

SECTION 328400 – IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.2 SUMMARY

- A. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein.
- B. This section includes irrigation systems.
- C. Suggested Division of Work: Sleeves under roads shall be installed by excavation contractor and coordinated with irrigation contractor.

1.3 SUBMITTALS

- A. Submit manufacturer's data sheets for materials, including sprinkler heads, valves, controllers, valve boxes, pipe, and other related items to the Project Representative.

1.4 QUALITY ASSURANCE

- A. Certification: Contractor installing HDPE pipe and the fusion jointing of fittings to HDPE pipe shall be certified for such work by ISCO Manufacturing, Howell, MI.
- B. Coordination: Contractor shall coordinate irrigation and excavation work, and coordinate with MSU for the installation of mainline, sleeves and Owner provided items.
- C. Weekly construction meetings with irrigation contractor, MSU staff and the Project Representative will be held to coordinate work and installation sequence. Attendance at meetings is mandatory.

1.5 SEQUENCING AND SCHEDULING

- A. The Owner will contract separately for the removal and replacement of pavement surfaces, the installation of sleeves as indicated on Drawings.
- B. The Owner will install electric power for well system, booster pumps and irrigation controllers.
- C. Should existing valves require replacement, the Owner will perform that work. Contractor shall remove the existing piping downstream of valve and connect the new piping to the valve.

1.6 WARRANTY

- A. For a period of 1 year from the date of final acceptance, Contractor shall provide a labor warranty to promptly furnish and install, without cost to the Owner, and all parts which prove defective in material or workmanship.
- B. If irrigation system fails as a result of defective workmanship or materials, and the failure causes damage to landscape or site features and finishes, then repair of the irrigation system shall include repairing or replacing the damaged landscape and site features. Repair of the irrigation system and costs to repair landscape and site features shall be at Contractor's expense.
- C. Pipe warranty installation data form shall be filled out and forwarded to the company and warranty presented to the Owner after completion and prior to payment.

1.7 MAINTENANCE

- A. Owner will winterize the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Toro.

2.2 POLYETHYLENE PIPE

- A. Lines 1-1/4-inch and smaller shall be high-density (HD) flexible, non-toxic polyethylene pipe made from 100% virgin polyethylene material, NSF approved. All sizes shall have a minimum 100 psi working pressure rating (ASTM F239), conforming to NSF standard for thermoplastic pipe dimensions ratio of SDR-15.
- B. 2-inch and larger (where specified on drawings as HDPE) shall be high-density, flexible, non-toxic polyethylene pipe (HDPE) made from 100% virgin polyethylene material, NSF approved. All sizes shall have a minimum 100 psi working pressure rating (ASTM F239), conforming to NSF standard for thermoplastic pipe dimensions ratio of DR-11.
- C. Polyethylene pipe shall be continuously and permanently marked with the manufacturer's name, material, size and schedule.
- D. Pipe shall conform to the US Department of Commerce Commercial Standard CS255-63-PE-3408 or latest version thereof. Pipe shall be suitable for potable water and shall bear the NSF trademark.

2.3 PVC PIPE

- A. Lines 1-1/2-inch and larger shall be virgin, high-impact polyvinyl chloride (PVC-1120), conforming to NSF Standard 14 and ASTM D2241 for thermoplastic pipe with a minimum 160 psi test strength.

- B. Pipe shall have standard thermoplastic pipe dimension ratio of SDR-26 and shall be continuously and permanently marked with the manufacturer's name, material, size and schedule.

2.4 POLYETHYLENE PIPE FITTINGS

- A. All fittings 1-1/4-inch and smaller, downstream of control valve, shall be plastic himax barbed insert fittings.
- B. Fittings for HDPE pipe shall be fusion joined.
- C. Joints shall be clamped with all stainless steel worm gear clamps.

2.5 PVC PIPE FITTINGS

- A. Fittings 1-1/2-inch through 3-inch shall be Schedule 40 PVC solvent weld, Type 1, meeting the requirements of ASTM D2466. No saddles allowed.
- B. 4-inch fittings shall be gasketed joint Harco PVC Class 200, meeting ASTM D1784 DR21 requirements. Bell shall be gasket joint conforming to ASTM D3139 with gaskets conforming to ASTM F477.
- C. 6-inch and larger fittings shall be Harco Ductile Iron Fittings, manufactured with a grade of 65-45-12 in accordance with ASTM A536. Fittings shall have deep push-on joints with gaskets meeting ASTM F477 requirements.

