

## ITEM 615.60 06 - IRRIGATION SYSTEM

### 1.0 DESCRIPTION

This work shall consist of the Contractor preparing and submitting an irrigation design prepared by an approved Irrigation Design Specialist, furnishing all labor, materials and equipment necessary for the proper installation of the in-ground automatic irrigation system. The system may be a combination of drip and/or spray systems (as most appropriate) automatically operated by an irrigation controller. The work includes, but is not limited to, the following:

- Proposed Irrigation Layout & Shop Drawing submittals.
- Trenching, excavation, and backfill for entire system.
- Installing fully operational automatically controlled irrigation system.
- Piping, manifolds, fittings, valves, valve boxes and covers, electric zone valves and appurtenances as required to complete the system.
- Proper backflow protection and water meter according to local codes, and ordinances.
- Exterior solenoid valves and rain sensor.
- Test all systems and making them operative, adjust as required.
- Prepare "As-built" for entire system.
- First Year Winterization and following Spring Activation.
- Maintenance and Operation Training and Demonstration
- Maintenance of the system for the duration of the contract (excluding water and electricity).
- Operational Maintenance Manual
- All required Permits and fees.

**1.01 Irrigation Design Specialist.** The Contractor shall obtain the services of an Irrigation Design Specialist to prepare an irrigation design proposal for the landscaped areas designated on the plans. The Irrigation Design Specialist shall have a minimum of three (3) years experience performing commercial irrigation design work. Certification with a specialty in "Commercial Irrigation Design" (CID-Commercial) by the Irrigation Association, Fairfax, VA, shall be considered proof of the requisite experience, however, any equivalent combination of education and experience may be submitted for approval. Grounds For Rejection of submitted layout plan: In selection and installation of sprinkler heads, irrigation specialist shall select the appropriate sprinkler heads to keep the paved areas, sidewalks, roadways, sitting areas, playground, etc., relatively dry without compromising the full irrigation of turf and planting areas. As much as is practical, the valve boxes shall not be located in playing areas of athletic fields.

**1.02 Qualifications.** Prior to the beginning any work under this item the contractor shall supply the Engineer in Charge with proof that the firm performing this work has a minimum of three years experience in the construction of irrigation systems and is a Certified Irrigation Contractor by the

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Irrigation association, Fairfax, VA. ([www.Irrigation.org](http://www.Irrigation.org))

**1.03 Permits and Fees.** The Contractor shall obtain all permits and pay all required fees to any governmental agency having jurisdiction over the work. Inspections required by local ordinances during the course of construction shall be arranged as required. On completion of the work, satisfactory evidence shall be furnished by the Irrigation Specialist to show that all work has been installed in accordance with the ordinances and code requirements.

**1.04 Approval.** Wherever the terms "approve", "approval" or "approved" are used in the specifications; they shall mean the approval of the Regional Landscape Architect in writing.

**1.05 Conference.** Prior to the start of work, a conference shall be held between the Contractor and the Regional Landscape Architect concerning the work under this Contract.

**1.06 Coordination.** The Irrigation system Contractor shall coordinate and cooperate with all other contractors on site to enable the work to proceed as rapidly and efficiently as possible.

**1.07 Inspection of Site.** The Contractor shall acquaint himself with all site conditions. Should utilities not shown on the plans be found during excavations, the Contractor shall immediately notify the Engineer for instructions as to further action. Failure to do so will make the Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities not shown on the plans. The Contractor shall make necessary adjustments in the layout as may be required to connect to existing stubouts. Should such stubs not be located exactly as shown, Contractor may be required to work around existing work at no increase in cost to the State.

**1.08 Existing Plants and Site Conditions.** The Contractor shall take all necessary precautions to protect existing site conditions. Should damage be incurred, the Contractor shall repair the damage to its original condition at no cost to the State.

**1.09 Substitution.** The State reserves the right to substitute, add or delete any material or work as the work progresses. Adjustment to the contract price shall be negotiated if deemed necessary by the Regional Landscape Architect.

**1.10 Rejection.** The State reserves the right to reject material or work which does not conform to the Contract Documents. Rejected work shall be removed or corrected immediately at no cost to the State.

**1.11 Work Schedule.** Within ten (10) days after award of the Contract, the Contractor shall submit to the Engineer a work schedule.

