Configure devices so that no sharp edges or corners greater than 45 degrees are presented.
3. Trim Chain:
   a. Provide 36-inches long fabricated from ¼-inch alloy, specifically designed for overhead lifting applications. Provide chain that is rated to resist the complete loads of both adjacent spans with the additional imposed impact factors.
   b. Wrap chain 1 ½ times around the batten and terminate with appropriately rated and installed hardware. Provide appropriately rated fasteners and hardware with locking devices for connections.
   c. Provide chain that is compatible with industry-recognized chain hardware. Chain link size shall match the Welded Steel Chain Specifications for Grade 30 Proof Coil Chain as specified by the National Association of Chain Manufacturers.
   d. Provide chain that is stamped with the manufacturer’s identifying mark.
   e. Provide chain that is lot traceable, with a coded date stamp on each piece of trim chain.
   f. Provide chain and connection devices specifically designed for overhead lifting as defined to OSHA (29 CFR 1926.251).
   g. The use of hardware not designed for connections in overhead lifting, such as bolts used as safety devices, will not be accepted.
   h. Provide certification of compliance from the manufacturer for the intended application.
4. Provide batten clamps, as described above, for all lighting raceway and orchestra shell battens.

K. Index Strip Light:
1. Provide a continuous index strip light for illumination of each locking rail. Provide continuously dimmable LED strips in blue and white. Provide fixture to direct light away from the stage. Provide fixtures that have a direct DMX connection for control, as well as local control
2. Where control via performance lighting system is not included, provide local dimmers and control for independent use of blue and white lights.
3. Configure outriggers for strip lights illuminating the lockrails at the stage floor to serve as continuous scenery bumpers without interfering with the strip light. Design and provide fixture and mounting to withstand anticipated loading and an additional 75% impact load. Provide bracing against lateral movement between outriggers. Support the strip light not less than every 5'-0", or as to prevent deflection of the housing exceeding 1/360 of span.
4. Suspend strip light from scenery bumper with rigid formed steel clamps.
5. Coordinate with Electrical contractor regarding the wiring and wiring location of the circuits.

L. Supplementary Rigging Equipment:
1. Trim Clamps:
   a. Provide grooved, five line adjustable trim clamps to accept 5, 5/8" diameter synthetic lift lines.
   b. Provide the clamp from two parallel steel plated equipped with spring "fingers" to accept the lines and keep them in place under anticipated loading, when plates are tightened together.
c. Employ bolts and wing nuts, arranged to ensure equal pressure on the lines, to provide plated spacing adjustment.
d. Provide an integral eye on one plate to allow for connection of a 3/4" diameter purchase line.

2. Belaying Pins:
a. Provide belaying pins of turned Hickory or other accepted hardwood. Provide 21" long pins not exceeding 1-3/16" diameter. Engineer the pin to withstand anticipated loading conditions. Turn the top of the pin to provide a secure hand hold and to prevent the pin from dropping through the rail.
b. Treat the pins to prevent organic decay and to protect the surface of the wood from damage. Treatment shall in no way react chemically with the rope or the steel pinrail in a fashion that would cause damage or operational failure of elements of the Work.
c. Provide one pin for each pinrail hole on the lockrail and stage galleries.

3. Snatch Blocks:
a. Provide snatch blocks steel sheaves and bronze bushed bearings.

4. Sand Bags:
a. Provide sand bags in the size and quantity specified herein. Fabricate from canvas and stitch to withstand intended loading. Fabricate the bags to result in a cylindrical pattern when filled; and provide with an interior flap to prevent leakage of the sand.
b. Provide sand bags filled with sand to the specified weight.
c. Clearly mark, on the bag, its weight in characters at least 2" high. Mark bags to indicate the level of the sand required to equal the capacity of the bag.
d. Securely sew a nylon web sling, appropriately sized for intended loading, to the bag to support the full designated weight. Pass the sling through a forged steel rigid eye safety hook, rated for the full load of the sandbag plus a 75% impact load.

2.04 COMPONENTS

A. Rigging Lines:
1. Suspend lifted elements by wire ropes, unless specified otherwise herein. Determine the classification of wire rope construction to suit the system operational requirements. Unless specifically required in the Contract Documents, the Contractor's engineer shall determine the classification.
2. Employ continuous lines from the same spool/length, free of knots, splices or mechanical fasteners along their length unless specifically required otherwise in the Contract Documents. Do not employ damaged or deformed cables. Excluding prefabricated systems, cut cable at the site from the manufacturer's spool.
3. Wire Rope: Refer to Section 11 61 00.
4. Synthetic Laid Rope:
   a. Material: filament and staple/spun polyester wrapped around a polyolefin core.
   b. Average tensile strength: 10,500 pounds ASTM D-4268 testing.
   c. Melting point: 330°F.
   d. Progressive strength loss occurring at: 200°F.
   e. Resistant to: Chemical and limited ultraviolet corrosion, anticipated physical wear.
   f. Diameter: 3/4"
   g. Color: White

B. Sand: Provide dry clean sand in referenced bags, free of foreign matter, weighing approximately 90# per cubic foot dry.

C. Factory Finishing Colors: Refer to Section 11 61 00 for finishing requirements.

D. Signage:
   1. Refer to Section 11 61 00 for signage requirements.
2.05 SOURCE QUALITY CONTROL

A. Work on the systems may be reviewed at the point of manufacture a minimum of one time during fabrication. This review will occur during the final factory checkout prior to shipping, unless the Manufacturer and Architect agree on a more advantageous inspection date.

2.06 SUPPLEMENTARY

A. Furnish equipment and hardware in addition to the items specified previously that are necessary to provide a fully working system in conformance with the intent of the Contract Documents.

PART 3 EXECUTION

3.01 ERECTION, INSTALLATION AND APPLICATION

A. Refer to Section 11 61 00 for execution requirements
B. Trim sets to provide horizontal track and batten set-up.
C. Align the center of each batten with the center line of the proscenium opening.
D. Counterweight Guide Tracks:
   1. Locate a complete battery of guide tracks against the stage wall as indicated on the drawings. Extend tracks from the stage floor to the underside of the headblock beam and certify vertical.
   2. Splice joints in proper alignment free of burrs and irregularities.
   3. Align vertically and horizontally by means of slot holes punched in the fixtures at the mounting and adjusting locations. Achieve final rigid adjustment by use of lock washers.
   4. Install guide track system to ensure compliance with the performance requirements of this Section and Section 11 61 00.
E. Install the locking rail with appropriate connections and accessories. Install to conform with required loading conditions.

3.02 CONSTRUCTION/RIGGING

A. General:
   1. Rig the counterweight system to allow battens to reach the maximum height above the stage floor based on arbor travel and an average low trim of 4'-0" above the finished floor.
   2. Rig arbors such that, unless otherwise indicated in the documents, the dead load of the arbor is even with the floor of the loading gallery.
   3. Immediately inform the Architect of conflicts between trim height, obstructions, and arbor capacities.
   4. Rig other loads as specified in the Contract Documents.
B. Block Connection:
   1. Align blocks as required by the Drawings and accompanying schedules. Conform alignment to the requirements set forth herein.
   2. Secure blocks as per accepted mounting design. Where connection device contact is not uniform, employ shims. Perform mounting to ensure blocks are securely attached to the support structure and are immobile except by intentional user action.
   3. Configure underhung loft block alignment to use the idler sheaves in logical sequence.
C. Fiber Rope Connection and Reeving:
   1. Purchase Line Employ rope fastenings which develop not less than 75% of the manufacturer's rated breaking strength of the rope employed.
   2. Reeve typical linesets with the specified wire rope for the lift lines and 3/4" synthetic rope for the purchase lines.
   3. Employ one continuous length of rope for each purchase line. The lengthening, joining or repairing of two or more sections of rope is prohibited. Mid-line splices are unacceptable.
4. Dead tie line with a thimble at the top of the arbor and two half hitches. Finish free end with two (2) serrated, self locking nylon cable ties, which should completely and neatly align rope dead end to live end. Trim ties after tightening. Whip the free end then cut. Pass the line up and over the headblock, down through the rope lock, under the tension block and tie off at the underside of the arbor, employing the same method of attachment as described above. Finish synthetic lines per manufacturer’s recommendations.

5. Adjust the length of the line after initial stretch to ensure proper function of the tension block.

D. Counterweights: Balance battens hung with permanent attachments (connector strips, traveler tracks, etc.).

3.03 DRAPERY AND TRACK INSTALLATION
A. Install draperies as supervised by the 11 61 43 Contractor.
B. Install drapery track and motors as supervised by the 11 61 44 Contractor.

3.04 ADDITIONAL INSTALLATION
A. Index Strip Lights:
   1. Suspend fixtures level and perpendicular to the proscenium wall, and to in no way interfere with the systems and equipment referred to in this Contract.
   2. Wire the strip light into the work light circuits to provide independently switched blue and white circuits.
   3. Locate the fixture illuminating the lock rail. Securely attach outriggers for the support of the lamp fixture to the wall.

B. Cable Management: Install electrical cable management as specified herein, and/or as indicated on the drawings.
C. Belaying Pins: Install belaying pins in all available pinrail locations.
D. Signage:
   1. Install signage employing mechanical fasteners.
   2. Install signage as described in 1161 00.
E. Counterweights:
   1. Store 80% of unused counterweights on the onstage side of the loading gallery, split between loading gallery elevations.
   2. Store 20% of unused counterweights on the onstage side of the rigging fly gallery.

3.05 TESTING, DEMONSTRATION AND INSTRUCTION
A. Refer to Section 11 61 00 for requirements.

3.06 MANUALS, DEMONSTRATION AND INSTRUCTION
A. Provide a total of twelve (12) hours of training on this equipment. Training may occur in conjunction with other systems under this contractor’s scope over multiple days.
B. Training shall be scheduled at a time agreed upon by the owner, and may not be concurrent with system commissioning and testing.
C. Provide instruction and maintenance manuals pursuant to Section 11 61 00

3.07 EQUIPMENT AND COMPONENT SCHEDULES
A. See Drawings

END OF SECTION
SECTION 11 61 37
PROSCENIUM FIRE SAFETY CURTAIN

PART 1 GENERAL

1.01 SUMMARY

A. Provide a Proscenium Fire Safety Curtains System made of approved materials constructed and mounted so as to intercept hot gases, flames and smoke, and to prevent a glow from a severe fire on the stage from showing on the auditorium side within a period of 30 minutes. The closing of the curtain from the full-open position shall be affected in less than 30 seconds, but the last 8 feet (2438 mm) of travel shall not require less than five seconds.

B. Section Includes:
   1. Provision of materials, components, modifications, assemblies, equipment and services as specified herein. These include:
      a. Verification of site dimensions and conditions.
      b. Submission of Shop Drawings signed and sealed by a licensed Professional Engineer experienced in work of similar nature and scope and licensed in the state of Installation.
      c. Engineering of equipment and systems as required by the Contract Documents.
      d. Manufacture of equipment and systems as required by the Contract Documents.
      e. Scheduling, sequencing and coordination with other trades.
      f. Site supervision of equipment and systems installation specified herein and elsewhere in the Contract Documents.
      g. Testing and demonstration of equipment and systems as specified herein and elsewhere in the Contract Documents.

C. Provide systems including:
   1. Electrically powered Proscenium Fire Safety Curtain including smoke pockets and controls.
   2. Additional support structures as required to meet the intent of the Contract Documents.
   3. Provide devices and components that are NEMA and UL approved for the applications. Wiring and electrical service shall be performed by a licensed electrician and conform to applicable codes.
   4. Provide electrical curtain release systems and associated detectors, control panels and components which are compliant with NFPA 72 National Fire Alarm Code for Local Fire Alarms and Remotes Stations Fire Alarm Systems and approved by Underwriters Laboratories for the applied use.

D. Related Sections:
   1. Division 1: General and Supplementary Requirements.
   2. Division 3: Concrete.
   3. Division 4: Masonry.
   4. Division 5: Metals.
   7. Division 11: Equipment.
      a. 11 61 00: Performance Machinery General Requirements.
      b. 11 61 33: Performance Manual Rigging
   8. Division 23: Mechanical.
   10. Division 28: Electronic Safety and Security

1.02 SYSTEM DESCRIPTION

A. Performance Requirements:
1. Section 11 61 00 establishes minimum safety requirements for the system. Where Federal, State and Local Legislation address these topics, the more stringent requirements take precedence. Factors listed below in no way relieve this Contractor from the sole responsibility of providing safe systems. The minimum standards for construction and installation shall meet or exceed the requirements of the International Building Code (per project), NFPA 80 – 20 (2016), and ANSI E1.22 (2009) except as modified by these specifications. Where standards requirements conflict, the construction shall conform to the following order: Federal, State, and Local Legislation; Applicable Project Building Code; NFPA 80; ANSI E1.22; these specifications.

2. Provide curtain, hoist, and counterweight arrangement as noted on the drawings. Contractor may, at his discretion, provide an alternate configuration with Architect’s approval, and provide it meets the performance requirements noted herein.

3. Provide the curtain to hang, in raised position, above the most critical sight line from the end seat of the first row of auditorium seats. Provide the smoke seals not more than 6" above the proscenium opening on the stage side of the proscenium wall in such a manner as to not interfere with the operation of the Proscenium Fire Safety Curtain. Configure to contact top seal and batten when curtain is in the lowered position.

4. Provide the fixed speed hoist to raise the Proscenium Fire Safety Curtain under powered control and lower the curtain by both powered control or automatic release. An alternate hoist configuration will be acceptable at the discretion of the contractor’s Professional Engineer, and as approved by the Architect provided it meets the intent of the Contract Documents.

5. The hoist shall achieve a 30 fpm. rate of speed when raising curtain. Provide the hoist in an electrohydraulic configuration so that the motive force is solely electrical and the hydraulic systems are employed solely to govern the descent speed of the Curtain. Provide the hoist with proper guarding and enclosures with appropriate access panels for maintenance; enclosure should not interfere with the operation of the fire safety curtain or any other system.

6. Provide a damper for checking the free emergency descent of the curtain. Calibrate damper to retard the last eight feet (8'-0") of fall as to require not less than five seconds and with the full closure cycle requiring not more than thirty seconds with the curtain settling to the floor without shock. Damper shall be activated by the number of hoist drum revolutions. Provide damper with calibrated signage to permit calculated adjustment of descent. The damper shall in no way prevent the Curtain from achieving a complete closed seal.

7. Secure the hoist to withstand anticipated loads imposed by the system and as required by applicable codes, legislation and conventions. Do not interfere with or obstruct the operation or safety of any other systems present. Provide the hoist and mounting structure to minimize lateral and resultant forces developed by the system from being transmitted to the facility structure.

B. Provide assemblies, cable components, connections, equipment, hardware and linkages employed in supporting, in whole or in part, overhead loads that are rated and designed for that application. Base loading for each component on the maximum percentage of the capacity of the set in which the component is employed. Base the set capacity on the weight of the battens, curtain and supporting elements inclusive of an imposed wind load of two (2) pounds per square foot (95.8Pa) over the entire area of the curtain.

C. Provide mule blocks, rollers and guides as required to provide proper alignment and maintain allowable fleet angles.

D. Provide systems designed to reflect safeguards and precautions related not only to normal use of the equipment under ideal operating and loading conditions but, additionally, to anticipate equipment misuse, human error, and misjudgment. Design and intent parameters set forth herein in no way relieve this Contractor from responsibility or liability arising from the Work.

1.03 INTEGRATION WITH BUILDING ALARM SYSTEM

1. Alarm system actuation by Proscenium Fire Safety Curtain
   a. Coordinate with the fire alarm contractor to provide an interface to notify the alarm system of an emergency closure of the Proscenium Fire Safety Curtain.
b. Integrate a temporary override in the alarm activation system such that the Proscenium Fire Safety Curtain emergency release may be tested on a regular basis without triggering a full building alarm event. Override must be accessible to end users without access to the fire alarm panel.

2. Proscenium Fire Safety Curtain actuation by Fire Alarm
   a. When the building alarm system is composed of addressable notification devices, provide an interface to actuate a fire curtain release only when an alarm is triggered in the stage zone.
   b. Unless specifically required by the Authority Having Jurisdiction, the Proscenium Fire Safety Curtain should not be actuated by an alarm initiated outside of the stage and/or audience zone.
   c. Coordinate device actuation requirements with fire alarm contractor.

1.04 SUBMITTALS
   A. In addition to submittals required under Division 1, provide manufacturer’s data and certification of compliance

1.05 WARRANTY
   A. Special Warranty:
      1. Warrant systems and equipment to be free of defective components, faulty workmanship and improper adjustment for a period of two years from the date of Final Acceptance. Paint and exterior finishes are excluded relative to failure due to unusual exposure. Replace items showing evidence of defective materials or workmanship (including installation workmanship) within thirty (30) days after notification. Make replacements without cost to the Owner. Rectify conditions that might present a hazard to human life, well-being and or property within 48 hours of notification.
      2. Designate warranties on manufactured equipment to the Owner on the date of system acceptance.

1.06 MAINTENANCE
   A. Maintenance Service: Provide maintenance service for a period of one year after Final Acceptance. This service consists of at least two half-yearly visits to the site for checking and adjusting of equipment. Perform the first visit six months after the system has been accepted. Arrange visit to be at a time mutually agreeable to the Owner and Contractor.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Provide the rigging systems from components (except where otherwise stated) that are the products of one of the following manufacturers:
      2. H&H Specialties Inc., South El Monte, CA.
      3. Texas Scenic, San Antonio, TX
   B. Bearings:
      1. Dodge/Reliance Electric Corp., Cleveland, OH
      2. FAG Bearings Corp., Stamford, CT.
      3. Timken Co., Canton, Ohio.
   C. Cable and chain connection hardware:
      1. Chicago Hardware and Fixture Company, Chicago, IL.
      2. Columbus McKinnon Corporation, Chain Division, Amherst, NY.
      3. Cooper Industries, Campbel Chain Division, Inc., NC.
      4. The Crosby Group, Inc., Tulsa, OK.
   D. Compression sleeves:
      2. National Telephone Supply Company, Cleveland, OH.
   E. Fire Curtain Control Panels:
1. Fire-Line Alarms, Northford, CT.
2. Honeywell, Inc., Morris Township, NJ

F. Guide tracks:
   1. Unistrut Corporation, Atkore International, Harvey, IL
   3. Automatic Devices Co. (ADC), Allentown, PA.

G. Wire Rope:
   1. Refer to current QPL-83420 for qualification certified manufacturers.

H. Proscenium Fire Safety Curtain:
   1. W.E. Palmer Company
   2. Newtex Industries, Inc.
   3. Thermotex Industries, Inc.

2.02 MATERIALS

2.03 MANUFACTURED UNITS
   A. Blocks: Refer to Section 11 61 00, Performance Machinery Basic Requirements for performance criteria.
   B. Drums and Sheaves: Refer to Section 11 61 00, Performance Machinery Basic Requirements for performance criteria.
   C. Proscenium Fire Safety Curtain:
      1. Fabric
         a. The fabric used for this curtain shall be 2-1/2 lb. per square yard, nickel-wire inserted, 100% glass yarn fabric, coated on both sides with a special high temperature coating. Wire may be omitted if contractor can substantiate by approved tests that the curtain meets or exceeds all applicable requirements.
      2. Construction
         a. The Fire Safety Curtain shall have a finished size so that it will overlap the proscenium opening 18 inches on each side and 24 inches at the top, and store above the proscenium opening in a minimum amount of space.
         b. A 3-inch yielding pad of non-combustible material shall be installed at the base of the curtain to form a seal against the stage floor. Smoke seal “flap” shall be provided at curtain top edge to bridge the gap between curtain top and proscenium wall. Curtain top edge shall be suspended from overhead roof steel.
         c. For unframed curtains, provide roller guides at each side of curtain to guide the curtain along a guide track. Guides must be attached 18-inch O.C. to reinforced curtain edges. Run guide tracks within the smoke pockets, between the roof steel and the stage floor.
         d. For framed curtains, provide brass knife guides at each side of curtain to guide the curtain along a guide track. Guides must be directly supported to the frame. Run guide tracks within the smoke pockets, between the roof steel and the stage floor.
      4. Unacceptable: Untested fabrics or fabrics incorporating asbestos.
   D. Smoke Pockets
      1. Construct smoke pockets of required structural steel supports and steel plate to form a C shape at each side of the proscenium arch.
2. Locate the pocket such that it cannot be seen from the audience. Extend the pocket from the stage floor to a height of 1'-0" above the top of the raised fire safety curtain or to the grid or roof steel whichever is less.

3. Incorporate a steel track channel in which the curtain roller guides engage.

4. Anchor the pocket to the proscenium wall as required to meet the force requirements described herein.

5. Provide one smoke pocket at each side of the proscenium arch.

E. Pipe Battens:

1. Provide typical pipe battens of seamless black wrought steel pipe as specified in herein. Provide splices from sleeved tubing arranged so the spliced batten equals or exceeds the strength of the continuous batten material. Secure splices using removable, appropriately rated threaded fasteners in a fashion that no part of the fastener extends beyond the batten surface by more than ½". Arrange splices to ensure batten deflection in any span does not exceed the deflection of a continuous batten of equal span under the loading criteria specified herein.

F. Batten Hanging Devices:

1. Provide one type of batten hanging device within the system as described below.

2. Batten Clamps:
   a. Provide connections to each lift line turnbuckles by removable steel clamps which encircle the complete circumference of the batten and allow for direct connection to the jaw of the turnbuckle. Employ appropriately rated fasteners with locking devices for connections.
   b. Configure the devices to each resist the complete loads of both adjacent spans with the additional imposed impact factors. Configure the devices to resist rotation of the batten with a load of 30 pounds per linear foot of the longest adjacent span applied at 12 inches horizontally from the section’s centroid.
   c. Configure devices so that the bottom and sides do not exceed the diameter of the batten by more than one batten diameter. Configure devices so that no sharp edges or corners greater than 45 degrees are presented.
   d. Mark clamps pursuant to OSHA 29 CFR 1926.251(a)(4).

3. Trim Chain:
   a. Provide 36-inches long fabricated from ¼-inch alloy, specifically designed for overhead lifting applications. Provide chain that is rated to resist the complete loads of both adjacent spans with the additional imposed impact factors.
   b. Wrap chain 1 ½ times around the batten and terminate with appropriately rated and installed hardware. Provide appropriately rated fasteners and hardware with locking devices for connections.
   c. Provide chain that is compatible with industry-recognized chain hardware. Chain link size shall match the Welded Steel Chain Specifications for Grade 30 Proof Coil Chain as specified by the National Association of Chain Manufacturers.
   d. Provide chain that is stamped with the manufacturer’s identifying mark.
   e. Provide chain that is lot traceable, with a coded date stamp on each piece of trim chain.
   f. Provide chain and connection devices specifically designed for overhead lifting as defined to OSHA (29 CFR 1926.251).
   g. The use of hardware not designed for connections in overhead lifting, such as bolts used as safety devices, will not be accepted.
   h. Provide certification of compliance from the manufacturer for the intended application.

G. Rate of Rise Detectors: Provide UL listed rate of rise detectors as required by the authority having jurisdiction. Rate of temperature rise of 15-20 degrees F. per minute shall cause the actuators to transmit a signal to the release system; initiating the Curtain's descent. Detectors shall continue to function in the event of a facility power loss. In addition to providing the systems as described, this Contractor is responsible for all wiring, termination and containment of detectors.

2.04 COMPONENTS

A. See Section 11 61 00 for Additional Component Requirements.
B. Rigging Lines:
   1. Suspend lifted elements by wire ropes, unless specified otherwise herein. Determine the classification of wire rope construction to suit the system operational requirements. Unless specifically required in the Contract Documents, the Contractor's engineer shall determine the classification.
   2. Employ continuous lines from the same spool/length, free of knots, splices or mechanical fasteners along their length unless specifically required otherwise in the Contract Documents. Do not employ damaged or deformed cables. Excluding prefabricated systems excluded, cut cable at the site from the manufacturer's spool.
   3. Wire Rope: Refer to Section 11 61 00.

C. Chains: Proscenium Fire Safety Curtain Safety Chains: 7/32" min. Grade 80 Chain, or meeting the requirements of Trim Chain as specified herein.

D. Fusible Links: Double eye links for loads up to 30 lbs at 160°F. Underwriters Laboratories approval required.

2.05 FACTORY FINISHING COLORS:
   A. Finish all non bearing ferrous metals in enamel red, excepting smoke pockets which shall be painted flat black.
   B. Do not paint cable bearing surfaces, fasteners, aluminum or galvanized materials and products.

2.06 SIGNAGE:
   A. Provide signage per Section 11 61 00.
   B. Provide signage affecting safety in accordance with ANSI Z535.2 Environmental And Facility Safety Signs including annexes.
   C. Signage shall be legible both in construction and grammar. Sign surfaces and characters shall be textured or otherwise treated to minimize glare and veiling reflectance.
   D. Provide signage in English.
   E. Employ printed or stenciled characters. Handwritten characters are not acceptable.
   F. Wall mount diagrams depicting the system layout and maximum load limitations (drawn not less than 1/4"=1'-0") in a protective transparent faced frame on the stage wall near the locking rail and near the loading gallery entrance as to be plainly visible, and as not to interfere with the operation of the system.
   G. Provide, adjacent to each Proscenium Fire Safety Curtain pull ring box, in plain view, a painted metal sign with 3" high white sans serif characters on a red background; bearing the inscription: "IN CASE OF FIRE, PULL RING TO LOWER PROSCENIUM FIRE SAFETY CURTAIN" with an indicator clearly pointing to the location of the ring. Character minimum height 0.840" sans serif.
   H. Label the Proscenium Fire Safety Curtain control box: "PROSCENIUM FIRE SAFETY CURTAIN HOIST CONTROL IN CASE OF EMERGENCY USE PULL RING BOXES" in white sans serif characters on a red background. Character minimum height 0.840" sans serif.
   I. In locations agreed to by the Architect, provide signage at the lock rail, loading gallery, grid iron identifying all pertinent hazards, avoidance procedures and consequences. In addition to safety requirement.

2.07 SOURCE QUALITY CONTROL
   A. Work on the systems may be reviewed at the point of manufacture a minimum of one time during fabrication. This review will occur during the final factory checkout prior to shipping, unless the Manufacturer and Architect agree on a more advantageous inspection date.

2.08 SUPPLEMENTARY
   A. Furnish equipment and hardware in addition to the items specified previously that are necessary to provide a fully working system in conformance with the intent of the Contract Documents.
PART 3 EXECUTION

3.01 ERECTION, INSTALLATION AND APPLICATION
   A. Refer to Section 11 61 00 for execution requirements
   B. Install curtain, track, winch, and other required components.

3.02 CONSTRUCTION/RIGGING
   A. Rig other loads as specified in the Contract Documents.
   B. Drum and/or Block Connection:
      1. Align drums and/or blocks as required by the Drawings and accompanying schedules. Conform alignment to the requirements set forth herein.
      2. Secure drums and/or blocks as per accepted mounting design. Where connection device contact is not uniform, employ shims. Perform mounting to ensure blocks are securely attached to the support structure and are immobile except by intentional user action.
      3. When used, configure underhung loft block alignment to use the idler sheaves in logical sequence.

3.03 ADDITIONAL INSTALLATION
   A. Signage: Install signage employing mechanical fasteners.

3.04 FIELD QUALITY CONTROL
   A. Reviews:
      1. Final review will be made by the Architect or his appointed representative, following receipt in writing or notification from this Contractor that the installation is completed. If review reveals details of construction, fabrication, or installation not in strict accord with the Contract Documents, approval will be withheld and Contractor shall be given thirty days to replace the rejected items with those conforming to specification requirements. In addition to the final review of various equipment components the right of review is reserved during the course of the installation. The Architect or his appointed representative and will be allowed access to materials at the site for eventual incorporation in the work. Preliminary visits shall not be construed as eliminating the possible rejection of various components during the final review detailed above.
      2. The completed installation of rigging equipment with draperies properly installed shall be tested and operated for the acceptance by the Architect and Authority having jurisdiction by the Contractor prior to acceptance.
      3. At the time of inspection, provide written, notarized certification that materials and methods employed, including connections, meet or exceed the requirements of the Contract Documents and applicable laws and regulations.
      4. The Contractor is completely and solely responsible for any testing required by the Architect and authorities having jurisdiction to ensure compliance with the Contract Documents and applicable laws and regulations.

3.05 MANUALS, DEMONSTRATION AND INSTRUCTION
   A. Provide a total of four (4) hours of training on this equipment.
   B. Provide 3 copies of an instruction and maintenance manual which includes:
      1. Contractor’s and principal Manufacturer’s contact information.
      2. System description.
      3. Safety instructions and warnings.
      4. Operation Instructions.
      5. Maintenance and inspection instructions, procedures and schedules.
      7. Product literature for components employed in the system.
      8. Reduced shop drawings of this part of the project.
      9. Recommended spare parts listing.
10. Final inspection reports.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. The tension wire grid consists of frames supporting a woven wire rope tension grid. The grid shall provide a serviceable walking surface for technical personnel for access to and hanging locations for performance lighting and performance equipment.

B. Section Includes:
   1. Provisions as required under Division 1.
   2. Verification of site dimensions and conditions.
   3. Submission of Shop Drawings signed and sealed by a licensed Professional Engineer experienced in work of similar nature and scope and licensed in the State of installation.
   4. Engineering of equipment and systems as required by the Contract Documents.
   5. Manufacture of equipment and systems as required by the Contract Documents.
   6. Scheduling, sequencing and coordination with other trades.
   7. Site supervision of equipment and systems installation specified herein and elsewhere in the Contract Documents.
   8. Testing, demonstration, and certification of equipment and systems as specified herein and elsewhere in the Contract Documents.

C. Provide a tension wire grid system consists of:
   1. Fixed steel frames supporting a woven wire rope tension grid spanning the dimensions provided in the drawings.
   2. Modular woven wire panels in the shape and configuration shown on the drawings.
   3. Support hangers from ceiling structure.
   4. Fixed and operable railings.
   5. Kickrails
   7. Installed and loose lighting pipe.
   8. Pipe connection accessories.
   9. Hanger and grid bracing as required by the contractor’s engineer.
   10. Components, labor and elements necessary to complete the system as specified in the Contract Documents.
   11. Signage

D. Related Sections:
   1. Division 1: General and Supplementary Requirements.
   2. Division 3: Concrete.
   3. Division 4: Masonry.
   4. Division 5: Metals.
   7. Division 11: Equipment.
      a. 11 61 00: Performance Machinery General Requirements.
      b. 11 61 43: Performance and Acoustic Draperies.
      c. 11 61 44: Performance Drapery Track
   8. Division 23: Mechanical.

1.02 SYSTEM DESCRIPTION

A. Performance Requirements:
1. Section 11 61 00 establishes minimum requirements for the system. Where Federal, State, Local Legislation and consensus standards address these topics, the more stringent requirements take precedence.

2. Cables, fittings, load bearing components - Minimum Safety Factor: 8 or 75% impact factor, whichever is greater.

3. Steel: 1/5 of yield.

4. Loading Criteria
   a. Grid Floor Live Load: See drawings.
   b. Allowable Concentrated Load: Per drawings, and concentrated on a 1’-0” square area.
   d. Maximum Cable deflection: 3” under 300# concentrated load.
   e. Allowable uniform and concentrated loads shall be non-concurrent.
   f. Maximum grid panel self-weight (dead load): 5psf, including frame, cable, and grid panel hardware.

5. Provide assemblies, cable components, connections, equipment, hardware and linkages employed in supporting, in whole or in part, overhead loads that are rated and designed for that application.

6. Provide systems designed to reflect safeguards and precautions related not only to normal use of the equipment under ideal operating and loading conditions but, additionally, to anticipate equipment misuse, human error, and misjudgment. Design and intent parameters set forth herein in no way relieve this contractor from responsibility or liability arising from the Work.

B. Design Requirements:
   1. Grid panels shall be designed to resist all horizontal loads associated with the design of the panel frame structure. No horizontal loads shall be imposed upon the building except for seismic loads and sway loads caused by the movement of personnel on the grid.
   2. Grid panel frames shall not exceed 2” in depth or width, except as noted on the drawings.
   3. The wire rope walking surface shall be factory tensioned and connected to the modular frame.
   4. The wire rope walking surface shall be located no more than ¼” from the top of the modular frame.
   5. Frame design shall not allow shearing or sharp bending of the wire rope walking surface.
   6. Grid panels shall be fabricated in the pattern to match the structure above.
   7. Grid panels shall facet in elevation at the points noted on the drawings to follow the elevation changes of the support structure.
   8. Cables shall be configured to align with adjacent panels.

1.03 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

B. Coordinate work with other trades doing adjoining work to assure proper fit, installation and first class results.

C. Protect grid components from corrosion, deformation, and other damage during delivery, storage, and handling.

1.04 SUBMITTALS

A. In addition to submittals required under Division 1 and Section 11 61 00, for items listed herein, provide manufacturer’s data and certification of compliance.

B. Shop Drawings
   1. Submit complete fully dimensioned, large-scale detailed fabrication drawings of all major components. Drawings and schedules shall show all information necessary to explain fully the design features, appearance, function, fabrication, installation, and use of system components in all phases of operation. All drawings shall be signed and sealed by a licensed Professional Engineer experienced in work of similar nature and scope and licensed in the State of installation.

C. Product Data. Submit catalog or standard data sheets for component parts as part of the shop drawing submittal. The data shall include all information which indicates compliance with the specifications.
herein. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information.

D. Calculations: Supply calculations demonstrating compliance with performance requirements and design criteria, including analysis data. Calculations shall be signed and sealed by a licensed Professional Engineer experienced in work of similar nature and scope and licensed in the State of installation. At a minimum, the analysis data shall demonstrate:
   1. Distribution of cable forces to the perimeter frame members based on relative stiffness of perimeter frames and wire ropes using non-linear analysis methods.
   2. Analysis of wire rope conforming to ASCE 19-10 Structural Applications of Steel cables for Buildings.
   3. Analysis of modular frame corner and internal connections as per AISC 360 Chapter K - Design of HSS Box Member Connections.

1.05 SAMPLES
   A. Samples of any or all items listed below shall be sent within thirty (30) days to the Architect or Designee as directed.
   B. The Architect or Designee reserves the right to make an examination of the samples as he may consider necessary to determine their quality and compliance with the specification, even to the destruction of the sample.
   C. Samples for submission include:
      1. Tension Grid Panel, minimum 1-0” x 1-0”. (300mm x 300mm)
      2. Sample shall be provided in the shape or proportion of the specified panel.
      3. Other items as deemed necessary by the Architect.
      4. In lieu of sample submission, Contractor may arrange for the Owner, Architect or Designee to visit completed work of similar scope at existing installations.
   D. Samples shall be shipped to a location selected by the Architect for evaluation.

1.06 SIGNAGE
   A. Provide signage conforming to requirements in 11 61 00.
   B. Provide 8x11 fire retardant polymer signs at each grid access locations.
   C. Provide signage that includes:
      1. Maximum Live Load
      2. Maximum Point Load
      3. Identification of all pertinent hazards, voidance procedures, and consequences associated with this equipment.

1.07 WARRANTY
   A. Special Warranty:
      1. Warrant systems and equipment to be free of defective components, faulty workmanship or improper adjustment for a period of two years from the date of Owner's acceptance. Paint and exterior finishes are excluded. Replace items showing evidence of defective materials or workmanship (including installation workmanship) within thirty (30) days after notification. Make replacements without cost to the Owner. Rectify conditions that might present a hazard to human life, well-being and or property within 48 hours of notification.
   B. Designate warranties on manufactured equipment to the Owner on the date of system acceptance.

1.08 MAINTENANCE
   A. Maintenance Service:
      1. Provide maintenance service for a period of one year after final acceptance of the installation. This service consists of at least two half-yearly visits to the site for checking and adjusting of equipment.
2. Perform the first visit sixty days after the system has been accepted. Arrange visit to be at a time mutually agreeable to the Owner and Contractor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide the tension grid panels that are the fabricated by one of the following manufacturers.
   Manufacturer inclusion does indicate acceptance of any deviations to the performance specifications noted herein.
   1. InterAmerica Stage, Inc, Sanford, FL
   2. Slingco America, Inc, Fayetteville, GA
   3. Hall Stage, Luton, United Kingdom
   5. Texas Scenic Company, San Antonio, TX.

B. Cable and chain connection hardware:
   1. Chicago Hardware and Fixture Company, Chicago, IL.
   2. Columbus McKinnon Corporation, Chain Division, Amherst, NY.
   3. Cooper Industries, Campbell Chain Division, Inc., NC.
   4. The Crosby Group, Inc., Tulsa, OK.
   6. JR Clancy, Syracuse, NY.

C. Lighting Pipe Accessories
   1. City Theatrical, Carlstadt, NJ
   2. The Light Source, Charlotte, NC
   3. Altman Lighting, Yonkers, NY
   4. JR Clancy, Syracuse, NY.

D. Compression sleeves:
   2. National Telephone Supply Company, Cleveland, OH.

E. Wire Rope:
   1. Refer to Section 11 61 00, Performance Machinery Basic Requirements.
   2. End fittings shall be pressed stainless steel ball.
   3. 50% of wire rope terminations shall be proof tested to one half of the minimum cable breaking strength. Certification of this testing shall be provided with the O&E materials.
   4. It shall be possible for a technician to use a standard hand swaging tool to repair any grid wire without removing any grid frame or component.
   5. Wire Rope Color: Black

2.02 MATERIALS

B. Steel Shapes and Plates: ASTM A36 - Structural Steel

2.03 ACCESSORIES

A. Swivel Pipe Coupler:
   1. Provide coupler with fixed screws and wing nuts for fastening pipes at varying angles, and fitting pipes between 1.25” Nom (1.66” O.D.) to 1.5” Nom (1.9” O.D.)
   2. Provide couplers that are finished matt black.
   3. Acceptable Products:
      a. Swivel Coupler, The Light Source
      b. Multiple Angle Swiveling Clamp, Altman Lighting

B. 90 Degree Pipe Coupler:
1. Provide coupler with fixed screws and wing nuts for fastening pipes at 90 degree angles, and fitting pipes between 1.25” Nom (1.66” O.D.) to 1.5” Nom (1.9” O.D.)
2. Provide couplers that are finished matt black.
3. Acceptable Products (Initial Layout):
   a. Mega-Coupler, The Light Source
   b. Mega Grid Lock Pipe Clamp, The Light Source
   c. Cross Grid Connector, JR Clancy
   d. Right Angle Clamp, Altman Lighting
4. Acceptable Products (Spare):
   a. Mega-Coupler, The Light Source
   b. Right Angle Clamp, Altman Lighting

2.04 FINISHES
A. Apply one coat (2 mils minimum) of High Performance Alkyd Metal Primer, and two coat of High Performance Protective Acrylic. Primer coat to be applied immediately after cleaning and pretreating.
B. Color: Matte Black

2.05 COMPONENTS
A. See 11 61 00 for component requirements.
B. Fasteners: Fasteners shall be rated for the anticipated loads. Provide fasteners with approved markings indicating their rating. Provide fasteners with a vibration resistant or positive locking design. Provide fastener system's components of equal ratings.
C. Factory Finishing Colors: Refer to Section 11 61 00 for finishing requirements.
D. Signage:
   1. Provide 8x11 fire retardant signs at each grid access locations.
   2. Provide signage that includes:
      a. Maximum Live Load
      b. Maximum Point Load
      c. Identification of all pertinent hazards, voidance procedures, and consequences associated with this equipment.
   3. Provide an engraved black lamacoid plaque, with white characters 3/8” high. Install as directed by the Design Consultant, adjacent to each entrance to the grid
   4. Refer to Section 11 61 00 for additional signage requirements.

2.06 SOURCE QUALITY CONTROL
A. Work on the systems may be reviewed at the point of manufacture a minimum of one time during fabrication. This review will occur during the final factory checkout prior to shipping, unless the Manufacturer and Design Consultant agree on a more advantageous inspection date.

2.07 SUPPLEMENTARY
A. Furnish equipment and hardware in addition to the items specified previously that are necessary to provide a fully working system in conformance with the intent of the Contract Documents.

PART 3 EXECUTION

3.01 EXAMINATION
A. Refer to Section 11 61 00 for execution requirements
B. Verification of Conditions:
1. Examine work prepared by others to receive work of this Section and report defects affecting installation to the Construction Manager for correction. Commencement of the work shall be construed as complete acceptance of preparatory work by others. The inspection includes but is not limited to:
   a. Assurance mounting surfaces are ready to accept the Work.
   b. Verification of flatness, plumb and level of mounting conditions.
   c. Inspection of components of the Work to ensure no damage has occurred during shipping or storage.
2. Discrepancies:
   a. In the event of discrepancies, immediately notify the Design Consultant.
   b. Do not proceed with the installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 PREPARATION
A. Verify field measurements at the site prior to installation and modify the system accordingly.
   1. Deliver equipment to the site only after the building has been closed in.
   2. Coordinate storage at the site and ensure the materials and components are undamaged.
   3. Protect the surrounding environment from damage by the Work.
B. Surface Preparation:
   1. Clean surfaces as necessary prior to commencing the Work.

3.03 ERECTION, INSTALLATION AND APPLICATION
A. Field construct and install tension grid system.
   1. Install prefabricated panels in to support structure above. Make necessary adjustments and modifications to insure satisfactory installation.
   2. Field verify material routing and access to theatre.
   3. Install items plumb, straight, square and level in location indicated on the contract documents and as shown on approved shop drawings.
   4. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints.
   5. Installation practices shall be in accordance with OSHA Safety and Health Standards and all local codes.
   6. All welding must be performed in full compliance with the latest edition of the Structural Welding Code (ANSI/AWS D1.1).
   7. Coordinate support to structure with Division 5.
   8. All finishes which are disturbed during shipping and installation shall be touched up to match the original finish.
B. Install lighting pipes as indicated on drawings. Spare materials shall be stored at grid level.
C. Signage:
   1. Install signage employing mechanical fasteners.
   2. Install signage as described in 11 61 00.

3.04 FIELD QUALITY CONTROL
A. Reviews:
1. Final review will be made by the Design Consultant or his appointed representative, following receipt in writing or notification from this Contractor that the installation is completed. If review reveals details of construction, fabrication, or installation not in strict accord with the Specification and Contract requirements, approval will be withheld and Contractor shall be given thirty days to replace the rejected items with those conforming to specification requirements. In addition to the final review of various equipment components the right is reserved to inspect during the course of the installation, and to be allowed access to materials at the site for eventual incorporation in the work. Preliminary inspection will not be construed as eliminating the possible rejection of various components during the final inspection detailed above.

2. The completed installation, properly installed, shall be load tested for the acceptance by the Design Consultant by the Contractor prior to acceptance.

3.05 TESTING, DEMONSTRATION AND INSTRUCTION
   A. Refer to Section 11 61 00 for requirements.
   B. Provide a total of four (4) hours of training on this equipment.
   C. Training shall be scheduled at a time agreed upon by the owner, and may not be concurrent with system commissioning and testing.
   D. Provide instruction and maintenance manuals pursuant to Section 11 61 00

3.06 EQUIPMENT AND COMPONENT SCHEDULES
   A. See Drawings for quantities, dimensions and configuration.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Performance lifts include fixed speed lifting systems. The system shall be operated by a unified programmable control system and include mechanical and electronic limits, safety devices and integrate safety devices on to fascias. Finished flooring, fascia surfaces, power and trim are not included in this section. Specific lift dimensions and travels are indicated on the drawings.

1. Section includes materials, components, modifications, assemblies, equipment and services as specified herein. These include, but are not limited to:
   a. Verification of site dimensions and conditions.
   b. Submittals as required by the Contract Documents.
   c. Engineering of equipment and systems as required by the Contract Documents.
   d. Design and Shop Drawings, engineered, signed and sealed by a Professional Engineer licensed to practice by the appropriate governing authority in which the Work is installed.
   e. Manufacture of equipment and systems as required by the Contract Documents.
   f. Scheduling, sequencing and coordination with other trades.
   g. Site supervision of equipment and systems installation specified herein and elsewhere in the Contract Documents.
   h. Testing and demonstration of equipment and systems as specified herein and elsewhere in the Contract Documents.

B. Provide Work including:
   1. Orchestra pit lift platform.
   2. Low profile electro-mechanical drive lifting mechanisms inclusive of brakes, motors, gearboxes and connecting devices, motors, starters and connection to power disconnect.
   3. Additional bracing, guides and support structure specific to the system
   4. Vertical barrier net along the upstage edge of the lift with accompanying storage trough at the Machinery Level.
   5. Temporary, removable access ladder to equipment and maintenance pit.
   6. Appropriate framing, substructure and sleepers for the connection of the finished flooring, fascia panels, and trim.
   7. Mechanical, electrical, and electronic limiting devices and safety systems for the positioning and coordination of the lift system.
   8. Safety devices integrated into removable railing system at audience level and on lift platform.
   9. Programmable control system, including control cable and receptacle plates.
   10. Accessories.
   11. Additional systems and support structures as required to meet the intent of the Contract Documents.

C. Products furnished under this section and installed under Division 26
   1. Motor Control Panel
   2. Specialty backboxes as required for the operation of the system. Standard boxes and conduit are excepted from this.
   3. Multiconductor cable for the purpose of providing power and control from the floor to the lift platform.
   4. Specialty control cable or multiconductor cable as required for the operation of the lift.
   5. Low voltage and line voltage disconnects at motor and otherwise as required to meet applicable codes and legislation.

D. Related Sections:
   1. Division 1: General and Supplementary Requirements.
   2. Division 2: Sitework.
3. Division 3: Concrete.
4. Division 4: Masonry.
5. Division 5: Metals.
7. Division 8: Doors and Windows.
8. Division 9: Finishes.
   a. 11 61 00: Performance Machinery General Requirements.
   b. 11 61 61: Performance Dimming and Controls.
10. Division 23: Mechanical.
11. Division 26: Electrical.

1.02 SYSTEM DESCRIPTION

A. Section 11 61 00 establishes minimum safety requirements for the system. Where Federal, State and Local Legislation address these topics, the more stringent requirements take precedence. Factors listed below in no way relieve this Contractor from the sole responsibility of providing safe systems. The minimum standards for construction and installation shall meet or exceed the requirements of the Applicable Project Building Code (per project) and ANSI E1.42 (2016) except as exceeded by these specifications. Where standards requirements conflict, the construction shall conform to the following order: Federal, State, and Local Legislation; Applicable Project Building Code; ANSI E1.42; these specifications.

B. Lifting systems shall fit completely within the perimeter of the lift platform. Lifts requiring penetrations in the bearing floor, other than that required for mounting and power supply, are not acceptable.

C. Lifting mechanism shall use electrical motors, drives, and other non-fluid powered equipment to perform lifting.

D. The lifting mechanism shall be inherently self locking at any elevation within the specified load range without supplementary mechanical interlocks.

E. Lifts must be powered to move.

F. The control station shall allow for operation via a portable pendant from connections at the stage and pit platform. The control system shall be configured to reflect the preset lift elevations per the contract documents. The system shall incorporate user accessible feedback of system activities. The system shall incorporate limits on lift motion as well as direct relation to safety interlock systems. The control system shall provide for repeatability of programmed states.

G. The safety interlock system shall provide feedback to the control system through addressable pressure sensitive, optical and mechanical interlock switches. Switching shall provide for limiting access when system is in use, overload cut off, prevention of shearing and crushing hazards, and motion elimination during hazardous conditions, such as earthquakes. The safety system shall report current conditions of activated sensors and switches to the operating console. The control pendant shall govern lift action based on specific sensor activation.

H. Provide a local control system comprised of a local logic processor, sensors, limits, feedback and external communication features.

I. Performance Requirements:
   1. The following is to establish minimum safety requirements for the system. Where Federal, State and Local Legislation address these topics, the more stringent requirement takes precedence. Factors listed below in no way relieve this Contractor from sole responsibility of providing a safe system.
      a. Load bearing components - Minimum Safety Factor: 3
      b. Maximum member deflection: L/360.
      c. Lift Floor Framing Level: .125” in a 10'-0" radius circle.
      d. Sustaining capacity: 150 PSF + self load.
      e. Lifting capacity: 50 PSF + self load + dynamic forces.
f. Concentrated Load Static or Dynamic: 1000 pounds in a 3'-0" square area.
g. Lift speed: Per Drawings
h. Maximum depth of lift in down position finished floor to top of finished lift floor: 3'-0".
i. Maximum Variation Between Preset Lift Surface Elevation and Adjacent Horizontal Surface: .125".
j. Maximum Tolerance Between Lift Edge and Adjacent Surface: 0.375".
k. Maximum Deviation From Plumb in X and Y Axes throughout Travel: 0.125".
l. Position Locking: Self Locking at all elevations within designated travel.
m. Leveling precision: ± 1/8" repeatability
n. Lift system shall be capable of continuous operation under full lifted load for a minimum of one hour.
o. Maximum Gap between finished lift floor and adjacent fixed floor: 0.314".

2. Provide guides, bracing and accessories as required to maintain proper alignment and movement.
3. This Contractor is in no way relieved from the primary responsibility to provide a safe, fully functional system.
4. The safety parameters set forth herein are intended to reflect minimum safeguards and precautions related not only to normal use of the equipment under ideal operating and loading conditions but, additionally, to anticipate equipment misuse, human error, and misjudgment. These parameters in no way relieve this Contractor from responsibility or liability arising from the Work.

J. Operational Requirements:
1. Powered lift movement shall only be possible after unlocking a keyswitch.
2. The principle means of controlling lift movement will be through a portable hand held pendant type controller, located at stage level.
3. The control system shall be programmed with the necessary data to ensure that the lift may be stopped at each of the preset positions shown in the drawings. Accommodate infinite intermediate stops by allowing the operator to de-energize the system movement control circuit; without requiring resetting.
4. The lift shall start, stop and run smoothly and quietly without excessive shutter, vibration or jerking.
5. On operation of the controls, the lift will only move in the direction intended.
6. Motor brake shall only be released when the motor is intentionally powered up and shall be engaged at all other times.

K. Sensing / Switching Parameters:
1. Unless specifically required otherwise, switching and sensing terminating lift motion shall require that the situation causing the termination be rectified before lift motion may be restarted. Start and restart of lift motion shall require deliberate action by the operator.
2. Provide sensors and switches so as not to intrude on aesthetic or functional qualities of the facility and lift system.
3. Protect sensors and switches from damage by system failures and activation.
4. Provide Emergency STOP switches as required.
5. Emergency STOP switches shall interface with central control system.
6. Operator contact switches for controlling motion of the lift shall be of the momentary contact type. Release of pressure on the switch shall cause lift motion to stop.
7. Provide continuous protection for lift edges and surfaces which have the potential of developing situations of entrapment, shearing, crushing, jamming or similar situations which may result in bodily injury, damage or destruction to property. Activation of such sensing shall cause the lift to immediately cease motion, but allow for motion in the reverse direction in order to clear the obstruction. Provide the system to ensure the response time is sufficient to prevent injury and damage from occurring. In the event that additional sensors are activated during the reverse motion, the lift motion shall be completely stopped.
8. Provide door interlocks for all doors adjacent to the lift area. Provide sensor / interlock to prevent:
   a. Opening of doors adjacent to lift zone to be opened when lift system is energized.
   b. Operation of the lift when a door adjacent to the lift zone is open.
9. Provide emergency release devices on door interlocks.
a. Provide a mushroom-style Emergency Stop switch on the pit side of the door to allow proper egress in an emergency situation. Mushroom switches should be illuminated any time the associated door lock is engaged.

b. Provide a keyed override switch on the exterior of the door. Keys for switch should match between all overrides and controls. Provide a minimum of two keys for each switch location.

10. Provide sensing to detect overloading. Where lifting capacity is exceed, the operation of the lift will not be permitted and feedback shall be reported to the control panel. In lieu of mechanical overload detection, the contractor may, at his discretion, provide current monitoring within the system such that a current draw above the initial surge required to move the lift at maximum capacity will prevent motion of the lift.

11. Provide overtravel limit switches, which when activated shall immediately cause the lift to stop.

12. Provide sensing to prevent lift motion in the event that the guide tracks are obstructed.

13. Provide closed loop telemetry to the control system allowing absolute positioning and status identification of the lift.

14. Provide position feedback to 11 61 61 contractor of lift location to automatically illuminate safety edge light.

L. Occupant Notification:

1. Provide an audible warning not less than 10db higher than the anticipated ambient noise, in accordance with applicable legislation. Activation of the lift shall cause the warning to sound. Provide the control station with a per use override for the warning.

2. Provide visible indicators, such strobes or rotating beacons to provide notice of lift movement to the hearing impaired. Provide the control station with a per use override for the visible beacon. Coordinate type and location of the beacon with legislative authorities and the Architect.

3. Overrides for visual and audible notifications should be capable of being used simultaneously. Overrides will reset to normal condition following a power cycling of the controller, or unplugging and re-plugging the hand held pendant.

1.03 WARRANTY

A. Special Warranty:

1. Warrant systems and equipment to be free of defective components, faulty workmanship or improper adjustment for a period of two years from the date of Final Acceptance. Paint and exterior finishes are excluded. Replace items showing evidence of defective materials or workmanship (including installation workmanship) within thirty (30) days after notification. Make replacements without cost to the Owner. Rectify conditions that might present a hazard to human life, well-being and or property within forty eight (48) hours of notification.

2. Designate warranties on manufactured equipment to the Owner on the date of Final Acceptance.

1.04 MAINTENANCE

A. Maintenance Service:

1. Provide maintenance service for a period of two years after Final Acceptance of the installation. This service consists of at least two half-yearly visits the first year, and a third visit the second year to the site for checking and adjusting of equipment. Perform the first visit six months after the system has been accepted. Arrange visit to be at a time mutually agreeable to the Owner and Contractor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Lift Systems
   1. GALA Systems Corp, St. Hubert, Quebec.
   2. SERAPID U.S.A., Inc, Sterling Hts, MI

B. Sensors and switches:
   1. Allen - Bradley Co., Milwaukee, WI.
2. Bircher Reglomat, Elk Grove, IL.
3. General Electric, Co., Plaineville, CT.
4. Mitsubishi International Corp., Bensenville, IL.
5. Square D Co., White Plains, NY.
6. Tapeswitch Corp., Farmingdale, NY.

C. Logic Control Systems:
1. Allen - Bradley Co., Milwaukee, WI.
2. Honeywell Inc., York, PA.
3. Mitsubishi International Corp., Bensenville, IL.

D. Bearings:
1. Dodge/Reliance Electric Corp., Cleveland, OH
2. FAG Bearings Corp., Stamford, CT.
3. Timken Co., Canton, Ohio.

E. Motors / Brakes and Gearing:
1. Eurodrive, Co., Bridgport, NJ.
2. Baldor Electric Company, Fort Smith, AR
3. TECO-Westinghouse Corp., Round Rock, TX.

2.02 MANUFACTURED UNITS

A. Control Systems:
1. Control Cabinet
   a. Provide a central control cabinet housing logic control, relays, transformers, contactors, starters, drives, safety systems and other elements required by the system control. Provide the cabinet to occupy the minimal space possible.
   b. Provide the cabinet with an integral disconnect.
   c. Provide the cabinet with an emergency Stop switch.

2. Limit Switches
   a. Top overtravel limit shall not operate until lift is at least 1" above normal top limit and bottom overtravel limit shall not operate until lift is at least 1" below normal bottom limit.
   b. Provide overtravel switches located on the lift guides and actuated by adjustable strikers on the lift structure. Neatly install and conceal from public view switches, strikers, wiring and conduits behind removable access panels.
   c. Provide switches and strikers to resist mechanical damage and abuse and to only be adjusted by use of tools.
   d. Provide overtravel limit switches of the slow action normally closed types.

3. Safe Edges
   a. Provide lift edges, lift fascia edges and adjacent fixed floor shear edges with safe edges configured to stop the lift and prevent injury to personnel or damage to equipment. If site inspection reveals any unanticipated toe or finger traps, provide additional safe edge devices as necessary unless these dangers can be removed by other means.
   b. Install safe edges on the underside edges of the surrounding floor, lift structure and fascia panels. Install as close as possible to the edge they are protecting.
   c. Connect safe-edge sections such that fail safe operation is maintained. Disconnection or damage to any part of the safe edge system shall indicate a fault and no lift motion will be possible.
   d. Unless specified otherwise, safe edges may be custom designed suspended steel sections operating limit switches, tape switches, fibre optic sensors or optical detectors provided that their integrity is continuously monitored while the lift controls are powered and any fault condition renders the lift inoperable.
   e. Provide continuous safe edges with no gaps. If joints are unavoidable then configure these joints so that the safe edge is effective across the joint. In employment of suspended steel section safe edges, do not exceed .25" between sections.
f. Where curved safe edges are indicated, provide smooth radiuses; without kinks or sharp bends, which closely follow the edge they are protecting without discontinuities.
g. Install safe edges with mechanical fasteners to resist anticipated wear and abuse. Glue or staple fixing is not acceptable.
h. Install safe edges on the surrounding floor and fixed fascias to be fitted after the finished floor and fascias are complete.
i. Provide safe edge devices sufficiently sensitive to prevent bodily injury or property damage, but able to withstand damage due to everyday use.

4. Emergency Stop Switches
a. Provide Stop switches as indicated on the drawings, and as required by authorities having jurisdiction. Integrate emergency stop system with other powered rigging systems located on and around the stage. Depressing of another system’s emergency stop switch shall stop lift motion, and in turn, depressing the lift’s emergency stop switch shall stop other hoist motion.
b. Provide red mushroom head Emergency Stop Switches with press to operate, twist to release mechanism. Operation shall disconnect power to lift by opening line contactors wired prior to the starter/reversing contactor.
c. Emergency door release switches shall illuminate continuously at any time the associated door lock is engaged.
d. Clearly label Stop buttons with the words STOP LIFT.

B. Lift Table Structure
1. Provide a platform subfloor configured to mount on lifting mechanisms and to support the finished floor and anticipated loadings. Provide the support framework of rolled or extruded steel or aluminum sections.
2. Provide framing floor joists on a minimum of 24” centers, perpendicular to the upstage wall of the stage. Ensure tops of all joists are accurately level within the tolerances specified in the Contract Documents.

C. Lifting Mechanism
1. Provide fixed structures for the support of lifting elements, transmission components, motors and guides. Obtain approval from the Architect for connections to structural and architectural elements.
2. Provide lifting mechanisms that are inherently self sustaining under anticipated load condition and which do not exhibit creep or settlement over extended time.
3. Provide lifting mechanism to permit sufficient lift travel at top and bottom for operation of overtravel limits and deceleration following failure of normal limits.
4. Provide oil tight drip trays beneath potential sources of leaks or spills to prevent oil contaminating floors or equipment.

D. Guide System
1. Provide the lift with guides to prevent lateral movement. Provide guide rails and shoes to ensure lateral stability to the platform throughout its travel without restricting vertical motion.
2. Provide tolerance between shoe and guide rail so as not to allow perceptible horizontal motion of the lift but to compensate for slight misalignments of guides or thermal expansion. Ensure that guides cannot bind or drag.
3. Do not employ guide systems requiring lubricant on guide tracks for proper operation. Protect guides from corrosion under normal indoor environmental conditions.
4. Provide guides capable of withstanding malfunctions of the lift.
5. Conceal guide tracks and guides from public view behind removable panels, with a slot open for the guide arm sized to allow anticipated movement while presenting a minimum exposure of the guide track.

E. Vertical safety net
1. Provide a safety net on the upstage, underside of the lift deck which extends to the floor of the machinery level. When the lift is at the stage floor level, hang the safety net within 3” of the upstage edge of the pit lift deck to prevent personnel and equipment from falling into the machinery level. When the lift is at the orchestra pit level, collect the safety net in a trough mounted at the machinery level.
F. Fascia Panels Support
   1. Provide steel tube frames as required for the installation of fixed fascia panels. Coordinate size, shape, and placement of frames with panel manufacturer.

G. Guide Track Covers Support
   1. Provide framing as required for the installation of guide track covers for each track.
   2. Guide track covers shall in no way inhibit the operation of the lift. Track covers shall cover the complete track with the exception of the area proximate to the lift guide arm and shoe.

H. Signage
   1. Provide signage affecting safety in accordance with ANSI Z535.2 Environmental And Facility Safety Signs including annexes.
   2. Signage shall be legible both in construction and grammar. Sign surfaces and characters shall be textured or otherwise treated to minimize glare and veiling reflectance.
   3. Wall mount diagrams depicting the system layout and maximum load limitations(drawn not less than 1/4"=1'-0") in a protective transparent faced frame on the stage wall near the Operator Control Station as to be plainly visible, and as not to interfere with the operation of the system. Provide an additional diagram adjacent to the Motor Control Panel.
   4. Labels: Self adhesive labels, reflective yellow characters on a black background. Characters Provide an engraved black lamacoid plaque, with white characters .375” next to the loading diagrams. Engrave a warning on the plaque cautioning against unauthorized and untrained personnel operating the system.
   5. Provide and fix in position a lamacoid loading notice located on DSR proscenium wall adjacent to the Operator Control Station. Letter in 1” high sans serif typeface lettering in white on green background:-
      (xxx = insert appropriate load in LBS)
      ORCHESTRA LIFT
      NO UNAUTHORIZED OPERATION
      DO NOT EXCEED
      MAXIMUM LOADS
      xxx LBS LIFTING
      xxx LBS STATIC
      EVENLY DISTRIBUTED
   6. Provide metal plates, at least 3” high, affixed to outside of control cabinet and to lift structure as follows:
      Manufacturer's Name, Address
      Telephone and Fax Number
      Year Of Installation
      Maximum Lifting and Static Loads
      Speed

2.03 SUPPLEMENTARY
   A. Provide equipment and hardware in addition to the items specified previously that are necessary to provide a fully working system in conformance with the intent of the Contract Documents.

PART 3 EXECUTION

3.01 DELIVERY
   A. Materials within this contract will be delivered by the contractor to the project site.
   B. Equipment furnished under Division 11 61 39 for installation by Division 26 will become the responsibility of the Division 26 Contractor at such time that the Division 26 Contractor takes possession of the equipment from the 11 61 39 contractor.
      1. At this time the Division 26 Contractor will document the exact condition, breakage or damage evident in the equipment.
2. Exact quantities will be documented.
3. Discrepancies in the quantities and damage or unsuitability of the product for the application will be provided in writing to the 11 61 39 contractor upon transfer of the equipment.
4. Acceptance of the equipment verifies proper physical condition of the product. Electrical functionality is not implied at acceptance and is not the responsibility of the Division 26 Contractor.

3.02 ERECTION, INSTALLATION AND APPLICATION

A. Install Lift, Control System, Safety systems, and other systems as required by the Contract Documents.
B. Interface
   1. Coordinate with the Division 26 Contractor in accordance with the contract documents.
   2. Coordinate with removable railing manufacturer and other trades to integrate required sensors.
   3. Contract documents are diagrammatic and indicate general arrangement of systems and work included.
   4. Follow drawings in laying out work and check drawings of other trades relating to work to verify spaces in which work is installed.
C. Activate lift and demonstrate over full travel before flooring work commences.
D. Prior to installation of finished flooring, demonstrate that the top steel surfaces of the platforms comply with the specified tolerances.
E. Coordinate the installation of surrounding areas of flooring with others to ensure that the lift is level with the fixed flooring in adjacent elevations.
F. Coordinate the installation of conduits, work light luminaries, receptacles, sound boxes, loudspeakers and associated cables with other contractors.
G. Adjust and align guide rails then lock securely in position before finished flooring, fascias and edging are installed.
H. Trim to provide horizontal lift set-up.

3.03 SUPERVISION OF INSTALLATION

A. Provide instruction and supervision to the Division 26 Contractor as it pertains to the installation of these systems. Provide the necessary personnel for coordination meetings and site visits prior to installation of systems.

3.04 INSPECTION & TESTS

A. Clearly record the date, time, details and results of all the following tests and demonstrations and any subsequent re-tests. This will form the start of a system log book to be handed over to the user after acceptance together with operation and maintenance manuals.
B. Inspect the completely assembled lift system including all mechanisms, fittings, control panels, and other equipment, and make good all deficiencies before declaring that the system is complete.
C. Demonstrate compliance with tolerances specified in the Contract Documents.
D. Take measurements of lift structure in unloaded state.
E. Measure deflection with approved instruments.
F. Verify speed, noise and stability compliance with the Contract Documents.
G. The complete electrical installation shall be tested and commissioned in accordance with the IEE Wiring Regulations.
H. Before and after installation of flooring and fascias demonstrate full lift motion in both directions.
I. Comprehensively verify the accuracy of positioning of the lift approached from both directions at the each preset levels.
J. Demonstrate controls, indicators, interlocks, visual and audible notification devices and safe edges comply with the Contract Documents.
K. The following tests should be performed as directed by the Architect or Consultant
   1. Demonstrate motion with full specified dynamic payload.
   2. With lift fully loaded, perform motor current checks. Test drive unit including the effect of a loss of
      one or more phases, of reduced voltage and of phase reversal. Test mobile control box and all
      indicators. Record results of all tests.
   3. Provide weights for the duration of the tests and any subsequent retesting. Test weights may be
      purpose made, sealed, stackable plastic containers filled with water in place on the platforms and
      drained after use or other approved test weights. Provide verification that the correct test load is
      provided.

L. Provide 14 days notice of all tests so that the Design Consultant or his representative may witness such
   tests.

M. Provide demonstration and testing as required to obtain certification by the applicable legislative
   authority. This Contractor is solely responsible for obtaining such certification and all costs arising
   therefrom. Certification is a condition of final payment.

3.05 DEMONSTRATION AND INSTRUCTION
   A. Provide a total of eight (8) hours of training on this equipment. Training shall be scheduled at a time
      agreed upon by the owner, and may not be concurrent with system commissioning and testing.

END OF SECTION
PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special Supplementary General Conditions, Supplementary Conditions and Division 1 Specifications, apply to this Section.

1.02 SUMMARY

A. Performance and acoustic draperies include fabric assemblies and related connection devices required for visual masking, decoration, and scenic effects on the stage. Fabric assemblies and associated connection devices used for acoustical treatment of the performance space(s) are included in this section.

B. Section Includes:

1. Materials, components, modifications, assemblies, equipment and services as specified herein. These include, but are not limited to:
   a. Verification of site dimensions and conditions.
   b. Submittals as required by the Contract Documents.
   c. Engineering of equipment and systems as required by the Contract Documents.
   d. Manufacture of equipment and systems as required by the Contract Documents.
   e. Scheduling, sequencing and coordination with other trades.
   f. Site supervision of equipment and systems installation specified herein and elsewhere in the Contract Documents.
   g. Testing and demonstration of equipment and systems as specified herein and elsewhere in the Contract Documents.

C. Products Furnished but Not Installed Under This Section:

1. Products, materials and assemblies described herein shall be furnished to the Performance Rigging Contractor for coordination and installation.

2. Furnish draperies and accessories including:
   a. Two panel velour Grand Drape.
   b. Velour Grand Valance.
   c. Velour Masking Borders.
   d. Velour Masking Legs.
   e. Two panel velour Blackouts.
   f. Scrims
   g. Cyclorama.
   h. Acoustic Control Drapes.

D. Related Sections:

1. Division 1: General and Supplementary Requirements.
2. Division 11: Equipment.
   a. 11 61 44: Drapery Track Systems.
   b. 11 61 33: Performance Rigging.

1.03 SUBMITTALS

A. Provide scaled drawings noting drapery panel sizes, hems, pleats, and construction details. Drawings to be scaled no smaller than \(\frac{1}{4}'' = 1'\) = 0".

B. In addition to submittals required under Division 1, provide
   1. Color swatches of proposed material for Drapery.
   2. Samples of each type of drapery material no smaller than 6" x 6".
3. Following color choice by architect, submit a 6'-0" wide x 8'-0" tall mock-up of Grand Drape, including webbing, grommets, weighted chain, and lining, constructed as specified in this document.

1.04 SYSTEM DESCRIPTION
A. Construct draperies to present decorative and functional finishes. Drapery construction shall reflect the standard of care, dimensional, acoustic and aesthetic requirements specified herein and elsewhere in the Contract Documents.
   1. Flameretardancy
      a. Provide materials that are flameretardant throughout to conform to NFPA 701 (2004) as well as other applicable Local, State, Province and Federal codes.
      b. Where required below, provide Inherently Flame Retardant (IFR) fabrics.
      c. For non-IFR fabrics, flameproof in accordance with the recommendations of manufacturers DuPont, Monsanto, or accepted equal. Materials submitted showing evidence of sprayed flameproofing is unacceptable. Employ non-hydroscopic, non-crystalline agents in the flameproofing process. Flameproof fabrics by immersion for compliance with applicable codes. Perform flameproofing in a manner to minimize stiffness in the fabric. Flameproof all fabrics prior to drapery fabrication. Provide certification of flame proofing.
   2. Construct draperies to withstand and compensate for reasonable variations in environmental conditions up to 65% relative humidity, normal wear and tear and usage.

1.05 WARRANTY
A. Special Warranty:
   1. Warrant systems and equipment to be free of defective components, faulty workmanship or improper adjustment for a period of two years from the date of Final Acceptance. Replace items showing evidence of defective materials or workmanship (including installation workmanship) within thirty (30) days after notification. Make replacements without cost to the Owner. Rectify conditions that might present a hazard to human life, well-being and or property within 48 hours of notification.
   2. Designate warranties on manufactured equipment to the Owner on the date of Final Acceptance.

1.06 MAINTENANCE:
A. Maintenance Service: Provide maintenance service for a period of one year after final acceptance of the installation. This service consists of at least two half-yearly visits to the site for checking and adjusting of equipment. The first visit occurring six months after the system has been accepted. Arrange visit to be at a time mutually agreeable to the Owner and Contractor.
B. Extra Materials: Provide 30% of the total quantity of tie lines and clips. Provide three (3) square yards of each fabric type employed for use as patching.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. The following are accepted component Manufacturers:
   1. Fabrics and materials:
      a. K-M Fabrics, Inc, Greenville, SC.
      c. JL deBall, America, Inc, New York, NY.
   2. Cable and chain connection hardware:
      a. Chicago Hardware and Fixture Company, Chicago, IL.
      b. Columbus McKinnon Corporation, Chain Division, Amherst, NY.
      c. Cooper Industries, Campbell Chain Division, Inc., York, PA.
      d. The Crosby Group, Inc., Tulsa, OK.
2.02 MATERIALS

A. Fabrics: Employ fabrics of one color from the same dye lot. Employ fabrics with no split widths for drapes with fullness, and no less than ½ widths for drapes sewn flat. Flame retard non-Inherently Flame Retardant (IFR) fabrics prior to fabrication.

1. Cotton Velour:
   a. Material: 100% cotton, 25 OZ per linear yard based on a 54" width
   b. Backing Ends Per Inch: 40
   c. Pile Ends Per Inch: 40
   d. Picks Per Inch: 32
   e. Pile Tufts Per In.: 640
   f. Approx. Pile Height -Thousandths: 135
   g. Basis of Design – KM Mills Memorable
   h. Masking drapery color: Black
   i. Grand drapery color: Custom color TBD By Architect during the submittal process.
   j. Acoustical drapery color: Custom color TBD By Architect during the submittal process.

2. Cotton Velour Acoustical Drape Backing:
   a. Material: 100% cotton, 16 OZ per linear yard based on a 54" width
   b. Backing Ends Per Inch: 44
   c. Pile Ends Per Inch: 22
   d. Picks Per Inch: 34
   e. Pile Tufts Per In.: 640
   f. Approx. Pile Height -Thousandths: 105
   g. Basis of Design – KM Mills Princess
   h. Acoustical Drape Color: Match Face Velour.

3. Cotton Lining:
   a. Material: 100% cotton, Ranger Cloth, 12 OZ per linear yard prior to dyeing and flameretarding based on a 54" width.
   b. Thread Count: 96x60
   c. Color: Black

4. Sharkstooth Scrim:
   a. Material: 100% cotton, 26 OZ linear yard based on a 30'-0" width.
   b. Thread Count: 8 twisted pairs/vertical inch, 22 twisted pairs/ horizontal inch
   c. Color: as per schedule.

5. Filled "leno" Cyclorama:
   a. Material: 100% cotton, 3.75# linear yard based on a 29'-0" width.

6. Paging Handles: Double layered canvas of a dark or matching color of face fabric, sewn to lining and blind stitched to face fabric.

B. Components:

1. Webbing Cotton Drapes: 3-1/2" wide preshrunk jute webbing.
2. Webbing – Synthetic Drapes: 4" Polyester webbing weighing not less than 2.8 oz per yard.
3. Grommets:
   a. Number 3 (7/16" hole diameter) black anodized grommets.
   b. Applicable specification: NASM16491.
4. Hook and Loop Fasteners:
   a. Black woven nylon flame retardant 1" wide fasteners.
   b. Applicable Specifications:
      1. MOV Safety Standard 30
      2. FAA 2853(A) & (B).
5. Thread: Air entangled, oval cross section 100% Locked filament polyester.
   a. Size: Tex 60
   b. Approximate Denier/Ply: 695x1
   c. Approximate strength: 6.8 pounds.
d. Approximately yardage: 7,000 yards/pound.
e. Approximate melting point: 260°C – shall not support combustion.

C. Accessories
2. Tie Lines: Solid braided black "venetian blind" or mason cord NO 4-1/2 (9/64" DIA)
3. Drapery Pocket Battens
   b. Scrim and Cyclorama: 1" nominal Schedule 40 Seamless Black Steel Pipe.

2.03 MANUFACTURED UNITS
A. Sewing and Fabrication:
1. Table drapery, as removed from bolts, across an inspection window for detecting weaving flaws and imperfections. Remove and do not incorporate detected flaws. Sew all draperies nap down.
   Construct fabrics and draperies as specified herein, unless otherwise noted.
2. Unless specified otherwise herein, sew fabrics with polyester filament cotton wrapped Tex 60 thread in a running interlock stitch and not less than seven stitches per inch.
3. Construct draperies with the center of the center panel of fabric on the centerline of the drape.
4. Fabricate the fabric panels to run the height of the various sections without horizontal seams. Box pleat at the top in the fullness listed, exclusive of turnback facing. Sew pleats on the face side of the drapery and reinforce across the top with jute webbing. Sew the webbing to the top of the drapery with two runs of stitching using a double needle machine with 1/2" needle spacing and heavy industrial thread on 2.75" spacing. Locate grommets in the center of the webbing width so no horizontal stitching is cut or severed. Locate grommets on each pleat on 12" centers. Employ matching thread throughout.
5. Double grommet the upper corners of each traveler section. Precisely arrange to fit double chains of master carriers regardless of whether drapery section is used right or left stage.
6. Provide full length drapery items operating from traveler tracks with nickel plated oblong spring carabiner type clips fastened in place by means of heavy nylon strap double stitched to webbing. Provide other drapery with tie lines for attachment to rigging. Employ black cotton solid braided "venetian blind" or mason cord No. 4-1/2 (9/64" DIA), 36" long, knotted and tied as tie lines.
7. Sew bottom hems 6" deep with full length items containing weighting chain in a separate pocket inside the bottom hem with chain being held 3" above extreme bottom of curtain (except where pipe batten weights are called out).
8. Lining:
   a. Provide lining of the same fullness as the face drape. Sew lining under the same webbing with the face fabric at the top and inside the bottom hem of the face fabric at the bottom. Integral shrinkage tucks equal to 6" per 15' height of the finished curtain shall be sewn into the lining to allow for vertical adjustment due to shrinkage.
   b. Attach the face fabric and lining loosely on the sides at the turnbacks with interlocking loops and a vertical 1" webbing. Provide loops on 9" centers along the full height of the drape, starting at the bottom hem. Provide same number of shrinkage tucks in vertical webbing as are provided in the lining fabric.
9. Fabricate so that the bottom edge of the face fabric and lining is within .25" parallel with the top edge of the drapery, for true hanging across full width.
10. Fabricate so that all panel vertical seams are continuous and even, without picks, bunching, or noticeable deviations.

B. Construction:
1. House Main Curtain (Grand Drape):
   a. Fabricate the Grand Drape from fabric indicated in two lined panels to provide for bipart action. Finish each panel to the dimensions and fullness indicated on the Drapery Schedule.
b. Face back the center edges of each panel with a 2/3 width of fabric. Finish the center edges with a double thickness of material and, in order to prevent billowing and rolling, hand-tack their entire height with three rows of continuous catch stitching spaced four inches apart. Stop the lining at the edge of this turnback and secure in place as described herein.

c. Provide paging handle on the back leading side of each panel and one on the offstage edge of each panel. Locate the handle 42” AFF and secure to the face material with a blind stitched canvas gusset.

d. Fabricate the bottom of each panel with a 6” double-turned hem with chain inserted in a separate pocket 3” above the floor and placed inside the hem.

e. Face back the offstage edges of each panel with at least 12” of fabric.

2. House Main Valence:
   a. Fabricate the Main Valence from fabric indicated. Finish each panel to the dimensions and fullness indicated on the Drapery Schedule.
   b. Face back the sides of each panel with at least 12” of fabric. Stop the lining at the edge of this turnback and secure in place as described herein.
   c. Fabricate the bottom of each panel with a 6” double-turned hem.

3. Split Blackout Drop:
   a. Provide each panel with fabric indicated and finished to the dimensions indicated in the Drapery Schedule.
   b. Face back the center edges of each panel with 6” side hems. Finish the center edges with a double thickness of material. If lined, stop the lining at the edge of this turnback and secure as described herein.
   c. Fabricate the bottom of each panel with a 6” double-turned hem.

4. Masking Legs, Borders and Tabs:
   a. Provide each panel with fabric indicated and finished to the dimensions and fullness indicated in the Drapery Schedule.
   b. Face back the sides of each panel with at least 4” of fabric. If lined, stop the lining at the edge of this turnback and secure in place as described herein.
   c. Fabricate legs with a 6” double turned bottom hem.
   d. For flat-sewn drapery, provide a separate pocket for removable 1/2” ID pipe battens inside this hem. Line batten pocket with #8 canvas duck.
   e. For drapery with fullness, sew a weighted chain inside the bottom pocket of full length drapes.
   f. Reinforce tops with webbing with brass grommets 12” OC and double grommets at both ends. Secure to batten with black 36” NO 4 black cotton tie lines.

5. Scrims and Cyclorama:
   a. Fabricate the scrims and cyclorama from seamless panels of fabric indicated herein finished to the dimensions indicated in the Drapery Schedule.
   b. Reinforce the top with webbing. Provide brass grommets and tie lines 12” OC. Provide double grommets at the ends.
   c. Fabricate the drapes with a 4” triple hem. Include a continuous duck lace pocket for a 1” ID pipe batten, triple stitched to the top of the hem so as to position the batten 1.25” above the bottom.
   d. Fabricate Cyclorama sides with 2” double turned hems and reinforced grommets 24” o.c.

6. Rear Projection Screen:
   a. Fabricate the rear projection screen from seamless panels of material indicated herein finished to the dimensions indicated in the Drapery Schedule.
   b. Reinforce the top with webbing. Provide brass grommets and tie lines 12” OC. Provide double grommets at the ends.
   c. Fabricate the screen with a 4” hem. Include a continuous pocket for a 1” ID pipe batten, weld to the top of the hem so as to position the batten 1.25” above the bottom.
   d. Fabricate sides with 2” double turned hems and reinforced grommets 24” o.c.

7. Acoustic Drapery:
a. Fabricate the face drape from fabric indicated in panels to provide for action described in Schedules and Drawings. Finish each panel to the dimensions and fullness indicated on the Drapery Schedule.
b. Face back the sides of each panel with at least 4” of fabric. If lined, stop the lining at the edge of this turnback and secure in place as described herein.
c. Fabricate the bottom of each panel with a 6” double-turned hem with chain inserted in a separate pocket 3” above the floor and placed inside the hem.
d. Face back the leading edges of each panel with at least 12” of fabric.
e. Fabricate with the nap facing down.
f. Where backing velour is used, provide hook and loop fasteners on the interior leading and trailing seems and at intermediate points to ensure facing drape and backing drape operate as a single unit. Arrange fasteners as to not be visible to the audience.

8. Acoustic Drape – Backing Velour:
   a. Provide each panel finished to the face dimensions indicated in the Drapery Schedule.
   b. Finish backing draperies without pleats, fullness or linings.
   c. Sew a weighted chain inside the bottom pocket
   d. Fabricate with brass grommets and ties attached to the jute webbing on 12” centers. Attach two adjacent grommets at the ends of the panels. Attach backing velour to same carriers as face velour.
   e. Fabricate with the nap facing the audience chamber.

C. Signage:
   1. Signage shall be legible both in construction and grammar.
   2. Mark the centerline of the jute webbing with indelible marker. Use a white tie line on the centerline grommet.
   3. Sew a white fabric label on the upper right and left corners of the webbing of the drape with the following information:
      a. Item Name
      b. Item Number.
      c. Dimensions.
      d. Fullness.
      e. Date of Manufacture.
      f. Three (3) blanks for flame retarding renewal dates (Non-IFR).
      g. Manufacturer.

D. Accessories
   1. Storage Hampers
      a. Provide rolling storage hampers of steel construction covered in heavy canvas. Base should be reinforced and constructed of wood or metal. Provide 4 – 3” minimum diameter swivel casters.
      b. Provide each hamper with minimum ½” plywood lid
      c. Provide each hamper with 4 loose caster “donuts” to allow stacking of hampers.
      d. Hamper Size: 19 bushel. Hamper must be able to fit through a standard 3’-0” wide door.
      e. Provide additional hampers as indicated in the Drapery and Accessory Schedule.

2. Drapery Storage Bags
   a. Provide storage bag constructed from canvas or polyester.
   b. Provide 1 storage bag for each stage drapery (except Grand Drape and Grand Valence), scrim, and cyclorama, sized appropriately for that drape.

E. Drapery Pipes
   1. Where legs and borders are sewn flat, provide a ½” pipe batten for each at the specified width of the drape.
   2. Provide a 1” pipe batten for each scrim and cyclorama.


**2.04 SOURCE QUALITY CONTROL**

A. Tests and Inspection:
   
   1. Work on the systems may be inspected at the point of manufacture a minimum of one time during fabrication. This inspection will occur during the final factory checkout prior to shipping, unless the Manufacturer and Design Consultant agree on a more advantageous inspection date. In lieu of a visit to the point of manufacture, the Consultant reserves the right to request and receive additional test reports and samples pertaining to the work as well as video tape of the work in progress. Costs arising from samples and video demonstration of the work in progress shall be borne by the Contractor.

**2.05 SUPPLEMENTARY**

A. Provide equipment and hardware in addition to the items specified previously that are necessary to provide a fully working system in conformance with the intent of the Contract Documents.

**PART 3 EXECUTION**

**3.01 DELIVERY**

A. Coordinate with the Performance Rigging Contractor to ensure the scope of this section is furnished and installed as required herein.

B. Coordinate delivery and installation.

**3.02 FIELD QUALITY CONTROL**

A. Supervise on-site installation of the Work.

B. Inspections:
   
   1. Final inspection will be made by the Architect or his appointed representative, following receipt in writing or notification from this Contractor that the installation is completed. If inspection reveals any detail of construction, fabrication, or installation not in strict accord with the Specification and Contract requirements, approval will be withheld and Contractor shall be given thirty days to replace the rejected items with those conforming to specification requirements. In addition to the final inspection of various equipment components the Architect reserves the right of inspection during the course of the installation, and he will be allowed access to materials at the site for eventual incorporation in the work. Preliminary inspection will not be construed as eliminating the possible rejection of various components during the final inspection detailed above.

**3.03 DEMONSTRATION AND INSTRUCTION**

A. The Contractor shall arrange and demonstrate to the Owner and Architect that the drapery elements perform per this intent of these Contract Documents prior to acceptance of the draperies.

**3.04 DRAPERY SCHEDULE**

A. See Drawings for Performance and Acoustical Drapery Schedule.

**3.05 ACCESSORY SCHEDULE**

A. See Drawings

END OF SECTION
PART 1 GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General, Special Supplementary General Conditions, Supplementary Conditions and Division 1 Specifications, apply to this Section.

1.02 SUMMARY
A. Performance drapery tracks and hangers include equipment assemblies, systems and components required for locating draperies in horizontal planes.
B. Section Includes:
   1. Provision of materials, components, modifications, assemblies, equipment and services as specified herein. These include:
      a. Verification of site dimensions and conditions.
      b. Submittals as required by the Contract Documents.
      c. Engineering of equipment and systems as required by the Contract Documents.
      d. Manufacture of equipment and systems as required by the Contract Documents.
      e. Scheduling, sequencing and coordination with other trades.
      f. Site supervision of equipment and systems installation specified herein and elsewhere in the Contract Documents.
      g. Testing and demonstration of equipment and systems as specified herein and elsewhere in the Contract Documents.
C. Furnish Performance Drapery Track Systems to be installed under 11 61 35.
D. Related Sections:
   1. Section 11 61 00: Performance Machinery General Requirements
   3. Section 11 61 33: Performance Manual Rigging
   4. 11 61 38: Tension Wire Grid

1.03 SYSTEM DESCRIPTION
A. Performance Requirements: The following establishes minimum safety requirements for the system. Where Federal, State and Local Legislation address these topics, the more stringent requirements take precedence. Factors listed below in no way relieve this Contractor from the sole responsibility of providing safe systems.
   1. Minimum factor of safety for lifted loads: 10 or a 75% impact factor, whichever is greater.
      a. Increase the factor of safety for ropes where normal operating loads include cyclic dynamic loads, as determined by the Contractor's engineer, to suit the system operational requirements for required service life.
   2. Minimum factor of safety for static loads: 8
      a. The factor of safety may be lowered, at the discretion and responsibility of the Contractor's engineer, if the static design loads are higher than the maximum lifted load.
   3. Cable bending ratio: Cable diameter x 30
   5. Bearings: Two times the required load at full speed for 2000 hours.
   6. Minimum Service Factor: 1.0
B. Provide assemblies, cable components, connections, equipment, hardware and linkages employed in supporting, in whole or in part, overhead loads that are rated and designed for that application. Base
loading for each component on the maximum percentage of the capacity of the set in which the component is employed.

C. Provide mule blocks, rollers and guides as required to provide proper alignment and maintain allowable fleet angles.

D. Provide systems designed to reflect safeguards and precautions related not only to normal use of the equipment under ideal operating and loading conditions but, additionally, to anticipate equipment misuse, human error, and misjudgment. Design and intent parameters set forth herein in no way relieve this Contractor from responsibility or liability arising from the Work.

E. Refer to 11 61 00 for additional requirements.

1.04 WARRANTY

A. Special Warranty:
   1. Warrant systems and equipment to be free of defective components, faulty workmanship and improper adjustment for a period of two (2) years from the date of Owner's acceptance. Paint and exterior finishes are excluded relative to failure due to unusual exposure. Replace items showing evidence of defective materials or workmanship (including installation workmanship) within thirty (30) days after notification. Make replacements without cost to the Owner. Rectify conditions that might present a hazard to human life, well-being and or property within 48 hours of notification.
   2. Designate warranties on manufactured equipment to the Owner on the date of Final Acceptance.

1.05 MAINTENANCE

A. Maintenance Service:
   1. Provide maintenance service for a period of one year after Final Acceptance of the installation. This service consists of at least two half-yearly visits to the site for checking and adjusting equipment. Perform the first visit six months after the system has been accepted. Arrange visit to be at a time mutually agreeable to the Owner and Contractor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The components (make and model) form the basis of design of the system.
   1. Where other manufacturers are known to be capable of providing equipment that meets the functional requirements of specified products they are listed.

B. Cable and chain connection hardware:
   1. Chicago Hardware and Fixture Company, Chicago, IL.
   2. Columbus McKinnon Corporation, Chain Division, Amherst, NY.
   3. Cooper Industries, Campbell Chain Division, Inc., NC.
   4. The Crosby Group, Inc., Tulsa, OK.

C. Traveler tracks and operating devices:
   1. H&H Specialties Inc. South El Monte, CA.
   2. Automatic Devices Co. (ADC), Allentown, PA.
   4. Triple E, Kent, GB

D. Compression sleeves:
   2. National Telephone Supply Company, Cleveland, OH.

E. Wire Rope: Refer to current QPL-83420 for qualification for certified manufacturers.

2.02 MATERIALS

A. Fasteners: Fasteners shall be rated for the anticipated loads. Provide fasteners with approved markings indicating their rating. Provide fastener system's components of equal ratings.

2.03 MANUFACTURED UNITS

A. Track Systems:
   1. General:
      a. Tracks:
         1. Provide each track assembly from as few pieces as possible, free of burrs, dents and irregularities. Do not exceed manufacturer’s specifications for the maximum spacing of hanger supports.
         2. Where bi-part tracks are used, overlap tracks 18”.
      b. Curtain Carriers:
         1. Provide one master carrier for each section of track. Provide each carrier with four neoprene wheels fitted with ball bearings and paired so that two wheels ride in the track on either side of the carrier slot.
         2. For pull line or motor operated tracks provide each carrier with two clamps for attachment of appropriately sized operating cord.
         3. Provide carriers with single plated swivels with 6” trim chains. Provide one single carrier for each 1'-0" of track length.
         4. For channel shaped tracks, provide tracks with end stacking (rear fold, back pack) devices to prevent on-stage “bunching” and provide drapery stacking only at offstage track ends.
   2. Channel Style Track – Type 1:
      a. Tracks:
         1. Provide the tracks from heavy duty channel type track constructed of 14 gauge steel formed to provide parallel double tracks for carrier wheels. Except for the bottom carrier slot, the track shall be totally enclosed.
      b. Curtain Carriers:
         1. Provide carriers with urethane ball bearing wheels and a means to bypass the operating line and prevent operating line sag.
      c. End Pulley Blocks:
         1. Provide heavy-duty type end pulley blocks with 8" diameter sheaves turned and grooved to fit the 1/2" operating cord and fitted with sealed ball bearings. Provide blocks to retain the operating cord in sheave grooves. Provide double vertical sheaves on the live end of tracks and a single horizontal sheave on the dead end.
         2. Secure housings to the track.
         3. Acceptable: No. 423 Live End Pulley and No. 424 Dead End Pulley, H&H Specialties.
      d. Floor Pulley Block:
         1. Provide a floor pulley block with an 8" diameter sheave. Slot the side plates of the floor block to permit vertical adjustment of the sheave to remove up to 12" of slack in the operating line. Provide block with a locking handle to permit sheave adjustment without wrenches or other tools. Incorporate a quick release mechanism with a positive action spring plunger locking device to prevent unintentional release.
         2. Provide a weighted sand bag attached to the bottom of the floor block.
         3. Acceptable: No. 422 Adjustable Floor Block, H&H Specialties.
         4. Arrange floor attachment such that floor inserts are flush and when the floor block is removed there are no protrusions or recesses of more than 1/4"left in the floor.
      e. End Stops:
         1. Provide end stops at the overlapping track ends to positively stop master carrier movement when the curtain is closed.
2. Secure stops to the tracks, and provide with rubber bumpers to reduce "stop noise".

f. Additional Track Equipment:
   1. Provide ½” black operating line at length required for operation.
   2. For walk-along drapes, provide a ½” black line connected to the master carrier at each end of the drapery, and hanging to 4'-0" AFF.
   3. Provide hardware not specified above but required to provide a properly operating system in accordance with the intent of the Contact Documents.

3. I-Style Track – Type 2 Assembly for Adjustable Acoustical Drapery
   a. Tracks:
      1. The tracks from heavy duty type track constructed of extruded aluminum I-channel construction consisting of a center rib and top, intermediate and bottom flanges. Track should be bent to match the locations shown in the drawings.
      2. Provide each track assembly from as few pieces as possible, free of burrs, dents and irregularities. Do not exceed 5'-0" on center for the maximum spacing of hanger supports.
      3. Provide wall and ceiling mounted clamps and hardware for drapery track as required. Coordinate blocking requirements with General Contractor prior to construction.
      4. Provide hardware not specified above but required to provide a properly operating system in accordance with the intent of the Contact Documents.
      5. Provide tracks that are black in color.
      6. See drawings, curtain requirements in 11 61 43, and verify site dimensions for track length requirements.
      7. Provide all mounting hardware required to mount tracks as indicated in the drawings.
      8. Tracks Acceptable: H&H Type 501B Heavy Duty Curved Track, CWANA including Ceiling Hanging Clamp, Splice Clamp, End Stop, 2828, H&H Specialties.
   b. Curtain Carriers:
      1. Provide each master carrier with four urethane wheels fitted with ball bearings and paired so that two wheels ride in the track on either side of the center rib. Provide each carrier with two plated swivels with a 6" trim chain for curtain attachment.
      2. Provide single carriers with two urethane ball bearing wheels. Provide carriers with single plated swivels with 6" trim chains. Provide one single carrier for each 1'-0" of track length.
   c. End Pulley Blocks:
      1. Provide heavy-duty type end pulley blocks with 6" diameter sheaves turned and grooved to fit the operating cord and fitted with sealed ball bearings. Provide blocks to retain the operating cord in sheave grooves. Provide double vertical sheaves on the live end of tracks and a single horizontal sheave on the dead end.
      2. Secure housings to the track.
      3. Acceptable: No. 503B Live End Pulley and No. 504B Dead End Pulley, H&H Specialties.
   d. Floor Pulley Block (Manual Operation tracks):
      1. Provide a floor pulley block with a 6" diameter sheave. Slot the side plates of the floor block to permit vertical adjustment of the sheave to remove up to 7" of slack in the operating line. Provide block with a locking handle to permit sheave adjustment without wrenches or other tools. Incorporate a quick release mechanism with a positive action spring plunger locking device to prevent unintentional release.
      2. Arrange floor attachment such that floor inserts are flush and when the floor block is removed there are no protrusions or recesses of more than 1/4"left in the floor.
      3. Acceptable: No. 508 Adjustable Floor Pulley, H&H Specialties.
   e. End Stops:
      1. Provide end stops at the overlapping track ends to positively stop master carrier movement when the curtain is closed.
2. Secure stops to the tracks, and provide with rubber bumpers to reduce "stop noise".

f. Additional Track Equipment:
   1. For manually operated tracks, provide 1/2” black operating line at length required for operation.
   2. For walk-along drapes, provide a ½” black line connected to the master carrier at each end of the drapery, and hanging to 4’-0” AFF.
   3. For motor operated tracks, provide cable, sized as required.
   4. Provide hardware not specified above but required to provide a properly operating system in accordance with the intent of the Contact Documents.

2.04 COMPONENTS
   A. Signage:
      1. Signage shall be legible both in construction and grammar.
      2. Sign surfaces and characters shall be textured or otherwise treated to minimize glare and veiling reflectance.

2.05 SOURCE QUALITY CONTROL
   A. Work on the systems may be reviewed at the point of manufacture a minimum of one time during fabrication. This review will occur during the final factory checkout prior to shipping, unless the Manufacturer and Architect agree on a more advantageous inspection date.

2.06 SUPPLEMENTARY
   A. Furnish equipment and hardware in addition to the items specified previously that are necessary to provide a fully working system in conformance with the intent of the Contract Documents.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Examine work prepared by others to receive work of this Section and report defects affecting installation to the Architect for correction. Commencement of the work shall be construed as complete acceptance of preparatory work by others. The sphere of inspection includes but is not limited to:
      1. Assurance mounting surfaces are ready to accept the Work.
      2. Verification of flatness, plumb and level of mounting conditions.
      3. Inspection of components of the Work to ensure no damage has occurred during shipping or storage.
   B. Discrepancies:
      1. In the event of discrepancies, immediately notify the Architect.
      2. Do not proceed with the installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 PREPARATION
   A. Verify field measurements at the site prior to installation and modify the system accordingly.
      1. Deliver equipment to the site only after the building has been closed in. Coordinate storage at the site and ensure the materials and components are undamaged.
      2. Protect the surrounding environment from damage by the Work.

3.03 FIELD QUALITY CONTROL
   A. Reviews:
1. Final review will be made by the Architect or his appointed representative, following receipt in writing or notification from this Contractor that the installation is completed. If review reveals details of construction, fabrication, or installation not in strict accord with the Contract Documents, approval will be withheld and Contractor shall be given thirty days to replace the rejected items with those conforming to specification requirements. In addition to the final review of various equipment components the right of review is reserved during the course of the installation. The Architect or his appointed representative and will be allowed access to materials at the site for eventual incorporation in the work. Preliminary visits shall not be construed as eliminating the possible rejection of various components during the final review detailed above.

2. The completed installation of rigging equipment with draperies properly installed shall be tested and operated for the acceptance by the Architect by the Contractor prior to acceptance.

END OF SECTION
SECTION 11 61 61
PERFORMANCE LIGHTING POWER AND CONTROLS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. The base system includes complete power and control systems serving:
   1. Main Theatre
   2. Studio Theatre
   3. Recital Hall

B. Work in this section includes the engineering, manufacture, furnishing, coordination and installation of performance dimmers and control systems for the following purposes:
   1. Work Lighting
   2. House Lighting
   3. Performance Lighting

C. Section Includes
   1. Materials, components, modifications, assemblies, equipment and services as specified herein.
      These include, but are not limited to:
      - Verification of site dimensions and conditions.
      - Submittals as required by the Contract Documents.
      - Engineering of equipment and systems as required by the Contract Documents.
      - Manufacture of equipment and systems as required by the Contract Documents.
      - Scheduling, sequencing and coordination with other trades.
      - Site supervision of equipment and systems installation specified herein and elsewhere in the Contract Documents.
      - Testing and demonstration of equipment and systems as specified herein and elsewhere in the Contract Documents.

D. Section Consists Of The following Subsystems
   1. DMX Driven Motorized Breaker Panels
   2. Company Switches
   3. Emergency Lighting Transfer Switches
   4. Emergency DMX Transfer Switches
   5. Architectural Lighting Controls
   6. Initial Programming
   7. Lighting Control Consoles & Peripherals
   8. Data Communications System
   10. Stage Edge Marker System
   11. Performance Lighting Circuit and Control Faceplates & Associated Cable Assemblies.
   12. Accessories.
   13. Data communications cable servicing control circuits connecting Performance Lighting Control faceplates specified herein to each other, to the dimmers specified herein and to the work lighting control system.

E. Products Furnished for installation by others.
   Unless otherwise noted installation will be by the Division 26 Contractor.
   1. Data communications cable servicing control circuits connecting Performance Lighting Control faceplates specified herein to each other, to the power control equipment specified herein and to the auditorium and work lighting control module.
2. Back boxes for faceplates. Gang backboxes, as outlined in the contract documents, are excepted from this and are provided under Division 26.
3. Devices with 100v and above terminations including lighting receptacles, connector strips, faceplates and backboxes.
4. Pipe mounted connector strip.
5. Busway power distribution.
6. Controlled motorized breaker panels.
7. Company Switches.
8. Emergency Lighting Transfer Switch
9. Emergency DMX Transfer Switch (Wall Mounted)
10. Emergency Bypass Detection Kit
11. Stage Edge Marker System

F. Products Terminated Under This Section:
1. Data Communications Cable serving architectural lighting fixtures to the processing rack. Termination of architectural lighting between fixtures are specifically excluded from the work of this section and are intended to be the work of the Electrical Contractor.
2. Termination at the Lighting Signal Processing Rack. Wire, interconnection, terminations, and configuration of architectural lighting fixtures are excluded from this section.

1.03 RELATED DOCUMENTS
A. Division 1 Specification Sections apply to this Section.
   1. Where Division 1 and this section conflict the more stringent shall apply.
B. Base Building Documents, Division 26.

1.04 DEFINITIONS
A. The term “furnish” means to supply and deliver to the job site, ready for unloading, unpacking, assembly, installation, and similar operations.
B. The term “install” is used to describe operations at the job site including the actual anchoring, applying, assembly, cleaning, curing, cutting, erection, finishing, patching, placing, protecting, pulling, terminating, unloading, unpacking, working to dimension, and similar operations that will render the systems complete and ready for the intended use.
C. The term “provide” means to furnish and install.
D. The term "primary components" refer to elements of the system which Control levels, such as dimmers, and control console.
E. Dimmer Rack: A frame and chassis accommodating dimmer modules, load and line connections, and circuit protection.
F. Dimmer Rack Chassis: A cluster of dimmer modules with a common power supply.
G. Plug-In Module: A modular unit which is installed in a standardized mounting location throughout the dimmer rack.
H. Dimmer Module: A type of Plug-In Module containing one or more dimmers.
I. Data Communications: Signals that provide control and feedback communications between devices in the system.
K. Products utilizing the “ACN” control protocol shall comply with the rules and recommendations of the following standard: Entertainment Services & Technology Association (ESTA) ANSI E1.17 – 2006, Entertainment Technology - Architecture for Control Networks.
L. Products utilizing the “RDM” control protocol shall comply with the rules and recommendations of the following standard: Entertainment Services & Technology Association (ESTA) ANSI E1.20 – 2006, Entertainment Technology - RDM - Remote Device Management over USITT DMX512 Networks.

M. Products utilizing “Lightweight/Streaming ACN” control protocol shall comply with the rules and recommendations of the following standard: Entertainment Services & Technology Association (ESTA) ANSI E1.31 – 2009, Entertainment Technology – Lightweight streaming protocol for transport of DMX512 using ACN.

N. Products utilizing a “0 – 10V” control protocol shall comply with the rules and recommendations of the following standard: Entertainment Services & Technology Association (ESTA) ANSI E1.3 - 2001 (R2006), Entertainment Technology - Lighting Control Systems - 0 to 10V Analog Control Specification.


Q. POE: Power Over Ethernet - an 802.3AF compliant scheme of powering devices on an Ethernet

R. Control Console: A Performance Lighting Control Console is capable of controlling stage lighting, house lighting, and work lighting channels via ACN.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION

A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.

B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
   3. Compliance with Credit EQ6.2: Material VOC Limits - Paints
   4. Compliance with Credit EQ6.3: Material VOC Limits - Coatings and anti-corrosive paints
   5. Compliance with Credit EQ6.4: Material VOC Limits - Flooring systems
   6. Compliance with Credit EQ6.5: Material VOC Limits - Composite wood and agrifiber

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 SYSTEM DESCRIPTIONS

A. Design Requirements
   1. Standards and Regulations
Components must comply with applicable regulations and ANSI Standards.
Provide systems and components that are approved by an accredited independent testing laboratory such as Underwriters Laboratory.

Equipment utilizing Stage Pin Connectors must comply with ANSI E1.24-2006.

DMX equipment has ports able to communicate with any DMX compliant products.

Ethernet systems are to be ACN compliant.

Systems are to be RDM compliant.

Controlled devices must comply with either DMX or ACN standards.

2. Emerging Standards:

   Systems must anticipate requirements of, comply with emerging standards.

   Systems must be compliant as much as is technologically possible at the time of the systems installation.

   Compliance will be evidenced by:
   - The utilization of updatedable code.
   - Provision of basic enabling hardware.
   - The absence of hardware or non-updatable software that will disable or interfere with the function of the emerging standard.

B. Performance Requirements

1. Key Switches

   Key switches do not interoperate with other equipment systems in the facility.

   **1.07 QUALIFICATIONS:**

   A. The Contractor shall have been authorized dealers or representatives of the manufacturers of the primary components for a minimum of two (2) years.

   B. Where a manufacturer of a primary component offers factory training in the use of that component the Contractor is to have received that training.

   C. The Contractor shall have been involved in Lighting Systems Contracting for Entertainment and Worship facilities for a period of five (5) years or more and shall have completed at least three (3) installations of this type and scope which have been in service for not less than two (2) years.

   D. The Contractor shall provide, as part of their internal organization, the base system and not less than one (1) of the sub-systems specified. Additional Work in the Contract will be performed under their authority and responsibility as defined in the Contract Documents.

   E. The Contractor shall maintain and operate shops for the integration and service of the system components.

   F. The right is reserved to inspect previous equipment or systems as furnished or installed by this Contractor. In addition, the right is reserved to reject a Contractor who has failed in any respect to comply with the provisions of previous contracts.

   G. No sub-contracting work is permissible, unless the Sub-Contractor is named and included as part of the bid. All terms and requirements herein apply to the Sub-Contractor. The right is reserved to reject the proposed Sub-Contractor based on the terms stated herein.

   H. The Design Consultant shall be the final judge of suitability of experience.

   I. Coordination with the electrical contractor and Work on site shall be supervised by an Entertainment Technician Certification Program (ETCP) Certified Electrician, or a licensee of authority having jurisdiction.

   J. Prequalified Contractors:

   1. 4Wall Entertainment, Nashville, TN
   2. Barbizon Lighting, New York, NY
   3. Bandit Lites, Knoxville, TN
   4. Productions Unlimited, Greer, SC
   5. Appalachian Light & Production, Telford, TN
   6. Prequalified contractors are not relieved from the responsibility to meet the project qualifications.
K. Other contractors seeking acceptance for Performance Lighting Power and Controls must submit the following information at least 10 business days prior to the bid opening date. Acceptance of contractors will be by addenda:

1. A written list of five equivalent installations including:
2. Name, address and telephone number of Owner.
3. Name, address and telephone number of Architect.
4. A brief written description of the scope of work with approximate value.
5. A brief written description of the contractor's operation including facilities, financial capabilities, and experience of key personnel.
6. A statement from a bonding company agreeing to provide the required bonds in the amount required for the project.

1.08 SUBMITTALS

A. Product Data
   1. Submittal shall include manufacturer’s information sheets of equipment not explicitly specified by make and model that the contractor intends to provide as part of the project. Equipment matching make and model called out in the specification need not be submitted.
   2. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
   3. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
      - Manufacturer's printed recommendations.
      - Compliance with recognized trade association standards.
      - Compliance with recognized testing agency standards.
      - Application of testing agency labels and seals.
      - Notation of dimensions verified by field measurement.
      - Notation of coordination requirements.
      - Material Safety Data Sheets (MSDS) for each product.
      - Catalog or data sheets indicating all component manufacturer's names, model numbers and performance data, where applicable.

B. Shop Drawings:
   1. Submittals shall be in accordance with Division 1.
   2. Shop drawings shall be submitted within 90 days of award of contract unless otherwise indicated in Division 1.
   3. Fabrication, Installation, and Erection shall not commence until shop drawings have been approved by the Consultant and Architect.
   4. Note and maintain one of the prints returned as a "Record Document".
   5. Sheets in the submittal shall be of the same size.
   6. Submittal shall include a title sheet listing sheets in the submittal.
   7. Drawing scales:
      - Mechanical Assembly Drawings (1/2"= 1'-0" minimum).
      - Faceplate Fabrication Drawings (6" = 1'-0" minimum)
      - Room layouts ( 1"=1'-0" minimum).
      - Block schematics and riser diagrams. (NTS)
      - Miscellaneous Details and Assembly Drawings. (scale as necessary)
      - Mechanical Detail Drawings. (1"=1'-0" minimum).
      - Mechanical General Layout. (1/4"= 1'-0" minimum).
      - Component Equipment Drawings. (1"=1'-0" minimum).
Erection Plans and diagrams. (1/4"=1'-0" minimum).
Wiring Diagrams showing system layout (1/4"=1'-0" minimum).
System assemblies, major sub assemblies, components, cabinets and enclosures (1"=1'-0" minimum).
Templates and installation details (1"=1'-0" minimum).

8. Highlight, encircle, or otherwise indicate deviations from the Contract Documents.
9. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.
10. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings.
11. Lettering on Shop Drawings is considered part of the Drawings.
12. Show information necessary to explain fully the design features, appearance, function, fabrication, installation, and use of system components in all phases of operation. Include the following drawings as a minimum:

Signal, control and power sequencing Block Diagrams detailing:
- Equipment
- Faceplates
- Interconnecting wires detailing the unique labels
- Terminating devices (Connectors or terminal strips)
Where custom wiring is necessary detail each component (Switches, indicators, resistors, power supplies, relays, etc)
- Multiconductor wiring
- Program logic and relationship to input / output points, either in logic diagrams or ladder logic diagram, or another appropriate format.
Faceplate & Rack Panel Fabrication Drawings detailing:
- Finishes
- Devices
- Engraving
Mounting Details - where custom mounting systems are employed and as required by the specifications
Patch Panel Layouts detailing:
- Layout
- Labeling
Rack Elevations detailing:
- Equipment location
- Equipment labeling
- Security covers
- Vent panels
- Fans
- Terminal points and their function
- Field wiring chases.
- Notation of coordination requirements.
- Notation of dimensions established by field measurement.
- Do NOT produce floorplans reiterating information already in the set, such as box layout and low voltage conduit. These have been issued and form part of scope of work by others.
- DO review box layout and low voltage conduit drawings and note any areas of concern in a Request for Information.

C. Coordination Drawings:
1. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.
Preparation of coordination Drawings is specified in section "Project Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
Submit coordination Drawings for integration of different construction elements. Show sequences and relationships of separate components to avoid conflicts in use of space.
2. Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities.
3. Show the interrelationship of components shown on separate Shop Drawings.
4. Indicate required installation sequences.
5. Required Coordination Drawings include, but are not limited to: Diagrams detailing cable and wire installation for cable and wire supplied to and installed by others. These diagrams should indicate boxes and the quantity and type of wire and cable pulled between them.

Dimmer room arrangement drawings.

Installation instructions for equipment installed by others.

D. Record Document Submittals (As Built Drawings)
1. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistant location; provide access to record documents for the Architect's reference during normal working hours.
2. On completion of Work and prior to final review, neatly transfer as-built notations to set of transparencies, stamp drawings in set "Certified As-Built Drawings" and submit record documents to the Architect.
3. Record Documents: Maintain a clean, undamaged set of Contract Documents, Shop Drawings and Product Data. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that are concealed or cannot otherwise be readily discerned later by direct observation.
4. Include details on internal setting of components.
5. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
6. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
7. Note related Change Order numbers where applicable.
8. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
9. Testing Data - Include in record submittal documentation of performance tests as required in the contract documents.
10. Upon completion of the Work, submit Record Documents to the Architect for the Owner's records.
11. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Architect and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.
12. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect for the Owner's records.

E. Maintenance Manuals
1. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder.
2. Operating and Maintenance Instructions: Provide instruction manuals describing proper operation and maintenance. Include a detailed review of the following items:
   Cleaning.
   Control sequences.
   Copies of warranties.
   Emergency instructions.
   Fixture lamping schedule.
Fuse list.
Hazards.
Identification systems.
Inspection procedures.
Lubricants.
Maintenance and operation manuals.
Recommended "turn around" cycles.
Record documents.
Shop Drawings and Product Data.
Spare parts and materials.
Spare parts list.
Specifications for expendables.
Tools.
Warranties and bonds.
Wiring diagrams reflecting actual labeling in the field.
Maintenance agreements and similar continuing commitments.
As Built drawings depicting actual locations and conditions of the system design, construction and arrangement.
Equipment inventory with a listing for every item furnished or provided that includes the following information:
Item
Make
Model
Serial Number
Firmware Version (where applicable)
Quantity (>1 if there is no SN, IP, or MAC address)
MAC Address (If IP Addressable)
IP Address or “DHCP” (If IP Addressable)

3. As part of instruction for operating equipment, describe the following procedures:
Start-up.
Operation.
Shutdown.
Emergency operations.
Noise and vibration adjustments.
Safety procedures.
Economy and efficiency adjustments.
Effective energy use.
Complete Subcontractor List including names and telephone numbers of persons to contact.
4. Provide four (4) copies of console manuals.
5. Provide three (3) sets of complete as built drawings.
6. Provide three (3) sets of maintenance manuals for the system.
7. Provide three (3) hard copies of initial system configuration.
8. Provide three (3) password protected editable soft copies of initial system configuration with a password to provide full access to make future changes to the configuration.
9. Provide three (3) binders documenting the functions of presets, submasters, groups, crossfaders, and DMX universes on the lighting playback controllers.

F. The Architect's review of Submittals is only for general conformance with performance systems design concept of the project and general compliance with the Contract Documents.
1. It is not a complete check on the method of assembly, engineering, erection or construction.
2. Review shall in no way be construed as: permitting any departure whatsoever from the Contract Documents, except where the Contractor, in accordance with the provisions herein, has previously notified the Owner of, and the Owner has accepted, such departure; relieving the Contractor of full responsibility for any error in quality of materials, details, dimensions, omissions or otherwise that may exist; relieving the Contractor of full responsibility for adequate field connection, erection techniques, bracing or deficiencies in strength; relieving the Contractor of full responsibility for satisfactory performance of all work and contractors; or permitting departure from additional details or instructions previously furnished by the Architect.

3. Review does not relieve the Contractor from the responsibility of errors in the Shop Drawings.

4. This Contractor is responsible for: dimensions and measurements which shall be confirmed and correlated at the job site, correct quantities, materials, fabrication processes and techniques of construction and for the coordination of his work with other trades.

G. Resubmittals
   1. Make changes in the shop drawings as required, consistent with the Contract Documents. When resubmitting, notify the Consultant in writing of any revisions other than those required.
   2. Action indicated is subject to the requirements of the Contract Documents.
   3. Adjustments made on shop drawings are not intended to change the Contract Price. If adjustments affect the value of the Work, state such in writing prior to proceeding with the Work.

1.09 QUALITY ASSURANCE

A. Supplementary:
   1. Secure equipment, except portable equipment, firmly in place. Mount components rigidly, except where resilient isolation is required. Design and provide fastenings and supports adequate to support their loads with a safety factor of at least three.
   2. Clearly mark switches, jacks, outlets, cables, connectors, etc. logically and permanently during fabrication and installation.
   3. Where many cables are run in close proximity color code by function in a logical manner.
   4. Take necessary precautions to prevent and guard against electromagnetic, electrostatic and radio frequency interference.
   5. Provide control system wiring which is continuous from the faceplates to the racks. Employ no splices for entire cable length.
   6. Exercise care in wiring, so as to avoid damage to the cables and to the equipment. Between racks, cabinets, consoles or modules insure cables are well-supported, neatly laced and dressed. Make joints and connections with mechanical connectors approved by the Consultant.
   7. Group terminals by signal type.
   8. When cable is surface mounted and crossing through fire walls, use the equivalent Belden fire rated plenum cable to the specified cable type.
   9. Run power and high level circuits on one side of the racks or cabinets, as viewed from the rear. Run other circuits on the opposite side, as viewed from the rear.
   10. Label terminal strips, punch blocks, wire and cables in a permanent and logical manner with a unique number on each end of cable runs.
   11. Terminate all connections with rack with mating connectors, punch blocks, or terminal strips.
   12. Final location of equipment is as shown on the Drawings, located in the field by the Architect or as shown on supplementary drawings prepared by the Consultant.

1.10 SCHEDULES

A. Schedule and sequence the Work in conjunction and agreement with trades performing related, adjacent and intersecting work and the Construction Manager. Accommodate the Owner's projected time schedule for installation, particularly where coordination with other trades is required.
B. Submit preliminary progress schedule coordinated with Project construction schedule.
C. After review, revise and resubmit schedule to comply with revised project schedule.
D. During progress of Work, revise and resubmit schedules as pertinent events are recognized.
1.11 COORDINATION

A. Summary
   1. The Work involving performance equipment may be performed simultaneously to general building construction occurring on site. It is incumbent on this contractor to provide necessary coordination this Work and with adjacent and intersecting work, trades and facilities.
   2. This section describes administrative and supervisory requirements necessary for Project coordination including:

   Coordination.
   Administrative and supervisory personnel.
   General installation provisions.

B. Related areas of coordination are described elsewhere in the Contract Documents.

C. Coordinate included construction activities to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included in the Project that are dependent upon each other for proper installation, connection, and operation.

D. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.

E. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.

F. Make adequate provisions to accommodate items scheduled for later installation.

G. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination.

H. Include such items as required notices, reports, and attendance at meetings.
   1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.

I. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work.

J. Accurately cut, fit, drill and tap Work herein to accommodate and fit work of other trades. Furnish or obtain templates and drawings to or from applicable trades for proper coordination of this Work.

K. Coordinate the Work with related trades and the Construction Manager, this includes the preparation of schedules and coordination of equipment delivery, storage and installation.

L. Coordinate the system installation with the requirements of adjacent and intersecting Work.

M. Coordinate the following areas:
   1. Preparation of schedules.
   2. Installation and removal of temporary facilities.
   3. Delivery and processing of submittals.
   4. Progress meetings.
   5. Project Close-out activities.

1.12 AVAILABILITY

A. Immediately upon signing Contract, review Product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify the Architect of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in the performance of the Work.

B. In the event of failure to notify the Architect at commencement of the Work and should it subsequently appear that the Work may be delayed for such reasons, the Owner reserves the right to substitute more readily available products of similar character, at no increase in Contract Price.
1.13 **WARRANTY**

A. In addition to manufacturer's warranties, warrant systems and equipment to be free of defective components, faulty workmanship or improper adjustment for a period of two years from the date of Owner's acceptance. Paint and exterior finishes are excluded.

B. Replace items showing evidence of defective materials or workmanship (including installation workmanship) within thirty (30) days after notification. Make replacements without cost to the Owner.

C. Rectify conditions that might present a hazard to human life, well-being and or property within 48 hours of notification.

D. Included in warranty, and additional to the maintenance service is one visit scheduled to occur approximately thirty (30) days prior to expiration of this warranty. The contractor will contact the owner approximately sixty (60) days prior to the expiration of the warranty to arrange visits to be at a time mutually agreeable to the Owner and Contractor. During the visit the technician will thoroughly examine system components, including error logs and replace failing or failed components.

1.14 **MAINTENANCE**

A. Maintenance Service
   1. Provide on-site maintenance service for a period of one year after final acceptance of the installation. This service shall cover the parts and labor resulting from correction of defects and/or improper installation of items specified in this section.
   2. In addition to repair visits, this service consists of at least two half-yearly visits to the site for checking and adjusting of equipment. The first visit occurring six months after the system has been accepted. Arrange visits to be at a time mutually agreeable to the Owner and Contractor.
   3. Provide 24 hour emergency service phone line. A field service engineer shall respond to an emergency call on this line within 30 minutes.

B. Extra Materials
   1. Provide replacement spares as required and described herein.

1.15 **PRODUCT HANDLING AND STORAGE**

A. Items Furnished to Others for installation
   1. The installing Contractor will make good or replace work, materials and equipment which have become contaminated, stolen, marred otherwise damaged, as directed by the Consultant and at no cost to the Owner once the equipment has been accepted by the installing Contractor.
   2. Equipment will remain the responsibility of the installing Contractor until turned over to the owner.

B. All other items remain the responsibility of this Contractor until turned over to the owner.

**PART 2 PRODUCTS**

2.01 **MANUFACTURERS**

A. Note that listing in this specification and its subsections does not relieve a manufacturer of compliance with the specified standards.

B. Note that listing in this specification and its subsections does not imply compliance with the specified standards.

C. A listed item found not to be in compliance with the specification will be rejected when the non-compliance is discovered.

2.02 **SUPPLEMENTARY**

A. Provide equipment and hardware in addition to the items specified previously that are necessary to provide a fully working system in conformance with the intent of the Contract Documents.

DESIGN RELEASE PACKAGE 4
ISSUED: 12/1/2017
2.03 FABRICATION
A. Shop Assembly:
   1. Workmanship: Work shall be performed by an experienced fabricator or manufacturer and installed by experienced tradesmen. Materials, methods of fabrication, fitting, assembly, bracing, supporting, fastening, operating devices and erection shall be in accordance with the Contract Documents, reviewed shop drawings and best practices of the industry, using new and clean materials specified, having structural properties sufficient to safely sustain or withstand stresses and strains to which materials and assembled work will be subjected. Assemble, fabricate and erect all work in a neat and accurate fashion.
   2. Employ materials that are free of defects impairing strength, durability or appearance and of best commercial quality for the purpose specified. Employ materials with structural proportions to safely sustain and withstand stresses and strains to which they will be subjected. Fabricate true to detail, clean, straight with sharply defined profiles and, unless otherwise noted, with smooth finished surfaces.
   3. Supplementary Parts: Provide as necessary to complete each item of work, even in the event that such supplementary parts are not specifically mentioned in the Contract Documents.
   4. Connections: Make connections with tight joints, capable of developing full strength of the members and flush unless indicated otherwise. Locate joints where least conspicuous. Unless indicated otherwise, weld or bolt shop connections; bolt or screw field connections. Provide control joints as required to accommodate environmental variations. Employ fastening systems of appropriate sizes, ratings and quantities for the application. Where rated fasteners are employed, provide domestically manufactured fasteners rated for anticipated loads and with approved markings indicating their rating. Provide fastener system's components of the same manufacture and equal ratings. Holes: Drill or cleanly punch holes, do not burn.
   In addition to all other requirements, install a hardened washer between bolt heads, nuts and materials having elongated holes. Unless specifically noted, and excepting graded, rated or otherwise certified fasteners, use nylon locking type nuts in locations subject to vibration and loosening. Unless otherwise noted, exposed bolt and screw heads shall be flat and countersunk.
   5. Insofar as practicable, perform fitting and assembly of the Work in the shop. Shop assemble the Work in the largest practical sizes to minimize field work. It is the responsibility of this Contractor to assure himself that shop fabricated items properly fit the field condition. In the event that shop fabricated items do not fit the field condition, return the item to the shop for correction.
   6. Cutting: Cut metal by sawing, shearing or blanking. Flame cutting is permitted only when edges are ground back to clean, smooth edges and no deformation or damage is caused to the metal by the process. Make cuts accurate, clean, sharp and free of burrs, without deforming adjacent surfaces or metals.
   7. Where dimensions and characteristics have been omitted, furnish based on criteria set forth herein.

PART 3 EXECUTION

3.01 SITE CONDITIONS
A. Sequence delivery and installation of components to protect their long-term viability. Of particular concern is protecting electronic contacts from abrasive construction dust and grit and protecting devices from the accumulation of dust which can lead to early component failure.
B. If devices must be installed prior to the room being clean, dry and dust free protect connectors and internal components from the infiltration of dust and thoroughly clean the components of all dust and grit before beginning testing. Devices with evidence of abrasion on the contacts will be rejected.
C. Devices not installed but required for testing are to be brought to the site for in time for testing.
D. Devices not required for testing are to be delivered at the first training session.
3.02 INSTALLATION

A. Provide racks, furniture, consoles, etc., required for the installation and needed to provide completed systems. Only to the extent that such ancillary equipment is specified elsewhere is it excluded from these system Specifications.

B. Provide low voltage cable.
   1. If a cable segment exceeds 90% of the maximum cable length in the applicable standard do one of the following:
   - Insert a repeater to regenerate the signal. Repeaters shall be accessible for service.
   - Convert to an alternate media for the run using a pair of transceivers retaining the specified terminal connectors. Transceivers shall be accessible.
   - Coordinate with the Electrical Contractor to identify and provide an alternate shorter route.

C. Terminate and install low voltage faceplates.

D. Terminate control lines.

E. Interface:
   1. Coordinate work with the Division 26 Contractor in accordance with the contract documents.
   2. Contract documents are diagrammatic and indicate general arrangement of systems and work included.
   3. Follow drawings in laying out work and check drawings of other trades relating to work to verify spaces in which work is installed.
   4. Maintain headroom and space conditions at all points.

3.03 DELIVERY

A. Materials within this contract will be delivered by the contractor to the project site.

B. Equipment furnished under Division 11 61 61 will become the responsibility of the Division 26 Contractor at such time that the Division 26 Contractor takes possession of the equipment from the 11 61 61 Contractor.
   1. At this time the Division 26 Contractor will document the exact condition, breakage or damage evident in the equipment.
   2. Exact quantities will be documented.
   3. Discrepancies in the quantities and damage or unsuitability of the product for the application will be provided in writing to the 11 61 61 contractor upon transfer of the equipment.
   4. Acceptance of the equipment verifies proper physical condition of the product. Electrical functionality is not implied at acceptance and is not the responsibility of the Division 26 Contractor.
   5. The 11 61 61 Contractor will be present at the time of transfer to coordinate and expedite this action. The 11 61 61 Contractor shall be given a two-week minimum lead time prior to this meeting.

