

## SECTION 02811

## IRRIGATION SYSTEMS

07/97

## PART 1 GENERAL

## 1.1 SUMMARY

The irrigation design is not included in this design package. The Contractor shall provide the design and installation to achieve full irrigation coverage of all plantings and turf. Provide a complete automatic turf and drip irrigation system for all plantings as per specifications and details. Layout of circuits shall be clearly defined into hydrozones/microclimates with similar water requirements and precipitation rates. Ensure each plant receives the required amounts of water without over or under saturating other plants within the same circuit. The irrigation system shall be designed based on the static pressure at the backflow preventer at the time of installation. A pressure test shall be performed prior to the start of work. Design shall meet all local codes and regulations and shall operate properly within the acceptable use of all equipment used.

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1989a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM B 32	(1989) Solder Metal
ASTM B 43	(1988) Seamless Red Brass Pipe, Standard Sizes
ASTM B 88	(1989) Seamless Copper Water Tube
ASTM D 1785	(1989) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(1989) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2287	(1981; R 1988) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM D 2464	(1989) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1989) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	(1988) Solvent Cements for (Poly Vinyl

Chloride) (PVC) Plastic Pipe and Fittings

ASTM D 2774 (1972; R 1983) Underground Installation of  
Thermostatic Pressure Piping

ASTM D 2855 (1983) Making Solvent-Cemented Joints with  
Poly(Vinyl Chloride) (PVC) Pipe and  
Fittings

ASTM D 3261 (1988a) Butt Heat Fusion Polyethylene (PE)  
Plastic Fittings for Polyethylene (PE)  
Plastic Pipe and Tubing

ASTM F 441 (1989) Chlorinated Poly(Vinyl Chloride)  
(CPVC) Plastic Pipe, Schedules 40 and 80

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.26.1M (1984) Water Hammer Arresters

ASME B1.2 (1983) Gages and Gaging for Unified Inch  
Screw Threads

ASME B16.3 (1985) Malleable Iron Threaded Fittings,  
Classes 150 and 300

ASME B16.15 (1985) Cast Bronze Threaded Fittings,  
Classes 125 and 250

ASME B16.18 (1984) Cast Copper Alloy Solder Joint  
Pressure Fittings

ASME B16.22 (1989) Wrought Copper and Copper Alloy  
Solder Joint Pressure Fittings

ASME B40.1 (1985) Gauges - Pressure Indicating Dial  
Type - Elastic Element

## AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1012 (Sep 1978) Backflow Preventers with  
Intermediate Atmospheric Vent

ASSE 1013 (Apr 1988) Reduced Pressure Principle  
Backflow Preventers

ASSE 1020 (Feb 1989) Pressure Vacuum Breaker,  
Assembly (Recommended for Outdoor Usage)

## AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C509 (1987) Resilient-Seated Gate Valves, 3  
through 12 NPS, for Water and Sewerage  
Systems

AWWA C901 (1988; Errata) Polyethylene (PE) Pressure  
Pipe and Tubing, 1/2 in. Through 3 in.,  
for Water Service

## FEDERAL SPECIFICATIONS (FS)

FS 0-F-506 (Rev C) Flux, Soldering; Paste and Liquid  
 FS WW-H-001220 (Basic) Head, Sprinkler, (Underground Connected)  
 FS WW-S-610 (Rev B; Am 1) Sprinkler, Lawn, (Surface Connected)

## FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCHR)

FCCHR-01 (Jun 1988; 8th Ed) Manual of Cross-Connection Control

## MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80 (1987) Bronze Gate, Globe, Angle and Check Valves  
 MSS SP-85 (1985) Cast Iron Globe and Angle Valves - Flanged and Threaded Ends

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2 (1988; Rev 1) Industrial Control Devices, Controllers and Assemblies  
 NEMA ICS 6 (1988; Rev 1) Enclosures for Industrial Control and Systems

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1990) National Electrical Code

## 1.2 PERFORMANCE REQUIREMENTS

System shall operate with a minimum water pressure of 50 pounds per square inch (psi) at connection to main.