**2.0 MATERIALS**

**2.01 General.** All materials throughout the system shall be new and in perfect condition. After award of the Contract, and prior to beginning the work, the Contractor shall submit for approval two copies of the complete list of materials which he proposes to install. Quantities of materials and equipment need not be included. No deviations from the specifications will be permitted without authorization of the Regional Landscape Architect.

**2.02 Plastic Piping.** All main line pipe 63mm (2.5" ) and smaller shall be Class 200; polyvinyl chloride (PVC) pipe and shall conform to CS-256-63. PVC pipe for pressurized mains, 76mm (3") and larger, shall be SDR 21, Class 200 Cresline Ring-Tite or equivalent as approved by Regional Landscape Architect. All lateral (zone) line pipe 51mm (2" ) and smaller may be polyethylene 689.475 KPA(100 psi) test, non-nsf, or Class 200; Type 1120-1220 polyvinyl chloride (PVC) pipe and shall conform to CS-256-63. All lateral (zone) line pipe 63mm (2.5") shall be Class 200; Type 1120-1220 polyvinyl chloride (Pvc) pipe and shall conform to CS-256-63.

**2.03 Fittings.** Plastic fittings shall be Schedule 40, polyvinyl chloride (PVC) standard weight. Only solvent weld or insert fittings are acceptable; no saddle type clamping of fittings will be used. Fittings for Ring-Tite pipe shall be ductile iron.

**2.04 Solvent Cement.** Compatible with PVC pipe and of proper consistency.

**2.05 Isolation Valves.** 76mm (3") and smaller isolation and drain valves shall be screwed bonnet, bronze body, solid-wedge type gate valves with threaded ends, non-rising stems, and shall be rated for a normal operating pressure (cold water) of at least 1379KPA (200 PSI). They shall be Kitz code 27. Main line isolation valves larger than 76mm (3") shall be iron body, bronze mounted units which meet AWWA specification C509, as manufactured by Waterous. They shall have a working pressure rating for cold water of at least 1379 KPA (200 PSI). The valves shall have push-on ends specifically designed for use with PVC pipe. The valves shall be equipped with non-rising stems and 51mm (2") square cast iron operating nuts. Two (2) T-handle valve wrenches shall be supplied for valve operation.

**2.06 Valve Boxes.** Access to all main line isolation valves shall be standard rectangular boxes. The valve boxes shall be 305mm (12") standard rectangular with green cover.

**2.07 Swing Joints.** Swing joints for Quick Couple Valves shall be 25.4mm (1") triple swing joint kits with double O-ring seals at threaded connections and brass insert .

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**2.08 Automatic Controller** - The approved Automatic Controller shall as a minimum fulfill the following requirements:

- Number of stations - 6, 9, or 12
- Number of programs - 2
- Control technology - Hybrid
- Wall mount plastic enclosure:
  - Dimensions: 355.6mm (14") ht. x 238mm (9 3/8") wide x 82.5mm (3 1/4") deep
  - \* High-impact plastic, weather-resistant, lockable
- Wall mount metal enclosure:
  - Dimensions: 343mm (13 1/2") ht. x 232mm (9 1/8") wide x 82.5mm (3 1/4") deep
  - \* Painted metal, weather-resistant, locking
  - \* Optional pedestal mount available for metal cabinet
- Watering indicator for each station
- Integrated Pump Start/Master Valve output
- Selectable delay for Pump/Master Valve activation
- Station run times from 1 to 90 minutes, or 10 minutes to nine hours
- Dual programming for lawn and shrub areas
- 14-day calendar or 1- to 14-day interval watering cycles
- Start times - up to three per program
- Master ON/OFF control for extended shut-downs
- 4-day variable Rain Delay
- Season Adjust by program for 20% to 200% in 10% increments
- Automatic split-cycle mode if Season Adjust exceeds 100% to prevent runoff
- Non-volatile memory retains program data for 10 years
- Fuse protected circuitry
- Input power:
  - \* 115 VAC, 50/60 Hz
  - \* 0.30 amps (35 W) maximum
  - \* UL, CSA listed
- Station output power:
  - \* 24 VAC
  - \* 0.50 amps (12 VA) per station maximum
  - \* 0.37 amps (9 VA) pump/master valve
  - \* 0.90 amps (21 VA) total load

**B. Bidding Specifications**

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The approved irrigation system controller shall use hybrid control technology and be capable of automatic, semi-automatic and manual operations. It shall be housed in a high-impact plastic painted metal, weather-resistant, lockable locking enclosure suitable for indoor or outdoor use. A pedestal mount shall be available for the painted metal enclosure.