3.04 SUPERVISION OF INSTALLATION

A. Provide instruction and supervision to the Division 26 Contractor as it pertains to the installation of these systems. Provide the necessary personnel for coordination meetings and site visits prior to installation of systems.

3.05 FIELD QUALITY CONTROL

A. Tests - Perform tests to ensure the following criteria and provide certification:
   1. Labeling of faceplates has correct correlation of dimmer number and faceplate circuit number.
   2. Polarity of circuits is correct.
   3. Test voltage drop at each end of circuits with a 2Kw load and record voltage.
   4. DMX and Ethernet lines for throughput, packet formation, termination, and noise.
   5. Pairing of circuits is correct.
B. If final acceptance is delayed beyond two test days or visits because the system does not fulfill this specification, pay for time and expenses of the Architect’s Consultant during any extensions of the acceptance testing period.

3.06 DEMONSTRATION & INSTRUCTION
   A. Create an initial configuration for test purposes which demonstrates the full capabilities of the system, demonstrates how it meets specification, and demonstrates areas in which it exceeds specification.
   B. Provide Training on this equipment system to be scheduled at times mutually agreed upon with the owner. This training time is to be divided into the following sessions as a minimum:
      1. Initial training
      2. Follow-up training.
      3. Attendance at the first cueing secession.

3.07 PROJECT CREDIT
   A. In publications where this project is mentioned give credit to:
      1. The Design Architect
      2. Theatre Consultant: Theatre Consultant’s Collaborative, Inc

3.08 SCHEDULES
   A. See Attached Equipment and Component Schedules for outline of major materials and components.
   B. Dimmer List
   C. System Drawings
   D. Construction Drawings

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY
   A. Work in this section includes the engineering, manufacture, furnishing, and coordination of the
      Architectural Lighting Control System and accessories.
      1. Controller
      2. Occupancy Sensors
      3. Initial Programming

1.02 SYSTEM DESCRIPTION
   A. Design Requirements:
      1. This system provides control of the all address in the control system.
      2. This system coordinates its status with the sound system via Ethernet UDP Protocol.
      3. Address the control system via ACN.
   B. Performance Requirements
      1. The system exhibits no perceptible lag between button push and response.

1.03 QUALITY ASSURANCE
   A. Supplementary Standards:
      1. Thoroughly comment code to assist in troubleshooting.
         a. Include descriptions of the use of each variable.
         b. Include descriptions of processes in each section.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. The following are accepted manufacturers:
      1. Controller
         a. Electronic Theatre Controls (ETC) Unison Paradigm

2.02 MANUFACTURED UNITS
   A. House Light / Work Light System - Architectural
      1. In systems without additional capacities outlined in the Cue Light / Work Light / House Light
         Processor section, provide a Dedicated House Light Processor with the following minimum
         capabilities and equipment:
            a. Standard Operating Features
               1. The control console provides, but is not limited to, the following operating features:
               2. Presets can mirror between stations.
               3. User configurable system parameters. These parameters include, but are not limited to:
                 current date, current time, dimmer type, high level limit, control station name, preset
                 names, presets, mirror designation, lockout modes, dimmer assignments per channel,
                 preset master names, station numbers, channel levels, and station names.
               4. Adjustable fade times on each preset from 0 - 999 seconds.
               5. Current time and date can be displayed at designated LCD stations.
               6. Preset masters are available to control groups of presets throughout the system.
            b. Software:
1. The programming language is a high-level language.
2. Comment lines allowing documentation to be inserted into the logic code.
3. Startup routines.
4. Input recognition based on on/off status and change in state.
5. Boolean expressions.
6. Conditionals including If-Then, and While-Do conditionals.
7. Subroutines.
8. Wait commands.
9. Character processing.
10. Transmittal of character strings to output ports.

2. Control Module - Architectural
   a. Employ DMX-512 or ACN protocol for communication between the Control Module and the dimmers.
   b. Rack mount installation no more than five (5) rack units (8.75") in height.

3. LCD Station - Architectural
   a. Provide LCD Stations with the following minimum capabilities and equipment:
      1. Twelve (12) push buttons.
      2. Eight (8) of the push buttons shall control and select information in the display.
      3. Four (4) of the push buttons shall control set function, up function, down function, and station off, respectively.
      4. The illuminated screen is adjustable to Two (2) intensities and off. This adjustment may be made during system operation.
      5. Each station shall control a minimum of ninety nine (99) channels and fourteen (14) presets.
      6. This station shall fit into a standard 4 gang "ears in" wall box.
      7. Face plate color will be chosen by the Architect after award of bid from Manufacturer's standard color selection.
   b. Screen faceplate signage pursuant to the Contract Documents.

4. Entry Stations
   a. Provide Entry Stations with the following minimum capabilities and equipment:
      1. Each station shall control a single channel and a single preset.
      2. This station shall fit into a standard single (1) gang wall box.
      3. Face plate color is chosen by the architect after award of bid form manufacturer's standard color selection.
      4. Faceplate signage is screened as per Contract Documents.

5. Portable House Light Control Panel - Architectural
   a. Provide (1) one House Light Control Station with the following minimum capabilities and equipment:
      1. This station shall consist of 1 LCD station mounted in a portable enclosure.
      2. Communicate with the processor via Ethernet.

6. Associated Faceplate Control Units

7. Interface with the Performance Lighting Control.

8. Acceptable Work Light / House Light System - Architectural Products:
   a. Electronic Theatre Controls, Middletown, WI. - “Unison - Paradigm”

B. Passive Infrared Occupancy Sensor: Wall Mounted
   1. Provides a dry contact closure to indicate occupancy status to architectural control system. Normally open. Contacts are rated at 100mA resistive / 30vdc.
   2. Provides remote activation of the walk light.
   3. Range of up to 85’ x 100’ x 90 degrees or 115’ x 8.2’ with curtain adapter.
   4. Vertical mounting range 5’-13” or 5.5’- 7.5” with curtain adapter.
5. Vertical coverage adjustability of +10 degrees to – 20 degrees.
6. Centrally powered: 8-16VDC
7. 14mA energized draw, 12mA quiescent load at 12VDC.
8. Walk test LED that is remotely switchable to off.
9. Standards Compliance:
   - EN50131-1 Grade 3 / Class II, EN50131-2-2, EN50131-2-4, EN300440, EN301489, EN60950.
10. Acceptable Products:
    a. Visonic Tower-10am.
    b. Long Range Curtain Adapter
       1. Curtain-10
11. Painting
    a. Where a finish other than white is specified a durable painted finish is required. Paint that is not fully bonded with the detector shell is not acceptable.
    b. Paint detectors using Krylon “Fusion” spray paint in the color indicated.
       1. Prepare the detector shell by disassembling it, masking the lens and indicators scuffing the surface to be painted with fine steel wool, and cleaning.
       2. Paint the detector so the finish is smooth and even with no underlying surface showing. Two coats may be necessary.

C. Passive Infrared Occupancy Sensor: Ceiling Mounted
   1. Communicates via LON network
   2. Centrally powered from LON network.
   3. Walk test LED that is remotely switchable to off.
   4. Standards Compliance:
      - CA Title 24.
   5. Coverage area: Circular
      a. Small Room: 450 sf at 8’ ceiling, 800 sf at 12’ ceiling (40’D)
      b. Large Room: 1,800 sf at 8’ ceiling, 3,000 sf at 12’ ceiling (80’D)
      c. High Bay: 350 sf at 10’ ceiling, 7,000 sf at 40’ ceiling (100’ D)
   6. Acceptable Products:
      a. Small Room: ETC P-OCC-SR
      b. Large Room: ETC P-OCC
      c. High Bay: ETC P-OCC-HCM
7. Painting
   a. Where a finish other than white or black is specified a durable painted finish is required. Paint that is not fully bonded with the detector shell is not acceptable.
   b. Paint detectors using Krylon “Fusion” spray paint in the color indicated.
      1. Prepare the detector shell by disassembling it, masking the lens and indicators scuffing the surface to be painted with fine steel wool, and cleaning.
      2. Paint the detector so the finish is smooth and even with no underlying surface showing. Two coats may be necessary.

2.03 ACCESSORIES

A. Backup Media
   1. Provide five (5) spare media for backing up the system configuration per control device.

PART 3 EXECUTION

A. Programming Process and Expectations
   1. There shall be one control system programmer who manages that portion of the project. Owner and Consultant shall be immediately notified of any changes in programming staff.
   2. Contractor’s programmer shall meet with Consultant to discuss specific programming requirements and goals. At that time, sample screening for this and/or similar projects shall be provided to the contractor to establish the visual language of the system.
3. During the submittal phase, screening images shall be provided to the Consultant for review. Screens shall include anticipated navigation and functions.

4. Following initial programming, but prior to system commissioning, provide programming simulation to Consultant for review.

5. The system programmer shall be available on site for system testing and commissioning. Testing and commissioning shall not commence until the contractor provides confirmation that all programming is complete.

6. Following system acceptance, provide a minimum of one (1) on site adjustment to programming based on user feedback. Provide a minimum of three (3) off-site programming changes during the first year following acceptance.

B. Logic Outline:

1. General
   a. When a portable device is plugged in: All synchronized I/O points will be set to mirror the state of the room as determined by the controller, non-synchronized I/O points will be set to their off state.
   b. The all indicators are to be synchronized between control stations.
   c. Indicators are to reflect the status of a change after the controlled device indicates that the command has successfully been executed.
   d. The system should be forced into night mode with the "Night" preset active and all other presets and submasters off.

2. Master
   a. Master States are mutually exclusive.
   b. The system may be in either Show, Rehearsal, Work, or Night mode at any one moment.
   c. The system will enter Night mode at the time set on the Timer Screen if the system is in Work mode and the timer is not disabled.
   d. If the system is in Night mode and any zone is switched on, change to Work mode.
   e. If the system is in Work mode and all zones are in the off state the system will change to Night mode.
   f. On entering Night Mode:
      1. Aisle lights and on stage running lights will fade after a 5 minute delay.
      2. All house presets will be faded to off (including the Out house light preset).
      3. All Work and Show submasters will switch off.
      4. On entering Night mode a submaster associated with night mode will come on and those associated with show and work mode will go off.
      5. Performance Lighting Circuits power down
      6. The sound system will be informed of the status change.
   g. On entering Show mode or Rehearsal Mode:
      1. A submaster associated with show mode will come on and those associated with work and night modes will go off.
      2. If the house is in Cleaning it will switch to Full.
      3. All illuminated work lights will switch to their associated Show submasters.
      4. Illuminated work lights with no associated show submaster turn off.
      5. Performance Lighting Circuits energize in a sequenced fashion
      6. The sound system will be informed of the status change.
      7. Note that Rehearsal mode has different impacts on the sound system.
   h. On entering Work mode:
      1. A submasters associated with work mode will come on and those associated with show and night mode will go off.
      2. If the house is in any preset other than Off it will switch to Cleaning.
      3. All illuminated show submasters will switch to their associated Work submasters.
      4. Performance Lighting Circuits power down
      5. The sound system will be informed of the status change.

3. Work / House
a. Calls to the Controller are executed in the order in which they are received.
b. The house lights may be at either Cleaning, Full, Half, Glow, Out, or toggled off. These states are mutually exclusive. Only the Cleaning state may be toggled off.
c. LEDs associated with faceplates Bx are illuminated when a submaster is not active.
d. The Work/House light panels have associated buttons illuminated when a submaster is active. These buttons are to be synchronized with the Bx faceplates.
e. House light states switch with cross fades of a set duration (initially 5 seconds). Each house light state will have an associated preset.
f. Faceplate Bx buttons will cause their associated submasters to bump on (1 second fade). The associated submaster will be dependent upon the mode the system is in.
   1. In show mode not all stations will have associated submasters in all modes. Such stations should be reset to the off state when the system is in a mode with no associated submaster.
   2. In work or night mode a submaster will be associated with each faceplate.
g. All submasters will appear on the touch panel.
h. All buttons on the work/house lighting console will have associated submasters.
i. Master states will not inhibit the function of the buttons on the touch panel.

4. Button Behavior
   Most buttons stations change function depending on whether the Show button is active or the work button is active. See the schedule on the drawings.

5. Recording
   a. Web based editing of presets is the preferred method. Where a web based interface does not meet the following requirements a capture system should be used for updating preset contents.
      Web interface requirements:
      1. Securable web interface that is password protected.
      2. Does not allow access to the underlying logic and configuration.
   b. Capture
      1. Captures the current controller output into the selected presets, filtering for allowable presets in the capture.
      2. The process is:
         a. Go to the preset screen by selecting Show Presets
         b. Select the preset to capture
         c. When selected the user will be prompted for a Capture password.
         d. Press Capture
         e. Press the preset again to confirm.
   c. Capture filters
      a. For masters ANY DMX channel may be captured
      b. For Special Presets ANY DMX channel may be captured
      c. For house lights only house light DMX channels may be captured
      d. For Work light and running lights only channels associated with that zone are captured.

6. Settings
   a. When selected the user will 1st be prompted for the Setup password. If the entry is correct the user will move to the setup screen. If it is incorrect they will receive the message “Incorrect Password” and then be returned to their previous screen.

7. Re-label Pop Up
   a. When selected the user will 1st be prompted for the Setup password.
   b. Next the user will be asked to select the key to relabel or exit. If the user does not select a key in 30 seconds the user will be returned to the main menu.
   c. Next the user will be presented with the current label and an alpha numeric keyboard (with left, right and backspace keys). The user will type the label (the system will limit the number of characters to what will fit on the button) and select OK to store.
   d. The user will be prompted to select the next key to exit or exit. If the user does not select a key in 30 seconds the user will be returned to the main menu.
   e. Special Presets and Work/Running zones may be relabeled.
8. Change Password (Setup or Capture)  
a. When selected the user will 1st be prompted for the Setup password.  
b. Next the user will be presented with the 6 asterisks and a numeric keyboard (with left, right and backspace keys). The user will type the new password and select OK to store.  
c. The password 91753264 will always work for either password and cannot be changed.  
9. Restore To Defaults  
a. When selected the user will 1st be prompted for a password.  
b. Next the user will be presented with the message: “Are you certain you want to change all settings on this screen and all preset labels to their default settings? The user will hit OK or Cancel..  
10. Time Buttons  
a. "Acquire time of day..." when selected brings up numeric pallet and allows entry of new time in HHMM format. Tells system when to reach out over internet to time server to correct it's clock. 0000 Tells the system not to automatically reset it's time.  
b. "Acquire Time Now" when pushed Tells system to reach out over internet to time server to correct it's clock now.  
c. "Manually Set Time..." when selected brings up numeric pallet and allows entry of new time in HHMM format. Tells system the current time.  
11. Occupancy Sensors  
a. Occupancy sensors only function when the system is in Work mode and when Override is not set On.  
b. Occupancy sensors turn their associated work zone to the Off state after preset duration of inactivity, initially 20 minutes.  
c. Occupancy sensors do not turn any zones On.  
d. Occupancy sensor indicators display status of occupancy sensors.  
12. Clean Screen Button  
a. Pressing this button displays the Clean Screen for 30 seconds and then returns to the previous screen. This allows the screen to be cleaned without inadvertent button presses.

3.02 INSTALLATION  
A. Provide racks, furniture, consoles, etc., required for the installation and needed to provide completed systems. Only to the extent that such ancillary equipment is specified elsewhere is it excluded from these system Specifications.  
B. Provide low voltage cable.  
C. Terminate control lines.  
D. Setup initial configuration.  
E. Assist architectural lighting designer and consultant in adjusting initial configuration.

3.03 SYSTEM TESTS AND ADJUSTMENTS.  
A. Test permutations and combinations of logic inputs to ensure predictable system outputs (reactions).  
B. Latency - measure time between button push and response.  
C. Test occupancy sensors for coverage and maximize coverage while adjusting to minimize falsing.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Work in this section includes the engineering, manufacture, furnishing, and coordination of the Performance Lighting Control Console and accessories.

B. Section Includes
   1. Lighting Control Consoles & Peripherals
   2. Accessories.
      a. Cables to connect devices.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The following are accepted manufacturers:
   1. Electronic Theatre Controls

2.02 MANUFACTURED UNITS

A. Twelve Thousand (12,000) Channel Performance Lighting Console in the Main Theatre:
   1. Acceptable products:
      a. ION Xe 20, Electronic Theatre Controls.

B. Two Thousand (2,000) Channel Performance Lighting Console in the Studio Theatre:
   1. Acceptable products:
      a. ION Xe 20, Electronic Theatre Controls.

C. Eighty (80) Device Performance Lighting Console in the Recital Hall:
   1. Acceptable products:
      a. ColorSource 40AV, Electronic Theatre Controls.

2.03 ACCESSORIES

A. Focus Remote - Wireless
   1. See contract documents for quantities
   2. Focus remote provides remote control lighting console.
   3. Remote functions supported include:
      a. Channel selection and level setting.
      b. Recording of levels.
   4. Exhibit no loss of connection during operation in the space where their access point is located.
   5. Battery life on the wireless remote focus unit is a minimum of 6 hours while communicating with the network.
   6. Focus Remote shall include one or more wireless access points (WiFi).
   7. Focus Remote shall be Apple iPad Mini4 or similar Android tablet. Provide Otterbox Defender case or approved equal.

B. Monitors
   1. Provide monitors in sufficient quantity to fully populate the monitor outputs on the specified console.
   2. Provide a color monitor compatible with the associated console.
3. Minimum size: 21 inches measured diagonally.
4. Provide cable and interface to attach Monitor to receptacle.
5. Provide a touchscreen monitor where consoles are capable of using a touchscreen interface.

C. Lighting Console Stand.
   1. Stand must accommodate console, monitor(s), backup console, external keyboard (if usable with console), printer, and provide a writing surface and work area for operator.
   2. Stand must include wheels.
   3. AnthroCarts AnthroBench, with 5” Casters, Monitor Arms, and necessary accessories

D. Provide dust cover for each console.

PART 3 EXECUTION

3.01 INSTALLATION

   A. Setup initial configuration.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY
A. Work in this section includes the engineering, manufacture, furnishing, and coordination of performance company switch for the connection of temporary equipment.

1. Company Switch furnished for installation by others:

1.02 SYSTEM DESCRIPTIONS
A. Performance Requirements
1. Operate at temperatures up to 40 degrees centigrade.
2. Breaker shunts when connection chamber is open.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. The following are accepted manufacturers:
   1. ETC: PSP Series
   2. Union Connector, Inc /SP series
   3. SSRC
   4. Lex Products
   5. ESL Power Systems

2.02 MANUFACTURED UNITS
A. General:
   1. Provide a breaker rated for at least 65K AIC
   2. Provide a breaker rated for continuous duty at 100% amperage capacity and 100% duty cycle.
   3. Provide a shunt trip for the breaker that is interlocked with the connection chamber door.
   4. Provide hasp for locking breaker in the off position.
   5. Provide CamLok J Series connections.
   6. Provide lug connections for bare leads.
   7. Provide a strain relief for the lug connections.
   8. Provide neon or LED indicators on each phase indicating power from the breaker to it’s phase labeled with NEC required color codes and alphabetic names of phases.
   9. Provide neon or LED indicator showing supply to ground continuity labeled in green with alphabetic name.
   10. Provide signage with the following text:
       "Connection and disconnection is to be made by qualified personnel only. Connection is to be made in the following order:
           1) Ground
           2) Neutral
           3) Hot
           Disconnection is to be made in the reverse order”
   11. Label each phase and neutral on the exterior of the switch at the connection points
   12. Provide signage indicating the panel and breaker feeding the company switch and the amperage of the switch.
13. Color code connectors according to prevailing regulations.
   In the absence of regulations label them as follows:
   a. 480/277 Service
       Phase A – Brown
       Phase B – Orange
       Phase C – Yellow
       Neutral – White
       Ground – Green
   b. 120/208 Service
       Phase A – Black
       Phase B – Red
       Phase C – Blue
       Neutral – White
       Ground – Green

B. 400A Company Switch
   1. Includes a second set of neutral connections for the feed side, the bare lead connections and the cam-lok connections.

C. Isolated Ground Company Switch
   1. Provide isolated ground terminations with separate supply terminations for building ground and power ground.
   2. In a system in which the isolated ground is lifted there should be no continuity between the conduit ground and the power ground.
   3. Provide signage indicating “Isolated Ground Sound Power”

D. Acceptable Products:
   1. Electronic Theatre Controls PSP Series
   2. Union Connector - #50-PBS-MXXXX-C/SP Series
   3. SSRC, Inc - DS-XXX-6W-C Series
   4. Lex Products, Inc - DBM XXX-CS001 - Series

PART 3 EXECUTION
(UNUSED)

END OF SECTION
**PART 1 GENERAL**

**1.01 SUMMARY**

A. Work in this section includes the engineering, manufacture, furnishing, installing and coordination of the control signal distribution system.

B. Section Includes

1. **DMX**
   a. Optical Isolators / Splitters.
   b. Digital to analog interface.

2. **Ethernet**:
   a. Patch Panels.
   b. Patch Cords.
   c. Switches.
   d. Power Over Ethernet Supply
   e. Console / DMX / Video Nodes.

3. **Electronics Racks**
   a. Rack Panels

4. **Performance Lighting Control Faceplates & Associated Cable Assemblies**

5. **Accessories**
   a. Power filtration.
   b. Cables to connect devices.
   c. Uninterruptible power supply.

6. Data communications cable servicing control circuits connecting Performance Lighting Control faceplates specified herein to each other, to the motorized breaker panel specified herein and to the work lighting control system.

7. Data communications cable servicing architectural lighting fixtures connecting Performance Lighting Control system.

**1.02 SYSTEM DESCRIPTIONS**

A. **Design Requirements**

1. **Standards and Regulations**
   a. DMX equipment has ports able to communicate with any DMX compliant products.
   b. Ethernet systems are to be ACN compliant.
   c. Systems are to be RDM compliant.

2. **The DMX System**
   a. Each DMX output is electrically isolated from all other DMX outputs.
   b. Systems are to be RDM compliant.
   c. Concurrent DMX inputs in a single domain are run through a pile-on processor which actively merges the data streams into a single stream repeating the higher of two conflicting values.

3. The **Ethernet System**
   a. Provide Ethernet jacks that are electrically isolated from all other jacks.
   b. Provide systems that are Category 5E or greater compliant.
   c. Merge multiple signals in a single domain through a partitioning hub, router, or switch.

4. **The Architectural Control System**
   a. Provide jacks that are electrically isolated from all other jacks.
   b. Provide cable per the manufacturer’s requirement. If the requirement is Ethernet, follow those requirements.
B. Performance Requirements
   1. DMX
      a. Data transmitted by a controller is passed to the receiving devices without evidence of
         skipping, or jumping from each input point.
      b. Fade data transmitted without skipping shall reach the receiving devices intact; without
         dropouts.
      c. Failure on one branch of the control system will not affect other branches.
   2. Ethernet:
      a. The hub isolates a failure on one node from effecting other nodes.
   3. The Architectural Control System
      a. Inputs exhibit no perceivable latency.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. The following are accepted ACN, DMX, RDM signal processing manufacturers
      1. Artistic License
      2. Doug Fleenor Designs
      3. Pathway
      4. Electronic Theatre Controls (ETC)
   B. The following are accepted data communications cable manufacturers:
      1. Belden
      2. Alpha Wire & Cable
   C. The following are accepted ethernet termination equipment manufacturers:
      1. Hubbell Inc
      2. Siemen Co
      3. Lucent Technologies
   D. The following are accepted ethernet hub, switch and router manufacturers
      1. Pathway Connectivity Solutions
      2. Bay Networks
      3. Cisco Systems
      4. Synoptics
      5. 3 Com.

2.02 MANUFACTURED UNITS
   A. DMX
      1. Optical isolator / splitter:
         a. Provides non-conductive isolation between incoming DMX-512 line and outgoing DMX-512
            lines.
         b. Provides distribution of DMX-512 lines.
         c. The isolator / splitter shall accept a DMX-512 input. The DMX-512 input is a male 5 pin
            XLR connector.
         d. Provide one (1) female 5 pin XLR connector to chain into a data stream with other interfaces
            and motorized breaker panel.
         e. The isolator / splitter shall provide a minimum of five (5) isolated DMX-512 outputs. Each
            DMX-512 output is a female 5 pin XLR connector.
         f. Passes RDM
         g. Mounts in a 19” equipment rack.
         h. Acceptable Products:
            1. Pathway DMXRepeater Pro
            2. Doug Fleenor Designs BIDI8
            3. Enttec RDS8
2. Digital to Analog Interface:
   a. Converts an incoming DMX-512 control signal to an analog control output.
   b. Accept one (1) DMX-512 input signal. The DMX-512 input connector is a male 5 pin XLR connector.
   c. Provide female 5 pin XLR connectors to chain into a data stream with other interfaces and motorized breaker panel.
   d. Mounts in a 19" equipment rack.
   e. Provide 16 analog output signals.
      1. The analog signals are via three (3) 36 pin female champ connectors. Signal are on pins 1-32. Pins 33-36 are used for signal ground.
      2. Maximum load per output is 10 ma with a total load of 200 ma.
      3. Outputs are 0/2 - 3/10 VDC (user selectable range).
      4. Outputs are diode protected and diode drop compensated.
   f. Provide built in diagnostics.
   g. Provide LEDs indicating power supply and signal status.
   h. Provide user selectable address and a user accessible data line terminator switch.
   i. Acceptable Products:
      1. Pathway #1004
      2. Fleenor DMX24ANL

B. Ethernet:
   1. The ethernet system is a 100BaseT based system wired in a star topology using switches and one node per vector.
   2. Where the runs require it the contractor will provide fiber optic cabling and transceivers.
   3. Provide Category 6E cable.
   4. Terminate in accordance with Category 6E guidelines.
   5. TIA-568B Pairing
   6. Switch
      a. The switch shall isolate each port (and attached node) from all others.
      b. The switch isolates a failure on one port from effecting other ports.
      c. The switch limits traffic to and from a port to that which effects the nodes resident on that port.
      d. The switch supports sACN and ACN implementations.
      e. The switch supports Dante compliant QoS settings.
   7. Nodes
      a. A node is a point of interface between lighting system and the ethernet network.
      b. A DMX node provides a point of interface with DMX channels.
      c. Acceptable Products:
         1. Electronic Theatre Controls Net 3 Series
   8. Patch Cables
      a. Have connectors compatible with switches and patch bays.
   9. Extension Cables
      a. Have Neutrik Ethercon compatible shells for enhanced durability.

C. Installed Cable
   1. Provide low voltage cable.
   2. Non-Plenum Rated
      a. DMX: Belden 1624R
      b. 0-10V: Belden 8760
      c. Other cables as per system requirements.
   3. Plenum Rated
      a. DMX: Belden 1624P
      b. 0-10V: Belden 88760
      c. Other cables plenum rated versions per system requirements.
D. Equipment racks and panels
   1. Racks
      a. EIA 19” standard modular rack frames providing sufficient panel space to accommodate indicated equipment with room for expansion, 21” of width, and 26” of depth, minimum.
      b. Provide side panels, one pair per rack group.
      c. Provide matching ventilation panels as needed.
      d. Provide matching blank or vent panels in spare rack spaces.
      e. Approved pan or truss head type panel mounting screws with non-metallic flat washers shall be used to secure rack-mounted equipment.
      f. Provide copper busbar in each rack for connection of ground wires.
      g. Racks shall have the same color finish (Textured Black).
   2. Blank Panels
      a. 1/8”, flat black aluminum blank panel in 1U through 6U heights.
   3. Vent Panels
      a. 16-gauge perforated steel vent panel with 5/32” diameter holes. In 1U through 3U rack heights with black baked enamel finish.
4. Signage
   a. Provide a sign stating:
      The installed ACN system is compliant with Category X Ethernet standard (Where X is replaced with the installed standard employed.) The installed DMX system is compliant with the DMX512-a standard

2.03 ACCESSORIES

A. Provide DMX-512 control cable.

B. Uninterruptible Power Supply
   1. Provide uninterruptible power supply(ies) (UPS) to service computer equipment provided.
   2. Provide a minimum of 1 for each location.
   3. Size each uninterruptible power supply (UPS) sized to power its associated device(s) for a minimum of 15 minutes after the loss of power.
   4. Input voltage < 132 VAC.
   5. Output voltage 115 VAC ± 5%
   6. Transfer voltage 103 VAC.
   7. Surge energy 240 Joules.
   8. Surge current 6500 Amp peak.
   9. Surge response time 0 Ns (instantaneous).
   10. Noise filtration, full time EMI/RFI suppression, 100 Khz to 10 Mhz, > 60 dB.
   11. Audible low battery signal.

PART 3 EXECUTION

(UNUSED)

END OF SECTION
SECTION 11 61 61.53
PERFORMANCE LIGHTING POWER AND CONTROLS
CONTROLLED MOTORIZED BREAKER PANEL

PART 1 GENERAL

1.01 SUMMARY
A. Work in this section includes the engineering, manufacture, furnishing, and coordination of DMX or ACN controlled motorized breaker panels for the control of switched circuits.
B. Section Includes
   1. Controlled motorized breaker panel furnished for installation by others:

1.02 SYSTEM DESCRIPTIONS
A. Performance Requirements
   1. Operate at temperatures up to 40 degrees centigrade.
   2. Exhibits no chatter when control signal is at switching threshold.
   3. Exhibits no spurious switching or interaction between circuits.
   4. Key switches do not interoperate with other equipment systems in the facility.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. The following are accepted assembly manufacturers for non-audio applications.
   1. Benjamin Electric
   2. Electronic Theatre Controls
   3. LynTec
B. The following are accepted motorized breaker manufacturers:
   1. SquareD
   2. Eaton/Cutler Hammer

2.02 MANUFACTURED UNITS
A. General
   1. Provide separate connection chambers for power and control
   2. Branch protection and control is provided by the motorized breaker.
      a. An acceptable substitution would be a factory wired panel board / relay panel combination where field connections are limited to one set of connections for each relay (hot and neutral plus ground) and one set of connections for the main feeders (3 hot, 1 neutral and ground).
   3. Panel board / Load Center
      a. Fed by 3 phase power.
      b. Panels with 30 branch breaker positions or less have a single feed rated at 100A or more.
      c. Panels with 48 branch breaker positions or less have a single feed rated at 200A or more.
      d. Panels with 49 branch breaker positions or more may have multiple feeds rated at 400A or more.
   4. Main breaker is required only where specified.
   5. Terminal Sizes. Provide terminals capable of accommodating wires of the following sized ranges:
      a. 10Amp-20A: #8-#14 AWG
      b. 50A: #4-#10 AWG
      c. 100A: #2/0-#8 AWG
B. Control:
1. Provide control wire termination at screw terminals.
2. Control via DMX or ACN and TCP/IP
3. Provide user configurable control addresses.
4. Each motorized breaker is able to have an individual control address.
5. Multiple motorized breakers may be configured to share the same control address.
6. Provide an indicator showing control signal present.
7. If control is via DMX, provide a user settable termination switch.
9. Provide an indicator showing control signal present.

C. Circuit Breakers
1. Rated for 200,000 on/off/on cycles
2. Other Rating per electrical section.
3. Basis of design:
   a. 15A and 20A breakers
      1. SquareD ECB-G3 series
      2. Eaton GHQ Series
   b. 30A and above breakers
      1. SquareD QO series
      2. Eaton GHQ Series

D. Multipole Contactors
1. Furnish three pole single throw contactor.
2. Furnish contactors rated for amperage as noted 277V load continuous duty at 100% amperage capacity and 100% duty cycle.
3. Furnish an indicator showing energized status of contactor.
4. Integrate control of contactor with motorized breaker panel.
5. Furnish enclosure to contain the specified contactors for each location. Once enclosure may contain multiple contactors providing they are of the same voltage.

E. Acceptable Products – Non-Audio applications
1. Benjamin Electric BCP Series
2. Electronic Theatre Controls Sensor IQ Series
3. Lyntec RPC Series

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Work in this section includes the engineering, manufacture, furnishing, and coordination of emergency lighting transfer switch for transferring branch loads from the Performance Controls to emergency power.

B. Section Includes
   1. Emergency Lighting Transfer Switch furnished for installation by others:

1.02 SYSTEM DESCRIPTIONS

A. Design Requirements
   1. Additional Standards and Regulations
      a. All components must comply with applicable regulations including, but not limited to:
         1. NFPA 70
         2. NFPA 110
         3. UL 924
         4. UL 1008

B. Performance Requirements
   1. Operate at temperatures up to 40 degrees centigrade.
   2. Load is transferred when main power partially or fully fails, and emergency power is present and more complete than normal power.
   3. Load is transferred when a contact closure from the fire alarm system opens.
   4. Key switches do not interoperate with other equipment systems in the facility.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The following are accepted additional manufacturers:
   1. Electronic Theatre Controls
   2. Lex Products
   3. Union Connector

2.02 MANUFACTURED UNITS

A. General:
   1. Provide transfer switches with pole count and emergency power configuration as noted in the equipment and component schedule.
   2. Provide lug connections for bare leads.
   3. Accept dry contact control from fire alarm system.
   4. Accept control from Remote Station
   5. Provide remote status indication at remote station.

B. Transfer Panel
   1. Normal power connections
      a. Accept normal continuous 3 phase power supply.
      b. Provide lug connections for bare leads.
c. Provide LED indicators on each phase indicating normal power from the breaker to it’s phase labeled with NEC required color codes and alphabetic names of phases.

2. Transfer Relays
   a. Provide multi-pole transfer relays with amperage capacity as required and quantities as specified.
   b. Relays are to exhibit no arching upon operation.
   c. Relays are to be modular and easily replaceable by qualified maintenance personnel.

3. Emergency power connections
   a. Where emergency power branch protection is required:
      1. Provide emergency power main connections phase configuration and amperage as required.
      2. Provide a emergency main power breaker rated for at least 65K AIC
      3. Provide emergency power branch breakers rated for continuous duty at 100% amperage capacity and 100% duty cycle.
   b. Provide lug connections for bare leads.
   c. Provide LED indicators on each phase indicating emergency power from the breaker to its phase labeled with NEC required color codes and alphabetic names of phases.

4. Load Connections
   a. Provide lug connections for bare leads.

5. Provide a lockable door.

6. Provide hasp for locking the emergency main power breaker in the off position.

7. Provide LED indicator showing transfer status

C. Remote Switch / Status Station
   1. Provide a key switch which throws emergency transfer switch.
   2. Provide LED indicator showing transfer status

**PART 3 EXECUTION**

*(UNUSED)*

**END OF SECTION**
SECTION 11 61 61.61

PERFORMANCE LIGHTING POWER AND CONTROLS
DMX EMERGENCY BYPASS CONTROLLER

PART 1 GENERAL

1.01 SUMMARY
A. Work in this section includes the engineering, manufacture, furnishing, and coordination of emergency lighting transfer switch for transferring branch loads from the Performance Controls to emergency power.
B. Section Includes
   1. DMX512 Emergency Bypass Controller:

1.02 SYSTEM DESCRIPTIONS
A. Design Requirements
   1. Additional Standards and Regulations
      a. DMX512 compliant.
      b. All components must comply with applicable regulations including, but not limited to:
         1. UL 924
   B. Performance Requirements
      1. Operate at temperatures up to 40 degrees centigrade.
      2. DMX512 control stream is replaced with a prerecorded preset when trigger switches to bypass setting.
      3. Acts on all channels in at least one (512 channel) universe of DMX512.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. The following are accepted additional manufacturers:
   1. Electronic Theatre Controls

2.02 MANUFACTURED UNITS
A. Common Attributes
   1. Functional
      a. Overrides a single universe of DMX512 control signals from “Normal” to “Bypass” when a trigger signal is detected via a two-pin trigger input
      b. Polls the bypass trigger input after a power loss and reacts upon start up
      c. Does not process DMX512 input in Normal mode (pass through)
      d. Records a single DMX512 preset (snapshot) of 512 channels for recall during “Bypass” mode
      e. Recalls default or recorded sequence immediately on restart if the trigger is also applied at restart.
      f. Distributes DMX-512 signal to a minimum of 6 optically isolated outputs. Refer to section 11 61 61.40 for characteristics of Opto-Isolator subsystem.
   2. Mechanical
      a. Enclosure constructed of 18gauge, formed steel panels with a removable front cover finished in gray, fine textured powder coat paint
      b. Internal voltage barrier provides separate wiring compartments for power and control wiring
      c. LED indicator visible from the exterior of the enclosure.
         1. Normal state with a “green” color light when Power is present
         2. Bypass state with a “red” color light when active
d. Test button accessible from the front of the enclosure without removing any panels

e. The test button shall be recessed to prevent accidental triggering

f. Internally accessible, labeled DIP switches for configuration of:
   1. DMX512 Record Mode
   2. Contact input type
   3. Wait Time for Restore incoming DMX512 (bypass trigger removed)

g. Internally accessible button for DMX512 Record (snapshot) with an indicator LED for record action

3. Electrical

   a. Supports 100 to 277-volt input power, 50/60 Hz, 0.2 amp maximum current
   b. Bypass Contact Input supports two, 12 AWG low voltage wires with two modes:
      1. +12VDC sent from the DEBC through a remote contact (dry)
      2. +12VDC to +24VDC sent from the remote device to the DEBC contact (wet)
   c. Bypass input configurable as Maintained Normally Open (default) or Maintained Normally Closed
   d. Supports one Universe (512 channels) of DMX512
      1. DMX512 Output and DMX512 Input terminals for Belden 9729 cable or equivalent
      2. Socketed DMX512 transceiver chip with onboard spare
   e. Nonvolatile memory for storage of a single recorded sequence of 512 channels.
   f. UL and cUL 924 Listed for Emergency Lighting applications.

4. Thermal

   a. Ambient room temperature: 40°C / 104°F
   b. Ambient humidity: 90% non-condensing

2.03 WALL MOUNT CONFIGURATION

1. Mechanical

   a. Designed for Wall mount applications

2. Electrical

   a. Power Input terminals accept two 24 – 10 AWG solid or stranded wires
   b. Grounding Lug accepts 14 AWG solid or stranded ground wire

PART 3 EXECUTION

(UNUSED)

END OF SECTION
SECTION 11 61 61.62
PERFORMANCE LIGHTING POWER AND CONTROLS
EMERGENCY BYPASS DETECTION KIT

PART 1 GENERAL

1.01 SUMMARY
A. Work in this section includes the engineering, manufacture, furnishing, and coordination of emergency lighting transfer switch for transferring branch loads from the Performance Controls to emergency power.

B. Section Includes
   1. Emergency Bypass Detection Kit furnished for installation by others:

1.02 SYSTEM DESCRIPTIONS
A. Design Requirements
   1. Additional Standards and Regulations
      a. All components must comply with applicable regulations including, but not limited to:
         1. UL 924

B. Performance Requirements
   1. Operate at temperatures up to 40 degrees centigrade.
   2. Provides a central location to detect power loss, fire alarm, and panic button.
   3. Bypass trigger is thrown when one or more of the following occurs:
      a. Main power partially or fully fails.
      b. A contact closure from the fire alarm system opens.
      c. Test switch is triggered.
   4. Key switches do not interoperate with other equipment systems in the facility.
   5. Phase Loss Detection circuitry shall provide 0.5 second delay to prevent nuisance tripping.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. The following are accepted additional manufacturers:
   1. Electronic Theatre Controls
   2. Philips - Strand

2.02 MANUFACTURED UNITS
A. General:
   1. Provide detection kit with pole count as noted in the equipment and component schedule.
   2. Provide lug connections for bare leads.
   3. Accept dry contact control from fire alarm system.

B. Panel
   1. Normal power connections
      a. Accept normal continuous 3 phase power supply.
      b. Provide lug connections for bare leads.
      c. Provide LED indicators on each phase indicating normal power from the breaker to its phase labeled with NEC required color codes and alphabetic names of phases.
   2. Transfer Relays
      a. Provide three (3) sets of output dry contacts capable of accepting 12 to 22-gauge wire.
      b. Each set includes Normally Open pole, Normally Closed pole and a common pole.
PART3 EXECUTION

(UNUSED)

END OF SECTION
SECTION 11 61 61.71

PERFORMANCE LIGHTING POWER AND CONTROLS
CONTROL FACEPLATES

PART 1 GENERAL

1.01 SUMMARY
A. Work in this section includes the engineering, manufacture, providing, and coordination of the control faceplates.
B. Section Includes
   1. Control faceplates
C. Products Furnished but Not Installed Under This Section:
   1. Back boxes for faceplates furnished to the Division 26 Contractor. Deliver backboxes for installation by the Division 26 Contractor on a mutually agreed upon date. Gang backboxes, as outlined in the contract documents, are excepted from this and are provided under Division 26.

1.02 SYSTEM DESCRIPTIONS
A. Design Requirements
   1. Faceplates are fabricated to match their mounting conditions.
   2. Faceplates have labels with circuit numbers that match their termination points.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. The following are accepted faceplate manufacturers:
   1. Electronic Theatre Controls
   2. SSRC
   3. Union Connector
   4. Lex Products
   5. Whirlwind
   6. RCI
   7. Wireworks
   8. Arkadium
B. The following are accepted data communications cable manufacturers:
   1. Belden
   2. Alpha Wire & Cable
C. The following are accepted connector manufacturers:
   1. Neutrik

2.02 MANUFACTURED UNITS
A. Faceplates, backboxes and junction boxes:
   1. Furnish faceplates, backboxes and junction boxes as specified in the Contract Documents.
   2. Backboxes
      a. Clearly mark backboxes with box number on the rear “INTERIOR” of the backbox.
      b. Protect this marking from destruction by other trades subsequent work.
   3. Cable on Faceplates:
      a. In boxes with pigtails or multiconductor cable is type SO sized to accommodate the maximum load of the terminating connector.
      b. Cable is to be black in color.
4. For surface mounted conditions faceplate and back box dimensions are equal.
5. Where faceplates are installed in flush mount conditions the edges of the faceplate are to extend a minimum of 3/8" beyond the edges of the back boxes.
6. Remove sharp edges and burrs on faceplates.
7. Faceplate Finishes
   a. Unless otherwise noted the finish is flat.
   b. Where no finish color is noted a custom color is required, which will be selected by the architect.
8. Provide cover screws with slotted holes to accommodate back boxes mounted out of vertical. The slots will be fabricated such that the horizontal clearance is equal to twice the vertical clearance.
10. Finish: 120 Grit, horizontally brushed anodized aluminum color as noted.
11. Reinforce faceplate as needed to minimize deflection.
12. Directly engrave into pre-anodized aluminum.
13. Ethernet receptacles are labeled with the maximum portable cable length. This is calculated by subtracting the installed cable length from 328'. Mechanically fasten this label to the faceplates with rivets.
14. Label Color: Natural (silver) or white fill.
   a. Legends shown on detail drawings are typical. Refer to drawings and submit proposed circuit numbers to Consultant for review. Faceplate title is typically labeled with the appropriate signal. Individual connectors are labeled with the corresponding circuit number.
   b. Legend size shall be 0.125" high characters of medium weight unless otherwise noted.

B. Portable Cable
1. General
   a. Each cable shall be color coded by length using a heat-shrink polyolefin sleeve near the male end of the cable. Exempted from this requirement are patch cables.
   b. This sleeve shall be hot-stamped with the name of the facility, or as directed by the Owner. Exempted from this requirement are patch cables.
   c. One to three bands of color code with the most significant digit closest to the connector. Color coding is as follows:
      white = 9
      gray = 8
      violet = 7
      blue = 6
      green = 5
      yellow = 4
      orange = 3
      red = 2
      brown = 1
      black = 0
   d. For example, a 50' would be Green / Black with Green closest to the connector and 25' would be Red /Green with Red closest to the connector.
2. Ethernet Cables
   a. Cables for signal distribution are to terminate in Ethercon Connectors. Exempted from this requirement are patch cables.
3. DMX Cables
   a. Are to terminate in 5-Pin XLR connectors.
PART 3 EXECUTION

3.01 (UNUSED)

END OF SECTION
SECTION 11 61 61.72
PERFORMANCE LIGHTING POWER AND CONTROLS
POWER FACEPLATES

PART 1 GENERAL

1.01 SUMMARY
A. Work in this section includes the engineering, manufacture, furnishing, and coordination of the line voltage faceplates.
B. Work in this section includes the engineering, manufacture, providing, and coordination of the control faceplates.
C. Section Includes
D. Products Furnished but Not Installed Under This Section:
   1. Back boxes for faceplates furnished to the Division 26 Contractor. Deliver backboxes for installation by the Division 26 Contractor on a mutually agreed upon date. Gang backboxes, as outlined in the contract documents, are excepted from this and are provided under Division 26.
   2. Devices with 100v and above terminations including lighting receptacles, connector strips, faceplates and backboxes.

1.02 SYSTEM DESCRIPTIONS
A. Design Requirements
   1. Faceplates are fabricated to match their mounting conditions.
   2. Faceplates have labels with circuit numbers that match their termination points.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. The following are accepted manufacturers:
   1. Electronic Theatre Controls
   2. SSRC
   3. Thomas Engineering
   4. Union Connector
   5. Lex Products
B. The following are accepted data communications cable manufacturers:
   1. Belden
   2. Alpha Wire & Cable

2.02 MANUFACTURED UNITS
A. Faceplates, backboxes and junction boxes:
   1. Furnish faceplates, backboxes and junction boxes as specified in the Contract Documents.
   2. Attributes common to all faceplates
      a. Cable on Faceplates:
         1. In boxes with pigtails or multiconductor cable is type SO sized to accommodate the maximum load of the terminating connector.
         2. Cable is to be black in color.
         3. Multiconductor:
            a. Shared ground conductors are acceptable. Provide at least one ground conductor for every 3 circuits.
            b. For surface mounted conditions faceplate and back box dimensions are equal.
c. Where faceplates are installed in flush mount conditions the edges of the faceplate are to extend a minimum of 3/8” beyond the edges of the back boxes.
d. Remove sharp edges and burrs on faceplates.
e. Faceplate Finishes
   1. Unless otherwise noted the finish is flat.
   2. Where no finish color is noted a custom color is required, which will be selected by the architect.
f. Provide cover screws with slotted holes to accommodate back boxes mounted out of vertical. The slots will be fabricated such that the horizontal clearance is equal to twice the vertical clearance.
g. Backboxes
   1. Size backbox to accommodate termination with the maximum wire design wire size.
   2. Clearly mark backboxes with box number on the rear “INTERIOR” of the backbox.
   3. Protect this marking from destruction by other trades subsequent work.
h. Terminal Sizes. Provide terminals capable of accommodating wires of the following sized ranges:
   1. 10Amp-20A: #8-#14 AWG
   2. 50A: #4-#10 AWG
   3. 100A: #2/0-#8 AWG
i. Connectors:
   1. 20A Stage Circuit
      a. Stage Pin
      b. Color: Black
   2. PowerCon
      a. True1
   3. 20A General Service
      a. 5-20
      b. Hospital Grade
      c. Color: Black

3. All Faceplates:
   b. Exterior finish: baked enamel color as noted.
   c. Provide terminal strips as needed for connection of wiring to connectors without screw connections.
   d. Reinforce faceplates as needed where deflection may occur under heavy use.
e. Labels:
   1. Number circuits as per Contract Documents.
   2. Material 1/8” black lamacoid.
   3. Finish: black with white fill.
   4. Engraving: 1/2” high characters with non-yellowing white fill.
   5. Apply labels rivets.
   6. Label faceplates for duplicate circuits located onstage as follows:
      a. Material 1/8” OSHA safety yellow lamacoid.
      b. Finish: OSHA safety yellow with black fill.
      c. Engraving: 1/2” high characters with black fill.
      d. Apply labels with rivets.
   7. Label connectors as follows, unless otherwise indicated:
      a. Engraving: 1/2” high characters with non-yellowing white fill.

4. Connector Strip:
   a. Material: 16 gage steel or extruded aluminum.
   b. Exterior finish: baked enamel color as noted.
   c. Rigged Connector Strip Hangars
1. Connect directly to rigging system lines at the top, enclose the connector strip in the middle and support a lighting pipe at the bottom.
2. Are engineered to support a load equal to 30#/ per linear foot of pipe between rigging lines with safety margins as required by appropriate engineering standards.
3. Are rated for overhead hanging
4. Center the pipe and the connector strip under the hanging point.
5. Do not employ U-bolts.
6. Have additional supports midspan to support the connector strip from the pipe as necessary.

d. Catwalk, static pipe, and wall mount connector strip hangars.
   1. Employ formed metal hangars specific to each mounting condition,
   2. May employ U-bolts providing the U-bolt only supports the connector strip and no other objects.

e. Connector Strip With Control Signal:
   1. Includes a partitioned low voltage section continuous over the length of the connector strip for the distribution of control signals.

5. Clamp Mounted Box:
   b. Exterior finish: baked flat enamel color as noted.

6. Floor Pocket:
   a. Material: 3/8" thick cast iron floor plate with hinged self closing cover for flush floor installation.
   b. Exterior finish: baked flat black enamel.
   c. Receptacles are mounted on a 14 gage angled steel faceplate.
   d. Additional Labeling Requirements
      1. Engraved 1/2" high characters on exposed area on top of box to list inclusive circuit numbers.
      2. Interior Labels:

7. Grid Iron Junction Box:
   b. Exterior finish: baked flat enamel color as noted.
   c. Provide terminal strips of sufficient quantity to accommodate circuits as specified in the contract documents.
   d. Provide bushing type strain relief on multiconductor exitway.
   e. Secure multiconductor to surrounding structure with a looped eye wire mesh strain relief.
   f. Provide a cable cradle for installation by rigging contractor on each multiconductor feed.
   g. Additional Labeling Requirements
      1. Label so labels are readily visible when box is installed

B. Portable Cable
   1. General
      a. Each cable shall be color coded by length using a heat-shrink polyolifin sleeve near the male end of the cable. This sleeve shall be hot-stamped with the name of the facility, or as directed by the Owner.
      b. One to three bands of color code with the most significant digit closest to the connector. Color coding is as follows:
         white = 9
         gray = 8
         violet = 7
         blue = 6
         green = 5
         yellow = 4
         orange = 3
         red = 2
brown = 1
black = 0
c. For example a 50' would be Green / Black with Green closest to the connector and 25' would be Red /Green with Red closest to the connector.

2. MultiConductor Cable:
   Provide multiconductor cable to labeled to match faceplates as indicated on the drawings.
   a. Acceptable Multi-circuit Connectors
      1. Veam VSC Series
      2. Socapex SL419 series
      3. LEX LSC19 Series
      4. LK Connectors LKS series with the set screw option.
   b. Terminate as per USITT Recommended Practice RP-1 "Contact Function Assignments For Multi-Circuit Circular Pin Connectors Used For The Distribution of Multiple Lighting Circuits"
   c. Multiconductor Fan-Out
      Provide 6 circuit, 20 amp, type SO or Procable, fan-out with male multiconnector and 20 amp grounded stage female connectors as per the contract documents.
   d. Multiconductor Breakout
      Provide 6 circuit 20 amp, type SO or Procable, breakout with male multiconnector and 20 amp grounded stage female connectors as per the contract documents.

PART 3 EXECUTION

3.01 INSTALLATION
   A. On split pin connectors adjust all pins on all receptacles to the same diameter, causing them to present uniform resistance to a single plug. Adjust all pins on all plugs to the same spread. Plugs should fit securely in any receptacle with enough resistance to prevent the plug from slipping out, but not so much resistance to inhibit the plugs from being easily and completely mated.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY
A. Work in this section includes the engineering, manufacture, furnishing, and coordination of performance busway for the connection of temporary equipment.
1. Busway and accessories furnished for installation by others:
2. BusPlugs

1.02 SYSTEM DESCRIPTION
A. The busway system consists of an extruded housing containing copper busbars and a series of plug in units (busplugs) that tap protected branch feeds off of the bus bars.
B. Performance Requirements
1. BusPlugs insert into Busway and engage and lock with a 90-degree turn.
2. Tools are not required for Busplug insertion.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. The following are accepted manufacturers:
1. Universal Electric Corporation: Starline Busway (basis of design)
   Rep / Point of Contact: Watson Sales 704-765-9636

2.02 MANUFACTURED UNITS
A. General:
1. The system is UL Listed.
2. Finish: power coated matte black paint.
B. Busway
1. Provides 100% Ground Path
2. 4 Pole configuration
3. Rated for 600V
C. Feeds
1. There are 3 types of feeds available for 100A and 200A bussway. Care should be taken to order the correct type of feed.
2. Busway mounted flush to the ceiling will require a top feed.
3. Busway fed from the right end employs a standard end feed unit and an end cap.
4. Busway fed from the left end of the unit employs a male end feed and an end piece.
D. BusPlugs
1. Provide breakers or fuses rated for at least 22K AIC
2. Provide a breaker rated for continuous duty at 100% amperage capacity and 100% duty cycle.
3. Labeled with phase of tap.
4. Low amperage system busplugs interchangeable for 100A and 225A busway.
5. High amperage system busplugs dedicated to 400A busway.
6. Receptacles comply with requirements in Circuit Faceplates subsection of this specification.
E. Acceptable Products:
1. 100A Busway
1. Universal Electric Corporation Starline Track Busway 100T3 series track
2. 225A Busway
   a. Universal Electric Corporation Starline Track Busway 225T3 series track
3. 400A Busway
   a. Universal Electric Corporation Starline Track Busway 400T5 series track
4. 100A-225A BusTaps
   a. Universal Electric Corporation Starline Track Busway T3 series busplugs
5. 400A BusTaps
   a. Universal Electric Corporation Starline Track Busway T5 series busplugs

PART 3 EXECUTION
(UNUSED)

END OF SECTION
SECTION 11 61 61.80
PERFORMANCE LIGHTING POWER AND CONTROLS
STAGE EDGE MARKING SYSTEM

PART 1 GENERAL

1.01 SUMMARY
A. A dimmable LED based stage edge marking system providing actively illuminated marker lights visible to the performer, but not the audience.
B. Work in this section includes the engineering, manufacture, furnishing, coordination and installation of the system.
C. Section Includes
   1. Low Voltage Fixture
   2. DMX driven dimming power supply
   3. Low Voltage Cable
D. Coordination
   1. Flooring Contactor provides the slot in the floor per the manufacturer’s requirements under Division 09.
   2. Conduit and Gang backboxes are provided under Division 26.
   3. Line voltage cable and terminations are provided under Division 26.
   4. Zone switching relay is provided by Lift Contractor under 11 61 39. Fixtures and control signal from fixture power supply are terminated to relay under this contract.

1.02 RELATED DOCUMENTS
A. Division 1 Specification Sections apply to this Section.
   1. Where Division 1 and this section conflict the more stringent shall apply.
B. Base Building Documents, Divisions 09, 11 61 39, Division 26.

1.03 SYSTEM DESCRIPTIONS
A. Control system will perform according the DMX standard and per criteria defined in 11 61 61.40

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Future Light - North Olmsted, OH
B. Batts Audio, Video & Lighting – Denison, TX

2.02 MANUFACTURED UNITS
A. lighting fixture
   1. common attributes:
      a. is no more than 0.5” deep x 0.75” wide.
      b. is powered from a dedicated low voltage power supply.
      c. uses amber LEDs except as noted.
      d. LEDs are spaced no more than 12” on center
      e. LEDs are recessed to minimized off axis visibility.
      f. is black
      g. can be painted.
      h. is water resistant
i. is capable of withstanding rolling loads typically found on stage, such as a concert grand piano, riser carts, man lifts, etc.

j. is capable of withstanding point loads typically found on stage, such as a stiletto heeled shoes.

k. can accept a 1,000# load.

l. is installed using friction fit.

m. can be bent to a radius of 15’-6” or greater.

2. perpendicular

a. LEDs are mounted to be visible by a person viewing it from one side looking down at a 45-degree angle.

b. the center stage edge and lift edge strip have a blue led on centerline and at ¼ points (measured at the proscenium opening).

c. all other LEDs are amber.

3. parallel

a. LEDs are mounted to be visible by a person viewing it from one end looking down at a 45-degree angle.

4. vertical:

a. LEDs are mounted to be visible by a person viewing it from above.

5. acceptable products:

a. Edgelyte by Future Light

b. 4th Wall by Batts Audio, Video & Lighting

B. power supply / DMX controller

1. mounts in a backbox no larger than 12x12x6.

2. accepts 120-230vac power input

3. accepts DMX control input and dims the fixture based on the DMX level.

4. has user a configurable DMX address.

5. uses 1 DMX address

6. has a user configurable minimum DMX level that takes precedence over the received DMX level.

7. turns the fixture to full intensity if DMX is lost.

8. may be set to manual mode.

9. powers connections are via screw terminals.

10. powers a minimum of 100’ of fixture.

11. acceptable products:

a. Edgelyte DMX controller by future light

b. 4th Wall by Batts Audio, Video & Lighting

PART 3 EXECUTION

3.01 INSTALLATION

A. Field verify the length of the fixtures and the locations of the center and ¼ point markers prior to creating shop drawings.

B. Install the fixtures. Install filler rail in floor to create an appearance of a continuous fixture with no gaps.

C. Provide low voltage cable.

D. Terminate and install low voltage faceplates.

E. Terminate control lines.

F. Configure DMX addresses.

G. Interface:

1. Coordinate the conduit infrastructure with the Division 26 contractor.

2. Coordinate the floor accommodation with the Flooring Contractor.

3. Contract documents are diagrammatic and indicate general arrangement of systems and work included.
4. Follow drawings in laying out work and check drawings of other trades relating to work to verify spaces in which work is installed.

END OF SECTION
PART 1 GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General, Special Supplementary General Conditions, Supplementary Conditions and Division 1 Specifications, apply to this Section.

1.02 SUMMARY
A. Pit safety net shall include horizontal netting and associated hardware complying with or exceeding OSHA standard 29 CFR 1926.502(c) and ANSI A10.11.
B. Section Includes:
   1. Provision of materials, components, modifications, assemblies, equipment and services as specified herein. These include:
      a. Verification of site dimensions and conditions.
      b. Submission of Shop Drawings signed and sealed by a licensed Professional Engineer experienced in work of similar nature and scope as required in the State of installation.
      c. Engineering of equipment and systems as required by the Contract Documents.
      d. Manufacture of equipment and systems as required by the Contract Documents.
      e. Scheduling, sequencing and coordination with other trades.
      f. Site supervision of equipment and systems installation specified herein and elsewhere in the Contract Documents.
      g. Testing and demonstration of equipment and systems as specified herein and elsewhere in the Contract Documents.

C. Provide systems including:
   1. Horizontal Pit Safety Net

D. Related Sections:
   1. Division 1: General and Supplementary Requirements.
   2. Division 3: Concrete.
   3. Division 4: Masonry.
   4. Division 5: Metals.
   7. Division 11: Equipment.
      a. 11 61 39: Orchestra Pit Lift.

1.03 SYSTEM DESCRIPTION
A. Horizontal Orchestra Pit Safety Net
   1. Provide net and associated hardware in a horizontal plane no more than 12” below the stage level.
   2. Connection hardware shall be installed such that it does not impede the travel of the orchestra pit left. Coordinate shear point requirements with Orchestra Pit Lift Contractor.
   3. Provide assemblies, cable components, connections, equipment, hardware and linkages employed in supporting, in whole or in part, overhead loads that are rated and designed for that application. Base loading for each component on the maximum percentage of the capacity of the set in which the component is employed.

B. Provide systems designed to reflect safeguards and precautions related not only to normal use of the equipment under ideal operating and loading conditions but, additionally, to anticipate equipment misuse, human error, and misjudgment. Design and intent parameters set forth herein in no way relieve this Contractor from responsibility or liability arising from the Work.
1.04 SUBMITTALS
   A. In addition to submittals required under Division 1, provide manufacturer’s data and certification of compliance

1.05 WARRANTY
   A. Special Warranty:
      1. Warrant systems and equipment to be free of defective components, faulty workmanship and improper adjustment for a period of two years from the date of Owner's acceptance. Paint and exterior finishes are excluded relative to failure due to unusual exposure. Replace items showing evidence of defective materials or workmanship (including installation workmanship) within thirty (30) days after notification. Make replacements without cost to the Owner. Rectify conditions that might present a hazard to human life, well-being and or property within 48 hours of notification.
      2. Designate warranties on manufactured equipment to the Owner on the date of system acceptance.

1.06 MAINTENANCE
   A. Maintenance Service:
      1. Provide maintenance service for a period of one year after Final Acceptance of the installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Cable and chain connection hardware:
      1. Chicago Hardware and Fixture Company, Chicago, IL.
      2. Columbus McKinnon Corporation, Chain Division, Amherst, NY.
      3. Cooper Industries, Campbell Chain Division, Inc., NC.
      4. The Crosby Group, Inc., Tulsa, OK.
   B. Wire Rope:
      1. Refer to current QPL-83420 for qualification certified manufacturers.
   C. Safety netting:
      1. InCord, Colchester, CT
      2. Leading Edge Safety Systems Div, Pucuda, Inc, Deep River, CT

2.02 MANUFACTURED UNITS
   A. Horizontal Safety Net:
      1. Provide net material that conforms to tests indicated under 29 CFR 1926.502(c)(4) and ANSI A10.11.
      2. Provide net material and locate net such that the net has sufficient sag to meet the requirements indicated above, but do not sag below 6'-6" AFF of the pit floor. Should these requirements conflict, the contractor should notify the architect in writing.
      3. In addition to personnel protection net material, provide webbed material to prevent objects or debris larger than 3/16" in diameter from falling through the net.

2.03 COMPONENTS
   A. Fasteners: Fasteners shall be rated for the anticipated loads. Provide fasteners with approved markings indicating their rating. Provide fastener system’s components of equal ratings.
   B. Compression Sleeves: Size compression sleeves appropriately for the cable construction and diameter of the cable with which they are employed.
      1. Material: Copper
      2. Cable connection sleeves: Oval pattern
      3. Cable stop sleeves: Cylindrical pattern
4. Military Specification MIL-51844

C. Eyebolts: Size eyebolts for the intended application. Employ dropped forged steel shoulder pattern eyebolts.

D. Shackles: Size shackles appropriately for the intended application. Execute chain connections with chain shackles; other connections may employ anchor shackles.
   1. Shackle Material: Forged Steel
   2. Pin Material: Alloy Steel
   3. Treatments: Heat Treat and Temper
   4. Pin Type: Safety type bolt type pin or safety type round pin.
   5. Federal Specification: RR-C-271D Type IV or IVB, Grade A or greater, Class 1.
   6. Size the screw pin to ensure that the threads are not included in the bearing surface of the bolt.

E. Thimbles, Wire Rope: Size wire rope thimbles appropriately for the cable construction and diameter of the cable with which they are employed.
   2. Finishing: Free of characteristics detrimental to the rope or adjacent elements.

F. Support cables and components:
   1. Provide net connection by wire ropes, unless specified otherwise herein. Determine the classification of wire rope construction to suit the system operational requirements. Unless specifically required in the Contract Documents, the Contractor's engineer shall determine the classification.
   2. Employ continuous lines from the same spool/length, free of knots, splices or mechanical fasteners along their length unless specifically required otherwise in the Contract Documents. Do not employ damaged or deformed cables. Excluding prefabricated systems excluded, cut cable at the site from the manufacturer's spool.
   3. Provide anchor connections set into concrete or welded to structure surrounding pit as indicated on the drawings. Anchors should be designed to resist required loading.

G. Storage Bags:
   1. Provide storage bags for nets that conform to manufacturers recommendations and requirements.

H. Signage:
   1. Signage shall be legible both in construction and grammar. Sign surfaces and characters shall be textured or otherwise treated to minimize glare and veiling reflectance.

2.04 SOURCE QUALITY CONTROL

1. Work on the systems may be reviewed at the point of manufacture a minimum of one time during fabrication. This review will occur during the final factory checkout prior to shipping, unless the Manufacturer and Architect agree on a more advantageous inspection date.

2.05 SUPPLEMENTARY

A. Provide equipment and hardware in addition to the items specified previously that are necessary to provide a fully working system in conformance with the intent of the Contract Documents.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Examine work prepared by others to receive work of this Section and report defects affecting installation to the Architect for correction. Commencement of the work shall be construed as complete acceptance of preparatory work by others. The sphere of inspection includes but is not limited to:
      a. Assurance mounting surfaces are ready to accept the Work.
      b. Verification of flatness, plumb and level of mounting conditions.
c. Inspection of components of the Work to ensure no damage has occurred during shipping or storage.

2. Discrepancies:
   a. In the event of discrepancies, immediately notify the Architect.
   b. Do not proceed with the installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 PREPARATION

A. Verify field measurements at the site prior to installation and modify the system accordingly.
   1. Deliver equipment to the site only after the building has been closed in. Coordinate storage at the site and ensure the materials and components are undamaged.
   2. Protect the surrounding environment from damage by the Work.

3.03 TESTING

A. Clearly record the date, time, details and results of all the following tests and demonstrations and any subsequent re-tests. This will form the start of a system log book to be handed over to the user after acceptance together with operation and maintenance manuals.

B. Inspect the completely assembled system including all hardware, fittings, net, etc, and make good all deficiencies before declaring that the system is complete.

C. Demonstrate compliance with tolerances specified in the Contract Documents.

D. Perform a drop-test as described in OSHA 1926.502(c)(4)(i). Contractor should then verify that there is no significant residual distortion in the net pattern or in the suspension system.

E. Provide demonstration and testing as required to obtain certification by the applicable legislative authority. This Contractor is solely responsible for obtaining such certification and all costs arising therefrom. Certification is a condition of final payment.

3.04 FIELD QUALITY CONTROL

A. Reviews:
   1. Final review will be made by the Architect or his appointed representative, following receipt in writing or notification from this Contractor that the installation is completed. If review reveals details of construction, fabrication, or installation not in strict accord with the Contract Documents, approval will be withheld and Contractor shall be given thirty days to replace the rejected items with those conforming to specification requirements. In addition to the final review of various equipment components the right of review is reserved during the course of the installation. The Architect or his appointed representative and will be allowed access to materials at the site for eventual incorporation in the work. Preliminary visits shall not be construed as eliminating the possible rejection of various components during the final review detailed above.

END OF SECTION
PART 1  GENERAL

1.01  RELATED SECTIONS
A. Section 06 10 00 - Rough Carpentry.

1.02  SUBMITTALS
A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
C. Shop Drawings: Include details of construction, and relationship with adjacent construction.
D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square representing actual product, color, and patterns.

1.03  QUALITY ASSURANCE
A. Manufacturer Qualifications: Minimum 5 year experience manufacturing similar products.
B. Installer Qualifications: Minimum 2 year experience installing similar products.

1.04  PRE-INSTALLATION MEETINGS
A. Convene minimum two weeks prior to starting work of this section.

1.05  DELIVERY, STORAGE, AND HANDLING
A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
B. Handling: Handle materials to avoid damage.

1.06  PROJECT CONDITIONS
A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.07  SEQUENCING
A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.08  WARRANTY
A. Warranty: Submit manufacturer's standard limited one year warranty.

PART 2  PRODUCTS

2.01  MANUFACTURERS
A. Acceptable Manufacturer: AS Hanging Display Systems, which is located at: 8396 State Route 9; West Chazy, NY 12992 ; Toll Free Tel: 866-935-6949 ; Email: request info (info@ashanging.com); Web: www.ashanging.com
B. Systematic Art Picture Hanging Systems, New York, New York, 888-426-4406; www.systematicart.com
C. Nova Display, 875 Wilson Street, Suite B, Eugene, OR 97402; 800-753-9688, www.novadisplay.com
D. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements and 01.25.13 - Product Substitution Procedures.

2.02 HANGING AND DISPLAY SYSTEM
A. Basis of Design: Classic Gallery System as manufactured by AS Hanging Display Systems. Provide materials and components required to provide a complete system by AS Hanging Display Systems for hanging corporate branding, display materials, informational and directional signage, art and regulatory notices, with rigid track as indicated or scheduled. Refer to Drawings.
1. Configuration: Suspended Rod.
2. Aesthetic: Commercial grade track for art display and display making.
3. Wall Track: Open-face.
4. Track Weight Capacity:
5. Wall Track: minimum of 300 lbs./6 foot track.
B. Classic Gallery System Display Reveal: Aluminum
1. Finish: Anodized Silver Satin.
2. Reveal is recessed into wall and wall finished to its flanges.
C. Vertical Component: 4x4 mm square Rod
1. Rod: P-End Aluminum Rod: Minimum weight capacity; 70 lbs.
2. Rod-End Hanger
3. Rod Length: 24 inches.
D. Hooks: Provide manufacturer's recommended type and quantity of hooks.

PART 3 EXECUTION

3.01 EXAMINATION
A. Do not begin installation until substrates have been properly prepared.
B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION
A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION
A. Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.

3.04 CLEANING
A. Clean installed system and remove excess materials.
B. Deliver any unused cable and fittings to Owner.
3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 12.12.30
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Window shades and accessories.
   B. Manual operation typical. Option for electric motor operators for Lobby and Rehearsal Spaces.
   C. Option for motor controls.

1.02 RELATED REQUIREMENTS
   A. Section 06.10.00 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.
   B. Section 09.21.16 - Gypsum Board Assemblies: Substrate for window shade systems.
   C. Section 09.51.00 - Acoustical Ceilings: Shade Pockets, pocket closures and accessories.

1.03 REFERENCE STANDARDS
   D. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
      2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.
   B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of all affected installers.
   C. Sequencing:
      1. Do not fabricate shades until field dimensions for each opening have been taken.
      2. Do not install shades until final surface finishes and painting are complete.

1.05 SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
      1. Motorized Shades: Include power requirements and standard wiring diagrams.
   C. Shop Drawings: Include shade schedule indicating size, location and keys to details.
   D. Shop Drawings - Motorized Shades: Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.
   E. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.
   F. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.
G. Selection Samples: Include fabric samples in full range of available colors and patterns.
   1. Optional Motorized Shades: Include finish selections for controls.

H. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, 
   preparation, and installation of product.

I. Optional Project Record Documents: Record actual locations of control systems and show 
   interconnecting wiring.

J. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and 
   operation and maintenance instructions; include copy of shop drawings.

K. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty 
   completed in Owner's name and registered with manufacturer.

L. Maintenance contracts.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE 
   DOCUMENTATION
   1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr 
   CHECKLIST/TRACKING FORM.

B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants

D. Submit documentation of quantity and material cost with monthly Application for Payment to the 
   Contractor.

1.07 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, 
   with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this type with minimum 3 years of 
   documented experience.
   1. Factory training and demonstrated experience.

1.08 MOCK-UP
A. Mock-Up: Provide full size mock-up of window shade complete with selected shade fabric including 
   sample of seam when applicable.
   1. Obtain Architect's approval of light and privacy characteristics of fabric prior to fabrication.
   2. Full-sized mock-up may become part of the final installation.

1.09 DELIVERY, STORAGE, AND HANDLING
A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.10 FIELD CONDITIONS
A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.11 WARRANTY
A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Shade Hardware: One year.
2. Electric Motors: One year.

PART 2 PRODUCTS

2.01 WINDOW SHADE APPLICATIONS

A. Shades: Sheer shades.
   1. Type: Roller shades.
   2. Fabric Performance Requirements:
      a. Openness Factor: 5% minimum.
   3. Color: As selected by Interior Designer from manufacturer’s full range of colors.

2.02 ROLLER SHADES

A. Roller Shades: Fabric roller shades complete with mounting brackets, roller tubes, hembars, hardware and accessories.
   1. Drop: Regular roll.
   2. Size: As indicated on drawings.

B. Fabric: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
   1. Sheer Shades: Reduce glare yet still reveal considerable details to the outside; no privacy; Openness Factor minimum of 5 percent.
   2. Flammability: Pass NFPA 701 large and small tests.
   3. Fungal Resistance: No growth when tested according to ASTM G21.

C. Roller Tubes: As required for type of operation.
   1. Size: Manufacturer's standard, selected for suitability for installation conditions, span, and weight of shades.
   2. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.

D. Hembars: Designed for weight requirements and adaptation to uneven surfaces, to maintain bottom of shade straight and flat.

E. Optional Motor Operation: Motor system housed inside roller tube, controlling shade movement via motor controls indicated; listed to UL 325.
   1. Audible Noise: Maximum 39 dBA measured 3 feet from the motor unit; no audible clicks when motor starts and stops.
   2. Motors: Size and configuration as recommended by manufacturer for the type, size, and arrangement of shades to be operated; integrated into shade operating components and concealed from view.
   3. Motor Type: Both AC and DC motors are acceptable; provide required transformers for DC motors.
   4. Coupling of Multiple Shades: Where possible, minimize number of motors by coupling adjacent shades.
   5. Control Compatibility: Fully compatible with the controls to be installed.

2.03 OPTIONAL MOTOR CONTROLS

A. Motorized shades to be controlled by wall-mounted controls and infrared handheld remote controls as specified below.

B. Control Requirements:
1. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.

2. Capable of controlling shade speed for tracking within plus or minus 0.125 inch throughout entire travel.

3. Capable of stopping within accuracy of 0.125 inch at any point between open and close limits.

4. Capable of assigning shades to groups and subgroups without rewiring.

5. Provide 10 year power failure memory for preset stops, open and close limits, shade grouping and subgrouping and system configuration.

6. Capable of synchronizing multiple units of the same size to start, stop and move in unison.

7. Provide all components and connections necessary to interface with other systems as indicated.

C. Wall-Mounted Controls: UV stabilized visible parts meeting ASTM D4674; furnished with backlit buttons; provided by shade manufacturer.

1. Control Functions:
   a. Open: Automatically open controlled shade(s) to fully open position when button is pressed.
   b. Close: Automatically close controlled shade(s) to fully closed position when button is pressed.
   c. Raise: Raise controlled shade(s) only while button is pressed.
   d. Lower: Lower controlled shade(s) only while button is pressed.
   e. Stop shade(s) in motion by tap on any button.

2. Button Engraving: Manufacturer's standard engraving, unless otherwise indicated.

D. Infrared Handheld Remote Control: Battery-powered; provided by shade manufacturer.

1. Control Functions:
   a. Open: Automatically open controlled shade(s) to fully open position when button is pressed.
   b. Close: Automatically close controlled shade(s) to fully closed position when button is pressed.
   c. Raise: Raise controlled shade(s) only while button is pressed.
   d. Lower: Lower controlled shade(s) only while button is pressed.
   e. Stop shade(s) in motion by tap on any button.

2. Finish: To be selected by Architect.

2.04 ACCESSORIES

A. Fascias: Size as required to conceal shade mounting.
   1. Style: As selected by Architect from shade manufacturer’s full selection.
   2. Material and Color: To match shade.

B. Brackets and Mounting Hardware: As recommended by manufacturer for mounting configuration and span indicated.

C. Fasteners: Non-corrosive, and as recommended by shade manufacturer.

2.05 FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Fabricate shades to fit openings within specified tolerances.
   1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.

C. Dimensional Tolerances: As recommended in writing by manufacturer.

D. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.
PART 3 EXECUTION

3.01 EXAMINATION
   A. Examine finished openings for deficiencies that may preclude satisfactory installation.
   B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
   C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION
   A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
   B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION
   A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
   B. Installation Tolerances:
      1. Inside Mounting: Maximum space between shade and jamb when closed of 1/16 inch.
   C. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.
   D. Adjust level, projection and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 SYSTEM STARTUP
   A. Optional Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.05 CLEANING
   A. Clean soiled shades and exposed components as recommended by manufacturer.
   B. Replace shades that cannot be cleaned to "like new" condition.

3.06 CLOSEOUT ACTIVITIES
   A. See Section 01.78.21 - Closeout Submittals, for closeout submittals.
   B. See Section 01.79.21 - Demonstration and Training, for additional requirements.
   C. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.
   D. Training: Train Owner's personnel on operation and maintenance of system.
      1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
      2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.07 PROTECTION
   A. Protect installed products from subsequent construction operations.
   B. Touch-up, repair or replace damaged products before Substantial Completion.
3.08 MAINTENANCE

END OF SECTION 12.24.00
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Countertops for architectural cabinet work.
   B. Countertops for manufactured casework.
   C. Wall-hung counters and vanity tops.

1.02 RELATED REQUIREMENTS
   A. Section 06.41.00 - Architectural Wood Casework.
   B. Section 12.35.30 - Residential Casework.

1.03 REFERENCE STANDARDS
   C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
   E. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.
   G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS
   A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Manufacturer's data sheets on each product to be used, including:
      1. Preparation instructions and recommendations.
      2. Storage and handling requirements and recommendations.
      3. Specimen warranty.
   C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.
   D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
   E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
   F. Installation Instructions: Manufacturer's installation instructions and recommendations.
   G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
   B. Provide documentation of construction wast diverted from landfills:
      1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
   C. Submit documentation demonstrating HPBr compliance for the following:
1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
3. Compliance with Credit EQ6.5: Material VOC Limits - Composite wood and agrifiber

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Store products in manufacturer's unopened packaging until ready for installation.
B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 FIELD CONDITIONS
A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS
A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
    1. Laminate Sheet, Unless Otherwise Indicated: NEMA LD 3, Grade HGF, fire retardant rated, 0.048 inch nominal thickness.
        a. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
        b. NSF approved for food contact.
        c. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
        d. Finish: Matte or suede, gloss rating of 5 to 20.
        e. Surface Color and Pattern: As selected by Architect from the manufacturer's full line.
    2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
    3. Back and End Splashes: Same material, same construction.
    4. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Custom Grade.

C. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
    1. Flat Sheet Thickness: 1-1/4 inch, minimum.
    2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
        a. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with the MIA Dimension Stone Design Manual.
        b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
c. NSF approved for food contact.
d. Finish on Exposed Surfaces: Polished.
3. Wall Panels: 3/4 inch thick.
4. Other Components Thickness: 3/4 inch, minimum.
5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.

2.02 MATERIALS
A. Wood-Based Components:
   1. Wood fabricated from old growth timber is not permitted.
B. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.
C. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
D. Joint Sealant: Mildew-resistant silicone sealant, white.

2.03 FABRICATION
A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches, unless otherwise indicated.
C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION
3.01 EXAMINATION
A. Do not begin installation until substrates have been properly prepared.
B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION
A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION
A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES
A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING
A. Clean countertops surfaces thoroughly.

3.06 PROTECTION
A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 12.36.00
PART 1 GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
A. Provide fixed audience seating as required by the Contract Documents. Include engineering and components required to fabricate the systems as described herein and the drawings.
B. This Section includes work in the following space:
   1. Auditorium #102
      a. Chair Type ‘A.1’; Base model, floor mounted
      b. Chair Type ‘A.1.D’; Base model, demountable
      c. Chair Type ‘B’, Side Box (add alternate)
   2. Auditorium Balcony #207
      a. Chair Type ‘A.1’; Base model
      b. Chair Type ‘B’, Side Box (add alternate)
   3. Recital Hall #104
      a. Chair Type ‘A.1’; Base model
      b. Chair Type ‘A.1.D’; Base model, demountable
      c. Chair Type ‘B’, Side Box (add alternate)
C. Audience seating includes the following:
   1. Upholstered fixed chairs with plastic components.
   2. Assemblies to allow quick removal of designated seating as shown on the drawings
   3. Self-rising mechanism.
   4. Armrests
   5. End of row panels
   6. Aisle lighting
   7. Signage and accessories
   8. Spare Parts and Materials
   9. Loose ‘Box’ chairs
D. Related Sections.
   1. Section 033000 “Cast in place concrete”
   2. Division 26 for electrical service and connections to seating junction box locations for aisle lighting fixtures

1.03 GENERAL BID ALTERNATES
A. Submit, with written approval from architect and subject to compliance with requirements, all products to be considered as alternates at least seven (7) days prior to bid closing or submit as an alternate.
B. Add or Deduct Alternates:
   1. Add Alternate #1: Auditorium #102 and Auditorium Balcony #207
      a. Delete plastic back outer shell
      b. Provide upholstered back with fabric on back panel.
      c. Delete plastic bottom seat panel.
      d. Provide upholstered seat with fabric on bottom surface
   2. Add Alternate #2: Recital Hall #104
      a. Delete plastic back outer shell
b. Provide upholstered back with fabric on back panel.
c. Delete plastic bottom seat panel.
d. Provide upholstered seat with fabric on bottom surface

3. Add Alternate #3: Recital Hall #104
   a. Delete plastic back outer shell
   b. Provide finished plywood outer panel for chair back.
   c. Wood veneer: Selected from Manufacturer’s standard range
   d. Thickness: Minimum ½”
   e. Finish: Selected from Manufacturer’s standard range
   f. Delete plastic bottom seat panel.
   g. Provide upholstered seat with fabric on bottom surface.

4. Add Alternate #4, Auditorium #102, Auditorium Balcony #207, Recital Hall #104
   a. Box Chair Type ’B’.
   b. Submit: Architect to select from manufacturer’s standard range. Manufacturer to provide images, specifications, load capacity and drawings showing dimensions with bid.
   c. Wood:
      1) Hardwood frame.
      2) Variety and finish: Selected from Manufacturer’s standard range.
   d. Upholstered seat and back pads. Fabric to match fixed seating.
   e. Architects may request sample to confirm selection prior to confirmation or acceptance of chair model.

1.04 DESCRIPTION
A. Design Requirements:
1. Intent of the Work is to provide a safe, efficient system of audience seating arranged for optimum sightlines conforming to the performance and aesthetic requirements herein and elsewhere in Contract Documents.
2. Fixed audience seating shall be manufactured to dimensions as required to maintain the minimum aisle dimensions, row radii and spacing as shown on Drawings.
3. It is the responsibility of this Contractor to supply a working seating system. Furnish all additional components or auxiliary elements as part of the Work.
4. Provide seating in compliance with applicable Building Codes and with the spirit and letter of the Americans with Disabilities Act (ADA).

1.05 SUBMITTALS
A. Product data: For each type of product.
   1. Include construction details, material descriptions, dimensions of components, and finishes for fixed audience seating
B. Shop Drawings and Catalog Cuts:
   1. Provide drawings based on accurate field dimensions, showing all information necessary to explain fully the design features, appearance, function, fabrication, installation and use of system in all phases of operation.
   2. Seating Layout: For each row, show chair types, spacing and widths, floor risers, aisle widths, aisle-end alignment and aisle light locations. Provide side elevations showing profile dimensions of seating, row-to-row clearance dimensions, clear walkway dimensions with seat bottom in upright position, clearance at riser, back pitch angles at all levels and floor mounting details.
   3. Provide total seat count and breakdown of each area and floor levels.
   4. ADA: Show all accessibility provisions including identification logos.
   5. Signage Plates: Show layout for row lettering and seating numbering including locations on chair. Show Donor’s plate locations.
   6. Accessories: Show locations and features.
7. Do not commence fabrication until the Theatre Consultant and Architect have reviewed the shop drawings and drawings have been released for fabrication.
8. Submit drawings not less than sixty (60) days prior to scheduled start of Fabrication.
9. Submit drawing sheets of uniform size with a title sheet listing all sheets in the submittal.

C. Samples for Verification: For each type of exposed finish required, prepared on samples of size indicated below:
   1. Molded Plastic: Manufacturer’s standard size unit, not less than 4 inches square.
   2. Wood and Plywood Materials and Finishes: Manufacturer's standard-size unit, not less than 12 inches square.
   3. Baked-on Coating Finishes: Manufacturer's standard-size unit, not less than 4 inches square.
   4. Upholstery Fabric: Full width by 36-inch long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.
   5. Arm Rest: End and mid-row showing proposed shape and wood cut.
   6. Aisle Lighting: Full size unit.
   7. Exposed Fasteners: Full size units of each type.

D. Product Certificates: For each type of fixed audience seating.

E. Field quality-control reports.

F. Provide Manufacturer’s Warranty.

G. Operation and Maintenance Data: For fixed audience seating to include in operation and maintenance manuals.
   1. In addition to items specified in Section 017821 "Operation and Maintenance Data," include the following:
      a. As built drawings
      c. Precautions for cleaning materials and methods that could be detrimental to seating finishes and performance.
      d. Contact information for service.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of seating required, including accessories and mounting components, from single source from single manufacturer.

B. Fire-Test-Response Characteristics of Upholstered Chairs:
   1. Fabric: Class 1 according to DOC CS 191-1953 or 16 CFR 1610, tested according to California Technical Bulletin 117.

C. Strength and Durability Performance: Chairs and components shall pass testing according to BIFMA X5.4.

D. Mockups: Build mockups to verify selections made under Sample submittals, demonstrate aesthetic effects, and set quality standards for fabrication and installation.
   1. Build mockups for the following chairs:
      a. Type ‘A.1.
      b. Type ‘B’; if applicable.
   2. Build mockups of a typical two-seat unit (center and end), with wired aisle lighting and lamps, with transformer if required and male connector for 120v AC, including finishes and accessories.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Final Acceptance.
E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Pre-installation Conference: Conduct conference at Project site.

G. Qualifications:
   1. This Contractor and all sub-contractors shall have been an authorized representative of the manufacturer of the specified equipment and systems for a minimum of five (5) years. The Architect shall be the final judge of suitability of experience.
   2. The Architect will have the right to inspect any previous equipment, or systems as furnished or installed by this Contractor. In addition, the right is reserved by the Architect to reject a Contractor who has failed in any respect to comply with all provisions of any previous contract.
   3. Identify all Sub-Contractors included as part of the bid.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install seating until spaces are enclosed and weather tight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary or permanent HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period unless specifically permitted or instructed in writing by Owner and/or Owner’s representative.

B. Field Measurements: Verify actual field dimensions including concrete shaping, electrical floor boxes, HVAC grill locations, partitions and walls. Verify seating layout prior to commencing fabrication.

1.08 SCHEDULING, SEQUENCING, AND COORDINATION

A. Schedule and sequence the Work in conjunction with Construction Manager and trades performing related work. Accommodate project time schedule.

1.09 WARRANTY

A. Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace components of fixed audience seating that fail in materials or workmanship within the specified warranty period. Replace or repair defective Work within thirty (30) days of notification. Rectify conditions that might present a hazard to human safety and/or property within forty-eight (48) hours of notification. Make corrections without cost to the owner.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including standards and pedestals.
      b. Faulty operation of self-rising seat mechanism.
      c. Faulty operation of electrical components.
      d. Wear and deterioration of fabric and stitching beyond normal use.
      e. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
   2. Warranty Periods: As follows, from date of Final Acceptance.
      a. Structural: 10 years.
      b. Operating Mechanisms: Five years.
      c. Wood and Painted Components: Three years.
      d. LED fixtures and associated Components: Five years.

1.10 EXTRA MATERIALS

A. Furnish extra materials from the same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Chair Seats and Backs: Furnish a quantity of full-size units equal to 3 percent of amount installed for each type and size of chair seat and back.
   2. Armrests: Furnish a quantity of full-size units equal to 3 percent of amount installed for each type of armrest.
3. Other Seat Parts: Furnish a quantity of 3 percent of amount installed for all other parts.
5. Wood Stain: Three 1/2 pint containers of matching wood stain.
6. LED and drivers: 5% of aisle seats

PART 2 PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide basis of design indicated or comparable products by one of the following
   1. Ducharme Seating International Inc.
      9275, le Royer
      St-Leonard, QC H1P 3H7, Canada
      (514) 704.4135
      Contact: Isabelle Duplantie
      iduplantier@siegesducharme.com
   2. Hussey Seating Company
      38 Dyer Street Extension
      North Berwick, ME 03906
      (207) 676 2271
      Contact: Barry Pickell
      (800) 341.0401
      bpickell@husseyseating.com
   3. Irwin Seating Co.
      3251 Fruit Ridge Avenue NW
      Grand Rapids, MI 49544
      (866) 464-7946 toll free
      Contact: Mark Wretschko
      Direct: (616) 574.7189
      mark.wretschko@irwinseating.com
   4. KI Seating Co.
      1330 Bellevue Street
      Green Bay, WI 54302
      (800) 424-2432 toll free
      Contact: Josh Misenheimer
      Direct: (865) 567.7330
      josh.misenheimer@ki.com
   5. Seating Concepts
      2225 Hancock Street
      San Diego, CA  92110
      (619) 491 3159
      Series Seating
      20900 NE 30th Ave, Suite 901
      Miami, FL. 33100
      (305) 932-4626
      Contact: Thomas Boyd
      tboyd@seriesseating.com

2.02 FIXED AUDIENCE SEATING: TYPE ‘A’

A. Layout: Assembly-space seating in permanent arrangement as shown on Drawings.
   1. Type ‘A.1’: Base model, floor mounted.
2. Type ‘A.2.D’: Base model, demountable

B. Chair Models: Subject to compliance with the requirements herein, the basis of design is based on the following pre-bid samples:
1. Ducharme: Symphony
2. Hussey Seating: Quattro
3. Irwin Seating: Millennium with #12 seat
4. KI Seating: Lancaster
5. Seating Concepts: ‘Producer’
6. Series Seating: Vera

C. Upholstered Chair Components:
1. Back: Shall be upholstered and padded on their face with manufacturer’s standard back panels.
   a. Shape: Selected from manufacturer’s standard range
   c. Outer Back Material: High density polyethylene or polypropylene, blow or injection molded, with smoother or finely textured surface that is mar and dent resistant.
   d. Padding Thickness: minimum 2 inches (38mm)
   e. Back Pitch: Provide variable pitch settings for optimum viewing comfort. Each level shall incorporate back pitch to suit viewing angles to the stage and to maintain required aisleway clearances.
2. Back Heights: Provide back heights as follows, measured from the center of the top of the seat back to a point on the floor directly beneath the chair standard.
   a. Manufacturer’s standard height: 32” to 36”
3. Seat: Shall be upholstered and padded on face with manufacturer’s standard bottom pan.
   a. Exposed Seat Bottom: High density polyethylene or polypropylene, blow or injection molded, with smoother or finely textured surface that is mar and dent resistant.
   b. Padding Thickness: Minimum 3” (76mm) at front and rear edges.
   c. Padding Material: Flexible, cellular, molded foam. Cushion shall extend past the bottom panel sufficiently to prevent front edge of the bottom panel from contacting the legs of a seated patron.
   d. Chair Widths: Vary chair widths to accommodate staggered sightlines at auditorium centerline and aligned armrests at aisles.
4. Incorporate chair widths of 20, 21, 22, and 23 inches (510mm, 530mm, 560mm and 585mm) from center to center of armrests.
5. Minimize use of 20” (510mm) widths.
6. Provide wider seats when clearances allow or to close gaps adjacent to steps.
7. Provide equally spaced gaps between chair backs. Vary seat widths to match backs.
8. Self-Rising Seat Mechanism: Seat shall be equipped with a gravity actuated or counter weighted mechanism to automatically self-lift to a full return position when unoccupied. Seat return shall be noiseless. Provide positive internal stops cushioned with rubber or neoprene. Comply with ASTM F851.

D. Chair Mounting Standards:
1. Type:
   a. A.1; Standard floor mount
2. Material: One-piece, heavy-tube or heavy plate steel with welded mounting plate and welded connections for seat pivots, backs, armrests, and end panels.
   a. Rolled Steel Plates, Shapes and Bars: Domestic Steel ASTM A366/A366M-97 or other ASTM standard/
3. End of row standard: To be exposed with no decorative panel.
   a. No sharp edges to prevent injury or damage to clothing
   b. Smooth welds appropriate for exposed to view condition.

E. End Panels: For all chairs adjacent to aisles
1. Style: selected from manufacturer’s standard range  

F. Armrests:  
1. Style: Selected from Manufacturer’s standard range  
2. Material: Hardwood, selected from Manufacturer’s standard range.  
3. Concealed mounting hardware.  
4. Incorporate concealed aisle light fixtures and wire.  

G. Aisle Lighting Fixtures: Manufacturer’s standard concealed in armrest fixtures and out of view from audience and performers on stage.  
1. Lamp: LED  
2. Control: Furnish user settable dimmers to be installed by Division 26  
3. For low-voltage lighting, provide manufacturer’s voltage reduction devices housed in safety enclosure equipped with fuses, terminal blocks.  
4. Illumination: Provide .5 fc illumination at floor level adjacent to aisle standards within a 36” (914mm) radius of a point vertically below the light.  
5. Furnish suitable voltage reduction devices (transformers) for the aisle lights. Transformers will be located remotely from the seat.  
6. Furnish concealed lighting harness to operate with all ADA transfer arm aisle panels.  
7. Furnish 12” (300mm) tail with plug to connect to floor receptacle for demountable chairs - (Type A.1.D).  
8. Color temperature rating between 2800k and 3000k.  

H. Employ materials and equipment that are new and undamaged.  

I. Fabric: Subject to compliance with requirements, provide basis of design indicated or comparable product by one of the following:  
1. Architect to select from Manufacturer’s standard range.  
2. Allowance: $20 square yard  
3. Abrasion: minimum 100,000 double rub Wyzenbeek test.  

J. Metal Finish: Finish exposed metal parts with manufacturer’s standard minimum 70 percent by weight, PVDF fluoropolymer resin baked-on powder coating. All concealed metal surfaces and assembly hardware shall be rust resistant and black plated.  
1. Color: As selected by Architect from manufacturer's full range.  

K. Plastic:  
1. Color: As selected by Architect from manufacturer's full range.  

L. Upholstered Chair Components:  

2.03 BOX CHAIR TYPE B (ALTERNATE 4)  
A. Wood-framed chair with arms, vinyl seat and fabric back ($45/yard on fabric)  
B. Manufacturers and Products:  
1. Daniel Paul  
2. Falcon  
3. KI Seating  
C. Colors: As selected by Architect from manufacturer's full range.  

2.04 ACCESSORIES  
A. Row-Letter and Chair-Number Plates: Provide a numbering system for identification of all chairs. Coordinate numbering systems directly with Owner’s representatives.  
1. Material: As selected by Architect from manufacturer’s full range.  
2. Chair Number Location: On front edge of seat.  

B. Donors Plates: Furnish blank plates and installed by the owner’s own crew. Owner shall arrange engraving.
   1. Material: As selected by Architect from manufacturer’s full range.
   2. Location: Top, front and center of chair back within wood reveal.
   3. Attachment: Manufacturer's standard method. Provide recess to set plate flush with wood finish.

2.05 ACCESSIBLE SEATING: TYPE ‘A’ WITH ‘D’ DESIGNATION.

A. Demountable Seating: Easily demountable, self-standing when in storage and an exact match of typical fixed chairs within same row or space.
   1. Locations: As indicated on drawings, but not less than the wheelchair numbers required by ADA legislation.
   2. Units Module:
      a. All single units with sled.
      b. Evenly spaced double arms rests with approximately 1” gaps and not exceeding 2”.
      c. No pairs or triples unless noted on seating layouts.
   3. Release Hardware:
      a. Easily demountable by hand.
      b. Locate units clear of walking paths. Shall not cause a tripping hazard.
      c. Provide smooth edges that will not damage shoes or cause injury to feet.

B. Designated Seating: Provide hinged or folding end standards and armrests on aisles seats in locations closest to accessible routes and not less than 5 percent of aisle seats.
   1. Identify this seating with Accessibility Logo.

C. Accessibility-Logo:
   1. Material: As selected by Architect from manufacturer’s full range
   2. Location: Top of armrest.
   3. Attachment: Manufacturer's standard method.
   4. Graphic: Shall conform to the requirements of ADA legislation.

2.06 ACOUSTIC

A. Noise Criteria:
   1. Seat bottoms shall not create noise exceeding 25 dBA with a fast meter setting measured when seat returning to upright position. Seats shall not create audible noise when sat upon or due to stress from a seated occupant.
      a. Hardware shall be permanently lubricated
      b. Stops shall be cushioned to provide quiet operation in both down and upswing direction

2.07 FABRICATION

A. Floor Attachments: Fabricate to conform to floor slope so that standards and pedestals are plumb and chairs are maintained at same angular relationship to vertical throughout Project.

B. Upholstery: Fabricate fabric-covered cushions with molded padding beneath fabric and with fabric covering free of welts, creases, stretch lines, and wrinkles. For each upholstered component, install pile and pattern run in a consistent direction.

C. Connections:
   1. Make connections with tight flush joints, capable of developing the full strength of the members. Locate joints where least conspicuous.
   2. Provide smooth continuous welds free of spatter and surface irregularities.
   3. Holes: Drill or cleanly punch holes, do not burn.
PART 3 EXECUTION

3.01 EXAMINATION
A. Examine floors, risers, and other adjacent work and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Assure that mounting surfaces are ready to accept the Work.
   2. Verify that flatness, plumbness and other surface conditions that may affect the quality of the installation are acceptable.
B. Verify field measurements at the site prior to installation. Modify the system accordingly
C. Verify locations of electrical connections are correct.
D. Report all defects and site conditions affecting the installation of the Work or compliance with the Contract Documents to the Construction Manager, Architect and the Owner. Proceed with installation only after unsatisfactory conditions have been corrected or as directed by Owner in writing.

3.02 PREPARATION
A. Protection: Protect the surrounding environment from damage by the Work.
B. Coordinate delivery and storage of product to the site and storage to ensure the materials and components are undamaged.

3.03 INSTALLATION
A. Install seating in locations indicated and fasten securely to substrates according to manufacturer's written installation instructions.
B. Install fixed audience seating with each chair capable of complying with performance requirements without failure or other conditions that might impair the chair's usefulness.
C. Install standards plumb.
D. Install seating so moving components operate smoothly and quietly.
E. Install seating with full stagger at center axis and end standards aligned at aisles as indicated from first to last row and with backs and seats varied in width to optimize sightlines and spacing.
F. Install chairs in curved rows at a constant radius and at the same floor elevations.
G. Install wiring conductors and cables concealed in components of seating and accessible for servicing.
H. Provide anchorage devices and fasteners suitable for securing seating to specific construction. There shall be a minimum of two (2) fasteners per standard. Fasteners for all demountable seats either on platforms or in concrete must use 3/8” #8 minimum flush inserts and bolts or quick release fasteners. Design removable fasteners to leave a flush surface when chair is removed. All connections should be designed to withstand constant use.
I. Perform the Work in conformance with the best trade practices. Coordinate the Work with trades doing adjoining work.
J. Leave related work areas “broom clean” at the completion of the work. Remove all debris created by this work from the site.

3.04 ADJUSTING
A. Adjust chair backs so that they are at proper angles and aligned with each other in uniform rows.
B. Adjust hardware and moving parts to function smoothly so they operate easily. Lubricate bearings and sliding parts as recommended in writing by manufacturer.
C. Adjust self-rising seat mechanisms so seats in each row are aligned when in upright position.
D. Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.
E. Replace damaged and malfunctioning components that cannot be acceptably repaired.
F. Replace upholstery fabric damaged during installation or work of other trades.

3.05 FIELD QUALITY CONTROL
A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Inspect components, assemblies, and equipment, including connections, to verify proper, complete, and sturdy installation according to manufacturer's written instructions and product specifications.
   2. Verify that seats return to correct and uniform at-rest position.

3.06 INSPECTION
A. Final inspection shall be made by the Architect, when the installation is complete. If inspection reveals any detail of construction, fabrication, or installation not in strict accord with the Contract requirements, approval shall be withheld and Contractor shall be given ten (10) days to replace the rejected items with those conforming to specification requirements. Previous inspections do not eliminate the possibility of rejection during the final inspection.
B. Inspection to confirm the following:
   1. Seat layout as per shop drawings.
   2. Seat dimensions.
   3. Seat numbering and plaques
   4. Fabric condition and quality installation.
   5. Wood and components finishes, color and condition.
   6. Securely fastened floor bolts
   7. Securely fastened armrests and backs.
   8. Smoothly rising seat bottom.
   9. Ensure noiseless components and connections
   10. Functional and correctly dimmed levels.
   11. No sharp edges.
   12. Chair cleanliness.

3.07 PROTECTION
A. Following installation, protect the seating from dust and damage. Protection to be removed when all work in the auditorium is complete and the facility is ready for occupancy.

END OF SECTION 12.61.00
PART 1 GENERAL

1.01 GENERAL REQUIREMENTS
   A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.02 WORK INCLUDED
   A. Work of the Section includes all labor, materials, equipment and services necessary to complete the spring-isolated gypsum board ceiling construction shown on the drawings and specified herein, including but not necessarily limited to the following:
      1. Spring-and Neoprene Hangers
      2. Cold-rolled carrying channel
      3. Drywall channel
      4. Gypsum board
      5. Neoprene
      6. Mineral wool batt insulation
      7. Metal framing channels

1.03 RELATED WORK
   A. Consult all other Sections to determine the extent of work specified elsewhere but related to this Section. This work shall be properly coordinated to produce an installation satisfactory to the Owner.

1.04 SUBMITTALS
   A. The Contractor shall be aware that all ceiling, ductwork, sprinklers, conduit, and lighting below the isolated ceiling will be supported from metal framing channels secured to the underside of the isolated ceiling. Contractor shall obtain loads for all ceiling supported systems for incorporation in calculations of spring sizing.
   B. Submit product literature and technical specifications for isolation materials
   C. Submit field-dimensioned and scaled Shop Drawings showing layout and location of each isolation hanger, location and direction of cold-rolled carrying channel, and complete details of edge conditions where isolated ceiling construction meets or adjoins other construction. Each isolation hanger shall be numbered on the plan. Numbering system shall correspond to each spring element shown in vibration isolation system schedule.
   D. Submit vibration isolation system schedule indicating the following:
      1. Manufacturer and type
      2. Deflection of each isolation element
      3. Spring constant of each isolation element
      4. Estimated imposed load on each isolation element
      5. Spring o.d., free operating, and solid heights

1.05 PRODUCT HANDLING
   A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.
   B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.
1.06 QUALITY ASSURANCE:
   A. Performance of isolated ceiling relies on the complete physical isolation of ceiling from surrounding
      construction. Installer shall exercise extreme care in maintaining this isolation by preventing bridging of
      solid materials between isolated and adjacent construction.
   B. No substitutions are to be made without approval. Any non-approved materials that have been installed
      shall be removed and replaced with approved materials at no expense to the Owner.

1.07 APPLICABLE STANDARDS
   A. Except as modified or otherwise specified herein gypsum drywall construction shall conform to the
      applicable requirements of Standard Specifications for the application and finishing of wallboard as
      approved by the American National Standards Association ANSI A97.1. All work shall be left ready to
      receive subsequent finish.

PART 2 PRODUCTS

2.01 GENERAL
   A. All components of all gypsum wallboard systems shall be manufactured by or be as approved by a single
      established manufacturer.

2.02 MATERIALS
   A. Gypsum Board: ASTM C36, 5/8” thick by 48” wide. Gypsum wallboard shall conform to Federal
      Specification SS-L-30, Type III, Class 1, Style 3, taper-edged or a combination of Styles 3 and 4, and of
      the grade and form hereinafter specified. Wallboard shall be supplied in 48” widths and in such lengths
      as will result in a minimum of joints.
   B. Screws for wallboard attachment: Shouldered flathead design for use with special power-driven tools.
      Metal screws shall be not less than 1” long with self-tapping threads and self-drilling points. Screws
      1-5/8” long shall be used for second ply attachment in two-ply application. Longer screws where
      required.
   C. Joint Reinforcing Tape and Adhesive: ASTM C475.
   D. Batt insulation: USG Thermafiber mineral wool batt insulation, 2.5 pcf minimum density. Thickness as
      noted on the Drawings. Note: Fiberglass blanket is not acceptable.
   E. Neoprene: 1/4” thick x 6” wide 30-durometer.
   F. Caulk: DAP Butylflex caulking.
   G. Spring Hangers:
      1. The following manufacturers of vibration supplies are approved provided the isolation systems are
         in compliance with the design and performance requirements described herein.
         a. Vibration Mountings & Controls Inc., Butler, NJ (VMCI)
         b. Mason Industries, Inc., Hollis, NY (MII)
         c. Kinetics Noise Control, Dublin, OH (KNC)
      2. All isolated ceilings shall be supported from a structural housing that cradles two 1-1/2” cold rolled
         channels at each isolator location. Pencil rods, gat clips, straps or nuts and bolts shall not be used
         for the fastening of these channels to isolator. Housing shall not extend above cold rolled channels
         more than 4”.
      3. Vibration hangers shall consist of a high frequency attenuation neoprene element on the leaving end
         of a low frequency attenuation coil spring. Spring shall have a minimum additional travel to solid
         equal to 50% of its specified deflection. Neoprene element shall have a static deflection of not less
         than 0.25” with a strain not exceeding 15% and a maximum hardness of 60 durometer. Both spring
         and neoprene element shall be seated in a neoprene cup with an integral bushing to prevent upper
support attachment contact with isolator housing. 1/2" threaded rod shall be provided at bottom of housing for attaching metal framing channels.

4. Static deflection of all ceiling isolators shall be 1”, maximum.

5. Hangers shall be Type LPRSH by VMCI or approved equal.

PART 3 EXECUTION

3.01 SEQUENCE OF CONSTRUCTION

A. Prior to start of the installation of the isolated ceiling, adhesively apply a layer of neoprene to surface of perimeter partition; allow for deflection of isolators. After installation of isolated ceiling cut exposed neoprene and caulk with DAP Butylflex.

B. Attach isolators to overhead concrete slab using appropriate fasteners.

C. Insert cold rolled channels into proper openings in isolators, running in one direction 48”o.c. Secure metal furring channels to carrying channels at 12”o.c.

D. Screw-fasten two layers of gypsum board to underside of furring channels. Joints of second layer shall be cross-laid 24” from joints of previous layer. Stagger end joints of layers by at least 12”. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length. Cut out gypsum board as required for neat close joints. Taping and spackling of joints is required for final layer only.

E. Drill gypsum board for threaded rod at isolators. Holes should be 1/2” diameter, maximum.

F. Do not tape and spackle concealed first layer of gypsum board. Tape and spackle final layer of gypsum board.

G. Lay 4” thick mineral wool batt insulation on top of gypsum board.

H. Attach metal framing channels to exposed threaded rod. Channels should be flush to underside of gypsum board. Caulk around threaded rod before attaching channels.

I. After all work has been completed, correct all surface damage and defects as required to leave finished gypsum surface smooth and without observable blemishes which will show through the paint or covering. All exposed joints, internal corners, metal trim, are to be taped, filled, sanded and finished to receive paint or other finishes.

END OF SECTION 13.48.23
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Complete electric traction elevator systems.
      1. Passenger type.
   B. Elevator Maintenance Contract.

1.02 RELATED SECTIONS
   A. Section 04.20.00 - Unit Masonry: Masonry hoistway enclosure; building-in and grouting hoistway door frames.
   B. Section 09.21.16 - Gypsum Board Assemblies: Gypsum shaft walls.
   C. Section 09.68.16 - Sheet Carpeting: Floor finish in car.
   D. Division 21 - Fire Suppression
   E. Division 22 - Plumbing: Pit sump and pump.
   F. Division 26 - Electrical: Dedicated telephone service and wiring connections.
   G. Division 26 - Electrical: Lighting and wiring connections at top of shaft and at pit.
   H. Division 26 - Electrical: Electrical power service and wiring connections.
   I. Division 26 - Electrical: Fire alarm system.

1.03 REFERENCE STANDARDS
   J. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
Q. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
R. NEMA MG 1 - Motors and Generators; 2014.
S. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
U. PS 1 - Structural Plywood; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work with other installers to provide necessary conduits for proper installation of wiring, including but not limited to, the following:
   2. Coordinate work with other installers for equipment provisions necessary for proper elevator operation, including but not limited to, the following:
      a. Automatic transfer switches with auxiliary contacts for emergency power transfer status indication.
      b. Shunt trip devices for automatic disconnection of elevator power prior to fire suppression system activation; include provisions for shunt trip power monitoring.
      c. Overcurrent protection devices selected to achieve required selective coordination.

B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
   1. Review schedule of installation, proper procedures and conditions, and coordination with related work.

C. Construction Use of Elevator: Not permitted.

1.05 SUBMITTALS

A. Product Data: Submit data on following items:
   1. Signal and operating fixtures, operating panels, and indicators.
   2. Car design, dimensions, layout, and components.
   3. Car and hoistway door and frame details.
   4. Electrical characteristics and connection requirements.

B. Shop Drawings: Submit drawings and details on following items:
   1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
   2. Hoistway Components: Size and location of car machine beams, guide rails, buffers, ropes, and other components.
   3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
   4. Clearances and over-travel of car and counterweight.
   5. Locations in hoistway and machine room of traveling cables and connections for car lighting and telephone.
   6. Location and sizes of hoistway and car doors and frames.
   7. Applicable seismic design data; certified by a licensed Professional Structural Engineer.
   8. Electrical characteristics and connection requirements.
   9. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.

C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Initial Maintenance Contract.
E. Maintenance Contract: Submit proposal to Owner for standard one year continuing maintenance contract agreement in accordance with ASME A17.1 and requirements as indicated, starting on date initial maintenance contract is scheduled to expire.
   1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.

1.06 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.07 QUALITY ASSURANCE
A. Maintain one copy of each quality standard document on site.
B. Designer Qualifications: Perform design under direct supervision of a licensed Professional Structural Engineer experienced in design of this type of work and licensed in Tennessee.
C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
D. Installer Qualifications: Supervisor along with trained elevator installation personnel on staff of elevator equipment manufacturer.
E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.08 WARRANTY
A. Provide manufacturer's warranty for elevator operating equipment and devices for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Basis of Design - Electric Traction Elevators: KONE; EcoSpace Machine Roomless (MRL).
B. Other Acceptable Manufacturers - Electric Traction Elevators:
   2. Schindler Elevator Corporation; Schindler 3100: www.us.schindler.com/#sle.
C. Substitutions: See Section 01.60.00 - Product Requirements.
   1. For any product not identified as Basis of Design, submit information as specified for substitutions.
D. Products other than Basis of Design are subject to compliance with specified requirements. By using products other than Basis of Design, the Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
   1. Items included with costs associated to modifications noted above, but not necessarily limited to are:
a. Structural changes in shaft sizes including walls, foundations and framing.  
b. Increased requirements for overhead runby space.  
c. Additional or increased bracing for lateral support of rails  
d. Increased electrical costs including overcurrent protection devices, conduit and conductors if  
   the electrical motor size is increased by the different product.

2.02 ELECTRIC TRACTION ELEVATORS

A. Electric Traction Passenger Elevator:
   1. Electric Traction Elevator Equipment:
      b. Basis of Design is KONE EcoSpace Machine Roomles (MRL) with an adjacent room control  
         space.  
   2. Drive System:
      a. Synchronous alternating current (AC) motors and variable voltage variable frequency (VVVF)  
         drive.  
   3. Operation Control Type:
   4. Interior Car Height: 96 inch.  
   5. Electrical Power: 480 volts; alternating current (AC); three phase; 60 Hz.  
   6. Rated Net Capacity: 4,000 lbs.  
   7. Rated Speed: 150 ft per minute.  
  10. Elevator Pit Depth: 60 inch.  
  11. Overhead Clearance at Top Floor: 156 inch.  
  12. Travel Distance: As indicated on drawings.  
  13. Number of Stops: As indicated on drawings.  
  15. Traction Machine Location: mounted to car guide rail at the top of the hoistway.

2.03 COMPONENTS

A. Elevator Equipment:
   1. Motors, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70.  
      Refer to Section 26.05.83.  
   2. Guide Rails, Cables, Counterweights, Sheaves, Buffers, Attachment Brackets and Anchors: Design  
      criteria for components includes safety factors in accordance with applicable requirements of  
      Elevator Code, ASME A17.1.  
   3. Buffers:
      a. Spring type for elevators with speed less than or equal to 200 feet per minute.  
      b. Oil type for elevators with speed greater than 200 feet per minute.  
   4. Lubrication Equipment:
      a. Provide grease fittings for periodic lubrication of bearings.  
      b. Grease Cups: Automatic feed type.  
      c. Lubrication Points: Visible and easily accessible.  

B. Electrical Equipment:
   1. Motors: NEMA MG 1.  
   2. Boxes, Conduit, Wiring, and Devices: As required by NFPA 70. Refer to Sections 26.05.33.13 and  
      26.05.83.  
   3. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables  
      in traveling cables.
4. Include wiring and connections to elevator devices remote from hoistway to elevator controller and other required connections. Provide additional components and wiring as required by the elevator controller and equipment. Refer to Section 26.05.83.

2.04 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).

B. Accessibility Requirements: Comply with ADA Standards.

C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.

D. Comply with seismic design requirements in accordance with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
   1. Comply with Elevator Safety Requirements for Seismic Risk Zone in accordance with ASME A17.1, ASCE 7 and other related requirements.
   2. Provide earthquake emergency operations in accordance with ASME A17.1 requirements.
   3. Provide seismic switch in accordance with ASME A17.1 and ASCE 7 requirements.

E. Perform welding of steel in accordance with AWS D1.1/D1.1M.

F. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.

G. Perform electrical work in accordance with NFPA 70.

H. Comply with fire protection sprinkler system of the hoistway design in accordance with NFPA 13 requirements and authorities having jurisdiction.

2.05 MATERIALS

A. Rolled Steel Sections, Shapes, Rods: 1.

B. Steel Sheet: 1, Designation CS (commercial steel), with matte finish.

C. Stainless Steel Sheet: 1, Type 304; No. 4 Brushed finish unless otherwise indicated.

D. Extruded Aluminum: 2 and 1, natural anodized finish unless otherwise indicated.

E. Plywood: 1, Structural I, Grade C-D or better, sanded.

2.06 OPERATION CONTROLS

A. Elevator Controls: Provide landing operating panels and landing indicator panels.
   1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
   3. Comply with ADA Standards for elevator controls.

B. Interconnect elevator control system with building security, fire alarm, card access, smoke alarm, and building management control systems.

C. Door Operation Controls:
   1. Program door control to open doors automatically when car arrives at floor landing.
   2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
   3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.

2.07 OPERATION CONTROL TYPE

   1. Refer to description provided in ASME A17.1.
   2. Set system operation so that momentary pressure of landing button dispatches car from other landing to that landing.
3. Allow call registered by momentary pressure of landing button at any time to remain registered until car stops in response to that landing call.
4. If elevator car door is not opened within predetermined period of time after car has stopped at terminal landing allow car to respond to call registered from other landing.

2.08 EMERGENCY POWER

A. Elevator Emergency Power Supply: Supplied by battery backup; provide elevator system components as required for emergency power characteristics.
B. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements. Coordinate with electrical to assure that emergency lighting is provided at the elevator control panel.
C. Provide operational control circuitry for adapting the change from normal to emergency power.
D. Upon transfer to emergency power, advance one elevator at a time to a main floor landing, stop car, open doors, disable operating circuits, and hold in standby condition.

2.09 MATERIALS

A. Rolled Steel Sections, Shapes, Rods: ASTM A36/A36M.
B. Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel), with matte finish.
C. Stainless Steel Sheet: ASTM A666, Type 304; No. 4 Brushed finish unless otherwise indicated.
D. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.
E. Extruded Aluminum: ASTM B221 (ASTM B221M), natural anodized finish unless otherwise indicated.
F. Plywood: PS 1, Structural I, Grade C-D or better, sanded.
H. Carpet Flooring: As specified in Section 09.68.16.
I. Plastic Laminate: NEMA LD 3, Type HGS, color as selected by Architect from manufacturer's standard line of colors.

2.10 CAR AND HOISTWAY ENTRANCES

A. Elevator, No. 1:
   1. Car and Hoistway Entrances, Main Elevator Lobby:
      a. Hoistway Fire Rating: 1 Hour.
      b. Elevator Door Fire Rating: 1 Hour.
      c. Framed Opening Finish and Material: Brushed stainless steel.
      d. Car Door Material: Stainless steel, with rigid sandwich panel construction.
      e. Hoistway Door Material: Stainless steel, with rigid sandwich panel construction.

2.11 CAR EQUIPMENT AND MATERIALS

A. Elevator Car, No. 1:
   1. Car Operating Panel: Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons, "Door Open" button, "Door Close" button, and alarm button.
      a. Panel Material: Integral with front return; one per car.
      b. Car Floor Position Indicator: Above car operating panel with illuminating position indicators.
      c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch above car finished floor.
      d. Provide matching service cabinet integral with front return panel, with hinged door and keyed lock in each car.
      e. Provide following within service cabinet as part of car operating panel:
1) Switch for each auxiliary operational control, keyed.
2) Switches for fan, light, and inspection control.
3) Emergency light.
4) Telephone cabinet and hard-wired connection with telephone.
5) Control for each other special feature specified.

3. Flooring: Carpeting.
5. Door Wall: Stainless steel, brushed finish.
6. Hand Rail: Stainless steel, brushed finish, at all three sides. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
   b. Stainless Steel Finish: No. 4 Brushed.
7. Ceiling:
   a. Canopy Ceiling: Translucent plastic panel.
   b. Lighting: As selected from manufacturer's standard line.
8. Provide emergency access panel for egress from car at ceiling.
9. Guardrailings for top of cab: If required by authority having jurisdiction.

B. Car Accessories:
2. Protective Pads: Canvas cover, padded with impact-resistant fill material, sewn with piping edges; fire resistant in compliance with ASME A17.1; brass grommets for supports, covering side and rear walls and front return, with cut-out for control panel; provide one set for each elevator.
   a. Color: As selected by Architect.
   b. Provide at least 4 inch clearance from bottom of pad to finished floor.
   c. Pad Supports: Stainless steel studs, and mounted from top of wall panels.

2.12 HOISTWAY ENTRANCES

A. Hoistway Entrances; Main Floor Elevator Lobby:
3. Hoistway Fire Rating: 1 Hour.
4. Door Fire Rating: 1 Hour.

B. Hoistway Entrances; Upper Floor Elevator Landings:
3. Hoistway Fire Rating: 1 Hours.
4. Door Fire Rating: 1 Hour.

C. Car Doors:
2. Car Doors: 18 gage, 0.0478 inch minimum sheet thickness, rigid sandwich panel construction.
3. Door Fire Rating: 1 Hour.

D. Hoistway Entrances and Car Doors:
1. Width: As indicated on drawings.
2. Height: 84 inch.
3. Door Type: Double leaf.
PART 3 EXECUTION

3.01 EXAMINATION
A. Verify existing conditions before starting this work.
B. Verify that hoistway, pit, and controller provisions are ready for work of this section.
C. Verify hoistway shaft and openings are of correct size and within tolerance.
D. Verify that electrical power is available and of correct characteristics.

3.02 PREPARATION
A. Arrange for temporary electrical power for installation work and testing of elevator components. Comply with requirements of Section 01.50.00 - Temporary Facilities and Controls.
B. Maintain elevator pit excavation free of water.

3.03 INSTALLATION
A. Coordinate this work with installation of hoistway wall construction.
B. Install system components, and connect equipment to building utilities.
C. Provide conduit, electrical boxes, wiring, and accessories. Refer to Sections 26.05.33.13 and 26.05.83.
D. Mount machines and motors on vibration and acoustic isolators.
   1. Place on structural supports and bearing plates.
   2. Securely fasten to building supports.
   3. Prevent lateral displacement.
E. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.
F. Install guide rails to allow for expansion and contraction movement of guide rails.
G. Accurately machine and align guide rails, forming smooth joints with machined splice plates.
H. Field Welds: Chip and clean away oxidation and residue with wire brush; spot prime with two coats.
I. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.
J. Fill hoistway door frames solid with grout in accordance with Section 04.20.00.
K. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime with two coats.
L. Wood Surfaces not Exposed to Public View: Finish with one coat primer; one coat enamel.
M. Adjust equipment for smooth and quiet operation.

3.04 TOLERANCES
A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.
B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.05 FIELD QUALITY CONTROL
A. Testing and inspection by regulatory agencies certified in accordance with ASME QEI-1 will be performed at their discretion.
   1. Schedule tests with agencies and notify Owner and Architect.
   2. Obtain permits as required to perform tests.
   3. Document regulatory agency tests and inspections in accordance with requirements.
4. Perform tests required by regulatory agencies.
5. Furnish test and approval certificates issued by authorities having jurisdiction.

B. Operational Tests:
   1. Perform operational tests in the presence of Owner and Architect.
   2. Test single elevator system by transporting at least 20 persons up from main floor to top floor landings during a five minute period.
   3. At an agreed time, and the building occupied with normal building traffic, conduct tests to verify performance.
      a. Furnish event recording of each landing call registrations, time initiated, and response time throughout entire working day.

3.06 ADJUSTING
   A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.
   B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch maximum from flush with sill.

3.07 CLEANING
   A. Remove protective coverings from finished surfaces.
   B. Clean surfaces and components in accordance with manufacturers written instructions.

3.08 CLOSEOUT ACTIVITIES
   A. Demonstrate proper operation of equipment to Owner's designated representative.
   B. Demonstration: Demonstrate operation of system to Owner's personnel.
      1. Use operation and maintenance data as reference during demonstration.
      2. Briefly describe function, operation, cleaning and maintenance of each component.
   C. Training: Train Owner's personnel on cleaning and operation and maintenance of system.
      1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
      2. Provide minimum of two hours of training.
      3. Instructor: Manufacturer's training personnel.
      4. Location: At project site, unless noted otherwise.

3.09 PROTECTION
   A. Do not permit construction traffic within car after cleaning.
   B. Protect installed products until Date of Substantial Completion.
   C. Touch-up, repair, or replace damaged products and materials before Date of Substantial Completion.

3.10 MAINTENANCE
   A. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for 12 months from Date of Substantial Completion.
   B. Submit proposal for continuation of Maintenance Contract in accordance with ASME A17.1 and requirements as indicated for installed elevator equipment.
   C. Perform maintenance contract services using competent and qualified personnel under the supervision and direct employ of the elevator manufacturer or installer.
   D. Maintenance contract services shall not be assigned or transferred to any agent or other entity without prior written consent of Owner.
   E. Examine system components monthly.
   F. Include systematic examination, adjustment, and lubrication of elevator equipment.
G. Maintain and repair or replace parts, whenever required, using parts produced by original equipment manufacturer.
H. Replace wire ropes when necessary to maintain the required factor of safety.
I. Perform work without removing cars from use during peak traffic periods.
J. Provide emergency call back service on overtime throughout period of this maintenance contract.
K. Maintain an adequate stock of parts for replacement or emergency purposes, and have personnel available to ensure the fulfillment of this maintenance contract without unreasonable loss of time.

END OF SECTION 14.21.00
1.01 SECTION INCLUDES
   A. Enclosed, self-contained vertical platform wheelchair lift.

1.02 RELATED SECTIONS
   A. Section 03 30 00 - Cast-In-Place Concrete: Concrete shaftway and anchor placement.
   B. Section 04 20 00 - Unit Masonry: Masonry shaftway and anchor placement.
   C. Section 06 10 00 - Rough Carpentry: Blocking in framed construction for lift attachment.
   D. Section 09 21 16 - Gypsum Board Assemblies: Gypsum board shaftway.
   E. Division 26 - Electrical: Dedicated telephone service and wiring connections.
   F. Division 26 - Electrical: Lighting and wiring connections at top of shaft.
   G. Division 26 - Electrical: Electrical power service and wiring connections.

1.03 REFERENCES
   B. ASME A17.5 - Elevator and Escalator Electrical Equipment.

1.04 SUBMITTALS
   A. Submit under provisions of Section 01 30 00.
   B. Product Data: Manufacturer's data sheets on each product to be used, including:
      1. Submit manufacturer’s installation instructions, including preparation, storage and handling requirements.
      2. Include complete description of performance and operating characteristics.
      3. Show maximum and average power demands.
   C. Shop Drawings:
      1. Show typical details of assembly, erection and anchorage.
      2. Include wiring diagrams for power, control, and signal systems.
      3. Show complete layout and location of equipment, including required clearances and coordination with shaftway.
   D. Selection Samples: For each finished product specified, provide two complete sets of color chips representing manufacturer's full range of available colors and patterns.
   E. Verification Samples: For each finished product specified, two samples, minimum size 1-3/4” x 2-1/4” inches, representing actual product, color, and patterns.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
   A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction waste diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%

C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants

D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

### 1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm with minimum 10 years experience in manufacturing of vertical platform lifts, with evidence of experience with similar installations of type specified.

