

SECTION 32 84 00 – PLANTING IRRIGATION

A. 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. This Section includes piping, valves, sprinklers, controls, and wiring for automatic control irrigation systems.
- B. Extent of the underground irrigation system is shown in the plans, schedules, and notes.
- C. Provide all labor. Materials and equipment required or inferred from the Drawing and Specifications to complete the Work of this Section.
- D. Provide a complete and operable system for the irrigation of all landscapes areas on the project site, unless indicated otherwise. The Drawings and specifications are intended to include all items obviously necessary and requisite for the proper irrigation of the project.
- E. The contractor shall be responsible for adjusting head locations, nozzle type and size, and any other system components so that the irrigation system layout is coordinated with actual field conditions. Such adjustments shall be made at no cost to the Owner except, when authorized in writing, such adjustments which will be compensated for at an agreed upon cost.

1.03 DEFINITIONS

- A. Lateral 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. Mainline 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:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. FRP: Fiberglass-reinforced plastic.
 - 3. PA: Polyamide (nylon) plastic.
 - 4. PE: Polyethylene plastic.
 - 5. PP: Polypropylene plastic.
 - 6. PTFE: Polytetrafluoroethylene plastic.

7. PVC: Polyvinyl chloride plastic.
8. TFE: Tetrafluoroethylene plastic.
9. HDPE High Density Polyethylene plastic.

1.04 PERFORMANCE REQUIREMENTS

- A. Head-to-head coverage irrigation system for lawns and exterior plants as shown or indicated on associated plans.
- B. Drawings are diagrammatic and generally indicate the Work to be installed. The Drawing do not indicate all off-set fittings that may be necessary. The Contractor shall furnish such items as may be required to complete the work.
- C. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain a minimum of head-to-head coverage and dripline row spacing for turf and planting areas unless otherwise indicated.
- D. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties, unless otherwise indicated:
 1. Irrigation Main Piping: 200 psi.
 2. Lateral Piping: 200 psi.

1.05 SUBMITTALS

- A. Approval: Obtain approval from Landscape Architect for all submittals prior to the beginning of Work, unless otherwise approved.
- B. Product Data: Individual copies for product data shall be submitted Include pressure ratings, rated capacities, and settings of selected models for the following:
 1. **Contractor Qualifications as per Section1.06.A.**
 2. Sprinklers and nozzles.
 3. Electrical Control Valves.
 4. Drip Control Valves.
 5. Quick Coupler Valves.
 6. Isolation Valves.
 7. Valve boxes.
 8. Drip Tubing and fittings.
 9. Drip Indicator.

10. Controllers and associated communication equipment.
 11. Control cables. Include splice kits.
 12. Decoders.
 13. Grounding equipment.
 14. Rain Sensor
 15. PVC fittings.
 16. PVC Primer and Cement.
 17. Mainline, Lateral and Sleeve piping.
 18. Mainline, Lateral pipe fittings
- B. As-Built Drawings: Any changes in the layout and or arrangements of the proposed irrigation system, or any other differences between the proposed system and actual installed conditions are to be recorded by the Irrigation Contractor in the form of an "As-Built" Drawing. As-Built Drawing to be produced in an electronic format using AutoCAD. Provide the Owner and the Landscape Architect and AutoCAD & PDF file along with five (5) hard copies of the As-Built Drawings before Work under this Contract will be considered for Acceptance. All automatic and manual valves, hose bibs or quick couplers, wire splice, and pressurized mainline locations shall be show with actual field dimensions in feet and inches from tow permanent reference points so they may be located easily in the field. Submittals of approved As-Built Drawing will precede any Application for Final Payment by the Contractor.
- C. Operation and Maintenance Data: For irrigation systems, to include in emergency, operation, and maintenance manuals, including data for the following:
1. Automatic-control valves.
 2. Isolation valves.
 3. Sprinklers.
 4. Control systems.
- C. Test Reports: Field test results of the irrigation supply well to include flow rates, and recovery rates.
- D. Shop Drawings: Submit certified shop drawings showing complete information for fabrication and installation of pump station. Shop drawings shall include a complete electrical wiring diagram.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Installing contractor must be licensed in the state that the work is being conducted. In the absence of a license requirement the contractor must be an Irrigation Association Certified Contractor, in good standing. Engage a firm or firms specializing in irrigation system installation. Installer shall have successfully completed five projects similar in material, size, scope and complexity to that indicated for this Project that have resulted in construction with a record of successful in-service performance. Provide listing of the 5 similar project showing number of zones, water source, mainline sizes, control system and project contact phone number and e-mail address. Contractor to be an Irrigation Association CID. Contractor must have manufacturers 2-wire installation and programming training certificates.

