

SECTION 328400

LANDSCAPE IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Piping.
 - 2. Manual valves.
 - 3. Automatic control valves.
 - 4. Automatic drain valves.
 - 5. Sprinklers.
 - 6. Quick couplers.
 - 7. Controllers.
 - 8. Boxes for automatic control valves.

1.2 PERFORMANCE REQUIREMENTS

- A. Irrigation zone control shall be automatic operation with controller and automatic control valves.
- B. Intent of Drawings: Sprinkler lines shown on the Drawings are diagrammatic. Locations of all sprinkler heads, valves, piping, wiring, etc. shall be established by the Contractor at the time of construction. Spacing of sprinkler heads and quick coupling valves are shown on the Drawings and shall be exceeded only with the permission of the Owner's authorized representative.
- C. Keep all areas of work clean, neat, and orderly at all times. Keep paved areas clean during installation operations.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For irrigation systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- D. Zoning Chart: Show each irrigation zone and its control valve.
- E. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.
- F. Field quality-control reports.
- G. Operation and maintenance data for the following:
 - 1. Irrigation controller.
 - 2. Valves and gate valves.
 - 3. Pipe and fittings.
 - 4. Valve boxes.
 - 5. Quick coupling valves.
 - 6. Low voltage wire and connections.
- H. Record Irrigation Drawings:
 - 1. Furnish Record Drawings of complete irrigation system in accordance with the General and Special Conditions.
 - 2. Procure full size set of Contract Drawings from Landscape Architect.
 - a. Construction Drawings shall be on-site at all times while irrigation system is under construction.
 - b. Make daily record of all work installed each day.
 - c. Actual location of valves and quick couplers and all irrigation and drainage piping shall be shown on prints by dimensions from easily identifiable permanent features, such as buildings, curbs, fences, walks, or property lines.
 - d. Drawings shall show approved substitutions of material. Include material, manufacturer's name, and catalogue number.
 - e. Drawings shall be to scale and all indications shall be easily understandable, legible, and neat.

1.4 QUALITY ASSURANCE

- A. Requirement of Regulatory Agencies:
 - 1. All work and materials shall be in full accordance with the latest rules and regulations of safety orders of Division of Industrial Safety; the Uniform Plumbing Code and other applicable laws or regulations, including the City of Houston.
 - 2. Nothing in Drawing is to be construed to permit work not conforming to these codes. Should the Contract Documents be at variance with the aforementioned rules and regulations, notify Landscape Architect and get instructions before proceeding with the work.
- B. Testing:
 - 1. Preliminary review of completed installation will be made by the Landscape Architect prior to backfilling trenches and during hydrostatic testing.

2. Final review shall be made in conjunction with the final review, shrubs, and tree planting.
- C. 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.

1.5 FINAL ACCEPTANCE

- A. Work under this Section will be accepted by Landscape Architect upon satisfactory completion of all work. Upon final acceptance, Owner will assume responsibility for maintenance of the work. Said assumption does not relieve Contractor of obligations under Warranty.

1.6 WARRANTY

- A. In addition to the manufacturer's guarantees or warranties, all work shall be warranted for one year from the date of Final Acceptance against defects, material, equipment and workmanship by the Contractor. Warranty shall also cover repair of damage to any part of the premises resulting from leaks or other defect in materials, equipment, and workmanship to the satisfaction of the Owner.
- B. Contractor shall not be held responsible for failures due to neglect by the Owner, vandalism, etc., during the Warranty or Guarantee period. Report such conditions to the Landscape Architect in writing.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials throughout the system shall be as specified and noted on the Drawings, new and in perfect condition.
- B. Gate Valves: Three inches in size and under, 125 pound bronze construction, non-rising stem type, sized to line. NIBCO #T113 or approved equal.
- C. Sleeves: Control wire and water line sleeves shall be PVC 1120-1220, Schedule 40 pipe.
- D. Water Meters: Per City of Houston
- E. Backflow Preventer:
 1. Pressure type: Manufacturer: Febco
 2. Double check: Manufacturer: Febco
 3. Use Pressure Type when the required elevation of the BFP is 3'-0" or less above finish grade.
 4. Use Double Check Valve when the required elevation for a Pressure Type BFP is greater than 3'-0" above finish grade.