B. Installer Qualifications: Licensed to install equipment of this scope, with evidence of experience with specified equipment. Installer shall maintain an adequate stock of replacement parts, have qualified people available to ensure fulfillment of maintenance and callback service without unreasonable loss of time in reaching project site.

### 1.07 REGULATORY REQUIREMENTS

A. Provide platform lifts in compliance with:
   3. ASME A17.5 - Elevator and Escalator Electrical Equipment.

### 1.08 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store components off the ground in a dry covered area, protected from adverse weather conditions.

### 1.09 PROJECT CONDITIONS

A. Do not use wheelchair lift for hoisting materials or personnel during construction period.

### 1.10 WARRANTY

A. Warranty: Manufacturer shall warrant the wheelchair lift materials and workmanship for two years following completion of installation.

B. Extended Warranty: Provide an extended manufacturer’s warranty for the entire warranty period covering the wheelchair lift materials and workmanship for the following additional extended period beyond the initial two year warranty. Preventive Maintenance agreement required.
   1. Five additional years.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

A. Basis of Design: Garaventa Lift; United States - P.O. Box 1769, Blaine, WA Toll Free: 800-663-6556. Tel: (604) 594-0422. Fax: (604) 594-9915; www.garaventalift.com; Email: productinfo@garaventalift.com

B. Substitutions: Subject to meeting these specifications other manufacturer's products will be considered.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 25 13.
2.02 **ENCLOSED VERTICAL WHEELCHAIR LIFT**

A. Capacity: 750 lbs (340 kg) rated capacity.

B. Mast Height:
   1. Model GVL-EN-120; 123 inches (3124 mm) maximum lifting height.

C. Nominal Clear Platform Dimensions:
   1. Standard: 37-1/4 inches (947 mm) by 54 inches (1370 mm).

D. Platform Configuration:

E. Landing Openings:
   1. Lower Landing: Door.
   2. Upper Landing: Gate.

F. Doors and Gates: Doors and gates shall be self closing type.
   1. Door Height: Flush mount, 80 inches (2032 mm).
   2. Gate Height: Flush mount, 42-1/8 inches (1070 mm).
   3. Door Construction: Aluminum frame with:
      a. Panels of 16 gauge (1.5 mm) painted galvanized steel.

4. Power Door/Gate Operator: Automatically opens the door/gate when platform arrives at a landing. Will also open at landing by pressing call button.
   a. ADA Compliant and obstruction sensitive.
   b. Low voltage, 24 VDC with all wiring concealed.
   c. Location:
      1) Lower Landing: Door.
      2) Upper landing: Door or Gate.

G. Lift Components:
   3. Platform Side Wall Panels: 42-1/8 (1070 mm) inches high. 16 gauge (1.5 mm) galvanized steel sheet. Custom aluminum extrusion tubing frame.
   4. Enclosure Panels:
      a. 16 gauge (1.5 mm) painted galvanized steel sheet.

H. Enclosure Height Above Upper landing:
   1. Enclosure shall extend 42-1/8 inches (1070 mm) above the upper landing level

I. Infill Panel Kit: Provide 16 gauge (1.5 mm) galvanized panels and mounting hardware to cover void between side of enclosure, drive mast and adjacent wall at the following locations:
   1. Lower landing.
   2. Upper landing.

J. Base Mounting and Access to Lift at Lower Landing:
   1. Pit Mount: Lift to be mounted in pit with dimensions to meet manufacturers requirements for the platform size specified. Pit construction shall be in accordance to Section 03300.

K. Leadscrew Drive:
   1. Drive Type: Self-lubricating acme screw drive.
   2. Battery Powered Emergency Lowering: Battery powered platform lowering device that automatically activates in the event of power failure. Allows passenger to drive platform downward to lower landing. Does not operate lift in up direction.
   3. Safety Devices:
      a. Integral safety nut assembly with safety switch.
   4. Travel Speed: 10 fpm (3.0 m/minute).
   5. Motor: 2.0 hp (560 W).
6. Power Supply:
   a. 120 VAC single phase; 60 Hz on a dedicated 20-amp circuit.
   b. 208/240 VAC, single phase; 50 Hz on a dedicated 16-amp circuit.

L. Hydraulic Drive:
1. Drive Type: Chain hydraulic.
2. Emergency Operation: Manual device to lower platform and use auxiliary battery power to raise or lower platform.
3. Safety Devices:
   a. Slack chain safety device.
   b. Shoring device.
4. Travel Speed: 17 fpm (5.2 m/minute).
5. Motor: 3.0 hp (2.2 kW); 24 volts DC.
6. Power Supply:
   a. 120 VAC single phase; 60 Hz on a dedicated 15-amp circuit.
   b. 208/240 VAC, single phase; 50 Hz on a dedicated 16-amp circuit.
   c. Powered by building continuous mains converted to 24 VDC and equipped with auxiliary battery backup power system capable of running lift up and down for a minimum of 5 trips with rated load. Required for high use lifts and lifts equipped with a fan and ventilation system.
   d. Powered by continuously charged battery system.

M. Platform Controls: 24 VDC control circuit with the following features.
1. Direction Control: Illuminated tactile and constant pressure push buttons with dual platform courtesy lights and safety light.
2. Illuminated and audible emergency stop switch shuts off power to lift and activates audio alarm equipped with battery backup.
4. Emergency Telephone: Platform shall be equipped with ADA compliant autodialer telephone with a stainless steel faceplate. Telephone shall operate in the event of power failure. A telephone line shall be supplied to the lift site as specified under Division 26.
5. Arrival Gong and Digital Floor Display.

N. Call Station Controls: 24 VDC control circuit with the following features.
1. Direction Control: Illuminated tactile and constant pressure push buttons with illuminated "In Use" indicator.
2. Keyed operation.
3. Call Station Mounting:
   a. Lower:
      1) Frame mounted.
   b. Upper:
      1) Frame mounted.

O. Safety Devices and Features:
1. Grounded electrical system with upper, lower, and final limit switches.
2. Tamper resistant interlock to electrically monitor that the door is in the closed position and the lock is engaged before lift can move from landing.
3. Pit stop switch mounted on mast wall.
4. Electrical disconnect shall shut off power to the lift.

P. Finishes
1. Lift Finish: Baked powder coat finish, color as selected by the Architect from manufacturers optional RAL color chart.
PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. Verify shaft and machine space are of correct size and within tolerances.
C. Verify required landings and openings are of correct size and within tolerances.
D. Verify electrical rough-in is at correct location.
E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install platform lifts in accordance with applicable regulatory requirements including ASME A 17.1, ASME A 18.1 and the manufacturer’s instructions.
B. Install system components and connect to building utilities.
C. Accommodate equipment in space indicated.
D. Startup equipment in accordance with manufacturer’s instructions.
E. Adjust for smooth operation.

3.04 FIELD QUALITY CONTROL

A. Perform tests in compliance with ASME A 17.1 or A18.1 and as required by authorities having jurisdiction.
B. Schedule tests with agencies and Architect, Owner, and Contractor present.

3.05 PROTECTION

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 14.42.16
SECTION 14.42.18
VERTICAL SHAFT WHEELCHAIR LIFTS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Vertical platform wheelchair lift installed within shaftway.

1.02 RELATED SECTIONS
A. Section 03 30 00 - Cast-In-Place Concrete: Concrete shaftway and anchor placement.
B. Section 04 20 00 - Unit Masonry: Masonry shaftway and anchor placement.
C. Section 06 10 00 - Rough Carpentry: Blocking in framed construction for lift attachment.
D. Section 09 26 00 - Gypsum Board Assemblies: Gypsum board shaftway.
E. Division 26 - Electrical: Dedicated telephone service and wiring connections.
F. Division 26 - Electrical: Lighting and wiring connections at top of shaft.
G. Division 26 - Electrical: Electrical power service and wiring connections.

1.03 REFERENCES
B. ASME A17.5 - Elevator and Escalator Electrical Equipment.

1.04 SUBMITTALS
A. Submit under provisions of Section 01 30 00.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Submit manufacturer’s installation instructions, including preparation, storage and handling requirements.
   2. Include complete description of performance and operating characteristics.
   3. Show maximum and average power demands.
C. Shop Drawings:
   1. Show typical details of assembly, erection and anchorage.
   2. Include wiring diagrams for power, control, and signal systems.
   3. Show complete layout and location of equipment, including required clearances and coordination with shaftway.
D. Selection Samples: For each finished product specified, provide two complete sets of color chips representing manufacturer's full range of available colors and patterns.
E. Verification Samples: For each finished product specified, two samples, minimum size 1-3/4” x 2-1/4”, representing actual product, color, and patterns.

1.05 TENNESSEE HIGH PERFORMANCE BUILDING REQUIREMENTS (HPBR) COMPLIANCE DOCUMENTATION
A. Reference document - State of Tennessee High Performance Building Requirements Manual, Version 1.01, as referenced in Section 01.78.50 HPBr Reporting and as tracked by the Section 01.78.50 HPBr CHECKLIST/TRACKING FORM.
B. Provide documentation of construction wast diverted from landfills:
   1. Compliance with Credit MR2.1 - Construction Waste Management - 50%
C. Submit documentation demonstrating HPBr compliance for the following:
   1. Compliance with Credit MR3.1: Sustainable Materials - Recycled content 10%.
   2. Compliance with Credit EQ6.1: Material VOC Limits - Adhesive and sealants
D. Submit documentation of quantity and material cost with monthly Application for Payment to the Contractor.

1.06 QUALITY ASSURANCE
A. Manufacturer Qualifications: Firm with minimum 10 years experience in manufacturing of vertical platform lifts, with evidence of experience with similar installations of type specified.
B. Installer Qualifications: Licensed to install equipment of this scope, with evidence of experience with specified equipment. Installer shall maintain an adequate stock of replacement parts, have qualified people available to ensure fulfillment of maintenance and callback service without unreasonable loss of time in reaching project site.

1.07 REGULATORY REQUIREMENTS
A. Provide platform lifts in compliance with:
   3. ASME A17.5 - Elevator and Escalator Electrical Equipment.

1.08 DELIVERY, STORAGE, AND HANDLING
A. Store products in manufacturer's unopened packaging until ready for installation.
B. Store components off the ground in a dry covered area, protected from adverse weather conditions.

1.09 PROJECT CONDITIONS
A. Do not use wheelchair lift for hoisting materials or personnel during construction period.

1.10 WARRANTY
A. Warranty: Manufacturer shall warrant the wheelchair lift materials and workmanship for two years following completion of installation.
B. Extended Warranty: Provide an extended manufacturer’s warranty for the entire warranty period covering the wheelchair lift materials and workmanship for the following additional extended period beyond the initial two year warranty. Preventive Maintenance Agreement required.
   1. Five additional years.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Basis of Design: Garaventa Lift; United States - P.O. Box 1769, Blaine, WA Toll Free: 800-663-6556.
   Tel: (604) 594-0422. Fax: (604) 594-9915; www.garaventalift.com; Email: productinfo@garaventalift.com
B. Substitutions: Subject to meeting these specifications other manufacturer's products will be considered.
C. Requests for substitutions will be considered in accordance with provisions of Section 01 25 13.
2.02 SHAFTWAY VERTICAL WHEELCHAIR LIFT

A. Capacity: 750 lbs. (340 kg) rated capacity.

B. Mast Height:
   1. Model GVL SW -120; 123 inches (3124 mm) maximum lifting height.

C. Nominal Clear Platform Dimensions:
   1. Standard: 39 inches (992 mm) by 54 inches (1370 mm).

D. Platform Configuration:
   1. On/Off Same Side Entry/Exit: One front opening only.

E. Landing Openings:
   1. Lower Landing: Door.
   2. Upper Landing: Door.

F. Door Construction:
   1. Fire Rated Doors: 1-1/2 hour B label rating. Pre-hung, constructed of 16 gauge (1.5 mm) steel, with a vision panel, delayed action door closer, pull handle and integrated interlock. Doors mount flush to the inside wall of the shaftway.
   2. Door Width:
      a. Lower Landing: 35-5/8 inches (905 mm).
      b. Upper landing: 35-5/8 inches (905 mm).

G. Power Door Operator: Automatically opens the door/gate when platform arrives at a landing. Will also open at landing by pressing call button.
   1. ADA Compliant and obstruction sensitive.
   2. Low voltage, 24 VDC with all wiring concealed.
   3. Provide power operators at the following locations:
      a. Lower Landing: Door.
      b. Upper landing: Door or Gate.

H. Lift Components:
   2. Base Frame: Structural steel tubing.
   3. Platform Side Wall Panels: 16 gauge (1.5 mm) galvanized steel sheet. Custom aluminum extrusion tubing frame.

I. Base Mounting and Access to Lift at Lower Landing:
   1. Pit Mount: Lift to be mounted in pit with dimensions to meet manufacturers requirements for the platform size specified. Pit construction shall be in accordance to Section 03300.

J. Drive Mast Side Wall Panels: Provide 16 gauge (1.5 mm) galvanized panels and mounting hardware to cover the void between both sides of the mast and the side of the shaftway. Panels to cover the front and top of the void area to the height of the top surface of the drive mast.

K. Leadscrew Drive:
   1. Drive Type: Self-lubricating acme screw drive.
   2. Emergency Operation: Manual handwheel device to raise or lower platform.
   4. Safety Devices:
      a. Integral safety nut assembly with safety switch.
      b. Shoring device.
   5. Travel Speed: 10 fpm (3.0 m/minute).
7. Power Supply:
a. 120 VAC single phase; 60 Hz on a dedicated 20 amp circuit.
b. 208/240 VAC, single phase; 50 Hz on a dedicated 16 amp circuit.

L. Hydraulic Drive:
1. Drive Type: Chain hydraulic.
2. Emergency Operation: Manual device to lower platform and auxiliary battery power to raise or lower platform.
3. Safety Devices:
a. Slack chain safety device.
b. Shoring device.
4. Travel Speed: 17 fpm (5.2 m/minute).
5. Motor: 3.0 hp (2.2 kW); 24 volts DC.
6. Power Supply:
a. 120 VAC single phase; 60 Hz on a dedicated 15 amp circuit.
b. 208/240 VAC, single phase; 50 Hz on a dedicated 16 amp circuit.
c. Powered by continuous building mains converted to 24 VDC equipped with auxiliary battery power system capable of running lift up and down for a minimum of 5 trips with rated load. Required for high usage lifts.
d. Powered by continuously charged battery system.

M. Platform Controls: 24 VDC control circuit with the following features.
1. Direction Control: Illuminated tactile and constant pressure buttons with dual platform courtesy lights and safety light.
2. Illuminated and audible emergency stop switch shuts off power to lift and activates audio alarm equipped with battery backup.
4. Emergency Telephone: Platform shall be equipped with ADA compliant autodialer telephone with a stainless steel faceplate. Telephone shall operate in the event of power failure. A telephone line shall be supplied to the lift site as specified under Division 16.
5. Arrival Gong and Digital Floor Display.

N. Call Station Controls: 24 VDC control circuit with the following features.
1. Direction Control: Illuminated and tactile constant pressure buttons with illuminated “in-use” indicator.
2. Safety indicator lamp.
4. Call Station Mounting:
a. Lower:
   1) Wall mounted recessed.
b. Upper:
   1) Wall mounted recessed.

O. Safety Devices and Features:
1. Grounded electrical system with upper, lower, and final limit switches.
2. At all landings a solenoid activated interlock shall electrically monitor that the door is in the closed position and the lock is engaged before lift can move from landing.
3. Pit stop switch mounted on mast wall.
4. Electrical disconnect shall shut off power to the lift.

P. Finishes
1. Lift Finish: Baked powder coat finish as selected by the Architect from manufacturer’s optional RAL color chart.
PART 3 EXECUTION

3.01 EXAMINATION
   A. Do not begin installation until substrates have been properly prepared.
   B. Verify shaft and machine space are of correct size and within tolerances.
   C. Verify required landings and openings are of correct size and within tolerances.
   D. Verify electrical rough-in is at correct location.
   E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory
      preparation before proceeding.

3.02 PREPARATION
   A. Clean surfaces thoroughly prior to installation.
   B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for
      the substrate under the project conditions.

3.03 INSTALLATION
   A. Install platform lifts in accordance with applicable regulatory requirements including ASME A 17.1,
      ASME A 18.1 and the manufacturer’s instructions.
   B. Install system components and connect to building utilities.
   C. Accommodate equipment in space indicated.
   D. Startup equipment in accordance with manufacturer’s instructions.
   E. Adjust for smooth operation.

3.04 FIELD QUALITY CONTROL
   A. Perform tests in compliance with ASME A 17.1 or A18.1 and as required by authorities having
      jurisdiction.
   B. Schedule tests with agencies and Architect, Owner, and Contractor present.

3.05 PROTECTION
   A. Protect installed products until completion of project.
   B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 14.42.18
PART 1 - GENERAL

1.01 PROJECT SUMMARY

A. Work in this Section includes, but is not necessarily limited to providing all engineering and associated costs, calculations, labor, materials, supervision, testing, permits and approvals required to design, install and obtain final acceptance of the automatic fire protection sprinkler system complete in all respects.

B. The fire protection system shall provide full and complete coverage of all areas, and shall be compatible with the contract document layouts and avoid interference with work of all other trades in the building. Contractor shall provide offsets as needed to avoid other trades, including but not limited to mechanical ductwork, hydronic piping, structural elements and lighting.

C. Provide fire protection system complete with all component equipment and material items. Install and test in full conformity with the requirements of all applicable codes, National Fire Protection Association (NFPA) 13-2012 Edition.

1.02 DEFINITIONS

A. Working Plans: Documents, including shop drawings, calculations, and material specifications prepared according to NFPA 13, 14, and 24 for obtaining approval from authorities having jurisdiction.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. Sprinkler systems shall not be calculated to less than 5 psi or 10% below the actual water supply available, whichever is greater. Sprinkler plans and calculations must take into account and show elevation loss from the flow test location to the flowing sprinklers. Flow test information must be recent to within one (1) year previous to submittal of sprinkler drawings.

B. NFPA standards require that the spray deflector of the sprinkler heads be installed eighteen (18”) inches minimum above the top of the shelves.

C. Sprinkler deflectors shall be positioned to avoid obstruction to both activation and discharge. Obstructions are (but are not limited to) lights, diffusers, duct-work, structural members (false or real), displayed signage or any object capable of impeding the proper activation and discharge of the fire sprinklers. Installation shall comply to the referenced NFPA 13 document (Chapter 4) and the manufacturers listing. The sprinkler contractor shall be responsible for final coordination.

D. All obstructions exceeding four (4') feet wide or which cannot be spaced around (to comply with 1.4.F) shall have sprinklers installed beneath the obstruction. If sprinklers are installed at or below 7.6” they shall be equipped with a listed head guard.

E. All sprinkler heads in finished ceilings shall be symmetrically spaced to provide proper coverage, and to avoid interference with lights, diffusers, grilles, or other ceiling mounted equipment. The head layout shall conform to the typical pattern and centered in any ceiling tile or similar feature.

F. All overhead piping located in areas containing ceilings shall run concealed above the ceiling, without exception.

G. Consult the bid specification drawings for acceptable locations for all piping to be run exposed (areas without ceilings).

H. Inspector's tests to be provided with half-inch orifice, discharging at three (3”) inches above a hard paved surface. Provide pressure relief valves at inspectors test locations on all "grid” type systems. All inspector's test shall not be located behind racking or other obstructions, and shall be located within eighteen (18”) inches of an exterior door opening.
I. Provide flushing and drainage as per required in NFPA 13.

J. Provide fire department connection. The exact placement and model of the fire department connection shall be verified with the local jurisdiction. Refer to the provided fire sprinkler drawings for location and arrangement.

K. System control valves accessed from the interior of the riser area and shall be tampered butterfly valves.

L. Provide sprinkler protection at electrical rooms per the requirements of the local jurisdiction.

M. The calculations shall include all sprinklers within the most hydraulically demanding area along each branch line within the distance determined using a 1.2 multiplier (times the square feet of the area).

N. The contractor shall provide a valve connection discharging onto a paved (outside) surface, to allow full system demand to flow forward of the backflow preventor for testing. The test connection shall be capable of full system flow and shall not require system drainage or alteration. Note, the two (2") inch main drain and FDC are not acceptable.

PART 2 - PRODUCTS

2.01 GENERAL PARAMETERS

A. All materials submitted and installed shall be UL listed, individually or as any assembly to be installed in a fire protection system.

B. All materials shall be acceptable to all national and local applicable codes and standards.

2.02 SPRINKLER HEADS

A. No sprinklers to be installed are permitted to have a rubber O-ring seal. Only metallic "spring seal" or equivalent seals are allowed.

B. All sprinkler types and temperature ratings shall be as indicated on the drawings.

2.03 BRACKETS

A. Brackets for attaching pipe hangers to building structure shall be the size and type for the intended use, and acceptable to the structural engineer in accordance with NFPA 13.

2.04 SWITCHES

A. Provide all tamper and flow switches for indicating control valves and systems and as required by local ordinances.

2.05 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. Specialty Valves and Devices:
      a. Grinnell Corp.
      b. Reliable Automatic Sprinkler Co., Inc.
      c. Viking Corp.

   2. Water-Flow Indicators and Supervisory Switches:
      a. Grinnell Corp.
      b. Reliable Automatic Sprinkler Co., Inc.
      c. Viking Corp.

   3. Sprinkler, Drain and Alarm Test Fittings:
      a. Central Sprinkler Corp.
      b. Grinnell Corp.
4. Sprinkler, Branch-line Test Fittings:
   b. Fire-End and Croker Corp.

5. Sprinkler, Inspector’s Test Fittings:
   a. Fire-End and Croker Corp.
   b. G/J Innovations, Inc.
   c. Triple R. Specialty of Ajax, Inc.

6. Fire Department Connections:
   a. Grinnell Corp.
   b. Guardian Fire Equipment, Inc.
   c. Reliable Automatic Sprinkler Co., Inc.

7. Sprinklers:
   a. Grinnell Corp.
   b. Reliable Automatic Sprinkler Co., Inc.
   c. Viking Corp.

8. Indicator Posts and Indicator-Post, Gate Valves:
   b. Grinnell Corp.
   c. Nibco, Inc.

9. Indicator Valves:
   a. Grinnell Corp.
   b. Nibco, Inc.
   c. Victaulic Co. of America

10. Fire Protection-Service Valves:
    a. Grinnell Corp.
    b. Nibco, Inc.
    c. Victaulic Co., of America

11. Grooved Couplings for Steel Pipe
    a. Grinnell Corp.
    b. National Fittings, Inc.
    c. Victaulic Co. of America

2.06 BACKFLOW PREVENTERS

A. Double Check Device: UL listed and FM approved, ASSE and USC approved double check backflow preventer consisting of two resilient seated full flow isolation valves, two independently operating, spring loaded poppet-type internally epoxy coated cast iron check valves and four resilient seated test cocks for field testing. Stainless steel springs and corrosion resistant materials shall be used throughout. Working pressure rating of 175 PSI. Preventer assembly to be lien size or size as called for on drawings. Backflow preventer shall be a Watts, Silver Buller, or Febco mount 4 foot maximum above the floor.

2.07 PIPE AND FITTINGS

A. Ductile-Iron Pipe: AWWA C151, push-on-joint type, with cement-mortar lining and seal coat according to AWWA C104. Include rubber gasket according to AWWA C111.
B. Ductile-Iron Pipe: AWWA C151, mechanical-joint type; with cement-mortar lining and seal coat according to AWWA C104. Include glad, rubber according to NFPA 1963 and matching local fire department sizes and threads, and bottom outlet with pipe threads. Include brass, lugged caps, gaskets, and brass chains; brass, lugged swivel connection and drop clapper for each hose-connection inlet; eighteen (18") inch (460-mm) high brass sleeve; and round, floor, brass, escutcheon plate with marking "AUTO SPKR."
   2. Finish Including Sleeve: Rough chrome-plated.
C. Other Pipe: ASTM A795, Sch 40 Steel Pipe (or Sch 10 where allowed by NFPA 13).

2.08 FIRE DEPARTMENT CONNECTIONS
A. Water-Flow Indicators: UL 346; electrical-supervision, vane-type water-flow detector; with 250 psig pressure rating; and designed for horizontal or vertical installation. Include two (2) single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts 7A, 125-V ac and 0.25A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that send signal if removed.
B. Pressure Switches: UL 753; electrical-supervision type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
C. Valve Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
D. Indicator-Post Supervisory Switches: UL 753; electrical; single-pole, double throw, with normally closed contacts, Include design that signals controlled indicator-post valve is in other than fully open position.

2.09 PRESSURE GAUGES
A. Pressure Gauges: UL 393, 3 ½ to 4 ½ inch - (90 to 115 mm) diameter dial with dial range of 0 to 300 psig.

PART 3 - EXECUTION

3.01 INSTALLATION
A. Furnish and install under this Section all hangers and steel fabrications, other than building structure, required for proper support of piping and equipment.

3.02 IDENTIFICATION
A. Identify exposed or accessible piping with snap-on or strap-on type markers. Color or markers shall be red for all fire protection service. Indicate pipe contents and direction of flow on marker. Install markers on piping not more than 20 feet apart, at valves, at access panels and at least once above each space.

3.03 HANGER ATTACHMENTS
A. Support of pipes with diameter larger than 2 ½ inches may require modification of structural members to support increased loads. Suspend piping and equipment supported by building structure only by those methods, and only at those locations acceptable to the structural engineer.
B. Provide supplementary supporting steel fabrication to bridge between structural steel fabrication to bridge between structural members to receive the hanger. Attach supplementary members to building structure only by those methods, and at those locations acceptable to the structural engineer.
3.04 INSPECTION, TESTING, AND CLEANING

A. Arrange for all inspections, examinations and tests in full conformity with the requirements of all applicable codes, National Fire Protection Association (NFPA) standards and authority having jurisdiction necessary to obtain complete and final acceptance of the fire sprinkler system.

B. Flush underground piping and pressure test at 200 psi for two (2) hours prior to connection to overhead piping. Flushing and testing shall be witnessed by the Fire Department.

C. Leave entire sprinkler system clean in every respect at the conclusion of the work.

D. Testing will occur after installation of all systems has been completed (approximately two (2) to three (3) weeks prior to opening). The contractor shall be required to provide a lift, air, and water pumps for system pressurization, and any necessary hand tools and apparatus for complete testing and draining of the systems. One (1) test of all systems should be completed within one (1) day. If all or any systems fail, the contractor shall be responsible to be present and furnish all items listed above until such time that systems are found to be acceptable or in accordance with NFPA 13, 25, and the bid documents. The contractor is responsible for notifying the Owner when installation is complete and testing may begin. Please allow five (5) to ten (10) working days for scheduling.

E. The contractor shall furnish to the owner a complete set of signed and witnessed test certificates for the following:
   1. Underground flushing.
   2. Underground hydrostatic test.
   3. Interior wet system hydrostatic test(s).
   4. All system trip tests.

F. The Contractor shall train owner on use of all equipment and furnish two (2) copies to be left on site, of NFPA 25 the latest edition, and all apparatus manuals, please allow seven (7) days for scheduling.

3.05 WARRANTY

A. Provide warranty in accordance with the General Conditions for a period of at least one (1) year.

END OF SECTION 21.10.00
SECTIONS 22.05.00
GENERAL PROVISION FOR PLUMBING

PART 1 - GENERAL

1.01 QUALITY ASSURANCE
A. Conform to the following:
   1. International Plumbing Code - 2012

1.02 STANDARDS
A. Comply with all pertinent standards.
   1. AWS: American Welding Society.
   2. ASME: American Society for Mechanical Engineers.
   3. MSS: Manufacturer's Standard Society.

1.03 SUBMITTALS
A. Submit under provisions of Division 01.
   1. Submit complete descriptions, specification data for material and equipment proposed. Clearly indicate proposed items when other items are shown on same sheet.
   2. Submittals in 3-ring binders shall include an index of contents and divider tabs.
   3. Shop Drawings:
      a. Plumbing Fixtures and Hardware
      b. Piping Systems
      c. Valves
      d. Insulation
      e. Pumps
      f. Water Heaters
      g. Plumbing Specialties

1.04 REGULATORY REQUIREMENTS
A. Perform Work specified in Division 22 in accordance with 2012 IPC and by the authority having jurisdiction.

1.05 PROJECT/SITE CONDITIONS
A. Layouts indicated on drawings are diagrammatical and intended to show relative positions and arrangement of equipment and piping. Coordinate plumbing work with other trades and measurements obtained at the job site, as applicable, prior to installation. Generally, install work in locations shown on Drawings, using as necessary, rises, drops, offsets, and alternate routings to fit in the available space unless prevented by Project conditions.

1.06 COMPLETENESS OF WORK
A. The Contract Documents depict plumbing systems which are intended to be complete and functioning systems. All products, materials, and labor necessary to render a fully functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.

B. Model numbers referenced throughout the Division 22 Drawings and Specifications are intended to convey a general understanding of the type and quality of the product required. Where written descriptions differ from information conveyed by a model number, the written description shall govern.
No extra shall be allowed because a model number is found to be incomplete or obsolete.

1.07 RECORD DRAWINGS
   A. Provide record drawings that illustrate the work of Division 22 as finally constructed. Provide dimensions of material installed below slab/grade from fixed and visible reference points. Deliver record drawings to the architect in a form suitable for production.
   B. Record drawings shall reflect all changes made to the Contract Documents, whether generated by addenda, change orders, or field conditions. Maintain a daily record of these changes and keep current set of drawings showing these changes.
   C. Deliver record drawings to Architect within 30 days of Substantial Completion.

1.08 OWNER AND OPERATING MANUALS
   A. Comply with the requirements of Division 01, but provide a minimum of three sets, in three ring binders, all sets identical.
   B. Manuals shall include clear and comprehensive operating instructions with appropriate graphics and project specific marked data to enable owner to operate and maintain all systems specified in this Division.
   C. Copies of approved submittals on furnished equipment shall be included.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXCAVATING AND BACKFILLING
   A. Provide trenching, excavating, and backfilling necessary for performance of plumbing work in accordance with Division 02.

3.02 CUTTING AND PATCHING
   A. Repair or replace damage caused by cutting or installation of work specified in Division 22.
   B. Perform repairs with materials which match existing and install in accordance with the appropriate section of these specifications.
   C. Correct unnecessary damage caused due to the installation of plumbing work.

3.03 FLASHING AND COUNTERFLASHING
   A. Counterflash pipes where penetration of roofs and outside walls occur.

3.04 DELIVERY, STORAGE, AND PROTECTION
   A. Insofar as possible, deliver items in manufacturer's original unopened packaging. Where deliver in original packaging is not practical, provide cover and shielding for all items with protective materials to keep them from being damaged. Use care in loading, transporting, unloading, and storing to keep items from being damaged.
   B. Store items in a clean, dry place, and protect from damage. Mechanical equipment may not be staged or stored outdoors unless intended for outdoor use. Do not install damaged or wet insulation; Remove from site.
   C. Protect nameplates on motors, pumps, and similar equipment. Do not paint or insulate over nameplate data.
   D. Protect valves and piping from damage. Cover equipment during work of finishing trades.
E. Keep dirt and debris out of pipes.
F. Repair, restore, and replace damaged items.
G. Cover factory finished equipment during work of finished trades, such plumbing fixtures and water heaters.

3.05 SLEEVES

A. Floors: Sleeve all pipe penetrations. Extend sleeve 1-1/2” above finished floor, except piping within pipe chases. Sleeve shall be flush with underside of floor.
B. Masonry or concrete walls: Sleeve all pipe penetrations. Sleeves shall be flush on both sides of wall.
C. Drywall partitions: Sleeve all penetration of piping in systems over 160 degree F.
D. Seal voids between outside surface of sleeve and wall, partition or floor. Seals shall be airtight.
E. Install piping, insulation and sleeves in strict accordance with applicable U.L. floor or partition assembly instructions. Coordinate with Division 07 firestop manufacturer’s installation instructions.
F. Penetrations not sleeved or firestopped:
   1. Seal voids between pipe and partition. Seals shall be airtight.

3.06 ESCUTCHEON PLATES

A. Provide chromium plates escutcheon plates for exposed uninsulated pipes projecting through floors or walls in "finished" spaces. Mechanical rooms, store rooms, electric closets, and janitor closets are not considered "finished" spaces.
B. Clearance between sleeve and pipe: Minimum of 1/2 inch for hot piping and 1 inch for cold piping or as otherwise dictated by U.L. Fire Resistance Directory.

3.07 TESTING

A. Test all installed equipment and systems and demonstrate proper operation. Correct and retest work found defective when tested.
B. Thoroughly check piping system for leaks. Do not add any leak-stop compounds to the system. Make repairs to piping system with new materials. Peening, doping, or caulking of joints or holes is not acceptable.
C. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at a water pressure of 125 psig for two hours without leaks.
D. Test drainage and venting system with necessary openings plugged to permit system to be filled with water and subjected to a minimum water pressure of 10 feet head at top of system. System to hold water for two hours without a water level drop greater than 4” in a 4” standpipe and without visible leakage. Test system in sections if minimum head can be maintained in each section.
E. Conduct air or smoke test if in opinion of Designer reasonable cause exists to suspect leakage or low quality workmanship.
F. Test flush valves for proper operation.

END OF SECTION 22.05.00
SECTION 22.05.53
IDENTIFICATION OF PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL (NOT USED)

PART 2 - PRODUCTS

2.01 NAMEPLATES AND TAGS
   A. Acceptable manufacturers: Seton Nameplate or Brady.
   B. Rigid plastic, "Setonite" or bakelite with engraved lettering, minimum 1/2" high.
   C. Brass tags, at least 1-1/2" inches in diameter, with alpha-numeric I.D., permanently stamped black filled letters showing the service, and black filled numbers showing the equipment number. At substantial completion, a schedule of all valves shall be submitted to the Architect and Owner's Representative.

2.02 PIPE MARKERS
   A. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering.

2.03 PIPE IDENTIFICATION
   A. Pipe Identification:
      1. Identify piping by snap-on or strap-on labels (to denote contents and direction of flow) on piping at no more than 20 foot intervals, at valves, and at least once in each separate space through which the pipe passes.
      2. Identification includes domestic cold water; hot water; recirculation hot water; rainwater; storm; waste; natural gas; compressed air.
      3. All piping in mechanical rooms shall be labeled to identify contents and direction of flow.

2.04 EQUIPMENT AND APPARATUS IDENTIFICATION
   A. Acceptable Manufacturers: Seton Name Plate Corporation or equal.
   B. Nameplates: Rigid plastic, "Setonite", Seton or Brady with engraved lettering (indicating names and numbers of mechanical apparatus), a minimum of 1/2" high. Fill engraved lettering with a permanent coloring material which contrasts with color of tag material to allow for easy reading.
   C. Use names, numbers, and abbreviations appearing in schedules on Contract Drawings.
   D. Provide nameplates, located in a conspicuous location directly on the equipment or apparatus, for mechanical equipment including, but not limited to:
      1. Water heaters
      2. Pumps
      3. Plumbing equipment
   E. Name tag Fasteners: Commercial quality, rust resisting nuts and bolts with backwashers, self-tapping screws, or rivets. If equipment surface does not allow for direct attachment, use copper or brass rings to attach tags.

PART 3 - EXECUTION

3.01 INSTALLATION
   A. Install pipe identification markers per manufacturer's installation instructions.
   B. Install equipment nameplates per manufacturer's installation instructions.

END OF SECTION 23.05.53
PART 1 - GENERAL

1.01 QUALITY ASSURANCE
   A. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 method.

1.02 EXISTING SERVICES
   A. Maintain existing services in operation during construction. Coordinate and schedule all service interruptions with Owner.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:
   A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
      Johns Manville Corp.
      Owens-Corning Fiberglas Corp.
      Rubatex Corp.

2.02 PIPING INSULATION MATERIALS:
   A. Fiberglass Piping Insulation: ASTM C 547, Type 1 unless otherwise indicated.
   B. Flexible Unicellular Piping Insulation: ASTM C 534, Type I (Tubular).
   C. Jackets for Piping Insulation: ASTM C 921, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at Installers option.
      1. Encase pipe fittings, valves, strainers, etc. with insulation with glass fabric and vapor barrier mastic applied as per manufacturer’s recommendations.
   D. Encase the following with 0.016” smooth aluminum jacket, secured with sheet metal screws and 1/4-inch aluminum bands. Fittings shall be covered with factory-formed aluminum elbow covers.
      1. All interior piping insulation within 7'-0" of floors or work surfaces.
      2. All valves, fittings, etc. within 7'-0" of floors or work surfaces.
      3. All fittings within 7'-0" of floors or work surfaces to be covered with factory formed aluminum elbow covers.
   E. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.
   F. Tees and elbows for insulated piping shall be factory premolded insulation fittings, similar to that manufactured by Hamfab.
   G. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

2.03 EQUIPMENT INSULATION MATERIALS:
   A. Flexible Unicellular Equipment Insulation: ASTM C 534, Type II.
   B. Jacketing Material for Equipment Insulation: Provide metal jacket, except as otherwise indicated.
   C. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.
D. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape, corner angles, anchors and stud pins as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PLUMBING PIPING SYSTEM INSULATION:

A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drain lines from water coolers, and pre-insulated equipment.

B. Cold Piping:
   1. Application Requirements: Insulate all cold plumbing piping systems, which include the following:
      a. Potable cold water piping.
      b. Horizontal interior above-ground storm and rain water piping.
      c. Condensate piping.
   2. Insulate each piping system specified above with one of the following types and thicknesses of insulation with a thermal conductivity of 0.24 to 0.28 BTU · in/(h · ft 2 · °F):
      a. Fiberglass: 1/2” thickness for cold water.
      b. Fiberglass: 1” thickness for storm/rain water.
      c. Fiberglass: 1 1/2” thickness for condensate piping.

C. Hot Piping:
   1. Application Requirements: Insulate all hot plumbing piping systems, which include the following:
      a. Potable hot water piping.
      b. Potable hot water recirculating piping.
   2. Insulate each piping system specified above with one of the following types and thicknesses of insulation with a thermal conductivity of 0.24 to 0.28 BTU · in/(h · ft 2 · °F):
      a. Fiberglass: 1 1/2” thick for potable hot water supply.
      b. Fiberglass: 1 1/2” thick for recirculating hot water piping.

D. Glass fiber blanket inserts with PVC covers are not acceptable for pipe fitting insulation.

E. Hangers:
   1. All hanger nuts to be tighten AFTER insulation is added to the piping.
   2. All metal shields should be installed BEFORE nuts are tightened. Minimum shield length shall be 12”.
      Provide a section of Foamglass insulation between pipe and metal shield to prevent crushing of insulation. All shields shall be 14 gauge.

F. Protection
   1. All damaged insulation caused by maintenance or construction shall be replaced by contractor, up to and through the completion of the Punch List.

G. Special Conditions
   1. Refer to other specifications and drawings for details regarding special acoustical treatments. In situations of conflict the most acoustically conservative application shall prevail.

3.03 INSTALLATION OF PIPING INSULATION:

A. Use glass fiber sectional pipe insulation for domestic water piping. Glass fiber factory premolded fitting matching basic insulation equivalent to that manufactured by Hamfab shall be provided at all pipe fittings (Tees and ells) and finished with glass fabric and vapor barrier mastic. Glass fiber blanket inserts with PVC covers are not acceptable for pipe fitting insulation.
B. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

C. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.

D. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

E. Clean and dry pipe surfaces prior to insulating. All butt-joints for cold water or condensate drain lines must be glued securely any openings to prevent the build-up of condensation.

F. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage. Repair any insulation jacket damaged so it has permanent seal. Cover all joints, rips, tears punctures, staples, insulpins or breaks in vapor barrier jacket with 4” wide woven glass fabric embedded in vapor barrier fire resistant mastic.

G. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run.

H. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

I. For hot pipes, apply 3” wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3” wide vapor barrier tape or band. Piping insulation to continue through 100% of pipe hangers. No insulation shall be cut where a hanger is located for any loop water, cold water or condensate drain lines.

J. Insulate all domestic water valves that could condensate and drip.

K. For any service when above grade, exposed to weather outside building, and exposed in equipment rooms to within 7 feet above floors, cover pipe insulation with 0.016” thick smooth aluminum jacket equivalent to Childers and cover valves and fittings with .024” thick aluminum factory formed covers equivalent to Childers E11-Jacs.

3.04 INSTALLATION OF EQUIPMENT INSULATION:

A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.

C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.

D. Apply insulation using staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.

E. Coat insulated surfaces with layer of insulating cement, troweled in workmanlike manner, leaving smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.

F. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2”. Apply over vapor barrier where applicable.

G. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

H. Hangers:
   1. All hanger nuts to be tighten AFTER insulation is added to the equipment
   2. All metal shields to be installed BEFORE nuts are tightened.
I. Protection
   1. If equipment will be walked on to do further maintenance or construction work then the insulation will be replaced by contractor, up to and through the completion of the punch list.
   2. If equipment that is insulated may need to be walked on for the long-term maintenance of the building, proper shields will be provided at traffic ways that cross the piping.

3.05 PROTECTION AND REPLACEMENT:
   
   A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

   B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

   END OF SECTION 22.07.19
SECTION 22.08.00
COMMISSIONING OF PLUMBING SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   B. Section 01.91.13 – General Commissioning Requirements
   C. Section 23.08.00 – Commissioning of HVAC
   D. Section 26.08.00 – Commissioning of Electrical Systems
   E. Commissioning Plan, dated 12/01/17

1.02 COMMISSIONED SYSTEMS
   A. Commissioning is an ongoing process and shall be performed throughout construction. Commissioning verifies that systems are operating in a manner consistent with the Contract Documents.
   B. Following is a detailed list of equipment included in each commissioning activity:
      1. Domestic Hot Water Heaters
      2. Mixing Valves
      3. Hot Water Circulating Pumps
      4. Sump Pumps

1.03 RESPONSIBILITIES
   A. The Contractor shall be responsible for scheduling, supervising and performing start-up, testing and commissioning activities specified in this section and necessary to demonstrate to the Owner successful operation of the commissioned systems.

PART 2 PRODUCTS

2.01 MEANS OF ACCESS
   A. The Contractor shall provide means for the CxA to access, observe and visually confirm proper operation of all equipment and systems. These means shall be in compliance with all OSHA and job-site safety regulations.

2.02 TEST EQUIPMENT
   A. The Contractor shall provide the necessary equipment to fully test the commissioned systems as defined in the functional performance test procedures to be provided by the CxA.

PART 3 EXECUTION

3.01 EQUIPMENT CHECKLISTS
   A. Equipment checklists, provided by the CxA, shall be completed by the Contractor on CxA-900. The following checklists shall be provided: {Review the following add/delete/modify as appropriate to the project scope}
      1. Equipment Receipt Inspection Checklist
      2. Equipment Pre-Functional Checklist
3.02 FUNCTIONAL PERFORMANCE TESTS

A. The Contractor shall provide all documentation as requested to the CxA for development of functional performance testing procedures. This documentation shall include, at a minimum, manufacturer installation, start-up, operation and maintenance procedures. The CxA may request further documentation as necessary for the development of functional performance tests.

B. The Contractor shall review the functional performance test procedures developed by the CxA.
   1. The Contractor shall respond in writing to the CxA regarding the acceptability of the proposed test procedures.
   2. The Contractor shall note any necessary modifications to the procedures due to the actual equipment/systems or safety concerns and shall submit these to the CxA for consideration.

C. The Contractor shall place equipment and systems into operation and continue the operation as required during each working day of the testing activities.

D. The Contractor shall accomplish the functional performance testing of equipment based on procedures developed by the CxA and as reviewed by the Contractor.
   1. The Contractor shall provide skilled technicians to operate the systems during functional performance testing. At a minimum, the contractor should provide one trade technician familiar with the system being tested and one controls technician to operate the system through the BAS.
   2. The Contractor shall correct any deficiencies identified during testing and retest equipment as required.

E. Functional performance testing is intended to begin upon completion of a system. Functional performance testing may proceed prior to the completion of the system at the discretion of the CxA and the Contractor.

F. Functional testing shall verify all sequences of operation defined in the Contract Documents for the commissioned equipment and systems.
   1. Testing shall occur by overriding setpoints or sensor readings at the BAS or by other means mutually agreed to by the Contractor, the CxA, and the Owner to initiate sequences of operation and verifying the response of the system.
   2. Sequences of operation shall be verified under normal power, emergency power, and fire alarm scenarios.

G. Upon successful completion of all functional performance tests, the Contractor(s) shall perform Integrated Systems Testing. The testing shall document and verify the proper response of all Division 22 systems to all potential utility and emergency power operating and failure scenarios.

END OF SECTION 22.08.00
SECTION 22.10.05
PLUMBING PIPING & VALVES

PART 1 - GENERAL

1.01 REFERENCES
A. Submit pipes, valves and fittings and have approval prior to starting construction. Pipe, valves and fittings shall be new and clearly marked with manufacturer's name, classification and working pressure.

PART 2 - PRODUCTS

2.01 SANITARY SEWER PIPING, BURIED
A. PVC Pipe: ASTM D 2665 or ASTM D 3034.
   1. Fittings: PVC.

2.02 SANITARY SEWER AND CONDENSATE PIPING, ABOVE GRADE
A. Sanitary Sewer - Cast Iron Pipe: CISPI 301, hubless service weight.
   1. Fittings: DWV Cast Iron.
B. Condensate Piping - Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

2.03 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING
A. Copper Pipe: ASTM B 42, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

2.04 WATER PIPING, ABOVE GRADE
A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

2.05 FLANGES, UNIONS, AND COUPLINGS
A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
B. Flanges for Pipe Size Over 1 Inch:
   1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.06 PIPE HANGERS AND SUPPORTS
A. Plumbing Piping - Drain, Waste, and Vent:
   2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

B. Plumbing Piping - Water:
2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
5. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
7. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.07 BALL VALVES
A. Construction, under 2 Inches: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, stainless steel brass ball, full port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, threaded ends with union. Nibco TS 585 or approved equal.

2.08 AIR VENTING
A. Provide manually operated air vents at high points in vertical risers to eliminate air from systems.
B. Use ball valves for manual air vents.

2.09 ESCUTCHEONS
A. Provide chrome plated escutcheons where insulated pipes penetrate walls or ceilings of finished spaces.

2.10 NATURAL GAS AND COMPRESSED AIR PIPING, ABOVE GRADE
A. Steel Pipe: ASTM A 53/A 53M Schedule 40 black.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION
A. Ream pipe and tube ends. Remove burrs.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION
A. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise. Install piping free of sags and bends. Group piping whenever practical at common elevations.
B. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

C. Do not use bullhead tees.

D. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

E. Install fittings for changes in direction and branch connections.

F. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

G. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

J. Provide access where valves and fittings are not exposed. Install piping to permit servicing.

K. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

N. Install bell and spigot pipe with bell end upstream.

O. Install valves with stems upright or horizontal, not inverted.

P. Install water piping to ASME B31.9.

Q. Install natural gas and compressed air piping in accordance with the IFG Code. Provide isolation and drip legs on equipment connections in accordance with IFG Code.

3.04 SLEEVES AND INSERT

A. Sleeve pipes passing through partitions, walls and floors.

B. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

3.05 PIPE HANGERS AND SUPPORTS:

A. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   8. Provide copper plated hangers and supports for copper piping.
   9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe
shafts, and suspended ceiling spaces are not considered exposed.

10. Provide hangers adjacent to motor driven equipment with vibration isolation.

3.06 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.
B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.07 ERECTION TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope.
B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.08 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system.
B. Prior to starting work, verify system is complete, flushed and clean.
C. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
F. Maintain disinfectant in system for 24 hours.
G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
I. Take samples no sooner than 24 hours after flushing, from 5 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.09 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe size: 1/2 inches to 1-1/4 inches:
         1) Maximum hanger spacing: 6.5 ft.
         2) Hanger rod diameter: 3/8 inches.
      b. Pipe size: 1-1/2 inches to 2 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 3/8 inch.
      c. Pipe size: 2-1/2 inches to 3 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 1/2 inch.
      d. Pipe size: 3 inches to 4 inches:
         1) Maximum hanger spacing: 12 ft.
         2) Hanger rod diameter: 1/2 inch.
PART 1 - GENERAL (NOT USED)

PART 2 - PRODUCTS

2.01 BACKFLOW PREVENTERS
   A. Reduced Pressure Backflow Preventers:
      1. Provide Wilkins Series 975 (3/4" - 2") Series 375 (2-1/2" - 4") or Watts Series 909 (3/4" - 4").
      Provide Wilkins 375-FS for 6" and greater service. ASSE 1013; bronze body with bronze internal parts
      and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type
      differential pressure relief valve located between check valves; third check valve that opens under
      back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves,
      strainer, and four test cocks. Design such that total pressure drop through complete backflow preventer
      does not exceed 12 psi at rated flow.

2.2 WATER HAMMER ARRESTORS
   A. Water Hammer Arrestors:
      1. Copper construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for
         operation in temperature range 34 to 250 degrees F (1 to 120 degrees C) and maximum 150 psi
         (1000 kPa) working pressure.

2.3 MIXING VALVES
   A. Thermostatic Mixing Valves:
      1. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature
         adjustment.
      2. Accessories:
         a. Check valve on inlets.
         b. Volume control shut-off valve on outlet.
         c. Stem thermometer on outlet.
         d. Strainer stop checks on inlets.
      3. Cabinet: 16 gage enameled steel, for surface mounting with keyed lock.

2.4 BALANCING VALVES
   A. Memory-Stop Balancing Valves
      2. Pressure Rating: 400-psig minimum CWP.
      3. Size: NPS 2 or smaller.
      4. Body: Copper alloy.
      5. Port: Standard or full port.
      7. Seats and Seals: Replaceable.
      8. End Connections: Solder joint or threaded.

2.5 WALL HYDRANTS
   A. Nonfreeze Wall Hydrants
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Chrome plated.
11. Operating Key(s): One with each wall hydrant.

### 2.6 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device
   4. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
   5. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
   6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

### 2.7 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves
   2. Pressure Rating: 400-psig minimum CWP.
   4. Body: Copper alloy.
   5. Ball: Chrome-plated brass.
   8. Inlet: Threaded or solder joint.

### 2.8 CLEANOUTS

A. Cleanouts at Exterior Surfaced Areas
   1. Round cast nickel bronze access frame and non-skid cover.

B. Cleanouts at Exterior Unsurfaced Areas
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

C. Cleanouts at Interior Finished Floor Areas
   1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

D. Cleanouts at Interior Finished Wall Areas
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

E. Cleanouts at Interior Unfinished Accessible Areas Caulked or threaded type.
   1. Provide bolted stack cleanouts on vertical rainwater leaders.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.

F. Pipe relief through fixed airgap and discharge to sewer.

G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water risers and supply piping to lavatories.

H. Install supply type, trap-seal primer valves with outlet piping pitches down toward drain trap at a minimum of 1 percent, and connect to floor drain body, trap or inlet fitting. Adjust valve for proper flow.

END OF SECTION 22.10.06
SECTION 22.11.23
DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.01 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.01 HOT WATER RECIRCULATING PUMP
A. Acceptable manufacturers: Taco, Aurora, or Bell and Gossett.
   1. Model number, capacity, accessories, and electrical characteristics as scheduled on drawings.
B. Provide in-the-line pump, all bronze construction, flange connections, hardened steel shafts, bronze sheathed, diamond bared, sleeve bearings, bronze impellers, and mechanical seals.
C. Provide flexible coupled motor, supported from pump casing and manual motor starter complete with thermal overload protection.
D. Provide operating and maintenance instructions.

PART 3 - EXECUTION

3.01 PUMP INSTALLATION
A. Verify location and clearance requirements.
B. Install in accordance with manufacturer's recommendations.
C. Hot water recirculating pumps
   1. Provide factory representative or manufacturer's service representative to verify proper installation, operation and performance as specified.
D. Install piping adjacent to pump to allow service and maintenance.
E. Install shut off valve on suction side of pump.

END OF SECTION 22.11.23
SECTION 22.33.00
WATER HEATERS - ELECTRIC

PART 1 - GENERAL

1.01 DESCRIPTION
A. Provide a factory packaged, electric storage type domestic water heater.

PART 2 - PRODUCTS

2.01 ELECTRIC, DOMESTIC-WATER HEATER
A. Electric, Storage, Domestic-Water Heater:
2. Storage-Tank Construction: Steel.
   b. Pressure Rating: 150 psig (1035 kPa).
   c. Interior Finish: Comply with NSF 61 Annex barrier materials for potable-water tank linings, including extending lining material into tappings.
3. Factory-Installed Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
   c. Drain Valve: ASSE 1005.
   d. Insulation: Comply with ASHRAE 90.2.
   e. Jacket: Steel, cylindrical, with enameled finish.
   f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
   g. Heating Elements: Two; electric, screw-in immersion type; wired for nonsimultaneous operation unless otherwise indicated. Limited to 12 kW total.
   h. Temperature Control: Adjustable thermostat.
   i. Safety Control: High-temperature-limit cutoff device or system.
   j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

2.02 DOMESTIC-WATER HEATER ACCESSORIES
A. Domestic-Water Compression Tank:
   1. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
   2. Construction:
      a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
      b. Interior Finish: Comply with NSF 61 Annex barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
      c. Air-Charging Valve: Factory installed.
B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
C. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
E. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

PART 3 - EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION
A. Domestic-Water Heater Mounting: Install electric, domestic-water heater on floor.
B. Install electric, domestic-water heater level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
   1. Install shutoff valves on domestic-water-supply piping to domestic-water heater and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 221005 "Plumbing Piping & Valves," for ball valves.
C. Install combination temperature-and-pressure relief valve in top portion of storage tank. Use relief valve with sensing element that extends into tank. Extend water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
D. Install water-heater drain piping as indirect waste to spill by positive air gap into open floor drain. Install hose-end drain valves at low points in water piping for electric, domestic-water heater that do not have tank drains.
E. Install thermometer on outlet piping of electric domestic-water heater.
F. Charge domestic-water compression tank with air.

3.02 CONNECTIONS
A. Comply with requirements for piping specified in Section 221005 "Plumbing Piping & Valves." Drawings indicate general arrangement of piping, fittings, and specialties.
B. Where installing piping adjacent to electric, domestic-water heater, allow space for service and maintenance of water heater. Arrange piping for easy removal of domestic-water heater.

END OF SECTION 22.33.00
SECTION 22.34.05
WATER HEATER, GAS FIRED

PART 1 - GENERAL

1.01 DESCRIPTION
A. Provide a factory packaged, natural gas fired, storage type domestic water heater.

PART 2 - PRODUCTS

2.01 EQUIPMENT
A. Unit manufactured by Hesco, Ruud, or A. O. Smith. Model number, capacity, accessories scheduled on drawings.
B. Storage tank to be carbon steel, epoxy glass lined, ASME Code stamped for 150 psi working pressure.
C. Burners to be stainless steel and 100% safety shutoff controls.
D. ASME temperature and pressure relief valve.
E. Fiberglass insulation with steel jacket.
F. Operating Instructions

PART 3 - EXECUTION

3.01 INSTALLATION
A. Verify location and clearance requirements.
B. Installation in accordance with manufacturers’ installation instructions.

END OF SECTION 22.34.05
BLANK PAGE
SECTION 23.05.00
GENERAL PROVISION FOR HVAC

PART 1 - GENERAL

1.01 QUALITY ASSURANCE
A. Conform to the following:
   2. International Mechanical Code - 2012

1.02 STANDARDS
A. Comply with all pertinent standards.
   1. AMCA: Air Moving and Conditioning Association
   3. ASHRAE: American Society of Heating Refrigeration and Air Conditioning Engineers.
   4. ASME: American Society for Mechanical Engineers.
   5. NEMA: National Electrical Manufacturer's Association.
   7. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.
   8. UL: Underwriters' Laboratories, Inc.

1.03 SUBMITTALS
A. Submit under provisions of Division 01.
   1. Submit complete descriptions, specification data for material and equipment proposed. Clearly indicate proposed items when other items are shown on same sheet.
   2. Submittals in 3-ring binders shall include an index of contents and divider tabs.
   3. Shop Drawings:
      a. Control System
      b. Air Handling Equipment
      c. Air Terminal Units
      d. Fan Coil Units
      e. Air Distribution, Ductwork, Grilles, Registers
      f. Insulation
      g. Filters
      h. Vibration Isolation
      i. Boilers
      j. Chillers
      k. Pumps and Hydronic Specialties
      l. Sound attenuators
      m. Steam/Hot Water Heat Exchanger
      n. VFD's
      o. Motors
      p. Fans
      q. Fire Dampers
      r. Valves, Traps and Strainers
      s. Water Treatment System
1.04 ADHESIVES AND SEALANTS
A. Adhesives, sealants, and sealant primers used inside the building (defined as inside the weatherproofing envelope and applied on site) shall comply with SCAQMD Rule 1168-2005 for volatile organic compound content limits.
B. Aerosol adhesives shall comply with GS 36-2011 for volatile organic compound content limits.

1.05 REGULATORY REQUIREMENTS
A. Perform Work specified in Division 23 in accordance with standards listed below of the latest applicable edition adopted by the authority having jurisdiction. Where these Specifications are more stringent, they shall take precedence. In case of conflict, obtain a decision from the Architect.
   3. ANSI Handicapped Code-A117.1
   4. IBC: International Building Code, with Mechanical and Plumbing Codes.
   5. Special regulations, supplement, and amendments of the State and/or local authorities having jurisdiction.
B. Comply with the applicable edition date of each regulation as adopted by the authorities having jurisdiction.

1.06 CONTINUITY OF EXISTING SERVICE AND SYSTEMS
A. Schedule work so existing systems will not be interrupted when they are required for normal usage of the existing building. Obtain approval from the Owner and Architect at least 7 days prior to any utility interruption or connection.
B. Perform work at such time and in such manner as to cause minimum inconvenience to the Owner and as approved by the Architect. No allowance will be made for lack of knowledge of existing conditions.

1.07 PROJECT/SITE CONDITIONS
A. Layouts indicated on drawings are diagrammatical and intended to show relative positions and arrangement of equipment, ductwork and piping. Coordinate mechanical work with other trades and measurements obtained at the job site, as applicable, prior to installation. Generally, install work in locations shown on Drawings, using as necessary, rises, drops, offsets, transitions, and alternate routings to fit in the available space unless prevented by Project conditions.

1.08 COMPLETENESS OF WORK
A. The Contract Documents depict HVAC systems which are intended to be complete and functioning systems. All products, materials, and labor necessary to render a fully functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.
B. Catalog numbers referenced throughout the Division 23 Drawings and Specifications are intended to convey a general understanding of the type and quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra shall be allowed because a catalog number is found to be incomplete or obsolete.

1.09 RECORD DRAWINGS
A. Provide record drawings that illustrate the work of Division 23 as finally constructed. Provide dimensions of material installed below slab/grade from fixed and visible reference points. Deliver record drawings to the architect in a form suitable for production.
B. Record drawings shall reflect all changes made to the Contract Documents, whether generated by addenda, change orders, or field conditions. Maintain a daily record of these changes and keep current set of drawings showing these changes.

C. Deliver record drawings to Architect within 30 days of Substantial Completion.

1.10 OWNER AND OPERATING MANUALS

A. Comply with the requirements of Division 01, but provide a minimum of three sets, in three ring binders, all sets identical.

B. Manuals shall include clear and comprehensive operating instructions with appropriate graphics and project specific marked data to enable owner to operate and maintain all systems specified in this Division.

C. Copies of approved submittals on furnished equipment shall be included.

PART 2 - PRODUCTS

2.01 HANGERS AND SUPPORTS

A. Hangers:
   1. General: Complete with rods and supports proportioned to the size of piping or equipment to be supported.
   2. For steel pipe: Steel or malleable iron, unless specified otherwise herein.
   3. For heating water, 3” and larger: Anvil 171, B-Line B3114, or ERICO 605 roll type with Anvil 160, B-Line B3160, or ERICO 630 pipe covering protection saddles.
   4. For copper piping: copper-plates; Anvil CT-69, B-Line B3170 CT, or ERICO 101.
   5. For chilled water: galvanized, Anvil 260, B-Line B3100, or ERICO 401.

B. Hanger Rods:
   1. One-piece steel type, threaded as required.
   2. Sizes, unless specified otherwise herein, shall be as follows:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Rod Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>2” and smaller</td>
<td>0.375”</td>
</tr>
<tr>
<td>2.5” and 3”</td>
<td>0.5”</td>
</tr>
<tr>
<td>4”</td>
<td>0.625”</td>
</tr>
<tr>
<td>6”</td>
<td>0.75”</td>
</tr>
<tr>
<td>10”-12”</td>
<td>0.875”</td>
</tr>
<tr>
<td>14”-18”</td>
<td>1.0”</td>
</tr>
</tbody>
</table>

   3. Sizes for gang or multiple hangers: Calculated for the combined weight of the piping and accessories.
   4. Sizes for equipment hangers: Calculated for the weight of the equipment supported.

C. Inserts:
   1. Adjustable type: Anvil 282, B-Line B3014, or ERICO 355.
   2. Continuous type: Anvil PS-5000, B-Line B321, or ERICO CON.

D. Expansion Anchors:
   1. In concrete: Wedge, self-drilling, or drilled flush type.
   2. In masonry: Sleeve type.

D. Expansion Anchors:
   1. In concrete: Wedge, self-drilling, or drilled flush type.
   2. In masonry: Sleeve type.
   3. Manufacturer: Hilti, ITW Ramset/Red Head, or Rawl.

E. Insulation Protectors: Anvil 167, B-Line B3151, or ERICO 125.
F. Channel strut systems: 14 gauge minimum galvanized steel, with factory-punched attachment holes. Straps shall be designed so that the attachment nut is captive on the shoulder of the strap when tightened. Attachment nuts shall be designed to provide a surface on the turned down edge while making positive contact with the side walls of the channel. Nuts, bolts, straps, and accessories shall be protected with same finish as channels.
   1. Manufacturer: B-Line, Kindorf, Midland-Ross, or Unistrut.

G. Pipe Stand Supports:
   1. For chilled water piping: adjustable pipe saddles, stanchion type with locknut nipple, reducer, flange and baseplate. Provide U-bolt yoke for pipe 12” and smaller.
      a. Manufacturer: Anvil 264, B-Line B3093, or ERICO 723.
   2. For heating water: Adjustable pipe roll stands with baseplate.

2.02 EQUIPMENT SUPPORTS
   A. Structural steel for supports: ASTM A36.
      1. Use galvanized members installed in fan plenums or areas of high humidity or condensation, and outside.
      2. Furnish other members with shop coat of red primer.
      3. Retouch primer after field welding.

2.03 FLASHINGS AND COUNTERFLASHINGS
   A. Furnish materials and coordinate installation for flashing and counterflashing roof penetrations for vents, pipe, drains, and ducts.

PART 3 EXECUTION

3.01 EXCAVATING AND BACKFILLING
   A. Provide trenching, excavating, and backfilling necessary for performance of mechanical work in accordance with Division 02.

3.02 CUTTING AND PATCHING
   A. Repair or replace damage caused by cutting or installation of work specified in Division 23.
   B. Perform repairs with materials which match existing and install in accordance with the appropriate section of these specifications.

3.03 FLASHING AND COUNTERFLASHING
   A. Counterflash ducts and pipes where penetration of roofs and outside walls occur.

3.04 DELIVERY, STORAGE, AND PROTECTION
   A. Insofar as possible, deliver items in manufacturer's original unopened packaging. Where deliver in original packaging is not practical, provide cover and shielding for all items with protective materials to keep them from being damaged. Use care in loading, transporting, unloading, and storing to keep items from being damaged.
   B. Store items in a clean, dry place, and protect from damage. Mechanical equipment may not be staged or stored outdoors unless intended for outdoor use.
   C. Protect nameplates on motors, pumps, and similar equipment. Do not paint or insulate over nameplate data.
   D. Protect valves and piping from damage. Cover equipment during work of finishing trades.
E. Keep dirt and debris out of pipes and ducts.
F. Repair, restore, and replace damaged items.
G. Cover factory finished equipment during work of finished trades, such as fan coils, fin tubes, etc.
H. Protect cooling and/or heating coils with temporary filter media during construction.

3.05 OPERATION OF HVAC SYSTEMS DURING CONSTRUCTION
A. Install specified filters prior to system operation. In addition to specified filters, install a roughing filter upstream of mixed air filter. Roughing filter shall consist of two layers of roll filter media clipped and sealed to entering side of filter frame (MERV 8 minimum). Change roughing filter as necessary to minimize dust collection on specified filters.
B. Cover and return and exhaust air grilles with temporary filter media (MERV 8 minimum). Attach media to avoid damage to grille or ceiling. Change temporary media as required to protect against dust buildup on ductwork. Remove temporary media from grilles after flooring is installed, walls are sanded and painted and other dust generating construction has been completed.
C. During period of excessive dust generation such as drywall sanding, seal off return and exhaust openings and grilles to prevent dust from accumulating in ductwork.
D. Furnish and install a new set of specified filter media prior to start of system test and balance. Furnish a new, clean set of the specified media and turn over to Owner's Representative.

3.06 EQUIPMENT GUARDS
A. Use suitable structural frames with minimum 12 gauge, 3/4” galvanized mesh, or expanded metal mesh. Attach to equipment by removable clips and bolts with wing nuts, or other approved connectors.
B. At belts, provide opening for measuring RPMs.
C. Provide at all belts, couplings, moving machinery and equipment.
D. Design for easy access to belts and other items required replacement.
E. Comply with OSHA regulations.

3.07 CLEANING HVAC SYSTEMS
A. General Cleanup:
   1. Upon completion of contract and progressively as work proceeds, clean up dirt, debris, oil materials, etc., and remove from site, keeping premises in neat and clean condition to satisfaction of the Architect.
   2. Seepage, discoloration or other damage to parts of the building, its finish, or furnishings due to Contractor's failure to properly clean piping systems or duct systems shall be repaired without cost to the Owner.
B. Factory Finishes:
   1. Clean items with factory finishes. Touch up bare places, scratches and other minor damage to finishes. Use only factory supplied paint of matching color and formula. If finishes are badly damaged or if there are many damaged, scratched or bare places, refinish the entire item.
C. Ducts and Apparatus:
   1. Thoroughly clean ducts and apparatus casings before fans and filters are operated.

3.08 Cleaning
A. Thoroughly clean ductwork and equipment casings before fans and filters are operated.
B. Repair damaged factory finishes covering all bare places and scratches.
C. Cleaning HVAC Systems Water Piping:
   1. Clean all equipment and piping of iron cuttings and other foreign matter as they are installed.
   2. Thoroughly flush HVAC water systems with precleaning chemicals designed to remove depositions such as pipe dope, oils, rust, mill scale, and other extraneous materials. Provide dosages of precleaner chemicals recommended by water treatment supplier and add and circulate throughout the water systems. Drain, refill, and flush water systems thoroughly until no foreign matter is observed and total alkalinity of the drain water is equal to that of the make-up water.
   3. Do not install devices in which foreign matter could become lodged such as control valves, until cleaning and flushing are completed. Position valves to bypass chiller and boiler. Connect supply and return runouts together at each coil location. Make connection of supply and return runouts with short lengths of high pressure rubber hose and brass fittings. One fitting shall be swivel type to eliminate turning fitting in hose.
   4. Fill system at city water make-up connection with all air vents open. After filling, close vents.
   5. Start main pump with pressure reducing valve makeup open. Check vents in sequence to bleed off any trapped air in order to assure circulation through all components of system. Verify pumps are properly aligned and bolted down before start-up to prevent damage to seals or couplings. Circulate water for at least two hours and then drain completely to flush out foreign matter.
   6. Remove, clean, and replace all strainer baskets. Clean all dirt legs. If indications are found of excessive dirt, repeat the above flushing.
   7. Fill the system with fresh water, adding precleaning chemicals designed to remove depositions such as pipe dope, oils, rust, mill scale, and other extraneous materials. Provide dosages of precleaner chemicals recommended by water treatment supplier. Alternate operation of primary and standby pumps, and circulate the cleaning solution for 24 hours. Then turn off the pump and completely drain the system.
   8. Remove, clean, and replace all strainer baskets. Clean all dirt legs. Replace suction diffuser start-up strainer with conventional strainer. Refill the system with clean water, venting all high points and equipment of air and gases. Bring water systems to operating temperature. Recheck all vent points during this process and remove all air.
   9. After the system has been completely cleaned, test system by litmus paper or other dependable method and leave system on slightly alkaline side (ph 7.5 to 8.5). If system is still on acid side (ph 7.0 or lower), add water conditioner.

3.09 TESTING MECHANICAL SYSTEMS
   A. Test all systems and equipment installed to demonstrate proper operation.
   B. Advise Architect of scheduled systems testing and completed system demonstration/operation schedules so that he may witness, if desired.
   C. Correct and retest work found defective when tested.
   D. Make repairs to piping systems with new materials. Peening, doping, or caulking of joints or holes will not be acceptable.
   E. HVAC Circulating Water Piping: Hydrostatically test piping at 150 psig pressure or at 1-1/2 times design pressure as indicated on drawings, whichever is greater, for a period of six hours without evidence of leaking.
   F. Records of Testing: Maintain records of system testing and results thereof. Deliver results as part of project closing file and on an intermediate basis as requested by Architect.

END OF SECTION 23.05.00
PART 1 - GENERAL

1.01 GENERAL

A. Provide all labor, materials, tools, and services required; maintain warranties and keep equipment in operating condition.

B. Principal equipment included are:
   1. Chillers
   2. Boilers
   3. Pumps
   4. Air Handling Units
   5. Fan Coil Units
   6. Variable Air Volume Boxes
   7. Variable Frequency Drives (VFD)
   8. Water treatment system
   9. Fans
   10. Air Distribution Devices
   11. Control System

C. No mechanical equipment shall be operated until the equipment has been started, approved and signed off by the equipment's respective supplier.

D. Air handlers shall be operated only in areas where painting and ceiling work is in progress. Air handlers shall not be operated when concrete grinding or drywall finishing is in progress.

E. When an air handler is placed in service, pre-filters shall be changed on a weekly basis. The Contractor shall maintain logs showing when filters are changed.

F. Air handlers shall not be operated over 30 Hz until factory start up is complete and copies of the start up report are provided to the Designer for approval.

G. The chillers shall not be operated until factory start up is complete and copies of the start up report are provided to the Designer for approval.

H. After start up of the chillers, the contractor shall visit the site at least three times a day to inspect and fill out Owner's equipment logs.

I. The chillers shall not be operated until the water treatment systems are fully functional.

J. The boilers and hot water system shall not be operated until the water treatment system is fully functional.

K. If air handling units are used during construction, filtration media with a minimum efficiency of MERV8 shall be used at each return grille.

L. Protect all HVAC equipment from both dust and odors.

M. Seal all duct and equipment openings with plastic. Protect the return/negative pressure side of all systems. Install and maintain (replace weekly) temporary filters over grilles and openings. The temporary filters shall have a rating of MERV8 or better.

1.02 CLEANING

A. Thoroughly clean ductwork, equipment casings, coils and VAV boxes and replace filters before turning equipment over to the Owner. Units having visible signs of construction dust will not be accepted.

B. Repair damaged factory finishes covering all bare places and scratches.

C. Thoroughly clean chilled water and hot water systems before system is turned over to the Owner.
PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION - NOT APPLICABLE

END OF SECTION 23.05.05
SECTION 23.05.13
MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SUBMITTALS
A. Submit motor information with submittals and shop drawings.

1.02 REFERENCE STANDARDS
A. All equipment and material furnished and installed on this project shall be UL or ETL listed in accordance with the requirements of the authorities having jurisdiction and suitable for its intended use on this project.

PART 2 - PRODUCTS

2.01 MOTORS
A. Acceptable manufacturers: MagneTek or Lincoln.
B. In general, motor voltages shall be as follows, unless specified or indicated otherwise:
   1. 3/4 hp and larger: 208V or 460V, three (3) phase, 60 hertz (reference drawings)
   2. Smaller than 3/4 hp: 120V, one (1) phase, 60 hertz
C. All motors shall be started across the line, unless specified otherwise. Motors shall be selected with low starting current and shall be designed for continuous duty to provide the running torque and pull in torque required to suit the load. Unless otherwise indicated on the Contract Documents, all motors shall be single speed (1750 rpm). All motors shall have standard open drip proof enclosures unless otherwise specified. All motors exposed to the actually installed outside in the weather shall be of the totally enclosed fan cooled (TEFC) or totally enclosed air over (TEAO) types. All motors not utilized with variable speed drives shall have a minimum service factor of 1.15 and shall be selected to operate at design conditions without exceeding their nameplate rating (without exploiting the service factor rating). Motors used in conjunction with variable speed drives shall have a 1.00 service factor unless otherwise indicated and be compatible with the drive and rated for inverter output duty.
   1. Standard open drip proof three (3) phase motors ten (10) horsepower and smaller shall have cast aluminum end bells with steel frames. Three (3) phase motors fifteen (!5) horsepower and larger shall have cast iron end bells and housings.
   2. Standard open drip proof single phase motors shall have cast aluminum end bells with steel frames.
   3. Totally enclosed fan cooled (TEFC) and totally enclosed air over (TEAO) three (3) phase motors shall have cast iron housings. TEFC motors shall have corrosion resistant fans.
D. Windings and Insulation:
   1. All motors shall have copper windings.
   2. Motors shall be equipped with Class B, 80°C rise or Class F, 105°C rise insulation suitable for use in a 40°C ambient temperature. Windings shall be treated with an epoxy varnish to inhibit the absorption of moisture.
E. Bearings:
   1. Single phase, fractional horsepower motors shall be equipped with quiet operating, all angle, babbit lined sleeve bearings.
   2. Polyphase motors shall be equipped with deep groove type ball bearings, generously sized for the loads to which applied and for severe duty application. Provide the necessary seals on the shaft to keep the bearing system free of contamination and moisture. Lubricant shall be high temperature, nonbleeding grease.
a. Provide inlet and outlet plugs on poly-phase motors so that grease fittings can be easily inserted for bearing relubrication except as otherwise specified. The end shields shall be carefully machined to add extra grease capacity. Lower outlet plugs shall be equipped with combination breather/drains on TEFC and TEAO motors.

F. Motors shall be specifically designed for quiet operation and for severe duty. Standard open drip proof motors shall be equipped with aluminum or stainless steel stamped nameplates. Totally enclosed fan cooled and air over motors shall be equipped with stainless steel stamped nameplates with either zinc or cadmium plated hardware. Motor nameplates shall clearly indicate frame size, horsepower, frequency, voltage, speed, starting torque class, insulation class, service factor and winding material.

G. Motors on belt driver equipment shall have slide rails with adjusting screws for belt tension adjustment. Motors exposed to the weather shall be weather protected.

H. Motors specified with variable frequency drive controllers shall be inverter duty rated and shall be insulated against eddy currents.

I. Install premium efficiency electric motors for motors 1 horsepower and above. Premium efficiency motors shall have efficiency and losses determined in accordance with the latest revisions of IEEE Standard 112. Polyphase squirrel-cage motors rated 1 through 125 horsepower shall be tested by dynamometer method B. The efficiency will be determined using segregated losses in which stray load loss is obtained from a linear regression analysis to reduce the effect of random errors in the test measurements. Guaranteed minimum load efficiency shall be as follows:

1. HP: 3/4 Eff: 80%
2. HP: 1 Eff: 84%
3. HP: 1-1/2 Eff: 86.5%
4. HP: 2 Eff: 86.5%
5. HP: 3 Eff: 89.5%
6. HP: 5 Eff: 89.5%
7. HP: 7-1/2 Eff: 91.7%
8. HP: 10 Eff: 91.7%
9. HP: 15 Eff: 93.0%
10. HP: 20 Eff: 93.6%
11. HP: 25 Eff: 93.6%
12. HP: 30 Eff: 94.1%
13. HP: 40 Eff: 94.5%
14. HP: 50 Eff: 95.0%
15. HP: 60 Eff: 95.4%
16. HP: 75 Eff: 95.4%

J. Sound power levels not greater than recommended in NEMA M61-12.49. VFD duty rated motors shall not increase by more than 3 dB when operating on VFD.

K. Provide motors with drive shafts long enough to extend completely through belt sheaves when sheaves are properly aligned or balanced.

2.02 STARTERS

A. Starters shall be as manufactured by Square D or approved substitute.

B. Starters used on 208-volt systems shall have two cartridge fuses in the control circuit.

C. Starters used on 480-volt systems shall have an individual 480/120-volt control transformer with two cartridge fuses in the primary and one in the secondary.

D. All starters to be provided with melting alloy overloads.

E. Starters used inside shall have NEMA 1 enclosures; starters used in damp locations or exposed to the weather to have NEMA 3R enclosures.

F. Manual Motor Starter with Heater Unit: Square D Class 2510.
G. Provide starters with disconnect switch.
H. Starters mounted in motor control center are specified under Division 26.
I. Single speed motors 25 horsepower and larger to have power factor correction capacitors.

PART 3 - EXECUTION

3.01 INSTALLATION
A. Arrange and set motors.
B. Line up motors on direct drive equipment using dial type gauges.
C. Make connections and test motor for proper rotation/phasing under Division 26.

3.02 ADJUSTMENTS
A. Motors, together with driven equipment, shall be dynamically and statically balanced. Imbalance shall be reduced to minimum specified by equipment manufacturers.
B. Fan vibration should be limited to manufacturer's recommendations, but should not exceed 2 mils in any case.

END OF SECTION 23.05.13
SECTION 23.05.14
VARIABLE FREQUENCY MOTOR DRIVES

PART 1 - GENERAL

1.01 GENERAL
A. Furnish complete variable frequency motor controllers (VSMC) for fans and pumps designated.

1.02 WARRANTY
A. The VSMC shall be warranted by the manufacturer for a period of 36 months from date of start-up. The warranty shall include parts and labor.
B. During warranty period, any warranty expense shall be born by the manufacturer, including travel costs or living expenses necessary to repair in warranty equipment.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. ABB or approved equal.

2.02 DRIVE TECHNOLOGY
A. Solid state design to transform input power into frequency and voltage controlled 3-phase output power suitable to provide positive speed and torque control to standard induction motors.
B. Front end: Input line filters as integral part of drive.
C. Invertor section: Transistorized sinecode pulse width modulation. Employ power transistors in the invertor without paralleling.
D. Power factor: Minimum of .95 and an efficiency of 95% at 100% full output.
E. Increase in audible motor noise with drive operating shall not exceed 3 decibels.

2.03 EQUIPMENT REQUIREMENTS
A. Enclosure: NEMA 1 enclosure with deadsides for installation in an individual wall installation.
B. Input disconnect: Integral, magnetic trip only circuit breaker or non-fused switch.
C. Ratings:
   1. Provide symmetrical A/C rating of 100,000 amps for fused input drives.
   2. Provide symmetrical A/C ratings of 50,000 amps for other than fused input drives at 460 volts and 35,000 amps for other than fused inputs at lower voltages.
   3. Provide higher ratings where available fault current exceeds these levels and as called for on drawings.
D. Provide an integral bypass contactor for operation of motor at constant speed, electrically independent of the inverter. Include motor overload protection when in bypass mode. Include necessary control relays and switches to allow automatic controls and safeties to operate when drive is in bypass mode.
E. Features and Specifications:
   1. Horsepower Rating: As scheduled on drawings.
   2. Input power: 460 VAC +/- 10%, 60 HZ +/- 3%.
   3. Output power: 0-460 volts, 1-60 HZ.
   4. Ambient temperatures:
      a. Drive operating: 32 degrees F. to 104 degrees F.
      b. Drive storage: 68 degrees F. to 140 degrees F.
5. Output Frequency Stability: Shall not vary with load, temperature or with +/- 10% input frequency variations.
6. The VSMC shall include a plug-in test meter for monitoring the different signals within the VSMC for start up and troubleshooting.

F. Speed Control:
   1. The output frequency may be adjusted in proportion to any one of the following:
      a. 0-10 VDC Analog Signal.
      b. 0-5 VDC Analog Signal.
      c. 4-20 MA DC Analog Signal.

G. Start-Stop Control: Drive may be started or stopped by any one of the following:
   1. A contact closure.
   2. Use of a motor starter or contactor in the input power line.
   3. The speed control signal dropping below or rising above minimum.
   4. An external 115 VAC signal.

H. Customer Contacts: Single pole, double throw contact which changes state on trip condition.
I. 115 Volt AC Power Supply: Used to provide a remote enabled indication.
J. Building Automation System Interface: Provide VFD interface to duplicate all points monitored locally at VFD into the BAS. Interface shall connect to BAS network communication bus.

2.04 SELF PROTECTION AND RELIABILITY FEATURES
A. Current Limit: Limit output current to 110% of inverter rating.
B. Instantaneous Overcurrent Trip: Limit output current in under 50 microseconds due to phase-to-phase short circuits or severe overload conditions.
C. Undervoltage Trip: Protect the inverter due to voltage levels in excess of its rating. Activates automatically when the DC bus in the controller exceeds 1000 VDC.
D. Overtemperature Trip: Protect the inverter from elevated temperatures in excess of rated temperatures.
E. Automatic Reset/Restart:
   1. Automatic reset on trip condition resulting from overcurrent, undervoltage, overvoltage, or overtemperature after removal or correction of the causative condition.
   2. Provide unlimited number of reset/restarts for undervoltage, overvoltage, and overtemperature.
   3. Limit the number of reset/restarts for overcurrent and require manual reset.
F. Isolation: Isolated current and voltage signals from logic circuitry.
G. Drive Logic: Microprocessor based.
H. Sustained Power Loss: In the event of a sustained power loss, shut down without component failure. Upon return of power, automatically return drive to normal operation if the start is in the "ON" condition.
I. Momentary Power Loss: In the event of a momentary power loss, shut down without component failure. Upon return of power, automatically return drive to normal operation, if the start is in the "ON" condition, being able to restart into a rotating motor regaining positive speed control without shutdown or component failure.
J. Short Circuit Protection: In the event of a phase-to-phase short circuit, shutdown safely without component failure.
K. Power Interruption: In the event that an input or output power contactor is opened or closed while the drive is activated, no damage to the control shall result.
L. Critical frequency avoidance circuit: Minimum of six user selectable bands to avoid operation at speeds which cause excessive vibration or noise in the driven equipment.
PART 3 - EXECUTION

3.01 INSTALLATION

A. Install and connect equipment in locations specified on Contract Drawings in strict accordance with the manufacturer’s instructions.
B. Provide materials and assistance as required by the manufacturer’s representative.
C. Coordinate installation with requirements for HVAC temperature controls.
D. Electrical:
   1. Control systems, components and control and interlock wiring for mechanical equipment will be furnished under this division.
   2. Provide power wiring to drives under Division 26. Power wiring shall consist of wiring to the line side terminals wiring away from the load side terminals to the equipment, except where such wiring is installed pre-wired by the equipment vendor such as for chiller units.
   3. Fire alarm control wiring among duct mounted smoke detectors, fire alarm system, drives, ATC panels DDC panels shall be furnished under Division 28.
E. Label enclosures with engraved plastic nameplate describing the equipment served, e.g. "AHU-1". Nameplates shall be attached with screws or rivets. Adhesives shall not be used to secure the nameplates.

3.02 START-UP, TESTING, DEMONSTRATION

A. Provide a factory trained technician to supervise the installation, start-up and testing of drives. As a minimum, check the following items:
   1. Motor voltage and frequency.
   2. Control input and automatic start/stop.
   3. Calibration and adjustment for minimum and maximum speed set points and acceleration and deceleration rates.
B. Provide a minimum of one day (8 hours) instruction to maintenance personnel.
C. Demonstrate the operation of the system to the maintenance personnel.
D. Provide the necessary coordination for test and balance procedure as required by Section 23 05 93.

END OF SECTION 23.05.14
SECTION 23.05.17
SLEEVES, ESCUTCHEONS, AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL (Not Applicable)

PART 2 - PRODUCTS

2.01 SLEEVES
A. sleeves shall be standard weight steel pipe except sleeves for concealed piping through floors not in structural members, and through interior drywall construction may be formed from 26 gauge galvanized sheet metal lapped and pop riveted.

2.02 EXTERIOR WALL - SLEEVE-SEAL SYSTEMS
A. Exterior Wall & Steam Vault Penetration System by Link-Seal or approved equal.
B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: Carbon steel.
   3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.03 SLEEVES
A. Materials
   1. Concrete floors, concrete and masonry walls: 18 gauge galvanized sheet metal.
   2. Drywall partitions: 18 gauge galvanized steel sheet metal
B. Sleeves shall be sized such that the annular space between outside surface of pipe or pipe insulation and the inside surface of the sleeve is not less than 1/2”. Provide larger annular space if required by firestopping product installation instructions
C. Sleeves supporting riser piping 4” and larger shall have three 6” long reinforcing rods welded radically at 120 degree spacing to the sleeve and shall be installed with the rods embedded in the concrete slab

2.04 PENETRATION SEALS
A. Refer to architectural specification for Fire Safing.

2.05 GROUT
A. Non-shrink type, conforming to ASTM C1107/C1107M-2013 when tested at fluid consistency. Grout shall exhibit zero bleeding at every age when mixed to fluid consistency. Minimum 28 day compressive strength, when mixed to fluid consistency, shall be 7000 psi.
B. Manufacturer: Cormix or Master Builders.

2.06 ESCUTCHEON PLATES
A. Provide chromium plated escutcheon plates for exposed, uninsulated pipes projecting through floors or walls in “finished” spaces. Mechanical rooms, store rooms, electrical closets and janitor closets are not considered “finished” spaces.
PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
   1. Piping requiring sleeves:
      a. Heating hot water
      b. Chilled water
      c. Copper pipes thru masonry walls

B. Where a pipe requiring sleeves passes through a wall, ceiling or floor slab, a steel sleeve shall be provided and the internal diameter of the sleeve shall be 2” larger than the external diameter of the pipe or insulated pipe passing through it. After all the piping is installed in that area, the Contractor shall check the clearance and correct it, if necessary to within 1/2”. Then the void shall be packed full depth with glass/mineral fiber and sealed at both ends, 1” deep with sealant backed by foam rod. Nothing in these paragraphs shall override the fire penetration details shown on the drawings.

C. Pipe sleeves shall be provided at non-rated partitions and floor penetrations. Pipe sleeves to be Schedule 40 or 18 gage steel. Sleeves to extend 1-1/2” in excess of partition depth on each side. Sleeves penetrating floors in wet areas, including all mechanical rooms, shall extend a minimum of 1 inch above the floor.
   1. Sleeves are not required for core-drilled holes.

D. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
   2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

E. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 “Joint Sealants.”

F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 “Penetration Firestopping.”

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 ESCUTCHEONS

A. Provide escutcheons where exposed piping passes through walls, floors, and ceilings in finished areas.

3.04 SLEEVES

A. Floors: Sleeve all pipe penetrations. Extend sleeve 1-1/2” above finished floor, except piping within pipe chases. Sleeve shall be flush with underside of floor.
B. Masonry or concrete walls: Sleeve all pipe penetrations. Sleeves shall be flush on both sides of wall.
C. Drywall partitions: Sleeve all penetration of piping in systems over 160 degree F.
D. Seal voids between outside surface of sleeve and wall, partition or floor. Seals shall be airtight.
E. Install piping, insulation and sleeves in strict accordance with applicable U.L. floor or partition assembly instructions. Coordinate with Division 07 firestop manufacturer's installation instructions.
F. Penetrations not sleeved or firestopped:
   1. Seal voids between pipe and partition. Seals shall be airtight.

3.05 ESCUTCHEON PLATES

A. Provide chromium plates escutcheon plates for exposed uninsulated pipes projecting through floors or walls in "finished" spaces. Mechanical rooms, store rooms, electric closets, and janitor closets are not considered "finished" spaces.
B. Clearance between sleeve and pipe: Minimum of 1/2 inch for hot piping and 1 inch for cold piping or as otherwise dictated by U.L. Fire Resistance Directory.

END OF SECTION 23.05.17
SECTION 23.05.29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL (NOT USED)

PART 2 - PRODUCTS

2.01 HANGERS
A. Anvil Figure #260 clevis hangers with Figure 167, MSS Type 40 galvanized insulation protection shields (sized for supporting insulation having a compressive strength of 4 psi). Support piping on outside of insulation. Size hangers so that pipe insulation passes through them without interruption.
   1. Hot water piping above 160 degrees F. 4” diameter and less.
   2. Chilled water piping.
B. Anvil Figure #171, MSS Type 41 with pipe roller, Anvil Figure #16x protection saddle and Anvil Figure 167, MSS Type 40 galvanized insulation protection shields (sized for supporting insulation having a compressive strength of 4 psi, at 8 foot intervals). Support piping on outside of insulation. Size hangers so that pipe insulation passes through them without interruption. Use these for:
   1. Hot water reheat above 160 degrees F. 6” diameter and larger
C. Anvil Figure #CT-121, MSS Type 8, riser clamps (at floor penetrations) to support:
   1. Copper pipe risers
D. Anvil Figure #261, MSS Type 8, riser clamps (at floor slab penetrations) to support:
   1. Steel pipe risers
E. Anvil Powerstrut Trapeze Hangers: Where three or more lines of pipe run parallel, support them with trapeze hangers, sized for maximum 3/16” deflection.

2.02 INSERTS
A. Concrete Insert: Anvil Figure #281, MSS Type 18, universal concrete inserts, adequately sized and correctly positioned to support full load operating systems.
B. Concrete Insert, Wedge Type: Anvil Figure #281, 1/4” to 7/8”.
C. Lightweight Concrete Insert: Anvil Figure #285.
D. Continuous Concrete Insert: Anvil Powerstrut Figure #PS-349 pre-galvanized.

2.03 EXPANSION ANCHORS
A. Hilti Kwik-bolt, zinc plated, metal expansion anchor.
B. Anchor to meet U.L., ICBO-4627 and FM listings.

2.04 CLAMPS
A. C-Clamps: Anvil Figure #92, MSS Type 23.
   1. Use these for attaching hangers to steel beams. Do not weld hanger rods to structural steel members.
B. Malleable Beam Clamps: Anvil Figure #218, MSS Type 30: Use these for attaching hangers to bar joists.

2.05 HANGERS RODS
A. Provide mild steel, all-thread rods with maximum loads as follows:
   1. 3/8” - 300 lbs.
   2. 1/2” - 600 lbs.
   3. 5/8” - 1,200 lbs.
2.06 TRAPEZE PIPE HANGERS
A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.07 THERMAL-HANGER SHIELD INSERTS
A. Protect insulation at each hanger and support point with a 14 gauge galvanized shield which extends up to the centerline of the pipe and is centered inside the pipe hanger. Minimum shield length shall be 12”. Provide a section of foam glass insulation between pipe and metal shield where glass fiberglass insulation is used on 3” and larger.

2.08 FASTENER SYSTEMS
A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.09 EQUIPMENT SUPPORTS
A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.10 UNISTRUT
A. Provide floor mounted Unistrut for variable frequency drives and control panels as required.

2.11 ROOF CURBS
A. Provide prefabricated metal roof curbs at all roof ductwork and piping penetrations and for support of all roof-mounted equipment, fans and ductwork. Construct curbs according to National Roof Contractor's Association guidelines. Prefabricated metal roof curbs shall be manufactured by ThyCurb, Custom Curb, or approved substitute.
B. Construction curbs with minimum 18 gauge galvanized steel (14 gauge for curbs with any side longer than 4'-0” and for all curbs supporting equipment) with fully mitered and welded corners, integral base plate, internal reinforcing with 1” x 1” x 1/8” steel angle for curbs with any side longer than 3'-0”, factory installed 1-1/2” thick, 3-pound density fiberglass insulation and factory installed pressure treated wood nailer. Minimum height of curb shall be 12” above finished roof surface. Consult architectural plans for roof type and thickness. Construct curbs to match slope of roof and provide a level top surface for mounting of mechanical equipment. Non-ducted equipment curbs shall be turned such that they are parallel to the slope of the roof (short side faces on-coming water).
C. Curb types shall be as follows:
   1. Fan and duct penetration curbs with standard curb construction as described above - Thy Curb Model TC-3 with no cant.
   2. Equipment support curbs with minimum 18 gauge galvanized steel shell, base plate and counterflashing, wood nailer, and internal bulkhead reinforcement - ThyCurb Model TEMS.
D. Install curbs in strict accordance with manufacturer's published installation instructions and as detailed on the drawings. Coordinate proper curb size, construction, and base prior to fabrication.

2.12 MISCELLANEOUS MATERIALS
A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported.
      Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured.
      Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment support in first paragraph below requires calculating and detailing at each use.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes. expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
4. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS
   A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
   B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
   C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS
   A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
   B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
   C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
      1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
      2. Obtain fusion without undercut or overlap.
      3. Remove welding flux immediately.
      4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING
   A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
   B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.05 PAINTING
   A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
      1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
   B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified Division 09.
   C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE
   A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
   B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
   3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
   4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
   6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
   7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
   8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
   9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
   2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
   2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
   2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar joist construction, to attach to top flange of structural shape.
   3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
   4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
   5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.

7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 lb.
   b. Medium (MSS Type 32): 1500 lb.
   c. Heavy (MSS Type 33): 3000 lb.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
   3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
   2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
   3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23.05.29
SECTION 23.05.33
HEAT TRACING FOR EXTERIOR CHILLED WATER PIPING

PART 1 - GENERAL

1.01 SUMMARY
A. Furnish and install a complete U.L. listed system of heaters, components, and controls to prevent chilled water pipe lines from freezing.

1.02 WARRANTY
A. Provide three years warranty from date of Substantial Completion. Manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.01 SELF-REGULATING HEATING CABLES
A. Comply with IEEE 515.1.
B. Heating Element: Pair of parallel No. 16 AWG, nickel-coated, copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating. The heater shall be equivalent to Raychem XL-Trace, Chromalox Rapid Trace or approved equal.
C. Electrical Insulating Jacket: Flame-retardant polyolefin.
D. Cable Cover: The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket.
E. Maximum Operating Temperature (Power On): 150 deg F.
F. Maximum Exposure Temperature (Power Off): 185 deg F.
G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
H. Capacities and Characteristics:

<table>
<thead>
<tr>
<th>Diameter of Pipe</th>
<th>Watts/Foot of Pipe @ 40°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 inch or less</td>
<td>5</td>
</tr>
<tr>
<td>4 to 6</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>10 to 16</td>
<td>16</td>
</tr>
</tbody>
</table>

2.02 CONTROLS
A. The system shall be controlled by an ambient sensing thermostat set at 40 degrees F. either directly or through an appropriate contractor.
B. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
C. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.
D. Corrosion-resistant, waterproof control enclosure.
2.03 ACCESSORIES
A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.
B. Warning Labels: Refer to Section 230553 "Identification for HVAC Piping and Equipment."
C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils (0.08 mm) thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.
1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): 3/4 inch (19 mm) minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches (150 mm) or Larger: 1-1/2 inches (38 mm) minimum.

PART 3 - EXECUTION

3.01 INSTALLATION
A. Install electric heating cable across expansion joints in strict accordance with manufacturer's written instructions; use slack cable to allow movement without damage to cable.
B. Install electric heating cables after piping has been tested and before insulation is installed.
C. Install electric heating cables according to IEEE 515.1.
D. Install insulation over piping with electric cables according to Section 230719 "HVAC Equipment and Piping Insulation."
E. Install warning tape on piping insulation where piping is equipped with electric heating cables.
F. Set field-adjustable switches and circuit-breaker trip ranges.
G. Ground fault equipment according to Section 427-22 of the National Electric Code.
H. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.02 FIELD QUALITY CONTROL
A. Perform the following tests and inspections:
   1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
   2. Test cables for electrical continuity and insulation integrity before energizing.
   3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.
C. Cables will be considered defective if they do not pass tests and inspections.
D. Prepare test and inspection reports.
E. Remove and replace damaged heat-tracing cables.

END OF SECTION 23.05.33
PART 1 GENERAL

1.01 GENERAL REQUIREMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this section.

1.02 WORK INCLUDED
   A. Provide complete vibration control systems as shown or specified and in accordance with the requirements of the Contract Documents. Systems shall be complete with foundations, vibration isolation, and supports for rigidly supported equipment.

1.03 RELATED WORK SPECIFIED ELSEWHERE
   A. Consult all other Section to determine the extent of work specified elsewhere but related to this Section. This work shall be properly coordinated to produce an installation satisfactory to the Owner. This work includes, but is not limited to the following:
      1. Fans
      2. Air Handling Equipment
      3. Ductwork
      4. Duct Insulation (External)
      5. Internal (Acoustical) Duct Insulation
      6. Pumps
      7. Piping
      8. Plumbing Fixtures
      9. Heating and Cooling Equipment
     10. Concrete Housekeeping Pads
     11. Noise Control for Mechanical Systems
     12. Noise and Vibration Control for Electrical Systems

1.04 CONTRACTOR'S RESPONSIBILITY
   A. Verify the completeness of the isolation installation and the overall suitability of the equipment to meet the intent of this specification. Any additional equipment needed to meet the intent of this specification, even if not specifically mentioned herein or in the Contract Documents, shall be supplied by the Contractor without claim for additional payment.
   B. Furnish and install seismic, wind, fire and flood resistance for all components specified in this Section in accordance with the requirements of the relevant portions of the applicable building code (IBC 2006).
   C. Performance or waiving of inspection, testing or surveillance for any portion of the work shall not relieve the Contractor of the responsibility to conform strictly with the Contract Documents.
   D. In the event of a conflict between two or more requirements of this specification, submit a written Request for Clarification prior to furnishing or installing any equipment or systems.

1.05 MANUFACTURER'S RESPONSIBILITIES
   A. Manufacturer of vibration isolation equipment shall have the following responsibilities:
      1. Provide vibration isolation systems as scheduled and specified.
      2. Guarantee specified isolation system deflection.
      3. Provide installation instructions, drawings and field supervision to ensure proper installation and performance.
      4. Determine all mounting sizes.
5. Ensure that all equipment to be isolated has sufficient support structure to distribute equipment loads onto isolators. Provide additional support structure where required.
6. Design seismic, wind, fire and flood resistance for all components specified in this Section in accordance with the requirements of the relevant portions of the applicable building code.

1.06 SUBMITTALS
   A. Submit fully coordinated shop drawings for all vibration control equipment. These submittals shall state the acoustical performance of the products as described below.
   B. Isolators: Submittal shall include drawings prepared by the isolation system manufacturer showing the construction of the isolation devices to be used, including project specific isolator selection.
   1. Submit vibration isolation system schedule indicating the following:
      a. Manufacturer, type, model number, size
      b. Height when uncompressed and static deflection of each isolation element
      c. Spring constant of each isolation element
      d. Estimated imposed load on each isolation element
      e. Spring o.d., free operating, and solid heights
      f. Design of supplementary bases
      g. Seismic restraints, including attachment calculations by the Seismic Restraint Manufacturer’s licensed Engineer substantiating the seismic restraints are furnished and installed in accordance with IBC 2006 and local building codes. A registered professional engineer having a PE from the same state as the project, or state of restraint manufacturer shall stamp all analyses, or as required by codes.
      h. Layout of isolator hangers, mounts, and other elements shown on an outline of the isolated equipment, including complete details of attachment to load-bearing structure or supplementary framing
      i. Piping isolators shown and identified on piping layout drawings, including a riser diagram for isolated shaft piping
      j. Furnish shop drawings showing adequate concrete reinforcing steel details and templates for all concrete foundations and supports, and all required hanger bolts and other appurtenances necessary for the proper installation of vibration isolation equipment. Include drawings of all required seismic, fire and flood resistance. All concrete foundations and supports (and required reinforcing and forms) will be furnished and installed by another trade.

1.07 QUALITY ASSURANCE
   A. It is the objective of this specification to control vibration due to the operation of machinery or equipment, and/or due to interconnected piping, ductwork or conduit.
   B. The installation of all vibration control systems shall be under the supervision of a manufacturer’s representative.
   C. All vibration isolation and seismic, wind, fire and flood resistance equipment and materials shall be provided by a single manufacturer. The following manufacturers are approved provided systems are in compliance with the specified design and performance requirements:
   2. Kinetics Noise Control, Dublin, Ohio
   3. The VMC Group, Bloomingdale, NJ

PART 2 PRODUCTS

2.01 GENERAL
   A. All equipment provided for vibration isolation shall be new and manufactured specifically for the purpose intended.
2.02 VIBRATION ISOLATION SYSTEMS

A. GENERAL
1. The static deflection of isolators shall be as given in the equipment schedule and specified below. The Vibration Isolation Schedule at the end of this section shall take precedence.
2. All vibration isolators shall be selected in accordance with IBC-2006, and all local building codes related to seismic, wind, fire and flood requirements.
3. Vibration isolator sizes and layout shall be determined by the vibration isolator supplier.
4. All vibration isolators shall have either known undeflected heights or calibration markings so that, after adjustment, static deflection may be verified.
5. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer, and must be linear over a deflection range of not less than 50% above the design deflection.
6. The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than ±10%.
7. All elastomeric mountings shall have Shore hardesses of 30 to 60 ±5, or as specified herein, after minimum aging of 20 days or corresponding over-aging.
8. Unless otherwise specified, steel spring isolation systems as described in the specifications shall utilize bare (unhoused) springs with the spring diameter not less than 80% of the loaded operating height of the spring. Each spring isolator shall be designed so that the ends of the spring remain parallel during and after the spring installation. All isolators shall operate in the linear portion of their load versus deflection curve and have 50% excess capacity without becoming coil bound.
9. All mounting systems exposed to weather and other corrosive environments shall be protected with factory corrosion resistance. All metal parts of mountings shall be provided with a powder coat finish. Springs shall be powder coated, and shall have a minimum 1000 hour rating when tested in accordance with ASTMB-117. Nuts and bolts shall be cadmium plated.

B. FLEXIBLE DUCT CONNECTORS
1. Flexible sleeves for duct connections shall be fabricated from flexible, airtight, flame-retarded fabrics, coating, and adhesives complying with UL Standard 181 Class 1.
2. Extra-Wide Metal-Edged Connectors: Factory-fabricated with a strip of fabric 6” wide attached to 2 strips of 3” wide, 24-gauge galvanized sheet steel or 0.032-gauge aluminum sheets. Select metal compatible with connected duct system. Fold and crimp metal edge strips onto fabric as illustrated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition 2005, Figure 2-17.
      1) Minimum Weight: 26 oz per square yard
      2) Minimum Tensile Strength: 480 lb per inch in the wrap and 360 lb per inch in the filling.
   3. [Flexible duct connectors shall be Durodyne “Neoprene”, or equal]

C. VIBRATION ISOLATION GROMMETS
1. Vibration isolation grommets shall be elastomeric sleeves used to isolate hold-down bolts from equipment bases.
2. Mason model HG, or as approved.

D. FLEXIBLE PIPE CONNECTORS
1. Flexible pipe connectors shall be peroxide cured EPDM throughout with Kevlar tire cord reinforcement. Solid steel rings shall be used within the raised face rubber flanged ends to prevent pullout. Flanges shall be split ductile iron or steel with hooked or similar interlocks. Higher rated connectors may be used to accommodate service conditions. All connections must be factory tested.
to 150% of rated pressure for 12 minutes before shipment. Safety factors to burst and flange pullout shall be a minimum of 3/1. Concentric reducers to the above ratings may be substituted for equal ended flexible connections. Control rods shall not be used. Flexible pipe connections shall be type SAFEFLEX SFEJ as manufactured by Mason Industries, Inc.

2. Where system pressure or contaminants dictate their use instead of EPDM flexible pipe connections, flexible metal hoses shall be used to isolate equipment from piping. Flexible metal hoses shall have stainless steel braid and carbon steel fittings. Sizes 3” (75mm) and larger shall be flanged. Smaller sizes shall have male nipples. Metal hoses length shall be a minimum of ten times the nominal pipe diameter. Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible. Flexible metal hoses shall be Mason type BSS, or approved equal.

E. THRUST RESTRAINTS
   1. Thrust restraints shall consist of a spring in series with an elastomeric pad. Restraint assembly shall be designed so it can be field adjusted to allow for a maximum of 3/8 inch movement at equipment start and stop. Restraint assembly shall be designed to sustain an overload force equal to 5 times the design force without failure. Attachment hardware is considered part of the restraint assembly if it is required for installation.
   2. Thrust restraints shall be Mason Industries type WB or approved equal.

F. ELASTOMERIC RISER GUIDE
   1. Riser guides shall consist of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1/2” (12mm) thickness of 60 durometer elastomeric material. Guides shall accommodate a minimum of 1-5/8 inches of vertical pipe motion in either direction.
   2. Riser guides shall be Mason type VSG, or approved equal.

G. ISOLATOR TYPE PAM
   1. Type PAM (pipe anchor mounts) shall consist of two sizes of steel tubing separated by a minimum of 1/2 inch thick, 60 durometer or less elastomeric material. Vertical restraint shall be provided by the same material arranged to prevent up or down vertical travel. Allowable loads shall not exceed 500 psi and the design shall be balanced for equal resistance in any direction.
   2. Acoustical pipe anchor mountings shall be Type ADA by Mason Industries, Inc., or as approved.

H. ISOLATOR TYPE WP
   1. Type WP (Waffle Pads) shall be 5/16” thick elastomeric pads ribbed or waffled on both sides. The pads shall be manufactured with bridge bearing quality elastomeric material, and selected for a maximum durometer of 50 and designed for 15% strain. Where required, steel load-spreading plates shall be incorporated between the equipment and the elastomeric pad.
   2. For equipment bolted to the structure, a vibration isolation grommet shall be installed under the bolt head between the steel washer and the base plate.
   3. Mason Industries type W, or equal.

I. ISOLATOR TYPE MWP
   1. Type MWP (Metal and Waffle Sandwich Pads) shall consist of two 5/16” thick ribbed or waffle elastomeric pads sandwiching a 16-gauge stainless steel shim plate. The pad shall be manufactured with bridge bearing quality elastomeric material, and selected for a maximum durometer of 50 and designed for 15% strain.
   2. For equipment bolted to the structure, a vibration isolation grommet shall be installed under the bolt head between the steel washer and the base plate.
   3. Mason Industries type WSW, or equal.

J. ISOLATOR TYPE SWP
1. Type SWP shall be a 3/4” thick waffle elastomeric pad manufactured with bridge bearing quality elastomeric material.
2. For equipment bolted to the structure, a vibration isolation grommet shall be installed under the bolt head between the steel washer and the base plate.
3. Mason Industries model Super W, or equal.

K. ISOLATOR TYPE DDNM
1. Type DDNM (Double Deflection Elastomer Mounts) shall be laterally stable, double deflecting, molded elastomeric isolators. All metal surfaces shall be covered with elastomeric material. The top and bottom surfaces shall be ribbed and bolt holes shall be provided in the base. The mounts shall have leveling bolts rigidly secured to the equipment.
2. The isolator shall be manufactured with bridge bearing quality elastomeric material, and selected for a maximum durometer of 50 and designed for 15% strain. DDNM mounts shall be selected for a static deflection of 3/8” unless otherwise specified.
3. Mason Industries type ND, or equal.

L. ISOLATOR TYPE DDNH
1. Type DDNH (Double Deflection Elastomer Hangers) shall consist of a molded elastomeric isolating element in a steel hanger box. An elastomeric sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 3/4” larger than the diameter of the hanger rod and permit the hanger rod to swing through a 30° arc. When installed, the hanger box shall be allowed to rotate through a full 360° without encountering any obstructions.
2. The isolator shall be manufactured with bridge bearing quality elastomer, and selected for a maximum durometer of 50 and designed for 15% strain.
3. Mason Industries type HD, or equal.

M. ISOLATOR TYPE BR [USE WHEN NEED HF ISO IN TENSION OR SHEAR, OR IN SEISMIC AREA, OTHERWISE, USE ND]
1. The mount shall consist of a ductile iron casting containing two separated and opposing molded elastomeric elements. The elements shall prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation. Mount shall have a minimum static deflection of 0.2” and all directional seismic capability.
2. Mason Industries Type BR or equal.

N. ISOLATOR TYPE SPNM
1. Type SPNM (Spring and Elastomer Mounts) shall have a free-standing and laterally stable steel spring without any housing. Springs shall be designed so that the ratio of the horizontal to vertical spring constant is between one and two. The spring diameter shall be not less than 80% of the compressed height of the spring at rated load. Loaded springs shall have a minimum additional travel to solid equal to 50% of the specified static deflection.
2. Isolator mounts shall be installed complete with 1/4” thick elastomeric pad between the isolator base plate and the supporting structure.
3. Mason Industries Type SLF, or equal.

O. ISOLATOR TYPE SPNH
1. Type SPNH (Spring and Elastomer Hangers) shall consist of a steel spring in series with an elastomeric isolating element. The spring shall have a minimum additional travel to solid equal to 50% of the specified deflection. The elastomeric element shall have a static deflection of not less than 0.3” with a strain not exceeding 15%.
2. Spring diameter and hanger box hole size shall be large enough to permit the hanger rod to swing through a 30° arc. An elastomeric sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter
of the clear hole in the hanger box shall be at least 3/4” larger than the diameter of the hanger rod. When installed, the spring element shall not be cocked, and the hanger box shall be allowed to rotate through a full 360° arc without encountering any obstructions.

3. Mason Industries Type 30N, or equal.

P. ISOLATOR TYPE CSNM
1. Type CSNM (Constrained Spring and Elastomer Mounts) shall be a housed spring and elastomeric mount that incorporates springs with built-in leveling device. CSNM mount shall incorporate resilient vertical restraints to prevent spring elongation when partial load is removed or when the unit is subjected to wind loading. Restraining bolts shall have an elastomeric bushing between the bolt and the housing. Limit stops shall be out of contact during normal operation. Since housings will be bolted or welded in position mounts shall contain an internal elastomeric isolation pad.

2. A minimum clearance of 1” shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring operation. Limit stops shall provide minimum 1/4” clearance under normal operation, and an elastomeric washer shall be installed beneath the bolt head/washer used to restrain the isolator.

3. Provide minimum 1/4” thick elastomeric acoustical base pad on underside of mount.

4. Mount shall be capable of supporting equipment at a fixed elevation during equipment erection. Installed and operating heights shall be identical.

5. Mason Industries Type SLR, or equal.

Q. BASE TYPE CIB
1. Inertia base Type CIB (Concrete Inertia Base) shall have an integral rectangular structural steel form into which concrete is poured.

2. Perimeter members shall be beams of depth equal to 10% of the longest span of the base, but not more than 12” nor less than 6” deep. Forms shall include motor slide base and all reinforcing steel. Where anchor bolt locations fall in concrete, the reinforcing steel shall include drilled members with sleeves welded below the steel to accept the anchor bolts. Height saving steel brackets shall be used in all mounting locations.

3. When the concrete base is T-shaped, isolators shall be located under the projections as well as under the main body in order to prevent cantilever distortion.

4. The structural perimeter frame, mounting templates, height saving brackets, and spring system shall be provided as an assembly by the vibration control vendor.

5. Each inertia base (rectangular or “T” shape) shall include supports and base elbows for any suction and discharge connections to pumps. Base elbows shall be bolted and grouted to the inertia base.

6. Concrete inertia base shall be provided with a 2” minimum operating clearance between the base and housekeeping pads. The concrete inertia base shall be at least 6 inches wider than the pump frame.

7. Concrete inertia bases with a smaller plan dimension greater than 40 inches shall be constructed with an air relief opening near the center.

8. Base shall be Mason Industries Type BMK or K, or equal.

R. BASE TYPE CMB
1. Base Type CMB (Curb Mounted Base) for roof-mounted equipment shall be a structural steel base mounted directly to the structure with an upper floating section on adjustable steel springs. The upper frame shall provide continuous support for the equipment. Steel springs shall rest on 1/4” minimum thickness elastomeric pads. All-directional elastomeric snubber bushings shall be minimum 1/4” thickness. All hardware shall be plated and the springs provided with a rust resistant finish.

2. Weatherproofing shall consist of a continuous galvanized flexible counterflashing nailed over the lower curb’s waterproofing and joined at the corners by EPDM bellows. All spring locations shall
have access ports with removable waterproof covers to allow for adjustment or replacement of springs. Lower curbs shall have provision for 2” insulation.

3. Duct connections shall be made using a length of flexible duct dimensioned to match the equipment opening, using an elastomeric gasket to seal against the unit bottom.

4. The floating member of the roof curb shall have perimeter angle and cross members to support two layers of 5/8” thick waterproof sheetrock laid on with staggered joints. Sheetrock shall surround duct penetrations completely, and shall be caulked at all seems and intersections. A four inch thick layer of 1.5 pcf density fiberglass shall cover the entire solid roof surface under the unit. Complete instructions shall be provided by manufacturer. [OPTIONAL DB PACKAGE OFFERED BY MASON. CONSIDER ADDING IF RTU DIRECTLY ABOVE SENSITIVE SPACE. DELETE IF CURB INCLUDED, BUT ADD. PACKAGE NOT NECESSARY]

5. Curb shall be Mason Industries Type RSC or equal.

S. BASE TYPE SCMB
1. Base type SCMB shall consist of an extruded aluminum top member that overlaps the bottom member to provide water runoff independent of the airtight seal. Aluminum members shall house electro-galvanized or powder coated springs selected for static deflection as given in the vibration isolation schedule at the end of this section. Travel to solid shall be 1.5” minimum. Spring diameters shall be no less than 0.8 of the spring height at rated load. Wind resistance shall be provided by means of resilient snubbers in the corners with a minimum clearance of 0.25” so as not to interfere with the spring action except in high winds. Manufacturer’s self adhering closed cell sponge gasketing shall be used both above and below the base and a flexible EPDM connection shall seal the outside perimeter. Foam or other sliding or shear seals are not acceptable.

2. Curb shall be Mason Industries Type CMAB or equal.

T. BASE TYPE SB
1. Base type SB shall be a structural steel rectangular base with cross members where the longest beam dimension exceeds 6 feet, to prevent twisting.

2. Structural steel shall have a depth equal to 10% of the longest span between mounting locations, but not more than 12” nor less than 4” deep.

3. Use height-saving brackets in all mounting locations.

PART 3 EXECUTION

3.01 GENERAL

A. All rotating or reciprocating equipment shall be mounted on or suspended from vibration isolators as specified herein or as shown on the drawings. Where a discrepancy between the drawings and this specification exists, the specification shall govern.

B. All rotating or reciprocating mechanical equipment not specifically identified in this specification shall be installed on elastomeric isolators. Floor mounted equipment shall be mounted on Type DDNM and ceiling mounted equipment shall be hung from Type DDNH isolators.

C. All rotating or reciprocating equipment mounted on vibration isolators shall be installed in accordance with the relevant requirements of IBC-2006 with respect to seismic, wind, fire and flood resistance.

D. All floor-mounted equipment shall be erected on 4” thick concrete housekeeping pads over the complete floor area of the equipment. These pads shall be integrally keyed to structural slab. Wherever vibration eliminating devices and/or concrete inertia blocks are specified, these items shall, in all cases, be in turn mounted on concrete housekeeping pads unless otherwise specified.

E. Furnish and install vibration isolation grommets for hold-down bolts to prevent any metal to metal contact.

F. Piping, ductwork, conduit or mechanical equipment shall be supported from building structure, not hung from or supported on other equipment, pipes, or ductwork.
G. Vibration isolated equipment connected to water or other fluid piping shall be erected at correct operating heights prior to connection of piping. When the system is assembled and fluid is added, the isolators shall be adjusted to allow removal of temporary blocking and shims.

H. Elastomeric isolators that will be exposed to temperatures below 32° F shall be fabricated from natural rubber.

I. Install all springs such that the ends of springs remain parallel. All springs installed with adjustment bolts.

J. Vibration isolators shall be selected to be non-resonant with equipment forcing frequencies or supporting structure natural frequencies.

K. Refer to Vibration Isolation Schedule at the end of this Section for specific vibration isolation requirements.

3.02 FAN ISOLATION

A. GENERAL
1. Fans and air handling units shall be leveled with the fans operating before the flexible connectors are attached.
2. Thrust restraints shall be installed on all fan heads, ceiling suspended fans, and air-handling equipment operating at 2 in. of water or more total static pressure. Thrust restraints shall incorporate the same static deflection as the unit isolators (as given in the Vibration Isolation Schedule at the end of this section). Install thrust restraints as near as possible to the centerline of thrust.
3. Drain pipes for air handling units shall be supported only from the isolated air handling unit frame. The condensate shall drip into a funnel that is supported from the floor or floor drain. A gap of at least 2” shall be maintained between the end of the air handling unit drain pipe and funnel or floor drain.

B. FLOOR MOUNTED CENTRIFUGAL FANS
1. Each such fan and driving motor shall be mounted on an integral one piece structural base, reinforced as necessary to prevent flexure of the base at start up and during operation of the fan.
2. The unitized structural base for the fan and motor shall include motor slide rails. The structural steel frame shall be drilled and tapped to receive the fan and motor so that the frame shall act as a template.
3. The structural steel integral base shall be supported on vibration isolators as specified in the Vibration Isolation Schedule at the end of this section.

C. FLOOR MOUNTED PACKAGED AIR HANDLING UNITS
1. Where the unit to be mounted is not furnished with an integral structural frame or external lugs, or where the furnished unit has any severe overhangs, an additional structural frame shall be furnished and installed beneath the unit.
2. The motor shall be integrally mounted to the unit and shall be mounted on slide rails.
3. Internal spring isolation will not be approved. Isolation shall be installed on unit exterior.

D. Computer room air conditioning units
1. Where the unit to be mounted is not furnished with an integral structural frame or external lugs, or where the furnished unit has any severe overhangs, an additional structural frame shall be furnished and installed beneath the unit.
2. Internal spring isolation will not be approved. Isolation shall be installed on unit exterior.

E. SUSPENDED FANS AND AIR HANDLING UNITS
1. Fans suspended from overhead structure shall be hung on vibration isolators as given in the Vibration Isolation Schedule at the end of this section.
2. Fans shall be suspended from above only if expressly noted as such on the drawings and schedules.
3.03 PUMP ISOLATION

A. GENERAL
   1. Flexible pipe connectors shall be installed on both sides of each pump between the pump and the inlet and discharge piping. Inlet and discharge piping shall be aligned with the pump prior to installation of flexible pipe connectors. Flexible pipe connectors shall not be used to correct equipment offsets. Flexible pipe connectors shall not support any of the vertical load of the pump or associated piping.

B. MOUNTING OF CENTRIFUGAL PUMPS - (3 HP OR GREATER):
   1. Each pump with its driving motor shall be bolted and grouted to a vibration isolated reinforced concrete inertia base. Inertia bases shall be supported on vibration isolators as given in the Vibration Isolation Schedule at the end of this section.
   2. Concrete inertia base minimum thickness shall be in accordance with the following schedule:

<table>
<thead>
<tr>
<th>Motor Size</th>
<th>Thickness Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 ≤ HP &lt; 15</td>
<td>6”</td>
</tr>
<tr>
<td>15 ≤ HP &lt; 50</td>
<td>8”</td>
</tr>
<tr>
<td>50 ≤ HP</td>
<td>12”</td>
</tr>
</tbody>
</table>

3.04 COOLING TOWERS

A. Cooling tower vibration mounts shall be hot dip galvanized in addition to powder coat finish as noted in item 1.1A.9 of this specification section.

3.05 BOILERS

A. Vertical and horizontal exhaust flues for gas boilers shall be supported by DDNH or DDNM isolators. In an exhaust flue the vertical rise shall have an Elastomeric Riser Guide to limit lateral movement and to prevent solid contact to a supporting structure. There shall be a minimum clearance of 1 inch between the flue and the riser guide (on all sides).

3.06 ICE MAKERS

A. All associated piping shall be connected to the tank with flexible pipe connections.

3.07 Expansion TANKS, deaerators, and water heaters

A. Each floor-mounted unit shall be supported on Type MWP elastomeric sandwich pads. Each suspended unit shall be supported on Type DDNH hangers. Where piping on isolators is connected to these units, per section 3.08 below, the connection shall be made with a flexible pipe connector.

B. If an associated pump is to be mounted on the unit and if the pump is 0.5 HP (0.4kW) or smaller, then the pump shall be mounted to the unit through Type RBA elastomeric isolators. Associated pumps larger than 0.5 HP (0.4kW), and pumps not mounted directly to the unit shall be supported from the building structure as noted in item 3.03 of this specification section, and given in the Vibration Isolation Schedule at the end of this section.

3.08 VIBRATION ISOLATION OF MECHANICAL SYSTEM PIPING

A. GENERAL
   1. The following piping connected to vibration isolated HVAC equipment shall be isolated:
      a. All piping within equipment rooms
      b. Piping outside of equipment rooms within 50 feet or 100 pipe diameters of connected rotating equipment, whichever is greater
      c. All piping greater than 2 inch diameter in shafts if the piping enters the shaft within the distances specified above [SPECIFIER SHOULD CONFIRM THAT NO PIPING SHAFTS LIE ADJACENT TO SENSITIVE AREAS. IF SO, MODIFY RECOMMENDATION TO
INCLUDE SPECIFIC RISERS. CONSIDER HAVING MEP NOTE ON RISER DIAGRAMS]

d. All piping where exposed on roof

2. Where supplementary steel is required to support piping, the supplementary steel shall be sized so that maximum deflection between supports does not exceed 0.08 inches. Supplementary steel shall be supported from the building structure with vibration isolation mountings and hangers as described below. Piping shall be rigidly attached to the supplementary steel.

3. Where isolated piping 8” and larger is supported directly below exposed steel beams, attachment to the beam shall be made by means of welded channel beam attachments located directly under the web of the beam. For piping 6” and smaller beam clamps may be used in lieu of welding subject to approval of beam clamp selection.

B. PIPES CONNECTED TO EQUIPMENT ON SPRING ISOLATORS

1. All pipes connected to equipment installed on spring vibration isolators, except sprinkler piping, shall be suspended on or supported by Type SPNH or Type SPNM isolators. Provide vibration isolation anchors and guides as specified elsewhere in this specification.

   a. Provide pre-compressed type isolators for all piping greater than 6 inches in diameter and all supplementary steel supports. The pre-compression shall be factory set at 75% of rated deflection.

2. The first three isolators both upstream and downstream of equipment on springs shall have a static deflection equal to 1.5 times that of the equipment isolators, up to a maximum of 2”. The static deflection of the remaining pipe isolators shall be 1”.

C. PIPES CONNECTED TO EQUIPMENT ON ELASTOMERIC ISOLATORS

1. Piping that is connected to machinery installed on elastomeric isolators only shall be either supported from the floor on Type DDNM mounts or suspended from the structure on Type DDNH hangers.

D. PIPES WITH MULTIPLE CONNECTIONS

1. Where a pipe run connects multiple items of equipment in the mechanical room the pipe isolators for the entire run shall be chosen to suit the connected equipment of greatest static deflection.

E. FLEXIBLE PIPING CONNECTORS

1. Flexible pipe connectors shall be installed to connect piping diameter 2” or greater to reciprocating or rotating equipment.

2. Install flexible piping connectors on the equipment side of the shut-off valve.

F. PIPING IN SHAFTS

1. Pipe riser guides, anchors and supports including piping anchors in mechanical equipment rooms or occupied spaces shall be isolated from the building structure such that there shall be no direct metal to metal contact of the piping with the building structure.

2. Piping in shafts requiring vibration isolation per the requirements of section 3.08.1 above shall be attached to the building structure through type PAM isolators, elastomeric riser guides, and resilient supports.

3. The pipe riser clamp at anchor points, shall be welded to the pipe and to pairs of type PAM mounts which in turn, shall be rigidly fastened to steel framing in the pipe shaft.

4. Where pipes rise in a vertical chase and require lateral bracing, elastomeric riser guides shall be mounted around the pipe to limit lateral movement and to prevent direct contact with the supporting structure.