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL DESCRIPTIONS:

SD-01 Data

Design Analysis and Calculations; GA.

Design analyses and pressure calculations verifying that system will provide the irrigation requirements.

Spare Parts; GA.

Spare parts data for each different item of material and equipment

specified, after approval of the related submittals and not later than the start of the field tests. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

#### SD-04 Drawings

Sprinkler System; GA.

Detail drawings showing all irrigation work including valves, sprinkler heads, backflow preventers, automatic controllers, emitter heads, lateral and mainlines. Drawing shall include legends and a complete list of equipment and materials, and manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed system layout, type and number of heads and emitters, zone valves, drain pockets, backflow devices, controllers, and mounting details of controllers.

As-built Drawings which provide current factual information after construction showing locations of mains, heads, valves, and controllers including deviations from and amendments to the drawings and changes in the work shall be included.

#### SD-09 Reports

Field Tests; GA.

Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of control valves.

Operations & Maintenance Manuals; GA.

Six copies of operations and six copies of maintenance manuals for the equipment furnished. One complete set prior to field testing and the remainder upon acceptance. Manuals shall be approved prior to the field training course. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout, simplified wiring and control diagrams of the system as installed, and system programming schedule.

#### SD-13 Certificates

Sprinkler System; GA.

The material supplier's or equipment manufacturer's statement that the supplied material or equipment meets specified requirements. Each certificate shall be signed by an official authorized to certify in behalf of material supplier or product manufacturer and shall identify quantity and date or dates of shipment or delivery to which the certificates apply.

#### 1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be protected from the weather; excessive humidity and temperature variation; direct sunlight (in the case of plastic or rubber materials); and dirt, dust, or other contaminants.

#### 1.5 FIELD MEASUREMENTS

The Contractor shall verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

### PART 2 PRODUCTS

#### 2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

##### 2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer who has produced similar systems which have performed well for a minimum period of 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

##### 2.1.2 Nameplates

Each item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

##### 2.1.3 Extra Stock

The following extra stock shall be provided: Ten heads of each size and type, two valve keys for operating manual valves, two wrenches for removing and installing each type of head, two quick coupler keys and hose swivels, and four irrigation controller housing keys.

#### 2.2 PIPING MATERIALS

##### 2.2.1 Copper Tubing and Associated Fittings

###### 2.2.1.1 Tubing

Tubing shall conform to requirements of ASTM B 88, Type K.

###### 2.2.1.2 Fittings

Fittings shall conform to ASME B16.22 and ASME B16.18, solder joint. Solder shall conform to ASTM B 32 95-5 tin-antimony. Flux shall conform to FS 0-F-506, Type I.

##### 2.2.2 Red Brass Pipe and Associated Fittings

###### 2.2.2.1 Pipe

Pipe shall conform to requirements of ASTM B 43, regular.

#### 2.2.2.2 Fittings

Fittings shall be Class 250, cast bronze threaded conforming to the requirements of ASME B16.15.

#### 2.2.3 Galvanized Steel Pipe and Associated Fittings

##### 2.2.3.1 Pipe

Pipe shall conform to requirements of ASTM A 53, Schedule 40.

##### 2.2.3.2 Fittings

Fittings shall be Class 150 conforming to requirements of ASME B16.3.

#### 2.2.4 Polyvinyl Chloride (PVC) Pipe, Fittings, Solvent Cement, and Risers

##### 2.2.4.1 Pipe

Pipe shall conform to the requirements of ASTM D 1785, PVC 1120 Schedule 40; and ASTM D 2241, PVC 1120 SDR 21, Class 200.

##### 2.2.4.2 Fittings

Solvent welded socket type fittings shall conform to requirements of ASTM D 2466, Schedule 40. Threaded type fittings shall conform to requirements of ASTM D 2464, Schedule 80.

