# SECTION 808

# LANDSCAPE IRRIGATION SYSTEM

## 808-1 DESCRIPTION

The work under this item shall consist of furnishing all materials and installing a complete and functioning landscape irrigation distribution system, including but not limited to, potable and non-potable systems both buried and above ground, temporary systems, and all irrigation equipment specified herein, at the locations shown on the project plans, and in accordance with the requirements of these specifications.

Landscape irrigation distribution plans are, in general, diagrammatic. The exact location of component units of the irrigation distribution system will be approved by the Engineer.

For the purpose of this section, main lines and/or pressure mains are defined as piping under constant pressure. Lateral lines are those lines which are located on the discharge side of the control valves or a pressure regulating device and not under constant pressure.

## 808-2 MATERIALS

Equipment, materials, or patented processes, noted on the project plans or in the Special Provisions, are so designated to establish a standard of quality, finish, appearance, or performance. The use of an alternative or substitute article or equipment, material, or process shall be in conformance with the requirements found in Section 106.

Any warranty or guarantee normally provided by the manufacturer for any item shall, when received, be furnished to the Engineer. At the final acceptance of the irrigation system, the contractor shall furnish the owner with one irrigation manual. This manual shall include a complete list of all materials used including model numbers, sizes, etc., and complete instructions for the annual operation and maintenance of the system. The manual shall be submitted in a protective notebook and shall be suitable for reproduction.

**808-2.01 Pipe and Fittings**. Pipe and fittings furnished shall be galvanized steel and/or polyvinyl chloride, hereinafter called PVC.

**(A)Galvanized Steel Pipe**. Galvanized steel pipe and fittings shall conform to the requirements of ASTM A 120. Pipe and fittings shall be threaded, standard weight, Schedule 40.

Joint compounds shall be compatible with, and of a recognized standard for use with the pipe and fittings specified.

**(B)Polyvinyl Chloride PVC Pipe**. All plastic and fittings used for the transportation of potable water shall comply with the requirements of, and bear the stamp of, the National Sanitation Foundation.

Materials used in the manufacture of pipe and fittings shall conform

to the requirements of ASTM D 1784, Class 1254-B.

All pipe 1/2 inch through 2 inches in diameter shall be bell-end or plain end, solvent weld type.

All pipe greater than 2 inches in diameter shall conform with ASTM D 2241 and shall be provided with rubber "O" ring gaskets. Rubber "O" rings shall conform with ASTM D 3130.

All rigid PVC pipe for lateral lines shall be solvent weld PVC pipe unless otherwise noted.

Cements, solvents, thinners and joint compounds shall be compatible with and/or of a kind recognized by the industry as proper for use with plastic pipe and fittings.

PVC pipe shall conform to the requirements of ASTM D 2241 for SDR 21 and SDR 26 pipe and ASTM C 1785 for Schedule 40 and Schedule 80 pipe.

The pipe classification and the pressure rating will be specified on the project plans or in the Special Provisions.

Pipe for use with elastomeric joint fittings shall be either plain-end or with thickened integral bell.

Bell-end, solvent weld PVC pipe shall conform to the requirements of ASTM D 2672. Bell-end, solvent weld pipe shall be used only on irrigation laterals.

Socket type fittings for use of PVC pipe shall be solvent weld.

Elastomeric seals for use in elastomeric ring joint fittings shall conform to the requirements of ASTM D 3139. All elastomeric joint fittings used with PVC pipe shall be factory fabricated, shall bear the manufacturer's fabrication mark, and shall be shipped with gaskets factory installed.

The twin gasket coupling body shall be extruded from a material identical to that of the pipe with which it is to be used. The push-on type coupling shall have a smooth outside diameter and be internally machined to receive square bottom elastomeric seal and shall have machined-in pipe stops.

Seal for twin gasket couplings shall have a square bottom with the leading edge concealed to prevent interference with the tapered pipe end during assembly.

All elastomeric seal couplings shall meet or exceed the performance requirements of the pipe with which it is to be used.

Plastic pipe shall be delivered to the site in unbroken, banded or tied bundles, and shall be so packaged as to prevent damage to pipe barrels or ends. If pipe is delivered from a local warehouse, the pipe need not be bundled or wrapped.

Upon delivery to the site, the contractor shall inspect all pipe for possible shipping damage. Following delivery and receipt of the pipe, the contractor shall certify, in writing to the Engineer, that the pipe and fittings, as received, are in good condition and all damaged material has been removed.

