

## **SECTION 16 IRRIGATION**

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### **16-01 GENERAL**

The Work shall consist of furnishing the materials and installing an irrigation system complete in accordance with the Plans, Standard Specifications, Special Provisions and Technical Provisions.

All Work shall be in full accordance with the latest rules and regulations of the safety orders of the Division of Industrial Safety, the Uniform Plumbing Code published by the Western Plumbing Officials Association, National Electric Code, Electrical Safety Orders of the State of California Division of Industrial Safety, and other applicable State or local codes or regulations.

Nothing in the Plans, Standard Specifications, Special Provisions or Technical Provisions is to be construed to permit Work not conforming to these codes, rules and regulations. When specifications call for a material or construction of a better quality or larger size than required by the codes, rules and regulations, specifications shall take precedence over the requirements of said codes, rules and regulations.

### **16-02 MATERIALS**

#### **16-02.01 Plastic Pipe**

All plastic pipe shall be free of blisters, internal striations, cracks, or any other defects. The pipe shall be continuously and permanently marked with the name of the manufacturer, material type, size, schedule or class, pressure rating in units of pounds per square inch (psi), and quality control identifications (for example, ASTM and SDR numbers). Individual sections of pipe to be of the same manufacturer.

A. Rigid Type. All Type 1, Grade 1 polyvinylchloride (PVC) with solvent weld connections.

1. Main line pipe shall be Schedule 40 conforming to ASTM D1784 and D1785.
2. Lateral pipe shall be Class 200 conforming to ASTM D1784 and D2241.

#### **16-02.03 Fittings**

Pipe and hose fitting shall be Schedule 40, uniformly white in color, Type 1, Grade 1 polyvinylchloride (PVC) conforming to ASTM D1784 and D2466.

#### **16-02.04 Nipples**

Nipples shall be standard weight Schedule 80 with molded threads. All threaded nipples exposed above grade shall be gray in color.

### **16-02.05 Solvents and Joint Compounds**

Joint compound for all threaded connections shall be by Teflon seal.

Primer and solvents shall be as recommended by the pipe manufacturer.

All cans shall have labels intact and stamped with the date of manufacture. No cans dated over one (1) year old will be permitted. No solvent or primer shall be thinned in any manner whatsoever.

### **16-02.06 Control Wiring**

All wires shall be solid copper, Type UF-AWG, UL-approved for direct burial. Wire shall be continuously and permanently marked with the manufacturer's name, wire size and identification. The size and color of control wire shall be as follows: pilot wire—No. 14 red; common wire—No. 12 white. No wire shall be smaller than the No. 14 in size.

All wire splices shall be made with a plastic heat-shrink type splice compound. All wire splices must be made in a splice box such as a Brooks 1419 heavy-duty plastic valve box with locking top or approved equal. Label splice boxes "splice" in one inch (1") letters with white enamel paint.

Install two (2) extra wires from controller to each valve cluster group.

### **16-02.07 Backflow Prevention Devices**

The backflow unit shall be Febco 860 series with ball valves to the size shown on the Plans or an approved equal.

### **16-02.08 Pressure Regulating Valves**

Pressure regulating valves shall be of the type and size shown on the Plans.

### **16-02.09 Irrigation Heads**

Shrub irrigation heads shall be impact plastic, 12 inch pop-up type by Rainbird, or approved equal. Turf and ground cover irrigation heads shall be high impact plastic, 6 inch pop-up type by Rainbird, or approved equal.

### **16-02.10 Automatic Control Valves**

Automatic control valves shall be Griswold 2030 valve or an approved equal. Control valves shall be normally closed, electrically operated and compatible for operation with the automatic controller. Control valves shall have two (2) inlets provided on each valve to enable installation in straight or angled configuration. The solenoid pilot must be corrosion proof, molded in epoxy and encased in brass housing. The valve must be constructed of brass and cast iron.

### **16-02.11 Automatic Controllers**

The controllers shall be Rainmaster Model RME "Eagle," or an approved equal, or as noted on the Plans and shall have the number of stations specified on the Plans.

### **16-02.12 Controller Enclosures**

Controller enclosures shall be stainless steel as manufactured by Strong Box or an approved equal.

### **16-02.13 Valve Boxes**

Valve boxes shall be precast concrete boxes with over the rim cover with steel locking lids.

### **16-02.14 Ball Valves**

Ball valves shall be cast steel and shall be as manufactured by Red-White Valve Corporation or an approved equal.

### **16-02.15 Master Valves**

Master valves shall be installed downstream of reduced pressure backflow preventor and shall be as manufactured by Griswold, Clay, Watts or an approved equal.

