PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes piping, valves, sprinklers, lawn sprinkler specialties, controls, and wiring.

1.3 DEFINITIONS

A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.

B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.

C. Pressure Piping: Downstream from point of connection to water distribution piping to and including control valves. Piping is under water distribution system pressure.

D. The following are industry abbreviations for plastic materials:

2. NP: Nylon plastic.
3. PE: Polyethylene plastic.
4. PP: Polypropylene plastic.
5. PTFE: Polytetrafluoroethylene plastic.
6. PVC: Polyvinyl chloride plastic.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Minimum Water Coverage: 100 percent of turf and planting areas.

B. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards.

C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties, unless otherwise indicated:

1. Pressure Piping: 200 psig.
2. Circuit Piping: 150 psig.
3. Drain Piping: 100 psig.
Verify that operating pressure and GPM are adequate to run system as designed before beginning construction. If available GPM or PSI are found to be inadequate, contractor to propose alternative to remedy the situation.

1.5 SUBMITTALS

A. Product Data: Include pressure rating, rated capacity, settings, and electrical data of selected models for the following:

1. Water regulators.
2. Water hammer arresters.
3. Valves. Include aboveground and underground; general-duty, manual and automatic control, and quick-coupler types.
4. Valve boxes.
5. Sprinklers.
7. Controllers. Include wiring diagrams.
8. Grounding Diagram

B. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include three letters of reference from owner’s representatives for projects utilizing two-wire irrigation systems completed in the past 5 years of similar scope and dollar value. Provide lists of completed projects with project names and addresses, dollar value of project, names and address of architects and owners, and other information specified.

C. Shop Drawings: Show lawn sprinkler piping, including plan layout and locations, types, sizes, capacities, and flow characteristics of lawn sprinkler piping components. Include water meters, backflow preventers, valves, piping, sprinklers and devices, accessories, controls, and wiring. Show areas of sprinkler spray and overspray.

D. Test Reports: As specified in "Field Quality Control" Article in Part 3.

E. Maintenance Data: To include in maintenance manuals specified in Division 1. Include data for the following:

1. Water regulators.
2. Automatic control valves.
4. Specialties.
5. Controllers.

1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of lawn sprinkler piping components and are based on specific types and models indicated. Other manufacturers’ products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
C. Comply with requirements of utility supplying water and authorities having jurisdiction for preventing backflow and back siphonage.

D. Comply with ASTM F 645, "Guide for Selection, Design, and Installation of Thermoplastic Water Pressure Piping Systems."


1.7 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves according to the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flange faces.
   3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves according to the following:
   1. Do not remove end protectors unless necessary for inspection; then, reinstall for storage.
   2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

D. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

E. Protect flanges, fittings, and specialties from moisture and dirt.

F. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.8 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations.

B. Investigate and determine available water supply water pressure and flow characteristics.

C. Site Information: Reports on subsurface condition investigations made during design of Project are available for informational purposes only; data in reports are not intended as warranties of accuracy or continuity of conditions (between soil borings). Owner assumes no responsibility for interpretations or conclusions drawn from this information.

1.9 SEQUENCING AND SCHEDULING

A. Maintain uninterrupted water service to building during normal working hours. Arrange for temporary water shutoff with Owner.
B. Coordinate lawn sprinkler piping with work specified in Division 2 Section “Landscaping.”
C. Coordinate lawn sprinkler piping with utility work.

PART 2 - PRODUCTS

2.1 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. Bronze, Automatic Control Valves:
   a. Netafim Irrigation, Inc.
   b. Rain Bird Sprinkler Mfg. Corp.
   c. Toro Co.; Irrigation Div.

2. Plastic, Automatic Control Valves:
   a. Netafim Irrigation, Inc.
   b. Rain Bird Sprinkler Mfg. Corp.
   c. Toro Co.; Irrigation Div.