##### 2.2.4.3 Solvent Cement

Solvent cement shall conform to the requirements of ASTM D 2564.

##### 2.2.4.4 Risers

Risers shall be schedule 80 PVC threaded at both ends and shall conform to ASTM D 2241.

#### 2.2.5 Polyethylene (PE) Plastic Piping

##### 2.2.5.1 Pipe

Pipe shall conform to AWWA C901, outside diameter base with dimension ratio (DR) of 9.3 to provide 150 psi minimum pressure rating.

##### 2.2.5.1.1 Distribution Tubing

Distribution tubing shall be linear low density polyethylene tubing. It shall have a nominal reference of 1/4 inch, outside diameter of .350 inch, inside diameter of .250 inch, and a average wall thickness of .050 inch. Tubing shall be vinyl plastic extruded from non-rigid chloride, integrally algae-resistant, homogeneous throughout, smooth inside and outside, free from foreign materials, cracks, serrations, blisters and other effects.

##### 2.2.5.2 Fittings

Fittings shall conform to ASTM D 3261, DR of 9.3.

### 2.2.6 Dielectric Fittings

Fittings shall conform to ASTM F 441, Schedule 80, CPVC threaded pipe nipples, 4-inch minimum length.

## 2.3 HEADS

### 2.3.1 Multi-Outlet Emitters

Multi-outlet emitter heads shall be self-cleaning, pressure compensating diaphragm with six self-piercing barbed outlets; each capable of emitting 2 gallons per hour flow. Emitter body shall be ultraviolet stabilized, algae, and heat resistant plastic construction.

### 2.3.2 Rotary Pop-Up Sprinklers

Sprinklers shall be gear driven with adjustable and full circle arc models. Sprinklers shall be capable providing various radius coverages at low precipitation rates. Pop-up head design shall be 3-3/4" pop up with adjustable radius capabilities. Construction shall be of high impact molded plastic with filter screen, drain check valve, and come with multiple nozzles.

### 2.3.3 Bubblers

Bubblers shall be fully adjustable flow with operation over a wide range of pressures. Heads to be of molded plastic and stainless steel construction.

## 2.4 VALVES

### 2.4.1 Gate Valves, Less than 3 Inches

Gate valves shall conform to the requirements of MSS SP-80, Type 1, Class 150, threaded ends.

### 2.4.2 Gate Valves, 3 Inches and Larger

Gate valves shall conform to the requirements of AWWA C509 and have encapsulated resilient wedge, parallel seats, non-rising stems, and open by counterclockwise turning. End connections shall be flanged. Interior construction of valves shall be bronze including stem containing a maximum 2 percent aluminum and maximum 16 percent zinc.

### 2.4.3 Quick Coupling Valves

Quick coupling valves shall have brass parts and shall be two-piece unit consisting of a coupler water seal valve assembly and a removable upper body to allow spring and key track to be serviced without shutdown of main. Lids shall be lockable vinyl with spring for positive closure on key removal.

### 2.4.4 Remote Control Valves, Electrical

Remote control valves shall be solenoid actuated globe valves of 3/4- to 3-inch size, suitable for 24 volts, 60/50 cycle, and designed to provide for shut-off in event of power failure. Valve shall be cast bronze or brass or plastic housing suitable for service at 150 psi operating pressure with external flow control adjustment for shut-off capability, external

plug at diaphragm chamber to enable manual operation, filter in control chamber to prevent valve body clogging with debris, durable diaphragm, and accessibility to internal parts without removing valve from system.

2.4.5 Automatic Drain Valves

Automatic valves shall be brass or plastic, spring loaded ball drip type, 150 pounds and threaded ends, designed to close at 6-foot pressure head with positive seal at 3 psi pressure or greater and be open to drain at less than 3 psi pressure.