Plastic pipe shall be handled and stored in the manner directed by the manufacturer.

Prior to beginning trench excavation, the contractor shall lay out the irrigation distribution system for the approval of the Engineer by providing necessary indicators at the locations of all pipe lines, pumps, tanks, valves, irrigation heads, and related structures.

Mainline pipe 3 inches or greater in diameter shall have concrete thrust blocks installed at specific filling locations as per the project plans and/or pipe manufacturer's recommendations and instructions.

**(C)PVC Fittings**. PVC pipe shall be coupled, as specified, by the following methods:

(1) Solvent weld, socket-type coupling. Primer shall be used on all solvent weld joints.

(2) Elastomeric seal coupling.

All PVC fittings shall conform to one or more of the following requirements:

(1) ASTM D 2466 for Schedule 40 socket type fittings.

(2) ASTM D 2467 for Schedule 40 socket type fittings.

(3) ASTM D 3139 for elastomeric seal type fittings.

(4) ASTM D 2464 for Schedule 80 threaded type fittings and fittings used for remote control valve assemblies.

Fittings shall be installed in accordance with the manufacturer's recommendations and these specifications.

Primer shall be in accordance with the requirements of ASTM F 656.

Solvent weld cement shall be in accordance with the requirements of ASTM D 2564. The type of solvent and set-up time shall conform to the recommendations of the manufacturer of the class, schedule and size of pipe being joined.

**808-2.02 Emitter Hose**. The flexible emitter hose, which shall deliver water to the emitter assembly shall be manufactured from virgin polyethylene material having the following physical characteristics:

| CHARACTERISTICS | VALUE |
|---|---|
| 0.D. | .704 inch |
| I.D. | .600 inch (min) |
| Wall | .0052 inch |
| Carbon Black | 1.5 - 3.5 |
| Density | .92 - .93 |
| Melt | 210° F to soften |
| Environmental Stress Crack Resistance | 0/100/100 |

Fittings for use with flexible emitter hose shall be of the compression, internal barb type, constructed of virgin PVC or glass-filled polypropylene materials, and as detailed on the project plans.

**808-2.03 Gate Valves.** Gate valves shall be either bronze or brass, ~~in the sizes~~ as specified on the project plans or in the Special Provisions for the size indicated.

The body of bronze valves shall be of heavy duty bronze conforming to the requirements of ASTM B 62, or approved equal. Valves shall have a service rating for non-shock, cold water, of 200 psi. Valves shall be of the double disc, taper seat type with non-rising stem, union bonnet and handwheel. Identification of valves by trade name, manufacturer, etc., shall be stamped or cast on the valve case. Valves shall be assembled as detailed on the project plans.

The body of gate valves constructed of brass shall have a non-rising stem, FPT threaded inlet and outlet and come equipped with a hand wheel.

**808-2.04 Ball Valves.** Ball valves shall be constructed with a brass body, stainless steel ball and FPT threaded ends. The ball valve shall be equipped with a handle having a 90-degree swing for full closure and opening of the valve. Valve size shall be in accordance with the project plans or Special Provisions or, if not noted, conform to the size of the incoming line.

**808-2.0X Valve Box.** The valve box shall be as detailed on the project plans or Standard Details. The valve box shall be of two-piece construction, consisting of a top and bottom section with a cover imprinted "IRRIGATION ~~WATER~~". Box assemblies shall be manufactured of a rigid combination of polyolefin and a fibrous inorganic component or concrete. The bottom section shall have an integral formed bell, 9 inches in diameter and 6 inches in height, unless otherwise specified on the project plans. The top section shall accommodate the lid as supplied by the manufacturer. Top and bottom sections shall be threaded to facilitate field adjustment as required. Box sizes and types shall be as specified in the Special Provisions.

**808-2.04 Electric Control Valves.** Control valves shall be of the types and sizes specified on the project plans or "as equal" as determined by the Engineer. The manufacturer's name and identification shall be cast or stamped on the valve. Valves shall

have a minimum service rating of 150 psi, non-shock cold water. Valve bodies, bonnets, and packing nuts shall be brass, bronze, or a glass-filled nylon construction.

Springs, where required, shall be of stainless steel. All valves shall have accurately machined valve seat surfaces and internal parts. End connections shall be machined female pipe thread unless otherwise specified. Electrically operated valves shall be of the same manufacturer as the automatic controller unless otherwise specified.

The remote control valves shall be electrical solenoid type.