3. Control-Valve Boxes:
   a. AMETEK; Plymouth Products Div.
   b. Watts Industries, Inc
   c. Zurn Industries, Inc.

4. Quick Couplers:
   b. Toro Co.; Irrigation Div.
   c. Hunter Irrigation

5. Sprinklers:
   b. Toro Co.; Irrigation Div.
   c. Hunter Irrigation

6. Water Regulators:
   b. Zurn Industries, Inc.; Wilkins Div.
   c. Red and White Industries, Inc.

7. Emitter and Drip-Tube Specialties:
   a. Netafim Irrigation, Inc.
   b. Rain Bird Sprinkler Mfg. Corp.
c. Toro Co.; Irrigation Div.

8. Miscellaneous Specialties:
   b. Toro Co.; Irrigation Div.
   c. Hunter Irrigation
   d. Tukor Inc.

9. Controllers:
   a. Tukor RKD Two-Wire Controller or equal

10. Valve Decoder
    a. Tukor Inc. or equal

2.2 PIPING MATERIALS
A. Refer to Part 3 "Piping Applications" and "Valve Applications" articles for application of pipe and tube materials, joining methods, and valve applications.

2.3 PIPES AND TUBES
A. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedules 40 and 80.

2.4 PIPE AND TUBE FITTINGS
B. PVC Socket Fittings, Schedule 80: ASTM D 2467.
C. PVC Threaded Fittings: ASTM D 2464.
D. Transition Fittings: Manufactured assembly or fitting, with pressure rating at least equal to that of system and with ends compatible to piping where fitting is to be installed.

2.5 JOINING MATERIALS
A. Refer to Division 2 Section "Utility Materials" for commonly used joining materials.

2.6 VALVES AND VALVE SPECIALTIES
A. Plastic Valves: PVC with 150-psig minimum pressure rating, ends compatible with piping, and tee handle.
B. Plastic Diaphragm Valves: Molded-plastic body, normally closed, with manual flow adjustment, and operated by 24-V, ac solenoid.
C. Automatic Drain Valves: Spring-loaded, ball valve of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig.

D. Manual Control-Valve Service Boxes: Cast iron with telescoping top section of length required for depth of bury of valve. Include cover with lettering "WATER," bottom section with base of size to fit over valve, and 3-inch-diameter barrel. Include valve key, 36 inches long with tee handle and key end to fit valve.

E. Control-Valve Boxes: PE, ABS, fiberglass, polymer concrete, or precast concrete box and cover, with open bottom, openings for piping, and designed for installing flush with grade. Include size as required for valves and service.

   1. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3 inches maximum to 3/4 inch minimum.

2.7 SPRINKLERS

A. Description: Manufacturer's standard sprinklers designed for uniform coverage over entire spray area indicated, at available water pressure.

B. Components: Brass or plastic housing and corrosion-resistant interior parts.

C. Flush, Surface Sprinklers: Fixed pattern, with screw-type flow adjustment.

D. Bubblers: Fixed pattern, with screw-type flow adjustment.

E. Shrubbery Sprinklers: Fixed pattern, with screw-type flow adjustment.

F. Pop-up, Spray Sprinklers: Fixed pattern, with screw-type flow adjustment and stainless-steel retraction spring.

G. Pop-up, Rotary, Spray Sprinklers: Gear drive, full-circle and adjustable part-circle types.

2.8 SPECIALTIES

A. Water Hammer Arresters: ASME A112.26.1M, ASSE 1010, or PDI WH-201 water hammer arrester. Include bellows or piston-type pressurized cushioning chamber and sizes complying with ASME A112.26.1M and PDI WH-201 Sizes A to F.

B. Drip Tubes: 1/2-inch NPS flexible PE or PVC for emitters and other devices, of length indicated, and with plugged end.

2.9 AUTOMATIC CONTROL SYSTEM

A. Exterior Control Enclosures: NEMA 250, Type 4 weatherproof enclosure with locking cover and two matching keys; and include provision for grounding.