5. Piping isolation supports at the base of risers shall be type MWP isolators. Suitable bearing plates sized to provide a pad loading of 500 psi maximum shall be provided. The stanchion between the
pipe and isolation support shall be welded to the pipe and welded or bolted to the isolation support. The isolation support shall be bolted to the floor slab with vibration isolation grommets.

G. PRESSURE REDUCING VALVES
   1. Pressure reducing valves and associated piping shall be suspended by or supported on type DDNH or type DDNM isolators for the lengths specified in section 3.08.1 above.

H. CONDENSER WATER PIPING
   1. Isolate all condenser water piping running inside the building between cooling towers and pumps with type SPNH isolators for all suspended piping and Type CSNM for floor or roof supported piping. All condenser water piping isolators shall have a nominal static deflection of 1 inch.

I. HVAC pipes crossing ACOUSTIC joints
   1. Any pipe crossing an acoustical joint shall have a flexible pipe connector at the joint and shall be suspended by vibration isolators as follows:
      a. Pipes with inner diameters less than 2” shall be suspended by Type DDNH isolators for a minimum distance of 20’ on each side of the joint.
      b. Pipes with an inner diameter of 2” or greater shall be suspended on Type SPNH isolators for a minimum distance of 20’ on the non-isolated structure and for the entire pipe length on the isolated structure.

3.09 DUCT VIBRATION ISOLATION
   A. Ducts shall be connected to fans, fan casings and fan plenums by means of flexible duct connectors. Flexible connectors shall be installed to prevent metal-to-metal contact across flexible connection. Flexible duct connectors shall not be used outside the mechanical room unless expressly shown on the drawings.
   B. Kitchen Exhaust Ducts
      1. Ceiling mounted ducts shall be supported on SPNH isolators
      2. Floor mounted ducts shall be supported on SPNM isolators
      3. Elastomeric riser guides shall be used if lateral restraint is required in shafts.

3.10 WIRING
   A. All wiring connections to mechanical equipment on vibration isolators (either spring or neoprene type) shall be made with flexible conduit having sufficient slack so as not to impede movement of equipment on isolators. This Contractor shall coordinate wiring connections with the Electrical Contractor.

3.11 FIELD QUALITY
   A. Contractor shall work in accordance with best trade practices, shall fabricate and install all items in accordance with manufacturer's recommendations and Architect's directions, and shall consult with trades doing adjoining work in order to provide an installation of first class quality.

3.12 ADJUSTMENT AND TESTING
   A. SITE ACCESS
      1. During installation of equipment, Contractor shall arrange for access as necessary for inspection of vibration isolation control equipment by Architect and his representatives.
   B. CONTRACTOR’S REPORT
      1. The vibration isolation vendor shall inspect and approve the installation of the vibration isolators and shall submit a report to the Owner that verifies that all of the isolation equipment has been properly installed and that the installation is in full conformance with the specification. The report shall record the vibration isolator identification and model or type. For isolators containing steel springs the report shall also record the size and uncompressed height, design static deflection and measured static deflection of the isolators provided.
C. CONSULTANT'S OBSERVATION

1. Notify the Architect in writing upon completing installation and adjustment for suitable operation of all work specified under this section. The letter shall certify that all work specified under this section is complete, operational and adjusted in every respect, and that all work is ready for the completion checkout. The notification letter shall be accompanied by a copy of the air balancing report and the vibration isolation report.

2. Upon notification of completion, Architect will schedule an observation by the Acoustics Consultant, who will measure the background noise level with all Mechanical Systems running.

3. For each inspection, Contractor shall perform such functions as are necessary for inspection of the equipment. Background noise level testing may be carried out during late-night hours when ambient noise from outside is at a minimum and the site is otherwise not occupied and no work is under way. Contractor shall turn on and off any and all mechanical equipment during such background noise level testing.

3.13 GUARANTEE

A. If, in the actual installation, any equipment fails to meet the vibration control requirements specified herein, that equipment shall be corrected or replaced without claim for additional payment, inclusive of all labor and material costs. Such corrective measures shall be done within a time schedule specified by the Owner.
<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>EQUIPMENT TAG</th>
<th>BASE TYPE</th>
<th>ISOLATOR TYPE</th>
<th>STATIC DEFLECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-Cooled Chiller</td>
<td>CH-1,2</td>
<td>CSNM</td>
<td></td>
<td>1”</td>
</tr>
<tr>
<td>Boiler</td>
<td>B-1,2</td>
<td>DDNM</td>
<td></td>
<td>0.4”</td>
</tr>
<tr>
<td>Floor-Mounted AHU’s</td>
<td>AHU-1,6,</td>
<td>SPNM</td>
<td>SPNM</td>
<td>1”</td>
</tr>
<tr>
<td></td>
<td>AHU-7</td>
<td></td>
<td></td>
<td>2”</td>
</tr>
<tr>
<td>Roof-Mounted AHU’s</td>
<td>AHU-2,3,4</td>
<td>CSNM</td>
<td>CSNM</td>
<td>2”</td>
</tr>
<tr>
<td>[IF CURB MOUNTED]</td>
<td>AHU-5</td>
<td>[CMB]</td>
<td></td>
<td>1”</td>
</tr>
<tr>
<td>Wall-mounted propeller fans</td>
<td>EF-1</td>
<td>SWP</td>
<td></td>
<td>0.1”</td>
</tr>
<tr>
<td>Small Roof-Mounted Mushroom Fans</td>
<td>EF2-8, EF10-11</td>
<td>DDNM (see</td>
<td>detail M010)</td>
<td>0.4”</td>
</tr>
<tr>
<td>Large Roof-Mounted Mushroom Fans</td>
<td>EF-9</td>
<td>SCMB</td>
<td></td>
<td>1”</td>
</tr>
<tr>
<td>Base-mounted pumps (3 hp or greater)</td>
<td>PCHWP-1,2, SCHWP-1,2</td>
<td>CIB</td>
<td>SPNM</td>
<td>1”</td>
</tr>
<tr>
<td>Floor-Mounted Air Compressor (Scene Shop)</td>
<td></td>
<td>SPNM</td>
<td></td>
<td>1”</td>
</tr>
<tr>
<td>Piping</td>
<td></td>
<td>Isolation per specification.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ducts</td>
<td></td>
<td>Isolation per specification.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION 23.05.48
SECTION 23.05.49
NOISE CONTROL FOR MECHANICAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this section.

1.02 WORK INCLUDED
A. Provide complete noise control systems as shown or specified and in accordance with the requirements of the Contract Documents. System shall be complete with:
1. Duct Silencers
2. Fan and Duct System Plenums
3. Sealing Around Penetrations Through Walls and Slabs

1.03 RELATED WORK SPECIFIED ELSEWHERE
A. Consult all other Section to determine the extent of work specified elsewhere but related to this Section. This work shall be properly coordinated to produce an installation satisfactory to the Owner. This work includes, but is not limited to the following:
1. Fans
2. Ductwork
3. Duct Insulation (External)
4. Internal (Acoustical) Duct Insulation
5. Pumps
6. Piping
7. Plumbing Fixtures
8. Heating and Cooling Equipment
9. Concrete Housekeeping Pads
10. Vibration Control for Mechanical Systems
11. Noise and Vibration Control for Electrical Systems
12. Sealant

1.04 CONTRACTOR'S RESPONSIBILITY
A. The Contractor shall be responsible for verifying the completeness of the installation and the overall suitability of the equipment to meet the intent of this specification. Any additional equipment needed to meet the intent of this specification, even if not specifically mentioned herein or in the Contract Documents, shall be supplied by the Contractor without claim for additional payment.
B. Performance or waiving of inspection, testing or surveillance for any portion of the Work shall not relieve the Contractor of the responsibility to conform strictly with the Contract Documents. The Contractor shall not construe performance or waiving of inspection, testing or surveillance by the Owner or Architects to relieve the Contractor from total responsibility to perform in strict accordance with the Contract Documents.

1.05 MANUFACTURER'S RESPONSIBILITY
A. Manufacturer of noise and control systems shall have the following responsibilities:
1. Provide piping and equipment isolation systems as scheduled or specified.
2. Provide installation instructions, drawings and field supervision to assure proper installation and performance.
1.06 BID PROPOSALS
A. The Contractor shall submit at the time of bidding the names and qualifications of the noise control equipment supplier(s). If a supplier is not one of the pre approved vendors, then the submittal shall be accompanied by a complete catalog of that supplier’s products.

B. Contractor shall submit at the time of bidding the design sound power level of each air moving device (including fans and package air handlers) as described in the Contract Documents. If the actual sound power generated by any device exceeds in any octave band the specified sound power levels for the equipment specified in the Contract Documents, the contractor shall include in his price system modifications as required to compensate for the additional noise at no expense to the Owner. Any such system modification shall be subject to review and approval.

C. If the standard sizes of silencers offered by the silencer supplier do not provide attenuation equal to or greater than the insertion loss specified in the schedule in each octave band 1 through 6, then at the time of bidding the supplier shall note all such discrepancies and propose how to make up the difference within the bid quote. The controlling requirements are the insertion loss, pressure drop and self-noise.

1.07 SUBMITTALS
A. Contractor shall submit fully coordinated shop drawings for all noise control equipment. These submittals shall state the acoustical performance of the products as described below.

B. Sheet Metal: Coordinated shop drawings at 1/4” = 1’-0” minimum scale shall be submitted for review and approval to indicate the following:
1. Length, width, height, and elevation of bottom of each duct segment.
2. Sheet metal gauge
3. Location of duct silencers, fire dampers, and balancing dampers.
4. Transition segments marked with entrance and exit sizes, as well as length and elevation. Markings should indicate which sides are held level, and which ones slope.
5. If a duct segment is offset in the horizontal or vertical direction, this information must be noted.
6. Duct lining thickness.
7. Any restraints or points of conflict due to existing conditions or planned piping, conduit, structure, or finish which will interfere with the installation of the ductwork.

C. Air moving devices (Supply, return and exhaust fans, package AHU’s): Submit sound power levels in octave bands from 63 Hz through 8000 Hz inclusive for the operating conditions specified. Data shall be obtained in accordance with AMCA 300-85. If fans are variable speed, provide sound power level data for maximum rpm and also at 80% and 60% of maximum rpm. Provide discharge, inlet and case-radiated sound power data for all fans.

D. Submit for each fan a performance curve showing the operating point for which the acoustical data has been provided.

E. Cooling Towers: Submit sound pressure levels in octave bands from 63 Hz to 8000 Hz inclusive measured at 5’ and 50’ in 4 cardinal directions and vertically above the top of the unit. Data shall be obtained in accordance with ANSI 12.34-1988.

F. Silencers: Submit test data from an independent laboratory showing the insertion loss and air flow regenerated noise of the specified silencers in octave bands from 63 Hz to 8000 Hz, measured in accordance with ASTM E477-73. Pressure drop ratings shall be measured for the same silencer tested for acoustical performance; the data shall be submitted with the acoustical performance data. The insertion loss of the silencers shall be measured and reported in octave band or 1/3-octave bands.

G. Acoustical Louvers: Submit test data from an independent laboratory showing the insertion loss and air flow regenerated noise of the specified louvers in octave bands from 63 Hz to 8000 Hz, measured in accordance with ASTM E477-73. Pressure drop ratings shall be measured for the same louver tested for acoustical performance; the data shall be submitted with the acoustical performance data. The insertion loss of the louvers shall be measured and reported in octave band or 1/3-octave bands. Submittal shall include assembly drawings and details of joints and fittings to be used in the installation.
H. Prefabricated Plenum Panels: Submit test data from an independent accredited laboratory indicating sound transmission loss performance of panel system in accordance with ASTM-E90 and sound absorption performance of panels, vision ports and access doors in accordance with ASTM C423. Submittal shall include assembly drawings and details of joints and fittings to be used in the installation.

I. Grilles and diffusers, variable air volume boxes and dual conduit boxes: Submit shop drawings complete with sound power levels generated by each terminal device at the air flow and pressure drop specified in the contract documents.

1.08 NOISE CRITICAL SPACES

A. Many areas of the building, referred to as “noise-critical spaces”, require special attention (special acoustical provisions and restrictions). The table below designates the noise-critical spaces; noise levels due to equipment, ductwork, grilles, registers, terminal devices, diffusers, etc., shall permit attaining sound pressure levels in all 8 octave bands in occupied spaces conforming to RC levels per ASHRAE handbook as indicated.

<table>
<thead>
<tr>
<th>Space</th>
<th>RC Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditorium</td>
<td>See below</td>
</tr>
<tr>
<td>Studio Theatre</td>
<td>20</td>
</tr>
<tr>
<td>Recital Hall</td>
<td>See below</td>
</tr>
<tr>
<td>Large Instrumental Rehearsal</td>
<td>25</td>
</tr>
<tr>
<td>Choir Rehearsal</td>
<td>25</td>
</tr>
<tr>
<td>Percussion Rehearsal—Large</td>
<td>25</td>
</tr>
<tr>
<td>Music Offices/Percussion Music Offices</td>
<td>30</td>
</tr>
<tr>
<td>Green Rooms</td>
<td>30</td>
</tr>
<tr>
<td>Lobby</td>
<td>40</td>
</tr>
<tr>
<td>Percussion Rehearsal—Small</td>
<td>35</td>
</tr>
<tr>
<td>Lobby</td>
<td>40</td>
</tr>
<tr>
<td>Mechanical/Electrical/IT/Telecom</td>
<td>N/A</td>
</tr>
</tbody>
</table>

The Auditorium and Recital Hall shall have octave band sound pressure levels no greater than the following values: (in dB re: 2 x 10^-5 Pascals):

<table>
<thead>
<tr>
<th>Octave Band</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1k</th>
<th>2k</th>
<th>4k</th>
<th>8k</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPL</td>
<td>39</td>
<td>30</td>
<td>25</td>
<td>20</td>
<td>15</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

B. Penetrations by ducts, pipes and conduit between noise critical spaces shall be sleeved, packed and sealed airtight with non-hardening sealant as described herein.

1.09 QUALITY ASSURANCE

A. It is the objective of this Specification to provide for the control of noise due to the operation of machinery or equipment, and/or due to interconnected piping, ductwork or conduit.

B. The installation of all noise control systems shall be under the supervision of the manufacturer's representative.

C. All prefabricated duct silencers shall be furnished by a single manufacturer with a minimum five years experience. The following manufacturers are approved provided equipment is in compliance with the specified design and performance requirements:

1. Vibro-Acoustics
2. Kinetics Noise Control
D. All prefabricated acoustical plenums shall be furnished by a single manufacturer with a minimum five years experience. The following manufacturers are approved, provided equipment is in compliance with the specified design and performance requirements:
   1. Vibro-Acoustics
   2. Kinetics Noise Control

E. The following duct liner manufacturers are approved, provided the product is in compliance with the specified design and performance requirements:
   1. Certainteed
   2. Owens Corning
   3. Knauf

PART 2 - PRODUCTS

2.01 GENERAL
   A. All equipment provided for noise control shall be new and manufactured specifically for the purpose intended.

2.02 INTERNAL ACOUSTICAL DUCT LINING
   A. The liner shall meet the Life Safety Standards as established by NFPA 90A and 90B, FHC 25/50 and Limited Combustibility and the airstream surface coating should contain an immobilized, EPA-registered, anti-microbial agent so it will not support microbial growth as tested in accordance with ASTM G21 and G22. The duct liner shall conform to the requirements of ASTM C 1071, with an NRC not less than .70 as tested per ASTM C 423 using a Type “A” mounting, and a thermal conductivity no higher than 0.25 Btu•in/hr•ft2•°F (0.039 W/m•°C) at 75°F (24°C) mean temperature. Duct liner shall comply with the requirement of NFPA 90A and the “Duct Liner Materials Standard” of the Thermal Insulation Manufacturer’s Association. Duct lining shall incorporate means to prevent fiber entrainment in the air stream.
   B. Duct lining shall have minimum density of 3.0 pcf.
   C. Sizes shown on the drawings are free area dimensions (after installation of duct liner)
   D. Acceptable product for lining rectangular section ducts and plenums: Shuller “Permacote Linacoustic” or approved equal.

2.03 FOAM ROD
   A. Foam backer rod shall be closed cell polyethylene suitable for use as a backing for non hardening sealant.

2.04 NON HARDENING SEALANT
   A. Sealant for penetrations shall be non-hardening polysulphide type.
   B. Permanently flexible, approved firestop putty may be used in lieu of the sealant on foam rod in noise critical walls that are also fire rated.

2.05 PACKING MATERIAL FOR PENETRATIONS
   A. Mineral fiber; non-combustible; resistant to water, mildew and vermin. Expanding resilient foams manufactured for this purpose are an acceptable alternative only if the material density is at least 15 pcf (40 kg/m3).

2.06 ACOUSTICAL LOUVERS
   A. Outer casing shall be of 16 gauge galvanized steel. Louver baffles shall be of airfoil configuration and be made of 22-gauge galvanized steel. Louvers shall be packed with inter, vermin and moisture proof
mineral fiber and provide the acoustical performance as indicated on the Drawings or specified herein. Louvers shall be factory primed for field finish painting.

B. Static pressure drop shall not exceed 0.25” at application design air flow. Manufacturer shall submit certified laboratory test data substantiating both the specific acoustical and aerodynamic performance.

C. Acoustical Louver shall have the following minimum Transmission Loss (TL) values in dB:

<table>
<thead>
<tr>
<th>Octave Band</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1k</th>
<th>2k</th>
<th>4k</th>
<th>8k</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL</td>
<td>5</td>
<td>7</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>12</td>
<td>9</td>
</tr>
</tbody>
</table>

2.07 FIRE DAMPERS

A. Fire dampers shall be a type with the blade stored out of the air stream.

2.08 FLEXIBLE DUCT CONNECTORS

A. Flexible sleeves for duct connections shall be fabricated from flexible, airtight, flame-retarded or noncombustible fabrics, coating, and adhesives complying with UL Standard 181 Class 1.

B. Extra-Wide Metal-Edged Connectors: Factory-fabricated with a strip of fabric 5-3/4” wide attached to 2 strips of 2-3/4” wide, 24-gauge galvanized sheet steel or 0.032-gauge aluminum sheets. Select metal compatible with connected duct system. Fold and crimp metal edge strips onto fabric as illustrated in SMACNA HVAC Duct Standard, 1st Edition, Figure 2-19.

   a. Minimum Weight: 26 oz per square yard
   b. Tensile Strength: 480 lb per inch in the wrap and 360 lb per inch in the filling.

2.09 DUCT SILENCERS

A. Rectangular duct silencers shall have outer casings of not less than 22-gauge galvanized steel. Seams shall be lock formed and mastic filled. The internal baffles (splitters) shall be not less than 24-gauge galvanized perforated steel having an open area of about 30%. The nosings shall be full radius or airfoil shape.

B. The sound absorbing media shall be not less than 4.5 pcf glass/mineral fiber packed under 5% compression. The fiber fill shall be incombustible, mildew resistant and vermin proof. The sound absorbing material shall be protected from erosion.

C. If the silencer is installed in a location exposed to water or weather, the fill shall be completely encapsulated in Mylar bagging. The Mylar bagging shall not degrade the acoustical performance of the silencer.

D. If the silencer is supplied in modular sections, the silencer shall meet or exceed the specification for single module silencers with respect to insertion loss, pressure drop, regenerated noise and air leakage.

2.10 PREFABRICATED PLENUM PANELS

A. Construction: 4” thick sandwich construction, manufactured from 16-gauge galvanized steel outer leaf and 22-gauge galvanized perforated steel inner leaf with an open area of 30%, with the perforations equally distributed over the full area of the inner leaf. Panel shall be internally stiffened using minimum 16-gauge steel channel stiffeners. Internal fill shall be 6 pcf density glass or mineral fiber packed under 10% compression.

B. Panels shall be joined together with minimum 16-gauge galvanized steel “H” members

C. Construction shall be self-supporting without the need for additional bracing or structure. Plenums shall be structurally designed to avoid excessive deflection or bowing and shall be sealed to prevent air leakage when subjected to 2000 Pa. differential pressure between inside and outside of plenum.

D. All openings for ductwork, piping, connectors, flanges, etc. shall be framed airtight with a minimum of 16-gauge galvanized steel.
E. Acoustical Criteria

Sound Transmission Loss: The octave band sound transmission loss of prefabricated plenum panels shall meet or exceed the following values measured in an accredited acoustical laboratory in dB:

<table>
<thead>
<tr>
<th>Octave Band</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>26</td>
<td>23</td>
<td>30</td>
<td>42</td>
<td>51</td>
<td>59</td>
<td>58</td>
<td>58</td>
</tr>
</tbody>
</table>

Sound Absorption: The octave band sound absorption coefficients of prefabricated plenum panels shall meet or exceed the following values as measured in an accredited acoustical laboratory in accordance with ASTM C423:

<table>
<thead>
<tr>
<th>Octave Band</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>NRC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.89</td>
<td>1.2</td>
<td>1.16</td>
<td>1.09</td>
<td>1.01</td>
<td>1.03</td>
<td>0.93</td>
<td>0.95</td>
</tr>
</tbody>
</table>

2.11 AIR TERMINAL UNITS

A. Unit manufacturer shall furnish when requested certified sound power levels for both discharged air and casing radiated sound in each of the second through sixth octave bands for every unit furnished with inlet pressures of 3/4", 1-1/2" and 3" w.g. determined in accordance with ASHRAE Standard 36-72, latest publication. Room sound levels [RC or NC] shall be shown for each unit for design CFM and inlet pressures of 3/4", 1-1/2" and 3" w.g. for both discharged air and casing radiated sound power sources. Terminal unit discharge and radiated sound levels shall not cause occupied space sound pressure levels to exceed scheduled levels shown below.

B. The maximum permissible sound-power levels in octave bands for airborne sound transmission through the combination of grilles, register, diffusers for terminal units, related pressure reducing devices, or fans when operated in installed condition per plans and specifications, shall be as follows:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>56</td>
<td>58</td>
<td>60</td>
<td>62</td>
<td>66</td>
</tr>
<tr>
<td>2</td>
<td>47</td>
<td>50</td>
<td>53</td>
<td>56</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td>37</td>
<td>41</td>
<td>45</td>
<td>49</td>
<td>54</td>
</tr>
<tr>
<td>4</td>
<td>31</td>
<td>36</td>
<td>41</td>
<td>46</td>
<td>51</td>
</tr>
<tr>
<td>5</td>
<td>28</td>
<td>33</td>
<td>38</td>
<td>43</td>
<td>48</td>
</tr>
<tr>
<td>6</td>
<td>27</td>
<td>32</td>
<td>37</td>
<td>42</td>
<td>47</td>
</tr>
<tr>
<td>7</td>
<td>26</td>
<td>31</td>
<td>36</td>
<td>41</td>
<td>46</td>
</tr>
<tr>
<td>8</td>
<td>27</td>
<td>32</td>
<td>37</td>
<td>42</td>
<td>47</td>
</tr>
</tbody>
</table>

C. The maximum permissible radiated sound power levels in octave bands for all terminal units, related pressure reducing boxes, or fans when operated in installed condition concealed in a ceiling over occupied spaces, shall be as follows:

<table>
<thead>
<tr>
<th>Octave Bands</th>
<th>RC-30</th>
<th>RC-35</th>
<th>RC-40</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>68</td>
<td>72</td>
<td>76</td>
</tr>
<tr>
<td>2</td>
<td>64</td>
<td>688</td>
<td>72</td>
</tr>
<tr>
<td>3</td>
<td>56</td>
<td>61</td>
<td>65</td>
</tr>
<tr>
<td>4</td>
<td>54</td>
<td>58</td>
<td>62</td>
</tr>
<tr>
<td>5</td>
<td>51</td>
<td>55</td>
<td>60</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>54</td>
<td>58</td>
</tr>
<tr>
<td>7</td>
<td>55</td>
<td>64</td>
<td>68</td>
</tr>
<tr>
<td>8</td>
<td>60</td>
<td>65</td>
<td>70</td>
</tr>
</tbody>
</table>

D. Boxes are not to be installed concealed in ceilings of spaces requiring less than RC-30 ambient noise levels as scheduled this Section.
2.12 AIR HANDLING UNITS
A. Units shall be tested by an independent acoustical testing laboratory having NVLAP certification in accordance with AHRI-260 (2001). The test setup shall be determined to most closely approximate the actual configuration of scheduled equipment.

B. Octave band sound pressure levels from 63 Hz to 8000 Hz for radiated, discharge, inlet, outside air, and exhaust air noise from all scheduled fan equipment shall be submitted for review and approval.

C. Sound power levels for specific fan equipment shall not exceed the ducted discharge, return air, outside air, exhaust air, and casing radiated data listed for AHUs 1-7 on sheet M002 (in dB re: 10^-12 watts):

2.13 FANS
A. Units shall be tested by an independent acoustical testing laboratory having NVLAP certification in accordance with AMCA Standard 300-85. The test setup shall be determined to most closely approximate the actual configuration of scheduled equipment.

B. Octave band sound pressure levels from 63 Hz to 8000 Hz for radiated, discharge and inlet noise from all scheduled fan equipment shall be submitted for review and approval.

C. Sound power level for specific fan equipment shall not exceed the following (in dB re: 10^-12 watts):

<table>
<thead>
<tr>
<th>Octave Band</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center Frequency (Hz)</td>
<td>63</td>
<td>125</td>
<td>250</td>
<td>500</td>
<td>1k</td>
<td>2k</td>
<td>4k</td>
<td>8k</td>
</tr>
<tr>
<td>EF-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EF-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PART 3 - EXECUTION

3.01 GENERAL
A. Piping, ductwork, conduit or mechanical equipment shall be supported from building structure, not hung from or supported on other equipment, pipes, or ductwork.

3.02 FLEXIBLE DUCT CONNECTORS
A. Ducts shall be connected to fans, fan casings and fan plenums by means of flexible connectors. Flexible connectors shall be installed to prevent metal-to-metal contact across flexible connection. Flexible duct connectors shall not be used outside the mechanical room unless expressly shown on the drawings.

3.03 DUCT SILENCERS
A. Duct silencers shall be furnished and installed as shown on the mechanical drawings and as called for in the silencer schedule.

B. Unless otherwise specified, the insertion loss of the duct silencers shall be not less than the values shown below.

<table>
<thead>
<tr>
<th>Silencer</th>
<th>Dynamic Insertion Loss (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tag</td>
<td>Serves</td>
</tr>
<tr>
<td>SA-1</td>
<td>S</td>
</tr>
</tbody>
</table>

C. The pressure drop across the duct silencers shall not exceed the values scheduled on the drawings.

D. Unless otherwise specified, the self noise of the duct silencers shall be not more than the following values at an air velocity of 1000 fpm in the direction of sound propagation.

Octave-Band Self-Noise Power Levels in dB at the following frequencies:

<table>
<thead>
<tr>
<th>Face Area</th>
<th>63Hz</th>
<th>125Hz</th>
<th>250Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 sq.ft.</td>
<td>38</td>
<td>26</td>
<td>30</td>
</tr>
<tr>
<td>4 sq.ft.</td>
<td>41</td>
<td>29</td>
<td>33</td>
</tr>
</tbody>
</table>
3.04 DUCTWORK FABRICATION
A. Fabricate ductwork so as to be free from vibration, rattle or drumming under all operating conditions; provide all materials necessary for specified construction, whether or not they are specifically called for or detailed on the drawings.

3.05 BRACING OF DUCTWORK
A. Do not install tie rods within ducts serving noise critical spaces.

3.06 ACOUSTICAL LINING OF DUCTS
A. Ducts, except where noted otherwise, shall be acoustically lined internally, from the air moving device to the terminal. Both supply and return systems shall be lined unless otherwise specified. Exhaust ducts shall be internally lined where shown on the drawings to reduce sound transmission.
B. Other ductwork shall be acoustically lined where shown on the drawings.
C. Acoustical duct lining shall be 2” thick in ducts within ME Rooms, buried below the Theater slab, in risers serving the Theater, and where shown on the drawings. Acoustical duct lining shall be 1” thick in all other internally lined sheet metal ducts, unless otherwise specified or shown on the drawings.
D. The acoustical liner shall be fixed to the duct with a minimum of 50% coverage of a fire resistant adhesive. Where the duct width exceeds 12” or the height 24”, the liner shall be additionally secured with mechanical fastening on maximum 16” centers on all sides. Mechanical fasteners that pierce the duct are unacceptable. All ends of the liner shall be coated with a fire resistant cementing material to prevent delamination, leakage or erosion. All joints shall be firmly butted and ends coated with an adhesive to ensure that the lining is smooth across all joints.
E. Where acoustical duct lining is installed, the dimensions of the sheet metal shall be increased to include the thickness of the lining material. Dimensions shown on the mechanical drawings are the clear internal dimensions after the liner has been installed.

3.07 ACOUSTICAL PLENUMS
A. Unless otherwise specified, acoustical plenums shall be lined with 4” glass or mineral fiber duct liner. Two layers of 2” lining is acceptable as an alternative to a single layer of 4” lining.

3.08 SHEET METAL AND PIPING PENETRATIONS OF SHAFTS, FLOOR SLAB AND/OR PARTITIONS
A. There shall be no direct contact of Sheet Metal or piping with shaft walls, floor slabs and/or partition.
B. All openings around pipes and ducts in the structure surrounding the mechanical equipment and surrounding noise-critical spaces shall be sealed packed with caulking for the full depth of the penetration, as described herein, and as shown on the drawings. This includes all slab penetrations and penetrations of noise critical walls.

3.09 DUCT PENETRATIONS
A. Where each duct passes through a wall, floor or ceiling, there shall be a clear annular space of 1” between the duct and structure. After all of the ductwork is installed the Contractor shall check the clearance, pack the voids full depth with mineral fiber batt insulation and caulk both ends with a non aging, non hardening sealant backed by a polyethylene foam rod or permanently flexible firestop material. Where there is not sufficient access space to pack around all sides of a duct (for example, at the underside of a slab), place a short stub duct in the wall, pack and caulk around it and then attach the inlet and outlet ducts to each end.
3.10 PIPE PENETRATIONS
A. HVAC, Domestic Water, Sewer, Drain And Vent Piping - Where a pipe passes through a wall, ceiling, or floor slab, a steel sleeve shall be cast or grouted into the structure. The internal diameter of the sleeve shall be 2” larger than the external diameter of the pipe passing through it. After all of the piping is installed in that area, the Contractor shall check the clearance and correct it, if necessary, to within 1/2”. Then the void shall be packed full depth with glass/mineral fiber and sealed at both ends, 1” deep, with sealant backed by foam rod.

B. Sprinkler Pipes
1. Fire protection and compressed air pipes may be sleeved and sealed as described above, or may be grouted and caulked into the structure as follows: before grout has set, rake a groove around the pipe on each side of the wall or slab; groove shall be 1/2” wide and 1/2” deep. After grout has set, fill groove full depth with sealant.
2. Penetration of sound isolating ceilings by sprinkler pipes and heads shall be sleeved and sealed as described herein. There shall be no rigid connection between ceiling and pipes or heads.

3.11 DAMPERS
A. Dampers shall be installed only where shown on the drawings or approved by the acoustics consultant. All variations in damper locations must be approved in writing by the acoustics consultant.

3.12 ELBOWS
A. All rectangular or round ductwork shall have full radius elbows or except where mitered elbows are shown on the drawings.

B. Where space limitations prevent the installations of full radius elbows, short radius elbows with a minimum two continuous splitter vanes shall be installed. Vane length shall be the entire length of the bend, or 36”, whichever is greater. Provide separate equal size sections for greater lengths.

3.13 CONTROLS
A. Pneumatic thermostats shall not be located in noise critical spaces.

B. Self-timers for mechanical systems shall not be located in noise critical spaces.

3.14 FIELD QUALITY
A. Contractor shall work in accord with best trade practices, shall fabricate and install all items in accordance with manufacturer’s recommendations and Architect’s directions, and shall consult with trades doing adjoining work in order to provide an installation of first class quality.

3.15 ADJUSTMENT AND TESTING
A. Site Access
1. During installation of equipment, Contractor shall arrange for access as necessary for inspection of isolation and noise control equipment by Architect and his representatives.

B. Consultant's Inspection
1. Upon completing installation and adjustment for suitable operation of all work specified under this section, the Contractor shall notify the Architect in writing. The letter shall certify that all work specified under this section is complete, operational and adjusted in every respect, and that all work is ready for the completion checkout. The notification letter shall be accompanied by a copy of the air balancing report and the vibration isolation report.
2. Upon notification of completion, Architect will schedule an inspection by the Acoustics Consultant, who will measure the background noise level with all Mechanical Systems running.
3. For each inspection, Contractor shall perform such functions as are necessary for inspection of the equipment. Background noise level testing must be carried out during late-night hours when ambient noise from outside is at a minimum and the site is otherwise not occupied and no work is
under way. Contractor shall turn on and off any and all mechanical equipment during such background noise level testing.

3.16 GUARANTEE

A. If, in the actual installation, any equipment fails to meet the noise control requirements specified herein, that equipment shall be corrected or replaced without claim for additional payment, inclusive of all labor and material costs. Such corrective measures shall be done within a time schedule specified by the Owner.

END OF SECTION 23.05.49
SECTION 23.05.53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY (Not Applicable)

PART 2 - PRODUCTS

2.01 NAMEPLATES AND TAGS
   A. Acceptable manufacturers: Seton Nameplate Corporation or Marking Services Inc.
   B. Rigid plastic, "Setonite" or bakelite with engraved lettering, minimum 1/2" high.

2.02 PIPE MARKERS
   A. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering.

2.03 PIPE IDENTIFICATION
   A. Identify piping with Snap-on or Strap-on type markers as manufactured by Seton or approved substitute. Indicate contents of pipe and direction of flow on marker. Install markers on piping not more than 20 feet apart, at valves, access panels and above each space. Identify chilled water and hot water piping.
   B. All piping in equipment rooms and concealed in accessible spaces (such as piping above lay-in ceiling space) shall be labeled to identify contents and direction of flow.

2.04 EQUIPMENT AND APPARATUS IDENTIFICATION
   A. Acceptable Manufacturers: Seton Name Plate Corporation or equal.
   B. Nameplates: Rigid plastic, "Setonite" or bakelite, with engraved lettering (indicating names and numbers of mechanical apparatus), a minimum of 1/2" high. Fill engraved lettering with a permanent coloring material which contrasts with color of tag material to allow for easy reading.
   C. Use names, numbers, and abbreviations appearing in schedules on Contract Drawings.
   D. Provide nameplates, located in a conspicuous location directly on the equipment or apparatus, for mechanical equipment including, but not limited to:
      1. Chillers
      2. Boilers
      3. Air Handling Units
      4. Variable Volume Terminals
      5. Starters
      6. Variable Frequency Drives
      7. Pumps
      8. Fans
      9. Fan Coil Units
     10. HVAC Equipment
     11. Control Panels
   E. Equipment Tags: Commercial quality, rust resisting nuts and bolts with backwashers, self-tapping screws, or rivets. Identification tags shall be constructed of engraving stock melamine plastic laminate, 1/8" minimum thickness, black and white core (letter color) punched for mechanical fastening. Letter height shall be minimum 1/2" tall.
F. Control Diagram Frames:
   1. Seton Name Plate Corporation, No. 111P aluminum frames, or equal by Brady or Avery, with "plexiglass" or "lucite" glazing.
   2. Provide control and systems instructions and diagrams, framed and glazed with specified items. Mount framed diagrams on walls in conspicuous, easily accessible places in each separate mechanical room housing an A/C systems to which the individual diagrams are applicable. The following instructions and diagrams are required:
      a. Control diagrams.
      b. Wiring diagrams.
      c. Sequence of operation, where applicable.
   3. Diagrams and instructions may be reduced in size provided they are easily readable and lettering is not smaller than "10 pt." type.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23.05.53
SECTION 23.05.93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SERVICES

A. The balancing agency shall inspect the installation of the piping systems, sheet metal work, and the temperature controls. A minimum of two inspections shall be performed periodically as work progresses.
   1. When 50 percent of the ductwork and piping is installed.
   2. When 50 percent of the equipment is installed.

B. Perform test and balance in accordance with AABC or NEBB Standards.

C. The TAB Contractor shall work with the Control Contractor to assist in calibrating all airflow and water flow stations and duct and pipe mounted differential pressure sensors and duct mounted temperature sensors.

D. The Contractor shall provide Test and Balance Agency with copy of plans and specifications of Construction Documents. The Contractor shall correct prompt deficiencies of materials and workmanship identified as delaying the completion of the TAB work. The Contractor shall be responsible for any additional costs to the Owner resulting from his failure to have the HVAC systems and Building ready or from his failure to correct deficiencies promptly.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.
   1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
   2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems,” or in SMACNA’s "HVAC Systems - Duct Design.” Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.
I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine variable-air-volume boxes, and hot water coils. Verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:
   a. Duct systems are complete with terminals installed.
   b. Volume fire dampers are open and functional.
   c. Clean filters are installed.
   d. Fans are operating, free of vibration, and rotating in correct direction.
   e. Variable-frequency controllers' startup is complete and safeties are verified.
   f. Automatic temperature-control systems are operational.
   g. Ceilings are installed.
   h. Windows and doors are installed.
   i. Suitable access to balancing devices and equipment is provided.

2. Hydronics:
   a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
   b. Piping is complete with terminals installed.
   c. Water treatment is complete.
   d. Systems are flushed, filled, and air purged.
   e. Strainers are pulled and cleaned.
   f. Control valves are functioning per the sequence of operation.
   g. Shut off and balance valves have been verified to be 100 percent open.
   h. Pumps are started and proper rotation is verified.
   i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
   j. Variable-frequency controllers' startup is complete and safeties are verified.
   k. Suitable access to balancing devices and equipment is provided.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
   1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
   2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233713 "Sheet Metal Specialties."
   3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation" and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 and 233115.

3.05 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:
   1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
   2. Verify that the system is under static pressure control.
   3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
   4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:
      a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
      b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
      c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
      d. Adjust controls so that terminal is calling for minimum airflow.
3.06 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
   1. Check liquid level in expansion tank.
   2. Check highest vent for adequate pressure.
   3. Check flow-control valves for proper position.
   4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
5. Verify that motor starters are equipped with properly sized thermal protection.
6. Check that air has been purged from the system.

### 3.07 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

**A.** Adjust pumps to deliver total design gpm.
   1. Measure total water flow.
      a. Position valves for full flow through coils.
      b. Measure flow by main flow meter, if installed.
      c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
   2. Measure pump TDH as follows:
      a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
      b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
      c. Convert pressure to head and correct for differences in gage heights.
      d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
      e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.


**B.** Adjust flow-measuring devices installed in mains and branches to design water flows.
   1. Measure flow in main and branch pipes.
   2. Adjust main and branch balance valves for design flow.
   3. Re-measure each main and branch after all have been adjusted.

**C.** Adjust flow-measuring devices installed at terminals for each space to design water flows.
   1. Measure flow at terminals.
   2. Adjust each terminal to design flow.
   3. Re-measure each terminal after it is adjusted.
   4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
   5. Perform temperature tests after flows have been balanced.

**D.** For systems with pressure-independent valves at terminals:
   1. Measure differential pressure and verify that it is within manufacturer's specified range.
   2. Perform temperature tests after flows have been verified.

**E.** Verify final system conditions as follows:
   1. Re-measure and confirm that total water flow is within design.
   2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
   3. Mark final settings.

**F.** Verify that memory stops have been set.

### 3.08 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

**A.** Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals, and proceed as specified above for hydronic systems.

**B.** Adjust the variable-flow hydronic system as follows:
   1. Verify that the differential-pressure sensor is located as indicated.
   2. Determine whether there is diversity in the system.

**C.** For systems with no diversity:
   1. Adjust pumps to deliver total design gpm.
      a. Measure total water flow.
1) Position valves for full flow through coils.
2) Measure flow by main flow meter, if installed.
3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
   b. Measure pump TDH as follows:
      1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
      2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
      3) Convert pressure to head and correct for differences in gage heights.
      4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer’s pump curve at zero flow and verify that the pump has the intended impeller size.
      5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

2. Adjust flow-measuring devices installed in mains and branches to design water flows.
   a. Measure flow in main and branch pipes.
   b. Adjust main and branch balance valves for design flow.
   c. Re-measure each main and branch after all have been adjusted.

3. Adjust flow-measuring devices installed at terminals for each space to design water flows.
   a. Measure flow at terminals.
   b. Adjust each terminal to design flow.
   c. Re-measure each terminal after it is adjusted.
   d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
   e. Perform temperature tests after flows have been balanced.

4. For systems with pressure-independent valves at terminals:
   a. Measure differential pressure and verify that it is within manufacturer’s specified range.
   b. Perform temperature tests after flows have been verified.

5. Prior to verifying final system conditions, determine the system differential-pressure set point.

6. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.

7. Mark final settings and verify that all memory stops have been set.

8. Verify final system conditions as follows:
   a. Re-measure and confirm that total water flow is within design.
   b. Re-measure final pumps’ operating data, TDH, volts, amps, and static profile.
   c. Mark final settings.

9. Verify that memory stops have been set.

3.09 TOLERANCES
A. Set HVAC system’s airflow rates and water flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
   2. Air Outlets and Inlets: Plus or minus 5 percent.
   3. Heating-Water Flow Rate: Plus or minus 5 percent.
   4. Cooling-Water Flow Rate: Plus or minus 5 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.
3.10 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   2. Include a list of instruments used for procedures, along with proof of calibration.
   3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Pump curves.
   2. Fan curves.
   3. Manufacturers’ test data.
   4. Field test reports prepared by system and equipment installers.
   5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:
   1. Title page.
   2. Name and address of the TAB specialist.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address.
   9. Signature of TAB supervisor who certifies the report.
   10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
   11. Summary of contents including the following:
       a. Indicated versus final performance.
       b. Notable characteristics of systems.
       c. Description of system operation sequence if it varies from the Contract Documents.
   12. Nomenclature sheets for each item of equipment.
   13. Data for terminal units, including manufacturer's name, type, size, and fittings.
   14. Notes to explain why certain final data in the body of reports vary from indicated values.
   15. Test conditions for fans and pump performance forms including the following:
       a. Settings for outdoor-, return-, and exhaust-air dampers.
       b. Conditions of filters.
       c. Cooling coil, wet- and dry-bulb conditions.
       d. Fan drive settings including settings and percentage of maximum pitch diameter.
       e. Settings for supply-air, static-pressure controller.
       f. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
   1. Quantities of outdoor, supply, return, and exhaust airflows.
   2. Water flow rates.
   3. Duct, outlet, and inlet sizes.
   4. Pipe and valve sizes and locations.
   5. Terminal units.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
   1. Unit Data:
a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer’s serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:
a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).

3. Test Data (Indicated and Actual Values):
a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Chiller test forms - Record the following items for each chiller:
1. Manufacturer, model number, and serial number
2. All design and manufacturer's rated data.
3. Rated and actual pressure drop across evaporators and condensers and related GPM.
4. Entering and leaving water temperatures for the evaporator and condenser.
5. Rated and actual operating current and voltage.

G. Chiller:
1. Record full load entering and leaving chilled water temperatures with glass stem, mercury thermometers accurate to 1/2 degree F.
2. Record GPM at time of test.
3. Record amperage and voltage.
4. Perform log-test for a minimum of one hour taking readings at least every ten minutes.
5. Average all readings and compute test capacity in BTU/HR, and in tons.
6. Average all readings and compute actual kw/ton of chiller.

H. Boiler test forms - Record the following items on each boiler test form:
1. Manufacturer and model number.
2. All design and manufacturer's rated data.
3. Service and location.
4. Actual pressure drop and related GPM, primary side.
5. Actual pressure drop and related GPM, secondary side.
6. Primary side entering and leaving temperatures.
7. Secondary side entering and leaving temperatures.
8. Temperature control setting.

I. Pump test forms - Submit pump curve showing design - operating - and no-flow points of operation. Also, record the following items on each pump test form:
1. Manufacturer, size, and serial number.
2. All design and manufacturer’s rated data.
3. Pump operating suction and discharge pressure and final total dynamic head.
4. No flow (pump discharge valve closed) suction and discharge pressure and corresponding total dynamic head. This procedure is to determine actual impeller size.
5. Rated and actual operating current, voltage, and brake horsepower of each pump motor as well as starter and heater data.

J. Apparatus-Coil Test Reports:
1. Coil Data:
   a. System identification.
   b. Location.
   c. Coil type.
   d. Number of rows.
   e. Fin spacing in fins per inch o.c.
   f. Make and model number.
   g. Face area in sq. ft.
   h. Tube size in NPS (DN).
   i. Tube and fin materials.
   j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
   a. Airflow rate in cfm.
   b. Average face velocity in fpm.
   c. Air pressure drop in inches wg.
   d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
   e. Return-air, wet- and dry-bulb temperatures in deg F.
   f. Entering-air, wet- and dry-bulb temperatures in deg F.
   g. Leaving-air, wet- and dry-bulb temperatures in deg F.
   h. Water flow rate in gpm (L/s).
   i. Water pressure differential in feet of head or psig.
   j. Entering-water temperature in deg F.
   k. Leaving-water temperature in deg F.

K. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and size.
   e. Manufacturer’s serial number.
   f. Arrangement and class.
   g. Sheave make, size in inches, and bore.
   h. Center-to-center dimensions of sheave and amount of adjustments in inches.
2. Motor Data:
   a. Motor make, and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Suction static pressure in inches wg.

L. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
   1. Report Data:
      a. System and air-handling-unit number.
      b. Location and zone.
      c. Traverse air temperature in deg F.
      d. Duct static pressure in inches wg.
      e. Duct size in inches.
      f. Duct area in sq. ft.
      g. Indicated airflow rate in cfm.
      h. Indicated velocity in fpm.
      i. Actual airflow rate in cfm.
      j. Actual average velocity in fpm.
      k. Barometric pressure in psig.

M. Air-Terminal-Device Reports:
   1. Unit Data:
      a. System and air-handling unit identification.
      b. Location and zone.
      c. Apparatus used for test.
      d. Area served.
      e. Make.
      f. Number from system diagram.
      g. Type and model number.
      h. Size.
      i. Effective area in sq. ft.
   2. Test Data (Indicated and Actual Values):
      a. Airflow rate in cfm.
      b. Air velocity in fpm.
      c. Preliminary airflow rate as needed in cfm.
      d. Preliminary velocity as needed in fpm.
      e. Final airflow rate in cfm.
      f. Final velocity in fpm.
      g. Space temperature in deg F.

N. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
   1. Unit Data:
      a. System and air-handling-unit identification.
      b. Location and zone.
      c. Room or riser served.
      d. Coil make and size.
      e. Flowmeter type.
   2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

O. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:
   a. Unit identification.
   b. Location.
   c. Service.
   d. Make and size.
   e. Model number and serial number.
   f. Water flow rate in gpm.
   g. Water pressure differential in feet of head or psig.
   h. Required net positive suction head in feet of head or psig.
   i. Pump rpm.
   j. Impeller diameter in inches.
   k. Motor make and frame size.
   l. Motor horsepower and rpm.
   m. Voltage at each connection.
   n. Amperage for each phase.
   o. Full-load amperage and service factor.
   p. Seal type.

2. Test Data (Indicated and Actual Values):
   a. Static head in feet of head or psig.
   b. Pump shutoff pressure in feet of head or psig.
   c. Actual impeller size in inches.
   d. Full-open flow rate in gpm.
   e. Full-open pressure in feet of head or psig.
   f. Final discharge pressure in feet of head or psig.
   g. Final suction pressure in feet of head or psig.
   h. Final total pressure in feet of head or psig.
   i. Final water flow rate in gpm.
   j. Voltage at each connection.
   k. Amperage for each phase.

P. Instrument Calibration Reports:

1. Report Data:
   a. Instrument type and make.
   b. Serial number.
   c. Application.
   d. Dates of use.
   e. Dates of calibration.

3.11 VERIFICATION OF TAB REPORT

A. The TAB specialist’s test and balance engineer shall conduct the inspection in the presence of Architect.

B. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:
   1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
   2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
   3. If the second verification also fails, Architect may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23.05.93
PART 1 - GENERAL

1.1 CERTIFICATION/QUALITY ASSURANCE

B. Fire-Test Response Characteristics: Testing in accordance with ASTM E-84. Insulation and related materials, adhesives, coatings, sealers, jackets and tapes, shall have a fire-test response characteristic of: Flame spread rating of 25 or less; Smoke development of 50 or less.
C. Materials shall meet the requirements of NFPA 90-A.

PART 2 - PRODUCTS

2.1 DUCTWORK INSULATION

A. Blanket Type Duct Insulation:
   1. Minimum 3/4 pound per cubic foot density, factory-reinforced foil-faced, kraft vapor barrier; with a minimum "R" value of 6.0.
   2. Acceptable manufacturers: Johns-Manville, or Owens Corning.
   3. Use on the following:
      a. Supply and Return ductwork serving non-noise sensitive areas - 2" thick.
      b. Medium pressure supply ductwork located outside sound sensitive areas
      c. Reheat coils, including reheat coils at terminal boxes - 2" thick.
      d. Air flow stations.
      e. Top of supply air diffusers.
B. Board Type Duct Insulation:
   1. Provide minimum 3 pound per cubic foot density semi-rigid, factory-reinforced foil faced Kraft vapor barrier glass fiber board "system" type insulation; having a minimum "R" value of 6, unless otherwise specified.
   2. Acceptable manufacturers: Johns-Manville, or Owens Corning.
   3. Use on the following services:
      a. Supply and Return ductwork within Mechanical room & Mezzanines- 2" thick.
      b. Ductwork supply outside air within Mechanical room & Mezzanines - 2" thick
      c. Outside air intake plenums, return air plenums, ductwork and connections to plenums in Mechanical room - 2" thick.
C. Duct Liner:
   1. Liner: Anti-microbial, 1" minimum thickness (unless otherwise indicated on drawings), UL listed, neoprene coated, mat faced, flexible fiberglass of three pounds per cubic foot density. Sizes shown on the drawings are free area dimensions, after installation of duct liner. If no external insulation is provided, liner shall provide the minimum same R value as that specified for external insulation.
   2. Provide liner that complies with UL 181 Erosion Test and has a flame spread rating of 25 or less and a smoke developed rating of 50 or less.
      a. Low pressure supply and return ductwork serving all noise sensitive spaces
      b. Medium pressure and single zone supply (and return) systems (AHU 3, 4, 5, 6) serving noise sensitive areas
      c. Plenums serving linear slot diffusers
D. Special Situations:
   1. In acoustically sensitive areas, other Specification Sections or details may identify additional requirements. The most conservative application shall prevail where conflicts exist.
PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL
A. Deliver and store insulation materials in manufacturer’s containers and kept free from dirt, water, chemical and mechanical damage.
B. Complete ductwork pressure testing prior to applying insulation.
C. Apply insulation in workmanlike manner by experienced, qualified, workmen.
D. Surfaces shall be clean and dry when covering is applied. Covering to be dry when installed and before and during application of any finish, unless such finish requires specifically a wetted surface for application.
E. Adhesives, cements and mastics shall be compatible with materials applied and shall not attack materials in either wet or dry state.
F. Stop duct coverings, including jacket and insulation, at fire penetrations of fire or smoke rated partitions, floors above grade and roofs. "Fan-out" or extend jacketed insulation at least 2" beyond angle frames of fire dampers and secure to wall. Maintain vapor barrier.

3.2 BLANKET TYPE DUCT INSULATION
A. Apply jacketed blanket type glass fiber covering to ducts pulled snug but not so tight as to compress corners more than 1/4". Use insulation having 2" tab, or cut insulation long enough to allow for "peel-off" of insulation from jacket to effect a minimum overlap of 2". Staple lap with flare type staples on 1" centers. Cover standing seams, stiffeners, and braces with same insulation blanket, using 2" jacket lap and staple lap as herein before outlined. Cover and seal all staples with Foster 30-80 reinforced with glass cloth. Do not use pressure sensitive tape.
B. Secure jacket to covering using equivalent of Foster No. 85-20 or Childers CP-82 adhesive.
C. For ducts 24" or wider, mechanically fasten insulation to duct bottom, using weld pins having self-locking, metal discs, locating fasteners on not over 12” centers laterally and longitudinally. Seal pins as above.
D. For ducts up to 18” deep, mechanically fasten insulation to duct sides, using one row of pins, plates or discs located on not over 12” centers longitudinally and equidistant laterally between duct top and bottom. For ducts over 24” deep, apply fasteners as before only using minimum of two rows.

3.3 BOARD TYPE DUCT INSULATION
A. Apply jacketed board type glass fiber covering to ducts using weld pins having self-locking coated metal or nylon discs; locate fasteners on not over 12” centers laterally and longitudinally. If insulation is grooved to fit around corners, in order to eliminate as many joints as possible, pin as required to hold insulation tight to duct, especially on bottom of duct. Seal pins and joints with Foster 30-80 reinforced with glass cloth.
B. Cover all joints, rips, tears, punctures, disc heads, staples, or breaks in vapor barrier jacket with 4” wide woven glass fabric tape embedded in equivalent of Foster 30-80 vapor barrier, fire resistant adhesive. Do not use pressure sensitive tape.

3.4 PREPARATION
A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
3.5 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.6 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
   1. Comply with requirements in Division 07 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

C. Insulation Installation at Floor Penetrations:
   1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 "Penetration Firestopping."

END OF SECTION 23.07.13
BLANK PAGE
PART 1 - GENERAL

1.1 SUMMARY
A. Section includes insulating the following HVAC piping systems:
   1. Chilled-water piping, indoors and outdoors.
   2. Heating hot-water piping, indoors.
B. Section includes insulating the following HVAC equipment that is not factory insulated.
   1. Boiler
   2. Chilled Water Pump
   3. Hot Water Heating Pump
   4. Expansion Tanks
   5. Air Separators

1.2 SUBMITTALS
A. Submit manufacturer's product data and installation procedures for review.

PART 2 - PRODUCTS

2.1 PIPE AND EQUIPMENT INSULATION MATERIALS
A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
B. Cellular Glass (Foamglass): Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Must have a minimum "R" value of 3.4 per inch at 75 degrees F mean temperature. Use Cellular Glass for the following:
   1. Exterior chilled water piping
C. Flexible Tubular Elastomeric:
   1. Provide fire-retardant closed-cell slip-on flexible type; minimum "R" value of 2.57
   2. Acceptable manufacturers: Armacell LLC or AP Armaflex
   3. Use on the following services:
      a. Moisture condensate drains - 1/2" thick
      b. Refrigerant suction and hot gas for split systems: 1" thick.
D. Flexible Sheet:
   1. Provide closed-cell flexible sheet type; minimum "R" value of 3.57
   2. Acceptable manufacturers: Armocell or AP Armaflex
   3. Use on the following services:
      a. Chilled water pump casings and flanges: 1" thick
      b. Chilled water piping valves, strainers and hydronic specialties: 1" thick
      c. Air separators - 1-1/2" thick
      d. Refrigeration machine cooler, suction piping and pipe connections: 1-1/2" thick.
E. Fiberglass Pipe Insulation:
   2. Use on the following services:
      a. Chilled water piping - 2" and under: 1" thick; 2-1/2" and over: 1-1/2" thick
      b. Heating hot water piping. Runouts to terminal units (12 feet or less) 2" and less - 1/2" thick; 2-1/2" and greater - 1-1/2" thick.
      c. Drain bodies, traps and horizontal drain lines receiving cold condensate - 1/2" thick
2.2 MATERIALS FOR FITTINGS, VALVES, AND SPECIAL COVERINGS

A. For all services, use premolded insulation for pipe fittings, elbows, tees, valves, and couplings matching basic insulation. Pre-molded insulation fittings shall be equal to those manufactured by Hamfab. Pre-molded insulation fitting shall be finished with glass fabric and vapor barrier mastic. Glass fiber blanket inserts with plastic cover are not acceptable for pipe fitting insulation. Field mitering is acceptable for fittings 8” and larger. Valves, strainers, flanges, etc. shall be covered with mitered insulation segments of the same type and thickness as adjoining pipe insulation.

B. For tanks, heat exchangers and large pipes in systems operating over 60 degrees F when exposed-to-view inside building or in equipment rooms, cover insulation with a smoothing coat of Keane Powerhouse cement, one layer of white colored woven glass fabric embedded and finished with Foster GPM mastic.

C. For pipe fittings, valves, strainers, and other irregular surfaces, in chilled water or refrigerant systems operating below 60 degrees F, when inside building or in equipment rooms, cover insulation with white colored woven glass fabric embedded in white vapor barrier coating, Foster 30-35 or equal.

D. All mechanical pipe and fittings within 7'-0" of floors or work surfaces in mechanical rooms and outdoors shall be protected with 0.016" thick smooth, aluminum jacket using factory formed aluminum covers for fittings and valves and secured with self-tapping crews and drawbands. No corrugated jacket with be allowed. Install jacket seams on bottom of pipe.

E. For flexible tubular elastomeric pipe and fitting insulation when exposed-to-view inside building or exposed to the weather, finish with two coats of fire retardant self-extinguishing vinyl lacquer type highly flexible coating equivalent to Armstrong "Armaflex Finish", custom color blended to match surrounding surfaces.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Adhesives, cements and mastics shall be compatible with materials applied and shall not attack materials in either wet or dry state.

E. Install insulation with longitudinal seams at top and bottom of horizontal runs.

F. Install multiple layers of insulation with longitudinal and end seams staggered.

G. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

H. Keep insulation materials dry during application and finishing.

I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

J. Install insulation with least number of joints practical.
K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

L. Apply adhesives, mastics, and sealants at manufacturer’s recommended coverage rate and wet and dry film thicknesses.

M. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
      a. For below-ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer’s written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

Q. For above-ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
   4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 7 "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
   1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
   2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
   3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
   4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
   5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
   2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

### 3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.8 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:
   1. Aluminum, Smooth: 0.016 inch thick.

### 3.9 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:
   1. Aluminum, Smooth: 0.016 inch thick.
3.10
   A. Manual volume damper handles, airflow station pressure ports, access door handles, duct mounted instrumentation shall be left exposed or accessible above the insulation vapor barrier. Damper handles in externally wrapped ductwork shall be provided with stand-off brackets and locking quadrants to ensure the handle can be adjusted without disturbing the insulation vapor barrier.

END OF SECTION 23 07 19
PART 1 GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   B. Section 01.91.13 – General Commissioning Requirements
   C. Section 22.08.00 – Commissioning of Plumbing Systems
   D. Section 26.08.00 – Commissioning of Electrical Systems
   E. Commissioning Plan, dated 12/01/17

1.02 COMMISSIONED SYSTEMS
   A. Commissioning is an ongoing process and shall be performed throughout construction. Commissioning verifies that systems are operating in a manner consistent with the Contract Documents.
   B. Following is a detailed list of equipment included in each commissioning activity:
      1. Chilled Water Pumps
      2. Air Cooled Chillers
      3. Hot Water Boilers
      4. Hearing Hot Water Pumps
      5. Fan Coil Units
      6. Split Systems
      7. Air Handling Units
      8. Exhaust Fans
      9. VAV Terminal Units
     10. Building Automation System

1.03 RESPONSIBILITIES
   A. The Contractor shall be responsible for scheduling, supervising and performing start-up, testing and commissioning activities specified in this section and necessary to demonstrate to the Owner successful operation of the commissioned systems.

PART 2 PRODUCTS

2.01 MEANS OF ACCESS
   A. The Contractor shall provide means for the CxA to access, observe and visually confirm proper operation of all equipment and systems. These means shall be in compliance with all OSHA and job-site safety regulations.

2.02 TEST EQUIPMENT
   A. The Contractor shall provide the necessary equipment to fully test the commissioned systems as defined in the functional performance test procedures to be provided by the CxA.
PART 3 EXECUTION

3.01 EQUIPMENT CHECKLISTS

A. Equipment checklists, provided by the CxA, shall be completed by the Contractor on CxAloy. The following checklists will be provided: [Review the following add/delete/modify as appropriate to the project scope]
   1. Equipment Receipt Inspection Checklist
   2. Equipment Pre-Functional Checklist

3.02 FUNCTIONAL PERFORMANCE TESTS

A. The Contractor shall provide all documentation as requested to the CxA for development of functional performance testing procedures. This documentation shall include, at a minimum, manufacturer installation, start-up, operation and maintenance procedures. The CxA may request further documentation as necessary for the development of functional performance tests.

B. The Contractor shall review the functional performance test procedures developed by the CxA.
   1. The Contractor shall respond in writing to the CxA regarding the acceptability of the proposed test procedures.
   2. The Contractor shall note any necessary modifications to the procedures due to the actual equipment/systems or safety concerns and shall submit these to the CxA for consideration.

C. The Contractor shall place equipment and systems into operation and continue the operation as required during each working day of the testing activities.

D. The Contractor shall accomplish the functional performance testing of equipment based on procedures developed by the CxA and as reviewed by the Contractor.
   1. The Contractor shall provide skilled technicians to operate the systems during functional performance testing. At a minimum, the contractor should provide one trade technician familiar with the system being tested and one controls technician to operate the system through the BAS.
   2. The Contractor shall correct any deficiencies identified during testing and retest equipment as required.

E. Functional performance testing is intended to begin upon completion of a system. Functional performance testing may proceed prior to the completion of the system at the discretion of the CxA and the Contractor.

F. Functional testing shall verify all sequences of operation defined in the Contract Documents for the commissioned equipment and systems.
   1. Testing shall occur by overriding setpoints or sensor readings at the BAS or by other means mutually agreed to by the Contractor, the CxA, and the Owner to initiate sequences of operation and verifying the response of the system.
   2. Sequences of operation shall be verified under normal power, emergency power, and fire alarm scenarios.

G. Upon successful completion of all functional performance tests, the Contractor(s) shall perform Integrated Systems Testing. The testing shall document and verify the proper response of all Division 23 systems to all potential utility and emergency power operating and failure scenarios.

3.03 TEST AND BALANCE VERIFICATION

A. The Contractor shall provide the labor and test equipment necessary to demonstrate to the CxA that the HVAC air and water systems have been properly balanced.

B. The CxA will randomly select devices, equipment and systems for verification purposes.
   1. The Contractor shall be prepared to demonstrate proper balance of at least 10% of non-critical systems. Non-critical systems are those whose sole purpose is to maintain thermal comfort conditions.
C. The Contractor shall regard this verification process as a functional performance test for purposes of time allowed to correct deficiencies and requirements regarding retesting if major problems are discovered.

END OF SECTION 23.08.00
SECTION 23.09.23
DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION
A. The Direct Digital Control/Building Automation System (DDC/BAS) shall be Johnson Controls Metasys or approved equal.
B. Provide a complete control system including electrical interlocks, wiring, conduit, relays, switches, control transformers, and all devices required for a complete operational system.
C. The Control Contractor shall work in close cooperation with the TAB agency in calibrating all airflow and water flow stations and all duct and pipe mounted differential pressure sensor/transmitters.

1.2 SUBMITTALS
A. Product Data: For each type of product include the following:
   1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
   4. Installation, operation and maintenance instructions including factors effecting performance.
   5. Bill of materials of indicating quantity, manufacturer, and extended model number for each unique product.
   6. When manufacturer's product datasheets apply to a product series rather than a specific product model, clearly indicate and highlight only applicable information.
   7. Each submitted piece of product literature shall clearly cross reference specification and drawings that submittal is to cover.
   8. Schematic drawings for each controlled HVAC system indicating the following:
      a. I/O points labeled with point names shown. Indicate instrument range, normal operating set points, and alarm set points. Indicate fail position of each damper and valve, if included in Project.
      b. I/O listed in table format showing point name, type of device, manufacturer, model number, and cross-reference to product data sheet number.
      c. A graphic showing location of control I/O in proper relationship to HVAC system.
      d. Wiring diagram with each I/O point having a unique identification and indicating labels for all wiring terminals.
      e. Unique identification of each I/O that shall be consistently used between different drawings showing same point.
      f. Elementary wiring diagrams of controls for HVAC equipment motor circuits including interlocks, switches, relays and interface to DDC controllers.
      g. Narrative sequence of operation.
      h. Graphic sequence of operation, showing all inputs and output logical blocks.
B. System Description:
   1. Full description of the existing DDC system architecture, network configuration, operator interfaces and peripherals, servers, controller types and applications, gateways, routers and other network devices, and power supplies.
   2. Complete listing and description of each report, log and trend available for format and timing and events which initiate generation.
3. Design Submittal Schedule and design calculations for control valves and actuators.
   a. Flow at Project design and minimum flow conditions.
   b. Pressure-differential drop across valve at Project design flow condition.
   c. Maximum system pressure-differential drop (pump close-off pressure) across valve at Project minimum flow condition.
   d. Design and minimum control valve coefficient with corresponding valve position.
   e. Maximum close-off pressure.
   f. Leakage flow at maximum system pressure differential.
   g. Torque required at worst case condition for sizing actuator.
   h. Actuator selection indicating torque provided.
   i. Actuator signal to control damper (on, close or modulate).
   j. Actuator position on loss of power.
   k. Actuator position on loss of control signal.

C. Product Certificates:
   1. Data Communications Protocol Certificates: Certifying that each proposed DDC system component complies with ASHRAE 135.

1.3 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For DDC system to include operation and maintenance manuals.
   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
      a. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format.
      b. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
      c. As-built versions of submittal Product Data.
      d. Names, addresses, e-mail addresses and 24-hour telephone numbers of Installer and service representatives for DDC system and products.
      e. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control and changing set points and variables.
      f. Backup copy of graphic files, programs, and database on electronic media such as DVDs.
      g. List of recommended spare parts with part numbers and suppliers.
      h. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
      i. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
      j. Licenses, guarantees, and warranty documents.
      k. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
      l. Owner training materials.

1.4 WARRANTY
A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace products that fail in materials or workmanship within specified 12 month warranty period.
   1. Failures shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner.
   2. Include updates or upgrades to software and firmware if necessary to resolve deficiencies.
      a. Install updates only after receiving Owner's written authorization.
3. Warranty service shall occur during normal business hours and commence within 24 hours of Owner's warranty service request.
4. Warranty Period: One year from date of Substantial Completion.
5. Replacing defective parts and components as required.

PART 2 - PRODUCTS

2.1 DDC SYSTEM DESCRIPTION
A. Direct Digital Control/Building Automation Systems (DDC/BAS) shall be fully compatible with ETSU College of Medicine Campus Standard automation system and shall be Johnson Controls Metasys.
B. Web based, building automation system (BAS) incorporating direct digital control (DDC), energy management, and equipment monitoring and control.

2.2 NETWORK AUTOMATION ENGINES (NAE)
A. Network Automation Engine (NAE 45XX)
   1. The Network Automation Engine (NAE) shall be a fully user-programmable, supervisory controller. The NAE shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Automation Engines.
   2. Automation network - The NAE shall reside on the automation network and shall support a subnet of system controllers.
   3. User Interface - Each NAE shall have the ability to deliver a web based User Interface (UI) as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.
      a. The web based UI software shall be imbedded in the NAE. Systems that require a local copy of the system database on the user's personal computer are not acceptable.
      b. The NAE shall support a minimum of two (2) concurrent users.
      c. The web based user shall have the capability to access all system data through one NAE.
      d. Remote users connected to the network through an Internet Service Provider (ISP) or telephone dial up shall also have total system access through one NAE.
      e. Systems that require the user to address more than one NAE to access all system information are not acceptable.
      f. The NAE shall have the capability of generating web based UI graphics. The graphics capability shall be imbedded in the NAE.
      g. Systems that support UI Graphics from a central database or required the graphics to reside on the user's personal computer are not acceptable.
      h. The web based UI shall support the following functions using a standard version of Microsoft Internet Explorer:
         1) Configuration
         2) Commissioning
         3) Data Archiving
         4) Monitoring
         5) Commanding
         6) System Diagnostics
      i. Systems that require workstation software or modified web browsers are not acceptable.
      j. The NAE shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems.
   4. Processor - The NAE shall be microprocessor-based with a minimum word size of 32 bits. The NAE shall be a multi-tasking, multi-user, and real-time digital processor. Standard operating systems shall be employed. NAE size and capability shall be sufficient to fully meet the requirements of this Specification.
5. Memory - Each NAE shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.
6. Hardware Real Time Clock - The NAE shall include an integrated, hardware-Based, real-time clock.
7. The NAE shall include troubleshooting LED indicators to identify the following conditions:
   a. Power - On/Off
   b. Ethernet Traffic - Ethernet Traffic/No Ethernet Traffic
   c. Ethernet Connection Speed - 10 Mbps/100 Mbps
   d. FC Bus - Normal Communications/No Field Communications
   e. Peer Communication - Data Traffic Between NAE Devices
   f. Run - NAE Running/NAE In Startup/NAE Shutting Down/Software Not Running
   g. Bat Fault - Battery Defective, Data Protection Battery Not Installed
   h. Fault - General Fault
   i. Modem RX - NAE Modem Receiving Data
   j. Modem TX - NAE Modem Transmitting Data
8. Communications Ports - The NAE shall provide the following ports for operation of operator Input/Output (I/O) devices, such as industry-standard computers, modems, and portable operator's terminals.
   a. USC port
   b. URS-232 serial data communication port
   c. RS-485 port
   d. Ethernet port
9. Diagnostics - The NAE shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Automation Engine shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.
10. Power Failure - In the event of the loss of normal power, the NAE shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.
   a. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.
   b. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.
11. Certification - The NAE shall be listed by Underwriters Laboratories (UL).
12. Controller network - the NAE shall support the following communication protocols on the controller network:
   a. The NAE shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
      1) A BACnet Protocol Implementation Conformance Statement shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.
      2) The Conformance Statements shall be submitted 10 days prior to bidding.
      3) The NAE shall support a minimum of 50 control devices.
   b. The NAE shall support LonWorks enabled devices using the Free Topology Transceiver FTT 10.
      1) All LonWorks controls devices shall be LonMark certified.
      2) The NAE shall support a minimum of 64 LonWorks enabled control devices.
   c. The NAE shall support the Johnson Controls N2 Field Bus.
      1) The NAE shall support a minimum of 50 N2 control devices.
      2) The Bus shall conform to Electronic Industry Alliance (EIA) Standard RS-485.
      3) The Bus shall employ a master/slave protocol where the NAE is the master.
      4) The Bus shall employ a four (4) level priority system for polling frequency.
      5) The Bus shall be optically isolated from the NAE.
6) The Bus shall support the Metasys Integrator System.

2.3 STAND-ALONG DDC PANELS

A. General: Stand-alone DDC panels shall be microprocessor based, multi-tasking, multi-user, real-time digital control processors. Each stand-alone DDC panel shall consist of modular hardware with plug-in enclosed processors, communication controllers, power supplies, and input/output modules. Each DDC panel shall operate independently be performing its own specified control, alarm management operator I/O and historical data collection.

B. Memory: Each DDC panel shall have sufficient memory to support its own operating system and databases.

C. Point Types: Each DDC panel shall support the following types of point inputs and outputs:
   1. Digital Inputs for status/alarm contacts
   2. Digital Outputs for on/off equipment control
   3. Analog Inputs for temperature, pressure, humidity, flow, and position measurements
   4. Analog Outputs for valve and damper position control, and capacity control of primary equipment
   5. Pulse Inputs for pulsed contact monitoring

D. Integrated On-Line Diagnostics: Each DDC panel shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all subsidiary equipment.

E. Surge and Transient Protection: Isolation shall be provided at all network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standard 587-1980. Isolation levels shall be sufficiently high as to allow all signal wiring to be run in the same conduit as high voltage wiring where acceptable by electrical code.

F. Powerfail Restart: In the event of the loss of normal power, there shall be an orderly shutdown of all stand-alone DDC panels to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data, and battery back-up shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours. Upon restoration of normal power, the DDC panel shall automatically resume full operation without manual intervention.

2.4 PERSONAL COMPUTER OPERATOR WORKSTATION (FACILITY OFFICE)

A. General: Provide an operator's workstation to access the BAS network.

B. Provide PC Compatible computer system configured for use with DDC system, Dell Inc. or approved equal with the following minimum features:
   1. Quad Core Intel® Core™ i7 920 processor
   2. 4.0 GB RAM memory
   3. 320 GB hard disk
   4. USB ports built-in
   5. DVD +/- RW 1-8X minimum CD-RV
   6. 22” LCD flat panel color monitor
   7. Microsoft USB mouse
   8. Microsoft Keyboard
   9. Software: Windows 7 Professional

C. Provide a color ink jet, multi-function, wireless printer, copier, fax and scanner equal to Lexmark S600. Printer shall print alarms, graphics and any other screen displays.

D. Network Connection: Graphical workstations shall allow for access to the BAS network through a pull-down menu approach using only a mouse. The keyboard shall be required only when entering text of for programming functions. The workstation shall be used as an interface to the BAS network and shall not be required to process any control or energy management algorithms nor manage any BAS network communications.
E. Provide context-sensitive help menus to provide instructions appropriate with operations and applications currently being performed.

F. Multiple user security levels shall be provided to allow for various degrees of system access and control. The system shall automatically generate a report of log-on/log-off time and system activity for each user. Provide automatic log-off capability to prevent unauthorized system use.

G. The workstation shall be provided with a key element display that records log-ons, log-offs, overrides, alarms and alarm acknowledgments.

2.5 SENSORS

A. BAS Sensors:
   1. Provide sensors, controls, instruments, and control interfaces to meet the performance specified herein. Sensors shall be high quality precision electronic type, selected to be compatible with the BAS controllers and appropriate for the service specified herein. Accuracy values specified herein include sensor, wiring, signal conditioning and display accuracies for overall end-to-end performance. Sensors shall be selected to place the expected value in the middle third of the device's range.
   2. Temperature sensors: 100 or 1000 ohm nickel resistance temperature device (RTD), Deutsche Industrial Norms (DIN) 43760, with an average percent change in resistance per degree (α) of 0.00385± 0.00002 ohms/ohm/°C, selected for normal range of media sensed with accuracy of ±0.5°F at 70°F except chilled water sensors used for Btu calculations shall have an accuracy of ±0.25°F at 32°F. Sensors used for Btu calculations shall be matched pairs at the calibration point. Temperature sensor stability errors shall not exceed 0.25°F cumulative over a 5 year period. Provide thermowells and insertion type sensors for water temperature sensing. Air temperature sensing shall be provided by duct insertion type sensors for supply or return duct temperatures and by extended element averaging type for plenum, and coil entering or leaving temperatures. RTD transmitters shall be a 2-wire, loop-powered device, producing a linear 4-20 mA output corresponding to the temperature span of the connected sensor. The output error shall not exceed 0.1% of calibrated span. Transmitters shall include noninteracting zero and span adjustments and RFI shielding and rejection circuitry to prevent disruption from ambient signals. Transmitter drift shall be less than 0.1°F per year.
   3. Space temperature sensors: space temperature type with setpoint adjustment range of 45°F to 85°F. the setpoint adjustment shall be locked out, overridden, or limited as to time or temperature in software from a central or remote operator's terminal. Precisions thermistors may be used in space temperature sensing applications below 200°F. Sensor accuracy over the application range shall be minimum 0.5°F between the range of 32°F to 150°F including sensor error and A/D conversion resolution error. Sensor manufacturer shall utilize 100% screening to verify accuracy. Thermistors shall be pre-aged and inherently stable. Stability error of the thermistor over 5 years shall not exceed 0.25°F cumulative. Sensor element and leads shall be encapsulated. Bead thermistors shall not be used. Space temperature sensors shall include a communications port for local connection of a portable test/terminal device for communications/programming access to the associated BCS controller.
      a. Covers:
         1) Space temperature sensors shall have cover, visible temperature indicator integral to the sensor, and accessible means of setpoint adjustment.
   4. Humidity sensors: bulk polymer type, with self-contained 4-20 mA transmitter and replaceable element. Accuracy shall be ±2% RH in the range of 20% to 90%. the transmitter shall include noninteracting zero and span adjustments with an output error not exceeding 0.1% of calibrated span. Saturation shall not alter calibration. Sensors for space humidity shall have same appearance as space temperature sensors.
   5. Pressure transmitters: 2-wire strain gauge type, designed for media sensed for static pressure or differential pressure. The span shall be continuously adjustable from 0% to 125% of the expected full pressure of full flow differential pressure. The zero shall be continuously adjustable on outputs. Transmitters shall product a 4-20 mA signal with an accuracy of ±1.0% of the upper range.
limit for 6 months from calibration. Instruments shall be capable of withstanding an overrange pressure limit of 300 normal.

6. Current sensing relays: current sensing relays shall provide an adjustable setpoint normally open contact rated at a minimum of 50 V peak and 0.5 A or 25 VA, noninductive. There shall be a single opening for passage of current carrying conductors. Relays shall be sized for operation at 50% rated current based on the connected load. Voltage isolation shall be a minimum of 600 V.

7. Filter status: filter status shall be sensed by digital pressure differential switches.

8. CO₂ sensors: dual channel infrared type, with 10 micron filter to prevent particulate contamination of sensing element. Sensor shall have an accuracy of ±5% of reading up to 10000 ppm, with a repeatability of ±20 ppm and a maximum drift of ±10 ppm per year, and a recommended calibration interval of 5 years. Sensor shall have a response time of no more than 2 minutes to a 90% of full scale change. Sensor and transmitter shall provide a 4-20 mA analog output proportional to gas concentration.

2.6 MATERIALS

A. Actuators:

1. BAS terminal unit actuators: 24 V nonstall type, providing complete modulating control for the full range of damper movement. Actuators shall be de-energized when the damper has reached the operator or system determined position. Actuators shall be supplied to the terminal unit manufacturer for factory mounting and calibration. Actuators shall be removable for servicing without removing the terminal unit. Actuators shall be provided with transformers for proper operation from the terminal unit controller power source.

2. Other actuators: 24 V electric worm-gear type; sized to provide required starting torque and to control the drive apparatus smoothly. Higher voltage actuators are acceptable for specific applications where 24 V actuators are not adequate. Actuators shall have spring return.

B. Control valves:

1. Valves shall be capable of full closure against 150% of design pump head, or a 50 psig differential pressure, whichever is greater.

2. Valves for water shall have equal percentage flow characteristics. Modulating control valves shall be sized for a pressure drop of 3 psig to 5psig, unless indicated otherwise on the Drawings. Two-position valves shall be in line size.

3. Valves for steam shall have linear flow characteristics. Steam valve sizes are indicated on the Drawings.

4. Pressure/temperature rating: as specified in Section 23 10 00, "Piping, Valves and Accessories".

5. At the Contractor's option, control valves may be butterfly type for chilled and condenser water service in piping 8" and larger. Modulating butterfly valves shall be sized for full flow pressure drop of 2psig to 4 psig at 60% open and be limited to this opening. Two-position butterfly valves shall be line size. Valves shall be rated for bubbletight closure at a differential pressure equal to the valve body rating.

C. Control dampers: single-blade up to 8" high, multiblade over 8" high; minimum 80% free area based on damper frame outside dimensions.

1. Blades: minimum 16 gauge galvanized steel, or extruded aluminum. Blades shall be airfoil shape.
   a. Pivot rods: steel, minimum 0.5" diameter or hex, with one rod extended 6" to permit operation of damper from outside the duct.
   b. Maximum length 42", maximum width 8".
   c. At points of contact: interlocking or overlapping edges, and compressible neoprene or extruded vinyl blade seals, and compressible metal side seals designed for temperature -40°F to 180°F at leakage rate specified herein.
   d. Type:
      1) Opposed blade: for balancing and modulating applications.
2) Parallel blade: for 2-position, and outside and return air mixing applications. For mixing applications, orient dampers to achieve maximum mixing at throttled conditions.

e. Maximum damper area per motor: 15ft².

2. Leakage when closed: less than 4 cfm/ft² at 1" wg differential static pressure based on a 48" damper width.

3. Frames: galvanized steel bar minimum 2" wide x 12 gauge for dampers 10" high or less, and 3.5" x 0.875", 16 gauge galvanized roll-formed channel with double-thickness edges or 5" x 1" x 0.125" extruded aluminum channel for 11" high and larger.
   a. Corner bracing.
   b. Full size of duct or opening in which installed.

   a. Thrust bearings: vertically mounted.
   b. Maximum spacing: 42".

5. Finish on steel parts: galvanized.

6. Operating linkage: factory-assembled, concealed in frame out of airstream, steel construction.

D. Panels: Surface type cabinet with hinged front panel and cylinder lock. Panels shall utilize one master key.

E. Thermowells: monel, brass, or copper for use in water piping and stainless steel for other applications. Thermowells shall have threaded plug and chain, retaining nut, and lagging neck to clear insulation. Inside diameter of insertion neck shall accommodate the element being installed.

F. Weather shield enclosures: NEMA 3R rated with transparent cover, sized for the device enclosed.

G. Airflow measurement systems: provide complete UL listed assemblies to monitor airflow in ductwork at locations indicated on the Drawings. Each system shall be complete with one or more multipoint measuring probes, airflow sensors and a single microprocessor-based transmitter.

1. Probes: Aluminum or stainless steel construction with mounting brackets. Probes shall be supported at both ends.

2. Airflow sensors: Designed to operate at velocities of 50 fpm to 5000 fpm, temperatures of -20°F to 140°F, and relative humidities of 0% to 99% (noncondensing). Each sensing point shall independently determine the airflow rate which shall be equally weighted and averaged by the transmitter prior to output.

3. The minimum number of sensors for each assembly shall be as follows:

<table>
<thead>
<tr>
<th>Area (ft²)</th>
<th>No. of Sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 4</td>
<td>4</td>
</tr>
<tr>
<td>4 to 8</td>
<td>6</td>
</tr>
<tr>
<td>8 to 12</td>
<td>8</td>
</tr>
<tr>
<td>12 to 16</td>
<td>12</td>
</tr>
<tr>
<td>&gt; 16</td>
<td>16</td>
</tr>
</tbody>
</table>

4. Transmitters: Designed to operate at temperatures of -20°F to 120°F and provided with LCD display 24 V AC power connection, and analog output signal (0-10 V DC or 4-20 mA) for connection to the BCS.

5. Accuracy: ±2% of reading over the entire operating airflow range.


2.7 ELECTRONIC AND ELECTRIC CONTROL COMPONENTS

A. Electric Thermostats: Thermostats to be manufacturer's best commercial grade thermostat with adjustable setpoint, dials calibrated in degrees F. Select thermostats with suitable range for service intended. Provide each thermostat with locking metal cover. Thermostat shall be equal to Johnson Controls TE-67NP-2N00.

B. Electronic Sensors/Transmitters: Sensors/transmitters to be 1000 Ohm platinum RTD type with high resistance change vs. temperature or humidity change, accurate to +/- 0.3 degrees F for temperature and
+/- 2.0% for humidity at applicable range, and provide 4 to 20 MA or 0 to 5 VDC output signal. Sensors/transmitters to be suitable for room, duct, or well mounting as required by application. Room type to have built-in setpoint potentiometer and digital room temperature/humidity indication. Select for temperature/humidity range of application. Provide appropriate mounting plate and hardware. Temperature sensors used as a part of Energy (BTU) Measurement System shall meet the applicable requirements of that section.

C. Freezestats (Low Limit Binary Type): Provide single, custom length Freon-filled capillary tube type with sensing element actuated by temperature on any one foot portion. Sensor shall be a single element with length of one linear foot for every one square foot of coil face area. Freezestats to be UL approved, manual reset type.

D. Control Panels: Control panels to be constructed of unitized steel or aluminum cabinets. Provide cabinets with hinged, locking door opening to the front. Multiple panels mounted side-by-side to be hinged to the left or on opposite sides to open in the middle. Start-stop switches, hand-off-automatic switches, pilot lights, and temperature indicating devices to be flush-mounted in panel door. All other devices to be internally mounted within panel. Local panels exposed to weather to be weatherproof construction. Panel locations to be approved by Designer and be accessible for operation and maintenance. All lines in panel shall have number I.D. bands. All devices inside the panel or mounted on panel face shall have an engraved laminated plastic nameplate. Wiring within panel to conform to National Electrical Code, and shall be neatly bundled and laced or enclosed in panduit trough.

E. Transformers: Provide all 24-volt control transformers necessary to convert 120-volt line voltage power to control voltage at control devices.

F. Relays, Hand-Off-Auto Switches, Pilot Lights: Provide all relays, hand-off-auto switches, and pilot lights necessary to accomplish automatic control of the mechanical systems. See electrical drawings for starters provided integral with hand-off-autos, pilot lights, and auxiliary contacts.

G. Pressure Switches: Pressure switches shall have contact action and pole configuration as required by application, U.L. listing, and adjustable setpoint.

2.8 AIR FLOW MEASURING STATION

A. Multi-point electronic thermistor probe suitable for duct or fan inlet airflow measurement with transmitter, equal to Ebtron Advantage II Gold Series. Provide aluminum alloy casing, ± 2% / ± .25% accuracy/repeatability and UL listed transmitter.

2.9 PRESSURE TRANSMITTERS/TRANSDUCERS:

A. Acceptable Manufacturers:
   1. Setra Systems, Inc.

B. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
   1. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
   2. Output: 4 to 20 mA.
   3. Building Static-Pressure Range: 0- to 0.25-inch wg.
   4. Duct Static-Pressure Range: 0- to 5-inch wg.

C. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.

D. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and testing to 300-psig; linear output 4 to 20 mA.

E. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.

F. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.
2.10 APPLICATION SPECIFIC CONTROLLERS - HVAC APPLICATIONS

A. Each stand-alone DDC controller shall be able to extend its performance and capacity through the use of remote Application Specific Controllers (ASCs).

B. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.

C. Each ASC shall have sufficient memory to support its own operating system and data bases.

D. The operator interface to any ASC point data or programs shall be through any network-resident PC workstation or portable operator's terminal connected to any DDC panel in the network.

E. Application specific controllers shall directly support the temporary use of a portable service terminal.

F. Powerfail Protection: All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the controller.

G. The modes of operation supported by each ASC shall minimally include, but not be limited to, the following:
   1. Daily/Weekly Schedules
   2. Occupancy Mode
   3. Economy Mode.
   4. Temporary override Mode

H. Continuous Zone Temperature Histories: Each ASC shall automatically and continuously maintain a history of the associated zone temperature to allow users to quickly analyze space comfort and equipment performance for the past 24 hours. A minimum of two samples per hour shall be stored.

I. Alarm Management: Each ASC shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

J. Application Descriptions:
   1. VAV Terminal Unit Controllers:
      a. VAV terminal unit controllers shall support, but not be limited to, the control of the following configurations of VAV boxes to address current requirements as described in the Execution portion of this specification, and for future expansion.
         1) Single Duct (Cooling Only or Cooling With Reheat)
      b. VAV terminal unit controllers shall support the following types of point inputs and outputs:
         1) Proportional Cooling Outputs
         2) Heating Outputs
      c. Each VAV terminal unit shall be provided with a thermostat with numerical temperature setpoint adjustment with scales graduated in degrees F.
   2. AHU Controllers:
      a. AHU controllers shall support all the necessary point inputs and outputs to perform the specified control sequences in a totally stand-alone fashion.
      b. AHU controllers shall have a library of control routines and program logic to perform the sequence of operation.

2.11 DDC CONTROLLERS

A. The DDC system shall consist of a combination of network controllers, programmable application controllers and application-specific controllers to satisfy performance requirements indicated.

B. DDC controllers shall perform monitoring, control, energy optimization and other requirements indicated.

C. DDC controllers shall use a multitasking, multiuser, real-time digital control microprocessor with a distributed network database and intelligence.
D. Each DDC controller shall be capable of full and complete operation as a completely independent unit and as a part of a DDC system wide distributed network.

E. Environment Requirements:
   1. Controller hardware shall be suitable for the anticipated ambient conditions.

F. Power and Noise Immunity:
   1. Controller shall operate at 90 to 110 percent of nominal voltage rating and shall perform an orderly shutdown below 80 percent of nominal voltage.
   2. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios with up to 5 W of power located within 36 inches of enclosure.

G. DDC Controller Spare Processing Capacity:
   1. Include spare processing memory for each controller. RAM, PROM, or EEPROM will implement requirements indicated with the following spare memory:
      a. Network Controllers: 50 percent.
      b. Programmable Application Controllers: Not less than 60 percent.
      c. Application-Specific Controllers: Not less than 80 percent.
   2. Memory shall support DDC controller's operating system and database and shall include the following:
      a. Monitoring and control.
      b. Energy management, operation and optimization applications.
      c. Alarm management.
      d. Historical trend data of all connected I/O points.
      e. Maintenance applications.
      f. Operator interfaces.
      g. Monitoring of manual overrides.

H. Input and Output Point Interface:
   1. Hardwired input and output points shall connect to network, programmable application and application-specific controllers.
   2. Input and output points shall be protected so shorting of point to itself, to another point, or to ground will not damage controller.
   3. Input and output points shall be protected from voltage up to 24 V of any duration so that contact will not damage controller.

2.12 PROGRAMMABLE APPLICATION CONTROLLERS

A. General Programmable Application Controller Requirements:
   1. Include adequate number of controllers to achieve performance indicated.
   2. Controller shall have enough memory to support its operating system, database, and programming requirements.
   3. Data shall be shared between networked controllers and other network devices.
   4. Operating system of controller shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
   5. Controllers that perform scheduling shall have a real-time clock.
   6. Controller shall continually check status of its processor and memory circuits. If an abnormal operation is detected, controller shall assume a predetermined failure mode and generate an alarm notification.
   7. Controllers shall be fully programmable.

B. Communication:
   1. Programmable application controllers shall communicate with other devices on network.
C. Operator Interface:
   1. Controller shall be equipped with a service communications port for connection to a portable
      operator's workstation.

D. Serviceability:
   1. Controller shall be equipped with diagnostic LEDs or other form of local visual indication of
      power, communication, and processor.
   2. Wiring and cable connections shall be made to field-removable, modular terminal strips or to a
      termination card connected by a ribbon cable.
   3. Controller shall maintain BIOS and programming information in event of a power loss for at least
      72 hours.

2.13 DYNAMIC COLOR GRAPHICS

A. The graphics application program shall be supplied as an integral part of the User Interface. Browser or
   Workstation applications that rely only upon HTML pages shall not be acceptable.

B. The graphics applications shall include a create/edit function and runtime function. The system
   architecture shall support an unlimited number of graphics documents (graphic definition files) to be
   generated and executed.

C. The graphics shall be able to display and provide animation based on real-time data that is acquired,
   derived, or entered.

D. Graphics runtime functions - A maximum of 16 graphic applications shall be able to execute at any one
   time on a user interface or workstation with 4 visible to the user. Each graphic application shall be
   capable of the following functions:
      1. All graphics shall be fully scalable.
      2. The graphics shall support a maintained aspect ratio.
      3. Multiple fonts shall be supported.
      4. Unique background shall be assignable on a per graphic basis.
      5. The color of all animations and values on displays shall indicate if the status of the object attribute.

E. Operation from graphics - It shall be possible to change values (setpoints) and states in system controlled
   equipment by using drop-down windows accessible via the pointing device.

F. Graphic editing tool - A graphic editing tool shall be provided that allows for the creation and editing of
   graphic files. The graphic editor shall be capable of performing/defining all animations, and defining all
   runtime binding.
      1. The graphic editing tool shall in general provide for the creation and positioning of point objects by
         dragging from tool bars or drop-downs and positioning where required.
      2. In addition, the graphic editing tool shall be able to add additional content to any graphic by
         importing backgrounds in the SVG, BMP or JPG file formats.

G. Aliasing - Many graphic displays representing part of a building and various building components are
   exact duplicates, with the exception that the various variables are bound to different field values.
   Consequently, it shall be possible to bind the value of a graphic display to aliases, as opposed to the
   physical field tags.

2.14 ELECTRICAL POWER DEVICES

A. Transformers:
   1. Transformer shall be sized for the total connected load, plus an additional 25 percent of connected
      load.
   2. Transformer shall be at least 40 VA.
   3. Transformer shall have both primary and secondary fuses.

B. DC Power Supply:
   1. Plug-in style suitable for mating with a standard eight-pin octal socket. Include the power supply
      with a mating mounting socket.
2. Enclose circuitry in a housing.
3. Include both line and load regulation to ensure a stable output. To protect both the power supply and the load, power supply shall have an automatic current limiting circuit.
4. Performance:
   a. Output voltage nominally 25-V dc within 5 percent.
   b. Output current up to 100 mA.
   c. Input voltage nominally 120-V ac, 60 Hz.
   d. Load regulation within 0.5 percent from zero- to 100-mA load.
   e. Line regulation within 0.5 percent at a 100-mA load for a 10 percent line change.
   f. Stability within 0.1 percent of rated volts for 24 hours after a 20-minute warmup.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install products to satisfy more stringent of all requirements indicated.
B. Install products level, plumb, parallel, and perpendicular with building construction.
C. Support products, tubing, piping wiring and raceways. Brace products to prevent lateral movement and sway or a break in attachment when subjected to a force.
D. If codes and referenced standards are more stringent than requirements indicated, comply with requirements in codes and referenced standards.
E. Fabricate openings and install sleeves in ceilings, floors, roof, and walls required by installation of products. Before proceeding with drilling, punching, and cutting, check for concealed work to avoid damage. Patch, flash, grout, seal, and refinish openings to match adjacent condition.
F. Firestop penetrations made in fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."
G. Seal penetrations made in acoustically rated assemblies. Comply with requirements in Section 079200 "Joint Sealants."
H. Fastening Hardware:
   1. Stillson wrenches, pliers, and other tools that damage surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening fasteners.
   2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
   3. Lubricate threads of bolts, nuts and screws with graphite and oil before assembly.
I. If product locations are not indicated, install products in locations that are accessible and that will permit service and maintenance from floor, equipment platforms, or catwalks without removal of permanently installed furniture and equipment.

3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, cabinets, building wire and cable according to Division 26.
   1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
   2. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
   3. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
   4. Number-code and color-code conductors for future identification and service of control system, except local individual room control cables.
   5. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
3.3 FINAL REVIEW

A. Submit written request to Architect and Construction Manager when DDC system is ready for final review. Written request shall state the following:

1. DDC system has been thoroughly inspected for compliance with contract documents and found to be in full compliance.
2. DDC system has been calibrated, adjusted and tested and found to comply with requirements of operational stability, accuracy, speed and other performance requirements indicated.
3. DDC system monitoring and control of HVAC systems results in operation according to sequences of operation indicated.
4. DDC system is complete and ready for final review.

B. Review by Architect and Construction Manager shall be made after receipt of written request. A field report shall be issued to document observations and deficiencies.

C. Take prompt action to remedy deficiencies indicated in field report and submit a second written request when all deficiencies have been corrected. Repeat process until no deficiencies are reported.

D. Prepare and submit closeout submittals when no deficiencies are reported.

E. A part of DDC system final review shall include a demonstration to parties participating in final review.

1. Provide staff familiar with DDC system installed to demonstrate operation of DDC system during final review.
2. Provide testing equipment to demonstrate accuracy and other performance requirements of DDC system that is requested by reviewers during final review.
3. Demonstration shall include, but not be limited to, the following:
   a. Accuracy and calibration of 20 I/O points randomly selected by reviewers. If review finds that some I/O points are not properly calibrated and not satisfying performance requirements indicated, additional I/O points may be selected by reviewers until total I/O points being reviewed that satisfy requirements equals quantity indicated.
   b. HVAC equipment and system hardwired and software safety functions and life-safety functions are operating according to sequence of operation. Up to 20 I/O points shall be randomly selected by reviewers. Additional I/O points may be selected by reviewers to discover problems with operation.
   c. Correct sequence of operation after electrical power interruption and resumption after electrical power is restored for randomly selected HVAC systems.
   d. Operation of randomly selected dampers and valves in normal-on, normal-off and failed positions.
   e. Reporting of alarm conditions for randomly selected alarms, including different classes of alarms, to ensure that alarms are properly received by operators and operator workstations.
   f. Trends, summaries, logs and reports set-up for Project.
   g. For up to three HVAC systems randomly selected by reviewers, use graph trends to show that sequence of operation is executed in correct manner and that HVAC systems operate properly through complete sequence of operation including different modes of operations indicated. Show that control loops are stable and operating at set points and respond to changes in set point of 20 percent or more.
   h. Software’s ability to communicate with controllers, operator workstations, uploading and downloading of control programs.
   i. Software’s ability to edit control programs off-line.
   j. Data entry to show Project-specific customizing capability including parameter changes.
   k. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
   l. Execution of digital and analog commands in graphic mode.
   m. Spreadsheet and curve plot software and its integration with database.
   n. Online user guide and help functions.
o. Multitasking by showing different operations occurring simultaneously on four quadrants of split screen.
p. System speed of response compared to requirements indicated.
q. For Each Programmable Application Controller:
   1) Memory: Programmed data, parameters, trend and alarm history collected during normal operation is not lost during power failure.
   2) Operator Interface: Ability to connect directly to each type of digital controller with a portable operator workstation and PDA. Show that maintenance personnel interface tools perform as indicated in manufacturer's technical literature.
   3) Standalone Ability: Demonstrate that controllers provide stable and reliable standalone operation using default values or other method for values normally read over network.
   4) Electric Power: Ability to disconnect any controller safely from its power source.
   5) Wiring Labels: Match control drawings.
   6) Network Communication: Ability to locate a controller's location on network and communication architecture matches Shop Drawings.
   7) Nameplates and Tags: Accurate and permanently attached to control panel doors, instrument, actuators and devices.
r. For Existing Operator Workstation:
   1) I/O points lists agree with naming conventions.
   2) Graphics are complete.
   3) UPS unit, if applicable, operates.

3.4 ADJUSTING
A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.5 DEMONSTRATION
A. Engage a factory-authorized service representative with complete knowledge of Project-specific system installed to train Owner's maintenance personnel to adjust, operate, and maintain DDC system.
B. Extent of Training:
   1. Base extent of training on scope and complexity of DDC system indicated and training requirements indicated. Provide extent of training required to satisfy requirements indicated even if more than minimum training requirements are indicated.
   2. Inform Owner of anticipated training requirements if more than minimum training requirements are indicated.
   3. Minimum Training Requirements: Provide not less than one day of training.
C. Training Schedule:
   1. Training shall occur within normal business hours at a mutually agreed on time.
D. Attendee Training Manuals:
   1. Provide each attendee with a color hard copy of all training materials and visual presentations.
   2. Hard-copy materials shall be organized in a three-ring binder with table of contents and individual divider tabs marked for each logical grouping of subject matter. Organize material to provide space for attendees to take handwritten notes within training manuals.
   3. In addition to hard-copy materials included in training manual, provide each binder with a sleeve or pocket that includes a DVD or flash drive with PDF copy of all hard-copy materials.

END OF SECTION 23.09.23
PART 1 - GENERAL

1.1 GENERAL

A. Submit pipe and fitting. Work shall not start until approval. Pipe, fittings, weights, working pressure and classification shall be clearly marked.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Hard-Drawn Seamless Copper Tubing: ASTM B 88, Type L (ASTM B 88M). Elbows are to be long radius pattern. Solder shall be 95-5 type. "Tee pullers" shall not be used in place of tees on copper piping.
   1. Heating hot water supply and return piping 2" and smaller.
   2. Chilled water supply and return piping 2" and smaller.

B. Copper Pipe Fittings: ASTM B-62, dimensions conforming to ANSI B16.22, wrought copper, with sweep patterns for copper tubing. Provide dielectric couplers at junction of steel pipe and copper piping systems.

C. DWV Copper Tubing: ASTM B 306, Type DWV for above ground moisture condensate drain piping.

D. Unions to be brass ground joint, 250-pound working pressure.

E. Nipples used in conjunction with copper pipe to be brass.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A-53, black steel, Schedule 40 with welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.
   1. Heating hot water supply and return piping 2-1/2" and larger.
   2. Chilled water supply and return piping 2-1/2" and larger.

B. Piping 2-1/2" and larger shall be seamless black steel, Schedule 40, ASTM A-53, Gr. B, or A106 with welded or flanged fittings, ANSI B16.9. ERW piping may be considered. Elbows are to be long radius pattern. Field-fabricated fittings are not acceptable. Forged steel, gasketed flanges, ANSI B16.5, of the welded neck type are to be used at flanged connections. Slip-on type may be used on straight pipe. Flanges must be compatible with valve and equipment connections. Where a branch connection from a main or header is one half the main diameter or smaller, saddle-type, forged steel welding fittings may be used.

C. Welding shall conform to ANSI Code for Pressure Piping, Section B31.1. All welds shall be of the single "V" butt joint type with optimum fusions and 100% weld penetration of wall thickness. Piping should be welded by the shielded arc type electrode-electric arc process. Butt joints should be made with split backing rings. In most cases, direct welded connections shall not be made to valves, strainers, equipment, etc. The contractor should be required to obtain certification of all pipe welders on the project, in accordance with Section IX of the ASME code.

D. Union or flanged connections should be provided at valves, equipment, etc. Provide dielectric unions at the junction of steel pipe and equipment with copper piping systems. Or, preferably, provide steel to brass to copper connections. Where size changes on horizontal lines, use reducing fittings having eccentricity down, top level. All piping take-offs should be made from the top of mains or headers. Do not "bullhead" tee connections.
2.3 DIELECTRIC FITTINGS
   A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS
   A. Makeup-water piping shall be the following:
      1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
   B. Makeup-Water Piping Installed Belowground and within Slabs: Type K (Type A), annealed-temper copper tubing, wrought-copper fittings, and soldered joints. Use the fewest possible joints.
   C. Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
   D. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
   E. Air-Vent Piping:
      1. Provide manual air vents at high points of vertical risers and at each water coil.
      2. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
      3. Outlet: Type K (Type A), annealed-temper copper tubing with soldered or flared joints.
   F. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

3.2 PIPING INSTALLATIONS
   A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
   B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
   C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
   D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
   E. Install piping to permit valve servicing.
   F. Install piping at indicated slopes.
   G. Install piping free of sags and bends.
   H. Install fittings for changes in direction and branch connections.
   I. Install piping to allow application of insulation.
   J. Select system components with pressure rating equal to or greater than system operating pressure.
   K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
   L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
   M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
   N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
   O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
P. Install valves according to Section 232116.

Q. Install unions in piping, 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Install shutoff valve immediately upstream of each dielectric fitting.

T. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves, Escutcheons and Sleeve Seals for HVAC Piping."

V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves, Escutcheons and Sleeve Seals for HVAC Piping."

W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230517 "Sleeves, Escutcheons and Sleeve Seals for HVAC Piping."

X. Do not use bullhead tees.

3.3 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for 2 and Smaller: Use dielectric unions.

C. Dielectric Fittings for 2-1/2 to NPS 4: Use dielectric flange kits.

D. Dielectric Fittings for 6 and Larger: Use dielectric flange kits.

3.4 HANGERS AND SUPPORTS

A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.

B. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
   2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
   3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
   4. Spring hangers to support vertical runs.
   5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
   1. 3/4: Maximum span, 7 feet.
   2. 1: Maximum span, 7 feet.
   3. 1-1/2: Maximum span, 9 feet.
   4. 2: Maximum span, 10 feet.
   5. 2-1/2: Maximum span, 11 feet.
   6. 3 and Larger: Maximum span, 12 feet.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
   1. 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
   2. 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
   3. 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   4. 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   5. 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   6. 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.
   E. Support vertical runs at each floor.

3.5 PIPE JOINT CONSTRUCTION
   A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
   B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
   C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
   D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.
   E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
      1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
      2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
   F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
   G. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.
   H. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

3.6 TERMINAL EQUIPMENT CONNECTIONS
   A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections. Reference floor plans for pipe sizes.
   B. Install control valves in accessible locations close to connected equipment.
   C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
   D. Install ports for pressure gages and thermometers at coil inlet and outlet connections.

3.7 WATER DRAINING
   A. Provide 3/4” hose end gate valves at low points and bottom of each riser to drain HVAC water systems.

3.8 FIELD QUALITY CONTROL
   A. Prepare hydronic piping according to ASME B31.9 and as follows:
      1. Leave joints, including welds, uninsulated and exposed for examination during test.
      2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
      3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
      4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
      5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
B. Perform the following tests on hydronic piping:
   1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
   2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
   3. Isolate expansion tanks and determine that hydronic system is full of water.
   4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, “Building Services Piping.”
   5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
   6. Prepare written report of testing.

C. Perform the following before operating the system:
   1. Open manual valves fully.
   2. Inspect pumps for proper rotation.
   3. Set makeup pressure-reducing valves for required system pressure.
   4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
   5. Set temperature controls so all coils are calling for full flow.
   6. Inspect and set operating temperatures of hydronic equipment, such as chillers and heat exchangers to specified values.
   7. Verify lubrication of motors and bearings.

END OF SECTION 23.21.13
BLANK PAGE
SECTION 23.21.14

EXTERIOR AND UNDERGROUND CHILLED WATER DISTRIBUTION SYSTEMS

PART 1 – GENERAL

1.01 APPLICABLE STANDARDS: The standards listed herein by society name, codes, etc. form a part of this specification to the extent referenced. The publications of such references are referred to in the text by the basic designation only, i.e., ASTM, ASME, etc.

1.02 SCOPE: Provide a completely operational prefabricated and pre-insulated underground distribution system for chilled water supply and return as shown on the drawings and specified herein. The work shall include but not be limited to the following:

A. The Contractor shall be responsible for field verification and site surveying required for determining exact dimensions for ordering materials and completing the installation.
B. Submittal of technical product data, installation instructions, certifications and shop drawings as required herein.
C. Manufacture of the system in strict accordance with quality control and testing requirements as specified herein.
D. Shipment, handling, storage and installation of the system in strict accordance with manufacturers’ instructions and requirements as specified herein.
E. Coordination with all other trades in the installation of this and other work associated with the project.
F. Provision of accessories, valves, specialties, seals, materials, labor and equipment required for a complete and operational system installation in accordance with Contract.
G. Testing, repair or replacement of defective materials or work, retesting to meet the test requirements of this section.
H. Excavation, dewatering, shoring, backfill and compaction as specified herein, and in accordance with manufacturers’ instructions and job site requirements.

1.03 APPROVED MANUFACTURERS: Basis of design is Rovanco Insul-8 steel carrier pipe with HDPE jacket.

A. Alternate approved manufacturer is Perma-Pipe XTRU- Therm. All requirements specified herein must be met by the system provided.
B. Substitutions of insulation materials, jacket materials, carrier pipe types and schedules shall not be permitted. Changes in pipe routing shown on the drawings shall not be permitted. Specified insulation thickness and jacket thicknesses shall be minimum permitted.
C. Only systems meeting the requirements of this section and listed under approved manufacturer’s paragraph will be accepted.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data, installation instructions and details, and Field Service Technician’s qualifications.
B. Shop Drawings: Submit scaled layout drawings of the systems, including details of all components, fittings, expansion/contraction compensation, end seals, and anchors. Drawings shall clearly indicate
pipe sizes, jacket sizes, slopes of horizontal runs, trench cross section details, and wall or floor penetration details. All dimensions shall be field verified prior to manufacturer of the system.

C. Record Drawings: Included installation details in the project Record Drawings upon completion of installation. Record Drawings shall reflect actual installed conditions of the systems in plan and elevations and shall accurately locate all system components.

D. Maintenance Data: Submit maintenance data for systems provided. Included this date with product, shop drawings, record drawings in an Owner’s maintenance manual.

PART 2 – PRODUCTS

2.01 GENERAL: The underground chilled water distribution system shall be a factory prefabricated and pre-insulated system consisting of carrier pipe, insulation and jacketing as specified, and supplied by an approved manufacturer listed herein.

2.02 System shall be designed for working pressures up to 150 psig and working temperature of 40° F, and shall meet the following requirements:

A. Carrier pipes shall be black steel, ASTM A53, Grade B, seamless, schedule 40 for sizes through 10” diameter; 0.375 inch wall thickness for sizes 12” and larger diameter.

B. Carrier pipe fittings shall be wrought steel, weld type, long radius, and shall match thickness of adjacent pipe. For pipe sizes less than 2.5” diameter, fittings shall be socket welded. For pipe sizes 2.5” and larger fittings shall be butt welded.

C. Insulation for pipe and fittings shall be polyurethane foam with the following characteristics: K factor of not greater than .15 at 50 degree F ambient temperature, minimum density of not less than 2 pounds per cubic foot, in conformance with MIL-I-24172, completely filling the annular space between carrier pipe and jacketing. Minimum insulation thickness will be in accordance with the following table.

D. Jacketing for all pipe and fittings shall be seamless, high density polyethylene (HDPE), conforming to ASTM D1248 and D3350, type III, category 5, Class C and grade P23/P34. Minimum jacket thicknesses and diameters shall be in accordance with the following schedule:

<table>
<thead>
<tr>
<th>MINIMUM INSULATION AND JACKET THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIPE SIZE</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>5 in. and below</td>
</tr>
<tr>
<td>6 in. thru 10 in.</td>
</tr>
<tr>
<td>12 in thru 18 in.</td>
</tr>
</tbody>
</table>

E. All fittings shall be factory prefabricated and pre-insulated at manufacturers’ plant. No insulation of fittings will be allowed on the job site. All factory fabricated jacket joints and miters for elbows, tees, anchors and accessories shall be HDPE butt fusion welded. The factory HDPE welding procedure and quality control method shall be submitted with product data submittals for approval.

F. After welding and testing of carrier pipes, field joint area shall be insulated with sectional urethane foam. No mixing, pouring or spraying of foam insulation shall be allowed at field joints. Sectional urethane foam insulated field joint shall be covered with a split HDPE rock shield of same thickness as adjacent jackets and the entire joint area covered with a polyethylene heat shrink cover, minimum 60 mils thickness.
G. End seals will be provided at all terminations of the pre-insulated system. End seals shall be pre-molded polyethylene shrink type.

PART 3 – EXECUTION

3.01 GENERAL: Installation of the prefabricated, pre-insulated systems shall be done in accordance with the following requirements and the manufacturer’s instructions.

3.02 EARTHWORK

A. Provide excavation, dewatering, backfilling, and shoring under this section. Comply with all local codes and safety ordinances related to this work.
B. Excavate trenches to the depths as indicated on the drawings, making allowance for 6” of bedding material. Grade the bottom of the trench to provide uniform beaming and support for the pipe. Remove shoring, bracing, support blocks and debris from the trench. Install a 6” layer of sand bedding material and hand compact to 90% modified proctor.
C. After placement of pipe back fill with sand or an approved sand-gravel mixture in 6” lifts to a distance of 12” above the top of the pipe casting or jacket. Hand compact each layer.
D. Place final backfill in one foot lifts. Final backfill material to be clean earth free of organic material, rocks, and foreign matter. Final backfill may be compacted using mechanical compaction equipment to 85% modified proctor.
E. Maintain minimum cover of 24” above top of pipe casting in grassed areas and 36” in paved areas and below sidewalks.

3.03 RECONDITIONING SURFACES

A. Unpaved surfaces shall be restored to their original condition and elevation. Sod or topsoil shall be carefully preserved and replaced after backfilling. Sod that is damaged shall be replaced.
B. Paved surfaces, sidewalks, gutters and curbs shall be patched or restored to an undisturbed condition.

3.04 WELDING: The contractor shall be solely and entirely responsible for the quality of system welding.

A. Qualification of welders, rules of procedure for qualification, and general requirements for fusion welding shall conform to applicable portions of ANSI 31.1 and AWS B3.0. All welds shall have 100% penetration. Each welder shall be examined at the job site by the Contractor to determine the ability of the welder to meet the qualifications required. The Contractor shall have available for review a listing of qualified welder’s names and corresponding code markings.
B. Field beveling and factory beveling may be by mechanical means or flame cut. For flame cut bevels, thoroughly clean surfaces of scale and oxidation just prior to welding. All beveling shall conform to ANSI B31.1 and AWS B3.0.
C. Use split welding rings for field joints on all pipe 2.5” and larger to assure proper alignment, complete penetration, and prevention of weld splatter reaching the interior of pipe. Make field joints for pipe less than 2.5” using welding sockets.
D. Test all welds in accordance with provisions of this section. Replace and re-inspect defective welds. Repairing defective welds by adding weld material over defect or by peening shall not be permitted.
E. Store electrodes in a heated dry area and keep free from moisture during fabrication operations.
F. For factory fabrications, all steel pipe and fittings shall be welded and tested in accordance with ANSI B31.1 Code for Pressure Piping. All steel pipe welders at the prefabrication plant shall be certified. Steel pipe welding procedures and certifications of welders are to be submitted with product data submittals.

3.05 TESTING

A. Carrier pipes shall be hydrostatically tested at 1.5 times working pressures or at 150 psig, whichever is greater, for a period of four hours. Visually inspect all joints for signs of leakage. Systems may be tested in stages, but every weld joint shall be tested.

B. Additionally, where piping crosses traffic thoroughfares and other areas subject to frequent vehicular or equipment loads, perform radiography for all field welds.

C. Designer shall be notified 48 hours prior to any test. Contractor shall submit test reports on every test indicating date of test, sections tested, beginning and ending times and beginning and ending pressures recorded.

END OF SECTION
PART 1 - GENERAL (Not Applicable)

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
   1. Hot-Water Heating Piping: 125 psig at 200 deg F.
   2. Chilled-Water Piping: 125 psig at 200 deg F.
   3. Makeup-Water Piping: 80 psig at 150 deg F.
   4. Condensate-Drain Piping: 150 deg F.
   5. Air-Vent Piping: 200 deg F.
   6. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 VALVES

A. Ball Valves
   1. HVAC Circulating Water Piping: 2" and less Figure T-585-70 or S-585-70, 2-piece, full port, 600 psi, WOG, TFE seats.
   2. Provide ball valves with locking handle.
   3. Provide extended lever for insulated service.
   4. Stainless Steel balls to be used.

B. Butterfly Valves - 2-1/2" And Up:
   1. HVAC Circulating Water Piping: Figure LD-2000, lug type, 200 psi, Class 125, EPDM liner, aluminum bronze disc.
   2. Butterfly valves rated bubble tight for dead end service at full pressure in both directions without the need for downstream blind flange.
   3. Provide hand wheel and closed housing worm gear on valves 8 inches and larger. Provide clamp lock hand lever operators on valves less than 8 inches.

C. Check Valves:
   1. HVAC Circulating Water Piping:
      a. System pressures 125 psi and less: Figure 910, non slam.

D. Control Valves:
   1. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 230923 "Direct Digital Control (DDC) System for HVAC.

E. Balancing Valves: Bronze, Calibrated-Orifice
   1. Body: Bronze, ball or plug type with calibrated orifice or venturi.
   2. Ball: Brass or stainless steel.
   3. Plug: Resin.
   4. Seat: PTFE.
   5. End Connections: Threaded or socket.
   7. Handle Style: Lever, with memory stop to retain set position.
   8. CWP Rating: Minimum 125 psig.
   9. Maximum Operating Temperature: 250 deg F.

F. Pressure-Reducing Valves: ASME labeled, Diaphragm-Operated
2. Disc: Glass and carbon-filled PTFE.
5. Diaphragm: EPT.
6. Low inlet-pressure check valve.
7. Inlet Strainer: Stainless steel, removable without system shutdown.
9. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

G. Diaphragm-Operated Safety Valves: ASME labeled.
   1. Body: Bronze or brass.
   2. Disc: Glass and carbon-filled PTFE.
   5. Diaphragm: EPT.
   7. Inlet Strainer: Stainless steel, removable without system shutdown.
   9. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

H. Flow Balancing Valve
   1. Type: Similar to B & G "Circuit Sentry", Armstrong "CBV" or Taco "AccuFlow".
   2. Provide calibrated, non-ferrous valve with provisions for connecting a portable differential pressure meter for flow measurement and balance.
   3. Provide meter connections with built-in check valves.
   4. Provide integral pointer to register degree of valve opening with tamper proof memory feature.
   5. Provide valve with drain connection.
   6. Construct valve with integral seals to prevent leakage around rotating element.
   7. Construct valve for 125 psi working pressure at 150 degrees F.
   8. Provide preformed polyurethane insulation for easy access to valve without disturbing field applied adjacent insulation.
   9. Provide valve with engraved tag attached indicated design flow, pressure, and flow characteristic of station.

2.3 ELECTROMAGNETIC FLOW METER
   A. Insertion style electromagnetic flow meter equal to Onicon F-3500 Series.

2.4 AIR-CONTROL DEVICES
   A. Manual Air Vents:
      1. Body: Bronze.
      2. Internal Parts: Nonferrous.
      3. Operator: Screwdriver or thumbscrew.
      4. Inlet Connection: NPS 1/2.
      7. Maximum Operating Temperature: 225 deg F.
   B. Expansion Tanks:
      1. Expansion tanks shall be bladder type, welded steel, designed, constructed, certified and stamped in accordance with ASME BPVC-VIII-1-2013 for a working pressure of 125 psig at 240°F. Bladders shall be replaceable elastomeric butyl rubber type.
2. Manufacturers: Bell & Gossett, Flo-Fab.

C. In-Line Air Separators:
1. Centrifugal inline tank type, capable of handling the water flow indicated on the drawings and constructed for 125 psig working pressure.
2. Manufacturer: Bell & Gossett, Flo-Fab.

2.5 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:
1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.

B. Stainless-Steel Bellows, Flexible Connectors:
2. End Connections: Threaded or flanged to match equipment connected.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

C. P.T. Test Plugs:
1. Provide 1/4 inch solid brass pressure/temperature test plugs at locations shown on drawings.
2. Nordel self-closing valve to be rated for 275 degrees F. service.
3. Plugs to be manufactured by Flow Design, Peterson Engineering, SISCO, or equal.

D. Pressure/Temperature Test Kit:
1. Provide Owner complete portable pressure and temperature test kit.
2. Kit to be complete with pressure test gauge, necessary connector hoses, temperature test thermometer with adapter, shutoff and vent valves and carrying case.
3. Readout kit to be manufactured by Bell & Gossett ITT or equal.

E. Pressure Gauges:
1. Provide 4-1/2 inch dial, liquid filled pressure gauges at locations shown on drawings.
2. Gauges to be equal to Trerice Model No. 500X with glycerin liquid fill, nylon, steel, or aluminum case, acrylic plastic window, brass movement, phosphor bronze bourdon tube, and brass socket.
3. Accuracy to be guaranteed within one-half percent.
4. Select scale range of gauges to indicate design pressure near midpoint of scale.
5. Provide each gauge with 1/4 inch size, brass construction needle valve equal to Trerice Model No. 735-2.
6. Provide each gauge with impulse dampener equal to Trerice Model No. 870.

F. Thermometers:
1. Provide Trerice or equal 9-inch scale, adjustable angle (rear, front, and side), industrial thermometers at locations shown on drawings.
2. Each thermometer to have aluminum case, clear acrylic plastic window, mercury tubing, scale with white background and black markings, brass stem, and separable brass well with 2-1/2” extension neck.

G. Thermometer Wells:
1. Provide Trerice or equal stainless steel thermometer wells for water temperature sensors and at other locations shown on drawings.
2. Test wells to be stainless steel with 2-1/2 inch extension neck and screw plug cap with chain and shall be filled with light clear oil.
2.6 BYPASS CHEMICAL FEEDER - CHILLED AND HOT WATER SYSTEM

A. Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves equal to Dearborn Type AV. Feeder shall be complete with 3/2" fill opening with 1/4 turn quick opening cover that cannot be removed while feeder is pressurized.
   1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.
B. Install calibrated-orifice, balancing valves at each branch connection to return main.
C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
B. Install piping from air separator to expansion tank with a 2 percent upward slope toward tank.
C. Install in-line air separators in pump suction. Install drain valve on air separators 2" and larger.
D. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.
   1. Install tank fittings that are shipped loose.
   2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.
E. Install expansion tank on the floor. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.
F. Chemical Treatment: Install complete systems in accordance with manufacturer's installation instructions. Provide all piping and tubing materials for interconnection of components.

END OF SECTION 23.21.16
PART 1 - GENERAL (Not Applicable)

1.1 GENERAL

A. Pump manufacturer shall furnish and be responsible for the selection, compatibility and performance of each unit consisting of pump, motor, coupling and base plate.

B. Motor horsepower indicated on schedule is selected to allow non-overloading operation of pump. Pumps shall not be selected requiring impeller sizes within 10 percent of maximum impeller size for that pump size and/or have an efficiency of 75 percent or less.

PART 2 - PRODUCTS

2.1 END-SUCTION CENTRIFUGAL PUMPS

A. Provide Bell & Gossett Series 1510 or Flo Fab Series 2000.

B. Description: Factory-assembled, non-overloading, single stage, end suction, horizontally frame-mounted, flexible coupled, bronze fitted, centrifugal type pump.

C. Pump Construction:
   1. Casing: Radially split, back-pullout-design, cast iron, with replaceable bronze wear rings, drain plug at bottom and air vent at top of volute, threaded gage tappings at inlet and outlet, and flanged connections.
   2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
   4. In "Mechanical Seal" Subparagraph below, retain "Buna-N" option for temperature rating of 225 deg F; retain "EPT" option for 250 deg F.
   5. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
   7. Mount pump volute solidly to base through a pedestal support.
   8. Provide motor rated for inverter duty used for systems with variable frequency drives.

D. Coupling and Base Plate
   1. Manufacturer to furnish and mount pump and motor on common steel base plate with drip pan and drain connection.
   2. Manufacturer to furnish and mount flexible coupling. Fasten metal coupling guard to pump base plate.
   3. NAMEPLATE: Provide pump and motor with stainless steel or aluminum nameplate securely fastened to casings. Nameplates to provide all data necessary for equipment identification and replacement.

E. Motor: Single speed and rigidly mounted to pump casing with integral pump support.
   1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Motor Requirements for HVAC Equipment."

2.2 PUMP SPECIALTY FITTINGS

A. Suction Diffusers and Triple Duty Valves to be manufactured by Bell & Gossett ITT or Flo Fab.
B. Suction Diffuser:
   1. Angle pattern.
   2. 250-psig pressure rating, cast-iron body and end cap, pump-inlet fitting.
   3. Bronze startup and bronze or stainless-steel permanent strainers.
   4. Bronze or stainless-steel straightening vanes.
   5. Drain plug.
   6. Bottom blowdown connection, inlet gauge port and adjustable support foot to carry weight of suction piping.

C. Triple-Duty Valve:
   1. Angle or straight pattern.
   2. 250-psig pressure rating, cast-iron body, pump-discharge fitting.
   3. Drain plug and bronze-fitted shutoff, balancing, and check valve features.
   4. Brass gage ports with integral check valve and orifice for flow measurement.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION
   A. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.
   B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
   C. Equipment Mounting:
      1. Install base-mounted pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Division 03 "Cast-in-Place Concrete."
      2. Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration Isolation for HVAC."

3.2 ALIGNMENT
   A. Perform alignment service.
   B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.
   C. Comply with pump and coupling manufacturers' written instructions.
   D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.3 CONNECTIONS
   A. Comply with requirements for piping specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping, Valves and Specialties."
   B. Drawings indicate general arrangement of piping, fittings, and specialties.
   C. Where installing piping adjacent to pump, allow space for service and maintenance.
   D. Connect piping to pumps. Install valves that are same size as piping connected to pumps.
   E. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
   F. Install triple-duty valve on discharge side of pumps.
   G. Install suction diffuser and shutoff valve on suction side of pumps.
H. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.
I. Provide one spare set of bearings and seals for each pump supplied.
J. Provide drip pans.
K. Install compound pressure gauges on pump suction and discharge. Reference detail on drawings.

END OF SECTION 23.21.23
PART 1 - GENERAL

1.1 DUCTWORK
A. Low pressure ductwork refers to systems operating at 2.0” w.g. total static pressure with velocities up to 2000 FPM.
B. Provide and/or construct all materials, ductwork, joints, transitions, dampers, access doors, etc., as set forth in these specifications necessary to install the low pressure sheet metal ductwork required by the Mechanical Drawings.
C. Seal all duct openings with plastic during construction. Protect the return/negative pressure side of ductwork system throughout the entire construction period.