~~The valve box, cover and necessary extension shall be as specified and detailed on the project plans.~~

The electric solenoid actuated type valve shall be a normally closed, slow acting diaphragm type, hydraulically operated of the globe or angle type. The solenoid shall be for 24-volt, 60 cycle operation with running current of 2.0 watts. The solenoid shall be completely epoxy encapsulated for positive waterproofing with a stainless steel shunt band.

The valve shall be slow opening and closing by means of a potential fluid resistor to avoid damage from surge pressures. Opening and closing speed shall not be less than 5 seconds.

The inlet port to the diaphragm chamber shall have a removable screen, and shall be accessible without removing the bonnet from the valve body. The outlet port from the diaphragm chamber shall discharge into the downstream side of the valve. The solenoid plunger shall be spring-loaded so that the valve may be operated when installed in any position, and shall be constructed of stainless steel with a neoprene seat and a grit filter to protect against solenoid plunger hang-up. The diaphragm shall be nylon-reinforced neoprene. The valve bonnet shall have a bleed screw or petcock for manual operation of the valve. The valve bonnet shall be secured to the valve body by stainless steel bolts.

Valves shall have a flow control stem and wheel handle for regulating or shutting off the flow of water.

**808-2.05 Pressure Reduction Riser**. The pressure reduction riser shall consist of the pressure reducing valve, union, valve box and all appurtenances.

The pressure reducing valve shall be a self-contained, single-seat, direct-acting, spring-loaded, diaphragm-actuated type. The valve shall be of all plastic construction, stainless steel body seat, composition seat discs, BUNA-N diaphragm with nylon insert and stainless steel springs. The valve shall have a maximum working pressure rating of 150 psi and shall be capable of regulating outlet pressure from 5 to 20 psi, and have an adjustment screw for setting the pressure. The downstream pressure variance shall not exceed a rate of 0.44 psi for every 10 psi variance (increase or decrease)

in upstream or source pressure. The valve shall have an integral "Shrader" pressure test valve. When shown on the project plans, the valve shall have a 1/2 inch MPT inlet and 3/4 inch MHT female outlet.

The valve box, cover, and necessary extensions shall be as shown on the project plans, and shall be manufactured of concrete or a molded, virgin plastic materials conforming to the following ASTM requirements and having the following physical characteristics:

| CHARACTERISTIC | ASTM | VALUES |
|---|---|---|
| Tensile Strength | D-638-72 | 3400 psi Minimum |
| Deflecting Temperature 66 psi Stress | D-648-72 | 230° F |

The valve box shall be 12 inches high. Valve box lids shall be bolt locking. Lids shall be hinged to permit access without removal of the lid.

The threaded in line spring check valve shall have a body constructed of Type 1 PVC. The valve stem shall be 18-8 stainless steel with BUNA-N poppet seal. The half pound spring shall be 18-8 stainless steel. The valve shall have male x female threads, 3/4 inch NPT.

**808-2.06 Backflow Prevention Unit**. Backflow prevention units shall be of the reduced pressure type and size as specified on the project plans.

Backflow prevention units and component fittings shall conform to applicable state and local health department regulations, local plumbing codes, and the performance requirements of the applicable ASSE Standards or Foundation for Cross Connection Control Research, University of Southern California. Field tests shall be performed by personnel approved by the Engineer, and at no additional cost to the Agency. All tests shall be as specified by the Foundation for Cross Connection Control Research, University of Southern California. Under no circumstances shall shutoff valves of any type be installed downstream from any atmospheric type backflow prevention device.

In the event of a malfunction of the unit, construction shall be such that in the normal operation of the device, the level of water in the zone between the two check valves shall be lowered to create, within the inlet, an air gap greater than the diameter of the inlet pipe.

The backflow prevention unit shall conform to the applicable standards of AWWA, ASSE, and IAPMO.

The reduced pressure backflow preventer shall consist of two independently operating check valves, an independent relief valve, resilient seat inlet and outlet, full port ball type shut-off valves and test cocks. The unit shall be designed for installation in a normal horizontal flow attitude. The independent relief valve shall be located between the two check valves.

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The backflow preventer shall include an integral sensing system that will automatically open the relief valve whenever the pressure upstream of the first check valve drops below 3 psi greater than the pressure in the zone between the two check valves. The relief valve shall remain open until a positive pressure differential of 3 psi is reestablished. The sensing passage shall be located within the unit housing to protect against accidental damage or crimping. To assure maximum size passageway, snubber or other restrictive elements shall not be used.