   1. Material: Molded plastic.

B. Transformer: Internal; and suitable for converting 120-V, ac building power to 24-V, ac power.
C. Controller Stations for Automatic Control Valves: Each station is variable from approximately five to 60 minutes. Include switch for manual or automatic operation of each station.

D. Timing Device: Adjustable, 24-hour, 14-day clock with automatic operations to skip operation any day in timer period; to operate every other day; or to operate two or more times daily.
   1. Manual or Semiautomatic Operation: Allow this mode without disturbing preset automatic operation.
   2. Nickel-Cadmium Battery and Trickle Charger: Automatically power timing device during power outages.

E. Wiring: UL 493, Type UF, solid-copper-conductor, insulated cable, suitable for direct burial.
   1. Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers.
   2. Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves and color-coded different than feeder-circuit-cable jacket color and with jackets of different colors for multiple-cable installation in same trench.
   3. Splicing Materials: Pressure-sensitive, thermoplastic tape; waterproof sealing packets; or other waterproof connectors.

PART 3 - EXECUTION

3.1 PREPARATION
A. Set stakes to identify proposed lawn sprinkler locations. Obtain Architect's approval before excavation.

3.2 TRENCHING AND BACKFILLING
A. Install warning tape directly above pressure piping, 12 inches below finished grades, except 6 inches below subgrade under pavement and slabs.
B. Install piping and wiring in sleeves under sidewalks, roadways, parking lots, and railroads.
   1. Install piping sleeves by boring or jacking under existing paving if possible.
C. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3 to 3/4 inch minimum, to 12 inches below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.
D. Provide minimum cover over top of underground piping according to the following:
   1. Pressure Piping: Greater depth of minimum of 36 inches below finished grade, or not less than 18 inches below average local frost depth.
   2. Circuit Piping: 12 inches.
   3. Drain Piping: 12 inches.

3.3 PIPING APPLICATIONS
A. Install components having pressure rating equal to or greater than system operating pressure.
B. Piping in control-valve boxes and aboveground may be joined with flanges instead of joints indicated.

C. Underground, Pressure Piping: Use the following:
   1. 4-Inch NPS and Smaller: Schedule 40 PVC pipe, Schedule 40 PVC socket fittings, and solvent-cemented joints.

D. Circuit Piping: Use the following:
   1. 2-Inch NPS and Smaller: Schedule 40 PVC pipe, Schedule 40 PVC socket fittings, and solvent-cemented joints.
   2. 2-1/2- to 4-Inch NPS: Schedule 40 PVC pipe, Schedule 40 PVC socket fittings, and solvent-cemented joints.

E. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80 PVC pipe, PVC threaded fittings, and threaded joints.
   1. Option: Plastic piping made for this application may be used instead of pipe and fittings specified.

F. Risers to Aboveground Sprinklers and Specialties: Schedule 80 PVC pipe, Schedule 80 PVC socket fittings, and solvent-cemented joints.

G. Drain Piping: Schedule 40 PVC pipe, Schedule 40 PVC socket fittings, and solvent-cemented joints.

H. Sleeves: Schedule 80 PVC pipe, Schedule 80 PVC socket fittings, and solvent-cemented joints.

3.4 VALVE APPLICATIONS

A. Underground, Shutoff-Duty Valves: Use the following:
   1. 3-Inch NPS and Larger: Gate valve, with elastomeric gaskets and stem nut, valve box, and shutoff rod.

B. Control Valves: Use the following:
   1. 2-Inch NPS (DN50) and Smaller: Plastic valve.
   2. 2-1/2- and 3-Inch NPS: Plastic diaphragm valve.

C. Drain Valves: Use the following:
   1. 1/2- and 3/4-Inch NPS: Automatic drain valve.
   2. 1- to 2-Inch NPS: Plastic valve.