The controller shall have a power input of 115 VAC (+/-10%) and be capable of operating one 24 VAC station at 0.50 amperes (12 VA). In addition to the operating station, the controller shall be capable of running a 24 VAC Pump/Master Valve output circuit at 0.37 amperes (9 VA). Total controller output load shall not exceed 0.90 amperes (21 VA) at 24 VAC.

The controller shall have a 12/24 hour real-time clock and a 14-day calendar. Time-of-day, day-of-week, programming and operational status information shall be shown in a large LCD display.

The controller shall have two irrigation programs (Program A and Program B) with each program capable of running in a 14-day variable (calendar) cycle or a one- to fourteen-day fixed interval cycle. Both programs may be temporarily disabled by setting the controller mode to OFF. Each program shall be capable of up to three automatic starts per active watering day. When a start-time slide control is moved, the actual start time represented by that slider shall be shown in the LCD display. If a program start time is entered that falls within the cycle time of another operating cycle, the new cycle will be stacked (placed on hold) until the operating program cycle is complete.

The controller shall have 6 \* 9 \* 12 stations with the ability to run each station from one to ninety minutes in one-minute increments, or each station (set in Hours mode) from ten minutes to 9 hours in ten minute increments. When a station control knob is being adjusted, the actual run time represented by that knob shall be shown in the LCD display. Each station may be assigned independently to either or both irrigation programs. Station run times shall be the same for each program when assigned to both.

The controller shall have a Season Adjust feature that allows the independent adjustment of each irrigation program from 20% to 200% in 10% increments. When the Season Adjust slider is moved, the actual adjust value represented by the slider shall be shown in the LCD display. When the season Adjust is greater than 100%, the controller shall run in an automatic split-cycle mode to reduce the possibility of water run-off.

The controller shall have a manual start feature that allows a single station, complete or partial program to be run. The Manual Operation LED shall be lit to indicate a manual program. When a program is running (automatically or manually started), the controller will light an LED for the station in operation. A manual or automatic program may be terminated by temporarily setting the controller mode to OFF, then returning it to ON.

The controller shall have a Rain Delay setting to allow all programs to be disabled for a specified period of one to four days. At the end of the specified rain delay period, the controller will automatically resume normal operation.

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The controller shall store program data in a non-volatile memory that will be faithfully retained for a minimum of ten years without power. In the event of an extended power outage, the LCD display will flash to indicate that the current time and day may need to be reset.

The controller shall be approved by the Regional Landscape Architect.

### **C. Recommended Installation Instructions**

The controller is housed in a high-impact plastic painted metal, weather-resistant, lockable locking enclosure that may be installed indoors or outdoors. The controller will be located in the location as noted on the plans or as directed by the Engineer.

Sleeving for the field wiring and electrical supply wiring are required from the ground level to the respective inlets on the controller. Alternately, such wiring may be routed through walls (local electrical codes permitting) by using the optional inlets located on the back side of the controller. The run of sleeving should be based on installation height which should be at eye level, about 5 feet to the base of the controller from the ground. The inlet size for the power wiring shall be 12.7mm (1/2"), and the inlet for the station wiring shall be 25.4mm (1").

Surge protection and grounding are very important to prevent electrical shock to maintenance personnel and to protect the internal components in lightning-prone areas. If no equipment ground is available, a low resistance earth ground conductor must be connected to the controller at the ground connection point. A ground conductor (or conductors) with a total resistance of 10 Ohms or less must be installed within 3.66M (12 ') of the controller installation site. Grounding instructions should be followed in accordance with local electrical codes.

### **2.09 Rainswitch**

**A. Description.** The rainswitch is an adjustable rain sensing device that, in the presence of moisture or rain, interrupts the common circuit and prevents valve operation when activated. Adjustments can be made from 3mm (1/8") to 25.4mm (1") of accumulated rainfall with an adjustment knob. The rainswitch shall be compatible with any 24 VAC irrigation controller and can be used in conjunction with a rainswitch bypass Switch. Existing irrigation schedules are not delayed, but continue to function (except for opening and closing valves), when the rainswitch is activated.