2.6 VALVES AND VALVE BOXES

- A. Isolation Valves:
 - 1. Valves 2-inch and smaller shall be brass ball valves.
 - 2. Valves 2-1/2-inch and larger shall be Matco 10RT- gate valve key operated.
- B. Automatic Valves: As indicated on Drawings.
- C. Quick Couplers: As indicated on Drawings.
- D. Valve Boxes:
 - 1. Manufacturer: Pentek.
 - 2. Valves shall be protected by a 2-piece or 3-piece valve box assembly consisting of a removal cover, box and extension (if required). The enclosure shall be rigid plastic material composed of fibrous components chemically inert and unaffected by moisture, corrosion and temperature changes.

3. Box Sizes:
 - a. 6-inch diameter for quick couplers.
 - b. 10-inch diameter for all automatic valves, ball valves and splice locations.
 - c. Side walls to extend to at least 2 inches below the bottom of the valve body; for deep mainline, appropriate extensions shall be used to reach depth of valve. Valve box shall not bear directly on pipe.
 - d. 10 inch x 12 inch Rectangular box with locking lid for gate valves and drip zone valve assembly.
4. Valve box shall be supported on all sides with a 2-inch x 4-inch x 8-inch concrete brick; or approved equal.

2.7 SWING JOINTS

- A. Sprinklers with the body of the unit buried in soil shall be attached to the piping with 2-elbow joints consisting of 3/8-inch flexible pipe with coordinating himax barbed elbows.
- B. Quick coupling valves shall be installed using a Spears swing joint with brass assembly, model #5815-01018. Size shall match inlet size of quick coupling valve.

2.8 COMMUNICATION CIRCUITRY - ELECTRIC

- A. Wire shall be 600-volt soft annealed copper, PVC insulated, UL approved, direct burial UF. Wire insulation color shall be of a different color than the wires used on the 115 volt A.C.
- B. Minimum Wire Size:
 1. 0 to 500 Lineal Foot Runs: No. 16 single strand.
 2. 500 to 2,000 Lineal Foot Runs: No. 14 single strand.
 3. Over 2,000 Lineal Foot Runs: No. 12 single strand.
 4. 18 gauge [*Specify Quantity of Conductors*] conductor multi-strand and color wire. Provide No. 14 single strand wire for ground wire.
- C. Splice wires only at valve boxes. Join wires with wire nuts and 3M Scotchpack sealing kit or 3M DBR/Y direct bury splice kit.

2.9 SPRINKLER HEADS

- A. Heads in landscape beds must be 12 inch bottom-feed pop-up type.
- B. Heads in turf areas must be a 6 inch pop-up, 5 inch rotor, or 12 inch rotor.

2.10 CONTROLLERS

- A. As indicated on Drawings.
- B. Must be compatible with Sentinel Central Control system.
- C. Must include an in-line flow sensor which is capable of reporting to Sentinel Central Control system.

2.11 BACK FLOW PREVENTION DEVICE

- A. As indicated on Drawings.

2.12 SLEEVES

- A. All sleeves to be sized at 6" which shall be a minimum PVC 160 or Schedule 40 DWV pipe. Sleeves to be installed perpendicular to hard surface with which it passes under unless otherwise specified by Owner.
- B. Marker ball shall be used to mark at least one end of sleeve unless sleeve crosses hard surface in distance greater than 25' then marker balls to be attached to both ends (Marker balls provided by Owner.) Refer to EARTHWORK- 312300 for appropriate color coding of marker ball for irrigation.