## **16-03 CONSTRUCTION**

### **16-03.01 General**

The Contractor shall install all products in strict accordance with the manufacturer's printed directions. If those directions conflict with Standard Specifications, the matter shall be brought to the attention of the Engineer for clarification prior to proceeding with the Work.

Within five (5) days after notice to proceed and before any irrigation system materials have been delivered to the job site, submit to the Engineer a complete list of all irrigation system materials proposed to be installed. Show the manufacturer's name and catalog number for each item, furnish complete catalog cuts and technical data for each item, and the manufacturer's recommendations for method of installation. Upon approval by the Engineer, or his designated representative, the printed recommendations will become the basis for acceptance or rejection of actual methods of installation used in the Work. No irrigation system component shall be brought onto the job site unless it has been approved by the Engineer.

### **16-03.02 Superintendence**

During the progress of this Work, a Contractor's Superintendent shall be on site at all times and shall be known to the Engineer. The Superintendent shall

supervise the Work constantly and shall not be changed without seven (7) calendar days notification to the Engineer. The Superintendent shall represent the Contractor in his absence, and his field decisions shall be as binding as if given by the Contractor. The Superintendent shall have a complete set of Plans on the job site at all times.

### **16-03.03 Layout and Verification**

The Contractor shall stake out the locations, all pipes, backflow prevention equipment, valves, quick coupling valves, sprinkler heads and emitters in accordance with the Plans. The Contractor shall check and verify dimensions of layout and report any variations to the Engineer before proceeding. Lay out Work as accurately as possible to the Plans.

Layout of irrigation heads is to provide one hundred percent (100%) head to head coverage, as per manufacturer's recommendation.

Minor changes in locations to the above from locations shown shall be made as necessary to avoid existing or proposed planting, piping, utilities, structures, at the Contractor's expense, when directed by the Engineer, providing such change is ordered before such items of Work directly connected to the same are installed, and providing no additional material are required.

The Contractor will be held responsible for the relocation of any items without first obtaining the Engineer's approval. The Contractor shall remove and relocate such items, at his expense, if so directed by the Engineer.

Before starting work on the irrigation system, the Contractor shall carefully check all grades to determine that Work may safely proceed, keeping within the specified material depths. The Contractor shall be aware of the fact that the Plans are horizontal dimensions. Actual measurements taken along the slope bank will differ from notes shown on the Plans.

No fittings shall be installed on pipe located underneath pavement or walls except where they are noted on the Plans. If such a need should occur, the Contractor shall bring it to the attention of the Engineer.

The Contractor shall verify the exact location of backflow prevention devices with the Engineer prior to installation.

All changes to the Plans shall be recorded on the record drawings.

### **16-03.04 Water and Electrical Points of Connections**

The Contractor shall provide connections to water and electrical sources as noted on the Plans. The Contractor shall also coordinate with local utility districts for service connections and bear all costs charged by the utility companies.

### **16-03.05 Workmanship**

The Contractor shall install all irrigation system components in accordance with the Plans, Standard Specifications, Special Provisions and Technical Provisions. The workmanship of the entire job must in every way be first class, and only experienced and competent persons will be allowed to work on the project. At least one (1) person shall be present at all times during the execution of this portion of the work who shall be thoroughly familiar with the type of materials being installed and the manufacturer's recommendations as to method of installation and who shall direct all Work performed under this section. The Contractor shall replace at his expense, at any time within one (1) year after installation is accepted, any and all defective parts.

### **16-03.06 Excavation and Trenching**

The Contractor shall restore all surfaces, existing underground installations, etc., damaged or cut as a result of the excavations to their original condition and in a manner satisfactory to the Engineer.

The Contractor shall use all means necessary to protect planting materials before, during, and after the irrigation installation and immediately make all repairs necessary to the approval of the Engineer at no additional cost to the City. Care shall be taken to examine the existing trees that are to remain and any roots cut that are larger than three-quarters of an inch (3/4") in diameter shall be filled with a tar-base sealant immediately. Trenches for mains and laterals shall be straight and true with bottoms graded on uniform slopes to low points. Trenches shall be made wide enough to allow a minimum of six inches (6") between parallel pipelines of other trades. Maintain four inch (4") minimum vertical clearance between irrigation lines at a minimum transverse angle of forty-five degrees (45°). Trenches for pipelines shall be made of sufficient depth to provide the minimum cover from finished grade as follows:

- A. Main Lines: Minimum twenty-four inches (24") of cover over main line pipes 2-1/2" to 4" outside diameter; eighteen-inches (18") of cover over main line pipes 1" to 2" outside diameter.
- B. Lateral Lines: Minimum fourteen inches (14") of cover over laterals; except for a minimum eighteen inches (18") of cover over remote control valve control lines (laterals) to sprinkler heads. Minimum eight inches (8") of cover over emitter lines.
- C. All lines under driveway or roadway pavement shall be located a minimum twenty-four inches (24") below subgrade except for a minimum eighteen inches (18") below subgrade for control lines.