**B. Construction.** The rainswitch shall be constructed of molded plastic of four separate pieces: 1) A mounting bracket with three screw-type flanges. The mounting bracket shall have an opening on the underside to thread wire between the rainswitch and controller.

2) An extension adapter to allow for placement of the rainswitch beyond roof eaves or other obstructions and/or for irregular angles encountered during installation.

3) A base containing 11 fiber washers capable of swelling in the presence of moisture.

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4) An adjustment knob that is capable of adjustment to allow for selection of a specific shut-off point based on accumulated rainfall.

5) The rainswitch includes a 7.5 M (25') length of four-lead, UV resistant, gray jacketed wire. Two leads are 18 AWG and two leads are 24 AWG. One lead of each gauge is natural copper, the other lead of each gauge is tinned copper.

**C. Operation.** In the presence of moisture and/or rainfall, fiber washers swell and break contact with the common circuit within the controller. The shut-off point may be selected by turning the ribbed knob on the end of the rainswitch in a clockwise or counter clockwise manner. Selections may be based on 3mm (1/8"), 6mm (1/4"), 12mm (1/2"), 18mm (3/4"), and 25.4mm (1") increments of accumulated rainfall or moisture. Existing controller programming remains unchanged and will resume normal functions once the fiber washers dry out.

### **2.10 Remote Control Valves**

#### **A. Specifications**

##### 1. Valves

- a. Operating Pressure -68.9 to 1034 KPA (10 to 150 PSI)
- b. Globe/angle configuration
- c. Rubber diaphragm
- d. Flow control and bleed screw
- e. Self cleaning metering pin (electric)
- f. Pressure regulation models (electric)
- g. 25.4mm (1"), 38mm (1.5"), 50mm (2") NPT female threads
- h. Stainless steel diaphragm seat

##### 2. 25.4mm ( 1") Size:

- a. Flow Range - 19 to 152 LPM (5 to 40 GPM)
- b. Size - 171.5mm (6.75") high x 127mm (5") wide x 76.2mm (3") diameter
- c. Weight - 1 lb. 2 oz.
- d. Lead Wires - 457mm (18")
- e. Inrush current - .251 amps; 6.0 VA
- f. Holding current - .187 amps; 4.5 VA

##### 3. 38mm (1.5")Size:

- a. Flow Range - 38 to 456 LPM (10 to 120 GPM)
- b. Size - 197mm (7.75") high x 152mm (6") wide x 101.6mm (4") diameter
- c. Weight - 2 lbs. 4 oz.

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- d. Lead Wires - 559mm (22")
- e. Inrush current - .256 amps; 6.3 VA
- f. Holding current - .200 amps; 4.8 VA

4. 50.8mm (2") Size:

- a. Flow Range - 38 to 684 LPM (10 to 180 GPM)
- b. Size - 241mm (9.5") high x 178mm (7") wide x 140mm (5.5") diameter
- c. Weight - 4 lbs. 12 oz.
- d. Lead Wires - 559mm (22")
- e. Inrush current - .265 amps; 6.3 VA
- f. Holding current - .200 amps; 4.8 VA

**B. Bidding Specifications**

1. The valve shall be of a globe/angle configuration with a female pipe thread inlet and outlet. The diaphragm shall be of rubber construction to retain flexibility and provide maximum sealing throughout its area. The Valve shall have a manual flow control.

2. Electric models and Pressure Regulating models:

The valve shall be held normally closed by internal water pressure. A 14 gauge solenoid lead wire shall be attached to a 24 VAC, 50/60 Hz solenoid with waterproof molded coil capable of being removed. Valve shall have a self-cleaning metering pin to protect bleed ports and to purge contaminants.

3. Pressure Regulating models:

The pressure regulator shall be a manually operated, locking type and shall regulate precisely over a 46 to 862 KPA (15 to 125 PSI) range. Regulator shall maintain the set pressure within 21 KPA (3 PSI)(with a 69KPA (10 PSI) differential between inlet and outlet). Valve shall contain a Schraeder type valve fitting for pressure gauge attaching.