- 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, and marked for intended use.
- C. Codes and Standards: Perform the work in compliance with applicable requirements of governing authorities having jurisdiction. County regulations supersede these specifications. Notify Landscape Architect in writing of all discrepancies immediately.
- D. Approval and Selection of Materials and Work: The selection of all materials and the execution of all operations required under the Drawings and Specifications is subject to the approval of the Owner and Landscape Architect. They have the right to reject any and all materials and any and all work which, in their opinion, does not meet the requirements of the Contract Documents at any state of the operations. Remove rejected Work and or materials from the project site and replace promptly.
- E. Do Not Make Substitutions: If the Contractor desires to make substitutions of materials, sufficient descriptive literature and material samples must be furnished to establish the material as an equal substitute. In addition, the Contractor must state his reasons for desiring substitute materials and any potential cost savings. Submit this request and information to the Landscape Architect.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. 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.
- B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.08 PROJECT CONDITIONS

- A. The site irrigation system is comprised of 2 major components, ground plane system and the Green Roof system.
- B. The irrigation system is designed to operate under the following conditions. Ground plane minimum of 55 psi water pressure, and at least a 25 gpm available water supply at the cistern pump station discharge outlet. Green roof minimum of 40 psi water pressure, and at least a 11 gpm available water supply at the cistern pump station discharge outlet.
- C. Insurance on irrigation materials or equipment stored or installed is the responsibility of the Contractor. Such insurance shall cover fire, theft and vandalism. Should the Contractor elect not to provide for such insurance, he will in no way hold the Owner responsible for any losses incurred by the aforementioned acts. The Contractor is responsible for all costs incurred in replacing damaged or stolen materials or equipment prior to Substantial Completion of the Work.
- D. Obtain all required permits and pay all required fees, at no additional cost to the Owner. Any penalties imposed due to the failure to obtain permits or pay fees are the responsibility of the Contractor.

- E. Provide and maintain all passageways, guard fences, warning lights and other protective devices required by the local authorities.
- F. Existing grades: Existing grades will be within .2 feet of grades shown on the Civil Engineering Drawings at the time of work. Determine conditions of existing grades prior to beginning the Work. When irregular or incomplete grading conditions are encountered, notify the Owner in writing before beginning the Work. Determine location of existing drainage patterns and maintain patterns in completed Work. Perform Work in a manner which will avoid damage to finished grading and drainage patterns. All damage to finished grading and drainage resulting from Work covered in these Contract Documents shall be repaired at the Contractor's expense.
- G. Existing Utilities: Determine location of underground utilities. Perform Work in a manner which will avoid possible damage. Excavate as required. Maintain grade stakes set by other unless removal is mutually agreed upon by parties concerned. All damage to utilities resulting from Work covered in these Contract Documents shall be repaired at the Contractor's expense.
- H. Existing Conditions: Perform irrigation Work in Tree Protection zones and in existing or previously completed landscape areas to avoid damage and disturbance to these areas. Limit work in these areas to only that necessary to perform work specified herein and shown on the Drawings. Return and repair any areas damaged or disturbed while performing the Work to the existing conditions encountered prior to the Work.
- I. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Owner's Representative no fewer than two (2) days in advance of proposed interruption of water service.
 - 2. Do not proceed with interruption of water service without Owner's Representative written permission.
- J. Removal of Hardscape: Do not remove hardscape surface unless permitted under the following conditions:
 - 1. Coordinate with Owner's Representative no fewer than two (2) days in advance of proposed hardscape removal.
 - 2. Hardscape removal must not interrupt normal traffic flow on hardscape area.
 - 3. Area of removal must be useable prior to close of workday and completely repaired within 2 days of removal.

1.09 COORDINATION

- A. Coordinate installation of irrigation system with Owner's Representative and/or all other trades on site to ensure irrigation system or other work on site will not be damaged. Should contractor fail to coordinate, and damages occur it will be the contractor's responsibility to repair damages at his own costs.