1.2 PERFORMANCE REQUIREMENTS
A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with the latest edition of SMACNA "HVAC Duct Construction Standards," (Metal and Flexible) and performance requirements and design criteria indicated in "Duct Schedule" Article.
B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA "HVAC Duct Construction Standards" (Metal and Flexible).

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS
A. General Fabrication Requirements: Comply with SMACNA "HVAC Duct Construction Standards" (Metal and Flexible) based on indicated static-pressure class unless otherwise indicated.
B. Transverse Joints: Select joint types and fabricate according to SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS
A. General Fabrication Requirements: Comply with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
   1. Manufacturer: Eastern Sheet Metal, SEMCO.
B. Transverse Joints: Select joint types and fabricate according to SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class,
applicable sealing requirements, materials involved, duct-support intervals, and other provisions in
SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct
Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-
pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other
provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows shall be smooth radius with a centerline radius of 1.5 times the duct diameter.

E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction
Standards - Metal and Flexible," "90 Degree Tees and Laterals," and "Conical Tees," for static-pressure
class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions
in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 Duct Access Doors
A. Provide insulated, factory fabricated access doors with dual latches and gaskets along perimeter. Door
shall match leakage and pressure class ratings of duct where door is located.

2.4 SHEET METAL MATERIALS
A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal
and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless
otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains,
discolorations, and other imperfections.

B. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum
diameter for lengths longer than 36 inches.

2.5 JOINT SEALER
A. Manufacturer by Hardcast Inc., Two Stage Sealant Process.
   1. Stage 1: Apply fiber DT tape.
   2. Stage 2: Brush on RTA-50 sealant over fiber tape.

2.6 GASKETS AND SEALS
A. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

B. Round Duct Joint O-Ring Seals:
   1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated
      for 10-inch wg static-pressure class, positive or negative.
   2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
   3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and
      fitting spigots.

2.7 HANGERS AND SUPPORTS
A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with
   threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and
   Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2,
   "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed
   for duct hanger service; with an automatic-locking and clamping device.
F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:
   2. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Seal all low pressure transverse and longitudinal joints with approved sealer in accordance with manufacturer's recommendation instructions.

D. Install round ducts in maximum practical lengths.

E. Install ducts with fewest possible joints.

F. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

G. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

I. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

J. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

K. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

L. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233713 "Sheet Metal Specialties" for fire and smoke dampers.

M. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
3.4 HANGER AND SUPPORT INSTALLATION
   A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
   B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
      1. Where practical, install concrete inserts before placing concrete.
      2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
      3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
      4. Do not use powder-actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4 inches (100 mm) thick.
   C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
   D. Hangers Exposed to View: Threaded rod and angle or channel supports.
   E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
   F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS
   A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
   B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 START UP
   A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.7 DUCT SCHEDULE
   A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
   B. Supply Ducts:
      1. Ducts Connected Downstream from Terminal Units:
         a. Pressure Class: Positive 2-inch wg.
      2. Ducts Connected to Single Zone-Volume Air-Handling Units:
         a. Pressure Class: Positive 2.5-inch wg.
      3. Ducts Connected Downstream of Variable-Air-Volume Terminal Units:
         a. Pressure Class: Positive 2-inch wg.
   C. Return/Exhaust Ducts:
      1. Ducts Connected to Air-Handling Units:
         a. Pressure Class: Positive or negative 2-inch wg.
   D. Exhaust Ducts:
      1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
         a. Pressure Class: Negative 2-inch wg.
   E. Outdoor-Air Ducts:
      1. Ducts Connected to Air-Handling Units:
a. Pressure Class: Positive or negative 2-inch wg.

F. Intermediate Reinforcement:

G. Elbow Configuration:
   1. Rectangular Duct: Elbows shall be smooth radius with a centerline radius of 1.5 times the duct diameter.

H. Branch Configuration:
   1. Rectangular Duct: Comply with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
      a. Rectangular Main to Rectangular Branch: 45-degree entry.
      b. Rectangular Main to Round Branch: Spin in.
   2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

I. Side Takeoff Fittings:
   1. Minimum 26 gauge: galvanized steel, designed for minimum pressure drop by an expansion from a rectangular connection to a round duct. The fitting shall include a 1” wide mounting flange with die formed corner clips, prepunched mounting holes, and an adhesive-coated flange gasket. The outlet collar shall be crimped and incorporate a bead.
   2. Manufacturer: Crown, of Flexmaster.

END OF SECTION 23.31.13
BLANK PAGE
SECTION 23.31.15
SHEET METAL DUCTWORK - MEDIUM PRESSURE

PART 1 - GENERAL

1.1 DUCTWORK
   A. Medium pressure ductwork refers to systems with velocities greater than 2000 fpm operating at a static pressure of 6" or less, but greater than 2" wg. These are ducts upstream of terminal units/VAV boxes.
   B. The contractor shall provide and/or construct all materials, ductwork, joints, transformations, fittings, access doors, etc., as set forth in these specifications necessary to install the medium pressure sheet metal ductwork required by the drawings.
   C. Seal all duct openings with plastic during construction.

1.2 PERFORMANCE REQUIREMENTS
   A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
   B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS
   A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards" based on indicated static-pressure class unless otherwise indicated.
   B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards".
   C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards", "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND AND FLAT OVAL DUCTS AND FITTINGS
   A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
      1. Manufacturer: Eastern Sheet Metal, SEMCO.
   B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class,
applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards" for static class.

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows shall be smooth radius with a centerline radius of 1.5 times the duct diameter.

E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," "90 Degree Tees and Laterals," and "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards" for static class.

2.3 INTERNALLY INSULATED DOUBLE WALL DUCT AND FITTINGS

A. Construction to be comprised of airtight outer pressure shell, 1" insulation layer, and perforated metal inner line completely covering insulation.

B. Provide outer pressure shell manufactured from galvanized steel meeting ASTM A-525. Duct and fitting construction to be as specified for single wall round and flat oval duct.

C. Provide inner liner manufactured from galvanized steel meeting ASTM A-525 in the following minimum gauges:

<table>
<thead>
<tr>
<th>Diameter or Minor Axis, Inches</th>
<th>0&quot; - 34</th>
<th>35&quot; - 59</th>
<th>60+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duct, Perforated Inner Liner</td>
<td>28</td>
<td>26</td>
<td>22</td>
</tr>
<tr>
<td>Fitting, Perforated Inner Liner</td>
<td>22</td>
<td>22</td>
<td>22</td>
</tr>
</tbody>
</table>

D. Perforations not to exceed 3/32" diameters. Percentage of open area to equal 13 percent.

E. Support inner liners of both duct and fittings with metal spacers welded in position to maintain spacing and concentricity.

F. Provide inner couplings to align inner lining to maintain airflow conditions equivalent to standard single wall medium-pressure duct joints. Butt joints are not acceptable for inner liner. Accomplish alignment by extending liner of fitting for slip joint into duct or by use of double, concentric coupling with two couplings held by spacers for rigidity and wall spacing. Provide insulation end fitting where internally insulated duct connects to uninsulated duct or fitting, fire damper, or flex to bring outer pressure shell down to nominal size.

G. Duct Access Doors

1. Provide double wall, insulated, factory fabricated access doors with dual latches and gaskets along perimeter. Door shall match leakage and pressure class ratings of duct where door is located.

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards" for acceptable materials, material thicknesses, and duct construction methods for static class. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
B. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.5 JOINT SEALER

A. Manufactured by Hardcast Inc., Two Stage-Sealant Process.
   1. Apply fiber DT tape.
   2. Brush on RT A-50 sealant over fiber tape.

2.6 GASKETS AND SEALS

A. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
B. Round Duct Joint O-Ring Seals:
   1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
   2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
   3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
G. Trapeze and Riser Supports:
   2. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations.
B. Install ducts according to SMACNA’s "HVAC Duct Construction Standards" for static pressure.
C. Seal all low pressure transverse and longitudinal joints with approved sealer in accordance with manufacturer's recommendation instructions.
D. Install round ducts in maximum practical lengths.
E. Install ducts with fewest possible joints.
F. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
G. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
I. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
J. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
K. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
L. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233713 "Air Duct Accessories" for fire and smoke dampers.
M. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 INSTALLATION OF EXPOSED DUCTWORK
A. All exposed ductwork shall be fabricated from paint grip sheet metal.
B. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
C. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
D. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
E. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
F. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING
A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards."

3.4 HANGER AND SUPPORT INSTALLATION
A. Comply with SMACNA's "HVAC Duct Construction Standards," Chapter 5, "Hangers and Supports."
B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
D. Hangers Exposed to View: Threaded rod and angle or channel supports.
E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
3.5 CONNECTIONS
A. Make connections to equipment with flexible connectors complying with Section 233713 "Sheet Metal Specialties."
B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 START UP
A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.7 DUCT SCHEDULE
A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
B. Intermediate Reinforcement:
C. Elbow Configuration:
   1. Rectangular Duct: Elbows shall be smooth radius with a centerline radius of 1.5 times the duct diameter.
D. Branch Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards," "Branch Connection for medium pressure ductwork."
      a. Rectangular Main to Rectangular Branch: 45-degree entry.
      b. Spun long radius bellmouth connections to be used at each round take off from medium pressure duct mains and plenums.
   2. Round: Comply with SMACNA's "HVAC Duct Construction Standards," "90 Degree Tees and Laterals," and "Conical Tees." Saddle taps are permitted in existing duct.
E. Side Takeoff Fittings:
   1. Minimum 26 gauge: galvanized steel, designed for minimum pressure drop by an expansion from a rectangular connection to a round duct. The fitting shall include a 1" wide mounting flange with die formed corner clips, prepunched mounting holes, and an adhesive-coated flange gasket. The outlet collar shall be crimped and incorporate a bead.
   2. Manufacturer: Crown, of Flexmaster.

3.8 LEAK TESTING
A. Install medium pressure ductwork to be pressurized to 50% over design operating pressure of 6" wg. whichever is greater. Air leakage at test pressure to be measured by a calibrated orifice type flow meter. Total allowable leakage of system shall not exceed 1/2 of 1% of system air handling capacity.

END OF SECTION 23.31.15
SECTION 23.34.23
HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Twin City, Cook or approved equal.

B. Housing: Removable, All aluminum housing roof mounted, belt driven, down blast centrifugal exhaust fan; square, one-piece, aluminum base with venturi inlet cone.
   1. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt Drives:
   1. Resiliently mounted to housing.
   2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
   5. Fan and motor isolated from exhaust airstream.

E. Accessories:
   1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
   2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
   3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
   4. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.
   2. Overall Height: 12 inches.

2.2 IN-LINE MIXED FLOW CENTRIFUGAL FANS

A. Twin City, Cook or approved equal.

B. Housing: Housings constructed from heavy-gauge steel and shall be continuously welded.

C. Mixed flow impeller with airfoil die-formed continuously welded blades.

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories:
1. Companion Flanges: For inlet and outlet duct connections.
2. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
3. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
4. Bolted access door

2.3 PROPELLER FANS
A. Twin City, Cook or approved equal.
B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
C. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.
D. Fan Wheel: Replaceable, extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.
E. Fan Drive: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
F. Fan Drive:
   1. Resiliently mounted to housing.
   2. Statically and dynamically balanced.
   3. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
   4. Extend grease fitting to accessible location outside of unit.
   5. Service Factor Based on Fan Motor Size: 1.4.
   6. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
      a. Ball-Bearing Rating Life: ABMA 9, L_{10} of 100,000 hours.
   8. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
   9. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
   10. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
G. Accessories:
   1. Heavy duty gravity backdraft damper.
   3. Wall Mounting Sleeve: Galvanized steel to match fan and accessory size.
   4. Disconnect Switch: Nonfusable type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

2.4 MOTORS
A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Motor Requirements for HVAC Equipment."
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
B. Enclosure Type: Totally enclosed, fan cooled.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install fans in accordance with manufacturer's published instructions.
B. Secure centrifugal roof mounted fans to curbs with stainless steel screws.
C. Connect ducts to fans to allow for straight and smooth airflow.
D. Provide flexible connections between fans and ducts.
E. Install fans level.
F. Check fan alignment and balance. Correct improperly aligned or vibrating fans.
G. Final installation to be free of leaks.
H. Ensure fans are interlocked with appropriate systems and/or controls.

END OF SECTION 23.34.23
BLANK PAGE
SECTION 23.36.00
AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Variable volume air terminal units to be pressure independent, single duct, DD control type with hot water reheat coil as manufactured by Johnson Controls or Titus.

PART 2 - PRODUCTS

2.1 VARIABLE VOLUME AIR TERMINAL UNITS

A. Provide pressure independent, single duct, DDC control type with hot water reheat coil as manufactured by Johnson Controls or Titus. Provide units complete with pressure taps and airflow curves for making airflow and pressure measurements. Terminal units to be pressure independent. Terminal unit airflow to be monitored by an integral, multiple point, averaging airflow sensing ring or cross to maintain constant airflow within 5 percent of rated cfm down to 25 percent of nominal cfm, independent of changes in system static pressure. Factory set, field adjustable settings for terminal unit maximum and minimum airflows to be provided in accordance with schedule on drawings. Integral flow taps and calibration chart to be provided for each terminal unit.

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Provide terminal units with minimum 22-gauge welded steel housing. Casing shall be internally lined with 1/2” thick fiberglass insulation.

1. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
2. Air Outlet: S-slip and drive connections, size matching inlet size.
3. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, 2 percent of nominal airflow at 6-inch wg inlet static pressure.

E. Hydronic Heating Coils: Provide factory mounted hot water reheat coils. Coils shall have a minimum .025 inch thick copper tube, with mechanically bonded aluminum fins. Design for minimum 200 psig and 220°F. Aluminum fins shall be a minimum of .0075 inch thick and spaced at a maximum of 12 fins/inch. Headers shall be heavy cast iron or steel. Designs shall be for a minimum operation of 200 psig at 220 degrees F. Coil casing shall be insulated with fiberglass duct wrap.

G. Maximum room N.C. due to discharge or radiated sound shall not exceed NC-35 when terminals are either in throttled or full open position with inlet static pressure ranging from 0.5 to 2” w.g. Correction of noise excesses not to constitute additional charges.

F. Controls:
1. Terminal units to be complete with factory installed, direct digital control actuator for connection to DDC controls provided by control contractor.
2. Coordinate controls with control contractor.

2.2 CASING LINER

A. Casing Liner: 1/2-inch thick elastomeric closed cell foam insulation. Insulation to be UL listed and meet NFPA-90A and UL-181 requirements.
2.3 **SOURCE QUALITY CONTROL**

A. Factory Tests: Test assembled air terminal units according to AHRI 880. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, and AHRI certification seal.

**PART 3 - EXECUTION**

3.1 **INSTALLATION**

A. Provide 3 diameters of straight duct at entrance to the terminal box. Final tie-in to the box shall be properly aligned so as not to restrict airflow into the box.

3.2 **HANGER AND SUPPORT INSTALLATION**

A. Comply with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Ch. 5, "Hangers and Supports" and with Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 **TERMINAL UNIT INSTALLATION**

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain 36" clear on VAV terminal unit for piping and control access.

C. Where installing piping adjacent to air terminal unit, allow space for service and maintenance.

D. Hot-Water Piping: Comply with requirements in Section 232113 "Hydronic Piping” and Section 232116 "Hydronic Piping, Valves, and Specialties," and connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

E. Comply with requirements in Section 233113 "Sheet Metal Ductwork - Low Pressure" for connecting ducts to air terminal units.

F. Make connections to air terminal units with flexible connectors complying with requirements in Section 233713 "Sheet Metal Specialties."

G. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

**END OF SECTION 23.36.00**
SECTION 23.37.13
SHEET METAL SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY
A. Grilles, registers and diffusers shall be provided with frames, borders, and mounting attachments for installation in the actual wall, soffit and ceiling construction in which installed.

PART 2 - PRODUCTS

2.1 AIR DISTRIBUTION TERMINALS
A. CD-1: Provide Square Ceiling diffusers equal to Titus Omni or approved equal with round duct collar, square center plaque face panel with 360 degree air pattern, all aluminum construction with sliding radial damper, where indicated on the drawings. The back of the face panel shall have an aerodynamically shaped, rolled edge to ensure a tight horizontal discharge pattern. Frame to match ceiling type. Finish shall be baked on, off-white enamel.
B. SD-1: Provide linear slot ceiling & side wall diffusers equal to Titus ML-39 or approved equal at all locations designated by schedule on drawings. Diffusers to be complete with horizontal to vertical airflow pattern adjustment. Minimum lengths of continuous border sections to be as indicated. Diffuser shall be furnished in multiple sections and joined together end-to-end with alignment pins to form a continuous slot appearance. Slot width to be one-inch. Total number of slots required to be indicated on drawings. Finish to be clear anodized aluminum. Provide flanged border and concealed mounting. Internal airflow pattern adjustment mechanism to be flat black. Provide each diffuser with insulated plenum with round duct connection, Titus MPI-39.
C. RG-1: Provide aluminum construction 24x24 return register complete with opposed blade damper and 1/2” x 1/2” x 1” cube egg-crate grid. Finish shall be off-white, baked on enamel. Reference architectural ceiling plans for lay-in or surface mount frame requirements.
D. RG-2: Provide aluminum construction 24x12 return register complete with opposed blade damper and 1/2” x 1/2” x 1” cube egg-crate grid. Finish shall be off-white, baked on enamel. Reference architectural ceiling plans for lay-in or surface mount frame requirements.
E. SR-1: Sidewall Return Registers: Provide Ruskin ELF15J fixer louver face, 45 degree, steel with white finish for paint adhesion.

2.2 FIRE DAMPERS
A. Fire dampers to be U.L. listed Dynamic in accordance with UL-555. Fire dampers to be held in an open position with a 165 degree F fusible link and arranged to lock in position on closure.
B. Fire dampers for rectangular duct to be type "B" and for round duct to be Type "C". Fire dampers for ductwork with a static pressure rating greater than 2” wg shall be Type "C". Fire dampers located behind sidewall registers and grilles and others specifically indicated on drawings to be Type "A". Fire dampers to be multi-leaf type with spring closing for horizontal mounting and weighted-gravity closing for vertical mounting. Dampers to be steel construction with rust resistant finish and provided with a factory-installed mounting sleeve suitable for structure. Mount per manufacturer's published U.L. approved installation instructions.
C. See Architectural drawings for hour-rating of walls and/or floors. Dampers to be compatible with hour ratings.

2.3 COMBINATION FIRE AND SMOKE DAMPERS
A. Low pressure ductwork: Ruskin Model FSD-36.
C. Install and mount qualified operator at time of fabrication by damper manufacturer. Furnish damper and operator by a single entity meeting applicable UL 555S qualifications for both damper and operator. Damper operator shall be of adequate size to open or close damper in 15 seconds.

2.4 SMOKE DAMPERS
A. Low pressure duct (2” pressure class and lower): Ruskin SD-35.
B. Medium pressure duct (4” - 6” pressure class): Ruskin SD-60.
C. Operators: Electric.
D. Install and mount qualified operator at time of fabrication by damper manufacturer. Operator shall be mounted out of airstream in accessible location. Furnish damper and operator by a single entity meeting applicable UL 555S qualifications for both damper and operator. Damper operator shall be adequate size to open or close damper in 15 seconds.

2.5 SLEEVES
A. Unless otherwise required by the authority having jurisdiction, sleeves for fire dampers and fire and smoke combination dampers shall be the rigid type of construction recommended in Schedule 2 of SMACNA Publication for “Fire Damper and Heat Stop Guide for Air Handling Systems”. Use 16 gauge for ducts 24” or less in diameter or either rectangular dimension and 14 for ducts over 24”. Provide minimum 18” long sleeves. Coordinate required length with wall thicknesses.
B. Conform to the requirements of UL 555S. Test damper and operator as a unit to comply with UL 555S.
C. Install 1-1/2” x 1-1/2” x 1/8” angle bar on four sides of sleeves and both sides of wall.
D. Fasten angles to sleeve only.
E. Do not fasten angles to the wall.

2.6 AUTOMATIC CONTROL DAMPERS
A. All automatic control dampers to be furnished by Control subcontractor and installed by this Contractor (except unit mounted dampers).
   1. Automatic control dampers to be low-leak, galvanized steel or aluminum construction parallel blade type, Ruskin Model CD36, Arrow Series 395, or approved equal.
   2. Dampers to be complete with minimum 4” deep, 16-gauge hat-shaped channel frame, minimum 16 gauge blades on maximum 6” centers, 1/2” diameter shafts, and corrosion resistant bearings.
   3. Dampers to have extruded vinyl blade seals and stainless steel or aluminum flexible metal compression type jamb seals to limit leakage to a maximum of ½% (maximum of 5.4 cfm/sq. ft. leakage for 48” x 48” size damper) when tested in accordance with AMCA Standard 500.
   4. Motor actuator to be oil immersed in gear train, 120- volt line voltage type with spring return to closed position on power interruption. Provide Honeywell Model M445/845, Barber-Colman MA-5210/5330 or approved equal complete with damper linkages.

2.7 MANUAL VOLUME DAMPERS
A. Type: Opposed blade.
B. Material: Steel, 3V type blades mounted in steel channel frame.
C. Shaft: 1/2” square rod operator with end bearings and gasket seal at duct penetrations. Terminate shaft in damper frame with bushings.
D. Operator: Locking quadrant handle with damper position indicator and insulation stand off mounting bracket for externally insulated ductwork.
2.8 FLEXIBLE CONNECTORS
A. Install UL listed flexible duct connectors between duct and fan/equipment connections. Flexible duct connectors to be made of 28-ounce, heavy glass fabric double coated with neoprene.

2.9 DUCT ACCESS DOORS
A. Duct access doors to be provided for access to all coils, fire dampers, automatic and backdraft dampers, duct smoke detectors, static pressure and air volume sensing devices, and other equipment installed in ducts and at other points indicated on drawings.
B. Access door construction and air tightness must be suitable for the duct pressure class used (low, medium, or high).
C. Access doors to be double-panel, galvanized steel construction with minimum 1” rigid insulation between panels. Access doors in exhaust duct may be uninsulated single panel, galvanized steel construction. Doors to mount in rigid frame constructed of formed galvanized steel. Angle iron bracing to be used as required to provide rigid assembly. Doors to hinge on one side with door latch on opposite side.
D. Access doors in ductwork shall fully comply with Figure 2-12 and 2-13 of SMACNA manual. Casing access doors shall fully comply with Figure 6-11 and 6-12 of SMACNA manual.
E. Doors to close against gasket seal.
F. Ductwork and/or equipment access doors shall be required at all motorized dampers, fire dampers, smoke detectors, airflow monitoring stations, duct-mounted temperature/pressure sensors and/or transmitters, vaned elbows, and any other mechanical and/or control device requiring inspection, maintenance or test access. In addition, 24” x 24” access doors shall be utilized wherever possible to facilitate adequate access for maintenance and/or testing.

2.10 FLEXIBLE DUCT (NON-CRITICAL NOISE AREAS ONLY)
A. Acceptable manufacturers:
   1. Flexmaster U.S.A., Model No. Type 5 insulated; Wiremold; Omniair 1200; J.P. Lanburn.
B. Characteristics of flexible duct to air terminals:
   1. Approved as UL Class 1 air duct.
   2. Flame spread less than 25, smoke developed rating less than 50.
   3. Insulated with 1/2” thick fiberglass insulation.
   4. Do not exceed four (4) feet flexible duct upstream of diffusers.
   5. Flexible duct shall meet standards of local building code.
C. Seal off the insulation jacket as its ends and at joints with mastic, hardcast, or similar material. Replace flex if jacket is punctured.
D. Install flexible duct without kinks or sags and support with 3/4” wide metal bands.
E. Do not route flexible duct through corridor walls, fire or smoke partitions.
F. No bends shall be made in flexible duct with the center line radius less than one and one-half duct diameter and only one bend may occur per four foot length of duct material.

2.11 BACKDRAFT DAMPERS
A. Backdraft Dampers (BDD): Backdraft dampers to be Ruskin Model CBD6 or approved equal low-leak counterbalanced backdraft dampers. Dampers to be heavy-duty type suitable for air velocities to 2500 fpm with all extruded aluminum construction, minimum 0.81” thick frame, and minimum .050” thick blades on maximum 4” centers. Provide blades with vinyl edge seals. Provide dampers with aluminum linkage and corrosion resistant type bearings. Provide dampers with adjustable counterbalances on blades to assist closing.
2.12 ROOF HOODS
A. Fabricate air inlet or relief hoods in accordance with SMACNA Low Pressure Duct Construction Standards.
B. Fabricate of 0.081 gauge extruded aluminum tiers welded to a minimum 8 gauge aluminum support structure. The aluminum hood shall be constructed of minimum 0.063 aluminum and provided with a layer of anti-condensate coating. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. Birdscreen constructed of 1/2" galvanized mesh shall be mounted across the relief opening.
C. Mount unit on minimum 14 inch high curb base with insulation between duct and curb.
E. Provide counterbalanced, adjustable barometric dampers in all relief hoods.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install sheet metal accessories in locations shown on drawings.
B. Install accessories in accordance with manufacturer's published recommendations as well as applicable sections of SMACNA manual and other standards set forth in Part 1.
C. Provide all screw, bolts, nuts, inserts, and material required for attaching sheet metal to duct, walls, floors, and ceilings.
D. Install spin-in fitting with balancing damper in duct runout.
E. Provide minimum 24” x 24” access door in inaccessible ceilings and walls where needed for access to any inaccessible duct access doors or other mechanical equipment including valves, dampers, VAV boxes, etc.

3.2 TESTING
A. Check work for satisfactory installation and performance.
B. Insure that adequate access does in face exit for fire and smoke dampers and that damper operator motors are not hindered in operation by proximity to walls or other objects.
C. Check duct connections at access doors for air leakage or condensation. Correct conditions found.

END OF SECTION 23 37 13
PART 1 - GENERAL (Not Applicable)

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance:
   1. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup."
   2. Comply with ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.
   3. All filters to meet NFPA 90A requirements for flammability.

B. Comply with NFPA 90A and NFPA 90B.

2.2 MERV-8 DISPOSABLE FILTERS

A. Provide 30% medium efficiency, disposable, pleated media filters equal to Farr 30/30/ with a minimum rating of MERV-8 per ASHRAE 52.2 - 1999.

B. Each filter shall consist of a non-woven cotton media, media support grid, and enclosing frame.

C. Filter shall be listed by UL as Class II.

D. Average efficiency of MERV-8 on ASHRAE Test Standard 52.2-1999.

E. 2-Inch Thick Media: Effective filter media area shall not be less than 4.6 square feet of media per square foot of face area.

F. Provide one complete set of replacement filters to Owner at job completion.

2.3 FILTER GAGES

A. Manometer-Type equal to Dwyer inclined tube draft gage.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install filter gage for each filter bank for each air handling unit.

B. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.

C. Install filter-gage, static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.

D. Coordinate filter installations with duct and air-handling-unit installations.

E. Contractor shall provide a new set of clean filters during construction bi-weekly if unit is operating.

F. Protect cooling coils and heating coils with filter media during construction.

G. Install temporary filters over grilles and openings on weekly basis during construction.

END OF SECTION 23.41.00
SECTION 23.51.23
GAS VENTS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes: Listed double-wall vents.

PART 2 - PRODUCTS

2.1 DOUBLE WALL POSITIVE PRESSURE SYSTEM
A. Provide UL tested and listed double wall pipe and fittings suitable for forced/induced draft boilers.
B. Suitable for use with natural gas.
C. Maximum 1000 degrees F continuous operating temperature, or 1400 degrees F intermittent.
D. Inner Shell:
   1. 20 gauge 304 stainless steel for natural gas.
E. Outer shell: 24 gauge aluminum coated steel.
F. Shell Separation: 1 inch air space.
G. Minimum rated clearance to combustibles: 10 inches.
H. Couplings: Flanged containment band.
I. AMPCO Model VSI-2, Metalbestos Model PS, or approved equal.

PART 3 - EXECUTION

3.1 APPLICATION
A. Install double wall vent per manufacturer's installation instructions.

3.2 INSTALLATION OF LISTED VENTS
A. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
B. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
C. Support vents at intervals recommended by manufacturer to support weight of vent and all accessories.
D. Lap joints in direction of flow.
E. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

END OF SECTION 23.51.23
PART 1 - GENERAL

1.1 SUMMARY
   A. Provide Water Tube Boiler complete with all controls and accessories ready to operate on natural gas.

PART 2 - PRODUCTS

2.1 BOILER
   A. Provide water tube type equal to Bryan RV Series or approved equal.
   B. Design working pressure 150 psi.
   C. The boiler shall be manufactured in accordance with ASME Boiler and Pressure Vessels Code.

2.2 VESSEL AND TUBE CONSTRUCTION
   A. The boiler shall be constructed on a heavy steel frame. The boiler pressure vessel shall be provided with adequately sized upper and lower drums. A minimum of two downcomers shall be provided and shall be located inside furnace chamber to maximize proper thermal internal water circulation. No external water circulation source shall be required. Steel water tubes are to be 1 1/2" O.D., .095 wall thickness, six-ass, flexible serpentine bend design, not subject to thermal shock damage. Individual water tubes shall be easily removable and replaceable without either welding or rolling. The boiler shall have no more than two tube configurations. The boiler shall be furnished with an adequate number of tappings and inspection openings to facilitate internal boiler inspection and cleaning.

2.3 BOILERS TRIM
   A. Provide the following controls and trim:
      1. ASME Safety Relief Valve.
      2. Low water cut off.
      3. High limit safety control.
      4. Water temperature control operator.
      5. Drain Valve.
      6. Combination thermometer and pressure gauge.

2.4 BOILER BURNER AND CONTROLS
   A. Boiler shall be furnished with a UL listed forced draft flame retention gas burner. Burner shall be complete with integral motor and blower for supplying sufficient combustion air with vent conditions.
   B. Provide boiler with the following controls:
      1. Manual gas shut off valve
      3. High and low gas pressure switches.
      4. Gas pilot shut off and solenoid valves.
      5. Gas pilot ignition assembly with ignition transformer.
      6. Pilot and main gas pressure regulators.
   C. Provide burner mounted control panel complete with the following:
      1. Two indicator lights - power and fuel
      2. Air Safety Switch
      3. Fused on/off switch
      4. Electronic combustion safety control
2.5 JACKET CONSTRUCTION

A. Provide boiler with complete metal jacket, 16 gauge, zinc-coated rust resistant steel casing, finished with a suitable heat resisting paint and shall be constructed on a structural steel frame and properly insulated with no less than 1 1/2" fiberglass insulation. Complete jacket and insulation shall be easily removable and reinstalled. The boiler shall incorporate individually removable jacket doors, with handles providing easy access to combustion chamber and access panels. The entire tube area shall be easily accessible for fireside cleaning.

B. All appropriate controls where possible, shall be mounted on boiler front.

C. A tube removal and replacement shall be demonstrated at time of start-up. Demonstration time not to exceed 40 minutes.

D. The boiler vessel shall be warranted for 25 years against thermal shock on a non-pro-rated basis.

2.6 CONTROL SYSTEM

A. Building Automation System Interface: Factory install hardware and software to enable system to monitor, control, and display boiler status and alarms.

1. Hardwired I/O Points:
   b. Control: On/off operation, hot-water-supply temperature set-point adjustment.

2. Communication Interface: BACnet communication interface shall enable control system operator to remotely control on/off and capacity of boiler and monitor the boiler operation from an operator workstation. Control features are available, and monitoring points are displayed locally at boiler control panel through the interface.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install boilers in accordance with NFPA 54, ASME, local codes, and manufacturer's instructions, and Factory Mutual requirements.

B. Boiler and accessories shall be installed and piped per manufacturer's recommendations and under his supervision. Drain valves on boiler shell, feedwater columns, condensate receivers, and boiler feed unit tanks shall be piped to the nearest drain, full size of the connection. Relief valves and vents shall be piped to outside the building using either the connection size or the size shown on the drawings, whichever is the larger. Ells on relief lines turning up through the roof shall be drip pan ellips. Pipe gas vent connections on gas controls to outside of the building.

C. Boilers shall receive factory start-up supervision tests to check construction, operation, and function of controls and to ensure proper preparation for use.

D. Assemble and install boiler trim, components, and accessories that are not factory installed.

E. Install control and electrical devices furnished with boiler that are not factory mounted.

F. Install control and power wiring to field-mounted control and electrical devices furnished with boiler that are not factory installed.

3.2 START-UP

A. Check operation of safety valves at 20 psi above schedule operation pressure.

B. Adjust firing equipment.

C. Operate boilers at 1/3, 2/3 and full loads.

D. Take readings every half hour for 3 hours for the following:
   1. Stack temperature.
   2. Percent carbon dioxide and oxygen.
E. Adjust fuel/air mix to maximum combustion efficiency.

3.3 OPERATING DEMONSTRATION
A. Demonstrate to Owner the operation of the system over entire range

3.4 FLUE CONNECTIONS
A. Boiler Flue Venting:
   1. Connect full size to boiler connection. Comply with requirements in Section 235123 "Gas Vents."
B. Connect breeching to full size of boiler outlet. Comply with requirements in Section 235116 "Fabricated Breechings and Accessories".

END OF SECTION 23.52.33
PART 1 - GENERAL (NOT USED)

PART 2 - PRODUCTS

2.1 PACKAGED AIR-COOLED WATER CHILLERS

A. Acceptable Manufacturers: York YLAA and Carrier 30RB Scroll Type Chillers.

B. Factory-assembled and run-tested water chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.

C. Cabinet:
   1. Base: Galvanized-steel base extending the perimeter of water chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
   2. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported from base.
   4. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 500-hour salt-spray test according to ASTM B 117.
   5. Sound-reduction package consisting of the following:
      a. Acoustic enclosure around compressors.
      b. Reduced-speed fans with acoustic treatment.
      c. Designed to reduce sound level without affecting performance.
   6. Security Package: Provide security grilles with fasteners for additional protection of compressors, evaporator, and condenser coils. Grilles shall be coated for corrosion resistance and shall be removable for service access.

D. Compressors:
   1. Description: Positive-displacement direct drive with hermetically sealed casing.
   2. Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.
   3. Operating Speed: Nominal 3600 rpm for 60-Hz applications.
   5. Oil Lubrication System: Automatic pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.

E. Compressor Motors:
   1. Hermetically sealed and cooled by refrigerant suction gas.
   2. High-torque, two-pole induction type with inherent thermal-overload protection on each phase.

F. Compressor Motor Controllers:
   1. Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing.

G. Refrigeration:
   1. Refrigerant: R-410a. Classified as Safety Group A1 according to ASHRAE 34.
   2. Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
   3. Refrigerant Circuit: Each circuit shall include a thermal-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
4. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line and the refrigerant liquid-line to allow the isolation and storage of the refrigerant charge in the chiller condenser.

H. Evaporator:
1. Brazed-plate or shell-and-tube design, as indicated.
2. Shell and Tube:
   a. Description: Direct-expansion, shell-and-tube design with fluid flowing through the shell and refrigerant flowing through the tubes within the shell.
   b. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
   c. Shell Material: Carbon steel.
   d. Shell Heads: Removable carbon-steel heads with multipass baffles designed to ensure positive oil return and located at each end of the tube bundle.
   e. Shell Nozzles: Fluid nozzles located along the side of the shell and terminated with mechanical-coupling end connections for connection to field piping.
   f. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
3. Brazed Plate:
   a. Direct-expansion, single-pass, brazed-plate design.
   b. Type 316 stainless-steel construction.
   c. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
   d. Fluid Nozzles: Terminate with mechanical-coupling end connections for connection to field piping.
4. Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator to minus 20 deg F.
5. Remote Mounting: Designed for remote field mounting where indicated. Provide kit for field installation.

I. Air-Cooled Condenser:
1. Plate-fin coil with integral subcooling on each circuit, rated at 450 psig.
   a. Construct coils of copper tubes mechanically expanded to aluminum fins.
   b. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
2. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
3. Fan Motors: Totally enclosed nonventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings, and having built-in overcurrent- and thermal-overload protection.
4. Fan Guards: Steel safety guards with corrosion-resistant coating.

J. Electrical Power:
1. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to water chiller.
2. House in a unit-mounted, NEMA 250, Type 3R enclosure with hinged access door with lock and key or padlock and key.
3. Wiring shall be numbered and color-coded to match wiring diagram.
4. Install factory wiring outside of an enclosure in a raceway.
5. Field power interface shall be to NEMA KS 1, heavy-duty, nonfused disconnect switch.
6. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
   a. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
   b. NEMA KS 1, heavy-duty, nonfusible switch.
   c. NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
7. Provide each motor with overcurrent protection.
8. Overload relay sized according to UL 1995, or an integral component of water chiller control microprocessor.
10. Provide power factor correction capacitors to correct power factor to 0.95 at full load.
11. Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
   a. Power unit-mounted controls.
   b. Power unit-mounted, ground fault interrupt (GFI) duplex receptacle.
13. Indicate the following for water chiller electrical power supply:
   a. Current, phase to phase, for all three phases.
   b. Voltage, phase to phase and phase to neutral for all three phases.
   c. Three-phase real power (kilowatts).
   d. Three-phase reactive power (kilovolt amperes reactive).
   e. Power factor.
   f. Running log of total power versus time (kilowatt hours).
   g. Fault log, with time and date of each.

K. Controls:
1. Stand-alone, microprocessor based.
2. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure of matching construction.
3. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, backlit, liquid-crystal display or light-emitting diodes. Display the following:
   a. Date and time.
   b. Operating or alarm status.
   c. Operating hours.
   d. Outside-air temperature if required for chilled-water reset.
   e. Temperature and pressure of operating set points.
   f. Entering and leaving temperatures of chilled water.
   g. Refrigerant pressures in evaporator and condenser.
   h. Saturation temperature in evaporator and condenser.
   i. No cooling load condition.
   j. Elapsed time meter (compressor run status).
   k. Pump status.
   l. Antirecycling timer status.
   m. Percent of maximum motor amperage.
   n. Current-limit set point.
   o. Number of compressor starts.
4. Control Functions:
   a. Manual or automatic startup and shutdown time schedule.
   b. Entering and leaving chilled-water temperatures, control set points, and motor load limit. Chilled-water leaving temperature shall be reset based on return-water temperature.
   c. Current limit and demand limit.
   d. External water chiller emergency stop.
   e. Antirecycling timer.
   f. Automatic lead-lag switching.
5. Manual-Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:
   a. Low evaporator pressure or high condenser pressure.
   b. Low chilled-water temperature.
   c. Refrigerant high pressure.
d. High or low oil pressure.
e. High oil temperature.
f. Loss of chilled-water flow.
g. Control device failure.
6. BAS Communications: BAC net MS/TP

L. Insulation:
1. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C534, Type I, for tubular materials and Type II, for sheet materials.
2. Thickness: 1-1/2 inches.
3. Factory-applied insulation over cold surfaces of water chiller components.
   a. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
4. Apply protective coating to exposed surfaces of insulation.

M. Accessories:
1. Factory-furnished, chilled-water flow switches for field installation.
2. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigeration circuit.
3. Factory-furnished neoprene or spring isolators for field installation.

2.2 SOURCE QUALITY CONTROL
A. Perform functional test of water chillers before shipping.
B. Factory test and inspect evaporator according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Stamp with ASME label.
C. Rate sound power level according to ARI 370 procedure.

PART 3 - EXECUTION

3.1 WATER CHILLER INSTALLATION
A. Install water chillers on support structure indicated.
B. Equipment Mounting:
   1. Install water chillers on grade on a 6" thick concrete pad.
   2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Isolation for HVAC."
C. Maintain manufacturer's recommended clearances for service and maintenance.
D. Charge water chiller with refrigerant if not factory charged and fill with oil if not factory installed.
E. Provide 5 year compressor warranty. Manufacturer shall warrant all equipment and material of its manufacture against defects in workmanship and material for a period of eighteen (18) months from date of shipment or twelve (12) months from date of start up, whichever occurs first.
F. Install separate devices furnished by manufacturer and not factory installed.

3.2 CONNECTIONS
A. Comply with requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping, Valves, and Specialties. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to chiller to allow service and maintenance.
C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with pressure gage,
flow meter, and drain connection with valve. Make connections to water chiller with a union, flange, or mechanical coupling.

D. Connect each drain connection with a union and drain pipe and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection if required.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.

C. Complete installation and startup checks according to manufacturer’s written instructions and perform the following:

1. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
2. Verify that pumps are installed and functional.
3. Verify that thermometers and gages are installed.
4. Operate water chiller for run-in period.
5. Check bearing lubrication and oil levels.
7. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
10. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

D. Prepare a written startup report that records results of tests and inspections.

END OF SECTION 23.64.23
PART 1 - GENERAL

1.1 DESCRIPTION
A. Provide Indoor single zone variable volume air handling unit and variable volume air handling units as scheduled.

1.2 PERFORMANCE REQUIREMENTS
A. Certify unit components in accordance with ARI Standard 430 as applicable.
B. Certify coils in accordance with ARI Standard 410.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. York/JCI, Carrier, and Trane.

2.2 UNIT CASINGS
A. Unit shall be double wall constructed in all sections.
   1. Exterior wall shall be minimum 18 gauge galvanized steel. Interior wall shall be minimum 20 gauge solid galvanized steel except at fan section which shall be perforated.
   2. All portions of the interior of the unit exposed to the airstream shall be covered with steel. Foil facing airstream is not acceptable. Insulate all sections with 2” thick 1-1/2lb matt faced fiberglass between two sheets of solid galvanized steel.
   3. The unit shall be supplied with full height, galvanized, double wall, hinged, removable access doors. Provide vent lock style handle that can be opened from unit interior.
   4. Provide IAQ drain pan under coil module. The drain pan shall be also provided under the complete supply fan section. Drain pans shall be stainless steel, double wall construction. Slope and construct drain pans to prevent standing water. Locate drain connection at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
B. Air-Handling-Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.

2.3 FANS
A. Provide supply fan section with plenum fan designed and suitable for class of service indicated in the unit schedule. Fan shaft to be properly sized and protectively coated with lubricating oil. Fan shafts shall be solid and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. Fans shall be statically and dynamically tested as an assembly at the required RPM to meet design specifications. Fan wheel shall be properly secured to shaft to prevent slippage.
B. Provide internal factory mounted canvas duct connection at fan discharge connection to fan module.
C. Provide self-aligning, grease lubricated pillow-block ball bearings with lubrication fittings. Provide extended grease lines to drive side of unit casing, for all fan bearings, rigidly attached for easy service access. Units shall include access doors on both sides of the units. All bearings shall perform to L-50 200,000 hour average life.
D. Fan, motor and drive shall be factory mounted with manufacturer's standard vibration isolation devices having a minimum of 2 inches static deflection.
2.4 MOTORS AND DRIVES
   A. Fan motors to be mounted and isolated on the same integral base as the fan.
   B. Fan motors shall be heavy duty, premium efficiency open drip-proof. See Section 23 05 13. Furnish "VFD Duty" motor for units with variable speed drives.
   C. Factory Mount Fan Drives: Make final alignment and belt adjustment after installation. Design drive for 1.5 service factor.

2.5 AIR FILTRATION SECTION
   A. Reference Section 234100.

2.6 COILS
   A. Hot Water Preheat Coil:
      1. Coil to be constructed of 5/8" outside diameter tubing (0.024 inch thick) with minimum .009" thick aluminum fins and cast iron or copper headers. Bond fins by mechanical expansion.
      2. Provide coils with a maximum working pressure of 175 psig at 200 degrees F.
      3. Provide circuited drainable coils with vent connection at highest point and drain connection at lower point.
   B. Hot Water Heating Coil:
      1. Coil to be constructed of 5/8" outside diameter tubing (0.024 inch thick) with minimum .009" thick aluminum fins and cast iron or copper headers. Bond fins by mechanical expansion.
      2. Provide coils with a maximum working pressure of 175 psig at 200 degrees F.
      3. Provide circuited drainable coils with vent connection at highest point and drain connection at lower point.
   C. Chilled Water Cooling Coil:
      1. Coil to be constructed of 5/8" outside diameter tubing (0.024 inch thick) with not more than 11 fins per inch with minimum .009" thick aluminum fins and cast iron or copper headers. Bond fins by mechanical expansion.
      2. Provide coils with a maximum working pressure of 175 psig at 200 degrees F.
      3. Provide circuited drainable coils with vent connection at highest point and drain connection at lower point.

2.7 ACCESS SECTIONS
   A. Access sections shall be supplied between unit sections as show on drawings. Access doors shall be provided on both sides of section.

2.8 ADDITIONAL SECTIONS
   A. Double Wall Filter Section
      1. Refer to Section 234110 "Air Filters".
      2. Provide factory-built filter section complete with filters as specified herein. Minimum filter area to be as specified on unit schedule but not to exceed 500 fpm filter face velocity. Filter sections to have full sized, hinged, latched, double wall access doors on both sides of section for filter service.
      3. Provide medium efficiency (MERV 8), 2" thick pleated disposable type panel filters equal to Farr 30/30.
      4. Provide high efficiency (MERV 13) 12" thick pleated disposable type cartridge filters equal to Farr Riga-Flo 100.
      5. Provide a factory mounted Dwyer inclined tube draft gage across each filter section and mark gage to indicate design clean and dirty loading conditions.
      6. Provide one complete set of replacement filters to Owner at job completion.
B. Double wall mixing section to have low-leak type outside and return air dampers with parallel blades. Arrange dampers so outside and return air merge when entering mixing box. Damper rods to rotate in nylon bushings.

C. Provide large coil access section for placement at chilled water coil, hot water coil, filter mixing section, and fan. Access doors shall be located on both sides of sections. Doors shall be full sized, hinged, latched, and double wall.

2.9 DAMPERS
A. Dampers shall have airfoil blades with extruded vinyl edge seals and flexible metal compressible jamb seals. Dampers shall have a maximum leakage rate of 4 cfm/square foot at 1” w.c.

PART 3 - EXECUTION
3.1 INSTALLATION
A. Rigidly install Air Handling Unit modules and base rails on a concrete curb sufficient height to install properly sized condensate drain

B. Connect condensate drain pans using 1-1/2, ASTM B 88, Type M (ASTM B 88M, Type C) copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

C. Arrange installation of units to provide access space around air-handling units for service and maintenance.

D. Install duct connections to each unit to allow for straight and smooth air flow. Do not install turns at the fan discharge which are in the opposite direction to the fan wheel and rotation.

E. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.

F. Comply with requirements for piping specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

G. Install piping adjacent to air-handling unit to allow service and maintenance.

H. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.

I. Hot- and Chilled-Water Piping: Comply with applicable requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping, Valves, and Specialties." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

J. Connect duct to air-handling units with flexible connections. Comply with requirements in Section 233713 "Sheet Metal Specialties."

END OF SECTION 23.73.13
SECTION 23 74 13
MODULAR, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.01 PERFORMANCE

A. Certify unit components in accordance with ARI Standard 430 as applicable.

B. Certify coils in accordance with ARI Standard 410.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. JCI, Trane, Daiken.

2.02 CASING CONSTRUCTION

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.

2. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F.

3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.

4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.

6. Access to filters, dampers, cooling coils, exhaust fans, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.

8. Units with cooling coils shall include double sloped 304 stainless steel drain pans.

9. Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.

10. Unit shall include lifting lugs on the top of the unit.

### 2.03 FANS

A. Provide supply fan section with plenum fan designed and suitable for class of service indicated in the unit schedule. Fan shaft to be properly sized and protectively coated with lubricating oil. Fan shafts shall be solid and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. Fans shall be statically and dynamically tested as an assembly at the required RPM to meet design specifications. Fan wheel shall be properly secured to shaft to prevent slippage.

B. Provide internal factory mounted canvas duct connection at fan discharge connection to fan module.

C. Provide self-aligning, grease lubricated pillow-block ball bearings with lubrication fittings. Provide extended grease lines to drive side of unit casing, for all fan bearings, rigidly attached for easy service access. Units shall include access doors on both sides of the units. All bearings shall perform to L-50 200,000 hour average life.

D. Fan, motor and drive shall be factory mounted with manufacturer’s standard vibration isolation devices having a minimum of 2 inches static deflection.

### 2.04 COOLING COILS

A. Chilled Water Cooling Coil:

1. Coils to be constructed of 5/8” outside diameter tubing (0.024 inch thick) with not more than 11 fins per inch with minimum .009” thick aluminum fins and cast iron or copper headers. Bond fins by mechanical expansion.

2. Provide coils with a maximum working pressure of 175 psig at 200 degrees F.

3. Provide circuited drainable coils with vent connection at highest point and drain connection at lower point.

### 2.05 HOT WATER PRE-HEAT AND RE-HEATING COILS:

A. Coil to be constructed of 5/8” outside diameter tubing (0.024 inch thick) with minimum .009” thick aluminum fins and cast iron or copper headers. Bond fins by mechanical expansion.

B. Provide coils with a maximum working pressure of 175 psig at 200 degrees F.

C. Provide circuited drainable coils with vent connection at highest point and drain connection at lower point.
2.06 FILTERS

A. Unit shall include 2 inch thick, pleated panel filters with an ASHRAE efficiency of 35% and a MERV rating of 8, upstream of the cooling coil.

B. Unit shall include a clogged filter switch.

2.07 OUTSIDE AIR/ECONOMIZER

A. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq. ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Damper assembly shall be controlled by spring return enthalpy activated fully modulating actuator. Unit shall include outside air opening bird screen, outside air hood, and barometric relief dampers.

2.08 ADDITIONAL SECTIONS

A. Double Wall Filter Section:

1. Provide factory-built filter section complete with filters as specified herein. Minimum filter area to be as specified on unit schedule but not to exceed 500 fpm filter face velocity. Filter sections to have full sized, hinged, latched, double wall access doors on both sides of section for filter service.

2. Provide medium efficiency (MERV 8), 2” thick pleated disposable type panel filters equal to Farr 30/30.

3. Provide a factory mounted Dwyer inclined tube draft gage across each filter section and mark gage to indicate design clean and dirty loading conditions.

4. Provide one complete set of replacement filters to Owner at job completion.

B. Double wall mixing section to have low-leak type outside and return air dampers with parallel blades. Arrange dampers so outside and return air merge when entering mixing box. Damper rods to rotate in nylon bushings.

C. Provide coil access section for placement at chilled water coil, hot water coil, filter mixing section, energy recovery wheel, and fan. Access doors shall be located on both sides of sections. Doors shall be full sized, hinged, latched, and double wall.

D. Provide unit manufactured, insulated piping vestibules for chilled water coil, pre-heat hot water coil and re-heat hot water coils.

2.9 DAMPERS

A. Outdoor-Air Damper: Linked damper blades, for 0 to 25 percent outdoor air, with motorized damper filter.

B. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
1. Damper Motor: Modulating with adjustable minimum position.

2. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1, with bird screen and hood.

2.10 AHU CURBS

A. Curbs shall be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curb gasket shall be furnished within the control compartment of the unit and mounted on the curb immediately before mounting of the unit.

B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

   1. Curb Insulation and Adhesive: Comply with NFPA 90A.
      a. Materials: ASTM C 1071, Type I or II.
      b. Thickness: 2 inches.

   2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
      a. Liner Adhesive: Comply with ASTM C 916, Type I.
      b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
      c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
      d. Liner Adhesive: Comply with ASTM C 916, Type I.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment Mounting:

   1. Install outdoor air handling units on factory roof curb.

B. Curb: Install in accordance with manufacturer’s instructions.

C. Unit Support: Install unit level on curb. Secure AHU’s to equipment rails with anchor bolts.

D. Install condensate drain, minimum connection size, with trap and indirect connection to nearest area drain.

E. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
1. Connect supply ducts to AHU’s with flexible duct connectors specified in Section 233713 "Sheet Metal Specialties."

2. Install return and supply isolation plenums.

### 3.02 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.

C. Tests and Inspections:

1. Reference Section 230593 "Testing, Adjusting, and Balancing for HVAC".

### 3.03 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing AHU’s and air-distribution systems, clean filter housings and install new filters.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
A. Section includes horizontal concealed fan coil units.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Factory-packaged and -tested units rated according to AHRI 440, ASHRAE 33, and UL 1995.

2.2 HORIZONTAL FAN COIL UNITS
A. Provide JCI, Trane, Daiken or approved equal.
B. Fabricated of heavy gauge panels insulated with antimicrobial elastomeric closed cell foam insulation.
C. All concealed units shall have a minimum 1-1/4 inch duct collar on the supply discharge. Provide return air plenum section with a 1-inch duct collar. Unit shall have a hinged bottom access panel.
D. All exposed units shall have a power coated finish. All exterior panels shall be finished on both sides with an anodic acrylic power paint of the standard factory color. Provide side and bottom access panels with quick open fasteners. Provide double deflection discharge grille and a bottom return grille.
E. Unit fan shall be dynamically balanced, forward curved, DWDI centrifugal type constructed of galvanized steel. Motors shall be high efficiency, permanently lubricated sleeve bearing, permanent split-capacitor type with UL listed automatic reset thermal overload protection.
F. Provide primary drain pan constructed of heavy gauge type 304 stainless steel. Stainless steel drain pans shall be externally insulated. Provide a condensate overflow switch in the primary drain pan.
G. Chilled and hot water coils shall have minimum 1/2-inch copper tubes, collared and corrugated aluminum fins. Minimum working pressure of 200 psig. Include manual air vent and drain valve.
H. Provide 1-inch pleated throwaway filter.
I. Provide piping package including 2-way modulating control valve, isolation ball valves, unions and pressure-temperature ports.
J. Thermostat shall be unit mounted with integral three speed fan switch.
K. Provide horizontal units with hanger suspension.
L. Units to have internal electrical junction box suitable for single point permanent wiring connection. Provide disconnect switch at junction box.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install fan coil units level and plumb.
B. Install fan coil units to comply with NFPA 90A.
C. Suspend fan coil units from structure with elastomeric hangers. Vibration isolators are specified in Section 230548 "Vibration and Isolation for HVAC."
D. Verify locations of thermostats and sensors with Drawings and room details before installation. Install devices 48 inches above finished floor.
E. Install new filters in each fan coil unit within two weeks after Substantial Completion.

F. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
   1. Install piping adjacent to machine to allow service and maintenance.
   2. Connect piping to fan coil unit factory hydronic piping package. Install piping package if shipped loose.
   3. Install condensate trap of adequate depth to seal against fan pressure.

3.2 FIELD QUALITY CONTROL
A. Perform the following tests and inspections:
   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
B. Remove and replace malfunctioning units and retest as specified above.
C. Prepare test and inspection reports.

3.3 ADJUSTING
A. Adjust initial temperature and humidity set points.
B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 23.82.19
SECTION 23.84.15
ELECTRIC STEAM HUMIDIFIERS

PART 1 - GENERAL

1.01 EQUIPMENT

A. Provide Dri-Steam or approved equal electric humidifier complete with the following:

1. Evaporating reservoir: fabricated of stainless steel, with gasket sealing capable of operating at designed pressure without steam or water leaks.

2. Immersion heaters: stainless steel clad and sized to produce required steam flow. Heaters shall be easily removable to facilitate cleaning or inspection. Heaters shall contract and expand to allow scale to flake off as it accumulates.


4. An adjustable surface water skimmer.

5. A removable access pane; to permit periodic scale removal and inspection.

6. A UL listed control panel to include all operating controls, magnetic contactor(s), fused control circuit transformer, numbered terminal block and heater fuses.

7. A solid state electronic level control module to provide automatic refilling, resetting, low water cutoff, and surface water skimming.

8. Adjustable timer and drain valve for automatic drain and flush at timed intervals.


11. Stainless steel dispersion tube and steam hose.

12. Support legs

13. Factory insulate unit with minimum ¾ inch thick insulation with jacket.


15. Return air duct humidistat.

16. Space humidistat

17. Supply duct high limit humidistat.

18. Solid state power (SCR) controller to modulate humidifier output from 0 to 100% capacity.

19. Multiple stage electronic controller mounted in control cabinet to stage humidifier output from 0 to 100 percent capacity.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install humidifiers in strict accordance with manufacturers’ published installation instructions.

3.02 START-UP AND TESTING

A. Start-Up and test humidifiers and humidistats for satisfactory operation. Check to ensure that humidifier responds to humidistat over selected ranges. Check high limit humidistat for proper operation. Instruct owner in system operation.
END OF SECTION 23.84.15
PART 1 – GENERAL

1.01 WORK INCLUDED

A. Provide all materials, labor, and equipment required to furnish and install a complete electrical system as indicated on the Drawings and as specified herein.

B. Electrical work includes, but is not limited to, the following:
   1. Complete distribution system for lighting and power including the electrical service and necessary feeders, panelboards, branch circuits, conduit, lighting fixtures, control switches, and receptacles.
   2. Excavation, trenching, and backfilling for conduit and/or cable.
   3. Grounding and lightning protection
   4. Data and Telephone system raceways, boxes, and cabling.
   5. Power wiring for equipment furnished under Division 21, 22 and 23.
   6. Fire Alarm System
   7. Field Lighting System

1.02 RELATED WORK

A. The following work shall be furnished under other Divisions of these Specifications, but shall be coordinated with said Divisions by Division 26 tradesman prior to bid.
   1. Flashing of conduits into roofing and outside walls.
   2. Painting.
   3. Cutting and patching.
   4. Heating, ventilating, air conditioning, and plumbing equipment.

1.03 DEFINITIONS

A. Provide: Shall mean "furnish, install, connect, and put in good working order."

B. Wiring: Shall mean "wire and cable, installed in raceway with all required boxes, fittings, connectors, etc. completely installed."

C. Engineer: Shall mean "Engineer of Record" whose seal is affixed to the contract specifications and drawings of Division 26.

1.04 CODES AND STANDARDS

A. Comply with applicable local, state, and federal codes.

B. Electrical work shall be installed in accordance with the Drawings and Specifications, the 2011 NEC, 2012 IBC and applicable accessibility code.

C. In event of conflict between Drawings, Specifications and such codes, Engineer shall be notified in writing prior to bid. A ruling will then be made by the Engineer in writing. All work shall be installed in strict accordance with applicable codes without additional cost to Owner.

D. Contractor shall submit and/or file all necessary specifications and drawings as required by governing authorities.

1.05 SUBMITTALS

A. Provide submittals on materials and equipment identified in the Specifications and Drawings prior to manufacturer, order, or installation in accordance with Shop Drawings, Product Data, and Samples.
B. Submittals shall include but not be limited to the following:

- Lighting fixtures
- Switchgear
- Fire Alarm System
- Lightning protection
- Voice/Data cabling
- Cable Tray
- Field Lighting

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 SITE VISIT

A. Visit job site prior to bid date to determine actual conditions under which work shall be done, to become familiar with project, and to verify total scope of work required. Failure to do so shall not constitute a reason for an extra charge.

3.02 COMMISSIONING

A. Complete testing of all lighting, wiring, generators, etc. per TBR specifications and complete the associated standard TBR/owner checklists.

END OF SECTION 26.05.00
SECTION 26.05.01
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 QUALITY ASSURANCE
A. Qualifications of Manufacturer: All materials and equipment used in work of Division 26 shall be produced by manufacturers regularly engaged in manufacturer of similar items and with history of successful production acceptable to the Engineer. They shall be new and be UL listed and labeled or listed and labeled by other recognized testing laboratory where such label is available.

B. Qualifications of Installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in necessary crafts and who are completely familiar with specified requirements and methods needed for proper performance of work of this Section.

1.02 GUARANTEE-WARRANTY
A. Guarantee work to be free of material and workmanship defects for a period of one year, from date of final acceptance for the project. Repair and replace defective work and other work damaged thereby which becomes defective during term of Guarantee-Warranty. Furnish Owner with three written copies of Guarantee-Warranty.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS
A. Reference in Specifications to any article, device, product, material, fixture, form and type of construction, by name, make, or catalog number shall be interpreted as established standard of quality and shall not be construed as limiting competition. Any article, device, product, material, fixture, form and type of construction which in the judgment of Engineer, expressed in writing, is equal to that specified, may be used.

B. Substitution shall be approved by Engineer before purchase and/or installation. If unapproved materials are installed, work required to remove and replace unapproved items shall be done at the Contractor's expense.

PART 3 - EXECUTION

3.01 INSTALLATION
A. Electrical drawings are diagrammatic and shall not be scaled for exact sizes or locations. They are not intended to disclose absolute or unconditional knowledge of actual field conditions.

B. Equipment shall be installed according to manufacturer's recommendations.

C. Protect work and materials from damage by weather, entrance of water, and dirt. Cap conduit during installation. Avoid damage to materials and equipment in place.

D. Satisfactorily repair or remove and replace damaged work with new materials.

E. Trenching and backfilling shall comply with Site Work of these Specifications and provide sheathing, shoring, dewatering and cleaning necessary to keep trenches and their grades in proper condition for work to be carried on. Trenches shall be excavated 6" below elevation of bottom of conduit. Backfill shall be per Site Grading and Filling.

F. Failure to route conduit through building without interfering with other equipment and construction shall not constitute a reason for an extra charge. Equipment, conduit and fixtures shall fit into available space in building and shall not be introduced into building at such times and manner as to cause damage to structure. Equipment requiring services shall be readily accessible.
G. Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
1. Coordinate electrical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, whether exposed or concealed.
10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
11. Install access panels or doors where units are concealed behind finished surfaces.
12. Insulate dissimilar metals so they are not installed in direct contact.

H. Conduits which pass through floor slabs (except ground floor) shall be sealed with Fire Stop Sealant. Seal around conduits or other wiring materials passing through partitions, floors, and fire rated walls. Use UL approved Fire Stop Sealant as detailed on the drawings.

I. Coordinate electrical power connection requirements with all equipment suppliers. Where power requirements differ from drawing design requirements, Engineer shall be notified for clarification and installation requirements prior to installing that portion of work. Cost for equipment and labor for improperly installed electrical connections not coordinated and approved by other trades and the Engineer shall be incurred by the Electrical Contractor and shall not constitute a reason for an extra charge because of rework.

3.02 CUTTING AND PATCHING
A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

3.03 TESTING AND EQUIPMENT SERVICING
A. Entire installation shall be free from improper grounds and short or open circuits. Conductors shall be tested before energizing circuit. Test to insure that entire system is in proper operating condition, and that adjustments and settings of circuit breakers, fuses, control equipment, and apparatus have been made. Correct defects discovered during tests.
3.04 REMOVAL OF DEBRIS
A. Remove surplus materials and debris caused by, or incidental to electrical work. Remove such debris at frequent intervals. Keep job site clean during construction.

3.05 IDENTIFICATION OF EQUIPMENT
A. Equipment shall be identified in accordance with Section 26.05.53, “Electrical Identification.”

3.06 AS-BUILT DRAWINGS
A. Maintain one set of blue line electrical prints on site, marked to show as-built conditions and installations, prints to be turned over to Owner after job is complete.

3.07 TEMPORARY LIGHTING AND POWER
A. Provide, maintain and remove after construction is completed, temporary lighting adequate for workman safety and temporary power for all trades including any 1 phase power required.

3.08 POWER OUTAGES
A. Coordinate all power outages with Owner and submit for approval proposed schedule of work indicating extent, number, and length of outages required to perform work. Contractor shall include in bid cost of overtime labor required for power outage to occur after Owner's normal hours of operation.

3.09 OTHER MATERIALS
A. Work of this Division shall also include those items not specifically mentioned or described, but which are obviously necessary to conform to the design intent, applicable codes and to produce complete electrical system that functions properly. These materials shall be as selected by Contractor but subject to approval of the Engineer.

3.10 OTHER COORDINATION
A. Contractor shall obtain and pay for all necessary permits and inspection fees required for the electrical installation.
B. Contractor shall coordinate electrical service requirements with the local electric utility company, and provide any required fee, conduit, transformer pad, metering equipment, etc. that is required.

END OF SECTION 26.05.01
SECTION 26.05.16
CONDUIT

PART 1 - GENERAL

1.01 WORK INCLUDED
A. Provide a complete conduit system to support all electrical equipment and systems. Conduit system includes conduit, couplers, connectors, fittings, boxes, covers and supports.
B. No conduit serving branch circuits shall be installed in or below concrete slabs unless required for branch circuits serving loads located in the center of a room.

1.02 QUALITY ASSURANCE
A. Listing and Labeling: Provide conduit that is listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
B. Conduit and its installation shall comply with requirements of the National Electrical Code.

PART 2 - PRODUCTS

2.01 CONDUIT
A. Electric Metallic Tubing (EMT): Allied, Wheatland, LTV Copperweld, or approved equal.
B. Rigid Metal Conduit (RMC): Allied, Wheatland, Republic, or approved equal.
C. Flexible Steel Conduit (Greenfield): Alflex, Electroflex, or approved equal.
D. Rigid Non-Metallic Conduit (PVC): Carlon Schedule 40, Cantex, Southern Pipe, Schedule 80 or approved equal.
E. Liquidtight Flexible Nonmetallic Conduit (LFNC): Aflex, Electroflex, or approved equal.

2.02 CONDUIT FITTINGS
B. Bushings: Appleton, T&B, O.Z., or Gedney
C. Straps and Hangers: Appleton, T&B, Steel City, or Minerallac.
D. Group Pipe supports: Unistrut, Kindorf, B-Line, or approved equal.
E. Expansion Fittings: O.Z. Gedney Type AX, or equal by Appleton, or approved equal.

PART 3 - EXECUTION

3.01 CONDUIT
A. In general, conduit installation shall follow layout shown on drawings. However, this layout is diagrammatic only and where changes are necessary due to structural conditions, other apparatus or other causes, such changes shall be made without cost to Owner. Offsets in conduits are not indicated and must be furnished as required.
B. Conduit shall be installed in accordance with the National Electrical Code.
C. Provide bushings on the open ends of conduit containing conductors. Insulated bushings shall be provided for conduits containing conductors #4 AWG or larger with an insulating ring an integral part of the bushing.
D. Use EMT where Drawings call for conduit to be concealed in walls or above ceilings or when cast in concrete slabs not on grade. Do not use EMT exposed lower than 4' above floor, in wet locations, or in exterior applications.

E. Use Schedule 40 PVC encased in concrete or when installed underground. Use Schedule 80 PVC when exposed.

F. When PVC conduit is used, turn up perpendicular to slab.

G. Support conduit and secure to forms when cast in concrete so that conduit will not be displaced during pouring of concrete. Stuff boxes and cork fittings to prevent entrance of water during concrete pouring and at other times during construction, prior to completion of conduit installation.

H. Route all conduit at right angles or parallel to walls of building.

I. Use proper sized tools for bending. Do not heat metal conduit. Dents and flat spots will be rejected. Cut and thread conduit so ends will butt in couplings. Make threads no longer than necessary and ream pipe free of burrs.

J. Minimum conduit size 1/2" unless otherwise required.

K. Leave one #10 AWG or equivalent nylon pull wire in empty conduits.

L. Use short pieces, approximately five (5’) feet of flexible conduit to connect motors and other devices subject to motion and vibration. Use liquid tight flexible conduit where outside or subject to water spray.

### 3.02 CONDUIT FITTINGS

A. When EMT is installed concealed in walls or above ceilings use steel double set screw connectors. All connectors shall have throated insulating bushing.

B. Support conduit vertically and horizontally by straps or hangers. Do not exceed intervals as described in the National Electrical Code.

C. Use expansion fittings, properly bonded to assure ground continuity, across expansion joints in floors and ceilings. Use double lock nuts and bushings on panel feeders at panel cans.

D. When connections are made to motors or other equipment, not near walls or columns, provide a vertical conduit, minimum 3/4", attached to floor with a floor flange, bring wiring out of this conduit by means of a condulet and flexible conduit extending to equipment junction box.

END OF SECTION 26.05.16
SECTION 26.05.19
WIRE AND CABLE

PART 1 - GENERAL

1.01 WORK INCLUDED
A. Wire and cable for all service, feeders, branch circuits, and instrument and control wiring rated 600 volts and below.

1.02 QUALITY ASSURANCE
A. Listing and Labeling: Provide wire and cable that is listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
B. Wire and cable and its installation shall comply with requirements of the National Electrical Code.

PART 2 - PRODUCTS

2.01 MATERIALS
A. Wires and cables shall meet applicable requirements of the National Electrical Code and UL for the type of insulation, jacket, and conductor specified or indicated.
B. All conductors shall be copper with 600 volt insulation unless otherwise indicated.
C. Wire and cable shall be manufactured by Belden, General Cable, Essex, Encore, Rome Cable, Southwire, or approved equal.
D. Use solid copper type THHN/THWN for branch circuit wiring #10 AWG and smaller. No conductor for branch circuit wiring shall be smaller than #12 AWG.
E. Use stranded copper, type THHN/THWN for feeder and power circuits #8 AWG and larger.
F. Provide color coded wire and with a different color for each phase and neutral and ground as follows: 208/120 volt circuits - phases A, B, and C: black, red, and blue respectively; neutral: white; ground: green; 480/277 volt circuits – phases A, B, and C: brown, orange, and yellow, respectively, neutral: gray; ground: green. Approved color tape is acceptable for feeders. Also provide color coded wire for control circuits.

PART 3 - EXECUTION

3.01 INSTALLATION
A. Complete conduit system before pulling any wire or cable. Use cable lubricants recommended by cable manufacturer as necessary.
B. Conductors shall be continuous from outlet to outlet or to branch circuit over-current devices. Make splices only in junction boxes. Splices shall not be made in panelboards. Control wiring shall be continuous between components and/or terminal boards.
C. A minimum of eight (8”) inches of slack conductor shall be left in every outlet or junction box. There should also be enough slack so three (3”) inches extends outside the outlet or junction box.
D. Make splices in conductors #10 AWG and smaller diameter with insulated, pressure-type connector. Use Scotchlok, Ideal, or equal wire connectors.
E. Make splices in conductors #8 AWG and larger diameter with solderless connectors and cover with insulation material equivalent to conductor insulation. Use Burndy compression connectors with crimpit cover, type CC, or equal.

3.02 TESTING
A. After completion of the installation and splicing and prior to energizing the conductors, wire and cable shall be given continuity and insulation tests as herein specified.
B. Test wiring to verify that no short circuits, open circuits, or accidental grounds exist. Continuity tests shall be conducted using a dc device with bell or buzzer.
C. Perform Megger tests on wiring #4 AWG and larger.
SECTION 26.05.26
GROUNDING AND BONDING

PART 1 – GENERAL

1.01 WORK INCLUDED
A. Grounding electrodes and conductors.
B. Equipment grounding conductors.
C. Bonding.

1.02 PERFORMANCE REQUIREMENTS
A. The grounding system to earth resistance shall be less than 5 ohms.

1.03 QUALITY ASSURANCE
A. Listing and Labeling: Provide grounding and bonding materials that are listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
B. Components and installation shall comply with the requirements of the National Electrical Code (NEC).
C. Materials shall comply with UL 467, “Grounding and Bonding Equipment.”

PART 2 – PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers shall be Burndy, T&B, or approved equal.

2.02 GROUNDING ELECTRODES
A. Ground rods shall be copper clad steel with minimum dimensions of ¾ inch diameter by 10 feet long.

2.03 CONNECTORS
A. Exothermic welded connections shall be provided in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.
B. Pressure connectors shall be high-conductivity-plated units.
C. Bolted clamps shall be heavy-duty units listed for the application.

2.04 WIRE AND CABLE
A. All grounding conductors shall be copper.
B. The grounding electrode conductor shall be stranded.
C. Equipment grounding conductors shall have green insulation.
D. Bare copper conductors shall conform to the following:
   1. Solid conductors: ASTM B-3
   2. Assembly of stranded conductors: ASTM B-8
   3. Tinned Conductors: ASTM B-33

2.05 MISCELLANEOUS CONDUCTORS
A. Ground bus shall be bare annealed copper bars.
B. Braided bonding jumpers shall be copper tape, braided number 30 gauge bare copper wire, and terminated with copper ferrules.

C. Bonding strap conductor/connectors shall be soft copper, 0.05 inch thick and two (2") inches wide, unless otherwise noted.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Grounding system shall be in accordance with Article 250 of the NEC except where the Drawings or Specifications exceed NEC requirements.

B. Install code size green grounding conductors in all feeder and branch circuits. Bond conductors to chassis or fixed equipment.

C. All grounding conductors shall be bonded to multi-terminal ground bus at panelboard or other distribution equipment. Grouping of grounding conductors under a single lug is not acceptable.

D. Bond interior metal piping systems and metal air ducts to equipment ground conductors of pumps, fans, electric heaters, and air cleaners serving individual systems.

E. Bond structural steel and reinforcing steel in foundation footing to grounding electrode conductor. Bond steel together. Bond columns and foundation re-bar as indicated on plans. Bonded columns and re-bar shall be connected to the ground ring.

F. Install a triad of ground rods, 15’ apart at the back of the building. All grounding electrode connections shall be made by minimum #4/0, or larger where required by NEC 250. Install a buried bare #4/0 copper ground ring around perimeter of building per drawings, minimum depth of 30” below finished grade per NEC 250.

G. Locate all grounding attachments away from areas subject to physical damage. Provide protective covering as required.

H. All separate grounding electrodes shall be bonded together to limit potential differences between them and between their associated wiring systems. This includes the power system, TVSS, telephone system, and system grounding electrodes.

3.02 CONNECTIONS

A. Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.

2. Make connections with clean bare metal at points of contact.

3. Aluminum to steel connections shall be with stainless steel separators and mechanical clamps.

4. Aluminum to galvanized steel connections shall be with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.

B. Use exothermic welded connections for connections to structural steel and for underground connections. Comply with manufacturer's written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. For compression-type connections, use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.
D. Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.

E. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B.

F. Where insulated ground conductors are connected to ground rods or ground buses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.

G. Do not use flexible metal conduit and fittings as a grounding means. Pull a green wire in each piece of flexible conduit, and screw to conduit system with lugs at both ends.

3.03 FIELD QUALITY CONTROL

A. Use the fall-of-potential method as described in IEEE Standard 81 to measure the resistance of the following. Record the measurements and provide to the Engineer.

1. The resistance between earth and each ground rod prior to interconnection with other ground rods.

2. The resistance between earth and the counterpoise.

3. The resistance of the grounding system at the grounding electrode connection to earth.
   a. Measure the ground resistance when there has been no precipitation for 5 days, without the soil being moistened by any means other than natural precipitation or natural drainage or seepage, and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Resistance shall be less than 5 ohms.

B. Perform continuity tests at all power receptacles to ensure the ground terminals are properly grounded to the facility ground network.

END OF SECTION 26.05.26
SECTION 26.05.29
SUPPORTING DEVICES

PART 1 – GENERAL

1.01 WORK INCLUDED
A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fasteners.

1.02 QUALITY ASSURANCE
A. Electrical Component Standard: Components and installation shall comply with the National Electrical Code.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
A. Subject to compliance with requirements, Slotted Metal Angle and U-Channel Systems shall be provided by Allied Tube & Conduit, American Electric, B-Line Systems, Inc., Unistrut Diversified Products, or approved equal.
B. Subject to compliance with requirements, Conduit Sealing Bushings shall be provided by Bridgeport Fittings, Inc., Cooper Industries, Inc., Killark Electric Mfg. Co., O-Z/Gedney, Raco, Inc., Spring City Electrical Mgf. Co., Thomas & Betts Corp., or approved equal.

2.02 COATINGS
A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be aluminum or hot-dip galvanized.

2.03 MANUFACTURED SUPPORTING DEVICES
A. Raceway Supports: Raceways shall be supported with clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
B. Fasteners: Types, materials, and construction features as follows:
   1. Expansion Anchors: Carbon steel wedge or sleeve type.
   2. Toggle Bolts: All steel springhead type.
C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.
D. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.
E. U-Channel Systems: 16-gauge steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacturer.
2.04 FABRICATED SUPPORTING DEVICES

A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

C. Pipe Sleeves: Provide pipe sleeves of one of the following:
   1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:
      a. 3-inch and smaller: 20-gauge.
      b. 4-inch to 6-inch: 16-gauge.
      c. over 6-inch: 14-gauge.
   2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

B. Coordinate with the building structural system and with other electrical installation.

C. Raceway Supports: Comply with the NEC and the following requirements:
   1. Conform to manufacturer's recommendations for selection and installation of supports.
   2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs., provide additional strength until there is a minimum of 200 lbs. safety allowance in the strength of each support.
   3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
   4. Support parallel runs of horizontal raceways together on trapeze-type hangers.
   5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
   6. Space supports for raceway types not covered by the above in accordance with NEC.
   7. Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.
   8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

D. Vertical Conductor Supports: Install simultaneously with installation of conductors.

E. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.
F. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.

G. Sleeves: Install in concrete slabs and walls and all other fire rated floors and walls for raceways and cable installations. For sleeves through fire rated wall or floor construction, apply UL listed firestopping sealant in gaps between sleeves and enclosed conduits and cables in accordance with manufacturer’s recommendations.

H. Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

I. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:

1. Fasten by means of wood screws or screw-type nails on wood; toggle bolts on hollow masonry units; concrete inserts or expansion bolts on concrete or solid masonry; and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.

2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.

3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock- resistant fasteners for attachments to concrete slabs.

END OF SECTION 26.05.29
SECTION 26.05.33
OUTLET AND JUNCTION BOXES

PART 1 – GENERAL

1.01 WORK INCLUDED
A. Wall and ceiling outlet boxes.
B. Pull and junction boxes.

1.2 QUALITY ASSURANCE
A. Listing and Labeling: Provide outlet and junction boxes that are listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
B. Outlet and junction boxes and their installation shall comply with the requirements of the National Electrical Code.

PART 2 – PRODUCTS

2.1 OUTLET AND JUNCTION BOXES
A. Outlet and junction boxes shall be galvanized steel, 1-1/2” deep minimum by Raco, T&B/Steel City, Crouse Hinds or approved equal.
B. Boxes for interior areas with exposed conduit shall be pressed steel and in exterior areas with exposed conduit shall be cast metal with threaded hubs, "FS" type. Use galvanized steel for concealed boxes.

PART 3 – EXECUTION

3.1 GENERAL
A. Outlet and junction boxes in inaccessible ceiling areas shall be located no more than 6 inches from ceiling access panel or from removable recessed luminaire.
B. Install boxes to preserve fire resistance rating of partitions and other elements, using UL listed fire stop materials and methods.
C. Do not install flush mounted boxes back-to-back in walls; provide minimum six (6”) inches separation. Provide minimum twenty-four (24”) inches separation in fire rated walls.
D. Do not fasten boxes to ceiling support wires.
E. Support boxes independently of conduit.
F. Bonding jumpers shall be used around knockouts.

3.2 OUTLET BOXES
A. Outlet boxes shall be securely anchored, set true, and plumb and no part of box shall extend beyond finished wall or ceiling. Flush mounted boxes shall be set to within 1/8” of finished wall and a plaster ring used to make cover flush with wall.
B. Select boxes according to intended use and type of outlet. Ceiling outlet boxes shall be four (4”) inches octagon and 2-1/2” deep. Use four (4”) inches square boxes where required. All ceiling outlet boxes shall have a fixture stud of the no bolt, self-locking type if required to hang the fixture specified at the outlet.
C. Receptacle and switch boxes installed in concrete block walls not plastered shall be Steel City, Appleton, Raco Series No. 690 through No. 699, or approved equal masonry boxes of proper depth and gang required and specifically designed for this purpose. If more than two conduits enter box from one direction, 4” square boxes with square-cut device covers not less than one (1”) inch deep specifically designed for this purpose, shall be used. Round edge plaster rings will not be acceptable for block walls. Sectional or gangable type outlet boxes will not be acceptable except in drywall construction.

D. Mount outlet boxes worked to nearest block course. Confirm ADA compliance.

E. Install blank device plates on outlet boxes left for future use.

F. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices. Confirm accessibility code compliance.

3.3 JUNCTION BOXES

A. Pull and junction boxes shall be sized in accordance with the National Electrical Code according to number of conductors in box or type of service to be provided. Minimum size is 4-11/16” square and 2-1/2” deep.

B. Pull boxes shall be provided where necessary in the conduit system to facilitate conductor installation. Conduit runs longer than 100 feet or with bends exceeding 270 degrees shall have a pull box installed at a convenient intermediate location.

C. Install in locations as shown on Drawings and as required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.

D. Install pull and junction boxes above accessible ceilings and in unfinished areas only.

3.4 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused box openings.

3.5 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION 26.05.33
SECTION 26.05.48
NOISE AND VIBRATION CONTROL FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this section.

1.2 WORK INCLUDED
A. Vibration Isolation
B. Sealing Around Penetrations Through Walls and Slabs
C. Sealant
D. Installation of flexible conduit between non-isolated construction and isolated construction, including mechanical equipment, fans, pumps, and bridging between isolated room-within-a-room and non-isolated adjacent construction.

1.3 RELATED WORK SPECIFIED ELSEWHERE
A. Consult all other Sections to determine the extent of work specified elsewhere but related to this Section. This work shall be properly coordinated to produce an installation satisfactory to the Owner.
B. Installation of Transformers
C. Performance Lighting System
D. Electric Service Distribution
E. Concrete Housekeeping Pads
F. General Lighting Systems

1.4 DEFINITIONS
A. The term “or as approved” means the contractor may propose an alternate product, but the consultant shall be sole judge of acceptability of alternate products. The term “Contractor” as used in this Section refers to that contractor directly responsible for the supply and installation of the Electrical Systems, including noise and vibration control.

1.5 CONTRACTOR’S RESPONSIBILITY
A. The Electrical Contractor shall be directly responsible for the supply and installation of noise and vibration control equipment and work for the Electrical Systems.
B. The Contractor shall be responsible for providing a complete and suitable installation of isolation equipment to meet the intent of this specification. Any additional equipment needed to meet the intent of this specification, even if not specifically mentioned herein or on the drawings, shall be supplied by the Contractor without claim for additional payment.
C. The Contractor shall provide seismic restraints for all vibration isolation systems where required by code. The Contractor shall submit drawings and specifications, certifying that the installation will meet all local seismic restraint requirements. The Contractor shall also certify that none of the required seismic restraints will reduce the isolation efficiency of any vibration isolation systems.
D. Performance or waiving of inspection, testing or surveillance for any portion of the Work shall not relieve the Contractor of the responsibility to conform strictly with the Contract Documents. The Contractor shall not construe performance or waiving of inspection, testing or surveillance by the Owner or Architects to relieve the Contractor from total responsibility to perform in strict accordance with the Contract Documents.
1.6 MANUFACTURER'S RESPONSIBILITY

A. Manufacturer of vibration isolation equipment shall have the following responsibilities:

1. Determine vibration isolation for all equipment and systems in accordance with all codes and authorities having jurisdiction on this project.
2. Provide equipment isolation systems as scheduled or specified.
4. Provide installation instructions, drawings and field supervision to assure proper installation and performance.
5. The vibration isolation systems shall be guaranteed to have deflection indicated on the schedule on the drawings. Mounting sizes shall be determined by the mounting manufacturer, and the sizes shall be installed in accordance with the manufacturer's instructions.
6. The vibration isolator vendor shall ensure that all equipment to be isolated has sufficient support structure to distribute equipment loads onto isolators. Where additional support structure is required, this shall be provided by vibration isolator vendor.

1.7 APPROVED MANUFACTURERS

A. All noise and vibration control apparatus shall be furnished by a single manufacturer who has supplied isolation equipment for at least five years. The vendor shall design and provide all hangers, isolators, bases, pads, sleeves and other devices specified, required, or detailed for the vibration isolation of all electrical equipment and conduit. The vendor for vibration control equipment shall be one of the following, or as approved:

1. Mason Industries Inc.
2. Amber-Booth
3. Kinetics Noise Control

1.8 BID PROPOSALS

A. The Contractor shall submit at the time of bidding the names and qualifications of the noise and vibration control supplier(s). If a supplier is not one of the pre-approved vendors, then the submittal shall be accompanied by a complete catalog of that supplier's products and samples of each proposed vibration isolator with reference to the specification part number.

1.9 SHOP DRAWINGS

A. Fully coordinated shop drawings for all vibration and noise control equipment and systems shall be submitted by the Contractor for review by the Owner’s Consultants. These submittals shall state the performance of the noise and vibration control products to be provided, such as, but not limited to, the following: vibration isolator model or type, size and static deflection; isolator location shown on an outline of the isolated equipment; seismic restraints; installation details; locations of isolated conduit hangers on conduit layout plans; materials and details for penetrations, including penetrations by groups of conduits, and locations of acoustically sealed pull boxes.

B. Seismic restraints, including attachment calculations by the Seismic Restraint Manufacturer’s licensed Engineer substantiating the seismic restraints are furnished and installed in accordance with local building codes. A registered professional engineer having a PE from the same state as the project, or state of restraint manufacturer shall stamp all analysis, or as required by local building codes.

1.10 NOISE CRITICAL SPACES

A. Many areas of the building, referred to as “Noise-Critical Spaces”, require special attention (special acoustical provisions and restrictions). The table below designates the Noise-Critical Spaces:

1. <list of spaces>
B. Penetrations by ducts, pipes and conduit between Noise-Critical Spaces shall be sleeved, packed and sealed airtight with non-hardening sealant, and treated with Acoustically-Sealed Pull Boxes as described herein.

1.11 DESCRIPTION OF SYSTEMS

A. VIBRATION ISOLATION
1. Vibration isolators shall be installed to attenuate the vibration transfer from equipment such as transformers, lighting dimmers, lighting ballasts, controls and relays to reduce vibration.
2. Flexible connections shall also be supplied for conduit and wiring serving electrical equipment on vibration isolators to ensure complete isolation of such equipment.

B. TRANSFORMERS
1. Transformers shall be located only where shown on the drawings. The noise sensitivity of this facility requires that all noise critical spaces be well isolated from transformer noise and vibration.

C. SEALING OF PENETRATIONS
1. Electrical equipment generates “tuned” noise that can be very disturbing in performance spaces. Walls and doors within the cave can effectively isolate air-borne noises from noise critical spaces, but the effectiveness of sound isolating structures can be severely compromised by penetrations for electrical conduit. Proper sealing around and inside conduits passing through penetrations as described herein will maintain the integrity of the sound isolating structure.
2. Special “Acoustically Sealed Pull Boxes” shall be used where a group of conduits penetrate a noise critical wall. These heavy-duty, airtight pull boxes are used to reduce the leakage of sound through the conduit walls and thus through the structure.

PART 2 - PRODUCTS

2.1 MATERIALS
A. FOAM ROD
1. Foam backer rod shall be closed cell polyethylene suitable for use as a backing for non-hardening sealant.

B. NON-HARDENING SEALANT
1. Sealant for electrical penetrations shall be non-hardening polysulphide type.
2. Permanently flexible, approved firestop putty may be used in lieu of the sealant on foam rod in noise sensitive walls that are also fire rated.

2.2 EQUIPMENT
A. GENERAL
1. All equipment provided for vibration isolation or noise control shall be new and manufactured specifically for the purpose intended.

B. VIBRATION ISOLATORS
1. GENERAL
a. The static deflection of isolators shall be as given in the equipment schedule and specified below.

b. Vibration isolator sizes and layout shall be determined by the vibration isolator supplier to meet performance criteria below. Static deflections specified shall be met with equipment fully operational.

2. ISOLATOR TYPE WP
a. Type WP (Waffle Pads) shall be minimum 5/16” thick neoprene pads ribbed or waffled on both sides. The pads shall be selected for 15% strain. Neoprene shall be bridge-bearing quality with a maximum durometer of 50. Where required to meet this strain criterion, steel load-spreading plates shall be incorporated between the equipment and the neoprene pad. If the isolator is bolted to the structure, a neoprene vibration isolation washer and sleeve (Uniroyal Type 620/660 or as approved) shall be installed under the bolt head between the steel washer and the base plate.

(Type WP: Mason Industries Type W, Super W, or as approved.)

3. ISOLATOR TYPE MWP

a. Type MWP (Metal and Waffle Sandwich Pads) shall consist of two 5/16” thick ribbed or waffle neoprene pads sandwiching a 16-gauge stainless steel plate. The pad shall be designed for 15% strain. Neoprene shall be bridge-bearing quality with a maximum durometer of 50. If the isolator is bolted to the structure, a neoprene vibration isolation washer and sleeve (Uniroyal Type 620/660 or as approved) shall be installed under the bolt head between the steel washer and the base plate.

(Type MWP: Mason Industries Type WSW or as approved.)

4. ISOLATOR TYPE RBA

a. Type RBA isolators shall be designed with a neoprene element to provide isolation in tension, shear or compression. Neoprene shall be bridge bearing quality with a maximum durometer of 30.

(Type RBA: Mason Industries Type RBA or as approved.)

5. ISOLATOR TYPE DDNM

a. Type DDNM (Double Deflection Neoprene Mounts) shall be laterally stable, double deflecting, molded neoprene isolators. All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed, and bolt holes shall be provided in the base. The mounts shall have leveling bolts rigidly secured to the equipment. The strain on the neoprene shall not exceed 15%. Neoprene shall be bridge bearing quality with a maximum durometer of 50. DDNM mounts shall be selected for a static deflection of 3/8” unless otherwise specified.

(Type DDNM: Mason Industries Type ND or as approved.)

6. ISOLATOR TYPE DDNH

a. Type DDNH (Double Deflection Neoprene Hangers) shall consist of a molded neoprene element in a steel hanger box. A neoprene sleeve shall be located where the lower hanger rod passes through the steel box supporting the isolator, such that the hanger rod cannot contact the steel hanger body. The diameter of the clear hole in the mounting box shall be at least 3/4” larger than the diameter of the hanger rod and permit the hanger rod to swing through a 30º arc. When installed, the hanger box shall be allowed to rotate through a full 360º arc without encountering any obstructions.

b. Unless otherwise specified, the static deflection of DDNH hangers shall be 0.3” with a strain not exceeding 15%. Neoprene shall be bridge-bearing quality with a maximum durometer of 50.

(Type DDNH: Mason Industries Type HD or as approved.)

7. ISOLATOR TYPE SPNM

a. Type SPNM (Spring and Neoprene Mounts) shall be free standing and laterally stable without any housing. Springs shall be designed so that the ratio of the horizontal to vertical spring
constant is between one and two. The spring diameter shall be not less than 80% of the compressed height of the spring at rated load. Loaded springs shall have a minimum additional travel to solid equal to 50% of the specified static deflection.

b. Unless otherwise specified, the minimum static deflection of SPNM isolators for equipment mounted on grade slabs shall be 1”, and the minimum static deflection for equipment mounted above grade level shall be 2”.

c. Two Type WP isolation pads sandwiching a 16-gauge stainless or galvanized steel separator plate shall be bonded to the isolator base plate.

d. Unless otherwise specified, isolators need not be bolted to the floor for indoor installations. If the base plates are bolted to the structure, a neoprene vibration isolation washer and sleeve (Uniroyal Type 620/660 or as approved) shall be installed under the bolt head between the steel washer and the base plate.

(Type SPNM: Mason Industries Type SLFSW or as approved.)

8. ISOLATOR TYPE SPNH

a. Type SPNH (Spring and Neoprene Hangers) shall consist of a steel spring in series with a neoprene element. The spring shall have a minimum additional travel to solid equal to 50% of the specified deflection. The neoprene element shall have a static deflection of not less than 0.3” with a strain not exceeding 15%. Neoprene shall be bridge-bearing quality with a maximum durometer of 50.

b. Unless otherwise specified, the static deflection of SPNH hangers shall be 2”.

c. Spring diameter and hanger box hole size shall be large enough to permit the hanger rod to swing through a 30º arc. A neoprene sleeve shall be inserted in the steel hanger box where the lower hanger rod passes through it, such that the hanger rod cannot contact the steel hanger body. The diameter of the clear hole in the mounting box shall be at least 3/4” larger than the diameter of the hanger rod. When installed, the spring element shall not be cocked, and the hanger box shall be allowed to rotate through a full 360º arc without compromising a minimum clearance of 1”.

(Type SPNH: Mason Industries Type 30N or as approved.)

9. NEOPRENE MOUNTING SLEEVES

a. Neoprene mounting sleeves for hold-down applications of equipment with vibration isolators shall be Uniroyal Type 620/660 or as approved.

10. ACOUSTICALLY SEALED PULL BOXES

a. Sides and cover shall be formed of minimum 14-gauge cold rolled steel. Inside surfaces of sides and cover shall be lined with 1” thick, neoprene-coated duct liner board of 3 pcf density. Entire perimeter of closure shall be sealed with 1” x 1/4” closed-cell sponge neoprene sound seal. Sides of the box shall be sealed airtight to the wall with non-hardening sealant on foam backer rod. Conduit penetrations through wall shall be packed and caulked as described herein.

PART 3 - EXECUTION

3.1 GENERAL

A. Ballasts, relays, dimmers, equipment controls and all transformers shall be located as shown on the drawings. If not shown, location is subject to review by architect and acoustical consultant prior to installation. Under no circumstances shall such devices be located within noise critical spaces or on walls, slabs or ceilings that are common to such spaces.
3.2 TRANSFORMERS

A. All transformers below 100 kVA shall be supported on [Type DDNM or Type DDNH isolators] with 0.35” static deflection. All transformers equal to or above 100 kVA shall be supported on [Type SPNM or SPNH spring isolators] with 1” static deflection. All wiring connections to transformers shall be made with flexible conduit having sufficient slack so as not to impede movement of equipment on isolators.

B. Transformers shall not be hung from or supported on other equipment, pipes or ductwork installed on vibration isolators, but shall be supported on or suspended from building structure.

3.3 DIMMER RACKS

A. Dimmer racks and other lighting equipment containing transformers, fans, choke coils or relays shall be installed on Type MWP isolation pads and shall be located a minimum of 3” from adjacent walls. Conduit within the dimmer rooms shall be suspended on Type DDNH neoprene hangers.

3.4 MOTORS AND ELECTRICAL EQUIPMENT

A. All wiring connections to motors and electrical equipment supported on Type SPNM or Type SPNH isolators shall be made with a slack U-shaped section of flexible conduit. Wiring connections to motors and electrical equipment supported on Type DDNM and or Type DDNH isolators shall be made with a slack U-shaped flexible conduit. Flexible conduit and cable shall be capable of and recommended for such curvature.

3.5 MOTOR CONTROL CENTERS

A. Motor control centers shall be mounted on Type MWP isolators.

3.6 SOUND SYSTEM RACKS

A. All sound and communication racks shall be mounted on Type MWP isolators.

3.7 ACOUSTICALLY SEALED PULL BOXES

A. Acoustically sealed pull boxes as described herein shall be installed at one side of each penetration at noise critical walls and slabs where the pull box exceeds 8” in at least one dimension.

3.8 PENETRATIONS OF WALLS AND SLABS

A. All conduit and cable penetrations of noise critical spaces shall be sleeved, packed and caulked airtight.

B. Where a conduit or cable passes through such a wall or slab, a steel sleeve shall be cast or grouted into the structure. The internal diameter of the sleeve shall be larger than the external diameter of the conduit passing through it by 2” for conduit 2” and over and by 1” for conduit under 2”. After all conduit is installed, the Electrical Contractor shall check the clearance and correct it, if necessary, to within 1/2”. The void shall be packed full depth with glass fiber; install foam backer rod on both sides, recessed into the sleeve by 1/2”. Cover the backer rod 1/2” deep with non-hardening, non-aging sealant. Alternatively, the void between sleeve and conduit shall be filled full-depth with GE silicone sealant Type RTV6428 or approved material with equal density and flexibility. For penetrations in fire-rated assemblies, use approved non-hardening, non-shrinking fire stop putty in lieu of the sealant and foam rod.

C. Where conduit crosses a building expansion joint between new and existing buildings, an 18” length of flexible conduit shall be used to bridge between the two constructions. Rigid conduit shall not be acceptable.

3.9 FIELD QUALITY

A. Contractor shall work in accord with best trade practices, shall fabricate and install all items in accordance with manufacturer's recommendations and Architect's directions, and shall consult and coordinate with trades doing adjoining work in order to provide an installation of first class quality.
3.10 TESTING AND ADJUSTMENT
   A. Contractor shall test and adjust noise and vibration control products and installations to achieve specified performance.

3.11 CONTRACTOR’S REPORT
   A. The vibration isolation manufacturer shall inspect and approve the installation of the vibration isolators, and shall submit a report to the Architect and Acoustics Consultant which verifies that all of the isolators for electrical equipment has been properly installed and that the installation is in full conformance with the specification. The report shall contain the type and measured static deflection of all spring isolators provided.

3.12 SITE ACCESS
   A. During installation of equipment, Contractor shall arrange for access as necessary for inspection of isolation and noise control equipment by Architect and Acoustics Consultant.

3.13 CONSULTANT’S INSPECTION
   A. Upon completing installation and adjustment for suitable operation of all work specified under this section, the Contractor shall notify in writing the Architect, who will schedule an inspection by the Acoustics Consultant. The letter shall certify that all work specified under this section is complete, operational and adjusted in every respect, and that all work is ready for the completion checkout. Defective equipment and installation shall be repaired at the cost of the Contractor, and another inspection shall be scheduled.

   B. In the event that a second (or subsequent) inspection is required, the Contractor shall reimburse the Owner for travel, food and accommodation expenses incurred by the Consultant and passed on to the Owner.

   C. For each inspection, workmen shall be furnished to perform such functions as are necessary for inspection of the equipment.

END OF SECTION 26.05.48
SECTION 26.05.53
ELECTRICAL IDENTIFICATION

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Extent and types of electrical identification are indicated herein and as follows:
   1. Operational instructions and warnings.
   2. Danger signs.
   3. Equipment/system identification signs.
   5. Power and control wiring identification.
   6. Terminal marking.
   7. Arc-flash warning.
   8. Panelboard Legends.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, identification products shall be provided by W.H. Brady Co., Ideal Industries, Inc., Panduit, T&B, or approved equal.

2.02 MATERIALS

A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

B. Cable/Conductor Identification Bands: Provide manufacturer's standard wrap-around type, vinyl-cloth, self-adhesive cable/conductor markers with either pre-numbered plastic coated type or write-on type with clear plastic self-adhesive cover flap, numbered to show circuit identification. Provide markers for all field control wiring.

C. Self-Adhesive Plastic Signs: Provide manufacturer's standard, self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings. Signs shall be of sizes suitable for application areas and adequate for visibility, with proper wording for each application (as examples: 208V, EXHAUST FAN or DANGER – HIGH VOLTAGE).
   1. Colors: Unless otherwise indicated or required by governing regulations, provide orange signs with black lettering.

D. Engraved Plastic-Laminate Signs: Provide three-layer engraving stock in sizes and thickness indicated, engraved with engraver's standard letter style of sizes and wording indicated, black and white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
   1. Thickness: 1/16", for units up to 20 sq. in. or eight (8") length; 1/8" for larger units.
   2. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

E. Underground Warning Tape: Provide four (4") inch wide detectable type, plastic, yellow warning tape with suitable warning describing type of cable/circuit over buried electrical lines.
2.03 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations, and other designations used in electrical identification work, with corresponding designations shown, specified, or scheduled. Provide numbers, lettering, and working as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment.

PART 3 – EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements:
   1. Coordination: Where identification is to be applied to surfaces, which require finish, install identification after completion of painting.
   2. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.
   3. Conduit Identification: Where electrical conduit is exposed in spaces with exposed mechanical piping which is identified by a color-coded method, apply color-coded identification on electrical conduit in a manner similar to piping identification. Except as otherwise indicated, use orange as coded color for conduit.
   4. Equipment/System Identifications: Install engraved plastic-laminate sign on each disconnect and control cabinets. Except as otherwise indicated, provide single line of text, 1/2” high lettering on 1-1/2” high sign (2” high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide identification and warning signs for each unit of the following categories of electrical work.
      a. Electrical cabinets and enclosures.
      b. Panelboards
      c. Access panel/doors to electrical cabinets.
      d. Control stations.
      e. Disconnect switches.

B. Install signs at locations indicated or, where not otherwise indicated, at locations for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with stainless steel tamperproof fasteners.

C. Install danger signs on all disconnect and control cabinet exteriors.

D. Install danger and notice to disconnect power before removing or opening on all inner panels.

E. Install underground warning tape in accordance with the National Electrical Code.

END OF SECTION 26.05.53
SECTION 26.05.73
OVERCURRENT PROTECTIVE DEVICES

PART 1 – GENERAL

1.01 WORK INCLUDED
A. This section includes circuit breakers and fuses.

1.02 SUBMITTALS
A. Provide manufacturer's product data for the following:
   1. Circuit breakers
   2. Enclosures
   3. Fuses (Provide complete list of all fuses and the equipment where they are used.)
   4. Shunt trips
B. Provide maintenance data for products for inclusion in the Operating and Maintenance Manual.
   1. Include a load current and overload relay heater list compiled by Contractor after motors have been installed. Arrange list to demonstrate selection of heaters to suit actual motor nameplate full load currents.

1.03 QUALITY ASSURANCE
A. Listing and Labeling: Provide overcurrent protective devices that are listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
B. Overcurrent protective devices and their installation shall comply with the requirements of the National Electrical Code.
C. Circuit breakers shall comply with UL 489, NEMA AB 1, and NEMA AB 3.
D. Fuses shall conform to NEMA FU 1.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
A. Circuit Breakers: Subject to compliance with requirements, provide products by Cutler-Hammer; General Electric Co.; Siemens Energy & Automation, Inc.; Square D Co.; or approved equal.
B. Fuses: Subject to compliance with requirements, provide products by Bussmann Mfg. Co., Littlefuse Co, Ferraz Shawmut, or approved equal.

2.02 MOLDED-CASE CIRCUIT BREAKERS
A. Circuit breakers shall be bolt-on only. Plug-in type circuit breakers are not permitted.
B. Circuit breakers shall be molded case, manually operated, trip-free, with inverse-time, thermal-overload protection, and instantaneous magnetic, short-circuit protection, as required. Circuit breakers shall be completely enclosed in a molded case, with the calibrated sensing element factory-sealed to prevent tampering.
C. Thermal-magnetic tripping elements shall be located in each pole of the circuit breaker and shall provide inverse-time-delay thermal overload protection and instantaneous magnetic short-circuit protection. On frame sizes larger than 100 amperes, the instantaneous magnetic tripping element shall be adjustable and accessible from the front of the breaker.
D. Breaker size shall be as required for the continuous current rating of the circuit. Breaker class shall be as required.

E. Interrupting capacity of the branch circuit breakers shall be sufficient to successfully interrupt the maximum short-circuit current imposed on the circuit at the breaker terminals. Circuit breaker minimum interrupting capacities shall be as shown on drawings and shall conform to NEMA AB 3.

F. Multipole circuit breakers shall be of the common-trip type having a single operating handle and shall have a two-position on/off indication. Circuit breakers shall have temperature compensation for operation in an ambient temperature of 104 degrees F. Circuit breakers shall have root mean square (rms) symmetrical interrupting rating sufficient to protect the circuit being supplied. Interrupting ratings may have selective type tripping (time delay, magnetic, thermal, or ground fault).

G. Breaker body shall be of phenolic composition. Breakers shall be capable of having such accessories as handle-extension, handle-locking, and padlocking devices attached where required.

H. Provide UL listed service entrance equipment when used for service disconnect.

I. Circuit breakers used for switching high intensity discharge lights or fluorescent lights shall be rated for that type of service.

2.03 ENCLOSED MOLDED-CASE CIRCUIT BREAKERS

A. Enclosed circuit breakers shall be thermal-magnetic, molded-case circuit breakers in surface-mounted, nonventilated enclosures, conforming to the appropriate articles of NEMA 250 and NEMA AB 1.

2.04 FUSES

A. A complete set of fuses for all switches shall be provided. Fuses shall have a voltage rating not less than the circuit voltage.

B. Provide Class RK5 fuses for motor branch circuits.

C. Fuses shall be labeled showing UL class, interrupting rating, and time-delay characteristics, when applicable.

D. Fuse holders field-mounted in a cabinet or box shall be porcelain. Field installation of fuse holders made of such materials as ebony asbestos, Bakelite, or pressed fiber shall not be used.

E. Provide a minimum of three (3) spare fuses of each size and type fuse installed.

F. Provide a complete list of all fuses and the equipment where they are used.

2.05 EQUIPMENT ENCLOSURES

A. Enclosures for equipment shall be in accordance with NEMA 250.

B. Equipment installed inside, clean, dry locations shall be contained in NEMA Type 1, general-purpose sheet-steel enclosures.

C. Equipment installed in wet locations shall be contained in NEMA Type 3R, rainproof, sheet-steel enclosures, constructed for outdoor use to protect against falling rain, sleet, and ice.

D. Ferrous-metal surfaces of electrical enclosures shall be cleaned, phosphatized, and painted with the manufacturer’s standard finish.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install overcurrent protective devices as indicated or required, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements.
B. Coordinate with other work, including electrical wiring work, as necessary to interface installation of overcurrent protective devices.

C. Fasten circuit breakers without mechanical stresses, twisting or misalignment being exerted by clamps, supports, or cables.

D. Install enclosed circuit breakers plumb with operating handle at five (5') feet above finished elevation.

E. Set field-adjustable circuit breakers for trip settings as indicated, subsequent to installation of devices.

F. Provide engraved plastic-laminate identification under the provisions of Section 26.05.53, "Electrical Identification" for enclosed circuit breakers and motor controllers.

3.02 FIELD QUALITY CONTROL

A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

B. In the presence of the Owner or Owner’s Representative, test each device and demonstrate its working as specified.

END OF SECTION 26.05.73
SECTION 26.08.00
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Section 01.91.13 – General Commissioning Requirements
C. Section 22.08.00 – Commissioning of Plumbing Systems
D. Section 23.08.00 – Commissioning of HVAC
E. Commissioning Plan, dated 12/01/17

1.02 SCOPE
A. Commissioning is an ongoing process and shall be performed throughout construction. Commissioning verifies that systems are operating in a manner consistent with the Contract Documents.
B. Following is a detailed list of equipment included in each commissioning activity:
   1. Transformers
   2. Panelboards
   3. Switchboards
   4. Lighting Controls
   5. Occupancy Sensors
   6. Daylight Dimming Controls
   7. Emergency Lighting
   8. Fire Alarm System

1.03 RESPONSIBILITIES
A. The Contractor shall be responsible for adhering to applicable code required procedures, standards and industry practices to ensure personal safety, the safety of others, and facility safety with regard to electrical equipment operation and testing. If there are procedures in the checklists or the functional performance tests which conflict with safety, the Contractor shall not proceed and shall notify the CxA immediately.

PART 2 PRODUCTS

2.01 MEANS OF ACCESS
A. The Contractor shall provide means for the CxA to access, observe and visually confirm proper operation of all equipment and systems. These means shall be in compliance with all OSHA and job-site safety regulations.

2.02 TEST EQUIPMENT
A. The Contractor shall provide the necessary equipment to fully test the commissioned systems as defined in the Contract Documents and as defined in the functional performance test procedures to be provided by the CxA.
B. The test equipment shall meet the following minimum requirements.
   1. All test equipment shall be in good mechanical and electrical condition.
   2. Field test metering used to check power system meter calibration will be more accurate than the instrument being tested.
   3. Accuracy of metering in test equipment shall be appropriate for the test being performed.
4. Waveshape and frequency of test equipment output waveforms shall be appropriate for the test and the tested equipment.

C. Calibration
1. Calibration of all test equipment shall be current.
2. Calibration accuracy shall be traceable to National Institute of Standards and Technology (NIST).
3. Test equipment shall be calibrated in accordance with the following schedule.
   a. Field instruments
      1) Analog – At least every 6 months
      2) Digital – At least every 12 months
   b. Leased Specialty Equipment – At least every 12 months
4. Dated calibration labels shall be visible on all test equipment.
5. Calibration records shall be provided for all test equipment used in the project.

PART 3 EXECUTION

3.01 START-UP PLAN
A. The Contractor shall perform start-up testing for each piece of equipment to ensure that the equipment and systems are properly installed and ready for operation, so that functional performance testing may proceed without delays.
B. The Contractor shall prepare a start-up plan for each piece of equipment. This plan shall be submitted to the CxA for review and comment. The start-up plan shall consist, at a minimum of the following:
   1. The manufacturer’s standard start-up and check out procedures copied from the installation manuals.
   2. Checklists and procedures with specific spaces for recording and documenting the inspection of each procedure and a summary block for deficiencies and explanations.
C. Two (2) weeks prior to expected start-up for a piece of equipment, the Contractor shall notify the Owner and the CxA in writing. The execution of the start-up plan shall be directed and performed by the Contractor. The CxA and/or the Owner may be present for the start-up of the first unit of each type of equipment.
D. The Contractor shall submit the completed equipment checklists to the CxA for review. The Contractor shall note all non-compliance items on these checklists. The Contractor shall notify the CxA when outstanding items have been corrected.
E. The Contractor shall complete the start-up plan and resolve or correct all issues resolved before functional testing may begin.

3.02 EQUIPMENT CHECKLISTS
A. Equipment checklists, provided by the CxA, shall be completed by the Contractor on CxAloy. The following checklists will be provided: [Review the following add/delete/modify as appropriate to the project scope.
   1. Equipment Receipt Inspection Checklist
   2. Equipment Pre-Functional Checklist

3.03 FUNCTIONAL PERFORMANCE TESTS
A. The Contractor shall provide all documentation as requested to the CxA for development of functional performance testing procedures. This documentation shall include, at a minimum, manufacturer installation, start-up, operation and maintenance procedures. The CxA may request further documentation as necessary for the development of functional performance tests.
B. The Contractor shall review the functional performance test procedures developed by the CxA.
   1. The Contractor shall respond in writing to the CxA regarding the acceptability of the proposed test procedures.
2. The Contractor shall note any necessary modifications to the procedures due to the actual equipment/systems or safety concerns and shall submit these to the CxA for consideration.

C. The Contractor shall place equipment and systems into operation and continue the operation as required during each working day of the testing activities.

D. The Contractor shall accomplish the functional performance testing of equipment based on procedures developed by the CxA and as reviewed by the Contractor.
   1. The Contractor shall provide skilled technicians to operate the systems during functional performance testing.
   2. The Contractor shall correct any deficiencies as identified during testing and retest equipment as required.

E. Functional performance testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of the system at the discretion of the CxA and the Contractor.

F. Upon successful completion of all functional performance tests, the Contractor(s) shall perform Integrated Systems Testing. The testing shall document and verify the proper response of all Division 26 systems to all potential utility and emergency power operating and failure scenarios.

END OF SECTION 26.08.00
SECTION 26.09.61
PERFORMANCE LIGHTING POWER AND CONTROLS DEVICES INSTALLATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
A. Work in this section includes the installation of the Performance Lighting, Power, and Controls System and provision of supporting conduit, wire and standard backboxes.
B. Section Includes
   1. Materials, components, modifications, assemblies, equipment and services as specified herein. These include, but are not limited to:
      a. Verification of site dimensions and conditions.
      b. Submittals as required by the Contract Documents.
      c. Engineering as required by the Contract Documents.
      d. Manufacture of equipment and systems as required by the Contract Documents.
      e. Scheduling, sequencing and coordination with other trades.
      f. Review of shop drawings provided by related sections
      g. Testing and demonstration of equipment and systems as specified herein and elsewhere in the Contract Documents in coordination with related sections
   2. Coordination with the 11 61 61 Contractor as specified in Section 11 61 61 for a complete performance lighting power and controls system.
   3. Power distribution devices, conduit and wire as required in this Section and related Specification Sections listed herein.
   4. Disconnects, power feeds as required for performance lighting power panels.
   5. Standard backboxes as noted in the contract documents. Specialized boxes are excepted from this.
   6. This specification is considered as an outline form and other appurtenances that may be required for the efficient and safe operation of the performance lighting power, and control systems specified in this section will be furnished under Section 11 61 61, the same as if specified herein.
C. Products Installed under this section and furnished under 11 61 61:
   1. Backboxes for faceplates furnished under 11 61 61. Standard boxes are excepted from this.
   2. Lighting receptacles, Connector Strips, and Faceplates carrying 100V or above.
   3. Busway
   4. Dimmer Racks
   5. Motorized Breaker Panels.
   6. Panel Board surge suppression.
   7. Multipole contactors
   8. Company Switches

1.03 DEFINITIONS
A. The term “furnish” means to supply and deliver to the job site, ready for unloading, unpacking, assembly, installation, and similar operations.
B. The term “install” is used to describe operations at the job site including the actual anchoring, applying, assembly, cleaning, curing, cutting, erection, finishing, patching, placing, protecting, pulling, terminating, unloading, unpacking, working to dimension, and similar operations that will render the systems complete and ready for the intended use.
C. The term “provide” means to furnish and install.
D. Performance Lighting Power Panel: A dimmer rack, relay, panel, motorized breaker panel or contactor panel controlled by the performance lighting system.
E. Data Communications: Signals that provide control and feedback communications between devices in the system.

1.04 SYSTEM DESCRIPTIONS
A. The performance lighting power, and controls system consists of wiring devices, both low and line voltage, performance power panels, lighting network control rack and remote consoles.
   1. Line voltage feeds to the distributed circuits require a dedicated neutral per circuit.
B. The DMX 512 control signal will be generated by various consoles and devices, and is connected to the performance power panels via conduit runs and low voltage cables.
C. The Ethernet control signal will be generated by various consoles and devices, and is connected to the hub via conduit runs and low voltage cables.
D. Equipment will be the coordinated and the system integrated by the 11 61 61 Contractor in coordination with the Division 26 Contractor.
E. The specified performance lighting power, and controls components are fully described in the Contract Documents. Complete technical data is also available from the manufacturer. Catalog numbers are those shown on Manufacturer’s data sheets and drawings unless otherwise noted.
F. Architectural Lighting Controls include the control of fixtures. The termination of control wiring (0-10VDC or DMX) are not the work of the 11 61 61 Contractor, except the end termination to their Lighting Signal Processing Rack(s). Interconnection of low voltage control wire and configuration of lights shall be the responsibility of the contractor providing the fixtures.

1.05 SUBMITTALS
A. Bid Submittals
   1. The Division 26 Contractor will examine drawings prior to submitting his bid. He will note adverse conditions to be overcome or circumvented, and favorable conditions to be taken advantage of. Submittal of a bid will indicate that the Division 26 Contractor has full knowledge of the problems involved in the work and that he has taken these into consideration in computing his bid.
   2. The Division 26 Contractor will bid on installation of the performance lighting power and control system as specified in 11 61 61 and any additional materials required to implement the system such as conduit, panel boxes and wire as specified in the Contract Documents.
   3. In addition to the submittals required under the general conditions of these specifications, bidders are required to furnish supporting documents as noted below in order for their bids to be considered.

1.06 QUALITY ASSURANCE
A. Supplementary:
   1. Secure equipment, except portable equipment, firmly in place. Mount components rigidly, except where resilient isolation is required. Design and provide fastenings and supports adequate to support their loads with a safety factor of at least three.
   2. Clearly mark switches, jacks, outlets, cables, connectors, etc. logically and permanently during fabrication and installation.
   3. Where many cables are run in close proximity color code by function in a logical manner.
   4. Take necessary precautions to prevent and guard against electromagnetic, electrostatic and radio frequency interference.
   5. Exercise care in wiring, so as to avoid damage to the cables and to the equipment. Between racks, cabinets, consoles or modules ensure cables are well-supported, neatly laced and dressed. Make joints and connections with mechanical connectors approved by the Consultant.
6. When cable is surface mounted and crossing through fire walls, use the equivalent fire rated plenum cable to the specified cable type.
7. Label terminal strips, punch blocks, wire and cables in a permanent and logical manner with a unique number on each end of cable runs.
8. Final location of equipment is as shown on the Drawings, located in the field by the Architect or as shown on supplementary drawings prepared by the Consultant.
9. Install control system wiring which is continuous from the faceplates to the racks. Employ no splices for entire cable length.

1.07 WARRANTY
A. In addition to manufacturer's warranties, warrant provided systems and equipment to be free of defective components, faulty workmanship or improper adjustment for a period of two years from the date of building acceptance. Paint and exterior finishes are excluded. Equipment supplied under 11 61 61 excluded.
B. In addition to manufacturer's warranties, warrant installation to be free of defective components, faulty workmanship or improper adjustment for a period of two years from the date of building acceptance.
C. Replace items showing evidence of defective materials or workmanship (including installation workmanship) within thirty (30) days after notification. Make replacements without cost.
D. Rectify conditions that might present a hazard to human life, well-being and or property within 48 hours of notification.

1.08 PROJECT CONDITIONS
A. Questions requiring clarification of the specifications are addressed to the Architect.
B. Provide continuous liaison with the 11 61 61 Contractor during demolition and construction, and coordinate delivery schedules and installation of equipment with related trades.

1.09 PRODUCT HANDLING AND STORAGE
A. The Division 26 Contractor will make good or replace work, materials and equipment which have become contaminated, stolen, marred otherwise damaged, as directed by the Consultant and at no cost once the equipment has been accepted by the Division 26 Contractor.
B. Equipment will remain the responsibility of the Division 26 Contractor until building acceptance.

PART 2 PRODUCTS
2.01 MATERIALS
A. Materials as specified under Division 26.

PART 3 EXECUTION
3.01 DELIVERY
A. Materials within this contract will be delivered by the Division 26 Contractor to the project site. Performance lighting power, and controls system equipment shall be delivered by the 11 61 61 Contractor.
B. Equipment furnished under Division 11 61 61 will become the responsibility of the Division 26 Contractor at such time that the Division 26 Contractor takes possession of the equipment from the 11 61 61 Contractor.
1. At this time the Division 26 Contractor will document the exact condition, breakage or damage evident in the equipment.
2. Exact quantities will be documented.
3. Any discrepancies in the quantities and any damage or unsuitability of the product for the application will be provided in writing to the 11 61 61 Contractor upon transfer of the equipment.
4. Acceptance of the equipment verifies proper physical condition of the product. Electrical functionality is not implied at acceptance and is not the responsibility of the Division 26 Contractor.
5. The 11 61 61 Contractor will be present at the time of transfer to coordinate and expedite this action. The 11 61 61 Contractor shall be given a two week minimum lead time prior to this meeting.

3.02 LOW VOLTAGE CONDUIT SYSTEM

A. Observe conduit separation requirements indicated in the contract documents.
B. Provide trade size 3/4” conduit, unless otherwise noted.
C. Provide a complete, continuous and clean conduit system including all conduits, conduit supporting means, all electrical boxes and enclosures, etc, and all connections to terminal cabinets, pull boxes, SVC panels, and receptacles.
D. All conduit shall be clean and free of burrs, nicks, etc. Ream all conduit ends to prevent damage to cables.
E. Conduit runs shall not exceed 180 degrees of bends between pull boxes. If a run exceeds 180 degrees of bends insert a pull box in an accessible location.
F. Cable runs between documented terminal points (inclusive of inserted pull boxes) shall not exceed 250’ (75m).
G. Provide nylon pull cord in all conduit runs, point to point.
H. Non-metallic conduit is considered free air and separations for free air installation are required.
I. Sound systems create significant amounts of low frequency energy which vibrates everything in the space. Unrestrained metal to metal contact will buzz. The contractor will install devices in a fashion that eliminates buzzing due to unrestrained metal to metal contact.
   1. Where metallic conduits pass through metal gasket the opening to eliminate metal to metal contact.
   2. Where metallic conduit comes in contact with metal mechanically fasten the conduit to the metal.
   3. Where 2 metallic conduits cross and come in contact mechanically fasten conduits together.
   4. Where 2 metallic devices come in contact either mechanically connect the devices or install non-metallic gasketing between the devices mechanically affixing the gasket to one of the devices.
   5. Where conduit is tied directly to an equipment rack employ an isolation bushing to eliminate continuity between the conduit and the equipment rack. Ground the equipment rack with a dedicated ground wire tied back to ground at the associated panel board.
J. Mark the interior of the boxes with the box number to facilitate identification.

3.03 SUPERVISION OF INSTALLATION

A. The 11 61 61 Contractor will provide instruction and supervision to the Division 26 Contractor as it pertains to the installation of these systems. Provide the necessary personnel for coordination meetings and site visits prior to installation of systems.

3.04 SYSTEM COMMISSIONING

A. At no time will the equipment furnished under Section 11 61 61 be energized prior to the 11 61 61 Contractor authorized commissioning.
B. The Division 26 Contractor will notify the 11 61 61 Contractor within at least two weeks time for system commissioning.
C. The Division 26 Contractor will confirm in writing that the following conditions have been met prior to scheduling system commissioning
   1. Arrangements will be made for access to equipment and terminations. Scaffolding, lifts or any other OSHA approved method will be acceptable.
2. Power Panels will be installed and wired.
3. Distribution equipment will be completely installed.
4. Continuity checks for the entire system will have been performed and failures remedied.

D. At the time of commissioning the Division 26 Contractor will provide a representative who has full working knowledge of the system, device placement and job conditions. This representative will be on-site throughout the commissioning process and will coordinate with, and aid, the 11 61 61 Contractor to expeditiously commission the system.

3.05 INSPECTION AND TESTING

A. Field Check-out & Final Approvals. After the system is commissioned and functions in accordance with the contract documents in the opinion of the Division 26 Contractor and the 11 61 61 Contractor, the Design Consultant will inspect and test the system.

B. Make necessary arrangements for parties concerned to be present, by scheduling such inspection in a manner acceptable to the Design Consultant and give a minimum of 14 days notice.

C. A representative from the Division 26 Contractor, the 11 61 61 Contractor and the Design Consultant will be present at the test.

D. Furnish equipment and instruments necessary for testing the complete wiring system during the progress of the work as well as after installation. Tests shall be demonstrated to the satisfaction of the designer.

Test include the following:
1. Circuits are continuous and free from short circuits.
2. Circuits are free from unspecified grounds.
3. Circuits are properly connected in accordance with the applicable wiring diagram.
4. Voltage drop at each end of the circuit with a 2000 watt load.
5. Low voltage circuits complying to industry standards.

E. Any defects will be repaired at once and the tests re-conducted.

3.06 RECORD DRAWINGS & OPERATION MANUAL

A. The Division 26 Contractor will provide three (3) copies of black and white prints on the system corrected in red to indicate changes made during construction.

END OF SECTION
This page intentionally left blank.
PART 1 GENERAL

1.01 SUMMARY

A. Work in this section includes the installation of the electrical components of Performance Machinery, and provision of supporting conduit, wire and standard backboxes.

B. Section Includes

1. Materials, components, modifications, assemblies, equipment and services as specified herein. These include, but are not limited to:
   a. Verification of site dimensions and conditions.
   b. Submittals as required by the Contract Documents.
   c. Engineering as required by the Contract Documents.
   d. Manufacture of equipment and systems as required by the Contract Documents.
   e. Scheduling, sequencing and coordination with other trades.
   f. Review of shop drawings provided by related sections
   g. Testing and demonstration of equipment and systems as specified herein and elsewhere in the Contract Documents in coordination with related sections

2. Coordination with the 11 61 39 Contractor as specified in Section 11 61 39 for the control and power system of a Performance Lift system.

3. Inclusion of conduit and standard junction boxes for future installation of motorized drapery systems.

4. Coordination with the 11 61 37 Contractor as specified in Section 11 61 37 for the control and power system of a Mechanized Fire Curtain.

5. Power distribution devices, conduit and wire as required in this Section and related Specification Sections listed herein.

6. Disconnects, power feeds as required for the equipment.

7. Standard backboxes as noted in the contract documents. Specialized boxes are excepted from this.

8. This specification is considered as an outline form and other appurtenances that may be required for the efficient and safe operation of the mechanical systems specified in this section will be furnished under Division 26, the same as if specified herein.

C. Products Installed under this section and furnished under sections indicated above:

1. Specialty backboxes and enclosures furnished under the sections indicated above. Standard boxes are excepted from this.