2.4.6 Reduced Pressure Backflow Preventer Assembly

Reduced pressure backflow preventer assemblies shall be tested, approved, and listed in accordance with FCCHR-01. Reduced pressure backflow preventers shall be in accordance with ASSE 1013. Backflow preventers shall be 150-pound flanged bronze mounted gate valve and strainer, stainless steel or bronze internal parts. Total pressure drop through complete assembly shall be a maximum of 10 psi at rated flow. Piping shall be galvanized steel pipe and fittings. Strainers shall be bronze or brass construction with gasket caps. Units shall have 200-mesh stainless steel screen elements.

2.5 ACCESSORIES AND APPURTENANCES

2.5.1 Valve and Emitter Boxes

Valve and emitter boxes shall be cast iron, plastic lockable, or precast concrete. Box sizes shall be adjustable for valve or emitter used. Cast iron box shall have bituminous coating. Boxes shall be sized as required to provide for easy access. The following inscription shall be burnt or permanently marked into the appropriate boxes lid:

<u>Type of Box</u>	<u>Inscription</u>
Drip valve assembly box	"Valve"
Quick coupling valve box	"QC"
Gate valve box	"GV"
Automatic drain valve box	"DV"
Emitter box	"Emitter"

2.5.2 Pressure Gauges

Pressure gauges shall conform to requirements of ASME B40.1, single style pressure gauge for water with 4-1/2-inch dial brass or aluminum case, bronze tube, gauge cock, pressure snubber, and siphon. Scale range shall be suitable for irrigation sprinkler systems.

2.5.3 Service Clamps

Service clamps shall be bronze flat, double strap, with neoprene gasket or "O"-ring seal.

2.5.4 Water Hammer Arresters

Water hammer arrester shall conform to the requirements of ASME A112.26.1M; stainless steel construction with an encased and sealed bellows compression chamber.

## 2.5.5 Drip Valve Assembly Accessories

### 2.5.5.1 Wye Strainer

Strainer shall be provided at inlet to each drip line. Strainer shall have stainless steel screen having equivalent of 140-mesh filtration capacity and incorporate flush valves within strainer to clean screen without disassembling unit.

### 2.5.5.2 Pressure Regulator

Pressure regulator shall be constructed of heat-resistant plastic and be provided with each remote control valve. The pre-set outlet pressure shall be 25 psi. Pressure regulator shall have a 3/4" female threaded inlet and outlet.

### 2.5.5.3 Riser Adapters

Riser adapters shall be provided with a rigid piping system.

### 2.5.5.4 Tubing Stakes

Tubing stakes shall be plastic coated steel, or other non-corrosive strong material to secure tubing.

### 2.5.5.5 Emitter Outlet Check Valve (Insect Cap)

Check valves shall be provided at end of each emitter outlet distribution line. Caps shall permit free flow of water with minimum restriction; prevent back siphoning, entry of insects, and contamination into outlet ports.

### 2.5.5.6 Closure Caps

Closure caps shall be in accordance with manufacturer's recommendations.

## 2.6 AUTOMATIC CONTROLLERS, ELECTRICAL

Controller shall conform to the requirements of NEMA ICS 2 with 120-volt single phase service, operating with indicated stations, and grounded chassis. Enclosure shall conform to NEMA ICS 6 Type 3R, with locking hinged cover, wall-mounted. Controller shall be programmed for various schedules by setting switches and dials equipped with the following features: A switch for each day of week for two schedules, allowing each station to be scheduled individually as to days of watering; a minute switch for each station with a positive increment range of 0-99 minutes or 0-9.9 hours, set time within one percent; a switch allowing selected schedules to be repeated after each completion of initial watering schedule and allowing each operation to be scheduled throughout a 24-hour day; a circuit breaker for surge protection; and circuit for a 9-volt rechargeable NiCad battery.

## 2.7 ELECTRICAL WORK

Wiring and rigid conduit for electrical power shall be in accordance with NFPA 70, and Section 16375, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

## 2.8 CONCRETE MATERIALS

Concrete shall have a compressive strength of 2500 psi at 28 days as specified in Section 03300, CONCRETE FOR BUILDING CONSTRUCTION.