### **16-03.07 Pipe Installation**

The Contractor is cautioned to exercise care in handling, loading and unloading, and storing plastic pipe and fittings. All plastic pipe and fittings will be stored under cover before using, and will be transported in a vehicle with a bed long enough to allow the length of pipe to lay flat so as not be subject to undue

bending or concentrated external load at any point. Any section of pipe that has been dented or damaged will be discarded until said section of pipe is cut out and rejoined with a coupling.

The Contractor shall provide the necessary means, lines and supports to ensure installation of the pipe to line and grade. The Contractor's facilities for lowering the pipe into the trench shall be such that neither the pipe nor the trench will be damaged or disturbed.

Connections to irrigation main lines shall be made with service saddles as approved by the Engineer.

All pipes shall be assembled free from dirt and pipe scale and shall be reamed and burrs removed. The main line supply shall be flushed out and tested for leaks before backfilling and with control valves in place before lateral pipes are connected to valves. Each section of lateral pipe shall be flushed out before sprinkler heads are attached.

The Contractor shall not lay plastic pipe when there is water in the trench.

The Contractor shall not use solvent-weld pipe length sections shorter than fifteen feet (15') without the approval of the Engineer.

The Engineer shall inspect all pipes before it is laid and reject any section that is damaged by handling or is found to be defective to a degree which will materially affect function and service of the pipe.

All foreign matter and dirt shall be removed from the inside of the pipe before it is lowered into position in the trench, and it shall be kept clean by approved means during and after laying the pipe.

#### **16-03.08 Solvent Weld Joints**

The Contractor shall use only the solvent recommended by the manufacturer to make plastic pipe joints. All connections shall be made as per manufacturer's recommendations for solvent-weld type.

All solvent weld joints shall be first primed.

The pipe and fittings shall be thoroughly cleaned of dirt, dust, and moisture before applying solvent.

The Contractor shall make solvent weld joints with a nonsynthetic bristle brush in the following sequence:

- A. Apply a liberal, even coat of solvent to the inside of the fitting.
- B. Apply a liberal, even coat of solvent to the outside of the pipe, making sure the coated area is equal to the depth of the fitting socket.

C. Insert the pipe quickly into the fitting and turn the pipe approximately one-quarter (1/4) turn to distribute the solvent and remove air bubbles. Hold the joint for approximately fifteen (15) seconds so the fitting does not push off the pipe.

D. Use a clean rag and wipe off all excess solvent. This is to prevent weakening at the joint.

E. Allow at least fifteen (15) minutes set-up time for each welded joint before moving it.

#### **16-03.09 Closing Pipe**

Open ends of the laterals and mains shall be capped or plugged, leaving caps and plugs in place until removal is necessary for completion of installation. Contractor shall take other precautions as necessary to prevent dirt and debris from entering pipe or equipment. Do not allow or cause any of the Work of this section to be closed until it has been inspected, tested and approved by the Engineer.

#### **16-03.10 Flushing Lines**

Lines shall be thoroughly flushed out before installing valves and sprinkler heads. After flushing, main line pipe may be partially backfilled, but joints, fittings and connections shall remain free and visible. Secure emitter line "N" caps.

#### **16-03.11 Backfilling and Compaction**

Initial backfill on all lines shall be of sand with no foreign matter larger than one-half inch (1/2") in size from an approved source. Backfill material shall be tamped in four-inch (4") layers, under the pipe and uniformly on both sides for the full width of the trench and the full length of the pipe. Material shall be sufficiently damp to permit thorough compaction under and on each side of the pipe, to provide support free of voids. Backfill for trenching shall be compacted to dry density equal to ninety percent (90%) of adjacent undisturbed soil, and shall conform to adjacent grades without dips, sunken areas, humps or other irregularities.

#### **16-03.12 Sprinkler Heads**

Sprinkler heads shall be installed where indicated and as detailed on the Plans.

#### **16-03.13 Remote Control Valves**

Install one (1) assembly per box where indicated and as detailed. Install no closer than six inches (6") to curb.

#### **16-03.14 Valve Boxes**

Install the top of the box level and flush with the finished grade and in a neat and orderly manner. Boxes shall be aligned parallel to paving or curbs. The number

of the circuit shall be stenciled on the top of the box in two-inch (2") letters with white enamel. Valve boxes shall not rest or come in contact with RCV.