1.10 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sprinkler Units: Equal to two (2) percent of amount installed for each type and size indicated, but no fewer than 10 units of each type.
 - 2. Spray Sprinkler Units: Equal to two (2) percent of amount installed for each type and size indicated, but no fewer than 10 units.
 - 3. Electric Control Valve Units: Equal to five (5) percent of amount installed for each type indicated, but no fewer than five (5) units of each size and type.
 - 4. Isolation Valves: Equal to five (5) percent of amount installed for each type indicated, but no fewer than two (2) units of each type.
 - 5. Decoders: A minimum of 2 units of each type.

1.11 PRE-INSTALLATION MEETING

- A. Conduct a virtual conference/meeting. Review methods and procedures related to the site landscape irrigation system including, but not limited to the following.
- B. The General Contractor is to contact the Irrigation Consultant/Landscape Architect and Owner Representative a minimum of 60 days prior to the schedule date of commencement of the irrigation installation.
- C. Meet with Owner Representative and Irrigation Consultant/Landscape Architect to review Contract documents.
- D. Verify current drawing release date with contractor's documents.
- E. Review submittal procedure including codes, substitutions, product data, qualifications, and As-Built procedures and formats.
- F. Review project conditions including tap & meter Size, permits, utility locations and water conditions.
- G. Review methods and procedures related to irrigation installation.
- H. Review and finalize construction schedule and verify availability of materials, contractor's personnel, equipment, and facilities needed to make progress and avoid delays.
- I. Review warranty guidelines.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide and warrantee products by one of the manufacturers specified.

2.02 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, Schedule 40, Type S or E, Grade A or B, galvanized with threaded ends.
 1. Steel Pipe Nipples: ASTM A 733 made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe with threaded ends.
 2. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface and female threaded ends.
 3. Gray-Iron Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 4. Cast-Iron Flanges: ASME B16.1, Class 125.
 5. Cast-Iron Flanged Fittings: ASME B16.1, Class 125, galvanized.
- B. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
- C. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
- D. PVC Pipe: ASTM D 1785, PVC 1120 compound, Class 200.
 1. Pipe 3" and larger to have gasket joint connections. Pipe 2-1/2" and smaller to be bell end.
 2. PVC Socket Fittings, Schedule 40: ASTM D 2466, 2-1/2" and smaller

3. Ductile Iron Gasket Joint Fittings ASTM A536 for pipe sizes 3" and larger, all ductile iron fittings to have joint restraints as per manufacturer's recommendations.

E. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedule 80.

1. PVC Socket Fittings, Schedule 80: ASTM D 2467.
2. PVC Threaded Fittings: ASTM D 2464.

2.03 GENERAL-DUTY VALVES

A. AWWA, Cast-Iron Gate Valves: AWWA C509, resilient-wedge nonrising-stem, gray- or ductile-iron body and bonnet gate valve, epoxy coated; with steel stem and 2" operating nut.

1. Minimum: Working Pressure: 200 psig.
2. End Connections: Mechanical join flanged or ring-tite.
Interior Coating: Complying with AWWA C550.
3. Manufacturers:
 - a. Matco
 - b. Leemco
 - c. Approved Equal

B. Isolation Valve Boxes: Ten-inch circular valve box with 6" SDR 21 PVC pipe riser from top of valve to center line of valve box. Pipe to be centered on operating nut to allow easy access.

1. Operating Wrenches: Furnish total of two (2) steel, tee-handle operating wrenches with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Bronze Gate Valves: MSS SP-80, Class 125, Type 1, non-rising-stem, bronze body with solid wedge, threaded ends, and malleable-iron hand wheel.

1. Manufacturers:
 - a. NIBCO INC.
 - b. Approved Equal.

2.04 SPECIALTY VALVES

- A. Quick-Couplers: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.
 - 1. Locking-Top Option: Vandal-resistant, locking feature. Include four matching keys with hose swivel for each key.
 - 2. Manufacturers:
 - a. Rain Bird.