**C. Recommended Installation Instructions**

The globe/angle valve family is offered in several configurations. Appropriate installation recommendations are as follows:

In commercial installations, it is advantageous to mount valves in a valve box. Most logically, if mounted in valve boxes, valves can be easily found, accessed and maintained. Instructions should include the use of clean aggregate to fill the box bottom keeping valve box locations away from structures, potential hardscaping features (such as sidewalks), and large

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planting locations. Additionally, valve box locations should generally be in shrub beds and at right angles to structure locations.

The pressure regulating model gives you a specifying choice in cases where you must reduce a high available pressure, where you are running downhill, or where you must isolate a lateral at lower pressure than the main line.

Electric control valve instructions should specify direct burial of wire utilizing different colors for hot hookup to each remote location and one color for the common valves.

Watertight splice connections are absolutely essential to proper valve operation and should be covered with in-depth instructions. Expansion curls are generally a good idea at each valve location on long run wire lengths.

**2.11 Quick Couple Valves.** Quick couple valves shall be 25.4mm (1") with vinyl locking covers.

**2.12 Control Wires.** Control wires from controller to valves shall be 24 volt solid wire U.L. approved for direct burial in ground. Minimum wire size: 14 gauge; 12 gauge for common wire.

**2.13 Sleeves for Control Wires.** Under all walks and paving and where indicated on drawings. PVC Sch 40 or Pvc Sch 80 plastic pipe as indicated or galvanized heavy wall steel conduit.

**2.14 Backflow Preventer.** The backflow preventer shall be a reduced pressure type. The back flow preventer shall be approved by the local water authority in writing. A copy of the approval shall be submitted by the contractor to the Engineer prior to activation of the system.

**2.15 Water Meter.** The water meter shall meet requirements of local codes, and ordinances.

**2.16 Control Wires.** Control wires from controller to valves shall be 24-volt solid wire U.L. approved for direct burial in ground. Minimum wire size: 14 gauge; 12 gauge for common wire.

**2.17 Sleeves for Control Wires.** Under all existing or proposed walks, paving and structures, where indicated on drawings, PVC Sch 40 or Sch 80 plastic pipe or galvanized heavy wall steel conduit shall extend at least 305mm beyond edges of pavement or construction

**2.15 Drip Irrigation**

**A. Dripperline.** The dripperline shall consist of nominal sized 25.4mm (1") low density linear polyethylene tubing, housing internal pressure compensating, self-cleaning, integral drip emitters. The tubing shall be black in color and conform to an outside diameter (OD) of 18mm (.71 ") and an

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inside diameter (ID) of 16mm (.62 ") The emitters shall have the ability to independently regulate discharge rates, with an input pressure of 48 to 480 KPA (7 to 70 PSI), at a constant flow. The emitter discharge rate shall be 2 litres (.53 gallons) per hour utilizing a combination turbulent flow/reduced pressure compensation cell mechanism and a diaphragm to maintain uniform discharge rates. The emitters shall continuously clean themselves while in operation. The dripperline emitter spacing utilized on this project shall be 457mm (18")

**B. Fittings.** All connections shall be made with fittings approved by the Regional Landscape Architect.

**C. Accessories.** All systems shall utilize automatic line flush valves at the end of each independent zone area or dripperline recommended by the manufacturer. This valve shall be capable of flushing at the beginning of each irrigation cycle. Each independent irrigation zone shall utilize a Air/Vacuum Relief Valve at its high point(s). The purpose of this valve is to evacuate air from the zone at start-up, and to relieve vacuum at system shut-down. The valve used shall be the one recommended by the manufacturer

**D. Pressure Regulation Valve.** The pressure regulator shall have a built-in indicator that shows when the proper outlet pressure is reached. It shall be able to respond immediately to any inlet pressure variation. The regulator shall be capable of regulating from 104 KPA to 276 KPA (15 PSI to 40 PSI.) or as recommended by the manufacturer and approved by the Regional Landscape Architect.

**E. Filter.** The Filter shall be a stainless steel screen filter design as approved by the Regional Landscape Architect.

**F. Recommended installation Instructions.** The dripperline is designed for use in surface and sub-surface applications utilizing a grid design, the result being a complete wetted area within each grid. It can also be installed as single or "snaked" lines where grids are not justified. The most effective way to install a dripperline is sub-surface at a uniform depth as specified.