In the event that pressure upstream of the first check valve drops to atmosphere or below, the construction of the unit shall be such that during the normal operation of the device, the level of water in the zone between the two check valves shall be lowered to create within the unit an internal air gap which is greater than the diameter of the inlet pipe.

Both check valves and the relief valve shall be spring loaded poppet type of modular design such that the complete assembly including valve, spring and seat may be removed and replaced using low cost replacements kits.

All parts shall be made from corrosion resistant materials.

The design shall place the sensing diaphragm and passage within the unit housing to eliminate danger of malfunction due to mechanical or vandalism damage.

The backflow preventer shall conform to the following material pressure and temperature range requirements:

| | |
|---|---|
| Body | Bronze |
| Check Valve Enclosures | Glass Filled Noryl |
| Valve Disc | EPT Rubber |
| Diaphragm | Buna N and Nylon |
| “O” Rings | Buna N |
| Springs | Stainless Steel |
| Screws | Stainless Steel |
| Maximum Working Pressure | 150 psi |
| Hydrostatic Test Pressure | 300 psi |
| Temperature Range | 32° F – 210° F |

Construction of the backflow prevention unit shall be such that any minor leakage at the second check valve will result in a visible flow from the relief valve even if the first check valve is totally disabled.

Each reduced pressure backflow prevention unit shall be factory assembled and tested prior to delivery.

The backflow prevention unit shall be protected form damage due to freezing temperature and from vandalism.

**808-2.07 Emitter Assembly**. Unless otherwise specified in the Special Provisions, emitters shall be of pressure compensation and continuous flushing type known as a Groove and Flap Short Path Emitter. The

case of the emitter shall be made of durable black, plastic material. It shall be resistant to temperature variation, ultraviolet radiation, smog (ozone), common liquid fertilizer and weed spray. The case shall completely encompass the diaphragm, protecting it from potentially harmful environmental factors.

The emitter shall be capable of continuous, self-flushing, clog free operation with 200 mesh (minimum) filtration for 1/2 GPH, and 150 mesh for 1 and 2 GPH emitter. The emitter shall be capable of being installed in any position and maintain its given flow characteristics. The emitter shall be non-adjustable and the flow regime shall be maintained by a flexible silicon rubber diaphragm.

The emitter shall function with a system pressure range of 20 psi minimum to 50 psi maximum. The emitter flow variation shall not exceed 10 percent within this pressure range.

The 2 GPH emitter shall be capable of delivering 2.05 GPH at 20 psi and 1.75 GPH at 50 psi.

The 1 GPH emitter shall be capable of delivering 1 GPH at 20 psi and 1 GPH at 50 psi.

The 1/2 GPH emitter shall be capable of delivering 0.5 GPH at 20 psi and 0.45 GPH at 50 psi.

The emitter distribution tubing between the emitter and the .580 inch ID emitter house shall be .187 inch ID, .250 inch OD. The tubing between the emitter outlet and the point of discharge shall be vinylized .150 inch ID, .220 inch OD. All tubing shall fit tightly with the corresponding emitter barbs, adapters, and discharge outlet opening.

**808-2.08 Filter**. The filter housing shall be constructed of glass reinforced polypropylene, and the removable filter cylinder shall be manufactured of 200 mesh stainless steel with an effective filter area of 27 square inches. The cartridge housing shall have an integral 3/4 inch ball valve for flushing of the filter without removal of the cartridge. Threads shall be 1 inch MPT.

The valve box, cover and necessary extension shall be termed standard meter. Box and extensions shall be 6 1/2 inches.

**808-2.09 Full or Part Circle Pop-up Rotor Sprinkler**. Unless otherwise specified in the Special Provisions, the full or part circle pop-up rotor sprinkler shall be a single nozzle turbine drive type, capable of covering 33 feet radius at 45 psi with a discharge rate of 1.9 GPM for part circle, and 42 foot radius with 3.7 gallons per minute for full circle heads. The sprinkler shall have an infinitely adjustable arc of coverage from 30° to 360°.

The sprinkler case and internal assembly, except for bearing spring, wiper seal, and bearing washers shall be constructed of durable plastic. The rotation of the sprinkler shall be accomplished by turbine drive rotor, actuated by the flow of water through the

sprinkler.

The sprinkler shall have a valve to prevent low sprinkler drainage.

The sprinkler shall have an adjustable diffuser pin for distance and distribution control and shall be capable of full or part circle operation. The sprinkler nozzle outlet trajectory shall be 23 degrees.