2.05 CONTROL-VALVE BOXES

- A. Plastic Control-Valve Boxes: Box and cover, with open bottom and openings for piping; designed for installing flush with grade. Size for all valves to be standard 14" rectangular.
 - 1. Shape: Rectangular.
 - 2. Sidewall Material: ABS or HDPE.
 - 3. Cover Material: ABS or HDPE.
 - a. Lettering: IRRIGATION.
 - b. Green in Color.
 - c. Lockable with hex key mechanism or similar.
 - 4. Manufacturers:
 - a. Rain Bird.
 - b. Approved Equal.

2.06 SPRINKLERS

- A. Description: Plastic housing and corrosion-resistant interior parts designed for uniform coverage over entire spray area indicated, at available water pressure.
 - 1. Manufacturers:
 - a. Hunter Industries.
 - b. Or Approved Equal
 - 2. Pop-up Spray Sprinklers: Fixed or adjustable pattern with screw-type flow adjustment, stainless-steel retraction spring, drain check valve, pressure regulation, co-molded riser seal that seals cap to body and pop-up heights of 4", 6", 12".
 - 3. Pop-up, Rotary Sprinklers: Gear drive, full-circle and adjustable part-circle types with screw-type flow adjustment, stainless-steel retraction spring, stainless steel riser, drain check valve, flow stop valve, minimum of 8 nozzles available, integral rubber cover, adjustable from the top of the sprinkler and pop-up heights of 4", 6", 12".

2.07 DRIP COMPONENTS

- A. Description: Inline Drip Tubing with pressure compensating and check valve emitters. Use manufacturers fittings specifically for specified tubing.
 - 1. Manufacturers:
 - a. Rain Bird.
 - b. Or Approved Equal
- B. Description: Drip Control Zone Kit with pressure regulation, disc filtration, filter cleaning indicator, 220 psi control valve and a pre-assembled package.
 - 1. Manufacturers:
 - a. Rain Bird.
 - b. Or Approved Equal
- C. Description: Drip Indicator. 12" pop-up sprinkler body with yellow indicator on sprinkler pop-up stem.
 - 1. Manufacturers:
 - a. Hunter Industries.
 - b. Or Approved Equal
- D. Description: Flush Valve. ½" plastic ball valve with barbed inlet and outlet.
 - 1. Manufacturers:
 - a. Hunter Industries.
 - b. Or Approved Equal

2.08 ELECTRIC CONTROL VALVES

- A. Description: Electrically controlled hydraulically actuated control valves.
 - 1. Manufacturers:
 - a. Rain Bird.
 - b. Or Approved Equal
- B. Features:
 - 1. 24vac solenoid with 410mA inrush current and 280mA holding current.
 - 2. Pressure rating of 220 psi.
 - 3. Fabric reinforced diaphragm.
 - 4. Internal and external bleed.
 - 5. Flow control handle.
 - 6. Contamination Resistant.

2.09 AUTOMATIC-CONTROL SYSTEM

- A. Manufacturers:
 - 1. Baseline
 - 2. Or Approved Equal

- B. Exterior Control Enclosures: NEMA 250, Type 4, weatherproof, with locking cover and two matching keys; include provision for grounding.
 - 1. Material: Enameled-steel or stainless steel.
 - 2. Mounting: Surface type for wall mounting, concrete mounting base for pedestal.

- C. Control Transformer/Decoder Output: 24VAC 4A secondary, with overload protection and or primary fuse.
 - 1. Decoder Line Output: 32 VAC RMS over 2-wire path
 - 2. Solenoid Capacity: 2 standard 24VAC solenoids per output, maximum output of 14 simultaneously.

- D. Controller Stations for Automatic Control Valves: Each station is variable from approximately 1 minute to 23.9 hours. Include switch for manual or automatic operation of each station.

- E. Timing Device: Adjustable, 24-hour, 365-day clock, with automatic operations to skip operation any day in timer period, to operate every other day, odd-even days, interval days, to operate 8 or more times daily.
 - 1. Manual or Semi-automatic Operation: Allows this mode without disturbing preset automatic operation.
 - 2. Minimum 30-day internal power storage: Automatically powers timing device during power outages.
 - 3. Eight (8) start times.
 - 4. Simultaneous program operation.
 - 5. Test program.
 - 6. One button manual start.
 - 7. Seasonal adjust 25% to 200%.
 - 8. Ninety-nine (88) independent programs.
 - 9. Surge Protection: Metal-oxide-varistor type on each station and primary power.
 - 10. Rain Sensor compatible with over-ride capabilities.
 - 11. Remote control capabilities.
 - 12. Four (4) Master Valve and Flow Meter inputs.
 - 13. Flow monitoring by station.
 - 14. Soil Moisture sensor compatible.
 - 15. Remote access from internet enabled device.
 - 16. ET based irrigation scheduling.
 - 17. Moisture Sensor based irrigation scheduling.