## 2.9 WATER SUPPLY MAIN MATERIALS

Tapping sleeves, service cut off valves, and connections to water supply mains shall be in accordance with Section 02660, WATER LINES.

## 2.10 INSULATING JOINTS

Insulating joints and dielectric fittings shall be in accordance with Section 02660, WATER LINES.

## 2.11 PEA GRAVEL

Pea gravel shall be approximately 3/8" in size and shall be washed smooth gravel clean of dirt and debris.

# PART 3 EXECUTION

## 3.1 INSTALLATION

Sprinkler system shall be installed after site grading has been completed. Excavation, trenching, and backfilling for sprinkler system shall be in accordance with the applicable provisions of Section 02222, EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified herein. Provide a 3/4" valve and capped line to shade structure for future misting system installation.

### 3.1.1 Trenching

Backfill shall be hand tamped over excavation. When rock is encountered, trench shall be excavated 4 inches deeper and backfilled with silty sand (SM) or well-graded sand (SW) to pipe grade. Trenches shall be kept free of obstructions and debris that would damage pipe. Subsoil shall not be mixed with topsoil. Existing concrete walks, drives and other obstacles shall be bored at a depth conforming to bottom of adjacent trenches. Pipe sleeves for bored pipe shall be two pipe diameters larger than irrigation pipe.

#### 3.1.1.1 Underground Utility and Communications

Before start of trenching, the Contractor shall mark all known underground utility and communication line locations as shown on drawings. Work crews shall note these locations and care shall be taken when working in their vicinity.

### 3.1.2 Piping System

#### 3.1.2.1 Cover

Underground piping shall be installed as to meet the minimum depth of backfill cover specified on plans.

#### 3.1.2.2 Clearances

Minimum horizontal clearances between lines shall be 4 inches for pipe 2

inches and less; 12 inches for 2-1/2 inches and larger. Minimum vertical clearances between lines shall be 1 inch for lateral lines. Do not place lateral lines directly over main line.

#### 3.1.2.3 Minimum Slope

Minimum slope shall be 6 inches per 100 feet in direction of drain valves.

#### 3.1.3 Piping Installation

##### 3.1.3.1 Polyvinyl Chloride (PVC) Pipe

a. Solvent-cemented joints shall conform to the requirements of ASTM D 2855.

b. Threaded joints shall be full cut with a maximum of three threads remaining exposed on pipe and nipples. Threaded joints shall be made tight without recourse to wicks or fillers, other than polytetrafluoroethylene thread tape.

c. Piping shall be joined to conform with requirements of ASTM D 2774 or ASTM D 2855, and pipe manufacturer's instructions. Pipe shall be installed in a serpentine (snaked) manner to allow for expansion and contraction in trench before backfilling. Pipes shall be installed at temperatures over 40 degrees F.

##### 3.1.3.2 Soldered Copper Tubing

Pipe shall be reamed and burrs removed. Contact surfaces of joint shall be cleaned and polished. Flux shall be applied to male and female ends. End of tube shall be inserted into fittings full depth of socket. After soldering, a solder bead shall show continuously around entire joint circumference. Excess acid flux shall be removed from tubings and fittings.

##### 3.1.3.3 Threaded Brass or Galvanized Steel Pipe

Prior to installation, pipe shall be reamed. Threads shall be cut in conformance with ASME B1.2. Pipe joint compound shall be applied to male end only.

##### 3.1.3.4 Insulating Joints

Insulating and dielectric fittings shall be provided where pipes of dissimilar metal are joined and at connections to water supply mains as shown. Installation shall be in accordance with Section 02660, WATER LINES.