### **16-03.15 Automatic Control Wiring**

Install control wires, main line and laterals in common trenches wherever possible. Install control wires alongside pipe with a minimum of twenty-four inches (24") of cover. Wires shall be a minimum of one inch (1") from any pipe or fitting, except at terminal points. Provide looped slack twelve inches (12") at valves, and snake wires in trench to allow for contraction of wire. Control wires shall be routed from the controllers in tight groupings. Tie wires and trench in bundles at ten foot (10') intervals with plastic electrical tape at a minimum of six (6) turns. All pilot and common wires shall be permanently marked at terminal points. Wherever wire is routed under concrete paving, walls, stairs or curbs, it shall be installed in a rigid PVC control wire sleeve. Refer to the materials section of these Standard Specifications for color coding of wiring.

Control wires shall be connected to each controller in accordance with the sequence indicated on the Plans. The Contractor shall be responsible for the coordination of hookups and connections, and for the installation of any materials and equipment necessary; all to facilitate the proper and complete operation of the controllers and electrical system.

### **16-03.16 Percentage Control Adapter (PCA)**

Percentage Control Adapters (PCA's) (12 or 24), including antennae shall be installed at each irrigation controller as indicated on the Plans.

### **16-03.17 Automatic Controllers**

Automatic controllers shall be installed as required in the Plans, Special Provisions and Technical Provisions and specified herein.

All control wires shall be labeled at the controller terminal points with preprinted vinyl-impregnated, self-adhesive number markers. The Contractor shall be responsible for the coordination of hookups and connections, and for the installation of any materials and equipment necessary; all to facilitate the proper and complete operation of the controllers and electrical system. Install irrigation controller cabinet as detailed on the Plans.

The Contractor shall provide one (1) controller chart for each automatic controller supplied, showing the area covered by the controller. The chart shall be a reduced drawing of the actual as-built system. However, the controller sequence must be legible when a drawing is reduced.

Charts shall be a black-line print with a different color use to show area of coverage for each station. When completed and approved, the chart shall be inserted between two (2) pieces of plastic, each piece being a minimum of twenty millimeter (20-mil.) thick. The chart must be completed and approved prior to final inspection of the irrigation system.

### **16-03.18 Adjusting System**

Adjust valves, align and adjust head coverage. If the Engineer determines that adjustments in the irrigation equipment will provide more adequate coverage, the Contractor shall make necessary changes or make arrangements with the manufacturer to have the adjustments made, prior to any planting. These changes or adjustments shall be made without additional cost. The entire system shall be operating properly before any planting operations commence.

### **16-03.19 Cleanup**

Upon completion of the Work, make the ground surface level, remove excess materials, rubbish, and debris and remove construction and installation equipment from the premises.

### **16-03.20 Manuals**

The Contractor shall furnish individually bound service manuals to the Engineer. The manuals shall contain complete exploded drawings, diagrams and spare part list of all equipment installed, showing components and catalog number together with the manufacturer's name and address. In addition, each service manual shall contain the following:

- A. Index sheet indicating the Contractor's name, address and phone number.
- B. Copies of equipment warranties and certificates.
- C. Complete operating and maintenance instructions and sufficient detail to permit operating personnel to understand, operate and maintain all equipment.

### **16-03.21 As-Built Drawings**

The Contractor shall prepare as-built drawings on a print of the irrigation plans showing deviations and changes in the layouts. Reproducible as-built drawings shall be delivered to the City for approval before final acceptance of the Work.

As-built drawings shall be maintained on the site at all times. Dimension the revised locations from a permanent point of reference (for example, building, sidewalk, curb, pavement, monuments and so forth). All dimensions shall be taken prior to backfill. All such changes shall be indicated in red.

## **16-04 TESTING**

### **16-04.01 Hydrostatic Tests—Open Trench**

A. Test to be accomplished at the expense of the Contractor and in the presence of the Engineer.

B. Set up piping with small amount of backfill to prevent arching or slipping under pressure. Do not cover any joints.

C. While the joints are exposed, all piping shall be subjected to a hydrostatic test. The Contractor shall supply all caps, belts, pumps and accurately calibrate recording gauges to be installed in a minimum of two (2) places. All piping shall meet the following requirements.

1. Supply lines must hold at 150 PSI for a minimum of four (4) hours with an allowable loss of 5 PSI.

2. Lateral lines must hold at 100 PSI for a minimum of one (1) hour with an allowable loss of 5 PSI.

D. During the test, all detectable leaks, regardless of the amount of leakage, should be stopped and all defects corrected. Materials and installation procedure used for making corrections shall be identical to those specified herein.

E. No pipe shall be backfilled until it has been inspected and approved in writing by the Engineer.