5. Protect Backflow preventer from vandalism with a lockable wire mesh cage.
Manufacturer: Backflow Protection; Model: "Ultimate Tuff Cage"
- F. Irrigation Controllers: Manufacturer: Base-line. Model 3200. Remote Control Valves:
Manufacturer: Rainbird – Model: PEB with Baseline decoders.
- G. Control Wiring: Solid copper, UL approved for direct burial in ground. Minimum gage#14 UF
(#12 UF for runs over 1,000 LF). Common ground wire shall be white.
- H. Valve Boxes: Injection molded of polymers and fibrous inorganic temperature resistant
components. Box shall provide adequate clearance to operate and service valve. Box and lid
shall be Green.
 1. Acceptable Manufacturers: Amtek, Christy, Carson, or approved equal.
 2. Valve boxes for remote control valves shall be rectangular, approximately 10-inch x 14-
inch inside dimensions by 15 inches deep. Boxes shall be black with lockable lids and
have painted on lid with 1-inch high white letters "RC".
 3. B. Valve boxes for gate valves and quick couplers, shall be round, approximately 9-inch
inside diameter by 10-inch deep. Boxes shall be black with lockable lids and have
painted on lid with 1-inch high white letters "QC".
- I. Quick Couplers:
 1. Valve and keys as specified on Drawings.
 2. Furnish two valve keys fitted with 3/4-inch swivel hose ells.
- J. Sprinkler Heads:
 1. Rotors: Hunter PGP
 2. Spray Heads: Rainbird MPR
- K. Conduit: All conduits for low voltage irrigation control wires shall be 2-inch Schedule 40 PVC.
Control wiring may be placed in common sleeve with lateral or main lines under paving when
sleeves are larger than 4-inches. Use galvanized steel pipe only under public roads or for high
voltage power conductors.

2.2 PIPING

- A. Piping on pressure side of irrigation control valves:
 1. Two and one-half inch diameter and smaller – ASTM D 1785, PVC 1120-1220 compound,
Schedule 40.
- B. Piping on non-pressure side of irrigation control valves:
 1. Two inch to three-quarter inch – ASTM D 1785, PVC 1120-1220, Class 200.
 2. One-half inch and smaller – ASTM D 1785, PVC 1120-1220, Class 315.

- C. Identification: Continuously and permanently marked with manufacturer's name or trademark, size, schedule and type of pipe, working pressure at 73 degrees F., and National Sanitation Foundation (NSF) approval.

2.3 FITTINGS

- A. Fittings for Solvent- Welded Pipe:
 - 1. Schedule 40, polyvinyl chloride, standard weight, as manufactured by "Sloane", "Lasco", or approved equal, to meet ASTM D-2466-73 and D-2467-73.
 - 2. Threaded PVC nipples - Schedule 80 PVC.
- B. Fittings for Polyethylene Pipe:
 - 1. Polyallomer as manufactured by "Flintkote" or approved equal.
 - 2. Compression type of CPVC as manufactured by "Pepco".
- C. Fittings for Swing Joints:
 - 1. Supply three (3) Schedule 40 "Marlex" elbows.
 - 2. Threaded PVC Nipples - Schedule 80 PVC.

2.4 PIPING JOINING MATERIALS

- A. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- B. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site Verification of Conditions:
 - 1. Contractor shall be acquainted with all site conditions. Should utilities or other work not shown on the plans be found during excavations, Contractor shall promptly notify Landscape Architect for instructions as to further action. Failure to do so will make Contractor liable for any and all damage arising from operations subsequent to discover of such utilities not shown on plans.
 - 2. Contractor shall take necessary precautions to protect site conditions. Should damage be incurred Contractor shall repair damage to its original condition or furnish and install equal replacement.

3.2 LAYOUT

- A. Consideration will not be given to design changes until after award of contract.
- B. Lay out work as closely to that shown on the Contract Drawings as possible. Contract Drawings are diagrammatic in nature. Adjust layout as necessary to accommodate actual site conditions. Locate pipe and valves shown under paving in adjacent planting area.
- C. Full and complete coverage is required. Contractor shall make minor adjustments to layout as required to assure full and complete coverage. When such adjustments require exceeding radius limitations shown on irrigation legend, contact Landscape Architect for direction.
- D. Substitutions for smaller pipe sizes will be not be accepted.