The sprinkler shall have a strong stainless steel retract spring for positive pop-down. Pop-up height shall be no less than 3-5/8 inches. The sprinkler shall have a co-molded bypass wiper seal for low pressure operation and for cleaning debris from riser as it retracts into case. The pop-up portion of the case diameter shall not exceed 1-3/4 inches diameter.

The sprinkler shall have a bottom inlet and an inlet screen to protect nozzle from clogging.

**808-2.10 Controller (Automatic)**. Automatic controllers shall be solid-state electronic type, capable of fully automatic operation of the system. The controller cabinet and pedestal, where specified, shall be constructed of heavy gauge steel. The cabinet shall be UL listed, rain and dust proof. All cabinets shall be locking and keyed alike.

The automatic controller shall have the number of stations as shown on the project plans.

Each of the controller stations shall be programmable to operate from one minute to nine hours and 59 minutes, in one minute increments. The controller shall have two independent programs with four automatic starts per day for each. Each controller shall have, at a minimum, a 14 day programming capability. During operation, the controller shall provide a monitoring readout indicating station in operation and time remaining.

The automatic controller shall be compatible with 2 watt V.A.C. solenoid valves.

A master on/off button shall provide for system shutdown while maintaining programming. Electrical surge protection and lightning protection shall be an integral part of the controller and shall be provided on both the primary and circuit lines.

The controller shall be capable of being operated manually at any desired time during operation. A manual single station operation for programmed time or new setting shall be possible without affecting the original program. The controller shall have a factory preset back-up program for standby operation in the event of program loss and a rechargeable battery back-up to maintain the program for up to 6 hours in the event of a power loss.

All programming shall be accomplished via keyboard entry with all readouts LED displayed.

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Electrical characteristics shall be as follows:

Input: 117 V.A.C., 60 Hz
Output: 24.0 V., 60 Hz, 1.1 AMP
Fuse: 1.0 A slow blow

Construction details shall conform to the applicable requirements of the General Specifications for Traffic Signal and Highway Lighting System, the Traffic Signal Standard Drawings, the National Electrical Code, latest edition, and as specified on the project plans.

All wiring to be used for connecting the electric remote control valve to the automatic controllers shall be UL approved, 600 volt, Type UF single conductor wire. Wire shall be solid copper, AWG sizes 12 or 14 as specified on the project plans. Insulation shall be 60 mils thick PVC ICC-100 compound. Wire shall be color-coded as approved by the Engineer.

Installation procedures shall be as specified.

Wire connections to remote control valves and at wire splices shall be made with UL approved, sealant-filled (cycohexanone), water-tight wire connectors installed as recommended by the manufacturer.

Services (120 VAC) shall be placed at the locations indicated on the project plans. The contractor shall provide for any deviations between the final locations and those indicated on the project plans.

Circuit breaker requirements shall be 20A, 1P, 120VAC and have a 10,000 AIC rating.

Concrete for the cabinet base shall have a 28-day compressive strength of 2,500 psi and shall conform to the requirements found in Section 1006.

**808-3 CONSTRUCTION DETAILS**

**808-3.01 General**. Within 30 days after the date of the preconstruction conference, the contractor shall submit to the Engineer 5 copies of a list of the materials and equipment he proposes to use. This list shall show the manufacturer's name, model number, size, capacity, and complete specifications to determine whether or not each piece of material or equipment is acceptable and to assure that all such materials and equipment, when incorporated into the work, will be in conformance with the requirements of the project plans.

The contractor shall not begin work until the material and equipment have been approved in writing by the Engineer.

The use of potable water by the contractor shall require the installation of an approved backflow prevention device. All backflow prevention devices shall be in place, tested and approved for use by the water utility prior to the contractor using any water from

the municipal water system.

Prior to beginning trench excavation, the contractor shall lay out the system or systems for the approval of the Engineer by providing approved indicators at the location(s) of major components such as meters, controllers, piping runs, valves, flow sensors, pumps, backflow preventers and tanks.

The contractor shall locate any existing water distribution system piping and appurtenances within the limits of the project which will be affected by new system construction and/or revisions.

Utility connections, both water and electrical, shall be as shown on the project plans or as determined by the utility company. Unless specifically exempted in the project plans or Special Provisions, the contractor shall be responsible for all costs to provide these services.