#### 3.1.4 Valves

##### 3.1.4.2 Remote Control Valves, Electrical

Remote control valves shall be pressure regulating, self-cleaning, solenoid actuated globe valves of 3/4 to 2-1/2 inch size, suitable for 24 volts, 60/50 cycle, and designed to provide for shut-off in event of power failure. Valve shall be glass filled nylon or plastic housing suitable for service at 150 psi. operating pressure with external flow control adjustment for shut-off capability, external plug at diaphragm chamber to enable manual operation, filter in control chamber to prevent valve body clogging with debris, durable diaphragm, and accessibility to internal parts without removing valve from system.

#### 3.1.4.1 Drip Valve Assembly

With each automatic valve, provide and assemble a wye strainer and a pressure regulator as shown on drawings. Valve assembly shall be set plumb in a valve box extending from grade to below valve body, with minimum of 4-inch cover measured from grade to top of valve.

#### 3.1.4.2 Drain Valves

Entire system shall be manually or automatically drainable. Low points of system shall be equipped with drain valve draining into an excavation containing 1 cubic foot pea gravel. Pea gravel shall be covered with weed fabric then backfilled with excavated material and covered with surface mulch as designated on drawings.

#### 3.1.5 Quick Coupling Valves

Quick coupling valves in valve boxes shall be installed plumb and level with terrain.

#### 3.1.6 Installation of Drip Irrigation System

##### 3.1.6.1 Distribution Tubing

Distribution tubing shall be connected to multi-outlet emitter and shall extend below ground to the plant as shown on the drawings. Tubing shall surface above subgrade at the plant and shall be placed below the mulch material. Install an insect cap at the end of each distribution tubing. When cutting tubing, shearing tools such as a pipe cutter, knife, or shears shall be used. Manufacturer's recommended tool and procedures when punching hose for emitters shall be followed.

##### 3.1.6.2 Multi-Outlet Emitters

Emitters shall be installed in a plastic emitter box. Emitter on a rigid PVC nipple shall be connected to PVC drip lateral with a tee or elbow. Tubing shall be attached to barbed fitting and daylight distribution tubing at root ball secured with stake, with bug cap at end of secured distribution tubing. After installing emitters and before operating system, end of drip lateral shall be opened and flushed clean. The number of emitters on a line shall not exceed manufacturer's recommendations for that hose or distribution tubing size and length. All orifices of the multi-outlet emitters that have been opened but are unused shall be installed with a closure cap.

##### 3.1.6.3 Tubing Stakes

Distribution tubing shall be secured with stakes where line is above ground. Stakes shall be spaced to ensure that tubing does not shift location in presence of foot traffic, operations, gravity on slope installations, or environmental effects. Discharge of the emitter distribution tubing shall be staked to ensure that discharge point of emitter will be maintained at specified position in relation to plant material to be irrigated.

#### 3.1. Turf heads

Install pop up heads to provide 100% coverage of all turf areas. Install

as per detail. Adjust radius and arcs where appropriate.

### 3.1.7 Reduced Pressure Backflow Preventer Assembly

Reduced pressure backflow preventer assembly shall be installed in new connection to existing water distribution system, between connection and control valves. Reduced pressure type shall be installed as follows: Flush pipe lines prior to installing device and protect device by a strainer located upstream. Device shall not be installed in pits or where any part of device could become submerged in standing water. Locate in shrub beds only.

#### 3.1.7.1 Insulation

All exposed piping and fittings shall be wrapped neatly with 1/2 inch minimum thickness of insulation tape or manufactured freeze protection blanket.

### 3.1.8 Control Wire and Conduit

#### 3.1.8.1 Wires

Low voltage wires may be buried beside pipe in same trench. Rigid conduit shall be provided where wires run under paving. Wires shall be number tagged at key locations along main to facilitate service. One control circuit shall be provided for each zone and a circuit to control irrigation system.

#### 3.1.8.2 Loops

A 12-inch loop of wire shall be provided at each valve where controls are connected.

#### 3.1.8.3 Expansion and Contraction

Multiple tubes or wires shall be bundled and taped together at 10-foot intervals with 12-inch loop for expansion and contraction.