- F. Wiring:
 - 1. Manufacturers:
 - a. Paige Electric.

- b. Or Approved Equal
- 2. Feeder-Circuit Cables: No. 14 AWG minimum, between building and controllers.
- 3. Decoder Output Cable: No. 14 Paige #P7072D "Maxi Cable".
- 4. Splicing Materials: 3M DBY-6 as required by manufacturer.
- 5. Conduit: PVC SCH 40 electrical conduit with sweep elbows.

PART 3 EXECUTION

3.02 GENERAL

- A. Observation of Work in Progress: During the installation, the Landscape Architect/Irrigation Consultant will make regular site visits and reject any work and materials which do not meet the requirements called for in the Contract Documents.
- B. Inspect project site prior to start of Work to determine that all site conditions are acceptable for Work to begin. Inform Landscape Architect/Irrigation Consultant of unsuitable conditions. Do not proceed with installation of the irrigation system until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- C. Locate all existing underground utilities prior to trenching and/or boring operations and protect them against damage during the Work. Obtain utility location from Owner and/or General Contractor and utilize utility locating services when necessary.

3.03 EXAMINATION

- A. Investigate and determine available water supply, water pressure and flow characteristics.
- B. When unanticipated utilities that conflict with the intended function or design are encountered, investigate, and measure the nature and extent of the conflict. Promptly submit a written report to the Owner for action.

3.04 EARTHWORK

- 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 prior to hardscape sub-base being installed if possible.
 - 2. Sleeving installed in open trench to be completely backfilled crushed limestone, approved by owner's representative and compacted to insure no future settling.
 - 3. Pipe sleeves are to be a minimum of two times the diameter of the pipe in the sleeve.
- C. Provide minimum cover over top of underground piping according to the following:

1. Irrigation Main Piping: Minimum depth of 18 inches from top of pipe to finished grade.
2. Circuit Piping: 12" within general landscape areas, piping to be a minimum of 3 inches laterally/vertically from any other pipe or conduit at all times.
3. Drain Piping: 12 inches.
4. Sleeves: 18 inches from top of pipe for mainlines and 12 inches from top of pipe for laterals.

3.05 EXCAVATION PREPARATION

- A. Set stakes to identify locations of proposed irrigation system. Obtain Owner's Representative's approval before excavation.
- B. Excavate area for pipe installation 4" wider than diameter of pipe.
 1. Level trench base to insure consistent contact of pipe to trench bottom.
 2. Remove all rocks and other sharp objects.
 3. Place pipe in trench snaking from side to side if possible.
 4. Backfill to the top of pipe compacting the sides.
 5. Backfill in 8" lifts compacting to 90% between lifts until complete.
 6. All trenches greater than 4" in width to be restored to grade, $\pm \frac{1}{4}$ ", with sod as approved by owner's representative.
 7. All trenches 4" or small in width to be restored to grade, $\pm \frac{1}{4}$ " with a minimum of 3" of topsoil as approved by owner's representative.
 8. Whenever possible trenching should be outside of a tree dripline. If trenching is done within the dripline it should be at least 10' from existing tree, if 10' is not possible the trenching must be done by hand and all tree roots greater than 1" to be left in place. All tree roots 1" or less may be removed by saw cutting root on either side of the excavation and root removal.

3.06 PIPING APPLICATIONS

- A. Install components having pressure rating as shown on the plan.
- B. Piping in above ground may be joined with flanges instead of joints indicated.
- C. Aboveground Irrigation Main Piping: Use the following piping materials for each size range:
 1. NPS 3 and Larger: Steel pipe; malleable-, gray-, or cast-iron fittings; and threaded joints.
 2. NPS 25 and Smaller: hard copper tube, wrought- or cast-copper fittings, and soldered joints.
- D. Underground Irrigation Main Piping: Use the following piping materials for each size range:

1. NPS 25 and Smaller: Class 200, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.
 2. NPS 3 and larger: Class 200 PVC, pressure rated pipe with gasket joint ends, Ductile Iron gasket joint fittings with manufacturer's recommended joint restraint.
- E. Circuit Piping: Use the following piping materials for each size range:
1. NPS 4 and Smaller: Class 200, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.
- F. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; acme threaded o-ring sealed PVC fittings.
1. Option: Plastic piping manufactured for this application may be used on sprinkler inlets of 1/2" or smaller instead of pipe and fittings specified, "swing pipe and spiral barbed elbows). If this is to be used the offset must be more than 12" and less than 18" as per detail.
- G. Risers to Aboveground Sprinklers and Specialties: Type L hard copper tube, wrought-copper fittings, and soldered joints.
- H. Sleeves: SCH 40 PVC pipe and socket fittings; and solvent-cemented joints.
- I. Transition Fittings: Use transition fittings for plastic-to-metal pipe connections according to the following:
1. Couplings:
 - a. Underground Piping NPS 2-1/2 and Smaller: Manufactured fitting or coupling.
 - b. Underground Piping NPS 3 and Larger: PVC Flange with stainless steel bolts and rubber gasket.
 2. Fittings:
 - a. Aboveground Piping: Plastic-to-metal transition fittings.
 - b. Underground Piping: Union with plastic end of same material as plastic piping.
- J. Dielectric Fittings: Use dielectric fittings for dissimilar-metal pipe connections according to the following:
1. Underground Piping:
 - a. NPS 2 and Smaller: Dielectric couplings or dielectric nipples.
 - b. NPS 2-1/2 and Larger: Prohibited except in valve box.

2. Aboveground Piping:
 - a. NPS 2 and Smaller: Dielectric unions.
 - b. NPS 2-1/2 to NPS 4: Dielectric flanges.
3. Piping in Valve Boxes or Vaults:
 - a. NPS 2 and Smaller: Dielectric unions.
 - b. NPS 2-1/2 to NPS 4: Dielectric flanges.

3.07 VALVE APPLICATIONS

- A. Aboveground, Shutoff-Duty Valves:
 1. NPS 2 and Smaller: Bronze gate valve.
 2. NPS 2-1/2 and Larger: Cast-iron, nonrising-stem gate valve.
- B. Isolation Valves:
 1. NPS 2 and Smaller: Bronze nonrising-stem gate valve.
 2. NPS 2-1/2 and Larger: Cast-iron, nonrising-stem gate valve with 2" operating nut.

3.08 PIPING INSTALLATION

- A. Location and Arrangement: Drawings indicate suggested location and arrangement of piping systems. Install piping as indicated unless deviations are approved by Owner's Representative.
- B. Install piping free of sags and bends.
- C. Install groups of pipes parallel to each other with a space between minimum of 4", spaced to permit single valve removal and or servicing.
- D. Install fittings for changes in direction and branch connections.
- E. Install dielectric fittings to connect piping of dissimilar metals.
- F. Install underground thermoplastic piping according to ASTM D 2774 and ASTM F 690.
- G. Lay piping on solid subbase, uniformly sloped without humps or depressions.

- H. Install PVC piping in dry weather when temperature is above 32 deg F 5 deg C. Allow joints to cure at least 24 hours at temperatures above 32 deg F 5 deg C before testing unless otherwise recommended by manufacturer.
- I. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Flush the line prior to installation to remove debris. Install the valve so that the flow arrow marked on the valve body tag corresponds to the flow through the line. Install shutoff valve on outlet.

3.09 VALVE INSTALLATION

- A. Electrical Control Valves: Install in valve box with top flush with and perpendicular to grade.
 - 1. All electrical control valve boxes to be 14" rectangular valve box.
 - 2. From bottom of valve to a depth of 6" install washed stone or gravel sized between ¾" and 1" in diameter to create sump and stabilize valve box.
 - 3. Install valve box extensions as necessary to bring lid level with finished landscape grade.
 - 4. Control Valves to be installed with center line of valve 12" below finished grade.
- B. Underground, Manual Control Valves: Install with 6" SDR 21 PVC riser from top of pipe to center line of valve box finishing with 10" round valve box level with finished landscape grade.
 - 1. Install valves and PVC pipe with restrained, gasketed joints as necessary at the same depth as the mainline pipe.