The contractor shall assume full responsibility for the correct installation of the water distribution system, as herein specified, and unless it can show past experience of installing this type of system, it shall arrange with the manufacturer for the services of a qualified manufacturer's representative to be on hand at the start of the installation and as necessary during the installation and testing of the system.

All materials and fittings shall be new, of manufacturer's most current design, and shall bear the appropriate national association's seal of approval; for example, NSF and UL. Similar parts shall be procured from the same manufacturer, and internal parts shall be common and interchangeable. Parts listing and source of supply for replacement parts shall be furnished to the Engineer. The contractor shall provide two complete manuals of all materials, equipment, parts, and manufacturer's installation, maintenance and owner manuals, to the Engineer prior to final project acceptance.

All enclosures shall remain closed and locked, and all valve box covers shall be in place throughout the construction and landscaping establishment period, except when actual work is in progress on the respective unit.

The contractor shall furnish sufficient numbers of pressure gauges with tire chucks, which shall be used in the testing and necessary adjustment of the emitter system during construction and landscaping establishment.

All pressure regulators shall be tested at 90 days intervals throughout the contract and establishment period. Regular tests shall be performed at a minimum of three working days prior to regularly scheduled project inspections.

Plastic pipe shall be delivered to the site in unbroken banded or tied bundles and shall be transported in a manner to prevent damage to pipe barrels and ends. When plastic pipe is delivered from a local source, it need not be bundled and/or wrapped.

Upon delivery to the site, the contractor shall inspect all pipe for possible shipping damage. Shipping straps shall be removed to prevent damage due to expansion in hot weather. Any damaged pipe shall be immediately removed from the project site.

All copper pipe required to install the backflow prevention unit or fertilizer injector assembly shall be type ”K”, hard drawn, of the size shown on the project plans. Copper fittings shall be wrought or cast, and of the configuration and size shown on the project plans.

All PVC pipe and fittings shall be stored as recommended by the manufacturer and as directed by the Engineer. All PVC pipe shall be covered to prevent exposure to sunlight. Sufficient air space shall be provided between the opaque covering material and the pipe to prevent undue heat buildup and retention.

PVC pipe which has been discolored by exposure to sunlight or has been scratched, scored or otherwise damaged in handling will not be acceptable.

Plastic pipe and fittings shall be installed in conformance with the requirements specified herein and the manufacturer’s recommendations.

Any PVC fitting or nipple marks from any device other than a strap tightening wrench shall be removed and replaced with a new component. Any system replaced shall be retested as herein specified.

No water distribution system main piping, laterals, other piping, or other components shall be installed through or beneath new or existing plant pits or plant material. The minimum distance between the plant pit and piping shall be 12 inches the plant pit and piping shall be determined by maximum supply lengths as specified on the project plans.

**808-3.02 Trenching and Piping**. Trenches shall be excavated to a uniform grade which shall not cause undue deflection of pipe and shall be no wider than is necessary for proper installation of the pipe, fittings and other required incidentals. The bottom of the trench shall be firm and free from large or sharp rocks.

The first 3 inches over the pipe shall be backfilled with dirt or sand fine enough to pass a 1/2 inch sieve and compacted to approximately 85% of the maximum density. The remainder of the trench shall be backfilled with excavated soil, free of rocks larger than 2 inches in diameter. Compaction shall be to approximately 85% of the maximum density. If additional backfill material beyond that generated by the trenching operations is required, it shall be select material obtained at the contractor's expense. Pipe joints shall not be backfilled until the system has been tested and accepted. Backfill must be capable of supporting healthy plant growth.

Where pavement or other impervious material is encountered in the excavation of trenches, such material shall be removed and disposed of in a satisfactory manner.

The quick term burst test shall be conducted in accordance with ASTM 1599. ~~Reference to other quick term burst tests shall be deleted.~~

Solvent welding shall be accomplished by applying primer to the pipe end (spigot) and to the coupling socket (bell). Solvent cement shall then be applied to the male spigot of the pipe only. All other manufacturing recommendations shall be followed.

Solvent-weld PVC within sleeves shall be of the size indicated, assembled, and tested as specified prior to placement in the sleeve. The above pressure test shall be in addition to the specified water system test.

Sleeves shall be provided at all locations where irrigation mainlines or laterals extend under roadways, drives, multi-use paths, sidewalks or other paved surfaces. Sleeves shall extend a minimum of one foot beyond the edge of the pavement. The location of all sleeves shall be clearly and accurately recorded on the record plans using station and offset measurements when possible.