2. Motor control panel enclosures.

3. Receptacles, wireways, and faceplates carrying 100V or above.

4. Control wireways.

5. Multiconductor cable furnished under 11 61 39 for the purpose of providing power and control from the floor to the lift platform.

6. Control wiring and cable.

1.02 DEFINITIONS

A. The term “furnish” means to supply and deliver to the job site, ready for unloading, unpacking, assembly, installation, and similar operations.

B. The term “install” is used to describe operations at the job site including the actual anchoring, applying, assembly, cleaning, curing, cutting, erection, finishing, patching, placing, protecting, pulling, terminating, unloading, unpacking, working to dimension, and similar operations that will render the systems complete and ready for the intended use.

C. The term “provide” means to furnish and install.
1.03 SYSTEM DESCRIPTIONS

A. The performance mechanized lift system consists of motor control and safety devices designed to provide safe operation of the orchestra pit lift platform.

B. The mechanized fire curtain system is designed so as to intercept hot gases, flames and smoke between the stage and the auditorium seating area. A component of this is a mechanically operated winch that raises and lowers this curtain in non-emergency situations.

C. Components of each of these systems include, but are not limited to motor control systems, occupant sensing and notification systems, emergency stop systems, and local and remote controls.

D. Equipment will be coordinated and the system integrated by the contractors indicated above in coordination with the Division 26 Contractor.

E. The specified components are fully described in the Contract Documents. Complete technical data is also available from the manufacturer. Catalog numbers are those shown on Manufacturer’s data sheets and drawings unless otherwise noted.

1.04 SUBMITTALS

A. Bid Submittals

1. The Division 26 Contractor will examine all drawings, including those related to the performance systems, prior to submitting his bid. He will note adverse conditions to be overcome or circumvented, and favorable conditions to be taken advantage of. Submittal of a bid will indicate that the Division 26 Contractor has full knowledge of the problems involved in the work and that he has taken these into consideration in computing his bid.

2. The Division 26 Contractor will bid on installation of the electrical components of the performance systems noted above and any additional materials required to implement the system such as conduit, panel boxes, and wire as specified in the Contract Documents.

3. In addition to the submittals required under the general conditions of these specifications, bidders are required to furnish supporting documents as noted below in order for their bids to be considered.

4. The Owner reserves the right to waive formalities, to be sole judge of quality and equality of the several bid proposals, and reserves the right to reject any and all bids.

1.05 QUALITY ASSURANCE

A. Supplementary:

1. Secure equipment, except portable equipment, firmly in place. Mount components rigidly, except where resilient isolation is required. Design and provide fastenings and supports adequate to support their loads with a safety factor of at least three.

2. Clearly mark switches, jacks, outlets, cables, connectors, etc. logically and permanently during fabrication and installation.

3. Where many cables are run in close proximity color code by function in a logical manner.

4. Take necessary precautions to prevent and guard against electromagnetic, electrostatic and radio frequency interference.

5. Exercise care in wiring, so as to avoid damage to the cables and to the equipment. Between racks, cabinets, consoles or modules insure cables are well-supported, neatly laced and dressed. Make joints and connections with mechanical connectors approved by the Consultant.

6. When cable is surface mounted and crossing through fire walls, use the equivalent fire rated plenum cable to the specified cable type.

7. Label terminal strips, punch blocks, wire and cables in a permanent and logical manner with a unique number on each end of cable runs.

8. Final location of equipment is as shown on the Drawings, located in the field by the Architect or as shown on supplementary drawings prepared by the Consultant.

9. Install control system wiring which is continuous between terminations. Employ no splices for entire cable length.
1.06 WARRANTY
A. In addition to manufacturer's warranties, warrant provided systems and equipment to be free of defective components, faulty workmanship or improper adjustment for a period of two years from the date of Owner's acceptance. Paint and exterior finishes are excluded. Equipment supplied under Division 11 excluded.
B. In addition to manufacturer's warranties, warrant installation to be free of defective components, faulty workmanship or improper adjustment for a period of two years from the date of Owner's acceptance.
C. Replace items showing evidence of defective materials or workmanship (including installation workmanship) within thirty (30) days after notification. Make replacements without cost to the Owner.
D. Rectify conditions that might present a hazard to human life, well-being and or property within 48 hours of notification.

1.07 PROJECT CONDITIONS
A. Questions requiring clarification of the specifications are addressed to the Architect.
B. Provide continuous liaison with the Contractors listed above during demolition and construction, and coordinate delivery schedules and installation of equipment with related trades.

1.08 PRODUCT HANDLING AND STORAGE
A. The Division 26 Contractor will make good or replace work, materials and equipment which have become contaminated, stolen, marred otherwise damaged, as directed by the Consultant and at no cost to the Owner once the equipment has been accepted by the Division 26 Contractor.

PART 2 PRODUCTS
2.01 MATERIALS
A. Materials as specified under Division 26.

PART 3 EXECUTION
3.01 DELIVERY
A. Materials within this contract will be delivered by the Division 26 Contractor to the project site.
B. Equipment furnished by the contractors indicated above will become the responsibility of the Division 26 Contractor at such time that the Division 26 Contractor takes possession of the equipment.
   1. At this time the Division 26 Contractor will document the exact condition, breakage or damage evident in the equipment.
   2. Exact quantities will be documented.
   3. Any discrepancies in the quantities and any damage or unsuitability of the product for the application will be provided in writing to the Division 11 contractor upon transfer of the equipment.
   4. Acceptance of the equipment verifies proper physical condition of the product. Electrical functionality is not implied at acceptance and is not the responsibility of the Division 26 Contractor.
   5. The Division 11 Contractor will be present at the time of transfer to coordinate and expedite this action. The Division 11 Contractor shall be given a two week minimum lead time prior to this meeting.

3.02 LOW VOLTAGE CONDUIT SYSTEM
A. All control wiring from panels to junction boxes shall be located in conduit unless noted otherwise.
B. Observe conduit separation requirements indicated in the contract documents.
C. Provide trade size 1” conduit, unless otherwise noted.
D. Provide a complete, continuous and clean conduit system including all conduits, conduit supporting means, all electrical boxes and enclosures, etc, and all connections to terminal cabinets, pull boxes, SVC panels, and receptacles.

E. All conduit shall be clean and free of burrs, nicks, etc. Ream all conduit ends to prevent damage to cables.

F. Conduit runs shall not exceed 180 degrees of bends between pull boxes. If a run exceeds 180 degrees of bends insert a pull box in an accessible location.

G. Cable runs between documented terminal points (inclusive of inserted pull boxes) shall not exceed 250’ (75m).

H. Provide nylon pull cord in all conduit runs, point to point.

I. Sound systems create significant amounts of low frequency energy which vibrates everything in the space. Unrestrained metal to metal contact will buzz. The contractor will install devices in a fashion that eliminates buzzing due to unrestrained metal to metal contact.
   1. Where metallic conduits pass through metal gasket the opening to eliminate metal to metal contact.
   2. Where metallic conduit comes in contact with metal mechanically fasten the conduit to the metal.
   3. Where 2 metallic conduits cross and come in contact mechanically fasten conduits together.
   4. Where 2 metallic devices come in contact either mechanically connect the devices or install non-metallic gasketing between the devices mechanically affixing the gasket to one of the devices.
   5. Where conduit is tied directly to an equipment rack employ an isolation bushing to eliminate continuity between the conduit and the equipment rack. Ground the equipment rack with a dedicated ground wire tied back to ground at the associated panel board.

J. Mark the interior of the boxes with the box number to facilitate identification.

3.03 SUPERVISION OF INSTALLATION

A. The Division 11 contractor will provide instruction and supervision to the Division 26 Contractor as it pertains to the installation of these systems. Provide the necessary personnel for coordination meetings and site visits prior to installation of systems.

3.04 SYSTEM COMMISSIONING

A. At no time will the equipment furnished under the contractors indicated above be energized prior to their authorized commissioning.

B. The Division 26 Contractor will notify the Division 11 Contractor within at least two weeks time for system commissioning.

C. The Division 26 Contractor will confirm in writing that the following conditions have been met prior to scheduling system commissioning
   1. Arrangements will be made for access to equipment and terminations. Scaffolding, lifts or any other OSHA approved method will be acceptable.
   2. Distribution equipment will be completely installed.
   3. Continuity checks for the entire system will have been performed and failures remedied.
   4. Low voltage control wire will be installed with 24” tails at each field backbox and 72” tails at each control panel location.

D. At the time of commissioning the Division 26 Contractor will provide a representative who is has full working knowledge of the system, device placement and job conditions. This representative will be on-site throughout the commissioning process and will coordinate with, and aid, the Division 11 Contractor to expeditiously commission the system.

3.05 INSPECTION AND TESTING

A. Field Check-out & Final Approvals. After the system is commissioned and functions in accordance with the contract documents in the opinion of the Division 26 Contractor and the Division 11 contractor, the Consultant will inspect and test the system.
B. Make necessary arrangements for parties concerned to be present, by scheduling such inspection in a manner acceptable to the Consultant and give a minimum of 14 days notice.

C. Any defects will be repaired at once and the tests re-conducted.

3.06 RECORD DRAWINGS & OPERATION MANUAL

A. The Division 26 Contractor will provide three (3) copies of black and white prints on the system corrected in red to indicate changes made during construction.

END OF SECTION
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Curtain Hoists</td>
<td>116137</td>
<td>260961.4</td>
<td>116137 except standard &quot;gang&quot; backboxes</td>
<td>260961.4</td>
<td>260961.4</td>
<td>260961.4</td>
<td>260961.4</td>
<td>116137</td>
<td>260961.4</td>
<td>260961.4</td>
<td>B, H, I, J</td>
</tr>
<tr>
<td>Performance Lifts</td>
<td>116139</td>
<td>260961.4</td>
<td>116139 except standard &quot;gang&quot; backboxes</td>
<td>260961.4</td>
<td>260961.4</td>
<td>260961.4</td>
<td>260961.4</td>
<td>116139</td>
<td>260961.4</td>
<td>260961.4</td>
<td>B, H, I, J</td>
</tr>
<tr>
<td>Dimming Racks, Motorized Breaker Panels/Relay Panels for Performance Lighting</td>
<td>116161</td>
<td>260961</td>
<td>116161 except standard &quot;gang&quot; backboxes</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>A, C, F</td>
</tr>
<tr>
<td>Circuit Faceplates for Performance Lighting</td>
<td>116161</td>
<td>260961</td>
<td>116161 except standard &quot;gang&quot; backboxes</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>A, C, F</td>
</tr>
<tr>
<td>Control Faceplates for Performance Lighting</td>
<td>116161</td>
<td>116161</td>
<td>116161 except standard &quot;gang&quot; backboxes</td>
<td>260961</td>
<td>260961</td>
<td>N/A</td>
<td>260961</td>
<td>116161</td>
<td>116161</td>
<td>116161</td>
<td>A, C, F</td>
</tr>
<tr>
<td>Emergency Lighting Transfer Switch &amp; Emergency DMX Bypass Devices</td>
<td>116161</td>
<td>260961</td>
<td>116161 except standard &quot;gang&quot; backboxes</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>116161</td>
<td>116161</td>
<td>116161</td>
<td>A, D</td>
</tr>
<tr>
<td>Architectural Lighting Fixtures, House Lighting, and Running Lights</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>116161</td>
</tr>
<tr>
<td>Emergency Lighting Fixtures</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>260961</td>
<td>116161</td>
</tr>
</tbody>
</table>

**Comments:**

A Refer to Sections 116161 and 260961 for additional information and requirements.

B Standard gang boxes are to be furnished and installed under Division 26; special boxes, as indicated on drawings, to be furnished by Division 11 Contractor and installed under Division 26.

C Standard gang boxes are to be furnished and installed under Division 26; special boxes, including connector strips, as indicated on drawings, to be furnished under Division 11, but installed under Division 26. Refer to Sections 116161 and 260961 for additional information and requirements.

D Control cable between architectural fixtures and dimming/light control rack shall be provided under Division 26-Electrical. Termination of cable at LED driver and at light control rack shall be done under Section 116161. Division 26 Contractor to provide extra cable slack to allow for flexibility on actual final termination point at both ends.

E All DMX-Controlled Emergency Lighting Fixture Control wiring should be daisy-chained, originating at the Emergency DMX Bypass Device. Maximum QTY of (4) Emergency DMX wire runs, with maximum (32) fixtures per run.

F Division 26 to provide in addition to conduit:

- Cable tray, cable passes and J-Hooks per TCP and Electrical Drawings.
- 120 volts, 60 Hz power to individual equipment racks from dedicated power system per electrical drawings.
- 120 volts, 60 Hz dedicated receptacles fed from dedicated power system.
- Audio system isolated technical ground.

- Refer to Section 274100 for additional information and requirements.

G Refer to Sections 116170, and 260961.20, and 260961.30 for additional information and requirements.

H Refer to Performance Machinery specifications, and 260961.40 for additional information and requirements.

I Low voltage wiring is inclusive of any wiring, including standard stranded wire, used to carry 70 volts or less as part of the control system.

J Installation refers to the installation of electrical devices, panel boards, and motor control cabinets as a part of that system.

END OF SCHEDULE
SECTION 26.22.00
DRY-TYPE TRANSFORMERS

PART 1 - GENERAL

1.01 SCOPE
   A. The Contractor shall furnish and install single-phase and three-phase general purpose individually mounted dry-type transformers of the two-windings type, self-cooled as specified herein, and as shown on the contract drawings.

1.02 REFERENCES
   A. The transformers and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of ANSI, NEMA and UL.
   B. Transformers shall meet the requirements of federal law 10 CFR Part 431 "Energy Efficiency Program for Certain Commercial and Industrial Equipment"

1.03 SUBMITTALS – FOR REVIEW/APPROVAL
   A. The following information shall be submitted to the Engineer:
      1. Outline dimensions and weights
      2. Technical certification sheet
      3. Transformer ratings including:
         a. kVA
         b. Primary and secondary voltage
         c. Taps
         d. Basic impulse level (BIL) for equipment over 600 volts
         e. Design impedance
         f. Insulation class and temperature rise
         g. Sound level.
      4. Product data sheets

1.04 SUBMITTALS – FOR CONSTRUCTION
   A. The following information shall be submitted for record purposes.
      1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
      2. Connection diagrams
      3. Installation information
      4. Seismic certification and equipment anchorage details as specified

1.05 QUALIFICATIONS
   A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
   B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
   C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.06 REGULATORY REQUIREMENTS
   A. All transformers shall be UL listed and bear the UL label.
1.07 DELIVERY, STORAGE AND HANDLING
   A. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of
      these instructions shall be included with the equipment at time of shipment.

1.08 OPERATION AND MAINTENANCE MANUALS
   A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall
      include instruction leaflets and instruction bulletins for the complete assembly and each major
      component.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Eaton products

      The listing of specific manufacturers above does not imply acceptance of their products that do not meet
      the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting
      these specifications in their entirety. Other manufacturers will be considered, provided their products
      meet the requirements of the documents.

2.02 RATINGS
   A. The kVA and voltage ratings shall be as indicated on the drawings.
   B. Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a
      year operation, with normal life expectancy as defined in ANSI C57.96.
   C. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings:

      | kVA       | Sound Level |
      |-----------|-------------|
      | 0 to 9    | 40 dB       |
      | 10 to 50  | 45 dB       |
      | 51 to 150 | 50 dB       |
      | 151 to 300| 55 dB       |
      | 301 to 500| 60 dB       |
      | 501 to 700| 62 dB       |
      | 701 to 1000| 64 dB      |
      | 1001 to 1500| 65 dB     |

2.03 CONSTRUCTION – GENERAL PURPOSE TRANSFORMERS
   A. Insulation Systems
      1. Transformer insulation system shall be as follows:
         a. Less than 15 kVA: 185 degrees C insulation system with 115 degree C rise, encapsulated
            design; 15 kVA and above: 220 degree C insulation system with 115 degree C rise, ventilated
            design.
      2. Required performance shall be obtained without exceeding the above indicated temperature rise in a
         40 degrees C maximum ambient, and a 24-hour average ambient of 30 degrees C
      3. All insulation materials shall be flame-retardant and shall not support combustion as defined in
         ASTM Standard Test Method D635
B. Core and Coil Assemblies
   1. Transformer core shall be constructed with high-grade, nonaging, silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10% above the nominal tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade aluminum with continuous wound construction.
   2. On three-phase units rated 15 kVA and below the core and coil assembly shall be completely encapsulated in a proportioned mixture of resin and aggregate to provide a moisture proof, shock-resistant seal. The core and coil encapsulation system shall minimize the sound level.
   3. On three-phase units rated 15 kVA and above the core and coil assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture. The assembly shall be installed on vibration-absorbing pads.

C. Taps
   1. Three-phase transformers rated 15 through 500 kVA shall be provided with six 2-1/2% taps, two above and four below rated primary voltage.
   2. All single-phase transformers, and three-phase transformers rated below 15 kVA and above 500 kVA, shall be provided with the manufacturer’s standard tap configuration.

D. Electrostatic Shielding
   1. Where shown on the drawings, provide shielded isolation transformers with an electrostatic shield consisting of a single turn of aluminum placed between the primary and secondary winding and grounded to the housing of the transformer.

2.04 ENCLOSURE – GENERAL PURPOSE TRANSFORMERS
   A. The enclosure shall be made of heavy-gauge steel. All transformers shall be equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90 degrees C. The core of the transformer shall be grounded to the enclosure.
   B. On three-phase units rated 15 kVA and below the enclosure construction shall be encapsulated, totally enclosed, non-ventilated, NEMA 3R, with lifting eyes.
   C. On three-phase units rated 15 kVA and above the enclosure construction shall be ventilated, NEMA 2, drip-proof, with lifting holes. All ventilation openings shall be protected against falling dirt.

2.05 FINISH
   A. Enclosures shall be finished with ANSI 61 color, weather-resistant enamel.

PART 3 - EXECUTION

3.01 FACTORY TESTING
   A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
      1. Ratio tests at the rated voltage connection and at all tap connections
      2. Polarity and phase relation tests on the rated voltage connection
      3. Applied potential tests
      4. Induced potential test
      5. No-load and excitation current at rated voltage on the rated voltage connection.
3.02 INSTALLATION
   A. The Contractors shall install all equipment per the manufacturer’s recommendations and the contract drawings.

3.03 FIELD ADJUSTMENTS
   A. Adjust taps to deliver appropriate secondary voltage.

3.04 FIELD TESTING
   A. Measure primary and secondary voltages for proper tap settings.

END OF SECTION 26.22.00
SECTION 26.24.00
MECHANICAL EQUIPMENT AND CONTROLS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
   A. General provisions of contract, including general and supplementary conditions and general requirements apply to work specified in this section.

PART 2 – PRODUCTS

2.1 STARTERS
   A. All starters for Division 22 and 23 package mechanical equipment will be furnished by Division 22 and 23, but installed and connected by Division 26.

2.2 CONTROL WIRING
   A. All control wiring for mechanical equipment shall be provided in conduit under each respective division. Control components for mechanical equipment will be furnished and installed by Division 22 and 23.

2.3 POWER WIRING
   A. All power wiring at 120, 208, 277 and 480 volts shall be provided by Division 26.

PART 3 – EXECUTION

3.1 INSTALLATION
   A. Coordinate electrical power connection requirements with Mechanical Contractor. Where power requirements differ from drawing design requirements, Engineer shall be notified in writing. Contractor shall be given clarification and installation requirements prior to installation of the portion of work. Cost of equipment and labor for improperly installed electrical connections not coordinated and approved by Engineer and Mechanical Contractor shall be incurred by the Electrical Contractor and shall not constitute a reason for an extra charge because of any rework.

END OF SECTION 26.24.00
SECTION 26.24.13
SWITCHBOARDS

PART 1 - GENERAL

1.01 SCOPE
A. The Contractor shall furnish and install, where indicated, a free-standing, dead-front type low voltage distribution switchboard, utilizing group mounted circuit protective devices as specified herein, and as shown on the contract drawings.

1.02 REFERENCES
A. The low voltage distribution switchboards and all components shall be designed, manufactured and tested in accordance with the latest applicable following standards:
   1. NEMA PB-2
   2. UL Standard 891

1.03 SUBMITTALS – FOR REVIEW/APPROVAL
A. The following information shall be submitted to the Engineer:
   1. Master drawing index
   2. Front view elevation
   3. Floor plan
   4. Top view
   5. Single line
   6. Schematic diagram
   7. Nameplate schedule
   8. Component list
   9. Conduit entry/exit locations
   10. Assembly ratings including:
       a. Short-circuit rating
       b. Voltage
       c. Continuous current
   11. Major component ratings including:
       a. Voltage
       b. Continuous current
       c. Interrupting ratings
   12. Cable terminal sizes
   13. Product data sheets
B. Where applicable, the following additional information shall be submitted to the Engineer:
   1. Busway connection
   2. Connection details between close-coupled assemblies
   3. Composite floor plan of close-coupled assemblies
   4. Key interlock scheme drawing and sequence of operations

1.04 SUBMITTALS – FOR CONSTRUCTION
A. The following information shall be submitted for record purposes:
   1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
   2. Wiring diagrams
   3. Certified production test reports
4. Installation information

1.05 QUALIFICATIONS
   A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
   B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
   C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.06 REGULATORY REQUIREMENTS
   A. The low-voltage switchboard shall be UL labeled.

1.07 DELIVERY, STORAGE AND HANDLING
   A. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.08 OPERATION AND MAINTENANCE MANUALS
   A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Eaton, Square-D, General Electric, and Siemens

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Other manufacturers will be considered, provided their products meet the requirements of the documents.

2.02 RATINGS
   A. The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current of 65,000 amperes symmetrical at rated voltage as shown on the drawings.
   B. Voltage rating to be as indicated on the drawings.

2.03 CONSTRUCTION
   A. Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.
   B. All sections of the switchboard shall be front and rear aligned with depth as shown on the drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front accessible enabling switchboard to be mounted against a wall.
   C. The assembly shall be provided with adequate lifting means.
   D. The switchboard shall be equal to Eaton type Pow-R-Line C utilizing the components herein specified and as shown on the drawings.
E. The switchboard shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.

2.04 BUS
A. All bus bars shall be silver-plated copper. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be based on NEMA standard temperature rise criteria of 65 degrees C over a 40 degrees C ambient.
B. Provide a full capacity neutral bus where a neutral bus is indicated on the drawings.
C. A copper ground bus (minimum 1/4 x 2 inch) shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard.
D. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type washers.

2.05 WIRING/Terminations
A. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer’s wiring diagrams.
B. Mechanical-type terminals shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 75 degrees C of the size as indicated on the drawings.
C. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the drawings.
D. All control wire shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

2.06 ENCLOSURES
A. NEMA 1 Enclosure

2.07 NAMEPLATES
A. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background. Characters shall be 3/16-inch high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish master nameplate giving switchboard designation, voltage ampere rating, short-circuit rating, manufacturer’s name, general order number, and item number.
B. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer’s wiring diagrams.

2.08 FINISH
A. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be ANSI 61 light gray.
2.09 SURGE PROTECTIVE DEVICE
   A. Provide surge protective device as specified on the drawings.

PART 3 - EXECUTION

3.01 FACTORY TESTING
   A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
      1. The switchboard shall be completely assembled, wired, adjusted, and tested at the factory. After assembly, the complete switchboard will be tested for operation under simulated service conditions to ensure the accuracy of the wiring and the functioning of all equipment. The main circuits shall be given a dielectric test of 2200 volts for one (1) minute between live parts and ground, and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one (1) minute between live parts and ground.
   B. The manufacturer shall provide three (3) certified copies of factory test reports.

3.02 MANUFACTURER’S CERTIFICATION
   A. A certified test report of all standard production tests shall be available to the Engineer upon request.

3.03 TRAINING
   A. The Contractor shall provide a training session for up to five (5) owner’s representatives for 1 normal workday at a job site location determined by the owner.
   B. A manufacturer’s qualified representative shall conduct the training session. The training program shall consist of instruction on operation of the assembly, circuit breakers, fused switches, and major components within the assembly.

3.04 INSTALLATION
   A. The Contractors shall install all equipment per the manufacturer’s instructions, contract drawings and National Electrical Code.
   B. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to the floor without the use of floor sills provided the floor is level to 1/8 inch per 3-foot distance in any direction. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

3.05 FIELD ADJUSTMENTS
   A. The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit study, protective device evaluation study and protective device coordination study.
   B. Necessary field settings of devices, adjustments and minor modifications to equipment to accomplish conformance with an approved short circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the owner.

END OF SECTION 26.24.13
SECTION 26.24.16
PANELBOARDS

PART 1 - GENERAL

1.01 SCOPE
   A. The Contractor shall furnish and install the panelboards as specified and as shown on the contract drawings.

1.02 REFERENCES
   A. The panelboards and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of NEMA and UL as follows:
      1. UL 67 – Panelboards
      2. UL 50 – Cabinets and boxes
      3. NEMA PB1
      5. Circuit breaker – Type I class I
      6. Fusible switch – Type II class I

1.03 SUBMITTALS – FOR REVIEW/APPROVAL
   A. The following information shall be submitted to the Engineer:
      1. Breaker layout drawing with dimensions indicated and nameplate designation
      2. Component list
      3. Conduit entry/exit locations
      4. Assembly ratings including:
         a. Short-circuit rating
         b. Voltage
         c. Continuous current
      5. Cable terminal sizes
      6. Product data sheets
   B. Where applicable, the following additional information shall be submitted to the Engineer:
      1. Key interlock scheme drawing and sequence of operations

1.04 SUBMITTALS – FOR CONSTRUCTION
   A. The following information shall be submitted for record purposes:
      1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
      2. Installation information

1.05 QUALIFICATIONS
   A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
   B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
   C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
   D. The panelboards shall be UL labeled.
1.07 DELIVERY, STORAGE AND HANDLING
   A. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.08 OPERATION AND MAINTENANCE MANUALS
   A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   A. Eaton, Square-D, General Electric, and Siemens
      The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Other manufacturers will be considered, provided their products meet the requirements of the documents.

2.02 RATINGS
   A. Panelboards rated 240 Vac or less shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 10,000 amperes RMS symmetrical.
   B. Panelboards rated 480 Vac shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 14,000 amperes RMS symmetrical.
   C. Panelboards shall be labeled with a UL short-circuit rating. When series ratings are applied with integral or remote upstream devices, a label or manual shall be provided. It shall state the conditions of the UL series ratings including:
      1. Size and type of upstream device
      2. Branch devices that can be used
      3. UL series short-circuit rating

2.03 CONSTRUCTION
   A. Interiors shall be completely factory assembled. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
   B. Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi flush cylinder lock and catch assembly. Door-in-door trim shall be provided. Both hinged trim and trim door shall utilize three point latching. No tools shall be required to install or remove trim. Trim shall be equipped with a door-actuated trim locking tab. Equip locking tab with provision for a screw such that removal of trim requires a tool, at the owner’s option. Installation shall be tamper resistant with no exposed hardware on the panelboard trim.
   C. Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.
   D. Surface trims shall be same height and width as box. Flush trims shall overlap the box by 3/4 of an inch on all sides.
   E. A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.
   F. All locks shall be keyed alike.
2.04 BUS
A. Main bus bars shall be copper sized in accordance with UL standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.
B. A system ground bus shall be included in all panels.
C. Full-size (100%-rated) insulated neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

2.05 BRANCH CIRCUIT PANELBOARDS
A. The minimum short-circuit rating for branch circuit panelboards shall be as specified herein or as indicated on the drawings. Panelboards shall be series rated. Panelboards shall be Eaton type Pow-R-Line 1a, Pow-R-Line 2a or Pow-R-Line 3a.
B. Bolt-on type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.
C. Circuit breakers shall be thermal-magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100-ampere frame and through 100-ampere trip sizes shall take up the same pole spacing. Circuit breakers shall be UL listed as type SWD for lighting circuits.
1. Circuit breaker handle locks shall be provided for all circuits that supply exit signs, emergency lights, energy management, and control system (EMCS) panels and fire alarm panels.
D. Circuit breakers shall have a minimum interrupting rating of 10,000 amperes symmetrical at 240 volts, and 14,000 amperes symmetrical at 480 volts, unless otherwise noted on the drawings.

2.06 DISTRIBUTION PANELBOARDS – CIRCUIT BREAKER TYPE
A. Distribution panelboards with bolt-on devices contained therein shall have interrupting ratings as specified herein or indicated on the drawings. Panelboards shall be series rated. Panelboards shall be Eaton type Pow-R-Line 3a or Pow-R-Line 4B. Panelboards shall have molded case circuit breakers as indicated below.
B. Where indicated, provide circuit breakers UL listed for application at 100% of their continuous ampere rating in their intended enclosure.
C. Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

2.07 ENCLOSURE
A. Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.
B. Enclosures shall be provided with blank ends.
C. Where indicated on the drawings, branch circuit panelboards shall be column width type.

2.08 NAMEPLATES
A. Provide an engraved nameplate for each panel section.

2.09 FINISH
A. Surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of gray ANSI 61 paint applied.
PART 3 EXECUTION

3.01 FACTORY TESTING
   A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.02 INSTALLATION
   A. The Contractors shall install all equipment per the manufacturer’s recommendations and the contract drawings.

END OF SECTION 26.24.16
SECTION 26.27.01
ELECTRICAL SERVICE ENTRANCE

PART 1 – GENERAL

1.01 WORK INCLUDED
   A. Electrical Power Service System

PART 2 – PRODUCTS

2.1 MATERIALS
   A. Furnish service entrance conduit and cable and miscellaneous hardware required.

PART 3 – EXECUTION

3.1 SERVICE
   A. System shall commence at pad-mounted transformer secondary and continue through the main switchboard, feeder circuits, panelboards, and branch circuits to wiring devices, appliances, apparatus, and other utilization equipment.
   B. Services shall be 480Y/277 volts, three (3) phase, four (4) wire, solidly ground wye, from padmounted transformers provided by the electrical utility company. Coordinate service location and requirements with JCPB.
   C. Metering will be provided by power company at the transformer secondary bushings. Final connections at transformer secondary will be by power company.
   D. Include all utility company aid to construction costs in bid.

END OF SECTION 26.27.01
BLANK PAGE
SECTION 26.27.26
WIRING DEVICES AND PLATES

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Switches
B. Receptacles
C. Plates

1.2 QUALITY ASSURANCE

A. Listing and Labeling: Provide wiring devices and plates that are listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

B. Wiring devices and plates and their installation shall comply with the requirements of the National Electrical Code.

PART 2 – PRODUCTS

2.1 SWITCHES

A. Switches shall be toggle, quiet-type with totally enclosed bodies of thermoplastic and mounting strap.
B. Switches shall be rated for 20 amps, 277 volts AC. Switches shall be specification grade Hubbell, P&S, Leviton, Cooper Wiring Devices, or approved equal.

2.2 RECEPTACLES

A. Receptacles shall be general purpose, heavy duty, duplex receptacles made of thermoplastic supported on a metal mounting strap in accordance with NEMA WD 1. Receptacles shall be 20 amp, 125 volt, specification grade Cooper Wiring Devices, Hubbell, Leviton, P&S.

B. Ground fault circuit interrupter receptacles shall be the “feed-through” type rated to protect 20 amps. Receptacles shall be specification grade duplex receptacles with almond impact-resistant nylon face with test and reset buttons.
   1. 20 Amp, 125 Volt: Cooper Wiring Devices, Hubbell, Leviton, P&S, or approved equal.
C. Special Receptacles: As indicated on Drawings, and including USB Charging type receptacles in public areas, corridors, and conference rooms.

2.3 PLATES

A. Provide UL listed, one-piece device plates to suit the devices installed.
B. For metal outlet boxes, plates on unfinished walls shall be of zinc-coated sheet steel or cast-metal having round or beveled edges.
C. Plates on finished walls shall be nylon or thermoplastic, mid-size, unless noted otherwise. Plates in the kitchens/food service areas shall be stainless steel.
D. Plates shall be same color as receptacle or toggle switch with which they are mounted. Screws shall be machine-type with countersunk heads in color to match finish of plate.
E. Plates installed in wet locations shall be gasketed and UL listed for “wet locations” as per NEC 406.8 (B).
PART 3 – EXECUTION

3.1 INSTALLATION

A. Provide proper size outlet boxes for all wiring devices in accordance with Section 26.05.33, “Outlet and Junction Boxes.”

B. Install switches forty-eight (48”) inches above finished floor on lock side and clear of door frame a minimum of three (3”) inches unless otherwise noted. Prior to rough-in, coordinate with architectural drawings to determine lockside of door.

C. All switches shall be made by the same manufacturer.

D. Where two or more snap switches are to be installed at the same location, they shall be mounted in one-piece ganged switch boxes, with at gang cover plate.

E. Combination snap switch and single or duplex receptacles shall be mounted in two-gang switch box with one-piece device plate.

F. Receptacles shall be mounted 18” above finished floor unless otherwise noted.

G. All wiring devices shall be mounted in accordance with accessibility code requirements.

H. The color of all devices and plates shall be selected by the architect.

END OF SECTION 26.27.26
SECTION 26.28.13
DISCONNECT SWITCHES

PART 1 – GENERAL

1.01 WORK INCLUDED
A. Fused Disconnect Switches

1.02 SUBMITTALS
A. Provide product data showing switch’s ratings and enclosure type.

1.03 QUALITY ASSURANCE
A. Listing and Labeling: Provide disconnect switches that are listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
B. Disconnect switches and their installation shall comply with the requirements of the National Electrical Code.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
A. Switches shall be Eaton, or approved equal. Examples are Square D, General Electric, Siemens Energy & Automation.

2.02 MATERIALS
A. Use heavy-duty type for 600 volt switches. Switches shall have quick make, quick break, load interrupter, enclosed knife switch manufactured to the requirements of NEMA KS 1.
B. All switches shall have externally operable handles with interlocking covers to prevent opening front cover with switch in the ON position and have provisions for multiple padlocks in the OFF position.
C. Provide equipment ground lug in each switch.
D. Provide NEMA 1 enclosures for interior installations, unless otherwise noted.
E. Provide NEMA 3R enclosures for exterior installations or in wet locations, unless otherwise noted.
F. Provide fuses as per equipment manufacturer recommendation, dual-element, time-delay, current limiting, with blown fuse indicator site glass.

PART 3 – EXECUTION

3.01 INSTALLATION
A. Provide safety switches sized as indicated on the Drawings.
B. Mount individually enclosed switches plumb and level with top four (4') feet above floor or grade, unless otherwise noted.
C. Provide a set of fuses in fusible disconnect switches, as per equipment manufacturer recommendations.
3.02 IDENTIFICATION
   A. Identify disconnect switches in accordance with Section 26.05.53, "Electrical Identification."

END OF SECTION 26.28.13
PART 1 – GENERAL

1.01 SUMMARY
A. This specification describes the mechanical and electrical requirements for a transient voltage surge suppressor herein known and shown on all drawings as TVSS. The TVSS shall be suitable for application in category C3 environments as described in ANSI/IEEE C62.41. The TVSS shall be parallel design and provide protection: Line to Line, Line to Neutral, Neutral to Ground. “Series” type TVSS units will be deemed unacceptable.

1.02 SUBMITTALS
A. The contractor shall submit all related TVSS specifications, electrical and mechanical drawings, maintenance manuals, and UL 1449 surge suppression ratings, as well as Independent tests performed on the TVSS that show that the TVSS being submitted is capable of controlling >104kA 8/20 surge current.

1.03 QUALITY ASSURANCE
A. Only pre-approved TVSS products shall be accepted.
B. Manufacturer Qualifications: All TVSS units shall be manufactured by a firm that has manufactured TVSS products, for at least 10 years. Firms must also regularly engage in the manufacturing of TVSS products for Categories B3 (ANSI/IEEE 62.41) and C3.
C. Codes and Standards
   1. UL compliance and Labeling: Listed per UL 1449 3rd Edition.
   3. NEC compliance: Comply with 2008 NEC as applicable to construction and Article 280 for installation.
   4. The TVSS shall be capable of surviving 2,500 sequential category B3 and C3 surges without failure. Follow IEEE test procedures in C62.45.
   5. The TVSS shall be warranted for no less than 10 years and shall include free replacement in whole or in part during that 10 years for any reason of failure.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers: Subject to compliances with requirements, provide pre-approved product by the following:
   1. Atlantic Scientific Corporation
   2. Approved Equal.

2.02 TVSS EQUIPMENT
A. Service Entrance Suppressor:
   1. The surge protection device shall be connected to a 50A overcurrent device installed in the service entrance electrical equipment with leads as short as possible and not to exceed 18 inches (ideally 10 inches).
   2. The surge protection devices shall be Atlantic Scientific Corporation Model ZoneMaster Plus 150 Series (Part # 1810(4)XCA) or approved equal and must include the following ratings and accessories:
      a. 150kA 8/20 per phase surge suppression capability.
b. Unit shall be of modular design consisting of bolt on modules (plug in type will be unacceptable) utilizing large block 40mm MOVs. The use of multiple 20mm MOV’s in parallel will not be acceptable.


d. A 200,000 AIC Ultra-safe fused disconnect.


f. UL Listed 1283 Extended Power Range Filter.

g. Multi Mode Surge counter that monitors surge current NOT voltage. Multi Mode surge counter must be able to monitor total normal mode surges, common mode, or surge currents on each individual phase.

h. Normally Open / Normally Closed Form C Dry Contacts.

i. Unit shall have “High Voltage” Neutral to Ground Module with Red LED indicator.

j. Unit shall have BOTH mechanical indicator flags and green LED indicators to show status of protection for each module.

k. All plastics shall be UL 94-5V flame class rated.

l. Housing shall be UL listed and CSA Certified.

3. Standard unit housings shall be non-metallic and meet NEMA 1, 2, 3, 3S, 4, 4X, 12 and 13 classifications.

4. Standard unit housings shall have a transparent front cover for complete visual inspection and monitoring the status of protection for each module, and onboard diagnostics, module configuration, and wiring configuration.

5. Standard unit warranty must be for at least 10 years and be stated in the manufacturer’s literature.

PART 3 – EXECUTION

3.01 APPLICATION OF TVSS

A. General: Apply TVSS on the load side of the main disconnect at the electrical service entrance switchboard.

B. Coordinate system voltage, wiring configuration, and location as shown on project drawings.

3.02 INSTALLATION OF TVSS

A. Install the TVSS with #8 AWG conductors from the main service panel. The conductors are to be as short and straight as practically possible and shall not exceed 18 inches in length. The TVSS shall be installed following the manufacturer’s recommended practices and in compliance with all applicable codes.

END OF SECTION 26.43.13
PART 1 – GENERAL

1.01 WORK INCLUDED
A. This Section includes interior lighting fixtures, lamps, ballasts, and accessories.

1.02 DEFINITIONS
A. Fixture: A complete lighting unit. Fixtures include lamps and parts required to distribute the light, position and protect lamps, and connect lamps to the power supply.
B. Luminaire: Fixture.
C. Average Life: The published time when 50 percent have failed and 50 percent have survived under normal conditions.

1.03 SUBMITTALS
Provide the following submittals:
A. Product data describing fixtures, lamps, and ballasts. Arrange product data for fixtures in order of fixture designation.
B. Shop drawings from manufacturers detailing nonstandard fixtures and indicating dimensions, weights, methods of field assembly, components, features, and accessories.
C. Maintenance data for products for inclusion in Operating and Maintenance Manual.
D. Provide complete set of fixture information and include in O&M Manuals.

1.04 QUALITY ASSURANCE
A. Listing andLabeling: Provide fixtures, ballasts, lamps, and emergency lighting units that are listed and labeled for their indicated use on the Project.
   1. Special Listing and Labeling: Provide fixtures for use in damp or wet locations and recessed in combustible construction specifically listed and labeled for such use.
   2. The term "Listed and Labeled": As defined in the 2008 National Electrical Code, Article 100.
   3. Listing and Labeling Agency Qualification: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
B. Interior lighting fixtures, lamps, ballasts, and accessories and their installation shall comply with the requirements of the 2008 National Electrical Code.
C. Manufacturers Qualifications: Firms experienced in manufacturing fixtures that are similar to those indicated for this Project and that have a record of successful in-service performance.
D. Coordination of Fixtures With Ceiling: Coordinate fixture mounting hardware and trim with the ceiling system.

1.05 EXTRA MATERIALS
A. Furnish extra materials matching products installed, as described below, packaged with protective covering for storage, and identified with labels describing contents. Deliver extra materials to the Owner.
   1. Lamps: 10 lamps for each 100 of each type and rating installed. Furnish at least 1 of each type.
   2. Ballasts: 1 for each 100 of each type and rating installed. Furnish at least 1 of each type.
   3. Globes and Guards: 1 for each 20 of each type and rating installed. Furnish at least 1 of each type.
PART 2 – PRODUCTS

2.01 FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs and sharp corners and edges.
B. Sheet Metal Components: Steel, except as indicated. Components are formed and supported to prevent warping and sagging.
C. Doors, Frames, and Other Internal Access: Smooth operating and free from light leakage under operating conditions. Arrange to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in the operating position.
D. Reflecting Surfaces: Minimum reflectances as follows, except as otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.
   4. Laminated Silver Metallized Film: 90 percent.
E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or water white, annealed crystal glass except as indicated.
   1. Plastic: Highly resistance to yellowing and other changes due to aging, exposure to heat and UV radiation.
   2. Lens Thickness: 0.125 inches, minimum.

2.02 LED & FLUORESCENT FIXTURES

A. Fixtures: Conform to UL 1570.
B. Ballasts: Conform to UL 935, "Fluorescent-Lamp Ballasts and LED Drivers."
   1. Certification: By Electrical Testing Laboratory (ETL).
   2. Type: Class P, high-power-factory type except as indicated otherwise.
   4. Voltage: Match connected circuits.
   1. Minimum Power Factor: 90 percent.
   2. Minimum Operating Frequency: 20,000 Hz.
   3. Harmonic Content of Ballast Current: Less than 10 percent.
D. Electromagnetic Interference Filters: Integral to the fixture assembly. Provide one filter for each ballast. Suppress electromagnetic interference as required by MIL-STD-461, "Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference."

2.03 LAMPS

A. Conform to ANSI Standards, C78 series applicable to each type of lamp.

2.04 FINISH

A. Steel Parts: Manufacturer's standard finish applied over corrosion-resistant primer, free of streaks, runs, holidays, stains, blisters, and defects. Remove fixtures showing evidence of corrosion during project warranty period and replace with new fixtures.
B. Other Parts: Manufacturer's standard finish.
PART 3 – EXECUTION

3.01 INSTALLATION
A. Setting and Securing: Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer’s printed instructions and approved shop drawings.

B. Support For Recessed and Semirecessed Fixtures: Install fixtures so they are supported independently from the suspended ceiling support system. Install fixture support rods or wires at a minimum of four rods or wires per fixture located not more than 6 inches from fixture corners.

1. Fixtures Smaller Than Ceiling Grid: Install a minimum of four (4) rods or wires for each fixture and locate at corner of the ceiling grid where the fixture is located. Do not support fixtures by ceiling acoustical panels.

2. Fixtures of Sizes Less Than Ceiling Grid: Center in the acoustical panel. Support fixtures independently with at least two (2) 3/4-inch metal channels spanning and secured to the ceiling tees.

3. Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture corners.

C. Lamping: Lamp units according to manufacturer's instructions. Fluorescent and LED lamp sources shall have minimum CRI of 82.

3.02 FIELD QUALITY CONTROL
A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Give advance notice of dates and times for field tests.

C. Provide instruments to make and record test results.

D. Tests: Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include the following in tests of emergency lighting equipment:

1. 1 ½ hour burn.

E. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

3.03 ADJUSTING AND CLEANING
A. Clean fixtures upon completion of installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 26.51.00
TECHNICAL POWER SYSTEMS FOR AV
SECTION 26.60.80

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. AV series large-format drawings
B. Specification Section 274100 AV Systems
C. Specification Section 266090 Cable Raceway Systems for AV

1.02 INTENT

A. It is the intent of this section to inform the Division 26 Contractor about specific requirements for the installation of the AV Technical Power (AVTP) system.
B. Certain items related to the AVTP system may require equipment or installation techniques which differ from those normally called out in Division 26.

1.03 GENERAL REQUIREMENTS

A. Applicable requirements of the Contract Documents and general requirements of other Division 26 Sections apply to the work of this Section.
B. The Division 26 Contractor shall refer to the large-format AV system drawings for the locations and quantities of all AVTP system circuits, outlets, receptacles, panel boards, and company switches.

1.04 SCOPE OF WORK

A. The Division 26 Contractor shall furnish and install the AVTP system as outlined in this Section and Division 26.
B. The Division 26 Contractor does not furnish or install the AV equipment. It is provided by the Division 27 Contractor.
C. The division of labor between the Division 26 Contractor and the Division 27 Contractor is detailed in Table 1 at the end of this Section.

1.05 DEFINITION OF TERMS & ABBREVIATIONS:

A. Furnish: to purchase and deliver to project site.
B. Install – to unload at project site and perform necessary operations for proper mounting and correct operation.
C. Provide: to furnish and install.
D. AV Designer: designer of the AV systems.
E. Division 26 Contractor: Electrical
F. Division 27 Contractor: AV Systems

1.06 AV TECHNICAL POWER SYSTEM DETAILS

A. One or more K-13 rated isolation transformers are required between the AV system equipment and all other building services. All of the AVTP system circuits, outlets, receptacles, panel boards, and company switches shall be fed from the AVTP system K-13 isolation transformer.
B. Only those circuits, outlets, receptacles, panel boards, and company switches identified as AVTP shall be connected to the AVTP system panels.
C. An isolated grounding system is required for all AV system equipment. A separate, insulated ground path is required between each AVTP system location and the isolated ground source.
1.07 SUBMITTALS
   A. The Division 26 Contractor shall submit a written verification report of the performance of the isolated
      ground system.

PART 2 – PRODUCTS

2.01 GENERAL
   A. All AVTP products shall conform to the requirements of other Division 26 Sections.
   B. No substitutions are allowed without the written authorization of the Electrical Engineer and the AV
      Designer.

2.02 HIGH HARMONIC LOAD ISOLATION TRANSFORMERS
   A. Subject to compliance with requirements, provide UL listed K-13 rated transformer with copper windings
      and electrostatic shielding.
      1. Manufacturer – LynTec, WWW.LYNTEC.COM, SQUARE-D, EATON, SIEMENS, GE
         a. Model Series – NLPC
         1) Quantity - See Drawings

2.03 DISTRIBUTION PANEL BOARDS
   A. Subject to compliance with requirements, provide distribution and branch circuit panelboards for non-
      linear loads.
      1. Manufacturer – Square D, WWW.SCHNEIDER-ELECTRIC.COM, EATON, SIEMENS, GE
         a. Model Series – NF, I-LINE, NQOD
         1) Quantity – See Drawings
   B. Each panelboard shall contain an isolated ground buss bar.
   C. Each panelboard shall have a label engraved - “AV ONLY – TECHNICAL POWER”
   D. Each panelboard shall have a 200% Neutral.

2.04 SURGE PROTECTIVE DEVICES
   A. Subject to compliance with requirements, provide surge protective device at the distribution panel board.
      1. Manufacturer – Square D, WWW.SCHNEIDER-ELECTRIC.COM, EATON, SIEMENS, GE
         a. Model Series – UL 1449, 3rd Edition
         1) Quantity – See Drawings

2.05 SEQUENCING PANELBOARDS
   A. Subject to compliance with requirements, provide sequencing panel boards.
      1. Manufacturer – LynTec, WWW.LYNTEC.COM
         a. Model Series – MSP
         1) Quantity – See Drawings
   B. Each panelboard shall contain an isolated ground buss bar.
   C. Each panelboard shall have a label engraved - “AV ONLY – TECHNICAL POWER”
   D. Each panelboard shall have a 200% Neutral.

2.06 CIRCUIT BREAKERS
   A. Subject to compliance with requirements, provide motorized circuit breakers for sequencing panel boards.
   B. The Division 26 Contractor shall provide all circuit breakers.
2.07 COMPANY SWITCHES
   A. Subject to compliance with requirements, provide company switch for portable AV equipment.
         a. Model Series – CS-xxxF-C5DB1
            1) Quantity – See Drawings
         b. Model Series – CS-xxxF-D5PS1
            1) Quantity – See Drawings
   B. Each company switch shall contain an isolated ground buss bar.
   C. Each company switch shall have a label engraved - “AV ONLY – TECHNICAL POWER”.

2.08 WIRING DEVICES
   A. Outlets for Standard AVTP circuits
      1. Subject to compliance with requirements, provide orange-colored isolated ground outlets.
         a. Model number – IG5362 for duplex
         b. Model number – IG5361 for single
         c. Model number – IG420 for quad
      3. Each outlet wall plate shall be engraved - “AV ONLY – TECHNICAL POWER”.
   B. Outlets for Specialty AVTP Circuits
      1. Subject to compliance with requirements, provide twist-lock outlets.
         a. Model number – NAC3FPX-ST for single
      3. Each outlet wall plate shall be engraved - “AV ONLY – TECHNICAL POWER”.
   C. Outlets for Non-Technical Power Circuits
      1. Subject to compliance with requirements, provide standard NEMA-5-15R outlets.

PART 3 – EXECUTION

3.01 INSTALLATION - GENERAL
   A. All of the AVTP system circuits, outlets, receptacles, and company switches must be fed from the AVTP panels.
   B. Only those circuits, outlets, receptacles, and company switches identified as AVTP may be connected to the AVTP system panels.
   C. An isolated grounding system must be maintained for the entire AVTP system.
   D. The AVTP system and isolated grounding system are detailed in Drawing AV-001.

3.02 INSTALLATION - VOLTAGE
   A. The K-13 isolation transformers must be installed and adjusted so that the Voltage at the AV panel boards is 120 VAC +/- 3%.

3.03 INSTALLATION - GROUNDING
   A. An isolated ground system is required for all AV system equipment. This ground system is in addition to any code requirements for safety ground. This system requires that:
      1. All AVTP panel boards and AVTP company switches are connected, through separate insulated cables, to the isolated ground buss bar located in, or adjacent to, the AVTP distribution panel boards.
      2. All individual AVTP circuits and outlets are connected, through separate insulated cables, to the isolated ground buss bars located in, or adjacent to, the AVTP sequencing panel boards.
      3. All AV racks are connected, through separate insulated cables, to the isolated ground buss bars located in, or adjacent to, the AVTP sequencing panel boards.
3.04 INSTALLATION – panel boards
   A. The Division 26 Contractor shall install the sequencing panel boards per manufacturer instructions.

3.05 INSTALLATION – Circuit breakers
   A. The Division 26 Contractor shall install the motorized circuit breakers in the sequencing panel boards per manufacturer instructions.
   B. Circuiting and sequencing requirements shall be supplied by the Division 27 contractor.

3.06 INSTALLATION - WIRING
   A. AVTP Circuits and Outlets
      1. AVTP system circuits and outlets are called out on the large-format AV system drawings.
      2. Each of the AVTP circuits and outlets shall have an individual circuit breaker and may NOT be combined with additional outlets.
      3. Each of the AVTP circuits and outlets shall have a separate, dedicated neutral conductor home run to the panel board.
      4. Each of the AVTP circuits and outlets shall have a separate, insulated, isolated ground conductor home run to the panel board.
      5. Wire sizes of branch circuit conductors shall conform to local code. At minimum, they will be #10 AWG for hot and neutral and isolated ground conductors.
      6. All conductors terminating at duplex or quad outlets require crimped spade lugs. Spade lugs shall be secured under the mounting screws. No push-in connections are allowed.
      7. Confirm each receptacle/outlet is wired with correct polarity.
   B. Non-Technical Power (NTP) Outlets
      1. NTP branch circuits are NOT part of the AVTP system and are NOT fed from AVTP panel boards.
      2. NTP outlets are called out on the large-format AV system drawings.
      3. Each of the NTP outlets shall have an individual circuit breaker and may NOT be combined with additional outlets.
      4. Wire sizes of branch circuit conductors shall conform to local code.
      5. Confirm each receptacle/outlet is wired with correct polarity.
   C. AVTP Panels
      1. Each AVTP panel requires a separate isolated ground conductor. Wire size of isolated grounding conductor must be, at minimum, 200% of the equipment ground.
   D. Equipment Racks
      1. Each AV equipment rack location requires a separate isolated ground conductor to the AVTP sequencing panel board. Wire size of isolated grounding conductor must be, at minimum, #4 AWG.

3.07 INSTALLATION - WIRING DEVICES
   A. Circuits and Outlets
      1. Standard AVTP system circuits and outlets; specialty AVTP system outlets; and non technical power outlets are called out on the AV system location drawings.
      2. Individual circuits called out as “deliver circuit to this location” shall be internally wired by the Division 27 Contractor. They do not require wiring devices.

3.08 INSTALLATION - CONDUIT
   A. AVTP system conduits shall be bonded to the distribution panel boards, company switches, panel boards, receptacle back boxes, and outlet back boxes.
   B. AVTP system conduits shall NOT be bonded to any AV equipment racks. Conduit runs entering or exiting the AV equipment racks shall be electrically isolated from the racks. PVC or other dielectric fittings shall be used to isolate conduits from the AV equipment racks.
   C. AVTP system conduits shall NOT be connected to the isolated ground system.
D. All AVTP system circuits must run in conduits separate from all other circuits.

3.09 INSTALLATION - ISOLATED GROUND TEST

A. Refer to Drawing AV-001 for details of the AVTP system and isolated grounding system.

B. Verify the integrity of the AVTP isolated ground system, as follows:
   1. Confirm that continuity is measured between each AVTP isolated ground receptacle/outlet neutral conductor and the grounding electrode at the AV K-13 isolation transformer.
   2. Disconnect the neutral bonding link at each AV K-13 isolation transformer and confirm that the AVTP neutral buss is isolated from the building ground. Locate and remove all connections between the neutral buss and the building ground other than the main bonding jumper. Reconnect the neutral bonding link.
   3. Confirm that continuity is measured between each isolated ground receptacle/outlet ground conductor and the grounding electrode at the AV K-13 isolation transformer.
   4. Disconnect the isolated ground bonding link at each AV K-13 isolation transformers and confirm that the AVTP isolated ground buss is isolated from the building ground. Locate and remove all connections between the isolated ground buss and the building ground other than the main bonding jumper. Reconnect the isolated ground bonding link.
   5. Confirm that each AVTP isolated ground receptacle/outlet is wired with correct polarity.
### TABLE 1 - PROJECT WORK SCOPE

<table>
<thead>
<tr>
<th>Items to be Furnished and Installed</th>
<th>Division 26 Contractor</th>
<th>Division 27 Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Furnish</td>
<td>Install</td>
</tr>
<tr>
<td><strong>HIGH VOLTAGE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main Power Service</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switch Board and Circuit Breakers</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Switch Board Conduits and Pull Boxes</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Switch Board Conductors</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Switch Board Terminations</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>AVTP (AV Technical Power)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transformers</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Transformer Conduits and Pull Boxes</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Transformer Conductors</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Transformer Terminations</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>AVTP Isolated Ground Wiring System</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolated Ground Conduits and Pull Boxes</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Isolated Ground Conductors</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Isolated Ground Terminations</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>AVTP Distribution Panel Boards</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distribution Panel Boards and Circuit Breakers</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Distribution Panel Board Conduits and Pull Boxes</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Distribution Panel Board Conductors</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Distribution Panel Board Terminations</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>AVTP Sequencing Panel Boards</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sequencing Panel Boards and Circuit Breakers</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Sequencing Panel Board Conduits and Pull Boxes</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Sequencing Panel Board Conductors</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Sequencing Panel Board Terminations</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>AVTP Company Switches (for portable equipment)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company Switches and Circuit Breakers</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Company Switch Conduits and Pull Boxes</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Company Switch Conductors</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Company Switch Terminations</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>AVTP Branch Circuits (stand-alone)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Branch Circuit Receptacles and Wall Plates</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Branch Circuit Back Boxes</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Branch Circuit Conduits and Pull Boxes</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
### Items to be Furnished and Installed

<table>
<thead>
<tr>
<th>Item</th>
<th>Division 26 Contractor</th>
<th>Division 27 Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Branch Circuit Conductors</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Branch Circuit Termination</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>AVTP Branch Circuits (delivered to AV Equipment Racks and Panels)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Branch Circuit Receptacles</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Branch Circuit Back Boxes and Face Plates mounted in AV Equipment Racks</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Branch Circuit Voltage Separation Barriers mounted in AV Panels</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Branch Circuit Conductors and Pull Boxes</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Dielectric Bushings separating AV Equipment Racks from Metallic Conduits</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Branch Circuit Conductors</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Branch Circuit Termination</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

### IT DATA DROPS (if IT infrastructure is being designed under Division 26)

<table>
<thead>
<tr>
<th>IT Data Drops (stand-alone)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Drop Connectors and Wall Plates</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Data Drop Back Boxes</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Data Drop Conduits and Pull Boxes</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Data Drop Conductors</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Data Drop Termination</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

### IT Data Drops (delivered to AV Equipment Racks and Panels)

<table>
<thead>
<tr>
<th>IT Data Drops (delivered to AV Equipment Racks and Panels)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Drop Connectors</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Data Drop Back Boxes and Face Plates mounted in AV Equipment Racks</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Data Drop Conduits and Pull Boxes</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Data Drop Conductors</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Data Drop Termination</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

### OTHER

<table>
<thead>
<tr>
<th>Item</th>
<th>Division 26 Contractor</th>
<th>Division 27 Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable Trays and Hooks for AV Cabling</td>
<td>x</td>
<td>x²</td>
</tr>
<tr>
<td>Cable Pass Sleeves for temporary AV Cables</td>
<td>x</td>
<td>x²</td>
</tr>
<tr>
<td>Empty Conduits and Pull Boxes for temporary AV Cables</td>
<td>x</td>
<td>x²</td>
</tr>
</tbody>
</table>

x² Installation criteria to be provided by Division 27 Contractor.
END OF SECTION 26.60.80
CABLE RACEWAY SYSTEMS FOR AV
SECTION 26.60.90

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
   A. AV series large-format drawings
   B. Specification Section 274100 AV Systems
   C. Specification Section 266080 Technical Power Systems for AV

1.02 INTENT
   A. It is the intent of this section to inform the Division 26 Contractor about specific requirements for the installation of the AV cable raceway systems.
   B. Certain items related to the AV cable raceway systems may require equipment or installation techniques which differ from those normally called out in Division 26.

1.03 GENERAL REQUIREMENTS
   A. Applicable requirements of the Contract Documents and general requirements of other Division 26 Sections apply to the work of this Section.
   B. The Division 26 Contractor shall refer to the large-format AV system drawings for the locations and quantities of all AV devices requiring cable raceway systems.

1.04 SCOPE OF WORK
   A. The Division 26 Contractor shall furnish and install the AV cable raceway systems as outlined in this Section and Division 26.
   B. The Division 26 Contractor does not furnish or install the AV equipment. It is provided by the Division 27 Contractor.
   C. The division of labor between the Division 26 Contractor and the Division 27 Contractor is detailed in Table 1 at the end of this Section.

1.05 DEFINITION OF TERMS & ABBREVIATIONS:
   A. Furnish: to purchase and deliver to project site.
   B. Install – to unload at project site and perform necessary operations for proper mounting and correct operation.
   C. Provide: to furnish and install.
   D. AV Designer: designer of the AV systems.
   E. Division 26 Contractor: Electrical
   F. Division 27 Contractor: AV Systems

1.06 AV CABLE RACEWAY SYSTEM DETAILS
   A. The AV cable raceway systems consist of the following:
      1. The Metallic Conduit System is a network of empty conduits into which the Division 27 Contractor shall install the cables for the AV system.
      2. The PVC Conduit System is a group of empty conduits which are used to route and conceal temporary AV cables.
      3. The Cable Sleeve System allows temporary AV cables to pass through walls and floors.
      4. The Cable Hook and Tray Systems allow routing of temporary AV cables along corridors and over doorways.
B. Unless specifically called out otherwise, all AV system wiring listed in the AV schedule of terminations shall be run in metallic conduit.

1.07 SUBMITTALS
   A. The Division 26 Contractor shall submit a conduit riser diagram for all AV system wiring.

PART 2 – PRODUCTS

2.01 GENERAL
   A. All AV cable raceway products shall conform to the requirements of other Division 26 Sections.
   B. No substitutions are allowed without the written authorization of the Electrical Engineer and the AV Designer.

2.02 METALLIC CONDUIT
   A. Subject to compliance with requirements, provide metallic conduit as specified in Section 260516.

2.03 PULL BOXES
   A. Subject to compliance with requirements, provide pull boxes as specified in Section 260533.

2.04 PVC CONDUIT
   A. Subject to compliance with requirements, provide PVC conduit as specified in Section 260516.

2.05 CABLE SLEEVES
   A. Subject to compliance with requirements, provide cable sleeves as specified in Sections 260501 and 260516.

2.06 CABLE Hooks
   A. Subject to compliance with requirements, provide wall-mount cable hooks as specified in Section 270529.
   B. Subject to compliance with requirements, provide ceiling-mount cable hooks as specified in Section 270529.

2.07 CABLE TRAYS
   A. Subject to compliance with requirements, provide wall-mount cable trays manufactured by Hubbell as specified in Section 270529.
   B. Subject to compliance with requirements, provide ceiling-mount cable trays manufactured by Hubbell as specified in Section 270529.

PART 3 – EXECUTION

3.01 INSTALLATION – GENERAL
   A. Prior to installation, the Division 26 Contractor shall submit a riser diagram for all AV system conduits.
   B. No installation work shall proceed until the conduit riser has been approved, in writing, by the Electrical Engineer and the AV Designer.

3.02 INSTALLATION – WIRE GROUPS IN CONDUIT
   A. The AV location drawings and the AV schedule of terminations indicate the origins and destinations for all AV cables. The method of cable routing described in those documents indicates the maximum number of conduit runs required to install the AV systems.
B. The actual diameter and path of each conduit run shall be determined by the Division 26 Contractor in accordance with field conditions.

C. Should the Division 26 Contractor choose to combine cable runs from individual terminations into a common conduit, they must conform to the wire grouping, conduit fill, and conduit separation requirements listed in this Section.

D. To prepare the required conduit riser diagram, the Division 26 Contractor must group cables by wiring type; determine the total number of cables in each conduit run; determine the diameter of each conduit run; determine the actual routing of each conduit run.

E. Conduit fill percentage for low voltage AV cables shall follow standard NEC tables.

F. Minimum conduit size allowed for AV cables is 3/4 inch.

G. Refer to Paragraph 3.03 of this Section for wiring group and conduit separation requirements.

H. Refer to Table 5 at the end of this Section for AV cable specifications.

3.03 INSTALLATION – CONDUIT SEPARATION

A. AV system wiring is divided into separate groups according to their nominal voltage levels. These wiring groups must never be intermixed within a given conduit run. See Table 2 at the end of this Section for wire type information.

B. Conduits carrying AV wiring must maintain a minimum separation from conduits carrying other types of AV wiring. When necessary, ninety degree crossings in close proximity are acceptable. See Table 3 at the end of this Section for AV conduit separation requirements.

C. Conduits carrying AV wiring must maintain a minimum separation from conduits carrying other types of electrical wiring. Unusually heavy current demands in; or long parallel runs with; electrical services may dictate greater separations to avoid interference with the AV system. See Table 4 at the end of this Section for electrical conduit separation requirements.

3.04 INSTALLATION – METALLIC CONDUIT SYSTEM

A. The metallic conduit system is specified by information called out in the large-format AV system drawings:
   1. The location drawings indicate the position of each AV device. The label indicates the cable types, quantities, and routing destination for all cables exiting the device.
   2. The schedule of terminations lists details for each AV device, including location; box type and size; and mounting type and height.

B. In most cases, each run of this conduit system shall be bonded to the AV termination back boxes which are provided by the Division 27 Contractor. The only exception is conduit which is routed to the AV equipment racks. Conduit runs entering or exiting the AV equipment racks shall be electrically isolated from the racks. PVC or other dielectric fittings shall be used to isolate conduits from the AV equipment racks.

C. Refer to Drawing AVxxx for details of conduit grounding and isolation.

D. Provide all empty conduits with measured pull lines.

3.05 INSTALLATION – pull boxes

A. Install pull boxes as required so the total number of conduit bends does not exceed two quarter bends (180 degrees) between pull points.

3.06 INSTALLATION – PVC CONDUIT SYSTEM

A. Refer to Drawing AVxxx for size and location details.

B. Provide all empty conduits with measured pull lines.

3.07 INSTALLATION – CABLE SLEEVES

A. Refer to Drawing AVxxx for architectural details.

B. Install with threaded cap at each end of sleeve. These caps shall be lubricated for easy removal and held
captive by a chain.

3.08 INSTALLATION – CABLE hooks
   A. Refer to Drawing AVxxx for quantity and location details.
   B. Install cable hooks per manufacturer instructions.

3.09 INSTALLATION – CABLE TRAYS
   A. Refer to Drawing AVxxx for location and routing details.
   B. Wall mount cable trays shall be supported from underneath, not suspended from above.
   C. Install ceiling mount cable trays per manufacturer instructions.
### TABLE 1 – PROJECT WORK SCOPE

<table>
<thead>
<tr>
<th>Items to be Furnished and Installed</th>
<th>Division 26 Contractor</th>
<th>Division 27 Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Furnish</td>
<td>Install</td>
</tr>
</tbody>
</table>

#### HIGH VOLTAGE

- **AVTP (AV Technical Power) Branch Circuits (delivered to AV Equipment Racks and Panels)**
  - x x
- **Branch Circuit Receptacles**
  - x x
- **Branch Circuit Back Boxes and Face Plates mounted in AV Equipment Racks**
  - x x
- **Branch Circuit Voltage Separation Barriers mounted in AV Panels**
  - x x
- **Branch Circuit Conduits and Pull Boxes**
  - x x
- **Dielectric Bushings separating AV Equipment Racks from Metallic Conduits**
  - x x
- **Branch Circuit Conductors**
  - x x
- **Branch Circuit Termination**
  - x x

#### LOW VOLTAGE

- **AV Systems**
  - **AV Equipment and Racks**
    - x x
  - **Panels and Connectors for AV Circuits**
    - x x
  - **Back Boxes for AV Circuit Panels**
    - x² x
  - **Floor Boxes for AV Circuit Panels**
    - x² x
  - **Ceiling Cans for AV Loudspeakers**
    - x² x
  - **Metallic Conduits, Pull Boxes, and Pull Strings among AV Equipment Racks and AV Panels**
    - x x
  - **Dielectric Bushings separating AV Equipment Racks from Metallic Conduits**
    - x x
  - **Dielectric Material separating AV Equipment Racks from Surrounding Structure**
    - x x
  - **Rack and Panel Cabling for AV Circuits**
    - x x
  - **Rack and Panel Terminations for AV Circuits**
    - x x

#### IT DATA DROPS

- **IT Data Drops (stand-alone)**
  - x x
- **Data Drop Wall Plates and Connectors**
  - x x
- **Data Drop Back Boxes**
  - x x
- **Data Drop Conduits and Pull Boxes**
  - x x
- **Data Drop Conductors**
  - x x
- **Data Drop Termination**
  - x x
### Items to be Furnished and Installed

<table>
<thead>
<tr>
<th>Items Description</th>
<th>Division 26 Contractor</th>
<th>Division 27 Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Furnish</td>
<td>Install</td>
</tr>
<tr>
<td>IT Data Drops (delivered to AV Equipment Racks and Panels)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Drop Connectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Drop Back Boxes and Face Plates mounted in AV Equipment Racks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Drop Conduits and Pull Boxes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Drop Conductors</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Data Drop Termination</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**OTHER**

| Items Description                                                                 |         |         |         |         |
|                                                                                 |         |         |         |         |
| Cable Trays and Hooks for AV Cabling                                             |         |         | x       | x²      |
| Cable Pass Sleeves for temporary AV Cables                                       |         |         | x       | x²      |
| Empty Conduits and Pull Boxes for temporary AV Cables                            |         |         | x       | x²      |
| AV Conduit Riser Diagram                                                         |         |         | x       | x       |

x² Installation criteria to be provided by Division 27 Contractor.

### TABLE 2 – AV WIRING TYPES

AV system wiring is divided into wiring groups according to their nominal voltage levels:

<table>
<thead>
<tr>
<th>Voltage Levels</th>
<th>Circuit Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>0 mV to 100 mV</td>
</tr>
<tr>
<td></td>
<td>Microphones</td>
</tr>
<tr>
<td></td>
<td>Sensitive Circuits</td>
</tr>
<tr>
<td>Group B</td>
<td>100 mV to 10 V</td>
</tr>
<tr>
<td></td>
<td>Audio Tie Lines</td>
</tr>
<tr>
<td></td>
<td>Video Tie Lines</td>
</tr>
<tr>
<td></td>
<td>Data Tie Lines</td>
</tr>
<tr>
<td></td>
<td>Digital Circuits</td>
</tr>
<tr>
<td></td>
<td>Control Circuits</td>
</tr>
<tr>
<td></td>
<td>Intercom</td>
</tr>
<tr>
<td>Group C</td>
<td>10 V to 70 V</td>
</tr>
<tr>
<td></td>
<td>Loudspeakers</td>
</tr>
<tr>
<td></td>
<td>Control Circuits</td>
</tr>
<tr>
<td>Group D</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Fiber Optics</td>
</tr>
<tr>
<td>Group E</td>
<td>120 V</td>
</tr>
<tr>
<td></td>
<td>Audio Video Technical Power (AVTP)</td>
</tr>
</tbody>
</table>

Note: These wiring groups must never be intermixed within a given conduit run!
TABLE 3 – AV CONDUIT SEPARATION
Minimum conduit separation between conduits carrying wiring of different AV groups:

<table>
<thead>
<tr>
<th>Group</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
<th>Group D</th>
<th>Group E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>adjacent</td>
<td>one foot</td>
<td>one foot</td>
<td>adjacent</td>
<td>two feet</td>
</tr>
<tr>
<td>Group B</td>
<td>one foot</td>
<td>adjacent</td>
<td>one foot</td>
<td>adjacent</td>
<td>two feet</td>
</tr>
<tr>
<td>Group C</td>
<td>one foot</td>
<td>adjacent</td>
<td>one foot</td>
<td>adjacent</td>
<td>one foot</td>
</tr>
<tr>
<td>Group D</td>
<td>adjacent</td>
<td>adjacent</td>
<td>adjacent</td>
<td>adjacent</td>
<td>one foot</td>
</tr>
<tr>
<td>Group E</td>
<td>two feet</td>
<td>two feet</td>
<td>one foot</td>
<td>one foot</td>
<td>adjacent</td>
</tr>
</tbody>
</table>

Note: Ninety degree crossings in close proximity are acceptable.

TABLE 4 – OTHER CONDUIT SEPARATION
Minimum conduit separation between conduits carrying AV wiring and other electrical service conduits:

<table>
<thead>
<tr>
<th>Service</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
<th>Group D</th>
<th>Group E</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 V branch circuits</td>
<td>two feet</td>
<td>two feet</td>
<td>one foot</td>
<td>one foot</td>
<td>one foot</td>
</tr>
<tr>
<td>Dimmer controlled lighting</td>
<td>two feet</td>
<td>two feet</td>
<td>one foot</td>
<td>one foot</td>
<td>one foot</td>
</tr>
<tr>
<td>SCR controlled devices</td>
<td>three feet</td>
<td>three feet</td>
<td>two feet</td>
<td>one foot</td>
<td>one foot</td>
</tr>
<tr>
<td>High voltage feeder circuits</td>
<td>six feet</td>
<td>six feet</td>
<td>three feet</td>
<td>one foot</td>
<td>one foot</td>
</tr>
<tr>
<td>All others (plumbing, heat, etc.)</td>
<td>two feet</td>
<td>two feet</td>
<td>two feet</td>
<td>two feet</td>
<td>two feet</td>
</tr>
</tbody>
</table>

Note: Heavy current demands in or long parallel runs with the above services may dictate greater separations to avoid interference with the AV systems.

TABLE 5 – AV CABLE Specifications

<table>
<thead>
<tr>
<th>ID</th>
<th>Manufacturer</th>
<th>Model</th>
<th>OD Inches</th>
<th>Signal Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIC</td>
<td>Belden</td>
<td>9451</td>
<td>0.135</td>
<td>A</td>
</tr>
<tr>
<td>AES</td>
<td>Belden</td>
<td>1696A</td>
<td>0.235</td>
<td>B</td>
</tr>
<tr>
<td>C16/4</td>
<td>West Penn</td>
<td>245</td>
<td>0.217</td>
<td>B</td>
</tr>
<tr>
<td>C18/2</td>
<td>West Penn</td>
<td>224</td>
<td>0.156</td>
<td>B</td>
</tr>
<tr>
<td>C18/4</td>
<td>West Penn</td>
<td>244</td>
<td>0.183</td>
<td>B</td>
</tr>
<tr>
<td>C22/6</td>
<td>West Penn</td>
<td>270</td>
<td>0.163</td>
<td>B</td>
</tr>
<tr>
<td>CATS</td>
<td>Belden</td>
<td>1351A</td>
<td>0.290</td>
<td>B</td>
</tr>
<tr>
<td>CATU</td>
<td>Belden</td>
<td>3632</td>
<td>0.235</td>
<td>B</td>
</tr>
<tr>
<td>COM1</td>
<td>Belden</td>
<td>9460</td>
<td>0.230</td>
<td>B</td>
</tr>
<tr>
<td>COM2</td>
<td>Belden</td>
<td>9460</td>
<td>0.230</td>
<td>B</td>
</tr>
<tr>
<td>DM</td>
<td>Crestron</td>
<td>DM-CBL-ULTRA-NP</td>
<td>0.311</td>
<td>B</td>
</tr>
<tr>
<td>LINE</td>
<td>Belden</td>
<td>9451</td>
<td>0.135</td>
<td>B</td>
</tr>
<tr>
<td>RG6</td>
<td>Belden</td>
<td>1694A</td>
<td>0.274</td>
<td>B</td>
</tr>
<tr>
<td>RG8</td>
<td>Belden</td>
<td>7810A</td>
<td>0.403</td>
<td>B</td>
</tr>
<tr>
<td>RG58</td>
<td>Belden</td>
<td>9311</td>
<td>0.193</td>
<td>B</td>
</tr>
<tr>
<td>RG59</td>
<td>Belden</td>
<td>1857A</td>
<td>0.360</td>
<td>B</td>
</tr>
<tr>
<td>SERL</td>
<td>Belden</td>
<td>1419A</td>
<td>0.248</td>
<td>B</td>
</tr>
<tr>
<td>ID</td>
<td>Manufacturer</td>
<td>Model</td>
<td>OD Inches</td>
<td>Signal Group</td>
</tr>
<tr>
<td>------</td>
<td>--------------</td>
<td>-------------</td>
<td>-----------</td>
<td>--------------</td>
</tr>
<tr>
<td>XTP</td>
<td>Extron</td>
<td>XTP-DTP-24</td>
<td>0.276</td>
<td>B</td>
</tr>
<tr>
<td>S10</td>
<td>West Penn</td>
<td>HA210</td>
<td>0.275</td>
<td>C</td>
</tr>
<tr>
<td>S12</td>
<td>West Penn</td>
<td>227</td>
<td>0.260</td>
<td>C</td>
</tr>
<tr>
<td>S14</td>
<td>West Penn</td>
<td>226</td>
<td>0.230</td>
<td>C</td>
</tr>
<tr>
<td>S16</td>
<td>West Penn</td>
<td>225</td>
<td>0.182</td>
<td>C</td>
</tr>
<tr>
<td>FB2M</td>
<td>Corning</td>
<td>002T6F-31390-29</td>
<td>0.280</td>
<td>D</td>
</tr>
<tr>
<td>FB2S</td>
<td>Corning</td>
<td>002E6F-31331-29</td>
<td>0.280</td>
<td>D</td>
</tr>
<tr>
<td>AVTP</td>
<td>Trade</td>
<td>as specified</td>
<td>as specified</td>
<td>E</td>
</tr>
<tr>
<td>GND2</td>
<td>Trade</td>
<td>#02 THHN</td>
<td>0.386</td>
<td>E</td>
</tr>
</tbody>
</table>

END OF SECTION 26.60.90
SECTION 26.61.00
GENERAL LIGHTING PROVISIONS

PART 1 – GENERAL

1.01 WORK INCLUDED
A. Fixtures
B. Controls
C. Lamps
D. Ballasts and Drivers
E. Exterior Fixtures
F. Emergency Lighting

1.02 SUBMITTALS
A. Submit shop drawings and product data in accordance with Section 26.05.00.
B. Submit shop drawings for luminaries showing pertinent physical characteristics and performance data.
C. Submit samples of luminaries prior to final production at Engineer's request on any proposed fixture substitution.
D. Provide a complete set of fixture information and include in O&M Manuals.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. Provide fixtures as shown in the fixture schedule or approved equal.

2.02 FIXTURES
A. Provide electronic drivers in all LED fixtures and programmable rapid start ballasts in all fluorescent lighting fixtures with less than 10% total harmonic distortion suitable for roof/floor or roof/ceiling fire rating indicated on architectural plans. Ballasts and drivers shall be Cree, Sylvania, Philips, Universal, Advance, or General Electric. Recessed LED and fluorescent lighting fixtures drivers and ballasts shall be provided with integral thermal protection.
B. Provide rapid start lamps for all fluorescent fixtures. Lamps shall be General Electric and 3,500 °K, CRI of 80 or better, unless specified otherwise.

2.03 CONTROLS
A. Time switches shall be Tork, Intermatic, or Paragon of types and quantity shown on Drawings.

2.04 EMERGENCY EGRESS LIGHTING UNITS AND EXIT SIGNS
A. Provide fully automatic operation on power failure. Units shall have integral battery back-up for 1½ hours per NFPA. Units shall be connected unswitched to lighting circuits.

PART 3 – EXECUTION

3.01 GENERAL
A. Furnish, locate, and install fixtures as indicated on Drawings.
3.02 INSTALLATION

A. Mount fixtures as called for in schedule on Drawings. Determine type of ceiling to be installed in each space and furnish fixtures suitable for exact type, including roof/floor or ceiling/floor fire rated design. Recessed fixtures shall be supported from building structure.

B. Lighting fixtures shall be structurally supported. LED and Fluorescent fixtures mounted in the ceiling shall be attached to ceiling system as required by NEC 410-16(b). Surface mounted fixtures shall be supported from building structural system by rods or rods and clamps, or by fixture outlet box which in turn shall be supported by rods.

C. Receive, store, uncrate, and install light fixtures shown in schedule on drawings to be specified by others.

D. Adjust lighting fixtures to illuminate the intended area.

E. Wire recessed luminaries with Type THHN wire not smaller than No. 12.

F. Wire surface mounted luminaries with Type THHN wire not smaller than No. 12 from outlet boxes.

G. Locate no splice or tap within an arm or stem. Wire shall be continuous from splice in outlet box of building wiring system to lamp socket or ballast terminals.

END OF SECTION 26.61.00
PART 1 - GENERAL

1.01 DESCRIPTION
   A. Telecommunications systems shall be provided as indicated on drawings and as called for hereinafter.

1.02 REFERENCE STANDARDS
   A. ETSU Communications Infrastructure Standard (CIS) policy 500.2, September 11, 2017.
   D. ANSI/NECA/BICSCI-568, Standard for Installing Commercial Building Telecommunications Cable.
   E. ANSI/TIA 569-D, Telecommunications Pathways and Spaces.
   F. ANSI/TIA 568.0-D, Generic Telecommunications for Customer Premises Standard Series
      568.1-D Commercial Building Cabling
      568-C.2 Copper Cabling Components
      568-C.3 Fiber Cabling Components
      568-C.4 Coax Cabling Components
   G. ANSI/TIA 606-B, Addendum 1, Administration Standard for Commercial Telecommunications Infrastructure.
   H. ANSI J-STD-607-B, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
   I. ANSI/TIA 758-B, Customer owned Outside Plant Telecommunications Cabling Standard
   J. ANSI/TIA-526, 7&14, Telecommunications Measurements of Optical Fiber Single and Multi Mode Power Loss
   K. ANSI/TIA 310-D, Cabinets, Racks, Panels, and Associated Equipment.
   L. FCC Part 68, Connection of Terminal Equipment to the Telephone Network.
   M. ADA of 2010 and Telecommunications Act of 1996, Physically Impaired and Accessibility.
   N. International Building Code - 2006
   O. IEEE 8-2.11.xx Wireless LAN’s
   R. ANSI/SCTE 77 Underground Enclosure Integrity

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 27.01.00
SECTION 27.05.28
TELECOMMUNICATIONS OUTSIDE PLANT (OSP)

PART 1 - GENERAL

1.01 DESCRIPTION
A. Furnish and install telecommunications outside plant (OSP) facilities as indicated on drawings and set forth hereinafter.

1.02 REFERENCE STANDARDS
A. See section 27.01.00 REFERENCE STANDARDS.
D. ETSU Communications Infrastructure Standard (CIS) policy 500.2, September 11, 2017.

PART 2 - PRODUCTS

2.01 MATERIALS
A. Inner Duct: MaxCell 3x3 (MXD3456), locatable and metallically detectable for OSP, with color ID.
B. Fiber Optic OSP Cable: Single Mode – Corning Altos OS2 XXXEU4-T4101D20(black); Multimode (50um) - Corning Altos OM3 XXXTU4-T4180D20 (black); Multimode (62.5um) Corning Altos OM1 XXXKU4-T4130D20 (black); XXX=strand count. Equivalent cables by CommScope are also approved for use.
C. Copper OSP Cable: 25 Pair PE89 BSW (Buried Service Wire) Phone Cable-as manufactured by Essex or General Cable.
D. OSP Coax installation:
   1. OSP Coax shall be flooded type, CommScope PIII 500 JCASS (under 500ft) PIII 750 JCASS (over 500ft).
   2. Coax .500 Series Fitting shall be Gilbert GRS-500-CH-DU-03-T
   3. Coax .750 Series Fitting shall be Gilbert GRS-750-CH-DU-03-T
E. Handholes - Handhole lids shall be traffic rated (AASHTO H-20) with "Communications" logo on cover of lid. See ETSU CIS and ITS Design and Installation Guidelines for more information.

PART 3 - EXECUTION

3.01 INSTALLATION
A. Provide one (2) 3x3 "MaxCell" innerducts in each of the 4" conduits entering building from OSP system. Provide conduits over 1” not filled with MaxCell, install 3/8” nylon rope with a pull rating of 200lb or more. Conduits 1” or less, fill with polyline (Greenlee 430). Each MaxCell is to have different color ID marking and shall be locatable. The use of flexible plastic innerduct shall not be permitted.
B. The use of 90-degree bends shall be prohibited for OSP conduits. Long communications sweeps shall be utilized where conduit turns are required. Use Schedule 80 PVC, under sidewalks, driveways, etc. Use Schedule 40 PVC elsewhere. Conduit to be free of water and debris throughout. Provide caps on ends.

DESIGN RELEASE PACKAGE 4
ISSUED: 12/01/2017
C. OSP conduits shall be marked with Detectable Warning Tape, CH Hansen 16626 or equal.

D. Handholes (HH) shall be 36”x60”x36D” minimum size, with open bottom (on top of 4” rack). Seal conduits at each HH to keep moisture, insects, and rodents out of building. Conduits entering building must be sloped. All Handholes where fiber splices are made shall be 36”x60”x36D” minimum. Use Quazite PG style with pull slot center pins, lid shall be labeled “COMMUNICATIONS”.

E. All OSP cabling shall be installed in neat and workmanlike manner. Cabling to be routed and secured around edges of HH to create additional space for future cabling.

F. Provide 50 foot maintenance loop for fiber optic lines and 25 foot for copper lines in all HH. Service loops to side of HH.

G. Label all OSP cabling as follows:
   1. "Caution Fiber Optic" adhesive marker every HH. Label to include SM an MM fiber count and "to and from".
   2. "Caution Fiber Optic" adhesive marker every 50’ of exposed fiber in building (including in cable tray). Label to include SM and MM fiber count and "to and from".
   3. OSP UTP cables shall be labeled with permanent, neat penmanship in every HH with "to and from".

H. Prior to backfill, contractor shall arrange for inspection of OSP installation with ETSU ITS Department.

I. Prior to commencing with work, a pre-construction meeting will be held between the contractor’s telecommunications cabling installer and appropriate representatives of the ETSU Physical Plant, ITS Department. Installation requirements shall be carefully discussed at the pre-construction meeting. Discrepancies between contract documents and pre-construction meeting shall be called to the attention of Project Engineer immediately prior to commencing with any telecommunications installation work.

J. All conduit shall be installed such that the top of the conduit is a minimum of 24” below grade.

END OF SECTION 27.05.28
PART 1 - GENERAL

1.01 SCOPE OF WORK
   A. Furnish and install a system of cabling supports above lay-in ceilings for network, voice, and CATV cabling as set forth hereinafter.

1.02 REFERENCE STANDARDS
   A. See SECTION 27.01.00 REFERENCE STANDARDS

PART 2 - PRODUCTS

2.01 MATERIALS
   A. J-hooks shall be utilized above lay-in ceilings in individual rooms downstream of the cable tray for support of low-voltage cabling. J-hooks shall be as follows:
      1. Use Panduit J-Pro Series non-metallic J-hooks for all horizontal cabling from outlet to cable tray. Steel J-hooks shall not be used.
   B. Cabling support shall be located 4’ to 5’ on center throughout the entire length of network and CATV cabling runs above ceiling, once cable leaves cable tray. Provide separate sets of low-voltage cabling supports along entire length of low-voltage cabling runs above ceiling to allow separation of network cabling and CATV cabling. Network cabling shall be installed in separate J-hook support system from CATV cabling. Locate supports well clear of acoustical lay-in ceiling tiles. Supports shall be located such that tiles can be removed without interfering with support system. J-hook supports shall be secured directly to metal wall studs or masonry walls, as applicable. J-hooks shall not be attached directly to gyp-board walls. J-hooks shall be located no further apart than 5’0” on center along entire length of runs, with supports adjusted to be closer together as needed to attach to metal studs. A maximum of 8 Category 6 cables shall be installed per J-hook.
   C. Provide cable tray as listed in ETSU CIS throughout corridor areas of the building for support of horizontal cabling runs originating in IDF communications rooms. 18” wide x 4” deep with trapeze type hangers 8 foot on center.
   D. Provide all necessary supports and attachments to allow connection to structure for these supports. Provide all necessary conduits, raceways, cable trays, sleeves, etc. as necessary for the installation.

PART 3 - EXECUTION

3.01 INSTALLATION
   A. Entire installation shall be in accordance with manufacturer's recommendations.
   B. Cable tray shall be installed per manufacturer’s recommendations and shall be grounded. Cable tray shall be used for both CAT 6 and CATV cabling.
   C. Provide two separate sets of low-voltage cabling supports along entire length of low-voltage cabling runs above ceiling, once leaving cable tray. One set of supports shall be of Category 6 network wiring. The second set of supports shall be for CATV wiring. Locate supports well clear of acoustical lay-in ceiling tiles. Supports shall be located such that tiles can be removed without interfering with support system.
   D. Coordinate installation of low-voltage supports with other trades as required.

END OF SECTION 27.05.29
SECTION 27.05.53
ADMINISTRATION / LABELING

PART 1 – GENERAL

1.01 DESCRIPTION
A. Provide administration and labeling of entire communications infrastructure in accordance with ETSU ITS Department requirements and as set forth hereinafter. Administration and labeling shall include but not be limited to all work area outlets (WAO’s), patch panels, 110 blocks, conduits, cable trays, backbone cables, etc.

1.2 REFERENCE STANDARDS
A. See SECTION 27.01.00 REFERENCE STANDARDS

PART 2 - PRODUCTS

2.1 MATERIALS
A. Products shall be as set forth elsewhere in these specifications.

PART 3 – EXECUTION

3.1 INSTALLATION
A. All WAO’s, patch panels, 110 blocks, conduits, cable trays, backbone cabling, outside plant cabling, etc., shall be labeled according to ANSI/TIA/EIA Standards with specific labeling scheme of ETSU OIT Department. Labeling is also to include the following:
   1. "Caution Fiber Optic" adhesive marker every 20' of exposed fiber in building (including in cable tray). Label to include SM and MM fiber count and "to and from".

END OF SECTION 27.05.53
PART 1 - GENERAL

1.01 DESCRIPTION
   A. Telecommunications spaces shall be provided as indicated on drawings and as called for hereinafter. Telecommunications spaces shall consist of equipment rooms (ER).

1.02 REFERENCE STANDARDS
   A. See section 27.01.00 for standards.

PART 2 - PRODUCTS

2.01 MATERIALS
   A. ER layouts shall include network racks, vertical wire management, cable trays, and associated facilities. Each ER shall include, but not be limited to, the following equipment:
      1. Equipment Racks in Main IT/MDF Room shall be Hubbell No. CS1976, 84” x 19” with VS86 6” Z channel vertical wire management or equivalent. Provide a Hubbell RKTGB grounding bus bar in each equipment room. Provide a Hubbell MCCPSS19TS surge protected power strip for each network rack. Provide cable management components at each rack including Hubbell HC219CE3N (2 per patch panel) horizontal management, Hubbell MCCPSR4 cable management rings, and Hubbell 110RA cable management troughs. Provide Hubbell MCCCS19P equipment shelves. Provide Chatsworth 10605-019 rack base insulator kit.
      2. Equipment Racks in TR/IDF Rooms shall be Hubbell No. HPW96RR19, 96” x 19” with (2) VS86 6” Z channel vertical wire management or equivalent. Provide a Hubbell RKTGB grounding bus bar in each equipment room. Provide a Hubbell MCCPSS19TS surge protected power strip for each relay rack. Provide cable management components at each rack including Hubbell HC219CE3N (2 per patch panel) horizontal management, Hubbell MCCPSR4 cable management rings, and Hubbell 110RA cable management troughs. Provide Hubbell MCCCS19P equipment shelves. Provide Chatsworth 10605-019 rack base insulator kit.
      4. Cable Tray: In each ER room, provide 18” wide cable tray around room and to each rack. Cable tray shall be Hubbell Next Frame 18” "HL" Series or Cooper B-Line SB17U18B.
      5. Plywood Backboards: All walls of each ER room shall be provided with 3/4” AC grade plywood, covered on all six sides with two coats of Benjamin Moore M59-220 (white) paint, with up to 2 ounces of tint allowed per gallon.
      6. All fiber, OSP and Riser shall be terminated

PART 3 - EXECUTION

3.01 INSTALLATION
   A. Furnish and install at each ER location a grounding conductor from grounding bus in local ER Room AC panelboard to grounding bus bar mentioned in 2.01, A. Materials. Grounding conductors shall be copper, with “THHN/THWN” insulation, with green tape marking to indicate grounding conductor. Refer to drawings for grounding conductor sizes. Grounding and bonding shall be in accordance with BICSI TDMM current edition, Chapter 8, and NFPA 70.
   B. Before any terminations and installation of equipment, the ER must be in finished stage, free of dust and debris with all walls and ceilings painted to finish coats and finished flooring installed and treated. After terminations and equipment are installed, contractor shall keep ER room door closed and locked at all times.
END OF SECTION 27.11.10
PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish and install voice and network cabling for the building as indicated on drawings and as called for hereinafter. This specification is for a voice and network cabling system. Products specified hereinafter are Hubbell, Mohawk, CommScope, or Belden cable and Hubbell connectivity including jacks, patch panels, patch cords, and faceplates shall be utilized. The Hitachi/Hubbell products specified hereinafter are utilized as campus standard for ETSU. Any proposed replacement products must meet or exceed the published specifications. Alternates must be verified with ETSU ITS by furnishing proper documentation of specifications verified by an industry-recognized test laboratory (U.L., ETL, ASTM).

B. This standard also establishes performance criteria for various system configurations and their elements.

C. Cabling contractor must maintain a full time RCDD on staff as project manager for this project. Field installers of cabling installation specified herein must be a certified trained installer using ANSI TIA Standards and the current edition of the BICSI TDMM (Telecommunications Distribution Methods Manual) as a guide for installation of inside cabling and associated components. Installer must be Hubbell Certified. Provide written documentation of these qualifications as part of the submittal process.

1.02 CABLE STRUCTURE

A. The elements of a cabling system are listed below:
   1. Horizontal Cabling
   2. Work Area Outlets (WAO)
   3. ER Rooms (See Section 27.11.00)

B. HORIZONTAL CABLES

   1. Horizontal cabling shall be of star topology, each work area connector shall be terminated in the telecommunications room. The maximum horizontal distance from ER to the WAO shall be 90 meters. When deductions are made for mandatory minimum slack, the cable distance is approximately 85 meters (281 feet).
   2. The amount of untwisting of individual pairs to terminate shall be less than or equal to .5 in. for Category 6.
   3. Minimum bend radius shall be 4 times the cable diameter.

C. REFERENCE STANDARDS

   1. See Section 27.01.00 REFERENCE STANDARDS

D. ADMINISTRATION STANDARD FOR COMMUNICATIONS INFRASTRUCTURE:

   1. Purpose: The purpose of this standard is to provide a uniform administration scheme that is independent of the applications. This standard defines guidelines for contractors involved in the installation of the computer cabling system.
   2. Scope: This standard specifies the administrative requirements of the communications infrastructure within a building or campus.
   3. Areas to be administered are as follows:
      a) Terminations for the communications media
      b) Communications media between terminations
      c) Pathways between terminations
      d) Spaces where terminations are located
      e) Bonding and grounding
   4. Pathway and Space Administration: All spaces must be labeled. Labels should be affixed at the entrance of the space.
5. **Wiring System Administration:** This section describes the administration of cables, termination hardware, splices and termination position. As changes are made, effected labels, records, drawings and reports shall be updated.
   a) Horizontal and backbone subsystem cables shall be labeled at each end. Each termination hardware or label shall be marked with an identifier.
   b) Each termination position label shall be recorded with an identifier.
   c) Each splice closure or label shall be marked with an identifier.
   d) "TMGB" shall be marked on the Telecommunications Main Grounding Busbar and the Bonding conductors from the TMGB to the TGB locations.

E. **LABELING AND COLOR CODING:**
   1. Labels are divided into 3 categories:
      a) Adhesive labels shall meet adhesion, defacement and legibility requirements defined in U.L. 969. Labels shall also meet exposure requirements in U.L. 969.
      b) Insert labels shall also meet U.L. 969 requirements for defacement, legibility and general exposure.
      c) Other labels include special purpose labels, such as tie-on labels.
      d) Labels shall be used instead of marking the cable.
   2. Refer to ITS Guidelines, Appendix M

F. **COLOR CODING RULES:**
   1. Termination labels at the two ends of the cable shall be of the same color.
   2. Cross-connectors made between termination fields are generally of two different colors.
   3. The color orange is used for the demarcation point.
   4. Green is for the network connections on the customer side of the demarcation point.
   5. Purple is for the termination of cables originating from common equipment.
   6. White is for the first level backbone media.
   7. Gray is for the second level backbone.
   8. Blue is for the termination of station telecommunicators media.
   9. Brown is for inter-building backbone cable terminations.
   10. Yellow is for termination of auxiliary circuits, alarms, security, and other miscellaneous circuits.

G. **DIFFERENTIATION OF TERMINATION FIELDS BY PERFORMANCE CATEGORY**
   1. If cables are of different performance classes, their ends should indicate the difference. The labels shall be marked with the proper category of the cable.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

A. **Wall-Station Jacks:**
   1. Network: Hubbell Speedgain, orange, HXJ6OR.

B. **Wall-Station Faceplates:** Wall station faceplates in office areas shall be Hubbell AFPI4EI Series with four port angled plate, color to match electrical outlets. All unused ports shall be provided with blank inserts, Hubbell SFBE10 Series. Provide blank inserts as required.

C. **Equipment Racks:** See Section 27.11.10.

D. **ER Cable Tray:** See Section 27.11.10.

E. **Voice and network horizontal cabling:** Cabling shall be as specified in ITS Guidelines, Appendix A. All network cable shall have blue outer insulation. Leave 8” of slack for each termination at wall outlet location. Leave one meter (3.28’) slack at the end of each conduit run. Cable slack shall not be stored in bundled loops. Cable slack shall be stored in an extended loop or in a Figure 8 configuration. Provide two data cables to each communications outlet illustrated on the drawings, unless noted otherwise.

F. **Patch Cords:** Provide 6’ grey patch cords to the ETSU ITS department. The patch cords shall be Hubbell model number PSX6GY. Provide one cable per patch panel port.
G. Backbone Voice Cable: Provide 50 twisted pair Cat 3 UTP riser as indicated on drawings. Backbone voice cable shall be terminated on plywood with 110, 5-pair blocks. Provide 110 troughs between backbone and horizontal 110 blocks. Use Mohawk M58522.

H. Backbone Fiber Optic Riser Cable: Single Mode – Corning MIC DX Armored Cable OS2 XXXE81-33131-DI (yellow); Multimode (50um) - Corning MIC DX Armored Cable OM3 XXXT81-33180-DI (blue); Multimode (62.5um) – Corning MIC DX Armored Cable OM1 XXXK81-31130-DI (orange); XXX=strand count. All fiber shall be terminated in fiber hubs per ETUS ITS standards.

I. Firestopping: Hilti CP-618 putty shall be installed inside the conduits and FS One or CP-653 re-entry sleeve shall be used outside and around the conduits.

PART 3 - EXECUTION

3.01 INTERIOR BUILDING INSTALLATION:

A. Installation of all voice and network wiring facilities shall be by personnel regularly engaged in the installation of local area network cabling.

B. All wiring shall be color coded and terminated. All cabling shall be Cat 6 terminated to T568A wiring scheme. All network cabling shall have blue outer insulation.

C. Submit shop drawings for approval.

D. Testing shall conform to ANSI/TIA-568-B.1 standard. Testing shall be accomplished using a Hubbell approved tester. Include tester calibration date. Refer to ITS CIS for Commissioning, Warranties, and Documentation.

E. All testing shall meet or exceed manufacturer’s recommendation for 25-year warranty program.

F. Test each pair and shield of each cable for opens, shorts, grounds, and pair reversal. Correct grounded and reversed pairs. If horizontal cable contains bad conductors or shield, remove and replace cable. Cable shall have no visible defects such as twist, kinks, and dents.

G. During installation of cabling, the bend radius of cables is not to be less than the manufacturer’s specific recommendation. Minimum bend radius shall be 10 times the diameter of the cable for fiber optic cable, and 4 times the diameter of the cable for copper cable. Contractor shall take and precaution not to exceed maximum tensile rating of cabling during installation.

H. Each horizontal cabling run shall include 10’ of slack at telecommunications room end and 8” of slack at the outlet end. There shall also be one meter (3.28’) of slack above each wall outlet. Station cables in the telecommunications rooms can be stored in a "Figure 8" configuration to maintain the proper bend radius and provide the needed slack.

I. Labeling of cables, wall outlets, 110 blocks, conduits, cable trays, patch panels, and backbone cabling shall be performed in accordance with requirements of the ETSU ITS Department.

J. Building Automation System (BAS) Connection: Cabling connecting BAS to the ETSU ITS network must follow the standards set forth in ANSI/TIA 862.

K. Contractor shall provide all required fire-stopping of rated penetrations as required by these construction documents, applicable codes, and as required in the ETSU CIS.

L. Contractor shall provide all required bonding and grounding for telecommunications systems as required by these construction documents, applicable codes, and as required in the ETSU CIS.

PART 4 – QUALITY ASSURANCE

4.01 QUALITY ASSURANCE:

A. Any contractor or subcontractor directly performing construction of these passive cabling systems shall
maintain qualifications as detailed below for the duration of the project:

1. **RCDD-of-Record Requirements**
   
a) The contractor or subcontractor performing construction shall maintain a BICSI Registered Communications Distribution Designer (RCDD-of-Record) overseeing the scope of work. He or she shall be a current Registered Communications Distribution Designer in good standing as awarded by BICSI from time of bid through project’s substantial completion.

b) The RCDD-of-Record shall be a permanent employee (not subcontractor or temporary employee) of the contractor or subcontractor performing construction.

c) The RCDD-of-Record shall submit a current and valid copy of both their RCDD certificate as well as proof of employment by the contractor or subcontractor.

d) The Designer shall coordinate all inspections with ETSU and the RCDD-of-Record. ETSU shall be notified a minimum of ten (10) business days in advance of the final inspection to give ample time to make accommodations to participate if so desired.

e) In addition the contractor shall have a current and active Hubbell product certification as referenced later in this document.

**PART 5 - SUBMITTALS**

**5.01 SUBMITTAL REQUIREMENTS**

A. All submittals shall be provided to ETSU in their entirety (including re-submittals) in both printed and PDF formats.

B. Submittals are required to be provided to ETSU for all materials to be provided/installed/fabricated. All pre-construction submittals must be approved by both the designer and ETSU prior to acquisition, installation or construction.

C. The following submittals are due in the Pre-Construction Phase

   1. **Product Information**
      
a) Provide cover sheet showing project number, name, and description. Include table of contents with all product names, manufacturer, and specific product number identified.

b) Materials and their manufacturer(s) part numbers shall be clearly called out for each item using a black arrow or circle. No highlighted submittals will be accepted.

   2. Provide scaled plan and elevation drawings of the proposed layout and construction of all components in all telecommunications rooms (scale to be not less than 1/4″ = 1'-0") indicating locations of bus-bars, racks, ladder rack, service loops, wall mounted equipment, etc.

D. The following submittals are due at Substantial Completion

   1. **Record Drawings (as-built drawings)**
      
a) Provide scaled drawings (floor plans not less than 1/16" = 1'-0") indicating actual location...
and size/length of TMGB, TGBs and TBB conductors and all splice points. Also to be included are all communications outlets and other points of termination including labeling and identification.

b) Provide scaled plan and elevation drawings of telecommunications rooms (not less than 1/4” = 1’-0”) indicating actual locations of TMGB and TGBs.

2. Provide a letter from the contractors Project RCDD stating that the grounding system has been installed in accordance with the project documents and the referenced codes, standards, and guidelines.

END OF SECTION 27.15.00
SECTION 27.15.33
COAX HORIZONTAL CABELING

PART 1 - GENERAL

1.01 DESCRIPTION
A. Furnish and install a complete 1 GHz CATV wiring system as described on drawings and called for hereinafter.
B. The catalog numbers specified herein are those of the Blonder-Tongue Company and constitute the type and quality of the products to be installed.
C. The quality and type of CATV materials must be accepted by industry standards. All passive and active equipment must be two-way and pass signals up to one GHZ "passive" and 750 MHZ “active”.

1.02 INSTALLER QUALIFICATIONS
A. Installation of CATV cabling system shall be done by personnel regularly engaged in installation of such facilities. Installers shall have NCTI, SCTE, and BICSI certifications. Provide documentation of these certifications as part of the submittal process. Installer shall have working knowledge of all codes/standards related to CATV wiring installation.

1.03 DISTRIBUTION LEVELS
A. Line extender outputs shall be 46/40 DBMV for single cascade, and 43/37 DBMV for two cascades. No more than two line extenders shall be provided in cascade. Tap levels shall not exceed 17 DBMV on any "F" fitting. Typical tap level shall be 12 DBMV. Output level at faceplate shall be 3 DBMV and maximum of 10 DBMV. Maximum 3 DB variation shall be allowed between adjacent channels.

1.04 REFERENCE STANDARDS
A. SECTION 27.01.00 – REFERENCE STANDARDS
B. ANSI/SCE 74 2003, Specification for braided 75 ohm Flexible Coaxial Cable.
C. FCC Part 76, Cable Television Service.

PART 2 - PRODUCTS

2.01 MATERIALS
A. Splitters: In the Telecommunications Room, Install splitters to take the cable TV feed and distribute it to each individual room. Splitters/combiners shall be vertical ports, capable of passing one GHZ signal with built-in grounding lug, Truespec DSVXG or equivalent. "X" represents the number of ports. Arrange splitters/combiners so that signal is evenly distributed among all ports. Provide vertical directional taps for riser cable RG11 or .500 as required.
B. Wall Plates: Wall plates for CATV outlets shall be flush mounted with single-gang Standard F81 through connector with 0 db isolation, and one data jack, Hubbell AFP14EI.
C. Coaxial Cable: Coaxial cable shall be installed from each television outlet location shown on drawings to the Telecommunications Room on a homerun basis. No series wiring for TV shall be permitted. The coaxial cable from the outlet to the Telecommunications Room shall be Belden 7915A Series RG6 cable, aluminum braid shield, flame retardant PVC jacket meeting NEC Article 820V rating, ETL listed or equivalent.
D. Coaxial Connectors: Use compression type, Belden Thomas and Betts FSNS6U.
E. Amplifier: Provide one amplifier in Telecommunications Room. Each amplifier shall be two-way broadband distribution amplifier, Blonder-Tongue Model No. BIDA-750-30 or 750-50 as directed by ITS.
F. Riser Coax installation:
   1. Riser Coax shall be RG11 Belden 9011 if under 300 feet and Comscope PIII 500 Plenum over 300ft.
   2. RG11 Fitting shall be Thomas and Betts 716SNS1P11H
   3. Coax .500 Series Fitting shall be Gilbert GRS-500-CH-DU-03-T

PART 3 - EXECUTION

3.01 INSTALLATION

A. Each coaxial cable shall be tested for signal loss, length of cable, and meet the manufacturers specifications. Testing shall be in accordance with FCC Part 76 signal leakage requirements. Coaxial cable tests will involve continuity and RF leakage, 20-uV/m leakage limit (10 feet from network). Limit will yield a dipole level of -43.67 dBmV 75 ohms. Carefully coordinate tie-in of incoming line with local cable operator. Complete TV feed to each individual outlet to verify that a proper signal is being distributed. After proper documentation disconnect each room at the headend location and make each connection for proper identification.

B. Cable drops shall be bundled by use of approved plastic ties. Tape shall not be permitted to bundle cable drops.

C. Grounding will meet NEC requirements for CATV. Refer to Article 820 of National Electrical Code for information.

END OF SECTION 27.15.33
SECTION 27.41.00

PERFORMANCE AUDIO & VIDEO SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Electrical systems drawings and specifications under Division 26.

C. AV series large-format drawings as listed in Appendix D.

D. ETSU campus network standards.

1.02 REFERENCES

A. National Fire Protection Association (NFPA)

B. National Electrical Code (NEC)

C. American National Safety Institute (ANSI)

D. Electronics Industries Association (EIA)

1.03 RESPONSIBILITY AND RELATED WORK

A. The written specification Section 274100 and large-format AV drawings shall be collectively referred to herein as the AV Systems Documents.

B. Contractor shall provide, based on the AV Systems Documents, a complete, turnkey system, tested and ready for acceptance testing. The AV Systems Documents are developed to the extent required to properly convey design intent, signal flow, and system infrastructure. It is understood by the Contractor that they are to provide additional equipment, as required, in order to provide a complete and working system.

C. System features or devices which are mentioned in one part of the AV Systems Documents may not be shown in the other. In case of conflict between the written specifications and the drawings, Contractor must seek clarification from the Designer. In the event the Contractor fails to obtain such clarification, the interpretation of the Designer will prevail.

D. Contractor shall obtain all licenses and permits necessary for the execution of any work pertaining to the installation within this scope of work.

E. Refer to drawing AV010 for division of responsibilities related to the AV Systems.
1.04 DEFINITION OF TERMS & ABBREVIATIONS:

A. Furnish: to purchase and deliver to project site.

B. Install: to unload at project site and perform necessary operations for proper mounting and correct operation.

C. Provide: to furnish and install.

D. Systems: AV systems.

E. Designer: designer of the AV systems.

F. Contractor: specialty contractor performing work of this Section.

G. OFE: Owner Furnished Equipment. Equipment will be furnished to Contractor for installation.

H. NIC: Not In Contract. Refers to items that are not included in the scope of work outlined in this Section but may be shown for coordination purposes or reference.

I. New: manufactured within the past year and never before used.

J. Future: Equipment that will be provided by Owner at a later date. Accommodations shall be provided for future equipment as shown on the drawings.

1.05 SCOPE OF WORK

A. Furnish all materials, labor, and required engineering services to provide complete and professionally installed Systems in working order as described herein. Labor furnished shall be specialized and experienced in Systems installation.

B. Furnish all back boxes and enclosures.

C. Deliver to the job site all back boxes which are to be installed by others.

D. Furnish and install all wire and cable.

E. Furnish any additional items, not specifically mentioned herein, to meet system requirements as specified, without claim for additional payment. Such items may include hardware, transformers, line/distribution amplifiers and other devices for proper installation, interface, isolation or gain structure.

F. Furnish shop drawings and receive approval, prior to fabrication and installation.

G. Perform initial adjustments and verification tests. Submit verification test report.

H. Participate in acceptance tests and perform final adjustments.

I. Participate in user training.

J. Provide system documentation including copies of all relevant drawings and equipment manuals.
K. Guarantee all equipment and components for the specified period from the date of acceptance.

L. Provide maintenance services for the specified period from the date of acceptance.

M. Requirements and materials that apply to the work of others related to the Systems are listed to define and establish Systems requirements.

N. Coordination with the Division 26 Contractor is required to assure correct Systems conduit routing, Systems backbox locations, and clean power circuit locations as specified in Division 26.

O. Work scope does not include the AC power system except as shown in the drawings.

1.06 SUMMARY DESCRIPTION

A. This Section includes the following:
   1. Audio and video systems for instruction and performance.
   2. This specification covers all audio and video systems as described below. The objective is to provide professional systems, installed, acceptance tested, and ready for use.

1.07 EXPANDED DESCRIPTION

A. Specific products to meet the system requirements described below will be called out in the contract bid documents.

B. The AV Systems for the Nazareth College Concert Hall include support for musical performances of various styles in the concert hall with learning systems to support instruction in rehearsal spaces.

C. Concert Hall
   1. Main Loudspeakers
      a. A center loudspeaker array is mounted in the gap between the downstage catwalk and the first house catwalk. This array provides the majority of speech reinforcement.
      b. Columnar loudspeakers are mounted downstage left and right in architectural recesses. These loudspeakers carry some speech and the majority of music playback.
      c. Portable subwoofers to support low frequency playback are included and deployed onstage, when needed.
   2. Mixing & Playback Equipment
      a. A digital mixing console combines signals from live microphones, prerecorded material, and audio special effects. These signals can then be assigned through a matrix to any of the loudspeaker systems located throughout the hall.
      b. Equipment is provided for basic recording and playback, with a DVD/Blu-Ray player for disc-based playback.
   3. Video Cameras & Projection
      a. A fixed-frame video projection screen is flown from a stage batten.
b. A video projector is mounted in the control booth. An optical glass center window allows placing the projector in the booth.

c. A remote-controlled camera is mounted in the back of the room for stage manager use. Locations to support additional future cameras are provided in the infrastructure.

4. ADA Compliant Audio System
   a. An ADA-compliant hearing assistance system is provided for the hearing impaired. Event attendees can check out personal hearing assistance devices that receive the audio program directly via an infrared signal. 25% of the provided devices will also be equipped to deliver sound directly to hearing aids or cochlear implants equipped with a tele-coil.
   b. The ADA system can also be used for transmission of narration or other selected program material for the sight-impaired or for translation.

5. Intercom System
   a. The technical intercom system supplies four channels of two-way communication among technical operating personnel through belt packs connected to headsets with boom-mounted microphones. Connections are provided for all technical operating positions in the stage, house, control booth(s), and other key areas.

6. Page & Program
   a. A paging system allows stage managers and house managers to selectively make pages and send show program to various zones of the lobby and backstage. When initiated, priority stage calls, public announcements, or chime tones override the program sound. Paging can be activated at several different locations by the stage manager, the house manager, or their designee.
   b. A mix of the console output with the default stereo recording pair serves as the primary source for lobby and backstage program, as well as the ADA hearing assistance system.

7. AV Distribution & Control
   a. Distribution of AV sources for learning and rehearsal functions is handled in a matrix switcher that can be controlled from backstage, the control booth and the lectern.

8. Recording
   a. A basic stereo microphone pair for archival/instructional recording of acoustic performance is provided.

9. Stage Manager System
   a. The stage manager system is a portable rack with an intercom station and a page initiation station. This rack can be connected at technical operating positions in the stage, house or control booth.

10. AV Furniture
    a. A lectern with hard-wired AV connections is provided for use by presenters. The lectern can be connected at any of three points downstage, and can also be used in the lobby.
    b. A touch panel is provided for access to audio and video signal routing matrices and preset assignments.
11. Loose Equipment
   a. A basic complement of wired and wireless microphones, stands, cables, adapters, and accessories, appropriate to program needs, is provided.
   b. Other loose equipment includes monitor and effects loudspeakers and associated portable cable.

12. AV System Infrastructure
   a. Connection panels around the stage and backstage provide inputs and outputs for a lectern and other equipment that needs hard-wired audio or video connections.
   b. Other connection panels are provided in the catwalks and seating area to support recording, monitoring and effects playback.
   c. Most AV signals terminate in equipment racks where signals can be routed to various destinations via patch bays and patch cables.
   d. Additional portable loudspeakers are provided to serve unusual room setups. These can also be used as performer monitors, when needed.

13. AV Equipment Hubs
   a. Fixed devices required to run the system (such as the signal processors, amplifiers and patch bays) are housed in permanent AV racks. These racks are in the booth.
   b. A wall-mounted rack backstage left provides patching for stage locations.
   c. A computer-based system allows remote monitoring, control, and diagnostic testing of the AV system. In addition, this system stores default presets, settings, and programs, and can be used to address most of the AV processing devices.

14. Power Distribution System
   a. A sequencing load center provides programmable, sequential start-up and shut-down of the AV systems.

D. Studio Theater
1. Main Loudspeakers
   a. Distributed overhead loudspeakers provide low level playback or voice reinforcement, when needed.
   b. Portable loudspeakers can be deployed for localized effects or reinforcement.

2. Mixing & Playback Equipment
   a. A digital mixing console combines signals from live microphones, prerecorded material, and audio special effects. These signals can then be assigned through a matrix to any of the loudspeaker systems located throughout the hall.
   b. Equipment is provided for basic recording and playback, with a DVD/Blu-Ray player for disc-based playback.

3. Video Cameras & Projection
   a. No fixed projection equipment is included for this theatre. Portable projection equipment can be deployed, when needed.
   b. A remote-controlled camera is mounted near the booth window for stage manager use.
4. ADA Compliant Audio System  
   a. An ADA-compliant hearing assistance system is provided for the hearing impaired. Event attendees can check out personal hearing assistance devices that receive the audio program via a radio frequency signal. 25% of the provided devices will also be equipped to deliver sound directly to hearing aids or cochlear implants equipped with a tele-coil.  
   b. The ADA system can also be used for transmission of narration or other selected program material for the sight-impaired or for translation.

5. Intercom System  
   a. The technical intercom system supplies four channels of two-way communication among technical operating personnel through belt packs connected to headsets with boom-mounted microphones. Connections are provided for all technical operating positions in the stage, house, control booth(s), and other key areas.

6. Page & Program  
   a. A paging system allows stage managers to selectively make pages and send show program to various zones of the lobby and backstage. When initiated, priority stage calls, public announcements, or chime tones override the program sound. Paging can be activated at several different locations by the stage manager, the house manager, or their designee.
   b. A mix of the console output with the default stereo recording pair serves as the primary source for lobby and backstage program, as well as the ADA hearing assistance system.

7. AV Distribution & Control  
   a. Distribution of AV sources for learning and rehearsal functions is handled in a matrix switcher that can be controlled from backstage, the control booth and the lectern.

8. Stage Manager System  
   a. The stage manager system is a portable rack with an intercom station and a page initiation station. This rack can be connected at the technical operating positions in the control booth.

9. Loose Equipment  
   a. A basic complement of wired and wireless microphones, stands, cables, adapters, and accessories, appropriate to program needs, is provided.
   b. Other loose equipment includes monitor and effects loudspeakers and associated portable cable.

10. AV System Infrastructure  
   a. Connection panels around the stage floor and tension wire grid provide inputs and outputs for equipment that needs hard-wired audio or video connections.
   b. Most AV signals terminate in equipment racks where signals can be routed to various destinations via patch bays and patch cables.
   c. Additional portable loudspeakers are provided to serve unusual room setups. These can also be used as performer monitors, when needed.

11. AV Equipment Hubs  
   a. Fixed devices required to run the system (such as the signal processors, amplifiers, and patch bays) are housed in a permanent AV rack. This rack is in the equipment room adjacent to the booth.
b. A computer-based system allows remote monitoring, control, and diagnostic testing of the AV system. In addition, this system stores default presets, settings, and programs, and can be used to address most of the AV processing devices.

12. Power Distribution System
   a. A sequencing load center provides programmable, sequential start-up and shut-down of the AV systems.

E. Recital/Lecture Hall
   1. Main Loudspeakers
      a. Two overhead loudspeakers provide the majority of speech reinforcement.
      b. Loudspeakers are mounted downstage left and right in architectural recesses. These loudspeakers carry some speech and the majority of music playback.
      c. Permanent subwoofers to support low frequency playback are also mounted in the recesses on each side of the stage.
   2. Mixing & Playback Equipment
      a. A digital mixing console combines signals from live microphones, prerecorded material, and audio special effects. These signals can then be assigned through a matrix to any of the loudspeaker systems located throughout the hall.
      b. Equipment is provided for basic recording and playback, with a DVD/Blu-Ray player for disc-based playback.
   3. Video Cameras & Projection
      a. A motorized video projection screen deploys from the upstage acoustic shelf.
      b. A video projector is mounted in the control booth. An optical glass center window allows placing the projector in the booth.
      c. A remote-controlled camera is mounted in the back of the room for stage manager use.
   4. ADA Compliant Audio System
      a. An ADA-compliant hearing assistance system is provided for the hearing impaired. Event attendees can check out personal hearing assistance devices that receive the audio program directly via an infrared signal. 25% of the provided devices will also be equipped to deliver sound directly to hearing aids or cochlear implants equipped with a tele-coil.
      b. The ADA system can also be used for transmission of narration or other selected program material for the sight-impaired or for translation.
   5. Intercom System
      a. The technical intercom system supplies two channels of two-way communication among technical operating personnel through belt packs connected to headsets with boom-mounted microphones. Connections are provided for all technical operating positions in the stage, house, control booth(s), and other key areas.
   6. Page & Program
      a. The intercom system provides stage manager communication to the green room.
      b. A mix of the console output with the default stereo recording pair serves as the primary source for lobby and backstage program, as well as the ADA hearing assistance system.
7. AV Distribution & Control
   a. Distribution of AV sources for learning and rehearsal functions is handled in a matrix switcher that can be controlled from backstage, the control booth and the lectern.

8. Recording
   a. A basic stereo microphone pair for archival/instructional recording of acoustic performance is provided.

9. AV Furniture
   a. A lectern with hard-wired AV connections is provided for use by presenters. The lectern can be connected at any of three points downstage, and can also be used in the lobby.
   b. A touch panel is provided for access to audio and video signal routing matrices and preset assignments.

10. Loose Equipment
    a. A basic complement of wired and wireless microphones, stands, cables, adapters, and accessories, appropriate to program needs, is provided.
    b. Other loose equipment includes monitor and effects loudspeakers and associated portable cable.

11. AV System Infrastructure
    a. Connection panels in the stage floor and backstage provide inputs and outputs for a lectern and other equipment that needs hard-wired audio or video connections.
    b. Other connection panels are provided in the seating area to support recording, monitoring and effects playback.
    c. Most AV signals terminate in equipment racks where signals can be routed to various destinations via patch bays and patch cables.
    d. Additional portable loudspeakers are provided to serve unusual room setups. These can also be used as performer monitors, when needed.

12. AV Equipment Hubs
    a. Fixed devices required to run the system (such as the signal processors, amplifiers and patch bays) are housed in a permanent AV rack. This rack is in a dedicated room adjacent to the booth.
    b. A computer-based system allows remote monitoring, control, and diagnostic testing of the AV system. In addition, this system stores default presets, settings, and programs, and can be used to address most of the AV processing devices.

13. Power Distribution System
    a. A sequencing load center provides programmable, sequential start-up and shut-down of the AV systems.

F. Rehearsal Rooms
   1. Rehearsal rooms are based on ETSU standard classroom design, but include upgraded loudspeakers and digital audio recording from semi-permanent recording microphones suspended from the ceiling.

G. Lobby and Backstage
   1. Page & Program
      a. Performance audio is fed to distributed loudspeakers mounted in the ceilings. Pages from the stage manager or house manager override the program audio and are fed through the same loudspeakers.
2. Program Video & Digital Signage  
   a. Commercial video displays designed for 24/7 use are mounted in architecturally coordinated locations in the lobby and backstage. Lobby displays carry show program during events, and carry digital signage content at other times. Backstage displays receive only show content.  
   b. The AV Integrator will provide the mounted displays and the live video stream to each location plus a signage player for each lobby displays. Signage content to any location will be handled by ETSU.

3. Lobby Performance Connections  
   a. Connections in the lobby allow the lectern (or another portable system) to access the page and program loudspeakers for lectures or social events.

1.08 QUALITY CONTROL

A. Any Contractor performing work described in this Section shall have the following qualifications:
   1. Contractor shall maintain a fully staffed and equipped service facility; shall be a franchised dealer and authorized service facility for the major brands specified; and shall be properly licensed to work on this project.  
   2. Contractor shall have had at least five years’ experience in the programming, fabrication, assembly, installation, and testing of AV systems.  
   3. Contractor shall have successfully installed at least three projects of comparable magnitude and complexity, completed within the last five years.  
   4. Contractor’s technicians shall be fully trained, qualified, and certified by the respective equipment manufacturers on the engineering, installation, programming, testing, and operation of the systems. At least one technician shall have valid CTS-D certification, and at least one shall have valid CTS-I certification from InfoComm International, or equivalent.

B. Qualification Submittals  
   1. The following Contractors have submitted the required qualifications and have been approved to bid:

<table>
<thead>
<tr>
<th>Contractor</th>
<th>Address</th>
<th>Contact</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Pro Sound</td>
<td>806 Beverly Parkway, Pensacola, FL 32505</td>
<td>Jon Giles</td>
<td>850-432-5780</td>
<td><a href="mailto:giles@allprosound.com">giles@allprosound.com</a></td>
</tr>
<tr>
<td>Ford Audio-Video</td>
<td>8349 East 51st Street, Tulsa, OK 74145</td>
<td>Ed Knoll</td>
<td>918-664-2420</td>
<td><a href="mailto:knole@fordav.com">knole@fordav.com</a></td>
</tr>
<tr>
<td>Onyx AudioVisual</td>
<td>1920 Association Drive, Suite B100, Reston, VA 20191</td>
<td>Tom Beaudry</td>
<td>800-766-2715</td>
<td><a href="mailto:tbeaudry@onyxav.com">tbeaudry@onyxav.com</a></td>
</tr>
<tr>
<td>Professional Audio Designs</td>
<td>11707-B West Dearbourn Avenue, Wauwatosa, WI 53226</td>
<td>Kim Leonard</td>
<td>414-476-1011</td>
<td><a href="mailto:kim@proaudiodesigns.com">kim@proaudiodesigns.com</a></td>
</tr>
</tbody>
</table>
BID SUBMITTALS

C. Bid submittals to comply with Division 01 requirements.

D. Include the following information with the bid submittal:
   1. Summary of professional qualifications for performing work in this Section.
   2. The total contract price.
   3. The total prices for any Add Alternates.
   4. An itemized equipment list including Unit Pricing provided in Microsoft Excel format utilizing the following column headings:

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Totals</th>
</tr>
</thead>
</table>
   5. The number of labor hours estimated for each of the following:
      a. Project management
      b. Engineering and programming
      c. Fabrication and assembly
      d. Wire pull labor
      e. On site labor
      f. Verification and acceptance testing
      g. Documentation

E. Contractor is responsible for reading and understanding all information presented in this Section. Discrepancies between drawings and specifications or other errors or omissions shall be brought to the Designer’s attention a minimum of 5 days prior to bid date. Failure to do so does not relieve the Contractor from the requirement to provide a fully operational and turnkey system as outlined.