3.10 SPRINKLER INSTALLATION

- A. Flush circuit piping with full head of water prior to installing sprinklers.
- B. Install sprinklers at manufacturer's recommended heights perpendicular to grade.
- C. Locate part-circle sprinklers to maintain a minimum distance of 4 inches from walls and 2 inches from other boundaries, unless otherwise indicated.
- D. Adjust all sprinklers to irrigated plant material indicated for the station.

3.11 DRIP COMPONENT INSTALLATION

- A. All dripline to be installed on FG. Flush all dripline tubing prior to covering with mulch. Install dripline in grid fashion as per plan details and manufacturers recommendations.

- B. Install drip control zone kit as per valve installation specification 3.09.A and plan detail.
- C. Install Drip Indicator as per specification 3.10.B and plan detail.
- D. Install Drip Flush Valves in a 10" valve box as per plan detail.

3.12 AUTOMATIC-CONTROL SYSTEM INSTALLATION

- A. Obtain approval of controller location from owner's representative prior to installation. Install wall mount controller level and at eye level. Securely fasten controller to wall with metallic fasteners appropriate for wall type or install pedestal controller on concrete pad with all necessary conduit installed through the pad to accommodate all wire to controller. All irrigation control wire between controller and finished grade to be in PVC electrical conduit.
- B. Install control wire conduit in same trench as mainline piping and at least 4 inches to the side of the piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install wire in separate sleeve under paved areas if irrigation piping is installed in sleeve. All wire splices to be in minimum 10" round valve box.

3.13 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Ground equipment according to ASIC Grounding Guidelines www.aisc.org. Resistance readings to ground to be as recommended by the manufacturer. If there are no manufactures requirements, then the controller should have a resistance of 10 ohms or less.
- C. 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.

3.14 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Remove and replace units and retest and re-inspect as specified above.

3.15 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service of control system.
- B. Verify that controllers are installed and connected according to the Contract Documents.
- C. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 Sections.
- D. Complete startup checks according to manufacturer's written instructions.

3.16 ADJUSTING

- A. Program controller(s) to ensure adequate moisture is available for the root zone of the plant. Ensure there is no run-off, over watering or deep percolation. Ensure controller operates within irrigation window as defined by Owner's Representative or local governing authorities. See additional controller programming notes on plans provided.
- B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit. Use pressure regulation for each control valve if pressure is higher than recommended for the sprinklers in the circuit.
- C. Adjust sprinklers so they will be 1/8 inch above finish grade in sodded lawns and 1/2 inch above grade in seeded lawns. In shrub beds adjust sprinklers to insure top of sprinkler is at finished mulch levels.
- D. Adjust sprinklers arc and radius to ensure no water is sprayed outside of the irrigated area

3.17 CLEANING

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

3.18 DEMONSTRATION

- A. It is contractors' responsibility to train Owner's maintenance personnel to adjust, operate, and maintain sprinklers, isolation valves, controllers, and automatic control valves.
- B. OBSERVATION AND ACCEPTANCE
- C. Periodic site visits will be made by the Landscape Architect/Irrigation Consultant to review the quality and progress of the work. Work found to be unacceptable must be corrected within five (5) calendar days. Remove rejected materials promptly from the project.
- D. Upon completion of the Work, the Contractor shall notify the Landscape Architect and Owner at least ten (10) days prior to the requested date of the site visit for Substantial Completion of all portions of the Work. Landscape Architect/Irrigation Consultant will issue a punch list for all work to be corrected. All work on the punch list must be complete within five (5) working days from the date of the site visit. Where Irrigation Work does not comply with the requirements, replace rejected Work. If such replacements are not completed within the time specified, the Irrigation Contractor may be considered to be in default of the Contract, and the Owner may use the Contract Retainage to hire other Contractors to finish the work.
- E. It will be the responsibility of the Irrigation Contractor to provide a reliable communication system (remote control or two-way radios) for Substantial Completion and all periodic site visits.
- F. If a site visit to verify Substantial Completion has been scheduled and the Landscape Architect/Irrigation Consultant arrives at the site and determines that the irrigation system is not substantially complete (all system components in place, operational and checked) the Contractor will be responsible for all expenses included but are not limited to the following: mileage, airfare, consultant's time, parking fees, meals, car rental, etc. All incurred expenses will be deducted from the final contract amount.

END OF SECTION