A dripperline is available in two dripper flow rates: 2 litres per hour (.53 gallons per hour) or 3.86 litres per hour (1.02 gallons per hour), with drippers spaced at 2.54mm (12") or 3.8mm (18") intervals. The drippers are designed to regulate flow at the specified output from 49 KPA to 490 KPA (7 to 70 PSI) with a maximum recommended pressure of 313 KPA (45 PSI) Installation shall be in as per the manufacturer's recommendations and approved by the Regional Landscape Architect.

A) the dripperline can be installed by:

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Trenching;

laying it out on a sub-grade lower than finished grade and backfilling to the specified finished grade depth;

near-surface installation using Support Staples spaced no more than every 1.5M (5') to hold it in place followed by a 50.8mm (2") soil layer followed by a 50.8mm (2") minimum shredded bark mulch cover.

**G. Accuracy.** Lay out work as accurately as possible to the drawings. The drawings, though carefully drawn, are generally diagrammatic to the extent that swing joints, offsets and all fittings are not shown.

**Coverage.** The Contractor shall be responsible for full and complete coverage of all irrigated areas and shall make any necessary minor adjustments at no additional cost to the State. If not specified on the plans, the Contractor shall be responsible for proper drip line placement and adjustment.

**Sprayheads**

Sprinklerheads for overhead irrigation will be considered subject to approval of Regional Landscape Architect for portions of the system that are impractical for drip and will not result in any over-spray. They shall be on a separate zone from any drip system. The heads shall be fully adjustable arc with interchangeable nozzles of an appropriate size and gear drive. All above ground risers shall be PVC pipe, permanently attached with plastic clamps to decay resistant wooden posts not less than 90 mm x 90 mm set not less than 1/3 of the overall height in ground

**I. Revisions.** Any major revisions to the irrigation system must be submitted and answered in written form, along with any negotiated change in contract price.

**3.0 CONSTRUCTION DETAILS**

**3.01 Submittals**

**A. Irrigation Design Specialist Qualifications.** The Contractor shall submit for approval, the name and qualifications of the proposed Irrigation Design Specialist including CID certification. As an alternate to certification, experience and a minimum of three (3) professional references, and sample drawings for three (3) designs of one (1) acre or larger, may be submitted. Submittal must be a minimum of 4 week prior to the proposed irrigation system installation date. The Irrigation Design specialist shall meet the qualifications listed on the first page of this item under the heading Irrigation Design Specialist.

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**B. Irrigation Layout and Shop Drawing.** The system shall be designed to cover turfgrass areas and planting beds as shown on the planing plan. A shop drawing is required, showing layout of the complete irrigation system, including the main line pipe, controller locations, remote control valves, quick-coupling valves, all sprinkler heads locations and spray pattern. All drawings must be prepared, signed and sealed by the approved Irrigation Design Specialist. Also see Grounds For Rejection, Irrigation Design Specialist heading.

**C. Catalogue Cuts.** The Contractor shall submit Catalog cuts of the sprinkler heads, valves, and all connected piping for approval prior to installation.

**D. "As-Built" Drawings and Operation Manual.** The Contractor shall prepare an "As-Built" drawing on a mylar reproducible or disk which will show deviations from the bid documents made during construction affecting the main line pipe, controller locations, remote control valves, quick-coupling valves and all sprinkler heads. The drawing shall also indicate and show approved substitutions of size, material and manufacturer's name and catalog name and catalog number. The drawings shall be delivered to the State before final acceptance of work. The Contractor will also provide a complete operations manual, including manufacturer's specifications, catalogue cuts, etc. for all of the equipment installed for the system(s). Should more than one system be employed, the "As-Built" Drawing(s) and Operation Manuals are required for each system.

**E. Warrantee.** The Contractor shall submit the manufacturer's standard warrantees for sprinkler heads and valves.

**F. Laminated Reference Materials.** The following submittals shall be prepared in a reasonable size/scale, laminated and mounted or hooked on the wall in the building at the site, as directed by the Engineer.

- A. Schematic color-coded layout (by zone) of the irrigation system along with step-by-step, clear operating instructions. Valve boxes shall be labeled on the plan and correspondingly marked in the field with indelible black marker.
- B. A detailed suggested watering schedule for the site. If automatic system, include start times, days and run time.
- C. One copy of a laminated O & M Manual hooked to wall as described above.
- D. Name and phone number of supplier(s) for all replacement parts.
- E. Detailed guide for trouble-shooting common system operation problems.
- F. Detailed Winterization / Sprint Activation instructions.