3.5 PIPING INSTALLATION

A. Locations and Arrangements: Drawings indicate location and arrangement of piping systems, which were used to size pipe and calculate friction loss, and other design considerations. Install piping as indicated, unless deviations are approved on Coordination Drawings.
B. Install piping at uniform slope of 0.5 percent minimum, down toward drain valves.
C. Install piping free of sags and bends.
D. Install groups of pipes parallel to each other, spaced to permit valve servicing.
E. Install fittings for changes in direction and branch connections.
F. Install unions adjacent to valves and final connections to other components with 2-inch NPS or smaller pipe connection.
G. Install flanges adjacent to valves and final connections to other components with 2-1/2-inch NPS or larger pipe connection.
H. Install underground thermoplastic piping according to ASTM D 2774 and ASTM F 690.
I. Lay piping on solid subbase, uniformly sloped without humps or depressions.
J. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperature above 40 deg F before testing, unless otherwise recommended by manufacturer.
K. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet.
L. Water Hammer Arresters: Install between connection to building main and circuit valves in valve box.

3.6 VALVE INSTALLATION
A. Underground Gate Valves: Install in valve box with top flush with grade.
   1. Install valves and PVC pipe with restrained, gasketed joints.
B. Control Valves: Install in control-valve service box.
C. Drain Valves: Install in control-valve box.

3.7 SPRINKLER INSTALLATION
A. Flush circuit piping with full head of water and install sprinklers after hydrostatic test is completed.
B. Install lawn sprinklers at manufacturer’s recommended heights.
C. Locate part-circle sprinklers to maintain a minimum distance of 4 inches from walls and 2 inches from other boundaries, unless otherwise indicated.

3.8 AUTOMATIC CONTROL SYSTEM INSTALLATION
A. Install controllers according to manufacturer’s written instructions and as indicated.
B. Install freestanding controllers on panel provided. See Electrical Plans.

C. Install control wiring in same trench with piping. Install wiring with loops at control valves and controllers, at intervals not greater than 100 feet, and changes in direction to allow for expansion. Bundle wiring in same trench at 10-foot intervals.

3.9 CONNECTIONS

A. Connect piping to valves, sprinklers, and specialties.

B. Connect water supplies to lawn sprinkler piping with backflow preventers at connections to potable-water supplies.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

D. Ground electric-powered controllers, valves, and devices.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Arrange for electric-power connections to controllers, control valves, and devices that require power. Electric power, wiring, and disconnect switches are specified in Division 16 Sections.

3.10 FIELD QUALITY CONTROL

A. Testing: Hydrostatically test piping and valves before backfilling trenches. Piping may be tested in sections.

1. Cap and test piping with static water pressure of 50 psig above system operating pressure and without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours.

2. Repair leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.

3.11 CLEANING AND ADJUSTING

A. Flush dirt and debris from piping before installing sprinklers and other devices.

B. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.

C. Carefully adjust lawn sprinklers so they will be flush with, or not more than 1/2 inch above, finish grade.

D. Adjust settings of controllers and automatic control valves.

3.12 COMMISSIONING
A. Starting Procedures: Follow manufacturer's written procedures. If no procedures are prescribed by manufacturers, proceed as follows:

1. Verify that specialty valves and their accessories are installed and operate correctly.
2. Verify that specified tests of piping are complete.
3. Verify that sprinklers and devices are correct type.
4. Verify that damaged sprinklers and devices are replaced with new materials.
5. Verify that potable-water supply connections have backflow preventers.
6. Energize circuits to electrical equipment and devices.
7. Adjust operating controls.

B. Operational Tests: Measure and record water flow rate and area coverage at each sprinkler. Adjust to achieve indicated values.

3.13 DEMONSTRATION

A. Demonstrate to Owner's maintenance personnel operation of equipment, sprinklers, specialties, and accessories. Review maintenance information.

B. Provide seven days' advance written notice of demonstration.

END OF SECTION 348423