2.13 SOLVENT AND PRIMER

- A. Solvent and primer used on PVC pipe shall meet the requirements of ASTM D2564 and shall be approved by the National Sanitation Foundation. All solvent and primer shall be used in accordance with manufacturer's specifications. Primer to be purple in color.
- B. Solvent shall be used as is from original container. No thinner shall be added to the solvent to change its viscosity. If viscosity or consistency is unsuitable, the solvent shall not be used.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Contractor shall call "MISS DIG" at 1-800-482-7171 and Physical Plant, Engineering Services 1-517-355-3372 (providing them with MISS DIG staking number) before excavation commences. Contractor shall be responsible for utilities damaged within 3 feet on either side of the staked route. It shall be the responsibility of Contractor to maintain the staked route throughout construction.

3.2 GENERAL

- A. Place sleeves under pavement systems, with the top of pipe 18 inches below the finished surface.
- B. Install equipment in strict accordance with the manufacturer's recommendations.
- C. Excavation and Backfill: In accordance with Division 31 Section "Earthwork."

- D. Contractor shall be responsible for full and complete coverage of irrigated areas and will be required to make necessary minor adjustments at no additional cost to the Owner.

3.3 LAYOUT AND STAKING

- A. Piping indicated on the Drawings is generally diagrammatic, however, the main line location on the Drawings is indicated where the Owner would prefer to see the route because of tree roots and other obstacles. Contractor and Owner shall together field verify the precise location of the main line, valves, and quick couplers. Contractor shall lay the system out for Owner approval.

3.4 TRENCHING

- A. Trenches shall be excavated so that the irrigation lines are installed with the following minimum depths for pipe cover:
 - 1. Polyethylene Lateral Pipe: Minimum depth 12 inches.
 - 2. PVC Lateral Pipe 1-inch: Minimum depth 12 inches.
 - 3. PVC Pipe:
 - a. 1-1/2-inch to 2-inch Pipe Size: 16-inch cover.
 - b. 2-1/2-inch to 4-inch Pipe Size: 20-inch cover.
 - c. 6-inch to 8-inch Pipe Size: 24-inch cover.
- B. PVC piping shall be trenched. PVC pipe 2-1/2-inch and smaller may be pulled provided depth of pipe is maintained at a minimum of 20-inch cover.
- C. Polyethylene distribution pipe may be pulled provided a 12-inch minimum depth is maintained.
- D. Trench excavation in excess of required depth shall have the bottom graded and tamped prior to placement of pipe.
- E. Where trenching of PVC or polyethylene pipe lines is not possible because of adverse soil conditions or obstructions, and backhoe operations is required, provide labor, materials and equipment for this operation.
- F. Existing soils may be assumed to be adequate to support pipe as bedding and excavated soils shall be used as backfill in all lawn areas. Backfill material shall be free from debris, including rocks, large stones, clay clumps or other unsuitable substances. Care shall be taken to prevent settling and damage to pipe during and after backfilling operations. New piping 4-inch and 6-inch diameter shall be laid on a leveling bed compacted to maximum thickness of 6 inches. If existing excavated onsite soils are found to be unacceptable for pipe bedding or backfill, the Owner shall provide and deliver to the Project site, sand to be used by Contractor for backfill. Contractor shall review such conditions with the Project Representative and sand backfill will be delivered within 48 hours of such determination. Contractor shall provide equipment to haul soils from onsite stockpile site to work area. Excess soils shall be hauled by Contractor to an MSU disposal area as directed by the Project Representative. Dig holes in bedding for bells and fittings so pipe bears uniformly along its length. Hand compact the haunching under the spring line of the pipe. Take extra care to control the density of the haunching on plastic pipe in

accordance with the manufacturer's instructions. When backfilling, soil shall be tamped in 6-inch layers with a minimum of 6 inches of acceptable soil.

G. Pavement:

1. No pavement shall be removed to install sleeves without approval of the Campus Arborist.
2. If Contractor determines that pavement must be removed, the pavement shall include the entire flag of concrete paving or 24 inches on each side of the trench for bituminous paved areas.
3. Replacement paving shall match Owner's specifications and be installed by the Owner's unit cost Contractor. The cost for removing and replacing pavement shall be at the irrigation Contractor's expense.