Sleeve size(s) shall be as noted on the project plans. Should the sleeve size not be noted on the project plans, the sleeve size shall be two standard pipe diameters larger than the pipe to be installed in the sleeve, but in no case shall the sleeve be less than two inches in diameter.

All sleeves shall be installed a minimum of 30 inches below pavement, or as directed by the Engineer, at the locations indicated. The cut ends of the pipe shall be reamed smooth and, at the time of inspection, both ends of pipe shall be visible and shall extend 1 foot beyond paving or curbs into a planting area. Where sleeving is provided for irrigation control wire and a pull box is indicated, the sleeve shall be extended and terminate in the pull box.

Sleeves shall be capped or plugged in a manner acceptable to the Engineer following installation and prior to placement of water piping.

Plastic pipe and fittings shall be installed in conformance with the requirements specified herein and the manufacturer's recommendations.

Any socket type fitting for use with water piping shall conform to the tolerances of the appropriate ASTM Specification for materials specified for the water piping.

Where threaded plastic to metal or plastic to plastic connectors are required, the metal connections shall be worked first. A non-hardening manufacturer recommended sealant/lubricant compatible with plastic fittings and/or components shall be used and the joint shall be handtightened with final tightening not to exceed one turn with a strap wrench.

Threaded polyvinyl chloride adapters into which pipe may be solvent welded shall be used where threaded plastic connectors are required.

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The contractor shall be responsible for protecting irrigation lines from freezing. Irrigation lines damaged as a result of freezing shall be repaired or replaced at the contractor's expense.

Gate valves will be installed as shown on the project plans and shall conform to the requirements detailed in these Special Provisions.

**808-3.03 Bedding and Cover Material.** When required, bedding and cover material for PVC piping, flexible emitter hose and 24 volt wiring shall be sand conforming to the gradation requirements of Subsection 1006-2.03 (B) with the following exceptions:

| SAND BEDDING SIEVE SIZE | PERCENT PASSING |
|---|---|
| No. 4 | 100 |
| No. 16 | 30-80 |
| No. 50 | 0-30 |
| No. 100 | 0-25 |
| No. 200 | 0-20 |

**808-3.04 Pressure Reduction Riser**. At the initial installation, the pressure reducing valve shall be field adjusted to 25 psi and maintained at 24 to 26 psi at the adjacent pressure check point.

Immediately prior to the initial operation of any of the pressure reducing valves on a continuous basis, all valves shall be retested and reset if necessary. The contractor shall, at the completion of the entire irrigation system, test and record the pressure readings at all pressure reducing valves. If any readings are not within the recommended pressure, necessary devices shall be reset and retested by the contractor.

**808-3.05 Emitter Assembly**. The emitter and distribution tubing shall be assembled using the manufacturer's recommended tools and accessories.

The maximum length of the distribution tubing shall be as detailed on the project plans. In the event the distance in the field exceeds the maximum length, the contractor shall extend the .600 inch ID emitter hose or PVC header as required by adding a tee and shall add a flush valve at the end of each extension. This work if necessary will be performed at the contractor's expense.

The emitter assembly, as detailed on the project plans, shall consist of the emitter unit, flexible polyethylene emitter distribution tubings (length as required), and molded polyethylene adapter.

**808-3.06 Emitter Hose**. The contractor shall assume full responsibility for the correct installation of the emitter system, as herein specified, and unless he can show past experience of

installing this type of system, he shall arrange with the manufacturer for the services of a qualified manufacturer's representative to be on hand at the start of the installation and as necessary during the installation and testing of the system. All emitter hose shall be flushed prior to and after installation of emitter assemblies. A manual self closing flush valve shall be installed at the end of each line.

**808-3.07 Filter**. The filter shall be installed in a manner that allows removal of the cartridge for visual inspection.

**808-3.08 Full or Part Circle Pop-Up Rotor Sprinkler**. Sprinkler heads shall be installed as detailed on the project plans or as directed by the Engineer. Minor adjustments may be made as needed to avoid guardrails and other obstructions from interfering with the intended coverage. The installed angle of the head may be adjusted relative to vertical to maximize intended coverage and minimize erosion.

**808-3.09 Programming of Controller to Minimize Erosion**. The irrigation controller shall be programmed to operate the sprinklers for a duration and at a frequency such that erosion during and after seed establishment is minimized. Any erosion damage shall be repaired by the contractor at no cost to the Agency.