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### **3.01 Excavating and Trenching**

**A.** Restore all surfaces, existing underground installations, etc., damaged or cut as a result of the excavations to their original condition and in a manner approved by the Owner.

**B.** Trenches shall be made wide enough to allow a minimum of 50.8mm (2") between parallel pipe lines. Trenches for pipe lines shall be made of sufficient depths to provide minimum cover from finish grade as follows:

- 1) 457 mm (18") minimum cover over main lines.
- 2) 304.8mm (12") minimum cover over control wires from controller to valves.
- 3) 304.8 mm (12") minimum cover over lateral lines to supply headers.
- 4) 254mm (10") minimum cover over supply and exhaust headers.

**C.** Maintain all warning signs, shoring, barricades, flares and red lanterns as required by the Safety Orders of the Division of Industrial Safety and any local ordinances.

### **3.02 PIPE LINE ASSEMBLY**

**A.** Install remote control valves where shown and group together where practical. Place no closer than 12.7mm (6") to walk edges, buildings, and walls.

**B.** Plastic pipe and fittings shall be solvent welded using solvents and methods as recommended by manufacturer of the pipe, except where screwed connections are required. Pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before applying solvent with a non-synthetic bristle brush.

**C.** Pipe may be assembled and welded on the surface. Snake pipe from side to side of trench bottom to allow for expansion and contraction.

**D.** Make all connections between plastic pipe and metal valves or steel pipe with threaded fittings using plastic male adapters.

### **3.03 CLOSING PIPE AND FLUSHING LINES**

**A.** Cap or plug all openings as lines have been installed to prevent the entrance of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.

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- B. Thoroughly flush out all water lines before installing heads, valves and other hydrants.
- C. Test in accordance with paragraph on Hydrostatic Tests.
- D. Upon completion of the testing, the Contractor shall complete drip assembly and adjust for proper distribution.

**3.04 Hydrostatic Tests**

- A. Request the presence of the Engineer in writing at least 48 hours in advance of testing.
- B. Testing to be accomplished at the expense of the Contractor and in the presence of the Engineer.
- C. Center load piping with small amount of backfill to prevent arching or slipping under pressure.
- D. Apply a continuous and static water pressure of 431 KPA (60 PSI) when welded plastic joints have cured at least 24 hours and with the risers capped as follows:
  - 1) Main lines and sub mains to be tested for 1 hour.
  - 2) Lateral lines to be tested for 1 hour. (If laterals and individual sub-mains downstream of control valves have less than 626.8 KPA (90 PSI) working pressure or less than 38 litres per minute (10 GPM) flow, hydrostatic tests are waived for these laterals).
- E. Repair leaks resulting from tests.

**3.05 Automatic Controllers.** Connect remote control valves to controller in a logical sequence to correspond with specification of the State.

**3.06 Automatic Control Wiring**

- A. Install control wires, mains and laterals in common trenches wherever possible.
- B. Install control wires at least 304.8mm (12") below finish grade and lay to the side and below main line. Provide looped slack at valves and snake wires in trench to allow for contraction of wires. Tie wires in bundles at 3M (10') intervals.
- C. Control wire splices will be allowed only in runs more than 152.5M (50'). Any splices must be installed in an existing valve box or separate valve box installed flush with finished grade.

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D. All wire passing under existing or future paving, construction, etc., shall be encased in plastic or galvanized steel conduit extending at least 304.8mm (12") beyond edges of paving or construction.

**3.07 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 rubbish.

B. Backfill for all trenches, regardless of the type of pipe covered, shall be compacted to minimum 90% density.

C. Compact trenches in areas to be planted by thoroughly flooding the backfill.

D. Dress off all areas to finish grades.

**3.08 Cleanup.** Remove from the site all debris resulting from work of this section. Job site must be left clean and repaired in

**METHOD OF MEASUREMENT**

Payment will be made by lump sum. No field measurements will be taken.

**BASIS OF PAYMENT**

The lump sum price bid shall include the cost of furnishing all labor, materials and equipment necessary for transporting, installing, maintaining, testing, and making any ordered equipment replacement.