3.3 EARTHWORK

- A. Perform excavation as required for installation of work included under this Section, including shoring of earth banks if necessary. Restore all surfaces, existing underground installations, etc., damaged or cut as a result of excavations, to their original condition.
- B. Should utilities not shown on the plans be found during excavation, promptly notify Landscape Architect for instructions as to further action. Failure to do so will make Contractor liable for any and subsequent discovery of such utilities. Indicate such utility crossings on the Record Drawings promptly.
- C. Dig trenches wide enough to allow a minimum of 4-inches between parallel pipe lines. Trenches shall be of sufficient depth of proved minimum cover from finish grade as follows:
 - 1. Over pipe on pressure side of irrigation control valve, control wires and quick coupling valves: 18 inches.
 - 2. Over pipe on non-pressure side of irrigation control valve: 12 inches.
- D. Trenching within the drip-line of existing trees shall not employ the use of mechanical trenching devices. Hand dig without severing roots which exceed 1-1/2" in diameter. Notify the Landscape Architect immediately if site conditions prohibit such action.

3.4 PIPING INSTALLATION

- A. General:
 - 1. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.
 - 2. Clean all pipes and fittings of dirt and moisture before assembly.
 - 3. Install piping free of sags and bends.
 - 4. Install groups of pipes parallel to each other, spaced to permit valve servicing.
 - 5. Install fittings for changes in direction and branch connections.

6. Install unions adjacent to valves and to final connections to other components with NPS 2 (DN 50) or smaller pipe connection.
 7. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 (DN 65) or larger pipe connection.
 8. Install expansion loops in control-valve boxes for plastic piping.
 9. Lay piping on solid sub-base, uniformly sloped without humps or depressions.
 10. Install ductile-iron piping according to AWWA C600.
 11. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.
- B. Solvent-Welded Joints for PVC Pipes:
1. Use solvents and methods by pipe manufacturer
 2. Cure joint a minimum of one hour before applying any external stress on the piping and at least twenty four (24) hours before placing the joint under water pressure.
- C. Threaded Joints for Plastic Pipes:
1. Use Teflon tape on the threaded PVC fittings except where Marlex fittings are used.
 2. Use strap-type friction wrench only. Do not use metal-jawed wrench.
 3. When connection is plastic to metal, male adaptors shall be used. The male adaptor shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be Teflon tape or approved equal.
- D. Joints for Polyethylene Pipes:
1. Double-clamp all connections 1-1/4-inch diameter and greater.
 2. Make all connections between polyethylene pipes and metal valves or pipes with threaded fittings using male adaptors.
- E. Laying of Pipe:
1. Pipes shall be bedded in at least 2-inches of finely divided material with no rocks or clods over 1-inch diameter to provide a uniform bearing.
 2. Pipe shall be snaked from side to side of trench bottom to allow for expansion and contraction. One additional foot per 100 feet of pipe is the minimum allowance for snaking.
 3. PVC Pipe shall not be laid when there is water in the trench.
 4. Install plastic pipe in a manner to provide for expansion and contraction as recommended by the manufacturer.
 5. Cut plastic pipe with PVC pipe cutters or hacksaw to ensure a square cut. Remove burrs at cut ends prior to installation to ensure that a smooth unobstructed flow will be obtained.
 6. All plastic to plastic joints shall be solvent-weld joints or slip seal joints. Only solvent recommended by the pipe manufacturer shall be used. Install plastic pipe and fittings as outlined and instructed by pipe manufacturer. It shall be the Contractor's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. Contractor shall assume full responsibility for the correct installation.