**808-3.10 Water Meter**. This work shall be performed by the appropriate local water department or company, and shall consist of furnishing all materials (including meters, meter boxes, covers, and valves), equipment, tools, and labor necessary to provide the specified size water service where indicated on the project plans.

It shall be the contractor's responsibility to notify the appropriate water department or company immediately following award of contract, requesting the installation of the required water services. It shall be the contractor's responsibility to coordinate his landscape and irrigation work with the schedule of appropriate water department or company.

The contractor shall be responsible for paying the water department or company for the installation of the water service and appurtenant equipment.

The contractor shall be responsible for providing all water necessary during the construction and plant establishment periods.

At the completion of the installation of piping, pumps, valves, tanks, and other irrigation system components and after all solvent welded joints have cured for 24 hours, the water distribution system shall be tested in conformance with the requirements indicated in this section.

**808-4 TESTING**

Prior to backfilling, the irrigation distribution system shall be tested in accordance with the requirements of these specifications and in the presence of the Engineer.

The contractor shall flush and bleed all lines prior to testing. Metal or plastic caps or adjustable irrigation heads may be used to facilitate flushing and testing. Backfill material placed on the lines shall be limited to the quantity required to stabilize the lines under pressure and to serve as insulation during testing in hot weather. During testing, all fittings and couplings shall be visible for inspection. Any failure evident during the test shall be repaired and the system retested before backfilling. The contractor shall furnish the necessary equipment required to perform the testing.

The main lines and/or pressure mains shall be subjected to 150 psi pressure for a minimum period of 2 hours. The contractor shall furnish all necessary pumps and test equipment at no additional cost to the Agency. All lateral lines shall be subject to test at static pressure, or proposed operating pressure, whichever is greater, for a period of 2 hours. During this time, all solvent-welded elastomeric seal joints, threaded connections, and other component parts shall be inspected to determine that no leaks exist.

All pressure testing shall be done following removal of entrapped air. Under no circumstances shall air be used to develop the test pressure.

Upon satisfactory completion of the main line and/or pressure main test, the water pressure shall then be reduced to static water pressure for a period of 2 hours. The system shall be checked for leaks at the end of this 2 hour period and all necessary repairs shall be made.

All control equipment and valves shall be tested. Valves shall be tested in sequence starting at the valve most remote from the source of water supply in order to subject the main lines to surge pressure. Testing on this phase shall be done at static water pressure. All valves shall be operated manually. All electric remote control valves shall be tested to the satisfaction of the Engineer prior to burial of wiring.

Any electrical or mechanical failures or leaks which may occur during testing shall be repaired. Defective materials shall be removed and replaced. After replacement or repairs have been made, the entire testing procedure shall be repeated until it is determined that there are no leaks or failures in the irrigation distribution system.

**808-5 RECORD AND AS-BUILT DRAWINGS**

The contractor shall provide and keep up to date a complete “as-built” record set of blue line prints which shall be corrected daily and show every change from the original drawings and specifications and the exact as-built locations, size, and kind of equipment. This set of drawings shall be kept on the site and shall be used only as a record set.

The as-built drawings shall also serve as work progress sheets. The contractor shall make neat and legible annotations thereon, daily as the work proceeds, showing the work as actually installed. These

drawings shall be available at all times for inspection, and shall be kept in a location acceptable to the Engineer.

The contractor shall dimension, from two permanent points of reference, building corners, sidewalk, road intersections, road station points, etc., and the location of the following items:

Connection to existing water lines and backflow prevention unit.

Connection to existing electrical power and controller.

Gate valves.

Routing of primary and lateral irrigation lines (dimension maximum 200 feet along routing).

Electric control valves and filters.

Routing of control wiring.

Quick coupling valves.

Other related equipment as directed by the Engineer.

All lettering on drawings shall be a minimum 1/8 inch in size.

Master control valves, flow meter and wiring.

Vacuum release valves.

Mainline pressure reduction valves.

On or before the date of final inspection, the contractor shall deliver the corrected and approved “as-built” record set of prints to the Engineer. Delivery of the “as-built” prints will not relieve the contractor of the responsibility of furnishing required information that may have been omitted.

**808-6 METHOD OF MEASUREMENT**

The landscape irrigation system will be measured on a lump sum basis or as individual unit prices as noted on the bid schedule for the work complete in place.

**808-7 BASIS OF PAYMENT**

Payment will be made at the contract lump sum price, or unit price(s), for the item(s) called for in the Bidding Schedule, which price shall be full compensation for the item(s) complete-in-place as described herein and on the project plans.