3.5 PIPING INSTALLATION

- A. No work will be permitted within the drip-line of trees without approval of the Project Representative.
- B. PVC pipe shall be laid on solid undisturbed soil or on thoroughly compacted full bed of sand. Maintain proper alignment and minimum slope for drainage.
- C. Polyethylene pipe connections shall be made with insert fittings held tightly in place with worm gear driven stainless steel clamps and screws at ferrules. Pipe sized 1-1/4-inch shall be double clamped.
- D. PVC pipe ends and PVC fittings shall be thoroughly cleaned for full depth of fitting with liquid cleaner cement. Method of application shall be in accordance with manufacturer's recommendations for solvent weld connections.
- E. At wall penetrations, pack the opening around pipe with non-shrink grout. At exterior face, leave perimeter slot approximately 1/2-inch wide by 4/5-inch deep. Fill this slot with backer rod and acceptable elastomeric sealant.
- F. Install PVC pipe during dry weather when temperature is above 40 degrees F (4 degrees C), in strict accordance with manufacturer's instructions. Allow joints to cure at least 24 hours at temperatures above 40 degrees F.

3.6 CONNECTION TO WATER SOURCE

- A. Point of connection shall be as indicated on Drawings. Contractor shall verify point of connection with the Project Representative.

3.7 CROSS CONNECTION PROTECTION

- A. Install according to State and local plumbing codes. Piping shall be galvanized steel pipe or copper pipe.

3.8 SPRINKLER HEADS

- A. Flush circuit lines with full head of water and install heads after flushing is complete.
 - 1. Install lawn heads at manufacturer's recommended heights.
 - 2. Install high pop risers flush with grade or as indicated on Drawings.
 - 3. Locate part-circle heads to maintain minimum distance of 4 inches from walls and windows and 2 inches from other boundaries, unless directed by the Project Representative.
 - 4. Irrigation heads shall be installed on swing joints, funny pipe, or as indicated on Drawings.
 - 5. Nozzles shall match sprinkler head manufacturer.

3.9 DIELECTRIC PROTECTION

- A. Use dielectric fittings at connections where pipes of dissimilar metals are joined.

3.10 THRUST BLOCK

- A. Provide concrete thrust blocks on thrust side of mainline pipe wherever pipe changes direction at tees, bends, or dead ends and at other locations where thrust is to be expected. Thrust blocks on 4-inch or larger pipes.
- B. Refer to pipe manufacturer's recommendations of type and method of thrust blocks.

3.11 AUTOMATIC CONTROLLERS AND FLOW METERS

- A. Install controller according to manufacturer's recommendations and as indicated on Drawings. Electric power for controller will be provided by Owner.
- B. Connect remote control valves to controller in the sequence as indicated on Drawings.
- C. 2-inch PVC pipe (or size as required for larger wire bundle) shall be used as a conduit for control wires from 6 inches below ground at the main line to the control box. Secure the PVC pipe with metal brackets bolted to the building with proper anchors.

Install flow meter no less than 5 times the meter's diameter away from the last obstruction ("T", elbow, valve, etc.) and 10 times the meter's diameter prior to the next obstruction.

3.12 ADJUSTING

- A. Upon completion of the system, adjust system components to provide optimum performance, including:
 - 1. Synchronization of controllers.

2. Adjustment to pressure regulators and pressure relief valves.
3. Part circle sprinkler head.
4. Individual station adjustments.
5. Other adjustments necessary to obtain satisfactory performance of system.
6. Flush lines and evacuate air and debris from system.

3.13 FIELD QUALITY CONTROL

- A. **Punch List:** Upon completion of irrigation work, Contractor shall notify the Owner that installation is complete as indicated on the Drawings and in the Specifications and is ready for inspection. The Owner and Contractor will inspect the installation together. A punch list will be prepared by the Owner that indicates non-conformances with Drawings and Specifications. Contractor shall immediately correct errors identified.
- B. **Record (As-Built) Drawings:** Contractor shall provide accurate record drawings showing dimensions from stationary points as they relate to items including valves, main and lateral lines, controllers, and quick couplers. Record drawings shall be submitted before final payment will be approved. Upon request, Owner will provide paper or electronic copies of design documents for Contractor's convenience.

3.14 DEMONSTRATION

- A. After completion, testing and acceptance of the system, instruct Owner's staff regarding the operation and maintenance of the system.

END OF SECTION 328400