3.5 EQUIPMENT INSTALLATION

- A. Gate Valves: Group valves together and locate in planted areas where possible. Box shall be flush with finish grade.
- B. Irrigation Control Valves: Install control valves in valve boxes where shown and group together where practical. Place no closer than 12-inches to walk edges, buildings, and walls. Valve boxes shall be flush with finish grade.
- C. SPRINKLER HEADS:
 - 1. Place all rotary pop-up sprinkler heads in lawn areas on swing joints as Detailed on Drawings with top of heads 1-Inch above finish grade. Place part-circle rotary pop-up sprinkler heads 8-inches from edge of and flush with top of adjacent walks, header boards, curbs, mowing bands, or paved areas at time of installation. Install rotary sprinklers on a swing joint assembly as detailed.
 - 2. Install spray heads and bubbler heads on a swing joint assembly as detailed on the Drawings.
- D. Quick Coupling Valves: Install quick coupling valves on a swing joint assembly as detailed on the Drawings.
- E. Automatic Controller:
 - 1. Install per local code and manufacturer's latest printed instructions.
 - 2. Connect remote control valves to controller in clockwise sequence to correspond with station setting beginning with Stations 1, 2, 3, etc.
 - 3. Affix controller name (i.e. "Controller A") on inside of controller cabinet door with letters minimum of 1-inch high.
 - 4. Affix a non-fading copy of irrigation diagram to cabinet door below controller name. Seal irrigation diagram between two sheets of 20 mil (minimum) plastic.
 - 5. Irrigation diagram shall be a reduced copy of the as-built drawing and shall show clearly all valves operated by the controller, showing station number, valve size, and type of planting irrigated.
- F. Control Wiring:
 - 1. Install control wires with sprinkler mains and laterals in common trenches wherever possible. Lay to the side of pipe line. Provide looped slack at valves and snake wires in trench to allow for contraction of wires. Tie wires in bundles at ten (10') foot intervals.
 - 2. Crimp and seal control wire splices at remote control valves with specified splicing materials. Line splices will be allowed only on runs of more than 500 feet. Line splices to be Scotchlok and sealed with Scotchkote sealer.
 - 3. Install a minimum of one (1) extra control wire to the control valve located the greatest distance from the controller in both directions and label each end blank or as shown on drawings.
- G. Closing of Pipe and Flushing of Lines:

1. Cap or plug all openings as soon as lines have been installed to prevent entrance of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.
2. Thoroughly flush out all water lines before installing heads, valves and other hydrants.
3. Test as specified.
4. Upon completion of testing, complete assembly and adjust sprinkler heads for proper distribution.
5. All sprinkler heads and quick coupling valves shall be set perpendicular to finished grades unless otherwise designated on the Drawings, or otherwise specified. Sprinkler heads adjacent to existing walls, curbs and other paved areas, shall be set to grade. Sprinkler heads which are to be installed in lawn areas where the turf has not yet been established shall be set 1-inch above the proposed finish grade. Heads installed in this manner will be lowered to grade when the turf is sufficiently established to allow walking on it without appreciable destruction. Such lowering of heads shall be done by Contractor as part of the original contract with no additional cost to the Owner.

3.6 BACKFILL AND COMPACTING:

- A. After system is operating and required tests and inspections have been made, backfill excavations and trenches with clean soil free of debris.
- B. Backfill for all trenches, regardless of the type of pipe covered, shall be compacted to minimum 95 percent density under pavements, and 85 percent under planted areas.
- C. Compact trenches in areas to be planted by thoroughly flooding backfill. Jetting process may be used in those areas.
- D. Dress off all areas to finish grades.

3.7 GUARANTEE

- A. The Contractor shall warrant all materials and workmanship for one (1) year from final acceptance.

3.8 CLEAN UP

- A. Clean up and remove all debris from the entire work area prior to Final Acceptance to satisfaction of Landscape Architect.

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Perform hydrostatic tests when welded PVC joints have cured per manufacturer's instructions.

1. Pressurized Mains:
 - a. Completely install mains, gate valves, and control valves. Do not install laterals.
 - b. Fill all lines with water.
 - c. Pressurize the main with air to 70 psi. Monitor gauge for pressure loss for four (4) hours. Maximum allowable loss over four (4) hour period - 3 psi.
 - d. Leave lines and fittings exposed throughout testing period.
 - e. Leaks resulting from tests shall be repaired and tests repeated until the system passes.
 - f. Test all gate valves for leakage.
2. Non-Pressure Laterals:
 - a. Test piping after laterals and risers are installed and system is fully operational.
 - b. Leave trenches open to detect possible leaks.
- C. Submit written requests for inspections to the Landscape Architect at least forty eight (48) hours prior to anticipated inspection date.
- D. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 1. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Any irrigation product will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.10 ADJUSTING

- A. Adjust settings of controllers.
- B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.
- C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch above, finish grade.

END OF SECTION 328400