1.09 PROJECT SUBMITTALS

A. All submittals are to comply with Division 01.

B. Submittal packages described below shall be coordinated and complete with all required information, unless issuance of a partial or interim set has been previously approved by the Designer. Uncoordinated sets will be returned without review.

C. Submittal package #1 (“Cut Sheets”) shall be provided for review within thirty days of contract award; this package will include PDF copies of the manufacturer's product data sheets for each item of equipment that will be provided as part of this contract, including a table of contents.

D. Submittal package #2 (“Shop Drawings”) shall be provided for review within sixty days of contract award; this package of shop drawings shall indicate the complete details and dimensions of work to be performed. At the minimum, shop drawings shall include, but not be limited to:
1. Table of Contents.

2. Speaker location, orientation and rigging detail drawings, which will be submitted with a licensed professional engineer’s stamp as appropriate for the type of work to be performed. Rigging drawings at a minimum will include all structure attachment information, welding calculations, types of hardware to be used, mounting angles, and coordination with other trades.

3. Complete, detailed wiring schematic for all systems, based on the AV Systems documents but including cable types, identification by number and color codes, and detailed wiring of connections, both at equipment and between equipment racks and wiring in conduit.

4. Location of all equipment in racks, consoles, millwork, or enclosures. Include dimensions, wire routing, AC power outlets, terminal strips, and UPS locations.

5. Schematic drawings of any custom circuitry or equipment modifications, including connector pinouts and component lists.

6. Schedule of terminations for all systems.

7. Rack AC power schedule and circuiting information coordinated with Division 26. Provide circuiting detail for power distribution within the rack(s) both in the equipment rooms as well as at the control positions.

8. Equipment room layouts, coordinated with current architectural drawings and with site conditions.

9. Panel fabrication details, including a panel engraving schedule.


11. Details and dimensions of any custom fabricated devices, including materials, finishes, and labeling.

12. Color information for all speakers, brackets, and panels to be furnished or installed.

E. Shop drawings shall be submitted as bound 42” x 30” PDF documents for designer review, plus hard copies of edge bound 42” x 30” sheets as required by the GC/CM and/or architect.

F. Failure to submit shop drawings in ample time for evaluation shall not entitle the Contractor to an extension of contract time. There will be no work authorized on site without the prior submittal (and subsequent approval) of a complete set of shop drawings. Any exceptions to this must be in writing and approved by the Designer.

G. The designer review of shop drawings is for general conformance with the design intent and general compliance with the AV Systems documents of the project. Corrections, comments or markings made do not relieve the Contractor from compliance with the AV Systems Documents nor allow departure there from. Contractor remains responsible for detailing and accuracy, confirming and correlating quantities and dimensions, selecting fabrication processing and techniques of construction, coordinating work with that of other trades, and performing work in a safe a satisfactory manner.

H. The Contractor is responsible for all software programming for the AV systems. Coordination with the Designer is required for the development of this programming.

1. Obtain loudspeaker crossover/tuning settings from relevant manufacturers and load these settings into DSP/processors as needed.

2. Provide for approval, at least four weeks prior to system commissioning, electronic copies of all custom control software including graphical interface.
I. The Contractor is responsible for submitting two copies of a Final Inspection Notification Report no later than two weeks prior to system commissioning. This report shall be a typed, neatly prepared checkout report for the entire system including, at the minimum:

1. A complete listing of every piece of equipment including serial number, the date it was tested and by whom, the results, and the date retested, if failure occurred during any previous tests. The final report will not be acceptable until it indicates every device has tested successfully.

2. A performance test report indicating that the system meets all of the Contractor testing requirements in Section 3, below.

### 1.10 CONTRACT CLOSEOUT SUBMITTALS

A. Comply with all requirements of Specification Division 01.

B. Submit all contract closeout documentation within thirty days after substantial completion, unless otherwise noted.

C. Work off of approved shop drawings only, and note any and all changes made during installation on a single set of drawings.

D. Provide a Project Manual prior to acceptance testing. This manual shall contain the following information:

1. Table of Contents.

2. A complete list of equipment, both installed and loose gear. Include manufacturer, model number, and serial number for all devices.

3. Operating manuals for each device.

4. Service manuals for each device.

5. Documentation of all testing results as outlined in Section 3, below.

6. Preliminary As-Built drawings in PDF format. (Final As-Built drawings shall be updated following commissioning and issued after substantial completion as outlined above.)

E. Software Licensing and Manuals. Provide backup computer discs, all software manuals and license certificates for all software loaded on all PC’s. Include a CD with all original software installed, or downloaded, to devices in the system.

F. Produce compact system flow diagrams showing all components, cables, and wire numbers that will be mounted on the wall of each equipment rooms(s). A maximum of 2 flow diagrams will be mounted on any equipment room wall. Provide as-built wiring diagrams at a reduced scale that are easy to handle and fully legible. After approval, drawings will be mounted behind clear acetate and located with the equipment racks.

G. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor will certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB).
1.11 WARRANTY

A. Installer shall warrant equipment to be free of defects in materials and workmanship for not less than one year after date of Substantial Completion. Defects occurring in labor or materials within one-year warranty shall be rectified by replacement or repair. Within the warranty period, provide answer to service calls and requests for information within a 48-hour period, and repair or replace any faulty item within a 72-hour period without charge, including parts and labor.

B. This warranty shall not void specific warranties issued by manufacturers for greater periods of time, nor shall it void any rights guaranteed to the Owner by law.

C. Owner Furnished Equipment is NOT covered by Contractor warranty. All service and repair will be charged on a time and materials basis, at the Contractor's standard shop and field repair rates.

D. Contractor to provide Owner with exact beginning and ending dates of the warranty period. Include the name of the person to call for service and telephone number. This information to be part of Project Record Drawings.

E. Contractor to provide a final site visit and verification that the system is operational and all items are functioning correctly at the end of the warranty period. The Contractor shall not be responsible for correcting items that have obviously been changed by the Owner or end user.

PART 2 PRODUCTS

2.01 UNAUTHORIZED MATERIALS

A. Materials and products required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the Owner.

2.02 ACCEPTABLE MANUFACTURERS & EQUIPMENT

A. Model numbers and manufacturers included in this specification are listed as a standard of quality.

B. Other qualified manufacturers will be considered subject to review by the Owner and Designer. The Contractor will furnish complete technical data specifications at the time of proposed substitution. The Contractor will arrange for product demo at the request of the Owner and will pay ground freight shipping to and from site, or to and from Designer’s office. The Owner reserves the right to accept or refuse any substitution without condition.

C. Substitutions: Any proposed substitutions must meet all specifications of the specified equipment. No product substitution will be accepted without the written approval of the Owner and Designer.
2.03 GENERAL

A. Equipment and materials shall be new, shall meet or exceed the latest published manufacturer specifications, and conform to applicable UL, CSA, or ANSI provisions.

B. The use of trade names in the written specifications or on the bid document drawings is to establish a performance standard to be used. It is not intended to exclude other manufacturers whose performance is equivalent to those named.

C. Supply the latest model available at the time of bidding for each piece of equipment. The Owner may request, at their option, the latest model of equipment or new technology that is available at the time of installation be provided. If a later model is requested, adjustments will be made to cover cost changes between the cost at bid submittal and the cost of the latest model at the time of installation.

D. Install rack mounted equipment with black 10-32 button head machine screws with Allen drive.

E. Provide security covers on non-user operated equipment having front panel controls. Install covers at the conclusion of Acceptance Testing.

F. Provide engraved lamicoid labels at the front and rear of signal processing equipment mounted in racks. Mount labels on the equipment and attach in a neat, plumb, and permanent manner. Embossed labels will not be accepted. Provide engraved labels at the rear only of equipment mounted in furniture consoles.

G. Custom rack panels shall be 1/8 inch thick aluminum, standard EIA sizes, brushed black anodized finish unless otherwise noted. (Brush in direction of aluminum grain only.) Custom connector plates (speaker, microphone, etc.) are typically stainless steel; however, verify plate finish with the Owner. Plastic plates will not be accepted.

H. Engraving shall be 1/8 inch block sans serif characters unless noted otherwise. On dark panels or pushbuttons, letters shall be white; on stainless steel or brushed natural aluminum plates, or light-colored pushbuttons, letters shall be black.

2.04 SPECIFIED EQUIPMENT

A. Refer to Appendix A for list of major system components.
   1. Provide additional equipment and accessories as required to produce a complete and functional system consistent with the design intent.
   2. All bids shall include the equipment specified in Appendix A; any substitutions must be provided as an alternate to the bid price based on the specified equipment, not as a base bid. Bids that do not include the specified base system components may be rejected.

B. Refer to Appendix B for list of Add Alternate components.
   1. Pricing for designed alternates shall be separate from the base bid, but shall follow the same format and requirements as stipulated for the base bid.

C. Refer to Appendix C for list of AV equipment manufacturers.
PART 3 EXECUTION

3.01 GENERAL

A. Provide custom DSP programming, as required to meet the design intent. Allow for onsite adjustments to programming during the AV systems commissioning.

B. Coordinate work with other trades to avoid causing delays in construction schedule.

C. Mount equipment and enclosures plumb and square. Permanently installed equipment to be firmly and safely held in place.

D. Cover edges of cable pass-through holes in chassis, racks, boxes, etc., with rubber grommets or Brady GRNY nylon grommetting.

E. AC Power and Grounding
   1. Coordinate final connection of power and ground wiring to racks. Provide j-box inside top or bottom of rack, as applicable, to make final connection between internal rack wiring by the Contractor performing work of this Section and external power wiring by Division 26.
   2. Install 3-conductor, isolated ground, 120 VAC outlets in each rack. Provide a minimum of two spare outlets in each rack. Label each outlet as to which AC circuit is feeding it and provide the same information in the circuit breaker panel.

F. Equipment Racks
   1. Mount equipment in racks and consoles and fully wire and test before delivery to job site. If field conditions prevent prior assembly of racks, notify Designer in writing that racks will be fabricated on site and the reasons for the change. Racks located on concrete floors in equipment rooms or non-finished spaces to mount on a 4 inch wood or concrete riser.
   2. Install rack mounted equipment with black 10-32 button head machine screws with Allen drive.
   3. Provide security covers on non-user operated equipment having front panel controls. Install covers at the conclusion of Acceptance Testing.
   4. Provide ventilation adequate to keep temperature within the rack below 100 degrees Fahrenheit. Provide whisper type ventilation fan in each rack if temperature in rack rises above 100 degrees with power on for five continuous hours. This ventilation system must be temperature actuated.
   5. Looking at the rack from the rear, locate AC power, digital control, DC control, and speaker wiring on the left; microphone, line level audio, and video wiring on the right. Panels or equipment mounted on the rear rack rails shall not block access to any front mounted components.

G. Rack Panels.
   1. Custom panels shall be 1/8 inch thick aluminum, standard EIA sizes, brushed black anodized finish unless otherwise noted. (Brush in direction of aluminum grain only.)
   2. Custom connector plates (speaker, microphone, etc.) are typically stainless steel; however, verify plate finish with the Owner. Plastic plates will not be accepted.
H. Floor Boxes.
   1. Boxes to be flush mounted in location where shown on the drawings.
   2. Engrave and load with panels and connectors as shown on the drawings.

I. Wall Panels.
   1. Panel to be mounted in J-box in locations where shown on the drawings.
   2. Coordinate panel size with J-boxes dimensions. Panels mounted on surface mount boxes shall not protrude beyond the edge of the box and creating a sharp edge condition.
   3. Panel to be fabricated, engraved, and loaded with connectors with information shown on Drawings.
   4. Panels to be black with engraved lettering filled with white paint.

J. System Wiring
   1. Take precautions to prevent and guard against electromagnetic and electrostatic hum. Shields not connected to be folded back over cable jacket and covered with heat-shrink tubing. Do not cut off unused shields.
   2. Exercise care in wiring; damaged cables or equipment will not be accepted. Isolate cables of different signals or different levels; and separate, organize, and route to restrict channel crosstalk or feedback oscillation in any amplifier section. Keep wiring separated into groups for microphone level circuits, line level circuits, loudspeaker circuits, and power circuits.
   3. Make joints and connections with rosin-core solder or with mechanical connectors approved by the Owner; where spade lugs are used, crimp properly with ratchet type tool. Spade lugs mounted on 22 gauge or smaller cable to be soldered after crimping.
   4. Route unbroken microphone, audio line, and control wiring from receptacle plate/chassis to patch panel/rack. Remove spliced cables and replace without additional charge to the Owner.
   5. Connect cable to active components through screw terminal connections and spade lugs whenever available. Make connections to speaker transformers with properly sized closed end connectors crimped with factory approved ratchet type tool. Wire nut or Scotchlock connectors are not acceptable. Do not wrap audio cable splices or connections with adhesive backed tape.
   6. Execute wiring in strict adherence to standard broadcast practices, as excerpted from:
      c. Audio Systems Design and Installation, Giddings, ISBN 9780992024406
   7. Follow ETSU campus network standards for installation and testing of all category-type cabling.
   8. Run vertical wiring inside rack in properly sized plastic raceway with snap-on covers (Panduit Type E series). Mount raceways on full length 3/4 inch plywood backboards attached to rack sides. Horizontal wiring in rack to be neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack but still allow for service and testing. Provide horizontal support bars if cable bundles sag. Neatly bundle excess AC power cable from rack mounted equipment with plastic cable ties. Rack wiring to be bundled with plastic cable ties or lacing twine. Electrical tape and adhesive backed cable tie anchors are not acceptable.
9. Connect loudspeakers electrically in phase, using the same wire color code for speaker wiring throughout the project.
10. Wiring and connections shall be completely visible and labeled in rack.

K. Cable and Control Wiring Terminations
1. Electrical conductors installed under this contract, except where otherwise specified, shall be soft drawn annealed stranded copper having a conductivity of not less than 98% of pure copper.
2. Panels shall be located in rack rooms for transition of wire and cable from building conduits to equipment racks.
3. Connections on panels to be DIN rail mounted barrier strip system.

L. Equipment and Cable Labeling
1. Provide engraved laminoid labels on the front and rear of active equipment mounted in racks. Mount labels in a neat, plumb and permanent manner. Embossed labels are not acceptable.
2. Engraved labels to have 1/8 inch high characters minimum. Labels to be black with white characters except where indicated.
3. All cables within the system shall be labeled with a unique identifying number at each end of the cable. Use only pre-printed labels. Cover labels with clear heat shrink tubing. Self-adhesive labels will not be allowed without prior approval of Designer.
4. Label each terminal strip with a unique identification code in addition to a numerical label (Cinch MS series) for each terminal. Show terminal strip codes on system schematic drawings included with Project Record Drawings.

3.02 CONTRACTOR VERIFICATION TESTS AND ADJUSTMENTS

A. Final Inspection Notification Report. Contractor to prepare a final checkout report submitted two weeks prior to system commissioning that the system is ready for acceptance testing. This report shall include verification that all tests outlined below have been performed, and include the results of those tests.

B. Contractor to verify the following prior to acceptance testing by the Designer. Provide written notification that all tests have been performed, and documentation showing how the tests were performed, who performed each test, and the results of each test.
1. General
   a. Clean all control spaces, equipment rooms, productions rooms and equipment racks so they are free from dust, debris, solder, boxes, etc.
   b. Clean air filters for all devices with operable fans (amplifiers, power supplies, etc.).
2. Electrical
   a. Verify that all circuits feeding the AV system are derived from a technical power panel.
   b. Verify that isolated ground receptacles are used for the technical power systems at all locations as outlined in the grounding details of the AV drawings. Notify the Designer of any deviation of this immediately. Check all outlets for proper termination of the hot, neutral, and ground conductors.
3. Grounding System Tests. Assist the Division 26 Contractor in providing the following grounding system tests.
   a. Measure and record the DC resistance between the technical ground in any equipment rack or console and the main building ground. Resistance shall be 0.1 ohms or less.
   b. When the AV systems technical grounding system is complete, the Contractor will be required to demonstrate that this system is in no way bonded to the building safety grounding system except at the main service entry panel. With the power to the central distribution panel removed, the Contractor will disconnect the AV systems technical ground conductor from the main ground bus bar at the central distribution panel. At this point, an open circuit greater than 1.0 megohm shall be measurable between the AV systems technical ground and the building safety ground. Provide this information in pre-commissioning report to Designer.

4. Amplifiers. Set all amplifier sensitivity switches to +26dB gain.

5. Loudspeaker System Tests. Perform the following tests and adjustments. Make corrections necessary to bring system(s) into compliance with the specifications.
   a. Measure and record the impedance of each loudspeaker at the equipment rack with the amplifier disconnected. Measurements shall be documented in a table that lists the impedance for each and every 1/3 octave band from 40 Hz to 10 kHz. Measurements shall be accurate to within one-tenth of an ohm. NOTE: This test is not required of constant voltage loudspeaker systems.
   b. Check polarity of loudspeakers with an electronic polarity checker and by applying music program or constant power per octave (pink noise) signal to system while walking through the transition areas of coverage from one loudspeaker to the next. Transition shall be smooth with no apparent shift in source from one speaker to the next.
   c. Apply sine wave sweep signal to each loudspeaker system, sweeping from 50 Hz to 5kHz and at a level 10 dB below full amplifier output, and listen for rattles or noise. Correct if apparent.

6. Signal Distribution. Confirm the following. Make corrections necessary to bring systems into compliance with the specifications.
   a. Proper circuits appearing at each termination location.
   b. Continuity of all conductors.
   c. Proper polarity is maintained.
   d. Absence of shorts between conductors.
   e. Absence of shorts between conductors and conduit.

7. Intercom systems. Confirm the following. Make corrections necessary to bring systems into compliance with the specifications.
   a. All base stations, remote stations, and plates are wired with proper channel configurations.
   b. There is no cross-talk between channels.
   c. Call lights are operational.
   d. Audio is free from hums and buzzes.

8. Category Wiring. Confirm the following end-to-end and bi-directionally:
   a. Continuity and proper polarity.
   b. Attenuation up to and including 300MHz.
   c. Near end crosstalk pair to pair up to and including 300MHz.
   d. Power sum near end crosstalk up to and including 300MHz.
   e. Impedance up to and including 300MHz.
f. Conformance to TIA draft category 6 or better standards.
g. Conformance to all standards required by ETSU campus network standards.

9. Fiber Optics. Confirm the following end-to-end and bi-directionally for:
   a. Continuity, length, and fiber damage with an optical time-domain reflectometer.
   b. Attenuation does not exceed the expected loss value. Use all appropriate wavelengths to the fiber under test to determine attenuation. This attenuation confirmation shall be performed using a light source, an optical power meter or optical time-domain reflectometer.
   c. Each installed fiber optic strand test conformed to TIA-568B.3, TIA-526-14, TIA-526-7, and manufactures testing methods.
   d. Provide all manufacture test reports.
   e. Provide all optical time-domain reflectometer test reports.

3.03 TEST EQUIPMENT

A. For final acceptance testing, provide all equipment necessary to adequately demonstrate the functionality of all systems. Equipment to be available for the entire period through final system acceptance. Prior to start of testing, provide a list to the Owner of test equipment make and model numbers that will be used. Test equipment will consist of, at minimum:
   1. Four walkie-talkie radios with spare batteries
   2. Access to WLAN (provide temporary Wi-Fi router if necessary)
   3. Laptop computer capable of addressing system components over Wi-Fi
   4. Audio oscillator with adjustable output level, 20 to 20k Hz at 0 dBm
   5. VGA test pattern generator
   6. HDMI test pattern generator with EDID and HDCP adjustment capability
   7. Impedance meter, 0 to 20k ohms
   8. Audio and video sources on CD and Blu-ray
   9. Dual-trace oscilloscope, 20 MHz bandwidth
  10. Digital multimeter, 1% accuracy
  11. Polarity checker for cables and loudspeakers
  12. Optical range finder
  13. Level and angle finder
  14. Assorted hand tools
  15. Category cable certification tester

B. Note: Designer may choose to supply some of their own test equipment.

3.04 ACCEPTANCE

A. The process of acceptance testing is estimated to take a minimum of twenty-four work hours. During this time the Contractor shall have 2 technicians available to assist the Designer and make adjustments or corrections to the system as required. Contractor shall be responsible for providing test equipment as outlined in Section 3 for the duration of the acceptance testing.

B. The following procedures will be performed by the Designer on each System:
   1. The audio fidelity test shall consist of driving the system with pink noise and measuring the response from 40 Hz to 16k Hz. Digital Signal Processing will be used to adjust the response of the system(s) to fit the requirements of the space.
2. Control functions shall be checked for proper operation, from controlling devices to controlled devices.
3. Adjust, balance, and align equipment for optimum quality and to meet the manufacturer’s published specifications. Establish and mark normal settings for each level control, and record these settings, in the System Operation and Maintenance Manual.
4. Installed and loose equipment will be inventoried for correct quantity.
5. Any other test on any piece of equipment or system deemed appropriate.

C. The process of acceptance testing the System may necessitate moving and adjusting loudspeaker aiming. Contractor to make changes without claim for additional payment. If the construction timeline or architecture interferes with the ability to make changes during acceptance testing, notify Designer in writing prior to loudspeakers becoming inaccessible so that final on-site aiming may be accomplished.

D. In the event the need for further adjustment or work becomes evident during equalization or acceptance testing, the Contractor will continue his work until the system is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications, the Contractor will pay for additional time and expenses of the Designer at their standard rate in effect at that time, during any extension of the acceptance testing period.

3.05 SYSTEM DOCUMENTATION

A. Within thirty (30) days of the Acceptance Testing, prepare and submit a CD-ROM of the preliminary systems documentation manual for approval by the Designer. Manual to include, at minimum, the following documents in PDF format:
1. Table of contents
2. Written Guarantee and service policy
3. Basic power on/off and operational procedure
4. List of all equipment with manufacturer, model, and serial number.
5. Copy of the Verification Test results
6. Copies of all shop drawings which have been updated to include any changes made during the installation process
7. One line signal flow diagram with all cable runs and patch points identified by alpha-numeric character
8. All available manufacturers’ operation and service literature for each major system component
9. Copy of conduit riser diagram
10. Copy of the tuning settings as of commissioning

B. Designer will review the above system documentation. Upon approval, Contractor shall prepare and submit to the Owner:
1. Five (5) copies of the final Operation and Maintenance manual on CD-ROM
2. Two (2) hard copies of the final Operation and Maintenance manual printed and neatly bound

C. Provide framed copy of the as-built signal flow diagrams to be mounted in the control room. This diagram shall have all cable runs and patch points identified by alpha-numeric character.
3.06 INSTRUCTION OF OWNER PERSONNEL

A. Provide minimum of four hours instruction to Owner designated personnel on the use and operation of the System, scheduled as one session, by an instructor fully knowledgeable and qualified in system operation. The System Reference Manuals shall be complete and on site at the time of this instruction. This training session shall be videotaped by the Contractor and two sets of DVD copies shall be provided to Owner.

B. The lead technician for the project installation shall be present at the first formal use of the main system.

APPENDIX A – MAJOR SYSTEM COMPONENTS

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
<th>Mfr</th>
<th>Model</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SYSTEM TERMINATIONS – CONCERT HALL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Termination – Downstage Left/Right</td>
<td>CUS</td>
<td>per  AA</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Termination – Upstage Left/Right</td>
<td>CUS</td>
<td>per  AB</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Termination – Upstage Center</td>
<td>CUS</td>
<td>per  AC</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Termination – Orchestra Pit</td>
<td>CUS</td>
<td>per  AD</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Termination – House Mix</td>
<td>CUS</td>
<td>per  AH</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Termination – Tech Table</td>
<td>CUS</td>
<td>per  AJ</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Termination – Supplemental I/O</td>
<td>CUS</td>
<td>per  AL</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>Termination – Supplemental I/O</td>
<td>CUS</td>
<td>per  AM</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Termination – Supplemental I/O</td>
<td>CUS</td>
<td>per  AN</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>Termination – Live Room Mic</td>
<td>CUS</td>
<td>per  AO</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Termination – Manned Camera</td>
<td>CUS</td>
<td>per  AS</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>Termination – Remote Camera</td>
<td>CUS</td>
<td>per  AT</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Termination – SM Stage/Booth</td>
<td>CUS</td>
<td>per  BA/BB</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>Termination – Intercom</td>
<td>CUS</td>
<td>per  BD</td>
<td>7</td>
</tr>
<tr>
<td>16</td>
<td>Termination – RF Mic Antennas</td>
<td>CUS</td>
<td>per  BM</td>
<td>2</td>
</tr>
<tr>
<td>17</td>
<td>Termination – Main Loudspeakers</td>
<td>CUS</td>
<td>per  CA</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>Termination – Main Loudspeakers</td>
<td>CUS</td>
<td>per  CB</td>
<td>2</td>
</tr>
<tr>
<td>19</td>
<td>Termination – Main Loudspeakers</td>
<td>CUS</td>
<td>per  CC</td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>Termination – Main Loudspeakers</td>
<td>CUS</td>
<td>per  CD</td>
<td>2</td>
</tr>
<tr>
<td>21</td>
<td>Termination – Front Fill Loudspeakers</td>
<td>CUS</td>
<td>per  CEA/CEB</td>
<td>14</td>
</tr>
<tr>
<td>22</td>
<td>Termination – Under-Balcony Fill</td>
<td>CUS</td>
<td>per  CF</td>
<td>4</td>
</tr>
<tr>
<td>23</td>
<td>Termination – Over-Balcony Fill</td>
<td>CUS</td>
<td>per  CG</td>
<td>3</td>
</tr>
<tr>
<td>24</td>
<td>Termination – Efx Loudspeakers</td>
<td>CUS</td>
<td>per  CH</td>
<td>22</td>
</tr>
<tr>
<td>25</td>
<td>Termination – TalkBack Loudspeakers</td>
<td>CUS</td>
<td>per  CJ</td>
<td>2</td>
</tr>
<tr>
<td>26</td>
<td>Termination – Dock Video</td>
<td>CUS</td>
<td>per  CM</td>
<td>1</td>
</tr>
<tr>
<td>27</td>
<td>Termination – Projector</td>
<td>CUS</td>
<td>per  CP</td>
<td>1</td>
</tr>
<tr>
<td>28</td>
<td>Termination – FoldBack Video</td>
<td>CUS</td>
<td>per  CV</td>
<td>2</td>
</tr>
<tr>
<td>29</td>
<td>Termination – Infrared Emitter</td>
<td>CUS</td>
<td>per  CZ</td>
<td>4</td>
</tr>
</tbody>
</table>

DESIGN RELEASE PACKAGE 4
ISSUED: 12/01/2017
<table>
<thead>
<tr>
<th></th>
<th>SYSTEM TERMINATIONS – STUDIO THEATRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>Termination – Stage Manager CUS per drawing DB 1</td>
</tr>
<tr>
<td>32</td>
<td>Termination – Intercom CUS per drawing DC 4</td>
</tr>
<tr>
<td>33</td>
<td>Termination – Deck Level I/O CUS per drawing DD 5</td>
</tr>
<tr>
<td>34</td>
<td>Termination – Grid Level I/O CUS per drawing DG 5</td>
</tr>
<tr>
<td>35</td>
<td>Termination – Local Monitor CUS per drawing DH 2</td>
</tr>
<tr>
<td>36</td>
<td>Termination – Mix Position CUS per drawing DM 1</td>
</tr>
<tr>
<td>37</td>
<td>Termination – Live Room Mic &amp; ADA Antenna CUS per drawing DO 1</td>
</tr>
<tr>
<td>38</td>
<td>Termination – Distributed Loudspeaker CUS per drawing DS 8</td>
</tr>
<tr>
<td>39</td>
<td>Termination – Stage Manager Camera CUS per drawing DV 1</td>
</tr>
<tr>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>SYSTEM TERMINATIONS – RECITAL HALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>Termination – Offstage CUS per drawing EB 2</td>
</tr>
<tr>
<td>43</td>
<td>Termination – Ceiling Mic CUS per drawing ED 1</td>
</tr>
<tr>
<td>44</td>
<td>Termination – Intercom Wall Loudspeaker CUS per drawing EE 1</td>
</tr>
<tr>
<td>45</td>
<td>Termination – Floor Box CUS per drawing EF 3</td>
</tr>
<tr>
<td>46</td>
<td>Termination – Local Monitor CUS per drawing EG 2</td>
</tr>
<tr>
<td>47</td>
<td>Termination – Announce Top CUS per drawing EH 2</td>
</tr>
<tr>
<td>48</td>
<td>Termination – Announce Side CUS per drawing EJ 2</td>
</tr>
<tr>
<td>49</td>
<td>Termination – Effects CUS per drawing EM 1</td>
</tr>
<tr>
<td>50</td>
<td>Termination – Mix Position CUS per drawing EN 1</td>
</tr>
<tr>
<td>51</td>
<td>Termination – Projection Screen CUS per drawing EN 1</td>
</tr>
<tr>
<td>52</td>
<td>Termination – Projector CUS per drawing EP 1</td>
</tr>
<tr>
<td>53</td>
<td>Termination – Stage Manager Camera CUS per drawing EV 1</td>
</tr>
<tr>
<td>54</td>
<td>Termination – Local Volume Control CUS per drawing EX 2</td>
</tr>
<tr>
<td>55</td>
<td>Termination – Stage Control CUS per drawing EZ 1</td>
</tr>
<tr>
<td>56</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>SYSTEM TERMINATIONS – BACKSTAGE &amp; PUBLIC ZONES</th>
</tr>
</thead>
<tbody>
<tr>
<td>58</td>
<td>Termination – Overhead Loudspeakers CUS per drawing FA/FB/FD 55</td>
</tr>
<tr>
<td>59</td>
<td>Termination – Wall Loudspeakers CUS per drawing FF 3</td>
</tr>
<tr>
<td>60</td>
<td>Termination – Volume Controls CUS per drawing FH/FK 19</td>
</tr>
<tr>
<td>61</td>
<td>Termination – Muting Volume Controls CUS per drawing FJ 1</td>
</tr>
<tr>
<td>62</td>
<td>Termination – Lobby Presentation Input CUS per drawing FP 1</td>
</tr>
<tr>
<td>63</td>
<td>Termination – Systems Control Panels CUS per drawing FS/FT 3</td>
</tr>
<tr>
<td>64</td>
<td>Termination – Lobby Video Displays CUS per drawing FW 3</td>
</tr>
<tr>
<td>65</td>
<td>Termination – Backstage Video Displays CUS per drawing FW 7</td>
</tr>
<tr>
<td>66</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>SYSTEM TERMINATIONS – REHEARSAL ROOMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>68</td>
<td>Termination – Wall Loudspeakers CUS per drawing HB 6</td>
</tr>
<tr>
<td>69</td>
<td>Termination – Ceiling Mic Input CUS per drawing HD 3</td>
</tr>
<tr>
<td>70</td>
<td>Termination – Presentation Input CUS per drawing HF 3</td>
</tr>
<tr>
<td>71</td>
<td>Termination – Projection Screen CUS per drawing HN 5</td>
</tr>
<tr>
<td>72</td>
<td>Termination – Projector CUS per drawing HP 5</td>
</tr>
<tr>
<td>73</td>
<td>Termination – Remote Camera CUS per drawing HT 3</td>
</tr>
<tr>
<td>74</td>
<td></td>
</tr>
</tbody>
</table>

DESIGN RELEASE PACKAGE 4
ISSUED: 12/01/2017
<table>
<thead>
<tr>
<th></th>
<th>Item</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>76</td>
<td>CONCERT HALL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>Loudspeaker</td>
<td>ACN</td>
<td>QR24</td>
<td>4</td>
</tr>
<tr>
<td>78</td>
<td>Loudspeaker</td>
<td>ACN</td>
<td>QM24</td>
<td>4</td>
</tr>
<tr>
<td>79</td>
<td>Accessory, Loudspeaker, Bracket</td>
<td>ACN</td>
<td>Till Bracket as needed</td>
<td>4</td>
</tr>
<tr>
<td>80</td>
<td>Loudspeaker</td>
<td>FUL</td>
<td>CX1265</td>
<td>1</td>
</tr>
<tr>
<td>81</td>
<td>Loudspeaker</td>
<td>FUL</td>
<td>CX1295</td>
<td>1</td>
</tr>
<tr>
<td>82</td>
<td>Accessory, Loudspeaker, Bracket</td>
<td>CUS</td>
<td>Array Rigging as needed</td>
<td>1</td>
</tr>
<tr>
<td>83</td>
<td>Loudspeaker, Portable Sub</td>
<td>FUL</td>
<td>US212</td>
<td>2</td>
</tr>
<tr>
<td>84</td>
<td>Loudspeaker</td>
<td>IVX</td>
<td>HL-UB1</td>
<td>11</td>
</tr>
<tr>
<td>85</td>
<td>Loudspeaker, Custom Rigging</td>
<td>CUS</td>
<td>Front Fill Portable</td>
<td>7</td>
</tr>
<tr>
<td>86</td>
<td>Loudspeaker, Custom Rigging</td>
<td>CUS</td>
<td>Under-Balcony</td>
<td>4</td>
</tr>
<tr>
<td>87</td>
<td>Loudspeaker</td>
<td>FUL</td>
<td>CX896</td>
<td>5</td>
</tr>
<tr>
<td>88</td>
<td>Loudspeaker, Custom Rigging</td>
<td>CUS</td>
<td>Pipe Rail Mounting</td>
<td>5</td>
</tr>
<tr>
<td>89</td>
<td>Digital Console and Accessories</td>
<td>YAM</td>
<td>CL-3</td>
<td>1</td>
</tr>
<tr>
<td>90</td>
<td>Lamp, Console</td>
<td>YAM</td>
<td>LA1L</td>
<td>1</td>
</tr>
<tr>
<td>91</td>
<td>Console Digital Cable</td>
<td>WWD</td>
<td>ENC2S010</td>
<td>2</td>
</tr>
<tr>
<td>92</td>
<td>Patch Multicable - XLR</td>
<td>WWD</td>
<td>ADI-CSC-28P-10F</td>
<td>1</td>
</tr>
<tr>
<td>93</td>
<td>Video Playback, BluRay</td>
<td>SNY</td>
<td>UBP-X800</td>
<td>1</td>
</tr>
<tr>
<td>94</td>
<td>BluRay Rack Mount Kit</td>
<td>CUS</td>
<td>As needed</td>
<td>1</td>
</tr>
<tr>
<td>95</td>
<td>Encoder, Video</td>
<td>AMX</td>
<td>NMX-ENC-N1122</td>
<td>1</td>
</tr>
<tr>
<td>96</td>
<td>Rack, Portable (for BluRay)</td>
<td>SKB</td>
<td>1SKB-R2U</td>
<td>1</td>
</tr>
<tr>
<td>97</td>
<td>Computer, System Control</td>
<td>TBD</td>
<td>OFE</td>
<td>1</td>
</tr>
<tr>
<td>98</td>
<td>Desk, Rolling, ADA Adjustable</td>
<td>GKD</td>
<td>Geekdesk V3 with casters</td>
<td>1</td>
</tr>
<tr>
<td>99</td>
<td>PTZ Camera System</td>
<td>VAD</td>
<td>RoboShot 30 HDBT</td>
<td>1</td>
</tr>
<tr>
<td>100</td>
<td>Accessory, Camera, Wall Mount</td>
<td>VAD</td>
<td>As needed</td>
<td>1</td>
</tr>
<tr>
<td>101</td>
<td>Microphone</td>
<td>DPA</td>
<td>4011A</td>
<td>2</td>
</tr>
<tr>
<td>102</td>
<td>Accessory, Microphone, Trapeze Bar</td>
<td>CUS</td>
<td>By Contractor</td>
<td>1</td>
</tr>
<tr>
<td>103</td>
<td>IR Emitter</td>
<td>LSN</td>
<td>LA-140-GY</td>
<td>4</td>
</tr>
<tr>
<td>104</td>
<td>Antenna Amplifier Inline</td>
<td>SHU</td>
<td>UA830</td>
<td>2</td>
</tr>
<tr>
<td>105</td>
<td>Screen, Framed Batten Flown, 16:10, 366&quot; diag</td>
<td>DRA</td>
<td>Mnfctr Quote #TBD</td>
<td>1</td>
</tr>
<tr>
<td>106</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>107</td>
<td>CONCERT HALL STAGE RACK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>108</td>
<td>Hub - Stage Rack</td>
<td>CUS</td>
<td>per drawing ZA</td>
<td>1</td>
</tr>
<tr>
<td>109</td>
<td>Audio Console, Stage Box</td>
<td>YAM</td>
<td>Rio 3224D</td>
<td>1</td>
</tr>
<tr>
<td>110</td>
<td>Patch Bay, Audio, 2x26</td>
<td>AAI</td>
<td>WEP-262EO-SH-JSK</td>
<td>3</td>
</tr>
<tr>
<td>111</td>
<td>Patch Cable, Audio, 12&quot;</td>
<td>AAI</td>
<td>621B</td>
<td>12</td>
</tr>
<tr>
<td>112</td>
<td>Patch Cable, Audio, 24&quot;</td>
<td>AAI</td>
<td>622A</td>
<td>12</td>
</tr>
<tr>
<td>113</td>
<td>Patch Bay, Video, 16x2, 2u</td>
<td>AAI</td>
<td>32MV2/CMIDT</td>
<td>1</td>
</tr>
<tr>
<td>114</td>
<td>Video, HD/SDI DA, 1x8</td>
<td>BMD</td>
<td>MiniCon Distro SDI4K</td>
<td>1</td>
</tr>
<tr>
<td>115</td>
<td>Rack Panel – Loudspeaker Patch</td>
<td>CUS</td>
<td>per drawing</td>
<td>1</td>
</tr>
<tr>
<td>116</td>
<td>Rack Panel – Power Connection</td>
<td>CUS</td>
<td>Per drawing</td>
<td>1</td>
</tr>
<tr>
<td>117</td>
<td>Patch Bay, Data, FeedThru, STP, Cat6, 24x2, 2u</td>
<td>BBX</td>
<td>JPM816A</td>
<td>2</td>
</tr>
<tr>
<td>118</td>
<td>Switch, D-Audio/D-Video/Control, 10 Managed</td>
<td>CIS</td>
<td>SG300-10</td>
<td>2</td>
</tr>
<tr>
<td>119</td>
<td>Switch, D-Audio/D-Video/Control, 28P Managed</td>
<td>CIS</td>
<td>SG300-28</td>
<td>1</td>
</tr>
<tr>
<td>120</td>
<td>Drawer with Lock 4 RU</td>
<td>MAP</td>
<td>D4-LK</td>
<td>1</td>
</tr>
<tr>
<td>121</td>
<td>Rack Accessories, Panel Light</td>
<td>LIT</td>
<td>RL-10-D-LED</td>
<td>2</td>
</tr>
<tr>
<td>122</td>
<td>Rack Panel, Blanks</td>
<td>MAP</td>
<td>As required, lot</td>
<td>1</td>
</tr>
<tr>
<td>123</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Quantity</td>
<td>Notes</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>------------------------------------------------------------------------------</td>
<td>----------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>124</td>
<td><strong>CONCERT HALL BOOTH &amp; BOOTH RACK</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>125</td>
<td>Hub - Main Rack</td>
<td>CUS</td>
<td>per drawing ZC</td>
<td></td>
</tr>
<tr>
<td>126</td>
<td>Hearing Assistance, Modulator, IR</td>
<td>LSN</td>
<td>LT-082-01</td>
<td></td>
</tr>
<tr>
<td>127</td>
<td>IR or RF Transmitter Rack Mount</td>
<td>LSN</td>
<td>LA-326</td>
<td></td>
</tr>
<tr>
<td>128</td>
<td>DSP, Open Architecture, Control Interface</td>
<td>SMX</td>
<td>ARC-PSE</td>
<td></td>
</tr>
<tr>
<td>129</td>
<td>DSP, Open Architecture, 12x8+</td>
<td>SMX</td>
<td>Radius EX</td>
<td></td>
</tr>
<tr>
<td>130</td>
<td>DSP, Open Architecture, Digital Output Card</td>
<td>SMX</td>
<td>Digital Output Card</td>
<td></td>
</tr>
<tr>
<td>131</td>
<td>DSP, Open Architecture, 12x12</td>
<td>SMX</td>
<td>Prism 12x12</td>
<td></td>
</tr>
<tr>
<td>132</td>
<td>Rack Accessories, Panel Light</td>
<td>LIT</td>
<td>RL-10-D-LED</td>
<td></td>
</tr>
<tr>
<td>133</td>
<td>Wireless Mics, Receiver</td>
<td>SHU</td>
<td>ULXD4Q</td>
<td></td>
</tr>
<tr>
<td>134</td>
<td>Intercom, Power Supply, 4-Channel</td>
<td>CLC</td>
<td>PS-704</td>
<td></td>
</tr>
<tr>
<td>135</td>
<td>Rack Panel – Intercom Dry Line Switch</td>
<td>CUS</td>
<td>per drawing</td>
<td></td>
</tr>
<tr>
<td>136</td>
<td>Patch Bay, Video, 16x2, 2u</td>
<td>AAI</td>
<td>32MV2/CMIDT</td>
<td></td>
</tr>
<tr>
<td>137</td>
<td>Patch Cable, Video, BNC 24&quot;</td>
<td>AAI</td>
<td>VBNC24</td>
<td></td>
</tr>
<tr>
<td>138</td>
<td>Video, HD/SDI DA, 1x8</td>
<td>BMD</td>
<td>MiniCon Distro SDI4K</td>
<td></td>
</tr>
<tr>
<td>139</td>
<td>Rack Panels, Custom, Amplifier Output Patch</td>
<td>CUS</td>
<td>Per drawing</td>
<td></td>
</tr>
<tr>
<td>140</td>
<td>Patch Cable, Loudspeaker</td>
<td>WWD</td>
<td>ADI-NL4-M/F-02F</td>
<td></td>
</tr>
<tr>
<td>141</td>
<td>Amplifier w processing, 4chan</td>
<td>ACN</td>
<td>Sentinel 3</td>
<td></td>
</tr>
<tr>
<td>142</td>
<td>Amplifier w processing, 8chan</td>
<td>BOS</td>
<td>PM8500N</td>
<td></td>
</tr>
<tr>
<td>143</td>
<td>Expansion Card, Dante</td>
<td>BOS</td>
<td>PM Dante Network Card</td>
<td></td>
</tr>
<tr>
<td>144</td>
<td>Patch Bay, Audio, 2x26</td>
<td>AAI</td>
<td>WEP-262EO-SH-JSK</td>
<td></td>
</tr>
<tr>
<td>145</td>
<td>Patch Cable, Audio, 12&quot;</td>
<td>AAI</td>
<td>621B</td>
<td></td>
</tr>
<tr>
<td>146</td>
<td>Patch Cable, Audio, 24&quot;</td>
<td>AAI</td>
<td>622A</td>
<td></td>
</tr>
<tr>
<td>147</td>
<td>Patch Bay, Data, FeedThru, STP, Cat6, 24x2, 2u</td>
<td>BBX</td>
<td>JPM816A</td>
<td></td>
</tr>
<tr>
<td>148</td>
<td>Patch Cable, RJ45, STP, 2ft</td>
<td>BBX</td>
<td>EVNSL0605MS-0002</td>
<td></td>
</tr>
<tr>
<td>149</td>
<td>Patch Cable Holder</td>
<td>AAI</td>
<td>PCH-X</td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>Switch, D-Audio/D-Video/Control, 10P Managed</td>
<td>CIS</td>
<td>SG300-10</td>
<td></td>
</tr>
<tr>
<td>151</td>
<td>Switch, D-Audio/D-Video/Control, 28P Managed, POE</td>
<td>CIS</td>
<td>SG300-28P</td>
<td></td>
</tr>
<tr>
<td>152</td>
<td>Switch, D-Audio/D-Video/Control, 52P Managed, POE</td>
<td>CIS</td>
<td>SG500-52PP</td>
<td></td>
</tr>
<tr>
<td>153</td>
<td>Video, Camera Controller</td>
<td>VAD</td>
<td>OneLink Bridge</td>
<td></td>
</tr>
<tr>
<td>154</td>
<td>Encoder, Video</td>
<td>AMX</td>
<td>NMX-ENC-N1122</td>
<td></td>
</tr>
<tr>
<td>155</td>
<td>Decoder, Video</td>
<td>AMX</td>
<td>NMX-DEC-N1222</td>
<td></td>
</tr>
<tr>
<td>156</td>
<td>Decoder, Network Audio</td>
<td>AMX</td>
<td>NMX-ATC-4321</td>
<td></td>
</tr>
<tr>
<td>157</td>
<td>Recorder, Network Video</td>
<td>MTX</td>
<td>Monarch LCS</td>
<td></td>
</tr>
<tr>
<td>158</td>
<td>Recorder, Network Audio</td>
<td>TAS</td>
<td>SS-R250N</td>
<td></td>
</tr>
<tr>
<td>159</td>
<td>Input Card, Dante</td>
<td>TAS</td>
<td>IF-DA2</td>
<td></td>
</tr>
<tr>
<td>160</td>
<td>Rackmount Keyboard/Monitor</td>
<td>MAP</td>
<td>RM-KB-LCD17</td>
<td></td>
</tr>
<tr>
<td>161</td>
<td>Rack Panel, Computer Mount</td>
<td>CUS</td>
<td>As needed</td>
<td></td>
</tr>
<tr>
<td>162</td>
<td>Computer, Control</td>
<td>TBD</td>
<td>OFE</td>
<td></td>
</tr>
<tr>
<td>163</td>
<td>Modulator, Video</td>
<td>ZVE</td>
<td>HBD2920-NA</td>
<td></td>
</tr>
<tr>
<td>164</td>
<td>Amplifier, Headend, RF Video</td>
<td>BLT</td>
<td>As needed</td>
<td></td>
</tr>
<tr>
<td>165</td>
<td>Video RF Distribution</td>
<td>BLT</td>
<td>As needed</td>
<td></td>
</tr>
<tr>
<td>166</td>
<td>Drawer with Lock 2 RU</td>
<td>MAP</td>
<td>D2-LK</td>
<td></td>
</tr>
<tr>
<td>167</td>
<td>Drawer with Lock 3 RU</td>
<td>MAP</td>
<td>D3-LK</td>
<td></td>
</tr>
<tr>
<td>168</td>
<td>Drawer with Lock 4 RU</td>
<td>MAP</td>
<td>D4-LK</td>
<td></td>
</tr>
<tr>
<td>169</td>
<td>Playback, Chime Module</td>
<td>NEL</td>
<td>Multi-Messager USB</td>
<td></td>
</tr>
<tr>
<td>170</td>
<td>Control System</td>
<td>CST</td>
<td>CP3N</td>
<td></td>
</tr>
<tr>
<td>171</td>
<td>POE Injector</td>
<td>CST</td>
<td>As needed</td>
<td></td>
</tr>
<tr>
<td>172</td>
<td>Control Touchscreen, 10&quot;</td>
<td>CST</td>
<td>TSW-1060</td>
<td></td>
</tr>
<tr>
<td>173</td>
<td>Control Systems, 24V Supply &amp; Relays</td>
<td>ATL</td>
<td>As needed, Lot</td>
<td></td>
</tr>
</tbody>
</table>

**DESIGN RELEASE PACKAGE 4**

**ISSUED: 12/01/2017**
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>174</td>
<td>UPS Line Interactive 2.2kVA</td>
<td>MAP</td>
<td>UPS-2200R</td>
</tr>
<tr>
<td>175</td>
<td>Rack Panel, Blanks</td>
<td>MAP</td>
<td>As required, lot</td>
</tr>
<tr>
<td>176</td>
<td>Power Sequencer Panel</td>
<td>LYN</td>
<td>RCPR-16</td>
</tr>
<tr>
<td>177</td>
<td>Projector, 3DLP, 13k lumen, laser phosphor</td>
<td>DPI</td>
<td>Highlight Laser II</td>
</tr>
<tr>
<td>178</td>
<td>Lens, Projector</td>
<td>DPI</td>
<td>As needed</td>
</tr>
<tr>
<td>179</td>
<td>Decoder, Video</td>
<td>AMX</td>
<td>NMX-DEC-N1222</td>
</tr>
<tr>
<td>180</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>181</td>
<td>STUDIO THEATRE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>182</td>
<td>Loudspeaker</td>
<td>FUL</td>
<td>RX699</td>
</tr>
<tr>
<td>183</td>
<td>Loudspeaker Mount</td>
<td>CUS</td>
<td>As needed</td>
</tr>
<tr>
<td>184</td>
<td>Loudspeaker</td>
<td>EAW</td>
<td>JF26</td>
</tr>
<tr>
<td>185</td>
<td>Loudspeaker</td>
<td>EAW</td>
<td>JF8</td>
</tr>
<tr>
<td>186</td>
<td>Loudspeaker</td>
<td>GLX</td>
<td>Hot Spot 7</td>
</tr>
<tr>
<td>187</td>
<td>Cable, Loudspeaker, NL4</td>
<td>WWD</td>
<td>NL410</td>
</tr>
<tr>
<td>188</td>
<td>Cable, Loudspeaker, NL4</td>
<td>WWD</td>
<td>NL425</td>
</tr>
<tr>
<td>189</td>
<td>Adapter, NL4 barrel</td>
<td>WWD</td>
<td>NL4MMX</td>
</tr>
<tr>
<td>190</td>
<td>PTZ Camera System</td>
<td>VAD</td>
<td>RoboShot 30 HDBT</td>
</tr>
<tr>
<td>191</td>
<td>Accessory, Camera, Wall Mount</td>
<td>VAD</td>
<td>As needed</td>
</tr>
<tr>
<td>192</td>
<td>Microphone</td>
<td>ATN</td>
<td>ES915ML12</td>
</tr>
<tr>
<td>193</td>
<td>Accessory, Microphone, Wall Mount</td>
<td>CUS</td>
<td>By Contractor</td>
</tr>
<tr>
<td>194</td>
<td>RF Antenna Kit</td>
<td>LSN</td>
<td>LA-122</td>
</tr>
<tr>
<td>195</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>196</td>
<td>STUDIO THEATRE BOOTH &amp; BOOTH RACK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>197</td>
<td>Hub - Main Rack</td>
<td>CUS</td>
<td>per drawing ZD</td>
</tr>
<tr>
<td>198</td>
<td>Digital Console and Accessories</td>
<td>YAM</td>
<td>CL-1</td>
</tr>
<tr>
<td>199</td>
<td>Lamp. Console</td>
<td>YAM</td>
<td>LA1L</td>
</tr>
<tr>
<td>200</td>
<td>Console Digital Cable</td>
<td>WWD</td>
<td>ENC2S010</td>
</tr>
<tr>
<td>201</td>
<td>Video Playback, BluRay</td>
<td>SNY</td>
<td>UBP-X800</td>
</tr>
<tr>
<td>202</td>
<td>BluRay Rack Mount Kit</td>
<td>CUS</td>
<td>As needed</td>
</tr>
<tr>
<td>203</td>
<td>Encoder, Video</td>
<td>AMX</td>
<td>NMX-ENC-N1122</td>
</tr>
<tr>
<td>204</td>
<td>Rack, Portable (for BluRay)</td>
<td>SKB</td>
<td>1SKB-R2U</td>
</tr>
<tr>
<td>205</td>
<td>Desk, Rolling, ADA Adjustable</td>
<td>GKD</td>
<td>Geekdesk V3 with casters</td>
</tr>
<tr>
<td>206</td>
<td>Hearing Assistance, Modulator, RF</td>
<td>LSN</td>
<td>LT-800-072-01</td>
</tr>
<tr>
<td>207</td>
<td>IR or RF Transmitter Rack Mount</td>
<td>LSN</td>
<td>LA-326</td>
</tr>
<tr>
<td>208</td>
<td>Audio Console, Stage Box</td>
<td>YAM</td>
<td>Rio 3224D</td>
</tr>
<tr>
<td>209</td>
<td>DSP, Open Architecture, 12X12</td>
<td>SMX</td>
<td>Prism 12X12</td>
</tr>
<tr>
<td>210</td>
<td>Rack Accessories, Panel Light</td>
<td>LIT</td>
<td>RL-10-D-LED</td>
</tr>
<tr>
<td>211</td>
<td>Wireless Mics, Receiver</td>
<td>SHU</td>
<td>ULXD4Q</td>
</tr>
<tr>
<td>212</td>
<td>Intercom, Power Supply, 4-Channel</td>
<td>CLC</td>
<td>PS-704</td>
</tr>
<tr>
<td>213</td>
<td>Patch Bay, Video, 16x2, 2u</td>
<td>AAI</td>
<td>32MV2/CMIDT</td>
</tr>
<tr>
<td>214</td>
<td>Patch Cable, Video, BNC 24&quot;</td>
<td>AAI</td>
<td>VBNC24</td>
</tr>
<tr>
<td>215</td>
<td>Video, HD/SDI DA, 1x8</td>
<td>BMD</td>
<td>MiniCon Distro SDI4K</td>
</tr>
<tr>
<td>216</td>
<td>Rack Panels, Custom, Amplifier Output Patch</td>
<td>CUS</td>
<td>Per drawing</td>
</tr>
<tr>
<td>217</td>
<td>Patch Cable, Loudspeaker</td>
<td>WWD</td>
<td>ADI-NL4-M/F-02F</td>
</tr>
<tr>
<td>218</td>
<td>Amplifier w processing, 8chan</td>
<td>BOS</td>
<td>PM8250N</td>
</tr>
<tr>
<td>219</td>
<td>Amplifier w processing, 8chan</td>
<td>BOS</td>
<td>PM8500N</td>
</tr>
<tr>
<td>220</td>
<td>Expansion Card, Dante</td>
<td>BOS</td>
<td>PM Dante Network Card</td>
</tr>
<tr>
<td>221</td>
<td>Amplifier, 2 Channel</td>
<td>LAB</td>
<td>E 2:2</td>
</tr>
<tr>
<td>222</td>
<td>Loudspeaker, Wall Mount, 70V</td>
<td>COM</td>
<td>DS5</td>
</tr>
<tr>
<td>223</td>
<td>Patch Bay, Audio, 2x26</td>
<td>AAI</td>
<td>WEP-262EO-SH-JSK</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Make/Model</td>
<td>Quantity</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------------------------------</td>
<td>------------</td>
<td>----------</td>
</tr>
<tr>
<td>224</td>
<td>Patch Cable, Audio, 12&quot;</td>
<td>AAI 621B</td>
<td>12</td>
</tr>
<tr>
<td>225</td>
<td>Patch Bay, Data, FeedThru, STP, Cat6, 24x2, 2u</td>
<td>BBX JPM816A</td>
<td>1</td>
</tr>
<tr>
<td>226</td>
<td>Patch Cable, RJ45, STP, 2ft</td>
<td>BBX EVNSL0605MS-0002</td>
<td>24</td>
</tr>
<tr>
<td>227</td>
<td>Patch Cable Holder</td>
<td>AAI PCH-X</td>
<td>2</td>
</tr>
<tr>
<td>228</td>
<td>Switch, D-Audio/D-Video/Control, 10P Managed</td>
<td>CIS SG300-10</td>
<td>1</td>
</tr>
<tr>
<td>229</td>
<td>Switch, D-Audio/D-Video/Control, 28P Managed, POE</td>
<td>CIS SG300-28</td>
<td>2</td>
</tr>
<tr>
<td>230</td>
<td>Switch, D-Audio/D-Video/Control, 28P Managed, POE</td>
<td>CIS SG500-28PP</td>
<td>1</td>
</tr>
<tr>
<td>231</td>
<td>Video, Camera Controller</td>
<td>VAD OneLink Bridge</td>
<td>1</td>
</tr>
<tr>
<td>232</td>
<td>Encoder, Video</td>
<td>AMX NMX-ENC-N1122</td>
<td>1</td>
</tr>
<tr>
<td>233</td>
<td>Decoder, Network Audio</td>
<td>AMX NMX-ATC-4321</td>
<td>1</td>
</tr>
<tr>
<td>234</td>
<td>Rackmount Keyboard/Monitor</td>
<td>MAP RM-KB-LCD17</td>
<td>1</td>
</tr>
<tr>
<td>235</td>
<td>Rack Panel, Computer Mount</td>
<td>CUS As needed</td>
<td>1</td>
</tr>
<tr>
<td>236</td>
<td>Computer, Control</td>
<td>TBD OFE</td>
<td>1</td>
</tr>
<tr>
<td>237</td>
<td>UPS Line Interactive 2.2kVA</td>
<td>MAP UPS-2200R</td>
<td>1</td>
</tr>
<tr>
<td>238</td>
<td>Rack Panel, Blanks</td>
<td>MAP As required, lot</td>
<td>1</td>
</tr>
<tr>
<td>239</td>
<td>Power Sequencer Panel</td>
<td>LYN RCPR-16</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241</td>
<td>RECITAL HALL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>242</td>
<td>Loudspeaker</td>
<td>FUL CX1265</td>
<td>2</td>
</tr>
<tr>
<td>243</td>
<td>Loudspeaker</td>
<td>FUL US212</td>
<td>2</td>
</tr>
<tr>
<td>244</td>
<td>Loudspeaker</td>
<td>FUL CX896</td>
<td>2</td>
</tr>
<tr>
<td>245</td>
<td>Accessory, Loudspeaker Rigging</td>
<td>CUS Rigging as needed</td>
<td>6</td>
</tr>
<tr>
<td>246</td>
<td>Loudspeaker</td>
<td>EAW UB22Z</td>
<td>4</td>
</tr>
<tr>
<td>247</td>
<td>U-Bracket</td>
<td>EAW UBKT22</td>
<td>4</td>
</tr>
<tr>
<td>248</td>
<td>Microphone</td>
<td>DPA 4011A</td>
<td>2</td>
</tr>
<tr>
<td>249</td>
<td>Accessory, Microphone, Trapeze Bar</td>
<td>CUS By Contractor</td>
<td>1</td>
</tr>
<tr>
<td>250</td>
<td>Servoreeler, Single Mic</td>
<td>XED SRL-40</td>
<td>2</td>
</tr>
<tr>
<td>251</td>
<td>Servoreeler, Positioning</td>
<td>XED MPS-2</td>
<td>1</td>
</tr>
<tr>
<td>252</td>
<td>Screen, Tab Tensioned 16:10, 185&quot; diag</td>
<td>DRA Mnfctr Quote #TBD</td>
<td>1</td>
</tr>
<tr>
<td>253</td>
<td>Accessory, Screen, Control Module</td>
<td>DRA Included in Quote Above</td>
<td>1</td>
</tr>
<tr>
<td>254</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>255</td>
<td>RECITAL HALL BOOTH &amp; BOOTH RACK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>256</td>
<td>Hub - Main Rack</td>
<td>CUS per drawing ZE</td>
<td>2</td>
</tr>
<tr>
<td>257</td>
<td>Digital Console and Accessories</td>
<td>YAM CL-1</td>
<td>1</td>
</tr>
<tr>
<td>258</td>
<td>Lamp. Console</td>
<td>YAM LA1L</td>
<td>1</td>
</tr>
<tr>
<td>259</td>
<td>Console Digital Cable</td>
<td>WWD ENC2S010</td>
<td>2</td>
</tr>
<tr>
<td>260</td>
<td>Video Playback, BluRay</td>
<td>SNY UBP-X800</td>
<td>1</td>
</tr>
<tr>
<td>261</td>
<td>BluRay Rack Mount Kit</td>
<td>CUS As needed</td>
<td>1</td>
</tr>
<tr>
<td>262</td>
<td>Encoder, Video</td>
<td>AMX NMX-ENC-N1122</td>
<td>1</td>
</tr>
<tr>
<td>263</td>
<td>Rack, Portable (for BluRay)</td>
<td>SKB 1SKB-R2U</td>
<td>1</td>
</tr>
<tr>
<td>264</td>
<td>Desk, Rolling, ADA Adjustable</td>
<td>GKD Geekdesk V3 with casters</td>
<td>1</td>
</tr>
<tr>
<td>265</td>
<td>PTZ Camera System</td>
<td>VAD RoboShot 30 HDBT</td>
<td>1</td>
</tr>
<tr>
<td>266</td>
<td>Accessory, Camera, Wall Mount</td>
<td>VAD As needed</td>
<td>1</td>
</tr>
<tr>
<td>267</td>
<td>Hearing Assistance, Modulator, RF</td>
<td>LSN LT-800-072-01</td>
<td>1</td>
</tr>
<tr>
<td>268</td>
<td>IR or RF Transmitter Rack Mount</td>
<td>LSN LA-326</td>
<td>1</td>
</tr>
<tr>
<td>269</td>
<td>Audio Console, Stage Box</td>
<td>YAM Rio 1608D</td>
<td>1</td>
</tr>
<tr>
<td>270</td>
<td>DSP, Open Architecture, 12X12</td>
<td>SMX Prism 12X12</td>
<td>1</td>
</tr>
<tr>
<td>271</td>
<td>Rack Accessories, Panel Light</td>
<td>LIT RL-10-D-LED</td>
<td>3</td>
</tr>
<tr>
<td>272</td>
<td>Wireless Mics, Receiver</td>
<td>SHU ULX4DQ</td>
<td>1</td>
</tr>
<tr>
<td>273</td>
<td>Intercom, Power Supply, 2-Channel</td>
<td>CLC PS-702</td>
<td>1</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Vendor</td>
<td>QTY</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
<td>--------</td>
<td>-----</td>
</tr>
<tr>
<td>274</td>
<td>Patch Bay, Video, 12x2, 2u</td>
<td>AAI</td>
<td>24MV2/CMIDT</td>
</tr>
<tr>
<td>275</td>
<td>Patch Cable, Video, BNC 24&quot;</td>
<td>AAI</td>
<td>VBN2C4</td>
</tr>
<tr>
<td>276</td>
<td>Video, HD/SDI DA, 1x8</td>
<td>BMD</td>
<td>MiniCon Distro SDI4K</td>
</tr>
<tr>
<td>277</td>
<td>Amplifier w processing, 8ch</td>
<td>BOS</td>
<td>PM8500N</td>
</tr>
<tr>
<td>278</td>
<td>Expansion Card, Dante</td>
<td>BOS</td>
<td>PM Dante Network Card</td>
</tr>
<tr>
<td>279</td>
<td>Patch Bay, Audio, 2x26</td>
<td>AAI</td>
<td>WEP-262EO-SH-JSK</td>
</tr>
<tr>
<td>280</td>
<td>Patch Cable, Audio, 12&quot;</td>
<td>AAI</td>
<td>621B</td>
</tr>
<tr>
<td>281</td>
<td>Patch Bay, Data, FeedThru, STP, Cat6, 24x2, 2u</td>
<td>BBX</td>
<td>JPM816A</td>
</tr>
<tr>
<td>282</td>
<td>Patch Cable, RJ45, STP, 2ft</td>
<td>BBX</td>
<td>EVNSL0605MS-0002</td>
</tr>
<tr>
<td>283</td>
<td>Patch Cable Holder</td>
<td>AAI</td>
<td>PCH-X</td>
</tr>
<tr>
<td>284</td>
<td>Switch, D-Audio/D-Video/Control, 10P Managed</td>
<td>CIS</td>
<td>SG300-10</td>
</tr>
<tr>
<td>285</td>
<td>Switch, D-Audio/D-Video/Control, 28P Managed</td>
<td>CIS</td>
<td>SG300-28</td>
</tr>
<tr>
<td>286</td>
<td>Switch, D-Audio/D-Video/Control, 28P Managed, POE</td>
<td>CIS</td>
<td>SG300-28P</td>
</tr>
<tr>
<td>287</td>
<td>Video, Camera Controller</td>
<td>VAD</td>
<td>OneLink Bridge</td>
</tr>
<tr>
<td>288</td>
<td>Encoder, Video</td>
<td>AMX</td>
<td>NMX-ENC-N1122</td>
</tr>
<tr>
<td>289</td>
<td>Decoder, Video</td>
<td>AMX</td>
<td>NMX-DEC-N1222</td>
</tr>
<tr>
<td>290</td>
<td>Decoder, Network Audio</td>
<td>AMX</td>
<td>NMX-ATC-4321</td>
</tr>
<tr>
<td>291</td>
<td>Recorder, Network Video</td>
<td>MTX</td>
<td>Monarch LCS</td>
</tr>
<tr>
<td>292</td>
<td>Recorder, Network Audio</td>
<td>TAS</td>
<td>SS-R250N</td>
</tr>
<tr>
<td>293</td>
<td>Input Card, Dante</td>
<td>TAS</td>
<td>IF-DA2</td>
</tr>
<tr>
<td>294</td>
<td>Rackmount Keyboard/Monitor</td>
<td>MAP</td>
<td>RM-KB-LCD17</td>
</tr>
<tr>
<td>295</td>
<td>Rack Panel, Computer Mount</td>
<td>CUS</td>
<td>As needed</td>
</tr>
<tr>
<td>296</td>
<td>Computer, Control</td>
<td>TBD</td>
<td>OFE</td>
</tr>
<tr>
<td>297</td>
<td>Servoreeler Controller PSU</td>
<td>XED</td>
<td>SRC-6</td>
</tr>
<tr>
<td>298</td>
<td>Servoreeler Control Module</td>
<td>XED</td>
<td>Option-A</td>
</tr>
<tr>
<td>299</td>
<td>Control System</td>
<td>CST</td>
<td>CP3N</td>
</tr>
<tr>
<td>300</td>
<td>POE Injector</td>
<td>CST</td>
<td>As needed</td>
</tr>
<tr>
<td>301</td>
<td>Control Touchscreen, 10&quot;</td>
<td>CST</td>
<td>TSW-1060</td>
</tr>
<tr>
<td>302</td>
<td>UPS Line Interactive 2.2kVA</td>
<td>MAP</td>
<td>UPS-2200R</td>
</tr>
<tr>
<td>303</td>
<td>Rack Panel, Blanks</td>
<td>MAP</td>
<td>As required, lot</td>
</tr>
<tr>
<td>304</td>
<td>Power Sequencer Panel</td>
<td>LYN</td>
<td>RCPR-16</td>
</tr>
<tr>
<td>305</td>
<td>Projector, 1DLP, 8k lumen, laser phosphor</td>
<td>DPI</td>
<td>E-Vision Laser 8500</td>
</tr>
<tr>
<td>306</td>
<td>Lens, Projector</td>
<td>DPI</td>
<td>As needed</td>
</tr>
<tr>
<td>307</td>
<td>Decoder, Video</td>
<td>AMX</td>
<td>NMX-DEC-N1222</td>
</tr>
<tr>
<td>308</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### REHEARSAL ROOMS

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Vendor</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>309</td>
<td>Hub - Local Rack</td>
<td>CUS</td>
<td>per drawing ZH</td>
</tr>
<tr>
<td>310</td>
<td>Recording Mic Patch Panel</td>
<td>CUS</td>
<td>Per drawing</td>
</tr>
<tr>
<td>311</td>
<td>DSP, Open Architecture, 4x4</td>
<td>BMP</td>
<td>Prism 12X12</td>
</tr>
<tr>
<td>312</td>
<td>Recorder, Network Audio</td>
<td>TAS</td>
<td>SS-R250N</td>
</tr>
<tr>
<td>313</td>
<td>Switcher, Video</td>
<td>CST</td>
<td>DMPS3-4K-150-C</td>
</tr>
<tr>
<td>314</td>
<td>Switcher, Video</td>
<td>CST</td>
<td>DMPS3-300-C</td>
</tr>
<tr>
<td>315</td>
<td>Video Playback, BluRay</td>
<td>SNY</td>
<td>UBP-X800</td>
</tr>
<tr>
<td>316</td>
<td>BluRay Rack Mount Kit</td>
<td>CUS</td>
<td>As needed</td>
</tr>
<tr>
<td>317</td>
<td>Rack Panel, Computer Mount</td>
<td>CUS</td>
<td>As needed</td>
</tr>
<tr>
<td>318</td>
<td>Computer, Control</td>
<td>TBD</td>
<td>OFE</td>
</tr>
<tr>
<td>319</td>
<td>Camera, Video PTZ</td>
<td>VDO</td>
<td>VPTZH-04</td>
</tr>
<tr>
<td>320</td>
<td>Accessory, Camera, Wall Mount</td>
<td>VDO</td>
<td>As needed</td>
</tr>
<tr>
<td>321</td>
<td>USB Extender TX</td>
<td>VDO</td>
<td>Springline TX</td>
</tr>
<tr>
<td>322</td>
<td>USB Extender RX</td>
<td>VDO</td>
<td>Springline RX</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Manufacturer</td>
<td>Quantity</td>
</tr>
<tr>
<td>------</td>
<td>-------------------------------------------------------</td>
<td>--------------</td>
<td>----------</td>
</tr>
<tr>
<td>324</td>
<td>Presenter Input</td>
<td>CST</td>
<td>3</td>
</tr>
<tr>
<td>325</td>
<td>Control Touchscreen, 10&quot;</td>
<td>TSW-1060</td>
<td>3</td>
</tr>
<tr>
<td>326</td>
<td>Touchscreen Rackmount</td>
<td>As needed</td>
<td>3</td>
</tr>
<tr>
<td>327</td>
<td>Presentation Touch Screen</td>
<td>SP518-NB</td>
<td>3</td>
</tr>
<tr>
<td>328</td>
<td>Articulating Mount for Presentation Screen</td>
<td>CHF</td>
<td>TBD</td>
</tr>
<tr>
<td>329</td>
<td>Switch, D-Audio/D-Video/Control, 10P Managed, POE</td>
<td>SG300-10MPP</td>
<td>3</td>
</tr>
<tr>
<td>330</td>
<td>Document Camera</td>
<td>ELM</td>
<td>P30HD:1338</td>
</tr>
<tr>
<td>331</td>
<td>Loudspeaker</td>
<td>FUL</td>
<td>FA28AC</td>
</tr>
<tr>
<td>332</td>
<td>Loudspeaker Mount</td>
<td>ATM</td>
<td>MM-060-BT</td>
</tr>
<tr>
<td>333</td>
<td>Projector, 1DLP, 6k lumen, laser phosphor</td>
<td>NEC</td>
<td>NP-PX602UL</td>
</tr>
<tr>
<td>334</td>
<td>Lens, Projector</td>
<td>NEC</td>
<td>As needed</td>
</tr>
<tr>
<td>335</td>
<td>Projector Mount</td>
<td>CHF</td>
<td>As needed</td>
</tr>
<tr>
<td>336</td>
<td>Decoder, Video</td>
<td>CST</td>
<td>DM-RMC-4K-100-C</td>
</tr>
<tr>
<td>337</td>
<td>Screen, Tab Tensioned, 16:10, RP</td>
<td>DLT</td>
<td>Mnfctr Quote #TBD</td>
</tr>
<tr>
<td>338</td>
<td>Screen, Tab Tensioned, 16:10, FP</td>
<td>DLT</td>
<td>Mnfctr Quote #TBD</td>
</tr>
<tr>
<td>339</td>
<td>Lectern</td>
<td>SPI</td>
<td>TBD</td>
</tr>
<tr>
<td>340</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>341</td>
<td>LOBBY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>342</td>
<td>Display, Video, Commercial Grade, 65&quot;, 4K</td>
<td>SMG</td>
<td>QM65H</td>
</tr>
<tr>
<td>343</td>
<td>Decoder, Video</td>
<td>AMX</td>
<td>NMX-DEC-N1222</td>
</tr>
<tr>
<td>344</td>
<td>Signage Player</td>
<td>BRT</td>
<td>XD233</td>
</tr>
<tr>
<td>345</td>
<td>Mount, Video Display, Wall, Fixed, Large</td>
<td>PRM</td>
<td>UF-PRO310</td>
</tr>
<tr>
<td>346</td>
<td>Loudspeaker, Ceiling, HC, 70V</td>
<td>JBL</td>
<td>Control 47HC</td>
</tr>
<tr>
<td>347</td>
<td>Loudspeaker, Ceiling, 70V</td>
<td>COM</td>
<td>D4</td>
</tr>
<tr>
<td>348</td>
<td>Volume Control</td>
<td>ATL</td>
<td>AT-35PA</td>
</tr>
<tr>
<td>349</td>
<td>System Control Panel</td>
<td>SMX</td>
<td>Arc-K1e</td>
</tr>
<tr>
<td>350</td>
<td>System Control Panel</td>
<td>SMX</td>
<td>Arc-EX4e</td>
</tr>
<tr>
<td>351</td>
<td>Microphone, PTT</td>
<td>SHU</td>
<td>514B</td>
</tr>
<tr>
<td>352</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>353</td>
<td>BACKSTAGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>354</td>
<td>Display, Video, Commercial Grade, 43&quot; W/Tuner</td>
<td>SMG</td>
<td>PM43H</td>
</tr>
<tr>
<td>355</td>
<td>Mount, Video Display, Wall, Fixed, Large</td>
<td>PRM</td>
<td>UF-PRO310</td>
</tr>
<tr>
<td>356</td>
<td>Loudspeaker, Ceiling, 70V</td>
<td>ATL</td>
<td>SD72W</td>
</tr>
<tr>
<td>357</td>
<td>Loudspeaker, Tile Bridge/Baffle/Back Cans</td>
<td>ATL</td>
<td>As needed</td>
</tr>
<tr>
<td>358</td>
<td>Volume Control</td>
<td>ATL</td>
<td>AT-35PA</td>
</tr>
<tr>
<td>359</td>
<td>System Control Panel</td>
<td>SMX</td>
<td>Arc-K1e</td>
</tr>
<tr>
<td>360</td>
<td>System Control Panel</td>
<td>SMX</td>
<td>Arc-EX4e</td>
</tr>
<tr>
<td>361</td>
<td>Loudspeaker, Wall Mount, 70V</td>
<td>ATL</td>
<td>WR-5A</td>
</tr>
<tr>
<td>362</td>
<td>Microphone, PTT</td>
<td>SHU</td>
<td>514B</td>
</tr>
<tr>
<td>363</td>
<td>LOUDSPEAKERS, PORTABLE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>364</td>
<td>Loudspeaker</td>
<td>EAW</td>
<td>JF8</td>
</tr>
<tr>
<td>365</td>
<td>Cable, Loudspeaker, NL4</td>
<td>WWD</td>
<td>NL410</td>
</tr>
<tr>
<td>366</td>
<td>Cable, Loudspeaker, NL4</td>
<td>WWD</td>
<td>NL425</td>
</tr>
<tr>
<td>367</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>368</td>
<td>LOOSE EQUIPMENT, ADA COMPLIANT SYSTEMS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>369</td>
<td>Receiver, RF, iDSP Basic, 12-pack, complete</td>
<td>LSN</td>
<td>LP-41-072</td>
</tr>
<tr>
<td>370</td>
<td>Receiver, IR, iDSP Basic, 12-pack, complete</td>
<td>LSN</td>
<td>LP-41-IR</td>
</tr>
<tr>
<td>371</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Model</td>
<td>Quantity</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
<td>-------</td>
<td>----------</td>
</tr>
<tr>
<td>372</td>
<td>LOOSE EQUIPMENT, INTERCOM</td>
<td>Remote Belt Pack</td>
<td>CLC RS-701</td>
</tr>
<tr>
<td>373</td>
<td>Handset</td>
<td>CLC HS-6</td>
<td>3</td>
</tr>
<tr>
<td>375</td>
<td>Headset-Single Muff</td>
<td>CLC CC-300-X4</td>
<td>18</td>
</tr>
<tr>
<td>376</td>
<td>Call Signal Flasher</td>
<td>CLC FL-7</td>
<td>3</td>
</tr>
<tr>
<td>377</td>
<td>Cable, Microphone, Quad, 10', Black, White Collar</td>
<td>WWD MKQ10NP-WSRWH</td>
<td>8</td>
</tr>
<tr>
<td>378</td>
<td>Cable, Microphone, Quad, 25', Black, Red Collar</td>
<td>WWD MKQ25NP-WSRRD</td>
<td>8</td>
</tr>
<tr>
<td>379</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>380</td>
<td>LOOSE EQUIPMENT, WIRELESS MICS</td>
<td>Transmitter, Bodypack, ULX System</td>
<td>SHU ULXD1</td>
</tr>
<tr>
<td>381</td>
<td>Transmitter, Handheld, ULX System, Beta 58</td>
<td>SHU ULXD2/BETA58A</td>
<td>8</td>
</tr>
<tr>
<td>383</td>
<td>Microphone Lavalier Omni</td>
<td>SEN MKE2-Gold w/ TA4F</td>
<td>16</td>
</tr>
<tr>
<td>384</td>
<td>Microphone Headworn Omni</td>
<td>SEN HSP2 w/TA4F (contractor to supply &amp; terminate TA4F)</td>
<td>16</td>
</tr>
<tr>
<td>386</td>
<td>LOOSE EQUIPMENT, STAGE MICROPHONES &amp; DI'S &amp; I/O</td>
<td>Microphone Dynamic Cardioid</td>
<td>SHU SM57-LC</td>
</tr>
<tr>
<td>387</td>
<td>Microphone Dynamic Cardioid Vocal</td>
<td>SHU SM58-LC</td>
<td>4</td>
</tr>
<tr>
<td>388</td>
<td>Microphone Condenser Cardioid</td>
<td>SHU SM81-LC</td>
<td>4</td>
</tr>
<tr>
<td>389</td>
<td>Microphone Condenser</td>
<td>AKG C451B</td>
<td>4</td>
</tr>
<tr>
<td>390</td>
<td>Microphone Dynamic</td>
<td>ADX D2</td>
<td>3</td>
</tr>
<tr>
<td>391</td>
<td>Microphone Dynamic</td>
<td>ADX D4</td>
<td>2</td>
</tr>
<tr>
<td>392</td>
<td>Microphone Dynamic</td>
<td>ADX D6</td>
<td>1</td>
</tr>
<tr>
<td>393</td>
<td>Microphone Dynamic</td>
<td>BEY M88</td>
<td>2</td>
</tr>
<tr>
<td>394</td>
<td>Microphone Dynamic Cardioid</td>
<td>EVI RE 20</td>
<td>3</td>
</tr>
<tr>
<td>395</td>
<td>Microphone Dynamic Cardioid</td>
<td>SEN MD421 II</td>
<td>8</td>
</tr>
<tr>
<td>396</td>
<td>Microphone Condenser Hemi Boundary</td>
<td>CRN PCC-160</td>
<td>3</td>
</tr>
<tr>
<td>397</td>
<td>Piano Pickup Transducer</td>
<td>CDU CPS-8P</td>
<td>1</td>
</tr>
<tr>
<td>398</td>
<td>Direct Box</td>
<td>CTN Type 85</td>
<td>4</td>
</tr>
<tr>
<td>399</td>
<td>Direct Box</td>
<td>WWD DIRECTOR</td>
<td>2</td>
</tr>
<tr>
<td>400</td>
<td>Direct Box</td>
<td>WWD PCDI</td>
<td>2</td>
</tr>
<tr>
<td>401</td>
<td>Direct Box</td>
<td>WWD PodDI</td>
<td>2</td>
</tr>
<tr>
<td>402</td>
<td>Direct Box Cable</td>
<td>WWD L06</td>
<td>6</td>
</tr>
<tr>
<td>403</td>
<td>Console Stage Box</td>
<td>YAM Rio1608D</td>
<td>2</td>
</tr>
<tr>
<td>404</td>
<td>Rack for Stage Box</td>
<td>SKB 1SKB-R3U</td>
<td>2</td>
</tr>
<tr>
<td>405</td>
<td>Stage Box Digital Cable</td>
<td>WWD ENC2S030</td>
<td>4</td>
</tr>
<tr>
<td>406</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>407</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>408</td>
<td>LOOSE EQUIPMENT, STANDS / CABLES / ACCESSORIES</td>
<td>Microphone Stand, Stackable, 35-63in,</td>
<td>KNM 26045-500-55</td>
</tr>
<tr>
<td>409</td>
<td>Microphone Boom 16in</td>
<td>KNM 21160-577-55</td>
<td>12</td>
</tr>
<tr>
<td>410</td>
<td>Microphone Case</td>
<td>SKB 3I-2011-MC12</td>
<td>4</td>
</tr>
<tr>
<td>411</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>412</td>
<td>Cable, Microphone, Quad, 3', Black, Black Collar</td>
<td>WWD MKQ03NP-WSRBK</td>
<td>12</td>
</tr>
<tr>
<td>413</td>
<td>Cable, Microphone, Quad, 10', Black, White Collar</td>
<td>WWD MKQ10NP-WSRWH</td>
<td>20</td>
</tr>
<tr>
<td>414</td>
<td>Cable, Microphone, Quad, 25', Black, Red Collar</td>
<td>WWD MKQ25NP-WSRRD</td>
<td>20</td>
</tr>
<tr>
<td>415</td>
<td>Cable, Microphone, Quad, 50', Black, Blue Collar</td>
<td>WWD MKQ50NP-WSRBL</td>
<td>8</td>
</tr>
<tr>
<td>416</td>
<td>Loudspeaker Stand 44-79in</td>
<td>USS TS-90B</td>
<td>4</td>
</tr>
<tr>
<td>417</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>418</td>
<td>LOOSE EQUIPMENT, MAINTENANCE</td>
<td>Cable Tester</td>
<td>WWD MCT-7</td>
</tr>
<tr>
<td>419</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>420</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**PORTABLE RACK SYSTEMS, LECTERN**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>421</td>
<td>PORTABLE RACK SYSTEMS, LECTERN</td>
<td>SPI</td>
<td>TBD</td>
<td>1</td>
</tr>
<tr>
<td>422</td>
<td>Rack, Lectern Frame</td>
<td>AMX</td>
<td>NMX-ENC-N1122</td>
<td>1</td>
</tr>
<tr>
<td>423</td>
<td>Encoder, Video</td>
<td>SVS</td>
<td>N9420</td>
<td>1</td>
</tr>
<tr>
<td>424</td>
<td>Microphone, Condenser Lectern Short Shot</td>
<td>ATN</td>
<td>ES915SML12</td>
<td>1</td>
</tr>
<tr>
<td>426</td>
<td>Cable, EtherCon6, 25’</td>
<td>WWD</td>
<td>ENC2025</td>
<td>1</td>
</tr>
<tr>
<td>427</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PORTABLE RACK SYSTEMS, STAGE MANAGER**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>428</td>
<td>PORTABLE RACK SYSTEMS, STAGE MANAGER</td>
<td>SKB</td>
<td>1SKB-R8U</td>
<td>2</td>
</tr>
<tr>
<td>429</td>
<td>Rack, Portable</td>
<td>CLC</td>
<td>RM-704</td>
<td>2</td>
</tr>
<tr>
<td>431</td>
<td>Page Panel</td>
<td>CUS</td>
<td>Per drawing</td>
<td>2</td>
</tr>
<tr>
<td>432</td>
<td>Rack Accessories, Panel Light</td>
<td>LIT</td>
<td>RL-10-D-LED</td>
<td>2</td>
</tr>
<tr>
<td>433</td>
<td>Drawer with Lock 2 RU</td>
<td>MAP</td>
<td>D2-LK</td>
<td>2</td>
</tr>
<tr>
<td>434</td>
<td>Cable, Bundle, 15’</td>
<td>CUS</td>
<td>Com+Arc+Power in Snkskn</td>
<td>2</td>
</tr>
<tr>
<td>435</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**APPENDIX B – ADD ALTERNATE COMPONENTS**

**LOBBY PORTABLE RACK**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>436</td>
<td>LOBBY PORTABLE RACK</td>
<td>OMR</td>
<td>CW30</td>
<td>1</td>
</tr>
<tr>
<td>438</td>
<td>Provide cable bundle in snakeskin for cables listed below</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>439</td>
<td>Drawer with Lock 3 RU</td>
<td>MAP</td>
<td>D3-LK</td>
<td>2</td>
</tr>
<tr>
<td>440</td>
<td>Digital Console and Accessories</td>
<td>YAM</td>
<td>TF-1</td>
<td>1</td>
</tr>
<tr>
<td>441</td>
<td>Interface Card, Console, Dante</td>
<td>YAM</td>
<td>NY64-D</td>
<td>1</td>
</tr>
<tr>
<td>442</td>
<td>Accessory, Rack Ears, Console</td>
<td>SKB</td>
<td>1SKB-RE-TF1</td>
<td>1</td>
</tr>
<tr>
<td>443</td>
<td>Power distribution, rack, 15A, 1u</td>
<td>APC</td>
<td>G5BLK</td>
<td>1</td>
</tr>
<tr>
<td>444</td>
<td>Cable, power</td>
<td>CUS</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>445</td>
<td>Cable, EtherCon5e, 25’</td>
<td>WWD</td>
<td>ENC2025</td>
<td>1</td>
</tr>
</tbody>
</table>

**APPENDIX C – EQUIPMENT MANUFACTURERS**

<table>
<thead>
<tr>
<th>#</th>
<th>Code</th>
<th>Manufacturer</th>
<th>Web Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AAI</td>
<td>Audio Accessories</td>
<td><a href="http://www.patchbays.com">www.patchbays.com</a></td>
</tr>
<tr>
<td>2</td>
<td>ACN</td>
<td>Alcons Audio</td>
<td><a href="http://www.alconsaudio.com">www.alconsaudio.com</a></td>
</tr>
<tr>
<td>3</td>
<td>ADX</td>
<td>Audix Corporation</td>
<td><a href="http://www.audixusa.com">www.audixusa.com</a></td>
</tr>
<tr>
<td>4</td>
<td>AKG</td>
<td>AKG Acoustics</td>
<td><a href="http://www.akg.com">www.akg.com</a></td>
</tr>
<tr>
<td>5</td>
<td>ALN</td>
<td>Allen Products Company Inc.</td>
<td><a href="http://www.allenproducts.com">www.allenproducts.com</a></td>
</tr>
<tr>
<td>6</td>
<td>ALS</td>
<td>Alesis Studio Electronics</td>
<td><a href="http://www.alesis.com">www.alesis.com</a></td>
</tr>
<tr>
<td>7</td>
<td>AMX</td>
<td>AMX</td>
<td><a href="http://www.amx.com">www.amx.com</a></td>
</tr>
<tr>
<td>8</td>
<td>ANH</td>
<td>Allen and Heath USA</td>
<td><a href="http://www.allen-heath.com">www.allen-heath.com</a></td>
</tr>
<tr>
<td>9</td>
<td>APL</td>
<td>Apple Computer</td>
<td><a href="http://www.apple.com">www.apple.com</a></td>
</tr>
<tr>
<td>10</td>
<td>ASH</td>
<td>Ashly Audio</td>
<td><a href="http://www.ashly.com">www.ashly.com</a></td>
</tr>
<tr>
<td>11</td>
<td>ATL</td>
<td>Atlas Sound</td>
<td><a href="http://www.atlassound.com">www.atlassound.com</a></td>
</tr>
<tr>
<td>12</td>
<td>ATM</td>
<td>ATM Fly-Ware</td>
<td><a href="http://www.atmflyware.com">www.atmflyware.com</a></td>
</tr>
<tr>
<td>13</td>
<td>ATN</td>
<td>Audio-Technica</td>
<td><a href="http://www.audiotechnica.com">www.audiotechnica.com</a></td>
</tr>
<tr>
<td>14</td>
<td>AVM</td>
<td>Aviom</td>
<td><a href="http://www.aviom.com">www.aviom.com</a></td>
</tr>
<tr>
<td>15</td>
<td>BEL</td>
<td>Belden Wire and Cable</td>
<td><a href="http://www.belden.com">www.belden.com</a></td>
</tr>
<tr>
<td>16</td>
<td>BEY</td>
<td>Beyerdynamic</td>
<td><a href="http://www.beyerdynamic.com">www.beyerdynamic.com</a></td>
</tr>
<tr>
<td>17</td>
<td>BMD</td>
<td>Black Magic Designs</td>
<td><a href="http://www.blackmagicdesign.com">www.blackmagicdesign.com</a></td>
</tr>
<tr>
<td>18</td>
<td>BMP</td>
<td>Biamp Systems</td>
<td><a href="http://www.biamp.com">www.biamp.com</a></td>
</tr>
<tr>
<td>19</td>
<td>BOS</td>
<td>Bose Corporation</td>
<td><a href="http://www.bose.com">www.bose.com</a></td>
</tr>
<tr>
<td>20</td>
<td>BRT</td>
<td>BrightSign</td>
<td><a href="http://www.brightsight.biz">www.brightsight.biz</a></td>
</tr>
<tr>
<td>21</td>
<td>BSS</td>
<td>BSS Audio USA</td>
<td><a href="http://www.bss.co.uk">www.bss.co.uk</a></td>
</tr>
<tr>
<td>22</td>
<td>BTL</td>
<td>Blonder-Tongue Laboratories</td>
<td><a href="http://www.blondertongue.com">www.blondertongue.com</a></td>
</tr>
<tr>
<td>23</td>
<td>CAG</td>
<td>CAIG Laboratories</td>
<td><a href="http://www.caig.com">www.caig.com</a></td>
</tr>
<tr>
<td>24</td>
<td>CDU</td>
<td>C-Ducer</td>
<td><a href="http://www.c-ducer.com">www.c-ducer.com</a></td>
</tr>
<tr>
<td>25</td>
<td>CHF</td>
<td>Chief Manufacturing</td>
<td><a href="http://www.chiefmfg.com">www.chiefmfg.com</a></td>
</tr>
<tr>
<td>26</td>
<td>CIS</td>
<td>Cisco Systems</td>
<td><a href="http://www.cisco.com">www.cisco.com</a></td>
</tr>
<tr>
<td>27</td>
<td>CLC</td>
<td>Clear-Com</td>
<td><a href="http://www.clearcom.com">www.clearcom.com</a></td>
</tr>
<tr>
<td>28</td>
<td>COM</td>
<td>Community Professional Loudspeakers</td>
<td><a href="http://www.community.chester.pa.us">www.community.chester.pa.us</a></td>
</tr>
<tr>
<td>29</td>
<td>CRN</td>
<td>Crown International</td>
<td><a href="http://www.crownaudio.com">www.crownaudio.com</a></td>
</tr>
<tr>
<td>30</td>
<td>CST</td>
<td>Crestron Electronics</td>
<td><a href="http://www.crestron.com">www.crestron.com</a></td>
</tr>
<tr>
<td>31</td>
<td>CTE</td>
<td>Christie Digital</td>
<td><a href="http://www.christiedigital.com">www.christiedigital.com</a></td>
</tr>
<tr>
<td>32</td>
<td>CTM</td>
<td>Countryman Associates</td>
<td><a href="http://www.countryman.com">www.countryman.com</a></td>
</tr>
<tr>
<td>33</td>
<td>CUS</td>
<td>Custom Built by Audio Contractor</td>
<td><a href="http://www.cus.com">www.cus.com</a></td>
</tr>
<tr>
<td>34</td>
<td>DBX</td>
<td>dbx Professional Products</td>
<td><a href="http://www.dbxpro.com">www.dbxpro.com</a></td>
</tr>
<tr>
<td>35</td>
<td>DDI</td>
<td>Display Devices</td>
<td><a href="http://www.displaydevices.com">www.displaydevices.com</a></td>
</tr>
<tr>
<td>36</td>
<td>DEL</td>
<td>Dell Computer</td>
<td><a href="http://www.dell.com">www.dell.com</a></td>
</tr>
<tr>
<td>37</td>
<td>DEN</td>
<td>Denon Corporation</td>
<td><a href="http://www.usa.denon.com">www.usa.denon.com</a></td>
</tr>
<tr>
<td>38</td>
<td>DLT</td>
<td>Da-Lite Screen Company</td>
<td><a href="http://www.dalite.com">www.dalite.com</a></td>
</tr>
<tr>
<td>39</td>
<td>DNB</td>
<td>d&amp;b Audiotechnik Corp.</td>
<td><a href="http://www.dbaudio.com">www.dbaudio.com</a></td>
</tr>
<tr>
<td>40</td>
<td>DPA</td>
<td>DPA Microphones</td>
<td><a href="http://www.dpamicrophones.com">www.dpamicrophones.com</a></td>
</tr>
<tr>
<td>41</td>
<td>DPI</td>
<td>Digital Projection</td>
<td><a href="http://www.digitalprojection.com">www.digitalprojection.com</a></td>
</tr>
<tr>
<td>42</td>
<td>DRA</td>
<td>Draper</td>
<td><a href="http://www.draperinc.com">www.draperinc.com</a></td>
</tr>
<tr>
<td>43</td>
<td>EAW</td>
<td>Eastern Acoustic Works</td>
<td><a href="http://www.eaw.com">www.eaw.com</a></td>
</tr>
<tr>
<td>44</td>
<td>ELM</td>
<td>Elmo Presentation</td>
<td><a href="http://www.elmousa.com">www.elmousa.com</a></td>
</tr>
<tr>
<td>45</td>
<td>EVI</td>
<td>Electro-Voice</td>
<td><a href="http://www.electrovoice.com">www.electrovoice.com</a></td>
</tr>
<tr>
<td>46</td>
<td>EWK</td>
<td>Earthworks</td>
<td><a href="http://www.earthworksaudio.com">www.earthworksaudio.com</a></td>
</tr>
<tr>
<td>47</td>
<td>EXT</td>
<td>Extron Electronics</td>
<td><a href="http://www.extron.com">www.extron.com</a></td>
</tr>
<tr>
<td>48</td>
<td>FUL</td>
<td>Fulcrum Acoustic</td>
<td><a href="http://www.fulcrum-acoustic.com">www.fulcrum-acoustic.com</a></td>
</tr>
<tr>
<td>49</td>
<td>FLK</td>
<td>John Fluke Manufacturing Company</td>
<td><a href="http://www.fluke.com">www.fluke.com</a></td>
</tr>
<tr>
<td>50</td>
<td>FOC</td>
<td>Focusrite</td>
<td><a href="http://www.focusrite.com">www.focusrite.com</a></td>
</tr>
<tr>
<td>51</td>
<td>FSR</td>
<td>FSR</td>
<td><a href="http://www.fsrinc.com">www.fsrinc.com</a></td>
</tr>
<tr>
<td>52</td>
<td>FUR</td>
<td>Furman Sound</td>
<td><a href="http://www.furmansound.com">www.furmansound.com</a></td>
</tr>
<tr>
<td>53</td>
<td>GKD</td>
<td>Geekdesk</td>
<td><a href="http://www.geekdesk.com">www.geekdesk.com</a></td>
</tr>
<tr>
<td>54</td>
<td>GLX</td>
<td>Galaxy Audio</td>
<td><a href="http://www.galaxyaudio.com">www.galaxyaudio.com</a></td>
</tr>
<tr>
<td>55</td>
<td>GNL</td>
<td>Genelec Inc.</td>
<td><a href="http://www.genelec.com">www.genelec.com</a></td>
</tr>
<tr>
<td>56</td>
<td>HOF</td>
<td>Hoffman Engineering Company</td>
<td><a href="http://www.hoffmanonline.com">www.hoffmanonline.com</a></td>
</tr>
<tr>
<td>57</td>
<td>IVX</td>
<td>Innovox Audio</td>
<td><a href="http://www.innovoxaudio.com">www.innovoxaudio.com</a></td>
</tr>
<tr>
<td>58</td>
<td>JBL</td>
<td>JBL Professional Products</td>
<td><a href="http://www.jblpro.com">www.jblpro.com</a></td>
</tr>
<tr>
<td>59</td>
<td>JEN</td>
<td>Jensen Tools</td>
<td><a href="http://www.jensentools.com">www.jensentools.com</a></td>
</tr>
<tr>
<td>60</td>
<td>JTF</td>
<td>Jensen Transformers</td>
<td><a href="http://www.jensen-transformers.com">www.jensen-transformers.com</a></td>
</tr>
<tr>
<td>61</td>
<td>KNM</td>
<td>Konig &amp; Meyer</td>
<td><a href="http://www.k-m.de">www.k-m.de</a></td>
</tr>
<tr>
<td>62</td>
<td>LAC</td>
<td>L-Acoustics US</td>
<td><a href="http://www.l-acoustics-us.com">www.l-acoustics-us.com</a></td>
</tr>
<tr>
<td>63</td>
<td>LEX</td>
<td>Lexicon</td>
<td><a href="http://www.lexicon.com">www.lexicon.com</a></td>
</tr>
<tr>
<td>64</td>
<td>LGE</td>
<td>LG Electronics</td>
<td><a href="http://www.lge.com">www.lge.com</a></td>
</tr>
<tr>
<td>65</td>
<td>LGP</td>
<td>Lab Gruppen</td>
<td><a href="http://www.labgruppen.se">www.labgruppen.se</a></td>
</tr>
<tr>
<td>66</td>
<td>LIT</td>
<td>Littlite/CAE</td>
<td><a href="http://www.littlite.com">www.littlite.com</a></td>
</tr>
<tr>
<td>67</td>
<td>LSN</td>
<td>Listen Technologies Corporation</td>
<td><a href="http://www.listentech.com">www.listentech.com</a></td>
</tr>
<tr>
<td></td>
<td>Company</td>
<td>Website</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>------------------</td>
<td>--------------------------------</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>LYN LynTec</td>
<td><a href="http://www.lyntec.com">www.lyntec.com</a></td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>MAP Middle Atlantic Products</td>
<td><a href="http://www.middleatlantic.com">www.middleatlantic.com</a></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>MEY Meyer Sound Laboratories</td>
<td><a href="http://www.meyersound.com">www.meyersound.com</a></td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>NEC NEC</td>
<td><a href="http://www.necdisplay.com">www.necdisplay.com</a></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>NEU Neumann USA</td>
<td><a href="http://www.neumann.com">www.neumann.com</a></td>
<td></td>
</tr>
<tr>
<td>73</td>
<td>NTK Neutrik USA</td>
<td><a href="http://www.neutrik.com">www.neutrik.com</a></td>
<td></td>
</tr>
<tr>
<td>74</td>
<td>OMN Omnimount Systems</td>
<td><a href="http://www.omnimount.com">www.omnimount.com</a></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>OPO OPPO Digital</td>
<td><a href="http://www.oppodigital.com">www.oppodigital.com</a></td>
<td></td>
</tr>
<tr>
<td>76</td>
<td>PAN Panasonic USA</td>
<td><a href="http://www.panasonic.com">www.panasonic.com</a></td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>PCM Polycam</td>
<td><a href="http://www.polycom.com">www.polycom.com</a></td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>PER Peerless Industries</td>
<td><a href="http://www.peerlessmounts.com">www.peerlessmounts.com</a></td>
<td></td>
</tr>
<tr>
<td>79</td>
<td>PFS Polar Focus</td>
<td><a href="http://www.polarfocus.com">www.polarfocus.com</a></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>PRM ProMounts</td>
<td><a href="http://www.promounts.com">www.promounts.com</a></td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>QSC QSC Audio Products</td>
<td><a href="http://www.qscaudio.com">www.qscaudio.com</a></td>
<td></td>
</tr>
<tr>
<td>82</td>
<td>RDL Radio Design Labs</td>
<td><a href="http://www.rdlnet.com">www.rdlnet.com</a></td>
<td></td>
</tr>
<tr>
<td>83</td>
<td>RHZ Renkus-Heinz</td>
<td><a href="http://www.renkus-heinz.com">www.renkus-heinz.com</a></td>
<td></td>
</tr>
<tr>
<td>84</td>
<td>RPG RPG Diffusor Systems</td>
<td><a href="http://www.rpginc.com">www.rpginc.com</a></td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>SCR Soundcraft USA</td>
<td><a href="http://www.soundcraft.com">www.soundcraft.com</a></td>
<td></td>
</tr>
<tr>
<td>86</td>
<td>SEN Sennheiser Electronic Corporation</td>
<td><a href="http://www.sennheiserusa.com">www.sennheiserusa.com</a></td>
<td></td>
</tr>
<tr>
<td>87</td>
<td>SGX Surgex</td>
<td><a href="http://www.surgex.com">www.surgex.com</a></td>
<td></td>
</tr>
<tr>
<td>88</td>
<td>SHU Shure</td>
<td><a href="http://www.shure.com">www.shure.com</a></td>
<td></td>
</tr>
<tr>
<td>89</td>
<td>SKB SKB Corporation</td>
<td><a href="http://www.skbcases.com">www.skbcases.com</a></td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>SMG Samsung</td>
<td><a href="http://www.samsung.com">www.samsung.com</a></td>
<td></td>
</tr>
<tr>
<td>91</td>
<td>SMX Symetrix</td>
<td><a href="http://www.symetrixaudio.com">www.symetrixaudio.com</a></td>
<td></td>
</tr>
<tr>
<td>92</td>
<td>SMT Smart Technologies</td>
<td><a href="http://www.smarttech.com">www.smarttech.com</a></td>
<td></td>
</tr>
<tr>
<td>93</td>
<td>SNY Sony Electronics</td>
<td><a href="http://www.sony.com">www.sony.com</a></td>
<td></td>
</tr>
<tr>
<td>94</td>
<td>SQD Square D Company</td>
<td><a href="http://www.squared.com">www.squared.com</a></td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>SRP Sharp Electronics</td>
<td><a href="http://www.sharpsusa.com">www.sharpsusa.com</a></td>
<td></td>
</tr>
<tr>
<td>96</td>
<td>STW Stewart Audio</td>
<td><a href="http://www.stewartaudio.com">www.stewartaudio.com</a></td>
<td></td>
</tr>
<tr>
<td>97</td>
<td>SWC Switchcraft</td>
<td><a href="http://www.switchcraft.com">www.switchcraft.com</a></td>
<td></td>
</tr>
<tr>
<td>98</td>
<td>TAN Tannoy North America</td>
<td><a href="http://www.tannoy.com">www.tannoy.com</a></td>
<td></td>
</tr>
<tr>
<td>99</td>
<td>TAS Tascam</td>
<td><a href="http://www.tascam.com">www.tascam.com</a></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>TCE TC Electronic of Denmark</td>
<td><a href="http://www.tcelectronic.com">www.tcelectronic.com</a></td>
<td></td>
</tr>
<tr>
<td>101</td>
<td>TLX Telex Communications</td>
<td><a href="http://www.telex.com">www.telex.com</a></td>
<td></td>
</tr>
<tr>
<td>102</td>
<td>TMB TMB</td>
<td><a href="http://www.tmb.com">www.tmb.com</a></td>
<td></td>
</tr>
<tr>
<td>103</td>
<td>TOA TOA Electronics</td>
<td><a href="http://www.toaelectronics.com">www.toaelectronics.com</a></td>
<td></td>
</tr>
<tr>
<td>104</td>
<td>TPL Tripp Lite</td>
<td><a href="http://www.tripplite.com">www.tripplite.com</a></td>
<td></td>
</tr>
<tr>
<td>105</td>
<td>UNC Union Connector Company</td>
<td><a href="http://www.unionconnector.com">www.unionconnector.com</a></td>
<td></td>
</tr>
<tr>
<td>106</td>
<td>USS Ultimate Support Systems</td>
<td><a href="http://www.ultimate-support.com">www.ultimate-support.com</a></td>
<td></td>
</tr>
<tr>
<td>107</td>
<td>VAD Vaddio</td>
<td><a href="http://www.vaddio.com">www.vaddio.com</a></td>
<td></td>
</tr>
<tr>
<td>108</td>
<td>VDO VDO360</td>
<td><a href="http://www.vdo360.com">www.vdo360.com</a></td>
<td></td>
</tr>
<tr>
<td>109</td>
<td>VTK Videotek</td>
<td><a href="http://www.broadcast.harris.com">www.broadcast.harris.com</a></td>
<td></td>
</tr>
<tr>
<td>110</td>
<td>WLR Wohler Technologies</td>
<td><a href="http://www.wohler.com">www.wohler.com</a></td>
<td></td>
</tr>
<tr>
<td>111</td>
<td>WPW West Penn Wire/CDT</td>
<td><a href="http://www.westpenn-cdt.com">www.westpenn-cdt.com</a></td>
<td></td>
</tr>
<tr>
<td>112</td>
<td>WRM Wiremold Company</td>
<td><a href="http://www.wiremold.com">www.wiremold.com</a></td>
<td></td>
</tr>
<tr>
<td>113</td>
<td>WWD Whirlwind Music</td>
<td><a href="http://www.whirlwindusa.com">www.whirlwindusa.com</a></td>
<td></td>
</tr>
<tr>
<td>114</td>
<td>WWK Wireworks Corporation</td>
<td><a href="http://www.wireworks.com">www.wireworks.com</a></td>
<td></td>
</tr>
<tr>
<td>115</td>
<td>XED Xedit</td>
<td><a href="http://www.servoreelers.com">www.servoreelers.com</a></td>
<td></td>
</tr>
<tr>
<td>116</td>
<td>XTA XTA Electronics</td>
<td><a href="http://www.xta.co.uk">www.xta.co.uk</a></td>
<td></td>
</tr>
<tr>
<td>117</td>
<td>YAM Yamaha Commercial Audio</td>
<td><a href="http://www.yamaha.com">www.yamaha.com</a></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- The table lists the manufacturers of audio and video equipment.
- The website links are provided for each company.
## APPENDIX D – LARGE-FORMAT DRAWINGS

<table>
<thead>
<tr>
<th>#</th>
<th>Drawing Number</th>
<th>Drawing Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AV010</td>
<td>AV SYSTEMS: GENERAL NOTES &amp; INSTRUCTIONS</td>
</tr>
<tr>
<td>2</td>
<td>AV011</td>
<td>AV SYSTEMS: ELECTRICAL COORDINATION</td>
</tr>
<tr>
<td>3</td>
<td>AV111</td>
<td>AV SYSTEMS: GROUND LEVEL QUADRANT 1 TERMINATIONS</td>
</tr>
<tr>
<td>4</td>
<td>AV112</td>
<td>AV SYSTEMS: GROUND LEVEL QUADRANT 2 TERMINATIONS</td>
</tr>
<tr>
<td>5</td>
<td>AV113</td>
<td>AV SYSTEMS: GROUND LEVEL QUADRANT 3 TERMINATIONS</td>
</tr>
<tr>
<td>6</td>
<td>AV114</td>
<td>AV SYSTEMS: GROUND LEVEL QUADRANT 4 TERMINATIONS</td>
</tr>
<tr>
<td>7</td>
<td>AV121</td>
<td>AV SYSTEMS: UPPER LEVEL QUADRANT 1 TERMINATIONS</td>
</tr>
<tr>
<td>8</td>
<td>AV123</td>
<td>AV SYSTEMS: UPPER LEVEL QUADRANT 3 TERMINATIONS</td>
</tr>
<tr>
<td>9</td>
<td>AV124</td>
<td>AV SYSTEMS: UPPER LEVEL QUADRANT 4 TERMINATIONS</td>
</tr>
<tr>
<td>10</td>
<td>AV131A</td>
<td>AV SYSTEMS: TECHNICAL LEVEL TERMINATIONS</td>
</tr>
<tr>
<td>11</td>
<td>AV131B</td>
<td>AV SYSTEMS: GRID LEVEL TERMINATIONS</td>
</tr>
<tr>
<td>12</td>
<td>AV201</td>
<td>AV SYSTEMS: CONCERT HALL MAIN DEVICES</td>
</tr>
<tr>
<td>13</td>
<td>AV202</td>
<td>AV SYSTEMS: RECITAL HALL MAIN DEVICES</td>
</tr>
<tr>
<td>14</td>
<td>AV203</td>
<td>AV SYSTEMS: DEVICE MOUNTING DETAILS</td>
</tr>
<tr>
<td>15</td>
<td>AV204</td>
<td>AV SYSTEMS: DEVICE MOUNTING DETAILS</td>
</tr>
<tr>
<td>16</td>
<td>AV301</td>
<td>AV SYSTEMS: SERIES A PANELS</td>
</tr>
<tr>
<td>17</td>
<td>AV302</td>
<td>AV SYSTEMS: SERIES B &amp; C PANELS</td>
</tr>
<tr>
<td>18</td>
<td>AV303</td>
<td>AV SYSTEMS: SERIES D PANELS</td>
</tr>
<tr>
<td>19</td>
<td>AV304</td>
<td>AV SYSTEMS: SERIES E PANELS</td>
</tr>
<tr>
<td>20</td>
<td>AV305</td>
<td>AV SYSTEMS: SERIES F &amp; H PANELS</td>
</tr>
<tr>
<td>21</td>
<td>AV401</td>
<td>AV SYSTEMS: PRIMARY RACK ELEVATIONS</td>
</tr>
<tr>
<td>22</td>
<td>AV402</td>
<td>AV SYSTEMS: SUPPLEMENTAL RACKS &amp; RACK PANEL DETAILS</td>
</tr>
<tr>
<td>23</td>
<td>AV701</td>
<td>AV SYSTEMS: RACK ZA SIGNAL FLOW</td>
</tr>
<tr>
<td>24</td>
<td>AV702</td>
<td>AV SYSTEMS: RACK ZC LINEAR SIGNAL FLOW PART A</td>
</tr>
<tr>
<td>25</td>
<td>AV703</td>
<td>AV SYSTEMS: RACK ZC LINEAR SIGNAL FLOW PART B</td>
</tr>
<tr>
<td>26</td>
<td>AV704</td>
<td>AV SYSTEMS: RACK ZC NETWORK SIGNAL FLOW</td>
</tr>
<tr>
<td>27</td>
<td>AV705</td>
<td>AV SYSTEMS: RACK ZD LINEAR SIGNAL FLOW</td>
</tr>
<tr>
<td>28</td>
<td>AV706</td>
<td>AV SYSTEMS: RACK ZD NETWORK SIGNAL FLOW</td>
</tr>
<tr>
<td>29</td>
<td>AV707</td>
<td>AV SYSTEMS: RACK ZE LINEAR SIGNAL FLOW</td>
</tr>
<tr>
<td>30</td>
<td>AV708</td>
<td>AV SYSTEMS: RACK ZE NETWORK SIGNAL FLOW</td>
</tr>
<tr>
<td>31</td>
<td>AV709</td>
<td>AV SYSTEMS: REHEARSAL ROOM SIGNAL FLOWS</td>
</tr>
<tr>
<td>32</td>
<td>AV710</td>
<td>AV SYSTEMS: SIGNAL FLOW DETAILS</td>
</tr>
</tbody>
</table>

END OF SECTION 27 41 00

©AcousticDistinctions
BLANK PAGE
PART 1 - GENERAL

1.01 SUMMARY
   A. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.
   B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications.
   C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:
      1. Fire alarm and detection operations
      2. Control and monitoring of elevators, smoke control equipment, door hold-open devices, fire suppression systems, emergency power systems, and other equipment as indicated in the drawings and specifications.
      3. One-way supervised automatic voice alarm operations.

1.02 ACCEPTABLE MANUFACTURERS
   A. Manufacturers: The equipment and service described in this specification are those supplied and supported by SimplexGrinnell and represent the base bid for the equipment. Substitutes will not be considered.

1.03 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
   B. The work covered by this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following sections apply:
      1. Division 26: "Basic Electrical Materials and Methods."
      2. Division 26: "Wiring Methods."
      3. Division 21: "Fire Protection"
      4. Division 23: "HVAC Systems"
   C. The system and all associated operations shall be in accordance with the following:
      1. Guidelines of the following Building Code: BOCA
      2. NFPA 72, National Fire Alarm Code
      3. NFPA 70, National Electrical Code
      5. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
      6. Other applicable NFPA standards
      7. Local Jurisdictional Adopted Codes and Standards
      8. ADA Accessibility Guidelines

1.04 SYSTEM DESCRIPTION
   A. General: Provide a complete, non-coded, addressable microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein. Connect the new fire alarm panel to the existing toke and ring fire alarm network via fiber optic cable, make any and all fiber connections necessary for a complete fire alarm network.
B. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory. System shall be capable of storing dual configuration programs with one active and one in reserve. Panel shall be capable of full system operation during a new configuration download.

C. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.

D. Recording of Events: Record all alarm, supervisory, and trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the occurrence. The printout differentiates alarm signals from all other printed indications.

E. Wiring/Signal Transmission:
   1. Transmission shall be hard-wired, using separate individual circuits for each zone of alarm operation as required or addressable signal transmission, dedicated to fire alarm service only.
   2. System connections for initiating (signaling) circuits and notification appliance circuits shall be Class B.
   3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone.

F. Remote Access:
   1. FACP shall have the capability to provide Remote Access through a Dial-Up Service Modem using the public switched telephone system of a private switched telephone system.
   2. A personal computer or technician's laptop, configured with terminal emulation software shall have the ability to access the FACP for diagnostics, maintenance reporting and information gathering.
   3. FACP shall have the capability to provide Remote Access through a listed Internet Interface via a standard web browser user interface.

G. Required Functions: The following are required system functions and operating features:
   1. Priority of Signals: Alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.
   2. Noninterfering: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent activations.
   3. Transmission to Remote Central Station: Automatically route alarm, supervisory, and trouble signals to a remote central station service transmitter provided under another contract.
   4. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and the remote annunciator, indicating the location and type of device.
   5. General Alarm: A system general alarm shall include:
      a. Indication of alarm condition at the FACP and annunciator(s).
      b. Identification of the device or zone that is the source of the alarm at the FACP.
      c. Operation of audible and visible notification devices throughout the building until silenced at FACP.
      d. Closing doors normally held open by magnetic door holders.
      e. Unlocking designated doors.
      f. Shutting down supply and return fans serving zone where alarm is initiated.
      g. Closing smoke dampers on system serving zone where alarm is initiated.
      h. Initiation of smoke control sequence through the building temperature control system.
i. Notifying the local fire department.

j. Initiation of elevator recall in accordance with ASME/ANSI A17.1, when specified detectors or sensors are activated.

6. Supervisory Operations: Upon activation of a supervisory device such as fire pump power failure, low air pressure switch, and tamper switch, the system shall operate as follows:
   a. Activate the system supervisory service audible signal and illuminate the LED at the control unit and the graphic annunciator.
   b. Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
   c. Record the event in the FACP historical log.
   d. Transmission of supervisory signal to remote central station.
   e. Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.

7. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible alarm signals shall cease operation.

8. System Reset
   a. The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
   b. Should an alarm condition continue, the system will remain in an alarmed state.

9. A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.

10. WALKTEST: The system shall have the capacity of 8 programmable passcode protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:
    a. The city circuit connection and suppression release circuits shall be bypassed for the testing group.
    b. Control relay functions associated to one of the 8 testing groups shall be bypassed.
    c. The control unit shall indicate a trouble condition.
    d. The alarm activation of any initiation device in the testing group shall cause the audible notification appliances to sound a voice announcement code to identify the device or zone.
    e. The unit shall automatically reset itself after signaling is complete.
    f. Any momentary opening of an initiating or notification appliance circuit wiring shall cause the audible signals to voice announce sound for 4 seconds indicating the trouble condition.

H. Analog Smoke Sensors:
   1. Monitoring: FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.
   2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
   3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.
   4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements. The reports shall be viewed on a CRT Display or printed for annual recording and logging of the calibration maintenance schedule.
5. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to indicate that a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate that a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a dirty sensor without creating a trouble in the system. If this indicator is ignored, a second level "DIRTY SENSOR" condition shall be indicated at the FACP and subsequently a system trouble is reported. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.

6. The FACP shall continuously perform an automatic self-test on each sensor which will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.

7. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.

8. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.

9. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.

I. Smoke Detectors: A maintenance and testing service providing the following shall be included with the base bid:
   1. Biannual sensitivity reading and logging for each smoke sensor.
   2. Scheduled biannual threshold adjustments to maintain proper sensitivity for each smoke sensor.
   3. Threshold adjustment to any smoke sensor that has alarmed the system without the presence of particles of combustion.
   4. Scheduled biannual cleaning or replacement of each smoke detector or sensor within the system.
   5. Semi-annual functional testing of each smoke detector or sensor using the manufacturer's calibrated test tool.
   6. Written documentation of all testing, cleaning, replacing, threshold adjustment, and sensitivity reading for each smoke detector or sensor device within the system.
   7. The initial service included in the bid price shall provide the above listed procedures for a period of five years after owner acceptance of the system.

J. Audible Alarm Notification: By voice evacuation and tone signals on loudspeakers in areas as indicated on drawings.
   1. Automatic Voice Evacuation Sequence:
      a. The audio alarm signal shall consist of an alarm tone for a maximum of five seconds followed by an automatic digital voice message. At the end of the voice message, the alarm tone shall resume. This sequence shall sound continuously until the "Alarm Silence" switch is activated.
      b. All audio operations shall be activated by the system software so that any required future changes can be facilitated by authorized personnel without any component rewiring or hardware additions.

K. Speaker: Speaker notification appliances shall be listed to UL 1480.
   1. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted/shielded wire.
   2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
   3. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.
L. Manual Voice Paging
1. The system shall be configured to allow voice paging. Upon activation of any speaker manual control switch, the alarm tone shall be sounded over all speakers in that group.
2. The control panel operator shall be able to make announcements via the push-to-talk paging microphone over the pre-selected speakers.
3. Facility for total building paging shall be accomplished by the means of an "All Call" switch.

M. Fire Suppression Monitoring:
1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.
3. WSO: Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device is in alarm on the initiating zone.

N. Power Requirements
1. The control unit shall receive AC power via a dedicated fused disconnect circuit.
2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 15 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.
3. All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control unit.
4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously while incoming power is present.
5. The system batteries shall be supervised so that a low battery or depleted battery condition or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.
6. The system shall support NAC Lockout feature to prevent subsequent activation of Notification Appliance Circuits after a Depleted Battery condition occurs in order to make use of battery reserve for front panel annunciation and control.
7. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.
8. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

1.05 SUBMITTALS
A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
2. Wiring diagrams from manufacturer.
3. Shop drawings showing system details including location of FACP, all devices, circuiting and details of graphic annunciator.
4. System Power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate per the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.
5. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, NAC, relay, sensor, and auxiliary control circuits.
6. Operating instructions for FACP.
7. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.
8. Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.
9. Record of field tests of system.

B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions if required to make clarifications or revisions to obtain approval.

1.06 QUALITY ASSURANCE
A. Installer Qualifications: A factory authorized installer is to perform the work of this section.
B. Each and all items of the Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "UL" label.

1.07 MAINTENANCE SERVICE
A. Maintenance Service Contract: Provide maintenance of fire alarm systems and equipment for a period of 12 months, using factory-authorized service representatives.
B. Basic Services: Systematic, routine maintenance visits on a quarterly basis at times scheduled with the Owner. In addition, respond to service calls within 24 hours of notification of system trouble. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.
C. Additional Services: Perform services within the above 12-month period not classified as routine maintenance or as warranty work when authorized in writing. Compensation for additional services must be agreed upon in writing prior to performing services.

PART 2 - PRODUCTS

2.01 FIRE ALARM CONTROL PANEL (SIMPLEX 4100-9111)
A. General: Comply with UL 864, "Control Units for Fire-Protective Signaling Systems."
B. The following FACP hardware shall be provided:
1. Power Limited base panel with beige cabinet and door, 120 VAC input power.
2. 2,000 point capacity where (1) point equals (1) monitor (input) or (1) control (output).
3. 2,000 points of Network Annunciation at FACP Display when applied as a Network Node
4. 2000 points of annunciation where one (1) point of annunciation equals:
   a. 1 LED driver output on a graphic driver or 1 switch input on a graphic switch input module.
   b. 1 LED on panel or 1 switch on panel.
5. From all battery charging circuits in the system provide battery voltage and ammeter readouts on the FCP LCD Display.
6. Municipal City Circuit Connection with Disconnect switch, 24VDC Remote Station (reverse polarity), local energy, shunt master box, or a form "C" contact output.
7. One Auxiliary electronically resetable fused 2A @24VDC Output, with programmable disconnect operation for 4-wire detector reset.
8. One Auxiliary Relay, SPDT 2A @32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control.
9. Where required provide Intelligent Remote Battery Charger for charging up to 110Ah batteries.
10. Power Supplies with integral intelligent Notification Appliance Circuit Class B for system expansion.
11. Four (4) form "C" Auxiliary Relay Circuits (Form C contacts rated 2A @ 24VDC, resistive), operation is programmable for trouble, alarm, supervisory of other fire response functions. Relays shall be capable of switching up to ½ A @ 120VAC, inductive.
12. The FACP shall support (6) RS-232-C ports and one service port.
13. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.
14. Programmable DACT for either Common Event Reporting or per Point Reporting.
15. Service Port Modem for dial in passcode access to all fire control panel information.

C. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.

D. Alphanumeric Display and System Controls: Panel shall include an 80 character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.

E. Voice Alarm: Provide an emergency communication system, integral with the FACP, including voice alarm system components, microphones, amplifiers, and tone generators. Features include:
1. Amplifiers comply with UL 1711, "Amplifiers for Fire Protective Signaling Systems." Amplifiers shall provide an onboard local mode temporal coded horn tone as a default backup tone. Test switches on the amplifier shall be provided to test and observe amplifier backup switchover. Each amplifier shall communicate to the host panel amplifier and NAC circuit voltage and current levels for display on the user interface.
2. All announcements are made over dedicated, supervised communication lines. All risers shall support Class B wiring for each audio channel.
3. Emergency voice communication audio controller module shall provide up to 32 minutes of message memory for digitally stored messages. Provide supervised connections for master microphone.

F. Fiber Optic Modem: Network communications shall be via Simplex 4100U Fiber Optic Modems. The fiber modems shall allow Full Duplex/Bi-Directional Network and Audio Communications over a single Fiber Optic Cable. Modems shall use Type ST fiber connections. Modems shall use Multi-Mode 62.5 micron fiber cable. Fiber transmission shall be via split frequency utilizing 1310nm and 1550nm. 4100-6074 Left Port Fiber Modem Assembly, and 4100-6075 Right Port Fiber Modem Assembly.

2.02 REMOTE CRTS, PC ANNUNCIATOR AND PRINTERS
A. Fire Alarm Control Unit shall be capable of operating remote CRT's and/or printers; output shall be ASCII from an RS-232-C connection with an adjustable baud rate.

B. Fire Alarm Control Unit shall be capable of operating a PC Annunciator which provides status annunciation and limited system control using a convenient and familiar Microsoft Windows® 2000 operating system based interface. PC Annunciator shall provide the following functions:
1. Login/logout password protection with time duration selectable automatic logout
2. Displays Alarm, Supervisory, Priority 2, and Trouble conditions with numerical tallies for each
3. Displays first and last alarms
4. Different event types have separate visible indicators with a common audible indicator
5. Event logs can be searched and printed
6. View and/or print TrueAlarm status reports and service reports (printing requires an available local or network printer)
7. Alarm Silence; System Reset; and Priority 2 Reset
8. Global and individual point acknowledge
9. Set system time and date; and clear event log
10. Individual point access for control or parameter revisions
   C. Each RS-232-C port shall be capable of supporting and supervising a remote Printer; the FACP shall support as many as two (2) remote displays. The Fire Alarm Control Panel shall support five (5) RS-232-C ports.

2.03 REMOTE LCD ANNUNCIATOR (SIMPLEX 4603-9101)
   A. Provide Remote LCD Annunciator with the same "look and feel" as the FACP operator interface. The Remote LCD Annunciator shall use the same Primary Acknowledge, Silence, and Reset Keys, Status LEDs and LCD Display as the FACP.
   B. Annunciator shall have super-twist LCD display with two lines of 40 characters each. Annunciator shall be provided with four (4) programmable control switches and associated LEDs.
   C. Under normal conditions the LCD shall display a "SYSTEM IS NORMAL" message and the current time and date.
   D. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.
   E. The LCD shall display the following information relative to the abnormal condition of a point in the system:
      1. 40 character custom location label.
      2. Type of device (e.g., smoke, pull station,水流).
      3. Point status (e.g., alarm, trouble).
   F. Operator keys shall be key switch enabled to prevent unauthorized use. The key shall only be removable in the disabled position. Acknowledge, Silence and Reset operation shall be the same as the FACP.
   G. General: Components include battery, charger, and an automatic transfer switch.
   H. Battery: (SIMPLEX 2081-9276) Sealed lead-acid. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode for a period of 15 minutes.