#### 3.1.8.4 Splices

Electrical splices shall be waterproof.

### 3.1.9 Automatic Controllers

Controllers shall be wall mounted to building wall, 48 inches above finish grade. See drawings for automatic controller location. Coordinate the electrical service to these locations. Install in accordance with manufacturer's recommendations and NFPA 70.

### 3.1.10 Thrust Blocks

Concrete shall be placed so that sides subject to thrust or load are against undisturbed earth, and valves and fittings are serviceable after concrete has set. Thrust blocks shall be as specified in Section 02660, WATER LINES.

### 3.1.11 Backfill (Minimum Cover)

Depth of cover shall be 12 inches for non-pressure lateral pipe; 24 inches for pressure mainline pipes and for pipes under traffic loads, farm operations, and freezing temperatures; and 24 inches for low-voltage wires.

Remainder of trench or pipe cover shall be filled to within 2 inches of top with excavated soil, and compact soil with plate hand-held compactors to same density as undisturbed adjacent soil. Surface shall be covered with mulch as specified.

### 3.1.12 Disinfection

Irrigation system fed from a potable water system shall be disinfected upstream of backflow preventer in accordance with Section 02660, WATER LINES.

### 3.1.13 Cleaning of Piping

Prior to the hydrostatic and operation tests, the interior of the pipe shall be flushed with clean water until pipe is free of all foreign materials. Flushing and cleaning out of system pipe, valves, and components shall not be considered completed until witnessed and accepted by Contracting Officer.

## 3.2 FIELD TESTS

All instruments, equipment, facilities, and labor required to conduct the tests shall be provided by Contractor.

### 3.2.1 Hydrostatic Pressure Test

Piping shall be tested hydrostatically before backfilling and proved tight at a hydrostatic pressure of 150 psi without pumping for a period of one hour with an allowable pressure drop of 5 psi. If hydrostatic pressure cannot be held for a minimum of 4 hours, Contractor shall make adjustments or replacements and the tests repeated until satisfactory results are achieved and accepted by the Contracting Officer.

### 3.2.2 Leakage Tests

Leakage tests for service main shall be in accordance with Section 02660, WATER LINES.

### 3.2.3 Operation Test

At conclusion of pressure test, emitter heads, quick coupling assemblies, and hose valves shall be installed and entire system tested for operation under normal operating pressure. Operation test consists of the system operating through at least one complete programmed cycle for all areas to be irrigated.

## 3.3 POSTING FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system. After as-built drawings are approved by Contracting Officer, controller charts and programming schedule shall be

prepared. One chart for each controller shall be supplied. Chart shall be a reduced drawing of actual as-built system that will fit the maximum dimensions inside controller housing. Black line print for chart and a different pastel or transparent color shall indicate each station area of coverage. After chart is completed and approved for final acceptance, chart shall be sealed between two 20-mil pieces of clear plastic.

#### 3.4 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of 2 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance manuals.

#### 3.5 CLEANUP

Upon completion of installation of system, all debris and surplus materials resulting from the work shall be removed.

#### 3.6 WATER PROGRAM

##### 3.6.1 Irrigation Program

The Contractor shall develop an irrigation program based on local evapotranspiration calculations, soil type, hydrozone, and plant establishment needs. The program shall provide watering rates and times for all valve circuits and provide a complete table of recommended seasonal irrigation times. Submit irrigation program along with the required As-builts to the Contracting Officer at the end of the maintenance period.

##### 3.6.2 Irrigation Program Adjustment

Upon completion of planting, the Contractor shall commence automatic irrigation of the plantings. Adjust and fine tune all parts of the irrigation system carefully to meet water needs and requirements for each plant and hydrozone.

#### 3.7 MAINTENANCE

See Section 02950, PLANTING AND LANDSCAPING, 3.11 for required maintenance and period.

-- End of Section --