2.04 ADDRESSABLE MANUAL PULL STATIONS (SIMPLEX 4099-9001)
   A. Description: Addressable single-action type, red LEXAN, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.
   B. Protective Shield: Where required provide a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations. When shield is lifted to gain access to the station, a battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.

2.05 SMOKE SENSORS
   A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
      1. Factory Nameplate: Serial number and type identification.
      2. Operating Voltage: 24 VDC, nominal.
      3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
      4. Each sensor base (SIMPLEX 4098-9792) shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.
5. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.

6. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.

7. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.

8. Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.

9. Removal of the sensor head for cleaning shall not require the setting of addresses.

B. Type: Smoke sensors shall be of the photoelectric (SIMPLEX 4098-9792) or combination photoelectric / heat type (SIMPLEX 4098-9602). Where acceptable per manufacturer specifications, ionization type sensors may be used.

C. Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base.

D. Duct Smoke Sensor: (SIMPLEX 4098-9756) Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for fan shutdown.

1. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct sensor shall be provided by the FACP.

2. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.

3. Duct Housing shall provide a relay control trouble indicator Yellow LED.

4. Compact Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.

5. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.

6. Duct Housing shall provide a magnetic test area and Red sensor status LED.

7. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.

8. Each duct sensor shall have a Remote Test Station with an alarm LED and test switch.

9. Where indicated a NEMA 4X weatherproof duct housing enclosure shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.

2.06 HEAT SENSORS (SIMPLEX 4098-9733)

A. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.

B. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.

C. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and] programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.

D. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.
2.07 ADDRESSABLE CIRCUIT INTERFACE MODULES (SIMPLEX 4090-9001)
   A. Addressable Circuit Interface Modules: Arrange to monitor one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of evacuation indicating appliances and AHU systems.
   B. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

2.08 MAGNETIC DOOR HOLDERS (SIMPLEX 2088-9608)
   A. Description: Units shall be listed to UL 228. Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Unit shall operate from a 120VAC, a 24VAC or a 24VDC source, and develops a minimum of 25 lbs. holding force.
   B. Material and Finish: Match door hardware.

2.09 STANDARD ALARM NOTIFICATION APPLIANCES
   A. VISIBLE ONLY: (SIMPLEX 4906-9101) Strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with selectable flash intensities of 15cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.
   B. SPEAKER/VISIBLE: (SIMPLEX 4906-9151) Combination Speaker/Visible (S/V) units combine the speaker and visible functions into a common housing. The S/V shall be listed to UL 1971 and UL 1480.
      1. Twisted/shielded wire is required for speaker connections on a standard 25VRMS or 70.7VRMS NAC using and UTP conductors, having a minimum of 3 twists per foot is required for addressable strobe connections.
      2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
      3. The S/V shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.
      4. The S/V installs directly to a 4” square, 1 1/2 in. deep electrical box with 1 1/2” extension
   C. Accessories: The contractor shall furnish the necessary accessories.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL
   A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.
   B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
      1. Factory trained and certified personnel.
      2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
      3. Personnel licensed or certified by state or local authority.

50% DESIGN DEVELOPMENT SPECIFICATIONS
ISSUED: 1/30/2017
3.02 EQUIPMENT INSTALLATION
   A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.
   B. All fire alarm panels shall be monitored and networked via the existing campus fiber optic network.
   C. Equipment Removal: After acceptance of the new fire alarm system, disconnect and remove the existing fire alarm equipment and restore damaged surfaces. Package operational fire alarm and detection equipment that has been removed and deliver to the Owner. Remove from the site and legally dispose of the remainder of the existing material. Remove all associated conduit and wiring. Provide blank cover plate over all abandoned outlets recessed in walls.
   D. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.

3.03 WIRING INSTALLATION
   A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AHJ) and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).
   B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.
   C. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.

3.04 FIELD QUALITY CONTROL
   A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.
   B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
      1. Factory trained and certified.
      2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
      3. International Municipal Signal Association (IMSA) fire alarm certified.
      4. Certified by a state or local authority.
      5. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.
   C. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
   D. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.
   E. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72.
   F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log.

H. Final Test, Certificate of Completion, and Certificate of Occupancy:
   1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy.

3.05 CLEANING AND ADJUSTING
   A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.
   B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.06 TRAINING
   A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
      1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours' training.
      2. Schedule training with the Owner at least seven days in advance.

END OF SECTION 28.03.00
SECTION 28 31 33.10
FIRE ALARM SYSTEM
PERFORMANCE EQUIPMENT INTERFACE

PART 1 GENERAL

1.01 SUMMARY
A. Work in this section includes the engineering, manufacture, furnishing, coordination and installation the interface of the fire alarm system to the Performance Equipment Systems.

1.02 SYSTEM DESCRIPTION
A. Section Includes:
   1. Provide all wiring from the main fire alarm control panel to the remote equipment racks associated with the listed systems:
   2. Provide relay and switching devices and all incidental material in order to provide the dry contact closures for connection to the systems circuits.
   3. Connection between Fire Alarm System and Performance Equipment Systems shall comply with NFPA72 requirements of Protected Premises Fire Safety Functions.
      a. The listed fire alarm relays used to initiate control of Protected Premises Fire Safety Functions shall be located within three (3) feet the controlled circuit or appliance.
      b. Because these functions are initiated on loss of power, installation wiring between the fire alarm control unit and the relay is not required to be monitored for integrity.
      c. The wiring between the fire alarm system and the performance equipment systems shall be monitored for integrity.
   B. Provision of a dry contact closure to the Performance Lighting System Emergency Devices to indicate an alarm condition.
      1. Relay operation will cause Performance Lighting System Emergency Devices to be user controllable during “normal” condition and brought to full during “Emergency” condition.
      2. Coordination:
         a. 11 61 61 Contractor will provide Performance Lighting System Emergency Devices with termination points for the fire alarm system contractor to land dry contact closures.
         b. The contractors will coordinate the normal state of this closure.
   C. Proscenium Fire Safety Curtain Interface Requirements
      1. Alarm system actuation by Proscenium Fire Safety Curtain
         a. Coordinate with the 11 61 37 contractor to provide an interface to notify the alarm system of an emergency closure of the Proscenium Fire Safety Curtain.
         b. Integrate a provision in the alarm system such that the Proscenium Fire Safety Curtain emergency release may be tested on a regular basis without triggering a full building alarm event.
      2. Proscenium Fire Safety Curtain actuation by Fire Alarm
         a. When the provided alarm system is composed of addressable notification devices, provide such device to actuate a fire curtain release only when an alarm is triggered in the stage and/or audience zone.
         b. Unless specifically required by the Authority Having Jurisdiction, the Proscenium Fire Safety Curtain should not be actuated by an alarm initiated outside of the stage and/or audience zone.
         c. Coordinate device actuation requirements with 11 61 37 contractor.
   D. Timed smoke disarm for each performance space.
      1. Design Requirements:
         a. Provide a keyed interface that:
            1. Initiates a disarm of the smoke detectors for 3 hours when turned to the left.
            2. Cancels the timed defeat when turned to the right.
3. Indicates the system status.
4. Is labeled “Timed Smoke Detector Disarm”
5. Configure the key to be removable at all times.
   b. Provide one (1) interface per performance space.
   c. Locate interface on control booth wall in the space it controls in a location agreed upon with the architect.
   d. Provide an indicator on the Control Panel displaying smoke disarm condition for each performance space.
   e. Disarm some detectors impacted by atmospheric effects in each space. Include detectors in the stage, audience, ducts, and adjacent spaces.
2. Performance Requirements:
   a. Heavy atmospheric effects should not trigger an alarm condition when the Timed Smoke Detector Disarm is active.

PART 2 PRODUCTS
(UNUSED)

PART 3 EXECUTION

3.01 SYSTEM TESTS AND ADJUSTMENTS
   A. Timed Smoke Detector Disarm
      1. As part of the smoke evacuation test verify that all detectors impacted by smoke are disarmed.
      2. Allow smoke to linger under performance HVAC conditions to that all detectors impacted by smoke are disarmed.
      3. Verify the automatic disarm.
   B. Inputs and Outputs: Verify the correct functioning of all inputs and outputs.

END OF SECTION
SECTION 32.10.00

ASPHALT CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Asphaltic concrete pavement required for this work is indicated on the drawings and includes, but is not necessarily limited to:

1. Final preparation of subgrade.
3. Asphalt surfacing materials.

B. Related Work Described Elsewhere:

1. Grading: Section 31.22.10.
2. Excavation, Backfilling, Compaction: Section 31.22.00.

1.02 QUALITY ASSURANCE

A. Qualifications of Workmen:

1. Provide at least one person who shall be thoroughly trained and experienced in the skills required, who shall be completely familiar with the design and application of work described for this section, and who shall be present at all times during progress of work of this section to direct all work performed under this section.

2. For actual finishing of asphaltic concrete surfaces and operation of the required equipment, use only personnel who are thoroughly trained and experienced in the skills required.

1.03 PRODUCT HANDLING

A. Protection: Use all means necessary to protect asphaltic concrete pavement materials before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Designer and at no additional cost to the Owner.
1.04 DUST CONTROL

A. Use all means necessary to prevent spread of dust during performance of the work of this section. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public.

PART 2 - PRODUCTS

2.01 MINERAL AGGREGATE (STONE) BASE

Tennessee Department of Highways Specifications 903.5, Class A, Grading D, and Specifications Section 303, as adopted March 1, 1995, with Addendums.

2.02 PRIME COAT AND TACK COAT

Bituminous surface treatments shall meet the provisions of Section 402 and 403 of the Tennessee Highway Department Specifications, Revised March 1, 1995.

2.03 HOT-MIX ASPHALT SURFACE COURSE


2.04 HOT-MIX ASPHALT BINDER COURSE


PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that asphaltic concrete pavement shall be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Designer.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 FINAL PREPARATION OF SUBGRADES

A. Refer to drawings for pavement thickness and construction.
B. Subgrade: Constructed to elevations shown on drawings, within a tolerance of 0.10 foot plus or minus under Section 31.22.00, by General Contractor.
   1. Inspect and perform finish grading of subgrade (if required) to the required profiles and grade under this section.
   2. Designer and Contractor shall be informed of deficiencies in the constructed profiles and grade under this section.
C. Aggregate Base Course: Place aggregate base material in compacted layers not more than 4" thick. Compact to not less than 100% of maximum dry density, ASTM D 698, Standard Proctor and construct according to Tennessee Highway Specifications.
D. Prime Coat: Uniformly apply at rate of 0.20 to 0.50 gallon per square yard over compacted and clean sub-base surface. Do not flood the surface. Allow to cure and dry. Blot excess with stone chips or sand.
E. Hot Mix Asphalt Surface Course: Place surface course on prepared surface, spread and strike-off using paving machine. Compact with power driven steel roller weighing not less than 8-tons and according to Tennessee Highway Specifications. Thickness of course to be as shown on drawings. Compact to no less than 92% of its maximum theoretical density.
F. Surface Smoothness: The hot-mix asphalt surface course shall be checked for smoothness with a 10' foot straight edge and a deviation greater than 3/8" will not be accepted.

3.03 PROTECTION
A. Protect from traffic during all operations and until the surface course is thoroughly set and cured.

3.04 FINISH TOLERANCES
Finish all surfaces to the following tolerances:
A. Asphatic Concrete Plus or Minus 0.05 feet at any point from surfacing: Line and grade shown on the drawings.

3.05 CONCRETE CURBS
A. Certain curbs to be constructed of concrete as shown on drawings. Concrete specifications to be same as given in "Concrete" section of the specifications.

END OF SECTION 32.10.00

100% DESIGN DEVELOPMENT SUBMITTAL
ISSUED: 3/13/2017
SECTION 32.16.00

CONCRETE CURBS AND WALKS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. All sidewalks, steps, and ramps shall be 4000 psi cast in place concrete with 2" to 4" slump. Concrete shall be 5' thick. Entrained air to be 3% to 6%.

B. Provide light broom finish with smooth troweled joints.

C. Apply two coats of concrete sealer.

D. Comply with Section 03.30.00 for concrete and reinforcement requirements.

E. Provide construction joints every 4 – 6 feet on center or as shown on drawings. Provide expansion joints every 28 to 30 feet on center, maximum. Construct contraction joints to depth equal to at least 1/4 concrete thickness. Use premolded joint filler for expansion joints. See caulking section for non-tractions self leveling joint caulking.

END OF SECTION 32.16.00
SECTION 32.17.23

PAVEMENT MARKING

PART 1 GENERAL

1.01 PURPOSE

A. Provide pavement marking for parking lines, handicap symbols, and other traffic control designations. Parking lines shall be 4" wide. Paint shall be chlorinated rubber paint, equal to Pittsburgh Paints Traffic and Zone Marking Paint. Colors are selected by Designer.

END OF SECTION 32.17.23
SECTION 32.30.00
SITE FURNISHINGS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Benches.
B. Bollards.
C. Bicycle Racks

1.02 RELATED REQUIREMENTS
A. Section 03.30.00 - Cast-in-Place Concrete: Bollard infill and underground encasement.
B. Section 05.50.00 - Metal Fabrications: Anchors to attach site furnishings to mounting surfaces.

1.03 REFERENCE STANDARDS
C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

1.04 SUBMITTALS
A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer’s specifications and descriptive literature, installation instructions, and maintenance information.
C. Shop Drawings: Indicate plans for each unit or groups of units, elevations with model number, overall dimensions; construction, and anchorage details.

1.05 WARRANTY
A. Provide manufacturer’s warranty against defects in materials or workmanship for ductile iron castings for a period of 10 years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 METAL FURNISHINGS
A. Metal Furnishings, General:
   1. Cast iron components: Ductile iron castings complying with ASTM A536; cleaned, treated, and powder-coated.
   2. Steel components: Plates, bars, and shapes complying with ASTM A36/A36M and tubing complying with ASTM A500/A500M; cleaned, treated, and powder-coated.
B. Benches: Metal frame and seat section with back and armrests.
   1. Frame: Steel.
   2. Seat: Steel slat.
   3. Products:
      a. SiteScapes, Inc; CityView: www.sitescapesonline.com.
C. Bike Rack: Metal frame.
1. Manufacturer: Dero Bike racks: www.dero.com
2. Color: Black

2.02 BOLLARDS
   A. Steel Pipe Bollards: Hollow steel pipe with plain shaft.
      1. Materials:
         c. Color: As selected by Architect from manufacturer's standard range.
      2. Mounting: In-ground.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that mounting surfaces, preinstalled anchor bolts, or other mounting devices are properly installed; and ready to receive site furnishing items.
   B. See Section 05.50.00 for anchors to attach site furnishings to mounting surfaces.
   C. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION
   A. Install site furnishings in accordance with approved shop drawings, and manufacturer's installation instructions.
   B. See Section 03.30.00 for bollard infill and underground encasement.
   C. Provide level mounting surfaces for site furnishing items.

END OF SECTION 32.30.00
SECTION 32.32.23
SEGMENTAL RETAINING WALL SYSTEMS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Work shall consist of designing, furnishing all materials, labor, equipment, and supervision and placement of a segmental retaining wall system in accordance with these specifications and in reasonably close conformity with the lines, grades, design and dimensions shown on the plans or as established by the Owner or Owner’s Engineer.

1.02 RELATED WORK

A. Excavation, Backfilling & Compaction: Section 31.23.00.
B. SubSurface Conditions: Section 32.23.00.

1.03 REFERENCE STANDARDS

A. Engineering Design:

1. NCMA Design Manual for Segmental Retaining Walls.
2. NCMA TEC 2-4: Specifications for Segmental Retaining Wall Units.
3. NCMA SRWU-1: Determination of Connection Strength Between Geosynthetics and Segmental Concrete Units.
4. NCMA SRWU-2: Determination of Shear Strength Between Segmental Concrete Units.

B. Segmental Retaining Wall Units:

1. ASTM C 140: Sampling and Testing Concrete Masonry Units.
2. ASTM C 1262: Evaluating the Freeze Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units.

C. Geosynthetic Reinforcement:

3. GRI GG-1: Single Rib Geogrid Tensile Strength.
5. GRI GG-5: Geogrid Pullout.
6. GRI GT-6: Geotextile Pullout.

D. Soils:
   2. ASTM D 422: Gradation of Soils.
   4. ASTM D G51: Soil pH.

E. Drainage Pipe:

F. Where specifications and reference documents conflict, the Owner’s Engineer shall make the final determination of applicable document.

1.04 APPROVED SEGMENTAL RETAINING WALL SYSTEMS

A. Suppliers of segmental retaining wall systems shall have demonstrated experience in the construction of similar size and types of segmental retaining walls on previous projects, and shall be approved by the Owner’s Engineer. The supplier must be approved prior to Bid opening.

B. Approved Manufacturers: Keystone, Versa-Lok, Rockwood Retaining Walls, Allan Block, Cornerstone.

1.05 SUBMITTALS

A. Material Submittals: The Contractor shall submit manufacturer’s certifications, 30 days prior to the start of work, stating that the SRW units, the geosynthetic reinforcement, and the drainage aggregate meet the requirements of Section 2 of this specification. The Contractor shall provide a list of successful projects with references showing that the installer for the segmental retaining wall is qualified and has a record of successful performance.
B. **Design Submittal:** The Contractor shall submit three (3) sets of detailed design calculations, construction drawings, and shop drawings for approval at least 60 days prior to the beginning of reinforced segmental retaining wall construction. A detailed explanation of the design properties for the geosynthetic reinforcements shall be submitted with the design. Design shall be in accordance with reference standards in paragraph 1.03.A. All computer generated calculations and drawings shall be prepared and sealed by a Professional Engineer, Licensed in the State of Tennessee.

### 1.06 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall inspect the materials upon delivery to assure that proper type and grade material has been received.

B. The Contractor shall store and handle all materials in accordance with manufacturer’s recommendations and in a manner to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping or other causes. Damaged material shall not be incorporated into the Retaining Wall.

### PART 2 – MATERIALS

#### 2.01 SEGMENTAL RETAINING WALL UNITS

A. SRW units shall be machine formed, Portland Cement concrete blocks specifically designed for retaining wall applications. SRW units currently approved for this project are:

1. VERSA-LOK Retaining Wall Units as manufactured by General Shale Products Corp.

2. Other products shall be submitted for approval.

B. Color of SRW units shall be as selected by the Designer from the manufacturer’s standard colors.

C. Finish of SRW units shall be split face.

D. SRW unit faces shall be of straight geometry.

E. SRW unit height shall be six (6") inches.

F. SRW units (not including aggregate fill in unit voids) shall provide a minimum weight of 105 psf wall face area.

G. SRW units shall be solid through the full depth of the unit.

H. SRW units shall have a depth (front face to rear) to height ratio of 2:1, minimum.
I. SRW units shall be interlocked with connection pins, designed with proper setback to provide 8:1 vertical to horizontal batter (a 7 degree cant from vertical).

J. SRW units shall be capable of being erected with the horizontal gap between adjacent units not exceeding 1/8” inches.

K. SRW units shall be capable of providing overlap of units on each successive course so that walls meeting at corner are interlocked and continuous. SRW units that require corners to be mitered shall not be allowed.

L. SRW units shall be capable of providing a split face, textured surface for all vertical surfaces that will be exposed after completion of wall, including any exposed sides and backs of units.

M. SRW units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or significantly impair the strength or permanence of the structure. Cracking or excessive chipping may be grounds for rejection. Units showing cracks longer than 1/2” shall not be used within the wall. Units showing chips visible at a distance of 30 feet from the wall shall not be used within the wall.

N. Concrete used to manufacturer SRW units shall have a minimum 28 days compressive strength of 3,000 psi and a maximum moisture absorption rate, by weight, of 8% as determined in accordance with ASTM C1372. Compressive strength test specimens shall conform to the saw cut coupon provisions of ASTM C140.

O. SRW units’ molded dimensions shall not differ more than ± 1/8” inch from that specified, in accordance with ASTM C1372.

2.02 SEGMENTAL RETAINING WALL UNIT CONNECTION PINS

A. SRW units shall be interlocked with connection pins approved by the block manufacturer. The pins shall consist of glass reinforced nylon made for the expressed use with the SRW units supplied.

2.03 GEOSYNTHETIC REINFORCEMENT

A. Geosynthetic reinforcement shall consist of geogrids or geotextiles manufactured as a soil reinforcement element. The manufacturers/suppliers of the geosynthetic reinforcement shall have demonstrated construction of similar size and types of segmental retaining walls on previous projects.

B. The geosynthetic type must be approved prior to bid opening. Geosynthetic types currently approved for this project are:

1. VERSA-Grid Geogrids.
C. The type, strength, and placement location of the reinforcing geosynthetic shall be as determined by the Wall Design Engineer, as shown on the final, P.E. sealed retaining wall plans.

2.04 LEVELING PAD

A. Material for leveling pad shall consist of compacted sand, gravel, or combination thereof (USCS soil types GP, GW, SP, & SW) and shall be a minimum of 6” inches in depth. Lean concrete with a strength of 200-300 psi and three (3”) inches thick maximum may also be used as a leveling pad material. The leveling pad should extend laterally at least a distance of 6” inches from the toe and heel of the lowermost SRW unit.

2.05 DRAINAGE AGGREGATE

A. Drainage aggregate shall be angular, clean stone or granular fill meeting the following gradation as determined in accordance with ASTM D422:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch</td>
<td>100</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>75-100</td>
</tr>
<tr>
<td>No. 4</td>
<td>0-60</td>
</tr>
<tr>
<td>No. 40</td>
<td>0-50</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-5</td>
</tr>
</tbody>
</table>

2.06 DRAINAGE PIPE

A. The drainage collection pipe shall be perforated or slotted PVC, or corrugated HDPE pipe. The drainage pipe shall be wrapped with a geotextile to function as a filter.

B. Drainage pipe shall be manufactured in accordance with ASTM D 3034 and/or ASTM D 1248.

2.07 REINFORCED (INFILL) SOIL

A. The reinforced soil material shall be free of debris. Unless otherwise noted on the final, P.E. sealed, retaining wall plans prepared by the Wall Design Engineer, the reinforced material shall consist of the inorganic USCS Soil Types GP, SW, SW, SP, SM, meeting the following gradation, as determined in accordance with ASTM D422:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>20-100</td>
</tr>
<tr>
<td>No. 40</td>
<td>0-60</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-35</td>
</tr>
</tbody>
</table>
B. The maximum particle size of poorly graded gravels (GP) (no fines) should not exceed 3/4" inch unless expressly approved by the Wall Design Engineer and the long term design strength (LTDS) of the geosynthetic is reduced to account for additional installation damage from particles larger than this maximum.

C. The plasticity of the fine fraction shall be less than 20.

PART 3 – EXECUTION

3.01 SOIL

A. The following soil parameters, as determined by the Owner’s Geotechnical Engineer shall be used for the preparation of the final design:

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Compacted No. 57 Stone</th>
<th>Compacted On Site Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle of Friction degrees</td>
<td>36</td>
<td>20</td>
</tr>
<tr>
<td>At Rest Pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient, $K_o$</td>
<td>0.43</td>
<td>0.66</td>
</tr>
<tr>
<td>Active Pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient, $K_a$</td>
<td>0.27</td>
<td>0.49</td>
</tr>
<tr>
<td>Passive Pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient, $K_p$</td>
<td>NA</td>
<td>2.04</td>
</tr>
<tr>
<td>Unit Weight of Material, pcf</td>
<td>110</td>
<td>125</td>
</tr>
<tr>
<td>Friction Factor (concrete</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bearing on Soil</td>
<td>NA</td>
<td>0.35</td>
</tr>
<tr>
<td>Allowable Soil Bearing Capacity, psf (on approved and Prepared subgrades)</td>
<td>NA</td>
<td>2000</td>
</tr>
</tbody>
</table>

Should the actual soil conditions observed during construction differ from those assumed for the design, design shall be reviewed by the Wall Design Engineer at the Engineer’s direction.

3.02 DESIGN

A. The design analysis for the final, P.E. sealed retaining wall plans prepared by the Wall Design Engineer shall consider the external stability against sliding and overturning, internal stability, and facial stability of the reinforced soil mass and shall be in accordance with acceptable engineering practice and these specifications. The internal and external stability analysis shall be performed in accordance with the “NCMA Design Manual for Segmental Retaining Walls”, using the recommended minimum factors of safety in this manual.
B. External stability analysis for bearing capacity, global stability, and total and differential settlement shall be the responsibility of the Owner and the Owner’s Geotechnical Engineer. Geotechnical Engineer shall perform bearing capacity, settlement estimates, and global stability analysis based on the final wall design provided by the Wall Design Engineer and coordinate any required changes with Wall Design Engineer.

C. While vertical spacing between geogrid layers may vary, it shall not exceed 2.0 feet maximum in the all design.

D. The geosynthetic placement in the wall design shall have 100 percent continuous coverage parallel to the wall face. Gapping between horizontally adjacent layers of geosynthetic (partial coverage) will not be allowed.

3.03 INSPECTION

A. Examine the area and conditions under which the work of this section will be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Contractor’s field construction supervisor shall have demonstrated experience and be qualified to direct all work at the site.

3.04 EXCAVATION

A. Contractor shall excavate to the lines and grades shown on the project grading plans. Contractor shall take precautions to minimize over excavation. Over excavation shall be filled with compacted infill material, or as directed by the Designer, at the Contractor’s expense.

B. Contractor shall verify location of existing structures and utilities prior to excavation. Contractor shall ensure all surrounding structures are protected from the effects of wall excavation. Excavation support, if required, is the responsibility of the Contractor.

3.05 FOUNDATION PREPARATION

A. Following the excavation, the foundation soil shall be tested by a qualified testing agency under the requirements of Section 01.41.00.

B. The excavation shall be examined by the Designer to assure actual foundation soil strength meets or exceeds the assumed design bearing strength. Soils not meeting the required strength shall be removed and replaced with infill soils, as directed by the Designer.

C. Foundation soil shall be proof rolled and compacted to 95% standard Proctor density and tested by the soils testing agency prior to placement of leveling pad materials.
3.06  LEVELING PAD CONSTRUCTION

A. Leveling pad shall be placed as shown on the final, P.E. sealed retaining wall plans with a minimum thickness of 6” inches. The leveling pad should extend laterally at least a distance of 6” inches from the toe and heel of the lower most SRW unit.

B. Granular leveling pad material shall be compacted to provide a firm, level bearing surface on which to place the first course of units. Well graded sand can be used to smooth the top 1/4" to 1/2" inch of the leveling pad. Compaction will be with mechanical plate compactors to achieve 95% of maximum standard Proctor density (ASTM D 698).

C. Leveling pad material shall be tested by the soils testing agency to verify compaction prior to proceeding with SRW unit installation.

3.07  SRW UNIT INSTALLATION

A. All SRW units shall be installed at the proper elevation and orientation as shown on the final, P.E. sealed wall plans and details or as directed by the Wall Designer. The SRW units shall be installed in general accordance with the manufacturer’s recommendations. The specifications and drawings shall govern in any conflict between the two requirements.

B. First course of SRW units shall be placed on the leveling pad. The units shall be leveled side to side, front to rear and with adjacent units, and aligned to ensure intimate contact with the leveling pad. The first course is the most important to ensure accurate and acceptable results. No gaps shall be left between the front of adjacent units. Alignment may be done by means of a string line or offset from base line to the back of the units.

C. All excess debris shall be cleaned from top of units and the next course of units installed on top of the units below.

D. Two connection pins shall be inserted through the pin holes of each upper course unit into receiving slots in lower course units. Pins shall be fully seated in the pin slot below. Units shall be pushed forward to remove any looseness in the unit to unit connection.

E. Prior to placement of next course, the level and alignment of the units shall be checked and corrected, where needed.

F. Layout of curves and corners shall be installed in accordance with the wall plan details or in general accordance with SRW manufacturer’s installation guidelines. Walls meeting at corners shall be interlocked by overlapping successive courses.
G. Procedures C. through F. shall be repeated until reaching top of wall units, just below the height of the cap units. Geosynthetic reinforcement, drainage materials, and reinforced backfill shall be placed in sequence with unit installation as described in Section 3.08, 3.09, and 3.10.

3.08 GEOSYNTHETIC REINFORCEMENT PLACEMENT

A. All geosynthetic reinforcement shall be installed at the proper elevation and orientation as shown on the final, P.E. sealed retaining wall plan profiles and details, or as directed by the Wall Design Engineer.

B. At the elevations shown on the final plans, (after the units, drainage material, and backfill have been placed to this elevation) the geosynthetic reinforcement shall be laid horizontally on compacted infill and on top of the concrete SRW units, to within one inch of the unit below. Embedment of the geosynthetic in the SRW units shall be consistent with SRW manufacturer’s recommendations. Correct orientation of the geosynthetic reinforcement shall be verified by the Contractor to be in accordance with the geosynthetic manufacturer’s recommendations. The highest strength direction of the geosynthetic must be perpendicular to the wall face.

C. Geosynthetic reinforcement layers shall be one continuous piece for their entire embedment length. Splicing of the geosynthetic in the design strength direction (perpendicular to the wall face) shall not be permitted. Along the length of the wall, horizontally adjacent sections of geosynthetic reinforcement shall be overlapped by a minimum amount of two grid sections.

D. Tracked construction equipment shall not be operated directly on the geosynthetic reinforcement. A minimum of 6” inches of backfill is required prior to operation of tracked vehicles over the geosynthetic. Turning should be kept to a minimum. Rubber tired equipment may pass over the geosynthetic reinforcement at speeds less than 5 mph.

E. The geosynthetic reinforcement shall be free of wrinkles prior to placement of soil fill. The nominal tension shall be applied to the reinforcement and secured in place with staples, stakes or by hand tensioning until reinforcement is covered by six (6") inches of fill.

3.09 DRAINAGE MATERIALS

A. Drainage aggregate shall be installed to the line, grades, and sections shown on the final P.E. sealed retaining wall plans. Drainage aggregate shall be placed to the minimum thickness shown on the construction plans between and behind units (a minimum of one cubic foot for each exposed square foot of wall face unless otherwise noted on the final wall plans).
B. Drainage collection pipes shall be installed to maintain gravity flow of water outside the reinforced soil zone. The drainage collection pipe shall daylight into a storm sewer or along a slope, at an elevation lower than the lowest point of the pipe within the aggregate drain.

3.10 BACKFILL PLACEMENT

A. The reinforced backfill shall be placed as shown in the final wall plans in the maximum compacted lift thickness of 10” inches and shall be compacted to a minimum of 95% of standard Proctor Density (ASTM D 698) at the moisture content within 2% of optimum. The backfill shall be placed and spread in such a manner as to eliminate wrinkles or movement of the geosynthetic reinforcement and the SRW units.

B. Only hand operated compaction equipment shall be allowed within 3’ feet of the back of the wall units. Compaction within the 3’ feet behind the wall units shall be achieved by at least three (3) passes of a lightweight mechanical tamper, plate, or roller.

C. At the end of each day’s operation, the Contractor shall slope the last level of backfill away from the wall facing and reinforced backfill to direct water runoff away from the wall face.

D. At completion of wall construction, backfill shall be placed level with final top of wall elevation. If final grading, paving, landscaping, and/or storm drainage installation adjacent to the wall is not placed immediately after wall completion, temporary grading and drainage shall be provided to ensure water runoff is not directed at the wall nor allowed to collect or pond behind the wall until final construction adjacent to the wall is completed.

3.11 SRW CAPS

A. SRW caps shall be properly aligned and glued to underlying units with a flexible, high strength concrete adhesive. Rigid adhesives or mortar are not acceptable.

B. Caps shall overhang the top course of units by 3/4” to 1” inch. Slight variation in overhang is allowed to correct alignment at the top of the wall.

3.12 CONSTRUCTION ADJACENT TO COMPLETED WALL

A. Ensure that construction adjacent to the wall does not disturb the wall or place temporary construction loads on the wall that exceed design loads, including loads such as water pressure, temporary grades, or equipment loading. Equipment with wheel loads in excess of 150 psf live load shall not be operated within 10’ feet of the face of the retaining wall during construction adjacent to the wall. Care should be taken to ensure water runoff is directed away from the wall structure until final grading and surface drainage collection systems are completed.

END OF SECTION 32.32.23
PART 1 - GENERAL

1.01 SUMMARY

A. Provide complete underground irrigation system as shown on the drawings and as specified here-in. The work includes:
1. Automatic irrigation systems including piping, fittings, sprinkler heads and accessories.
2. Valves and fittings.
3. Controllers and control wire
4. Testing
5. Excavating and backfilling irrigation system work.
6. Associated interior and exterior plumbing, wiring, and accessories to complete the system.
7. Pipe sleeves.

B. The irrigation system shall be compliant with the latest edition of the State of Tennessee Sustainable Design Guidelines. Provide calculations and documentation as requested by the Architect for the Landscape Irrigation Water Efficiency Credit as required to demonstrate that the system utilizes at least 50% less water than a conventional system.

1.02 RELATED REQUIREMENTS

1. Grading: Section 31.22.10
2. Seeding: Section 32.92.19
3. Sodding: Section 32.92.23
4. Trees, shrubs, and ground covers: Section 32.93.00

1.03 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
B. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
C. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.
D. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.

1.04 QUALITY ASSURANCE

A. Acceptable Manufacturers:
1. Rainbird Sales, Inc.,
2. Hunter Industries, Inc.
3. The Toro Company

B. Provide underground sprinkler irrigation systems as a complete unit with brand name goods produced by a single acceptable manufacturer, including heads, valves, piping circuits, controls and accessories.

C. Installer's qualifications: The firm shall have a minimum of 3 years experience with a satisfactory record of performance for installing irrigation systems of comparable size and quality. The firm shall be a contractor licensed by the State of Tennessee Board of Licensing Contractors. The Contractor shall hold one or more of the following classifications: BC-29, HRA-E(2) or S (Lawn and
Golf Course Sprinkler Systems); and have a monetary limit of $250,000 or more. Workmanship shall be of the highest quality. It is also preferred, but not mandatory, the contractor hold a C.I.C. certification from the Irrigation Association.

D. Materials, equipment, and methods of installation shall comply with all applicable codes and standards including:
4. The Irrigation Association, (IA).

E. Excavating, backfilling, and compacting operations: Comply with requirements as specified herein.

F. Obtain in writing Landscape Architect's acceptance of installed and tested irrigation system.

G. American Society of Safety Engineers:
1. ASSE 1013 – Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
2. ASSE 1015 – Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies.

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.05 SUBMITTALS

A. Submit the following in accordance with Section 01300.
1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Shop Drawings: Shop drawings for the complete irrigation system. Include piping layout and details illustrating location and types of factory sprinkler heads and control valves, control systems and wiring, and list of fittings.
4. Zoning Chart: Show each irrigation zone and its control valve.
5. Material Samples: Furnish upon request.
6. Prior to final inspection and before irrigation system acceptance, submit written operating and maintenance instructions including schedule of operation with run times and days for each station. Obtain Landscape Architect's approval for the same in writing.
7. Provide to Owner's appointed maintenance personnel instruction in proper use and monitoring of irrigation system. Submit with Close-Out Documents statement signed by Contractor and Owner's representative that Contractor has provided specified training.
8. Warranties for each component warranted by manufacturer.
9. Provide irrigation system record drawings:
   a. Legibly mark drawings to record actual construction.
   b. Indicate horizontal and vertical locations, referenced to permanent surface improvements using planting plans or other appropriate drawings as base sheets. Submittals shall include one mylar reproducible of each sheet and three (3) sets of prints.
   c. Identify field changes of dimension and detail and changes made by Change Order.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Deliver irrigation system components in manufacturer's original undamaged and unopened con-
tainers with labels intact and legible.
B. Deliver plastic piping in bundles, packaged to provide adequate protection of pipe ends, both
threaded or plain.
C. Store and handle materials to prevent damage, theft, and deterioration.
D. Provide secure, locked storage for valves, sprinkler heads, and similar components that cannot be
immediately replaced, to prevent installation delays.

1.07 PROJECT CONDITIONS
A. The water supply for each area of the site shall be as shown on the Site Utilities and Plumbing
drawings or the Irrigation drawings as appropriate.
B. The Contractor shall, at his own expense, locate, excavate and verify the alignment and depth of
all known underground utilities as shown or inferred on the drawings. Protect existing utilities,
paving, and other facilities from damage caused by irrigation installation operations.
C. Promptly repair damage to adjacent facilities caused by irrigation system work operations. All
damage to adjacent facilities resulting from work covered in these specifications will be repaired
at the Contractor's expense.
D. Protect new and existing trees, plants, lawns, and other features designated to remain as part of the
final landscape work.
E. Promptly repair damage to finish grades, lawn areas and planting caused by irrigation system work
operations. All damage to grades, lawns and planting resulting from work covered in these speci-
fications will be repaired at the Contractor's expense.
F. Promptly notify the Landscape Architect in writing of unexpected sub-
surface conditions.
G. Coordinate irrigation work with other trades to avoid conflicts and permit all trades to perform
their work in a timely manner.

PART 2 - PRODUCTS
2.01 MATERIALS
A. General:
1. Provide only new materials, without flaws or defects and of the highest quality of their
specified class or kind.
2. Provide pipe sizes required. No substitution of smaller pipes will be permitted. Larger
sizes may be used subject to acceptance of the Landscape Architect. Remove damaged
and defective pipe.
3. Provide pipe continuously and permanently mark with manufacturer's name or trademark,
size schedule and type of pipe, working pressure at 73 degrees F. and National Sanitation
Foundation (NSF) approval.
B. Plastic pipe, tubes, fittings, and connections:
1. Comply with requirements in the piping schedule for applications of pipe, tube, and fit-
ting materials, and for joining methods for specific services, service locations, and pipe
sizes. Provide one insulated No. 12 solid copper "locator" wire with all water line instal-
lations as required.
2. Saddle and cross fittings are not permitted.
3. Schedule 80 PVC pipe may be threaded.
4. Use male adapters for plastic to metal connections. Hand tighten male adapters plus one
turn with a strap wrench.
a. PE Pipe with Controlled ID: ASTM F 771, PE 3408 compound; SIDR 11.5 and
SIDR 15.
1) Insert Fittings for PE Pipe: ASTM D 2609, nylon or propylene plastic with barbed ends. Include bands or other fasteners.

b. PE Pipe with Controlled OD: ASTM F 771, PE 3408 compound, SDR 11.
   2) PE Socket-Type Fittings: ASTM D 2683.

c. PE Pressure Pipe: AWWA C906, with DR of 7.3, 9, or 9.3 and PE compound number required to give pressure rating not less than [160 psig (1100 kPa)] [200 psig (1380 kPa)].
   2) PE Socket-Type Fittings: ASTM D 2683.

d. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedules 40 and 80.
   1) PVC Socket Fittings: ASTM D 2466, Schedules 40 and 80.
   2) PVC Threaded Fittings: ASTM D 2464, Schedule 80.
   3) PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.

e. PVC Pipe, Pressure Rated: ASTM D 2241, PVC 1120 compound, SDR 21 and SDR 26.
   1) PVC Socket Fittings: ASTM D 2467, Schedules 80.
   2) PVC Socket unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.

C. Sprinkler heads, valves, and associated equipment:

1. In order to afford the Owner their best possible warranty support as stated by the manufacturer and herein, all irrigation brand name goods (i.e. valves, controllers, heads, etc.) shall be purchased from an authorized distributor recognized by the manufacturer to provide warranty support for the geographic location of the project.

2. Sprinkler Head: Manufacturer's pop-up unit with built-in check valve and 45-PSI pressure regulator designed to provide uniform coverage over entire area of spray shown on drawings as follows:
   a. Flush Surface: Fixed pattern, with screw-type flow adjustment and precipitation rates matched across patterns and sets.
   b. Bubbler: Fixed pattern, with screw-type flow adjustment.
   c. Shrubbery: Fixed pattern, with screw-type flow adjustment and precipitation rates matched across patterns and sets.
   d. Nozzles for Pop-up Spray Sprinklers:
      1) Fixed Pattern Spray Nozzles: The nozzle shall be constructed of corrosion and UV-resistant plastic and have a stainless steel screw to adjust the flow and radius of throw from the nozzle. It shall be compatible with a plastic screen that protects the nozzle against debris in the water. The nozzle base shall be color coded to differentiate between the radius options.
      2) Adjustable Arc Spray Nozzles: The nozzle shall be constructed of corrosion and UV-resistant plastic and have a stainless steel screw to adjust the flow and radius of throw from the nozzle. It shall be compatible with a plastic screen that protects the nozzle against debris in the water. The nozzle base shall be color coded to differentiate between the radius options.
      3) Utilize Fixed Pattern Spray Nozzles, (Rain Bird U-Series), whenever
possible with minimal over-spray. Adjustable Arc Nozzles (Rain Bird HE-VAN Series) are to be utilized only when necessary to mitigate over-spray onto adjacent paving or structures.

e. Pop-up Spray Body for Spray nozzles:

1) The sprinkler shall be available with a 4-, 6-, or 12-inch pop-up stroke, depending on the body specified, to bring the nozzle into a clean environment. The sprinkler shall have a factory-installed drain check valve capable of checking up to 10 feet in elevation change. The sprinkler shall have the words “CHECK VALVE” or “SAM” stamped in white lettering on the body cap, (Rain Bird 1800-SAM-PRS)

2) The sprinkler shall have a standard pressure-regulating device as an integral part of the pop-up riser. This regulator will prevent fogging or misting of the nozzle spray pattern by maintaining a constant nozzle outlet pressure of 30 PSI with inlet pressures of up to 100 PSI, regardless of the nozzle installed. (Rain Bird 1800-SAM-PRS)

3) The body of the sprinkler shall be constructed of corrosion and UV-resistant, heavy-duty A.B.S. The riser of the sprinkler shall be constructed of abrasion and UV-resistant A.B.S. and shall be adjustable for pattern alignment. The riser shall be compatible with female threaded nozzles and shall have a stainless steel spring for positive retraction when irrigation is complete.

4) The sprinkler shall have a pressure-activated, multi-function, UV stable wiper seal that will clean debris from the pop-up stem while it retracts. This seal shall prevent the sprinkler from sticking in the up position and be capable of sealing the sprinkler riser stem to the sprinkler cap under normal operating pressures. The seal shall be removable from the cap for easy service and shall be replaceable.

e. Pop-up Rotor Sprinklers:

1) Gear or turbine drive, full circle and adjustable part circle type.

2) The sprinkler shall be available with eight (8) standard nozzles discharging from 1.2 to 9.8 GPM, or four (4) low-angle nozzles discharging from 1.6 to 4.7 GPM. There shall also be one set of specialty nozzles available: A short distance set discharging from .36 to 3.1 GPM. In addition, the rotor shall have MPR nozzle sets available from 25’ to 35’ radius, with a precipitation rate of .60”/hr, to allow for matched precipitation rates and for use with simultaneous operation of the Rain Bird Rotary Nozzles.

3) The sprinkler shall have radius adjustment capabilities by means of a stainless-steel nozzle retainer/radius adjustment screw.

4) The sprinkler shall be both full-circle and adjustable part-circle operation in a single unit. The sprinkler shall be minutely adjustable from 40° to 360°.

5) The sprinkler shall be equipped with a self-adjusting stator to ensure constant rotation speed regardless of nozzle installed.

6) The sprinkler shall have a non-strippable drive mechanism that allows the nozzle turret to be turned during operation, without damage. It shall also have an automatic arc return feature that returns the nozzle turret to its proper orientation if it is turned outside its intended arc of coverage, as well as a brass shaft connecting the nozzle turret to the drive assembly which is designed to provide tremendous side impact resistance. (Rain Bird 5505 & 8005 series)
7) The sprinkler shall have a minimum of 4-inch pop-up stroke (measured from the top of the sprinkler body to the center of the nozzle) to bring the rotating nozzle turret into a clean environment. The sprinkler shall be available as an aboveground shrub head, a 6-inch pop-up, and as a 12-inch pop-up. (Rain Bird 5000 series with SAM-PRS option)

8) The body and riser of the sprinkler shall be constructed of corrosion resistant, impact resistant, heavy-duty A.B.S. It shall have a stainless steel spring for positive retraction of the riser when irrigation is complete. When specified, the 4 and 6-inch models shall have the riser and nozzle-turret assembly encased in stainless steel.

g. Rotator nozzles:

1) The sprinkler shall be of the viscous fluid brake rotary type and be a multi-stream, multi-trajectory rotating stream sprinkler.

2) The sprinkler shall produce and maintain a matched precipitation rate no greater than 0.6” per hour throughout the arc adjustment range and radius adjustment range, (up to 25% of radius reduction), when spaced at 50% of wetted diameter.

3) Full or part circle sprinklers shall be capable of up to 25% radius reduction using a stainless steel radius adjustment screw. The radius reduction screw shall have a slip clutch mechanism to prevent internal damage if turned past the minimum or maximum radius settings. The radius reduction screw shall reduce the pressure and flow upstream of the adjustable orifice thereby maintaining stream integrity.

4) Part circle sprinklers shall have arc adjustment capabilities using a stainless steel ring. The adjustment ring shall be effective only while the sprinkler is popped up and shall be ineffective while the sprinkler is popped down. When turned past the minimum or maximum arc limits the adjustment mechanism shall have a ratcheting action to prevent internal damage.

5) This same ratcheting action shall allow the orientation of the left edge of the variable arc when installed on a fixed riser or in a popup body. This is independent of and in addition to any ratchet that may exist in a popup body.

6) The sprinkler itself shall pop-up at approximately 15 psi of water pressure. Upon cessation of water pressure, the sprinkler itself shall retract. When installed in a pop-up body the sprinkler itself shall pop-up after the body stem is almost fully extended. Upon decreasing pressure the sprinkler itself shall pop-down before the pop-down of the body stem is complete.

7) The sprinklers adjustable orifice shall be manufactured from polyurethane and acetyl plastic materials for durability.

8) The sprinkler shall be fitted with a detachable filter.

h. Pop-up Spray Body for Rotator Nozzles:

1) The sprinkler shall be available with a 4-, 6-, or 12-inch pop-up stroke, depending on the body specified, to bring the nozzle into a clean environment. The sprinkler shall have a factory-installed drain check valve capable of checking up to 14 feet in elevation change.

2) The sprinkler shall have a standard pressure-regulating device as an integral part of the pop-up riser. This regulator will provide optimal distribution uniformity of the Rotator nozzles by maintaining a constant
outlet pressure of 40-45 PSI with inlet pressures of up to 100 PSI, regardless of the rotator installed.

3) The body of the sprinkler shall be constructed of corrosion and UV-resistant, heavy-duty A.B.S. The riser of the sprinkler shall be constructed of abrasion and UV-resistant A.B.S. and shall be adjustable for pattern alignment. The riser shall be compatible with female threaded nozzles and shall have a stainless steel spring for positive retraction when irrigation is complete.

4) The sprinkler shall have a pressure-activated, multi-function, UV stable wiper seal that will clean debris from the pop-up stem while it retracts. The seal shall be molded around a rigid plastic ring to prevent seal deformation. This seal shall prevent the sprinkler from sticking in the up position and be capable of sealing the sprinkler riser stem to the sprinkler cap under normal operating pressures. The seal shall be removable from the cap for easy service and shall be replaceable.

3. Master valves shall be 200 PSI-rated globe style valve, low power solenoid, normally closed fiberglass filled nylon body and bonnet with low flow, low pressure operating capabilities having brass flow control stem, manual open/close control, nylon reinforced rubber diaphragm and manual internal and external bleed.

4. Manual circuit valves of 3’ or less shall be globe valves of brass and rated for 200 psi and come complete with handle. One valve shall be installed on supply side of each automatic circuit valve.

5. Automatic circuit valves:
   a. The electric remote control valve shall be a normally closed 24 VAC 50/60 Hz (cycles/sec)solenoid actuated globe pattern design.
   b. The valve pressure rating shall not be less than 200 psi (13.80 bar).
   c. The valve body shall be constructed of heavy-duty glass-filled UV-resistant nylon and have stainless steel studs and flange nuts; diaphragm shall be of nylon reinforced nitrile rubber.
   d. The valve shall have both internal and external manual open/close control (internal and external bleed) to manually open and close the valve without electrically energizing the solenoid.
   e. The valve’s internal bleed shall prevent flooding of the valve box.
   f. The valve shall house a fully-encapsulated, one-piece solenoid. The solenoid shall have a captured plunger with a removable retainer for easy servicing and a leverage handle for easy turning. This 24 VAC 50/60 Hz solenoid shall open with 19.6 VAC minimum at 200 psi (13.80 bar). At 24 VAC, average inrush current shall not exceed 0.41 amps. Average holding current shall not exceed 0.28 amps.
   g. The valve shall have a brass flow control stem for accurate manual regulation and/or shut-off of outlet flow.
   h. The valve must open or close in less than 1 minute at 200 psi (13.80 bar), and less than 30 seconds at 20 psi (1.38 bar).
   i. The PESB valve shall have a self-cleaning stainless steel screen designed for use in dirty water applications.
   j. The valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.
   k. Optional Feature Specification:
      1) PRS-D Pressure Regulating Module:

1. 100PEB-PRS-D 100PESB-PRS-D
m. 150PEB-PRS-D 150PESB-PRS-D
n. 200PEB-PRS-D 200PESB-PRS-D
o. When so indicated on the design, the 1”, 1½” and 2” electric remote control plastic valves shall have a pressure regulating module (PRS-D) capable of regulating outlet pressure between 15 and 100 psi (0.3 psi) (104 and 690 bar (0.21 bar)).
p. The PRS-D module shall have an adjusting knob for setting pressure and Schrader valve connection for monitoring pressure. The pressure shall be adjustable from the PRS-D when the valve is internally manually bled or electrically activated.
  1) Non-Potable Flow Control Handle *
q. PEB-NP-HAN1 - Fits 1”
r. PEB-NP-HAN2 - Fits 1½” and 2”
s. When so indicated on the design, the valve shall have a purple flow control handle to indicate to the user that non-potable water is being used. There shall be no difference between the black and purple handles except for the color.

6. Quick coupling values shall be heavy-duty two piece brass construction with locking rubber cover.

7. Water hammer arrester, if required, shall be compatible with the systems and system operating pressures and flow rates as shown on the drawings.

D. Drip Irrigation:
  1. Control Zone Kits and Sensors:
     a. General:
        1) Control zone kit assemblies for drip irrigation zones must include a valve, filtration and pressure regulation to meet the flow requirements of the zone. Where necessary a check valve shall also be installed.
        2) Components shall be sized according to the hydraulic demands of the system.
     b. Irrigation Control Zone Kits with Valve, Pressure Regulator and Filter:
     c. Irrigation Control Zone Kit for zones with flows from .5 to 15 GPM (30 to 900 GPH)
        1) The valve shall be available in a globe configuration and shall be equipped with a flow control mechanism with removable handle that will regulate flow from full on to completely off.
        2) The body and bonnet shall be molded of non-corrodible, PVC, rated to 150 PSI (10.3 bar, 1034 kPa). Models with flow control capability shall have bonnets molded out of glass-reinforced nylon. The diaphragm assembly shall be of molded construction. The diaphragm shall be equipped with a serrated disc to screen water-borne contaminants, preventing them from reaching the metering area, and bleed ports of the valve. A perforated diaphragm support ring shall fit into the valve body just below the diaphragm to relieve stress on the diaphragm when the valve is closed. The bonnet bolts shall be serviceable with a slotted screwdriver, Phillips screwdriver, or a hex wrench, and shall be held captive in the bonnet when the bonnet is removed from the valve body.
        3) The standard solenoid shall be a 24 VAC unit with a 370mA inrush current and 190mA holding current at 60 cycles or a 475 mA inrush...
current and 230 mA holding current at 50 cycles. When specified, the unit shall be equipped with a DC latching solenoid for use with battery-operated controllers. The solenoid shall be an encapsulated, one-piece unit with captive plunger. It shall be equipped with manual internal and external bleed capability to release the upper chamber water to the downstream piping or to atmosphere, allowing the valve to open.

4) The valve shall carry a two-year, exchange warranty.

5) The Pressure Regulator shall provide pressure regulation for protection of downstream components of a drip irrigation system. The pressure regulating device is a normally open device that allows full flow with little pressure loss unless the inlet pressure is greater than the pre-set level. As the inlet pressure increases above the preset level it compresses a spring and begins to reduce the downstream pressure. The pressure regulator shall have a preset outlet pressure of approximately 25 or 40 psi (1.7 or 2.8 bar), depending on model specified, and shall have 1-inch female threaded inlet and outlet.

6) The Filter shall have a body and cap that are made of glass-filled, UV-resistant polypropylene, with 150 psi (10.3 bar) pressure rating. The filter screen shall be constructed of durable stainless steel mesh attached to a polypropylene frame. The standard 150-mesh screen shall be serviceable for cleaning purposes by unscrewing the cap from the body and removing the filter element. The design shall be of a compact “Y” body and cap configuration. The 1” filter body shall have a 1” male threaded inlet and outlet.

7) The control zone kits shall have an automatic irrigation control valve.

E. Inline Emitter Drip Tubing, Pressure-Compensating with Check Valve (for sloped areas):

a) The inline emitter shall be welded to the inner circumference of the polyethylene tubing. The inline emitter shall have dual outlet ports, 180° apart, ensuring only one port has contact with the ground when the tubing is installed at grade and mulched over.

b) Drip line emitters shall pressure compensate by lengthening the emitter’s turbulent flow path. The emitter shall be cylindrical in shape and provide surface area for filtration throughout 360° of its outer circumference. This increased filtration surface area shall assure that the water that enters the inline emitter can always come from the upper half, or cleanest part of the flow path in the polyethylene tubing regardless of how the inline tubing lays on the ground.

c) Drip tubing shall conform to a Nominal .5575” Inside Diameter, Nominal .045” Wall Thickness and shall be compatible with all industry standard 17MM fittings (Both barbed and compression).

d) Drip tubing shall have factory installed, check valve and pressure-compensating, inline emitters with spacing as indicated on drawings.

e) The flow rate from each installed inline emitter shall be a consistent [0.4], [0.6] or [1.0] gallons per hour (1.35, 2.35, or 3.75 liters per hour [LPH]) or when inlet pressure is between 15 and 50 psi (1.0 to 3.5 bar).

f) OPERATIONAL PRESSURE RANGE OF 15-50PSI (1.0-3.5
F. Inline emitter drip tubing with standard or sub-surface emitter tubing (Rain Bird XF-SDI series):
   a. Pressure compensating with Copper Shield
   b. The inline emitter shall be welded to the inner circumference of the polyethylene tubing. The inline emitter shall have dual outlet ports, 180° apart, ensuring only one port has contact with the ground when the tubing is installed at grade and mulched over.
   c. Emitter shall pressure compensate by lengthening the emitter’s turbulent flow path. The emitter shall be cylindrical in shape and provide surface area for filtration throughout 360° of its outer circumference. This increased filtration surface area shall assure that the water that enters the inline emitter can always come from the upper half, or cleanest part of the flow path in the polyethylene tubing regardless of how the inline tubing lays on the ground.
   d. Dripline shall have factory installed, pressure-compensating, inline emitters installed every [12] or [18] or [24] inches. OR
   e. Dripline shall have factory installed, pressure-compensating, inline emitters with spacing as indicated on drawings.
   f. The flow rate from each installed inline emitter shall be a consistent [0.6] or [0.9] gallons per hour when inlet pressure is between 8.5 and 60 psi (0.7 to 4.1 bars).
   g. Operating pressure range: 8.5 to 60 psi (0.7 to 4.1 bar).

G. Automatic Control System – Weathermatic SL1600
1. Controller shall be capable of standard timed watering or auto adjust watering times when equipped with an optional weather monitor. Auto Adjust watering shall be based on real time, on-site weather data and system audit data entered by the user. Auto adjust timing shall be based on the Hargreaves ET calculation formula. Controller shall provide reviewable watering deficits, scheduled run times by zone and a total run time recap for each zone which is resettable by the user. A “more or less” function shall be provided to allow run time adjustment by zone for shade/sunlight, system efficiency and other local factors. Auto adjust mode shall also include automatic calculation of run/soak times based on both soil type & zone elevation.
2. Each program shall have eight independent start times, calendar schedules, watering budgets by month and a soak/cycle for varying soil percolation rates.
3. Controller shall have a pump start/master valve position, which shall be programmable to operate on demand from any selected zone. A programmable safety delay shall be included for zone to zone delay and master valve to zone delay for opening and closure.
4. Controller shall have input for rain and freeze sensor devices selectable by zone. Weather monitor shall incorporate the rain and freeze shutdown functions and shall incorporate a 48-hour delay (adjustable 0 – 99 hours) after closure of the rain sense switch.
5. Controller shall have self-diagnostic capabilities to detect “short” or “open” zones and the ability to display lists of faults on an LCD display for the user. Diagnostics shall also include LCD display of volt/amp readings by zone and for transformer output as well as backup battery reading. A chatter function shall also be provided to assist in locating buried valves. The controller shall automatically prevent master valve opening or pump start when the valve locator diagnostic is used.
6. Controller display shall be backlit for clear viewing in all lighting conditions. Zone timing shall be settable from 1 minute to 9 hours and 55 minutes.
7. Program D shall operate concurrently with programs A, B and C. Programs A, B and C shall stack in sequence of start time operation.
8. Program schedules shall include options for days of the week, odd date, even date or an
interval of 1 to 30 days. A ‘no water’ window shall be available to inhibit daily operations of a program between two selected times on a given day; omission of up to 15 specified calendar dates or specific days of the week. Adjustments for leap year shall be automatic.

9. Manual operation shall be provided by program, by station, or on a programmable test program with durations from ten seconds to ten minutes. The programmable test program shall also check for short and open conditions on each zone each time it is run.

10. A "non-volatile" memory shall retain all programming and real-time clock shall be provided to maintain date and time.

11. Controller shall be capable of incorporating cell card allowing for web-based interface into controller to allow communications between web site and controller.

H. Weather Station Weathermatic SLW5

1. One compatible device shall be provided for each controller. Install per manufacturer’s latest printed instructions.

2. Verify with Owner’s Authorized Representative as to final location of weather station

I. Backflow Preventer:
   a. Comply with requirements and codes of local governing authority regarding backflow prevention.
   b. Provide the necessary materials, insulation/draining capabilities, and insulated stainless steel insulated enclosure.
   c. Backflow preventers shall be type suitable for use in high hazard cross connection to potable water system as manufactured by one of the following manufacturer’s:
      1) Watts Regulator Company
      2) Febco
      3) Wilkins.
   d. Reduced pressure backflow preventers shall be ASSE # 1013 and labeled accordingly.
   e. Double check valve assembly backflow preventers shall be ASSE # 1015 and labeled accordingly.
   f. In absence of local codes or requirements, provide double check assembly backflow preventer installed in strict accordance with manufacturer’s written instructions.

2.02 MISCELLANEOUS MATERIALS

A. Drainage fill: Clean 3/4" crushed stone.

B. Fill: Clean soil free of stones larger than 2" diameter foreign matter, organic material, and debris.
   1. Provide imported fill material as required to complete the work. Obtain rights and pay all costs for imported materials.
   2. Suitable excavated materials removed to accommodate the irrigation system work may be used as fill material subject to the Landscape Architect’s review and acceptance.

C. Low voltage wire connectors: Socket seal type wire connectors and waterproof sealer, direct burial splice (DBY) by 3M or other approved equal.

D. Valve access box, cover and frame: Tapered enclosure of rigid plastic material with frame and bolt locking cover comprised of fibrous components chemically inert and unaffected by moisture, corrosion and temperature changes as manufactured by Carson, or approved equal.

E. Meter box shall conform to requirements of local utility company.

F. Teflon tape of virgin material and free of deleterious substances.
G. Locator wire: No. 12 solid copper wire with THWN insulation.

H. Concrete: 3000 psi.

I. Soil Separator: Rot resistant polypropylene filter fabric, water permeable, and unaffected by freeze-thaw.

J. Sleeves: Schedule 80 PVC as shown and specified.

**PART 3 - EXECUTION**

3.01 **INSPECTION**

A. Examine final grades and installation conditions. Do not start irrigation system work until unsatisfactory conditions are corrected.

3.02 **PREPARATION**

A. Install SCH 80 PVC sleeve(s) at each location where pipe crosses pavement as shown on the drawings. Extend sleeves 2'-0" minimum beyond edge of pavement and cap the sleeve at both ends for future use. Where control wire crosses pavement install 2" PVC electrical conduit in same trench with sleeve. Coordinate with other trades to achieve timely installation of sleeves. No pavement patching shall be permitted.

B. Layout and stake the location of each water main, pipe run and all controllers, water meters, sprinkler heads, and sprinkler valves and of pressure regulators, etc. where required. Coordinate layout with planting drawings and other trades to avoid conflicts. Obtain Landscape Architect’s acceptance of layout in writing prior to excavating.

C. Notify Landscape Architect in writing of adverse sub-surface conditions. State conditions and submit a proposal for correction including costs. Obtain approval for method of correction prior to continuing work in the affected area. In the event that alternate locations are selected, the Contractor will prepare such areas at no additional expense to the Owner. Irrigation installation shall be performed only by experienced workmen familiar with installation procedures under the supervision of a qualified supervisor.

D. Pressure/Flow Test: Perform calculations according to the Irrigation Association’s 3-Step Method. Provide written calculations to the Owner including the following site information:

1. Static or residual pressure at the POC.
2. Calculation of pressure for “worst case” sprinkler head.
3. Calculation of GPM per zone.

E. Prior to installation, receive approval from General Contractor to proceed with construction.

F. Contractor shall field verify all aboveground and underground utilities prior to start of work.

3.03 **INSTALLATION**

A. Excavating and backfilling:

1. All excavation shall be considered unclassified excavation and include all materials encountered.
2. Excavate trenches of sufficient depth and width to permit proper handling and installation of pipe and fittings. Bottoms shall slope uniformly to low points.
3. Excavate to depths required to provide 3" depth of earth fill or sand bedding for piping unless otherwise indicated.
4. Fill to match adjacent grade elevations with approved earth fill material. Place and compact fill in layers not greater than 8" depth.
   a. Provide approved earth fill or sand to a point 4" above the top of pipe.
   b. Fill to within 6" of final grade with approved excavated or borrow fill materials free of lumps or rocks larger than 1" in any dimension.
   c. Provide clean topsoil fill free of rocks and debris for top 6" of fill.
5. Install main supply lines with a minimum cover of 24" based on finished grades.
6. Install irrigation lines with a minimum cover of 12" based on finished grades.
7. Excavate trenches and install piping during the same working day. Protect open trenches or partially filled trenches open overnight.
8. Provide one cubic foot of drainage fill aggregate around and below each pop-up impact type sprinkler head installed to permit drainage from the sprinkler case.

B. Plastic pipe:
1. Install plastic pipe in accordance with manufacturer's installation instructions. Provide for thermal expansion and contraction. Install one insulated No. 12 solid copper "locator" wire continuous in trench with all pipe installations unless surface features such as sprinkler heads indicate pipe routing. Terminate locator wire in valve box nearest each end of pipe run where locator wire is required.
2. Saw cut plastic pipe. Use a square-in-sawing vice, to ensure a square cut. Remove burrs and shavings at cut ends prior to installation.
3. Slope circuit piping to drain valve at 2" in 10'-0" minimum.

C. Joint Construction:
1. Ream ends of pipes and tubes and remove burrs.
2. Make plastic to metal joints with plastic male adapters.
3. Allow joints to set at least 24 hours before pressure is applied to the system.
4. Remove dirt, and debris from inside and outside of pipe and fittings before assembly.
5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   b. Damaged Threads: Do not use pipe or pipe fittings with threads that are damaged.
6. Flanged Joints: Select rubber gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
7. PE Piping Fastener Joints: Join with insert fittings and bands or fasteners according to piping manufacturer's written instructions.
8. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
   a. Plain-End PE Pipe and Fittings: Use butt fusion.
   b. Plain-End PE Pipe and Socket Fittings: Use socket fusion.
9. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   b. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
   c. PVC Non-pressure Piping: Join according to ASTM D 2855.

D. Sprinklers, fittings, valves, and accessories:
1. Install fittings, valves, sprinkler heads, pressure regulators, and accessories in accordance with manufacturer's instructions.
a. Install a manual valve on the supply side of each remote control valve.
b. Make minor adjustments in location of sprinkler heads to avoid plantings and other obstructions. Obtain approval in writing from Landscape Architect if locations shown on plan require alteration.
c. Provide concrete thrust blocks on 2-1/2" pipe and larger at all 90's, 45's, and tees.

2. System pressures shall be indicated on the drawings at source and at last sprinkler head in circuit.
3. Install sprinkler heads perpendicular to finished grades or on risers where shown.
4. Install pop-up spray, pop-up impact, turbine or gear driven sprinklers with an adjustable double swing joint riser of at least 3 standard 90 degree elbows. Fabricate double swing joint risers of schedule 80 PVC nipples and schedule 40 PVC elbows. The horizontal nipple connected directly into the side of the lateral line shall be a minimum of 3" long. All other nipples of the swing joint riser shall be of length as required for proper installation of the sprinkler head. Polyethylene pipe and proper barbed fittings may also be used to make up swing joints provided maximum flow does not exceed 8 gpm.
5. Obtain Landscape Architect's review and acceptance of height for proposed sprinkler heads, and valves prior to installation.
6. Install sprinklers after hydrostatic test is completed.
7. Locate sprinkler heads to assure proper coverage of indicated areas. Minimum water coverage shall be 95% in turf areas and 85% in other planting areas. Do not exceed spacing distances indicated on the approved shop drawings.
8. Locate part-circle sprinklers to maintain a minimum distance of 4 inches from walls and 2 inches from other boundaries unless otherwise indicated.
9. Install in-ground control valves, manual gate valves, quick coupling valves, and pressure regulators in a valve access box. Electric valves shall have a minimum of 6" clearance between wires and top of box when wiring is complete.
10. Install valve access boxes on a suitable base of gravel completely enclosed with soil separator fabric to provide a level foundation at proper grade and to provide drainage of the access box as shown on the drawings.
11. Seal threaded connections on pressure side of control valves with Teflon tape or approved plastic joint type compound.
12. Install manual gate valve, minimum 1" size, at the end or low point of all dead end laterals to provide for flushing and system drain-down in the fall.
13. Mark all automatic valve box and quick coupler valve box locations with paint dot on top of nearest curb as directed by the Landscape Architect.
14. Install manual gate valve on the main line, same size as main line, in a valve box on the source side of any roadway crossing.

E. Drip Irrigation Installation:
1. Install freestanding emitters on pipe riser to mounting height indicated.
2. Install manifold emitter systems with tubing to emitters. Plug unused manifold outlets. Install emitters on off-ground supports at height indicated.
3. Install multiple-outlet emitter systems with tubing to outlets. Plug unused emitter outlets. Install outlets on off-ground supports at height indicated.
4. Install drip tubes with direct-attached emitters on ground.
5. Install drip tubes with remote-discharge on ground with outlets on off-ground supports at height indicated.
6. Install off-ground supports of length required for indicated mounted height of device.
7. Install application pressure regulators and filter units in piping near device being protected, and aboveground in control-valve boxes.
8. Install air relief valves and vacuum relief valves in piping, and aboveground in control-valve boxes.

F. Control Wiring Installation:
1. Install electric control cable in the piping trenches wherever possible. Place wire in trench a minimum of 4" vertically above pipe. Install wire with slack to allow for thermal expansion and contraction. Expansion joints in wire may be provided at 200-foot intervals by making 5-6 turns of the wire around a piece of 2" pipe instead of slack. Where necessary to run wire in a separate trench, provide a minimum cover of 12". Tape wire into bundles @ 20 feet on center maximum.
2. Provide sufficient slack at site connections at remote control valves in control boxes, and at all wire splices to allow raising the valve bonnet or splice to the surface without disconnecting the wires when repair is required.
3. Connect master valve to master valve terminal on the controller. Provide one master valve per water supply connection.
4. Connect each remote control valves to decoders as specified.
5. Make wire connections to remote control electric valves, decoders and splices of wire in the field, using wire connectors and sealing cement in accordance with manufacturer’s recommendations.
6. Provide tight joints to prevent leakage of water and corrosion build-up on the joint.
7. Install manufacturer's recommended surge protection device between field valves and control unit.

G. Sleeves:
1. Install sleeves for installation of irrigation system prior to paving installation. No cutting and patching of finished surfaces shall be permitted.

H. Water hammer arrester:
1. Install water hammer arrester between tap on main line and circuit valves as required to protect water main and underground irrigation system.

I. Controller:
1. Install controllers as shown on the drawings. Make connections as required to make the automatic control fully operational.
2. Obtain 120V electrical power from locations shown on the drawings.
3. Provide maximum manufacturer’s recommended grounding for the Southeastern U.S.
4. Equipment Mounting: Install wall-mounted controllers on as indicated on drawings for series shown.
   a. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   b. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Equipment Mounting: Install exterior freestanding controllers on precast concrete bases or as indicated on drawings.
   a. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   b. Install anchor bolts to elevations required for proper attachment to supported
equipment.
6. Install control cable in same trench as irrigation piping and at least 2 inches (51 mm) below or beside piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas.

J. Automatic Controller Accessory and/or Sensor Assembly Installation:
1. Install all accessories per Manufacturer’s written recommendations.

3.04 FLUSHING, TESTING, AND ADJUSTMENT
A. After piping is installed and before sprinkler heads are installed, open control valves and flush out the system with full head of water.
B. Perform system testing upon completion of each section. Make necessary repairs and retest repaired sections as required.
C. Adjust sprinklers after installation for proper and adequate distribution of the water over the coverage pattern. Adjust for the proper arc of coverage.
D. Tighten nozzles on spray type sprinklers after installation. Adjust sprinkler adjusting screw on lateral line or circuit as required for proper radius. Interchange nozzles patterns if so directed by the Landscape Architect, to give best arc of coverage.
E. Adjust all electric remote control valves, pressure regulators and flow control stems for system balance and optimum performance.
F. Test and demonstrate the controller by operating appropriate day, hour, and station selection features as required to automatically start and shut down irrigation cycles. Demonstrate that system meets coverage requirements which are based on operation of one circuit at a time.
G. Upon completion of seeding/sodding by others and repair to seeded/sodded areas, carefully adjust lawn sprinkler heads so they will be flush with or not more than 1/2” above finish grade.

3.05 SERVICE
A. Engage factory-authorized service representatives to perform services during the installation and warranty periods.
B. When requested, or as required, return to the site during the subsequent fall season and winterize the system. Drain all water from the system or blow out the system with compressed air.
C. When requested, or as required, return to the site during the subsequent spring season and demonstrate to the Owner the proper procedures for the system start-up, operation, and maintenance. Repair damage to irrigation system that occurred during the winter due to improper installation.

3.06 DISPOSAL OF WASTE MATERIAL
A. Stockpile, haul from site, and legally dispose of waste materials, including unsuitable excavated materials, rock, trash, and debris.
B. Maintain disposal route clear, clean, and free of debris.

3.07 TEST REPORT RECORD
A. Tests of all water lines shall be recorded on a form with the data and format as listed below. When the form(s) is (are) completed, it (they) shall be turned over to the Owner.
B. Job Name: ____________________________
C. Test Location: __________________________
D. Type System: Landscape Irrigation
E. Test Pressure: __________________________
F. Length of Time for Test: __________________________
G. I certify that the above test was performed in my presence and that all leaks observed were fixed
prior to backfilling.

H. SIGNED: ____________________________________________

   General Contractor's Superintendent

I. SIGNED: ____________________________________________

   Irrigation Contractor's Superintendent

**3.08 INSPECTION AND ACCEPTANCE**

A. Upon completion of work, notify Landscape Architect in writing at least ten (10) days prior to requested date of inspection for acceptance. Submit written operating and maintenance instructions with request for inspection. Where inspected irrigation work does not comply with requirements, replace rejected work as specified until re-inspected by Landscape Architect and found to be acceptable. Remove rejected materials promptly from project site.

B. Test and demonstrate to the Landscape Architect and Owner the satisfactory operation of the system free of leaks.

C. Instruct the Owner's designated personnel in the operation of the system, including adjustment of controller and valves.

D. Upon acceptance the Owner will assume operation of the system.

**3.09 WARRANTY**

A. Warrant all components of underground and interior irrigation systems for a period of one year after the date of Substantial Completion. Replace in accordance with the drawings and specifications, any defective material or damage to the system which is the result of improper installation procedures, at no additional cost to the owner.

**3.10 CLEANING**

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from irrigation system installation.

END OF SECTION 32.84.00
SECTION 32.92.19
SEEDING

PART 1 - GENERAL

1.01 SUMMARY
A. Provide seeded areas as shown and specified. The work includes:
   2. Seeding lawns and other indicated areas.
   3. Mulching.

1.02 RELATED REQUIREMENTS:
1. Section 31.22.00: Grading
2. Section 32.84.00: Landscape Irrigation System
3. Section 32.92.23: Sodding
4. Section 32.93.00: Trees, Shrubs and Ground Covers

1.03 QUALITY ASSURANCE
A. Testing agency shall be acceptable to the Architect. Provide the following data:
   1. Test representative material samples proposed for use.
   2. Test soil material samples proposed for use in accordance with Section 32 91 19 - Landscape Grading:
B. Conduct a meeting at least thirty (30) days prior to start of fine grading work to review detailed requirements for compost spreading, fine grading, seeding, geotextile installation, irrigation and planting. Review status of submittals, samples and availability of materials. Establish and/or confirm work schedule. Establish procedures for coordinating work of related trade contractors for compost spreading, fine grading, irrigation installation, seeding, geotextile installation and planting. Request that representatives of each entity directly concerned with the above mentioned trades attend meeting including, but not limited to, the following:
   1. Contractor’s superintendent
   2. Earthwork trade contractor
   3. Topsoil supplier
   4. Seeding trade contractor
   5. Geotextile trade contractor
   6. Compost supplier
   7. Irrigation trade contractor
   8. Planting trade contractor
   9. Landscape Architect and Consultants
   10. Owner’s Representative

1.04 SUBMITTALS
A. Submit seed vendor's certification for required grass seed mixture, indicating percentage by weight, and percentages of purity, germination, and weed seed for each grass species.
B. Submit the following material samples:
   1. Seed
   2. Hydromulch
C. Submit the following material certification:
1. Fertilizer analysis.
2. Tackifier
3. Asphaltic emulsion
D. Submit materials test report.
E. Upon seeding, submit written maintenance instruction recommending procedures for maintenance of seeded areas.

1.05 DELIVERY, STORAGE AND HANDLING
A. Deliver seed and fertilizer materials in original unopened containers, showing weight, analysis, and name of manufacturer. Store in a manner to prevent wetting and deterioration.

1.06 PROJECT CONDITIONS
A. Work notification:
B. Notify Architect at least 7 working days prior to start of seeding operations.
C. Protect existing utilities, paving and other facilities from damage caused by seeding operations.
D. Perform seeding work only after planting and other work affecting ground surface has been completed.
E. Restrict traffic from seeded areas until seed is established. Erect signs and barriers as required.
F. Provide hose and watering equipment as required.
G. Furnishing and placement of topsoil shall be limited to locations shown on the drawings and shall be by earthwork contractor and is not a part of the seeding work.
H. Irrigation System: The irrigation system will be installed prior to seeding. Coordinate all work with irrigation subcontractor as required. Locate, protect, and maintain the irrigation system during seeding operation.

1.07 WARRANTY
A. Warrant all seeding for a period of one year after the date of acceptance against defects including death and unsatisfactory growth in the opinion of the Landscape Architect.
B. Replace in accordance with the drawings and specifications, all seeding that is dead or, as determined by the Landscape Architect, is in an unhealthy or unsightly condition. The cost of such replacement or repair is at Contractor's expense. Warrant all replacement seeding for 1 year after installation.
C. Warranty shall not include damage or loss of seeding caused by fires, floods, freezing rains, lighting storms, or winds over 75 miles per hour, winter kill caused by extreme, cold and severe winter conditions not typical of planting area; acts of vandalism or negligence on the part of the Owner.
D. Replacements:
   1. Replacements are subject to all requirements stated in this specification and subject to inspection by the Landscape Architect.
E. Repair grades, lawn areas, paving and any other damage resulting from replacement seeding operations, at no additional cost to the Owner.
F. Inspect job site monthly during warranty period to determine what changes, if any, should be made in the maintenance program. Submit all recommended changes in writing to the Landscape Architect and the Owner. In the absence of monthly written reports from the Contractor it shall be assumed that the Contractor is satisfied with the Owner's maintenance operations and procedures and waives any and all claims for damages against the Owner with respect to the warranty requirements of this specification.
G. At the close of warranty period, one year after acceptance of the work, notify the Owner and Landscape Architect in writing of the date for warranty inspection. Make any repairs or replacements identified by the Landscape Architect in the Warranty Inspection.
PART 2 - PRODUCTS

2.01 MATERIALS

A. Seeds shall meet the requirements of applicable seed laws and shall be tested in accordance with the most current edition of the U.S. Department of Agriculture Handbook No. 30, Testing Agricultural and Vegetable Seed. Seeds shall be from the last preceding crop and comply with the requirements outlined below for purity and germination. Each variety of seed shall be furnished in separate, strong bags with each bag being fully tagged or labeled to show the variety, weight, purity, germination, and test data prescribed by law. All test results shall be fully certified by the vendor or by a recognized seed testing agency. Seeds found not to comply with specification requirements shall be subject to rejection.

B. When mixing or forming seed mixture, the seeds shall be carefully and uniformly mixed. Seeds shall not be mixed until each variety of seed to be used in the mix has been inspected and/or tested separately and approved.

<table>
<thead>
<tr>
<th>Seed Varieties</th>
<th>Purity Minimum %</th>
<th>Germination Minimum %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kentucky Bluegrass (variety to be determined) Poa pratensis</td>
<td>95</td>
<td>90</td>
</tr>
<tr>
<td>Jasper II Creeping Red Fescue Festuca rubra ‘Jasper II’</td>
<td>95</td>
<td>90</td>
</tr>
<tr>
<td>Padre Fescue Festuca arundinacea ‘Padre’</td>
<td>95</td>
<td>85</td>
</tr>
<tr>
<td>Biltmore Fescue Festuca arundinacea ‘Biltmore’</td>
<td>95</td>
<td>85</td>
</tr>
<tr>
<td>Stetson Fescue Festuca arundinacea ‘Stetson’</td>
<td>95</td>
<td>85</td>
</tr>
</tbody>
</table>

C. Seeding materials shall be free from seeds or bulbets of Wild Onion (Allium vineal), Canada Thistle (Cirsium arvense), and Johnson Grass (Sorghum halepense).

D. Seed species shall not contain more than six seeds per ounce of the seed of any of the following noxious weeds or the seeds of any other weed specifically listed as noxious including Bindweed (Convolvulvs arvensis), Oxeye Daisy (Chrysanthemum leucanthemum), Buckhorn (Plantago lanceolata), Corncockle (Agrostemma githago), Quackgrass (Agropyron repens), Dodder (Cuscuta species), Sorrel (Rumex acetosella).

E. Seed species shall not contain an excess of 2 percent by weight of weed seeds, noxious or otherwise.

F. Seed Mixtures, Rates and Seasons: Seeding mixtures, rates, and seasons shall be those specified herein. The types to be used for each area are specified by the drawings. Seeding shall be planted during the season and between the dates specified. Temporary cover shall be planted when it is required during seasons not suitable for planting the seed specified by the drawings.

1. Lawn (LWN): Spring or fall seeding.
   a. Dates: Plant between March 15 and May 1 or between August 15 and October 15.
   b. Seed Mix:
      1) 33.3% Biltmore Fescue, 33.3% Stetson Fescue and 33.3% Padre Fescue blend at 6 lbs. per 1000 sq. ft.
2. Turf Mix I: 3:1 or steeper Slopes.
   b. Seed Mix:
      1) 33.3% Biltmore Fescue, 33.3% Stetson Fescue and 33.3% Padre Fescue blend at 3 lbs. per 1,000 sq. ft.
      2) Kentucky Bluegrass at 2 lbs. per 1,000 sq. ft.
      3) Jasper II Creeping Red Fescue at 2 lbs. per 1,000 sq. ft.

3. Temporary Winter Seeding.
   a. Dates: Plant between October 15 and March 15.
   b. Seed Mix:
      1) Annual Ryegrass 2 lbs. per 1000 sq. ft.
      2) White Clover 0.50 lb. per 1000 sq. ft.

4. Temporary Summer Seeding.
   a. Dates: Plant between May 1 and August 15.
   b. Seed Mix:
      1) Red Clover 1 lb. per 1000 sq. ft.
      2) Weeping Lovegrass 0.50 lb. per 1000 sq. ft.

G. Compost – Seeded areas shall receive a minimum of compost as indicated on the drawings and as specified in section 32.19.19- Landscape Grading.

H. Fertilizers - Fertilizers shall be those readily available commercially. The application of fertilizer shall be at a rate of 200 pounds Ureaform (38-0-0) per acre with either 400 pounds of 15-15-15 per acre of 600 pounds of 6-12-12. Fertilizer rates shall be modified by the recommendations of the soil test and shall be approved by the Architect in writing.

I. Limestone - Limestone shall contain no less than 85 percent calcium carbonate by weight. It shall be crushed so that at least 85 percent will pass a no. 10 sieve. The application of limestone shall be at the rate of 2 tons per acre. Hydrated lime may be substituted at a rate of 1 ton per acre. Limestone rates shall be modified by the recommendations of the soil test and shall be approved by the Architect in writing.

J. Straw Mulch - Clean oat or wheat straw well seasoned before bailing, free from mature seed bearing stalks or roots of prohibited or noxious weeds. Use straw on slopes no steeper than 4:1 unless a tackifier/binder is applied. Omit straw if hydromulching procedure is used.

K. Wood cellulose fiber mulch - Degradable green dyed wood cellulose fiber of 100% recycled long fiber pulp, free from weeds or other foreign matter toxic to seed germination and suitable for hydromulching. Use for hydromulching in lieu of straw on erosion prone slopes greater than 4:1 or drainage swales.
   1. Available manufacturers and types:
      c. Superior Turf Fiber: Cellin Mfg. Inc., Lorton, VA

L. Tackifier - Liquid concentrate diluted with water forming a transparent 3--dimensional film like crust permeable to water and air and containing no agents toxic to seed germination. Use tackifier on erosion prone slopes to hold either wood cellulose fiber mulch or straw.
   1. Available Manufacturers and types:
      a. Polybind DLR: Celtite, Inc., Cleveland, OH
      b. Curasol AK: American Hoechst Corp., Elk Grove, IL
M. Water - Free of substances harmful to seed growth. Hoses or other methods of transportation shall be furnished by the Contractor.

N. Geotextiles: As specified in Section 32.05.19.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine finish surfaces, grades, compost quality, and depth. Do not start seeding work until unsatisfactory conditions are corrected and acceptable for seeding.

3.02 PREPARATION

A. Limit preparation to areas which will be immediately seeded.

B. Loosen soil and topsoil of seeded areas to minimum depth of 4". Remove stones over 1" in any dimension and sticks, roots, rubbish and extraneous matter. It is strongly recommended that scarifying and preparation of seedbeds on cut and fill slopes be accomplished with tools or equipment specially designed for this purpose. Small furrows or grooves formed in the slopes shall be horizontal or as nearly horizontal as practical. The work shall be performed only when the ground is in a workable and tillable condition as determined by good farming practices.

C. Grade seeded areas to a smooth, free drainage even surface with a loose, moderately coarse texture. Roll and rake, remove ridges, and fill depressions as required to drain.

D. Apply compost at depth determined on the drawings.

E. Apply limestone, at rate determined by the soil test, to adjust pH of topsoil. Distribute evenly by machine and incorporate thoroughly into topsoil.

F. Apply fertilizer to all seeded areas at the approved rates as determined by the soil test.

G. Apply fertilizers by mechanical rotary to drop type distributor, thoroughly and evenly incorporated with soil to a depth of 3" by discing or other approved method. Fertilize areas inaccessible to power equipment with hand tools and incorporate into soil.

H. Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to seeding.

3.03 INSTALLATION

A. Seeding:

1. Seed immediately after preparation of bed. See 2.01 F - Seed Mixtures, Rates and Seasons.

2. Seed all areas within and adjoining project limits disturbed as a result of construction operations.

3. Perform seeding operations when the soil is dry and when winds do not exceed 5 miles per hour velocity.

4. Apply seed with a rotary or drop type distributor. Installed seed evenly by sowing equal quantities in 2 directions, at right angles to each other.

B. Hydromulching:

1. Hydromulching is acceptable in areas of greater than 4:1 slopes.

2. Use a hydromulcher (sprayer) and apply mixtures at the following rates. Mix in accordance with manufacturer's recommendations.

3. Apply hydromulch slurry to indicated areas.

   a. Tackifier: 60 gals/acre.

   b. Wood cellulose fiber mulch:

      1) 2,000 lbs./acre on slopes greater than 4:1.

      2) 1,500 lbs./acre on slopes less than 4:1.
C. Mulching:
1. Place straw mulch on seeded areas within 24 hours after seeding. Omit straw mulch if hydroseeding procedure is used.
2. Place straw mulch uniformly in a continuous blanket at the rate of 2-1/2 tons per acre, or two 50 lb. bales per 1,000 sq. ft. of area. A mechanical blower may be used for straw mulch application when acceptable to the Architect.
3. Anchor straw mulch with liquid tackifier applied uniformly at a rate of 60 gal. per acre on slopes greater than 4:1.
4. Protect structures, walls, paving, plantings, and all nonseeded areas from liquid tackifier over-spray.

D. Geotextiles:
1. Place geotextile on seeded areas the same day of seeding.
2. Place geotextile with minimum lap recommended by the manufacturer for the specific type of installation.
3. Place geotextile in direct contact with surface of soil.
4. Anchor geotextile with pins or staples in accordance with Section 32.05.19.
5. Anchor toe and top of geotextile installation with manufacturer’s recommendations for the specific type of installation.

E. Provide straw bale checking at intervals as shown on the drawings and as required to adequately slow water velocity and impede soil loss

3.04 MAINTENANCE
A. Maintain seeded areas until completion and acceptance of the entire project or not less than 30 days after completion and acceptance of seeding operations.
B. Maintain seeded areas, including watering, spot weeding, mowing, applications of herbicides, fungicides, insecticides, and re-seeding until a full, uniform stand of grass free of weeds, undesirable grass species, disease, and insects is achieved and accepted by the Architect.
1. Water periodically to maintain adequate surface soil moisture for proper seed germination. Continue watering for not less than 30 days. Thereafter apply water as required until provisional acceptance.
2. Repair, rework, and re-seed all areas that have washed out, are eroded, or do not catch.
3. Mow lawn (LWN) and Turf Mix I areas as soon as lawn top growth reaches a 4" height. Cut back to 3" in height. Repeat mowing as required to maintain specified height. Following mowing limit as directed by the Architect.

3.05 CLEAN UP AND PROTECTION:
A. During seeding work, keep pavements clean and work area in an orderly condition.
B. Upon completion of work, clear grounds of debris, superfluous materials and all equipment. Remove from site to satisfaction of the Architect.
C. Protect seeding work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged seeding as directed, at no additional cost to the Owner.

3.06 INSPECTION AND ACCEPTANCE
A. Upon completion of work, notify the Architect at least ten (10) days prior to requested date of inspection for acceptance. Where inspected work does not comply with requirements, replace rejected work and continue specified maintenance until re-inspected by the Architect and found to be acceptable.
1. Seeded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, uniform, close stand of the specified mixture is established free of weeds, undesirable species, disease, and insects.

2. No individual seeded areas shall have bare spots or unacceptable cover totaling more than 2% of the individual areas, in areas requested to be inspected.

B. Upon satisfactory completion of repairs and, or replacements, the Architect certifies, in writing, the acceptance of the work in total.

**END OF SECTION 32.92.19**
SECTION 32.92.23
SODDING

PART 1 - GENERAL

1.01 DESCRIPTION
A. Provide sodded lawns as shown and specified. The work includes:
   2. Sodding lawns and other indicated areas.
   3. Maintenance

1.02 RELATED REQUIREMENTS:
A. Grading: Section 31.22.10
B. Landscape Irrigation System: Section 32.84.00
C. Seeding: Section 32.92.19
D. Trees, Shrubs and Ground Covers: Section 32.93.00

1.03 QUALITY ASSURANCE
A. Sod: Comply with American Sod Producers Association (ASPA) classes of sod materials.
B. Provide and pay for materials testing. Testing agency shall be acceptable to the Landscape Architect. Provide the following data:
   1. Test representative materials samples proposed for use.
      a. Topsoil:
         1) Water pH factor.
         2) Mechanical analysis.
         3) Percentage of organic content.
         4) Soil test ratings for Phosphorus, Potassium, Calcium, Magnesium, Zinc, Iron, and Manganese.
         5) Soluble salt concentration.
         6) Recommendations on type and quantity of additives required to establish satisfactory pH factor and supply of nutrients to bring nutrients to satisfactory level for planting.

1.04 SUBMITTALS
A. Submit sod growers certification of grass species. Identify source location.
B. Submit the following materials certification:
   1. Fertilizer analysis.
   2. Limestone analysis.
C. Submit topsoil test report.
D. Upon sodded lawn acceptance, submit written maintenance instructions recommending procedures for maintenance of sodded lawns.

1.05 DELIVERY, STORAGE AND HANDLING
A. Cut, deliver, and install sod within 24-hour period.
B. Do not harvest or transport sod when moisture content may adversely affect sod survival.
C. Protect sod from sun, wind and dehydration prior to installation.
D. Do not tear, stretch or drop sod during handling and installation.
1.06 PROJECT CONDITIONS
A. Work notification: Notify Landscape Architect at least 7 working days prior to start of sodding operations.
B. Protect existing utilities, paving, and other facilities from damage caused by sodding operations.
C. Perform sodding work only after planting and other work affecting ground surface has been completed.
D. Restrict traffic from lawn areas until grass is established. Erect signs and barriers as required.
E. Provide hose and lawn watering equipment as required.
F. The irrigation system will be installed prior to sodding. Coordinate all work with irrigation contractor as required. Locate, protect and maintain the irrigation system during sodding operations. Repair irrigation system components damaged during sodding operations.

1.07 WARRANTY
A. Warrant all sodding for a period of one year after the date of acceptance against defects including death and unsatisfactory growth in the opinion of the Landscape Architect.
B. Replace in accordance with the drawings and specifications, all sod that is dead or, as determined by the Landscape Architect, is in an unhealthy or unsightly condition. The cost of such replacement(s) is at Contractor's expense. Warrant all replacement sod for 1 year after installation.
C. Warranty shall not include damage or loss of sodding caused by fires, floods, freezing rains, lightning storms, or winds over 75 miles per hour, winter kill caused by extreme, cold and severe winter conditions not typical of planting area; acts of vandalism or negligence on the part of the Owner.
D. Replacements:
   1. Replacements are subject to all requirements stated in this specification and subject to inspection by the Landscape Architect.
E. Repair grades, lawn areas, paving and any other damage resulting from replacement sodding operations, at no additional cost to the Owner.
F. Inspect job site monthly during warranty period to determine what changes, if any, should be made in the maintenance program. Submit all recommended changes in writing to the Landscape Architect and the Owner.
G. At the close of warranty period, one year after acceptance of the work, notify the Owner and Landscape Architect in writing of the date for warranty inspection.
H. Make any repairs or replacements identified by the Landscape Architect in the Warranty Inspection.

PART 2 - PRODUCTS
2.01 MATERIALS
A. Sod:
   1. Sod shall be nursery grown sod composed of a blend of turf-type fescues plus 5% Kentucky Bluegrass.
   2. Sod containing Common Bermudagrass, Quackgrass, Johnsongrass, Poison Ivy, Nutsedge, Nimblewill, Canada Thistle, Timothy, Bentgrass, Wild Garlic, Ground Ivy, perennial Sorrel, or Bromegrass weeds will not be acceptable.
   3. Provide sod free of grassy or broadleaf weeds.
   4. Provide well-rooted, healthy sod, free of diseases, nematodes and soil borne insects. Provide sod uniform in color, leaf texture, density, and free of weeds, undesirable
grass, stones, roots, thatch, and extraneous material; viable and capable of growth and
development when planted.

5. Furnish sod machine stripped in square pads or strips not more than 3'-0" long; uniformly
   1" to 1-1/2" thick with clean cut edges. Mow sod before stripping.

B. Fertilizer - Fertilizers shall be those readily available commercially. The application of fertilizer
   shall be at a rate of 200 pounds Ureaform (38-0-0) per acre with either 400 pounds of 15-15-15 per
   acre or 600 pounds of 6-12-12. Fertilizer rates shall be modified by the recommendation of the
   soil test and shall be approved by the Landscape Architect in writing.

C. Limestone - Limestone shall contain no less than 85 percent calcium carbonate by weight. It shall
   be crushed so that at least 85 percent will pass an no. 10 sieve.
   1. The application of limestone shall be at the rate of 2 tons per acre.
   2. Hydrated lime may be substituted at a rate of 1 ton per acre.
   3. Limestone rates shall be modified by the recommendations of the soil test and shall be
      approved by the Landscape Architect in writing.

D. Stakes - Use where sod slopes greater than 3:1 or in drainage swales.
   1. Softwood, 3/4" dia. x 8" long or,
   2. Steel, tee shaped pins, 4" head x 8" leg.

E. Water:
   1. Free of substance harmful to sod growth.
   2. Hoses or other methods of transportation furnished by Contractor.

PART 3 - EXECUTION

3.01 INSPECTION
A. Examine finish surfaces, grades, topsoil quality and depth. Do not start sodding work until
   unsatisfactory conditions are corrected.

3.02 PREPARATION
A. Limit preparation to areas which will be immediately sodded.
B. Loosen topsoil of lawn areas to minimum depth of 4". Remove stones over 1" in any dimension
   and sticks, roots, rubbish and extraneous matter.
C. Grade lawn areas to smooth, free draining and even surface with a loose, uniformly fine texture.
   Roll and rake; remove ridges and fill depressions as required to drain.
D. Apply limestone at rate determined by the soil test, to adjust pH of topsoil. Distribute evenly by
   machine and incorporate thoroughly into topsoil.
E. Apply fertilizer at the approved rates. Apply fertilizer by mechanical rotary or drop type
   distributor, thoroughly and evenly incorporated with the soil to a depth of 3" by discing or other
   approved methods. Fertilize areas inaccessible to power equipment with hand tools and
   incorporate it into soil.
F. Dampen dry soil prior to sodding.
G. Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine
   grading and prior to sodding.

3.03 INSTALLATION
A. Sodding:
   1. Lay sod to form a solid mass with tightly-fitted joints. Butt ends and sides of sod strips.
      Do not overlay edges. Stagger strips to offset joints in adjacent courses. Remove excess
      sod to avoid smothering of adjacent grass.
2. Provide sod pad top flush with adjacent curbs, sidewalks, drains, and seeded areas.
3. Do not lay dormant sod or install sod on saturated or frozen soil.
4. Install initial row off sod in a straight line, beginning at bottom of slopes, perpendicular to direction of the sloped area. Place subsequent rows parallel to and lightly against previously installed row.
5. Peg sod on slopes greater than 3 to 1 to prevent slippage at a minimum rate of 2 stakes per yd. of sod but no less than 2 stakes per individual piece of sod.
6. Water sod thoroughly with a fine spray immediately after laying.
7. Roll with light lawn roller to ensure contact with sub-grade.

3.04 MAINTENANCE
A. Maintain sodded lawns until completion and acceptance of the entire project or not less than 30 days after completion and acceptance of sodding operations.
B. Maintain sodded lawn areas, including water, spot weeding, mowing, application of herbicides, fungicides, insecticides and resodding until a full, uniform stand of grass free of weed, undesirable grass species, disease, and insects is achieved and accepted by the Landscape Architect.
C. Water sod thoroughly every 2 to 3 days, as required to establish proper rooting.
D. Repair, rework and resod all areas that have washed out or are eroded.
E. Replace undesirable or dead areas with new sod.
F. Mow lawn areas as soon as lawn top growth reaches a 4" height. Cut back to 3" height. Repeat mowing as required to maintain specified height.
G. Not more than 40% of grass leaf shall be removed at any single mowing.
H. Apply herbicides as required to control weed growth or undesirable grass species.
I. Apply fungicides and insecticides as required to control diseases and insects.
J. Remove sod pegs.

3.05 CLEAN UP AND PROTECTION
A. During sodding work, keep pavements clean and work area in an orderly condition.
B. Upon completion of work, clear grounds of debris, superfluous materials and all equipment. Remove from site to satisfaction of Landscape Architect.
C. Protect sodding work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged sodding work as directed, at no additional cost to the Owner.

3.06 INSPECTION AND ACCEPTANCE
A. Upon completion of work, notify Landscape Architect at least ten (10) days prior to requested date of inspection for acceptance. Where inspected work does not comply with requirements, replace rejected work and continue specified maintenance until re-inspected by Landscape Architect and found to be acceptable. Sodded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, even colored viable lawn is established, free of weeds, undesirable grass species, disease, and insects.
B. Upon satisfactory completion of repairs and/or replacements, the Landscape Architect certifies, in writing, the acceptance of the work in total.
C. The one-year warranty period begins on the date of the acceptance of the work in total.
PART 1 - GENERAL

1.01 SUMMARY

A. Provide and furnish all trees, shrubs and ground covers, labor, miscellaneous materials and equipment required or inferred from drawings and specifications to complete the work of this section.

1.02 RELATED REQUIREMENTS

A. Grading: Section 31.22.10

B. Landscape Irrigation System: Section 32.84.00

C. Seeding: Section 32.92.19

D. Sodding: Section 32.92.23

1.03 QUALITY ASSURANCE

A. Installers Qualifications:

1. The Contractor shall have a minimum of seven (7) years specialized experience in the installation of planting projects of comparable size and quality.

2. The Contractor shall have completed one planting project whose contract sum was no less than the value of the planting work of this project within the last three (3) years.

3. The firm shall be a contractor licensed by the State in which the project is located.

4. The Contractor shall hold the specialty classifications on their contractor's license that relate to the work of this section in accordance with the requirements of authorities having jurisdiction.

5. The Contractor's license shall have a monetary limit that is not exceeded by the value of the planting work of this project.

6. The Contractor shall have a satisfactory record for installation and warranty performance on said projects. Workmanship shall be of the highest quality.

B. Applicable Standards:

1. Plant names indicated comply with "Standardized Plant Names" as adopted by the latest edition of the American Joint Committee of Horticultural Nomenclature. Names of varieties not listed conform generally with names accepted by the nursery trade. Provide stock true to botanical name and legibly tagged.

2. Provide stock true to botanical name and legibly tagged. Characteristics of individual plant species shall be as described in "Hortus Third". The character of individual plant varieties not listed shall be as defined in current horticultural literature and practice.


C. General: All plants shall be grown in a recognized nursery in accordance with good horticultural practice. Provide healthy stock free of disease, insects, eggs, larvae and defects such as knots, sun scald injuries abrasions or disfigurement.

D. Substitutions: Do not make substitutions. If specified plant material is not obtainable, submit to Landscape Architect proof of non-availability and proposal for use of equivalent material. For
proof of non-availability submit a written statement from a minimum of 6 reliable nursery sources (American Nurserymen's Association Members) that the plant in question is not obtainable in the Eastern United States.

E. Analysis and Standards: Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

F. Topsoil: Before delivery of imported topsoil, furnish Landscape Architect with written statement giving location of properties from which topsoil is to be obtained, depth to be stripped, and, if applicable, crops grown during past 2 years.

G. Soil Test Report: Contractor shall engage a reputable laboratory to include testing and analysis of soils representative of planting areas on site and imported topsoil with reference to specified plant materials. The soil test report should provide the following data: Water pH; soil test ratings for Phosphorus, Potassium, Calcium, Magnesium, Zinc, Iron and Manganese; percentage of organic matter; soluble salts; recommendations on type and quantity of additives required to establish satisfactory pH factor and supply nutrients to bring nutrients to satisfactory level for planting specified plant materials.

H. Approval and Selection of Materials and Work: The selection of all materials and the execution of all operations required under the specifications and drawings are subject to the approval of the Landscape Architect. The Landscape Architect has the right to reject any and all materials and any and all work which, in the opinion of the Landscape Architect does not meet the requirements of the Contract Documents at any stage of the operations. The Contractor shall promptly remove rejected work and or materials from job site. The Contractor shall replace rejected work and or materials promptly.

1.04 SUBMITTALS

A. Unit Pricing: - To be submitted by landscape contractor (after bidding) for the Landscape Architect and Owner’s reference if quantity changes are requested during construction.

1. Submit unit prices for each plant species specified on the drawings and for landscape materials including, but not limited to:
   a. Seeding
   b. Sod
   c. Topsoil
   d. Mulch
   e. Bed Edging
   f. Geosynthetics (if applicable)
   g. Root Barrier (if applicable)

2. Unit pricing may be denoted with both “add” and “deduct” units for materials which are time sensitive or which are non-refundable. The “add” units, however, must concur with the bid and/or approved proposal.

B. Certification:

1. Submit certificates of inspection for all plant materials with project close-out documents and as required by governmental authorities.

2. Submit manufacturer's or vendor's certified analysis for soil amendments and fertilizer materials. Submit other data substantiating that materials comply with specified requirements.
C. Notice of Sources: Within 15 days following the award of Contract, the Landscape Architect shall be notified in writing of the sources of all plant materials for this project. This notification shall include an itemized list of all plant materials and the complete address and telephone number of the supplier of each plant. Any requests for plant material substitution shall be included with this notification. Requests for substitution will not be considered before or after this notification.

D. Specimen Plant Material Photography:
1. Contractor must locate, photograph or videotape from both sides with a scale figure, and tag at the source each individual plant material labeled "Specimen" in the Plant List.
2. The Contractor must furnish photographs of each individual plant and inform Landscape Architect in writing of the source/location at least ten (10) days prior to digging.
3. Subsequently the Landscape Architect may, at his discretion, inspect and seal specimen plant materials before digging. In the event plant material is found to be unacceptable, the Contractor will pursue other sources until acceptable plant material is found, at no additional cost to the owner.

E. The contractor will reimburse the owner for time and travel costs incurred by the Landscape Architect ($920.00 per day plus travel costs) because of requested inspections of unacceptable specimen plant materials.

F. Approval at the plant source does not impair the right of inspection and rejection during the progress of the work.

G. Planting Schedule: Submit planting schedule showing scheduled dates for each type of planting work in each area of site. Submit planting schedule prior to beginning of the work. Planting schedule shall demonstrate a thorough understanding of the overall project schedule in accordance with the requirements of this specification section and good horticultural practices of the area in which the project is located.

H. Maintenance Instructions: Upon completion of the installation, submit typewritten recommendations for maintenance of any portion of the landscape which, in the opinion of the Contractor, requires special attention.

I. Topsoil Sample: Submit one cubic foot of topsoil proposed for use, two (2) weeks prior to beginning work. If topsoil source changes submit sample from new source.

J. Soil Test Report: Submit results of laboratory soil tests two (2) weeks prior to beginning of the work. If topsoil source changes submit soil test report from new source.

K. Approval: Obtain approval from Landscape Architect in writing for all submittals including miscellaneous materials prior to beginning of work.

L. Miscellaneous Materials: Submit product literature and samples of all miscellaneous materials required to complete the work of this section.

M. Provide plant material record drawings:

N. Legibly mark drawings to record actual construction.

O. Identify field changes of dimension and detail and changes made by Change Order referenced to permanent surface improvements.
1.05 DELIVERY, STORAGE AND HANDLING:

A. Deliver fertilizer materials in original, unopened, and undamaged containers showing weight, analysis, and name of manufacturer. Store in manner to prevent wetting and deterioration.

B. Shipment and Delivery:

1. Promptly notify the Landscape Architect in advance, when the plant material is to be delivered and the manner of shipment.
2. Furnish therewith an itemized list of the actual quantity and sizes
3. Deliver the necessary inspection certificates to accompany each plant or shipment prior to acceptance and planting.
4. When shipment is made by truck, pack all plant material to provide adequate protection against climate and breakage during transit and tie to prevent whipping.
5. Cover the tops with tarpaulin to minimize wind whipping and drying, or spray adequately with anti-transparent.
6. Exercise care at all times during the handling operations to prevent damage to bark, branches, and root system.
7. Employ a suitable method of handling to insure the careful workmanlike delivery of heavy balled plants to preclude cracked plant balls. No balled plant shall be planted if the ball is cracked or broken either before or during the planting operation.

C. Protection After Delivery: The balls of "B & B" plants which cannot be planted immediately on delivery shall be covered with moist soil or mulch, or other protection from drying winds, sun, and freezing temperatures. Rooted plants shall be planted or heeled in immediately upon delivery. All plants shall be watered as necessary until planted.

D. Do not remove container-grown stock from containers until planting time.

E. Label at least one tree and one shrub of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.

F. Do not remove labels attached to plant material until directed by the Landscape Architect to do so.

1.06 PROJECT CONDITIONS

A. Work notification: Notify Landscape Architect at least 7 working days prior to installation of plant material.

B. Protect existing utilities, paving, and other facilities from damage caused by landscaping operations.

C. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required. Schedule delivery of plant materials to closely coincide with installation and to minimize stored plant materials. All stored plant materials shall be protected, maintained and subject to all provisions of this specification.

D. Existing Utilities: The Contractor shall—at his own expense—locate, excavate and verify the alignment and depth of all underground utilities as shown on the drawings. Perform work in a manner which will avoid possible damage. Maintain grade stakes set by others unless removal is mutually agreed upon by parties concerned. All damage to utilities resulting from work covered in these specifications will be repaired at the Contractor's expense.
E. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, adverse soil conditions or obstructions, notify Landscape Architect in writing before planting.

F. Planting Time:
   1. Plant or install materials during suitable weather conditions.
   2. A dormant season planting is required.

G. Planting Schedule: Submit proposed planting schedule to Landscape Architect. Schedule dates for each type of landscape work during contract period.

H. Out-of-Season Planting: Out-of-Season planting shall not be permitted. If an out-of-season planting would otherwise be required in order to complete the work, submit in writing a proposed date during the dormant season for completing required planting or plant replacement work and obtain Landscape Architect's approval in writing.

1.07 WARRANTY

A. Warrant all trees, shrubs and ground covers against defects including death and unsatisfactory growth in the opinion of the Landscape Architect. Warrant trees shrubs and groundcovers for one (1) year from the date of Substantial Completion of the entire project.

B. Replace in accordance with the drawings and specifications, all plants that are dead or, as determined by the Landscape Architect, are in an unhealthy or unsightly condition, and have lost their natural shape due to dead branches, or other causes. The cost of such replacement(s) is at Contractor's expense. Warrant all replacement plants for one (1) year after installation.

C. Warranty shall not include damage or loss of trees, plants, or ground covers caused by fires, floods, freezing rains, lightning storms, or winds over 75 miles per hour, winter kill caused by extreme cold and severe winter conditions not typical of planting area; acts of vandalism or negligence on the part of the Owner.

D. Remove and immediately replace all plants, as determined by the Landscape Architect, to be unsatisfactory during the initial planting installation and one year warranty period.

E. Replacements: Match adjacent specimens of same species. Replacements are subject to all requirements stated in this specification and subject to inspection by the Landscape Architect.

F. Repair grades, paving and any other damage resulting from replacement planting operations, at no additional cost to the Owner.

G. Inspect job site monthly during warranty period to determine what changes, if any, should be made in the maintenance program. Submit all recommended changes in writing to the Landscape Architect and the Owner. In the absence of monthly written reports from the Contractor it shall be assumed that the Contractor is satisfied with the Owner's maintenance operations and procedures and waives any and all claims for damages against the Owner with respect to the warranty requirements of this specification.

H. At the close of the warranty period, one (1) year after Substantial Completion of Trees, Shrubs, and Groundcovers work, notify the Owner and Landscape Architect in writing of the date for warranty inspection. Make any repairs or replacements identified by the Landscape Architect in the Warranty Inspection.
I. Upon satisfactory completion of repairs and/or replacements the Landscape Architect certifies, in writing, the final acceptance of the work.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. New topsoil shall be fertile, friable, natural surface soil of fine to medium textured loamy character. Topsoil scarified and stockpiled on site may be utilized for landscaping in lieu of imported (new) topsoil.

B. Topsoil should be representative of the dark brown surface soils in the vicinity that produce heavy growth.

C. The topsoil shall be reasonably free from subsoil, objectionable weeds, litter, sod, stiff clay, stones larger than one inch in any dimension, stumps, roots, weeds, toxic substances, or any other material which may be harmful to plant growth or hinder planting operations.

D. Topsoil shall exhibit the following characteristics as evidenced by the soil test report:

   1. Water pH 6.5 minimum
   2. Phosphorus 9-30 pounds per acre
   3. Potassium 45-160 pounds per acre
   4. Organic matter 2.5% minimum
   5. Soluble salts 0-1060 parts per million.

E. Obtain topsoil only from naturally, well drained sites where topsoil occurs in a depth of not less than four inches.

F. Topsoil shall not be delivered, handled or transported in a frozen or muddy condition.

G. The furnishing or on-site transportation and amendment (if required) of all topsoil needed for planting and soil mix will be considered a subsidiary portion of this specification and covered in the cost of trees, shrubs, and ground covers.

2.02 SOIL AMENDMENTS

A. Fertilizer shall be a mixed commercial fertilizer, of Grade 10-10-10 or as recommended by the Soil Report with guaranteed chemical analysis of contents marked on containers or sacks.

B. Fertilizer shall not be added to topsoil utilized at areas planted with native grasses and/or native wildflowers.

C. Lime:

   1. Ground or pulverized of horticultural grade capable of neutralizing soil acidity and containing not less than 85% of total carbonates.
   2. Containers or sacks shall be labeled to show chemical and mechanical analysis.
2.03 PLANTING SOIL MIX

A. Planting soil mix shall be provided amended as per soils test report recommendations.

Basic soil mix is as follows:
1. 100% Topsoil (as specified)
2. Fertilizer as recommended
3. Lime as recommended

2.04 PLANT MATERIALS

General:

A. A complete list of plants including a schedule of sizes, quantities, and other requirements is shown on the drawings. In the event that quantity discrepancies or material omissions occur in the plant materials list, the planting plans shall govern.

B. Specific requirements concerning plant material and the manner in which it is to be supplied are shown on the drawings and plant list.

C. Acclimatization: Plants must have grown under climatic conditions and temperature extremes similar to those of the locality of the project site for a minimum of two years immediately prior to being planted on the job.

D. Quality and Size:

1. Plants shall have a habit of growth that is normal for a well maintained sample of the species and shall be sound, healthy, vigorous and free from insect pests, plant diseases, and injuries. Plants to be selected for specific branching habit where a range of habit occurs within a species shall be furnished thickly branched as noted on the plant list. All plants shall equal or exceed the measurements specified in the plant list, which are minimum acceptable sizes. They shall be measured before pruning with branches in normal position. Pruning shall be done at the discretion of or as directed by the Landscape Architect, but in no case shall the plants supplied under this contract be pruned back to such an extent that they no longer meet specifications. Requirements of plants in the plant list generally follow the code of standards currently recommended by the American Association of Nurserymen, Inc., in the American Standard of Nursery Stock.

E. Collected Plant Material. (Plants which are not nursery grown). Plant material shall be collected only if specifically authorized in writing by the Landscape Architect. Any collected plant material which is authorized shall be dug with a ball of earth which has a diameter at least 1/3 greater than that specified for nursery-grown stock and burlapped.

F. Plants furnished shall be at least the minimum size indicated. Larger stock is acceptable, at no additional cost, and providing that the larger plants will not be cut back to size indicated. Provide plants indicated by two measurements so that only a maximum of 25% are of the minimum size indicated and 75% are of the maximum size indicated.

G. Specimen Plant Material: Plants labeled "Specimen" in the plant list shall be outstanding plants of the species and shall be of the highest quality possessing all the characteristics shown in the plant materials list.

H. Furnish plants to match as closely as possible whenever symmetry is called for.
I. Ball and Burlapped Plants: All plants designated "B &B" on the plant list shall have firm natural balls of soil in sizes as set forth in the "American Standard for Nursery Stock" and shall be:
   a. Wrapped firmly with burlap or approved material.
   b. Bound carefully with twine, cord or wire mesh, in a manner so as not to damage the bark, break branches, or destroy natural shape.
   c. Covered with moist soil, mulch, or other protection from drying if not planted immediately. Cracked or mushroomed balls are not acceptable.

J. Bare Root Plants: Plants designated "BR" in the list of plants to be furnished shall be dug with substantially all of the root system intact, and with the earth carefully removed from the roots. Cover all roots with a thick coating of mud by puddling, or otherwise protect from drying after they are dug.

K. Container grown plants in cans or plastic containers will be acceptable in lieu of balled and burlapped plants provided that they are of specified quality. The container must be removed prior to planting, care being exercised as to not injure the plant.

L. Trees:
   1. Provide trees of height and caliper listed or shown and with branching configuration recommended by ANSI Z60.1 for type and species required. Provide single stem trees except where special forms are shown or listed.
   2. Determining dimensions for trees are caliper, height and spread. Caliper taken 6" above ground for trees up to and including 4" caliper. Trees over 4" caliper measure 12" above ground. Height and spread dimensions specified refer to the main body of the plant and not from branch tip to tip. Take measurements with branches in normal position.
   3. Evergreen trees shall be branched to the ground unless noted otherwise on the drawings.
   4. No pruning wounds shall be present with a diameter of more than 1" and such wounds must show vigorous bark on all edges.

M. Shrubs:
   1. The measurements for height shall be taken from the ground level to the average height of the top of the plant and not the longest branch.
   2. Single stemmed or thin plants will not be accepted.
   3. Side branches shall be generous, well-twiggled, and the plant as a whole well-bushed to the ground.
   4. Plants shall be in a moist, vigorous condition, free from dead wood, bruises, or other root or branch injuries.

N. Ground Cover:
   1. Provide good ground cover plants established and well-rooted in removable containers or integral peat pots and with not less than minimum number and length of runners by ANSI Z60.1 for the pot size shown and as listed in plant list.

O. Perennials:
1. Provide perennial bulbs, corns and tubers which are fleshy and free of rot and not less than the grade and size recommended by ANSI Z60.1 for the size shown or listed.

2. Provide good perennials in either a dormant condition or actively growing. Actively growing perennials shall be furnished rooted in removable containers or field dug. Field dug perennials shall be in a moist, vigorous condition with no sign of desiccation.

### 2.05 MISCELLANEOUS LANDSCAPE MATERIALS

A. Burlap for wrapping earthball to be biodegradable jute mesh not less than 7.2 oz. per square yard.

B. Stakes: screw-in steel anchors in various lengths from 15" to 48" capable of holding from 200 to 6000 pounds as distributed by A.M. Leonard Co. (1-800-543-8955) and Ben Meadows Co. (1-800-241-6401), 2 x 2 or better uniform grade pressure treated pine, or sound new hardwood or redwood free of knot holes and other defects.

C. Guy and Wire Ties: ArborTie tree staking tie or approved equivalent. Install in accordance with manufacturer’s recommendation. Three (3), equally spaced guys per tree.

D. Soil Separator: Rot resistant polypropylene filter fabric, water permeable, and unaffected by freeze-thaw.

E. Drainage Gravel: Clean 3/4" crushed stone.

F. Water transportation is the sole responsibility of the Contractor.

G. Mulch: 6 month old well rotted shredded native hardwood bark mulch not larger than 4" in length and 1/2" in width, free of woodchips and sawdust.

H. Anti-Desiccant: Protective film emulsion providing a protective film over plant surfaces; permeable to permit transpiration. Mixed and applied in accordance with manufacturer's instructions.

I. Pre-Emergence Herbicide for general use shall be "Ronstar", "Casaron", or approved equal. Apply at the rates, times and manner recommended by the manufacturer.

J. Metal Bed Edging: Powder-coated Steel Bed Edging, 3/16” thick X 4” height with compatible Steel Stakes, 10ga thick X 12” length, color: Black, as manufactured by Col-Met, Collier Metal Specialties, 3333 Miller Park South, Garland, Texas 75042. TEL: 9724943900, www.colmet.com, or approved equivalent.

### PART 3 - EXECUTION

#### 3.01 PREPARATION

A. General

1. Contractor must examine conditions under which planting is to be installed. Review applicable architectural and engineering drawings, and be familiar with alignment of underground utilities before digging.

2. Planting Time: Planting operations are to be performed at such times of the year as the job may require, with the stipulation that the Contractor guarantees the plant material as specified herein. Plant only during periods when weather conditions are suitable.
3. Layout individual tree and shrub locations and areas for multiple plantings. Stake locations and outline areas and secure Landscape Architect's acceptance before start of excavation for planting work. Make adjustments as may be requested.

4. Notify Landscape Architect before planting in writing of adverse sub-surface drainage or soil conditions. State conditions and submit a proposal for correction including costs. Obtain approval for method of correction prior to continuing work in the affected area. In the event that alternate locations are selected, the Contractor will prepare such areas at no additional expense to the Owner.

5. Planting shall be performed only by experienced workmen familiar with planting procedures under the supervision of a qualified supervisor.

3.02 EXCAVATION

A. Preparation of Tree and Shrub Pits:

1. Excavate pits with vertical sides, as specified and as shown on the drawings. For balled and burlapped (B & B) trees and shrubs, make excavations at least half again as wide as the ball diameter and equal to the ball depth, plus an allowance for setting of ball on a layer of compacted backfill. Allow for 6" minimum setting layer of planting soil mixture.

2. Loosen hardpan and moisture barrier to a depth of 2' minimum below the bottom of the tree pit or until hardpan has been broken and moisture is allowed to drain freely. For shrub pits, loosen hardpan 8" minimum below bottom of excavation or until hardpan has been broken and moisture is allowed to drain freely.

3. For container grown stock, excavate as specified for balled and burlapped stock, adjusted to size of container width and depth.

4. Conduct drainage tests.

5. During planting process fill planting pit excavation to final grade using planting soil mix.

B. Test Drainage:

1. Acceptable Drainage Rate: Minimum acceptable percolation rate for tree pits, shrub pits and shrub/ground cover beds shall be 0.10 inch per hour.

2. Tree and Shrub Pits: Fill each pit with water. If percolation is less than 0.10 inch per hour in a 24 hour period, drill a 12" auger to a depth of four feet below the bottom of the pit. Fill auger hole with 3/4" stone and cover with soil separator. Re-test pit. In case drainage is still unsatisfactory, notify Landscape Architect, in writing, of the condition before planting in such questionable areas. If not, Contractor is fully responsible for warranty of trees.

C. Dispose of subsoil removed from landscape excavations. Do not mix with planting soil, use as backfill or use to construct saucers around plant pits.

3.03 PREPARATION OF PLANTING SOIL MIX

A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.
B. Mix specified soil amendments and fertilizers with topsoil at rates specified. Delay mixing of fertilizer if planting will not follow placing of planting soil within a few days.

C. For pit and bed type backfill, mix planting soil prior to backfilling.

3.04 PLANTING TREES AND SHRUBS

A. Set plants on 6" of backfill soil mix to such depth that the finished grade level at the plant after settlement will be the same as that at which the plant has grown. They shall be planted upright and faced to give the best appearance or relationship to adjacent structures. No burlap shall be pulled out from under balls. Platforms, wire and surplus binding from top and sides of the balls shall be removed. Roots shall be spread in their normal position. All broken or frayed roots shall be cut off cleanly. Soil shall be placed and compacted carefully to avoid injury to roots and to fill voids. When the hole is nearly filled, add water as necessary and allow it to soak away. Fill the hole to finish grade, and form a shallow saucer around each plant by placing a ridge of topsoil around the edge of each pit. After the ground settles, additional soil shall be filled into the level of the finished grade.

B. Form shallow saucers to the finished grade outside the tree pit approximately 4" - 6" height capable of holding water about each plant by placing a mound of topsoil around the edge of each filled-in pit.

C. If deciduous trees or shrubs are moved in full leaf, spray with anti-desiccant at nursery before moving and again after planting as per manufacturer's recommendations.

D. Mulching: Immediately after planting work has been completed, mulch pits, trenches and planting beds. Provide not less than 3" thickness of hardwood bark mulch as shown on drawings. Apply/incorporate pre-emergence herbicide per manufacturer's instructions. Finish edges according to detail.

E. Water: Soak all plants immediately after planting, continue watering thereafter as necessary until acceptance of the work in total.

F. Smooth planting areas to conform to specified grades after full settlement has occurred and mulch has been applied.

3.05 STAKING, GUYING AND PRUNING:

A. Upon request by the Landscape Architect, stake and guy trees immediately after planting. Plants shall be plumb after staking or guyling. Maintain stakes, wires and guys until acceptance of the work in total. Tree staking is generally not required, but may be requested for trees planted on slopes, in windy areas or for specific species.

B. Staking trees of 1" to 3" caliper:
   1. Drive stakes securely into ground and fasten to tree with approved tie material.
   2. Adhere to staking details unless alternate detail has been approved by Landscape Architect prior to beginning of planting operation.

C. Staking trees of 1" and under or 4' height:
   1. Use single stake with rubber hose and wire loop around trunk.

D. Guy deciduous trees over 3" to 5" caliper and evergreen trees 4'-8' all as described and detailed.
1. Position guys around trunk at approximately two-fifths the height of the tree.

2. Anchor guys in ground either to steel rods driven securely into ground with top end 3" below finish grade or steel anchors securely screwed into ground with top end at or below finished grade.

3. Flag all guy wires as required.

E. Guy deciduous trees over 5" caliper and evergreen trees over 8' tall as described and detailed.

1. Install 3 screw anchors minimum equally spaced around the tree at approximately two-fifths the height of the tree.

2. Securely anchor cable to screw anchors.

3. Use hose around cable so cable is not in contact with plant.

4. Secure cable around tree trunk.

5. Securely attach ends of cable to turnbuckle so that cable is taut before adjusting turnbuckle.

6. Flag all guy cables as required.

F. Pruning:

1. Unless otherwise directed by the Landscape Architect do not cut tree leaders, and remove only injured or dead branches from trees, if any.

2. Prune shrubs at the direction of the Landscape Architect.

3. Remove and replace promptly any plants pruned or misformed resulting improper pruning.

4. Paint wounds and cuts over 3/4" in diameter with approved tree paint designed for this purpose.

3.06 MAINTENANCE:

A. Begin maintenance immediately after planting.

B. Maintain trees, shrubs and other plants until Substantial Completion of the entire project and for not less than 30 days after Substantial Completion of the entire project.

C. Maintain trees, shrubs and other plants by watering, pruning, cultivating, weeding, and re-mulching as required for healthy growth.

D. Restore planting saucers.

E. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical position as required.

F. Spray as required to keep trees and shrubs free of insects and disease.
3.07 CLEAN UP AND PROTECTION:
A. During landscape work, keep pavements clean and work area in an orderly condition.
B. Upon completion of work, clear grounds of debris, superfluous materials and all equipment. Remove from site to satisfaction of Landscape Architect.
C. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers.
D. Maintain protection during installation and maintenance periods.
E. Treat, repair or replace damaged landscape work as directed, at no additional cost to Owner.

3.08 SUBSTANTIAL COMPLETION AND FINAL COMPLETION
A. Upon completion of work, notify Landscape Architect at least ten (10) days prior to requested date of inspection for Substantial Completion. Remove rejected plants and materials promptly from project site.
B. Landscape Architect will review the work and document incomplete or incorrect work in an inspection report or list. If trees, Shrubs, and Groundcovers work is found to be substantially complete a Certificate of Substantial Completion will be issued that establishes a date of substantial completion. The list of incomplete or incorrect work will be attached to the Certificate.
C. Complete or correct Trees Shrubs and Groundcovers work identified on the list within the number of days established in the Certificate of Substantial Completion.
D. Upon satisfactory completion of repairs and/or replacements, the Landscape Architect certifies, in writing, the Final Completion of the work.

END OF SECTION 32.93.00