9-15 IRRIGATION SYSTEM

All materials and equipment incorporated in the system shall be new, undamaged, of standard quality, and shall be subject to testing as specified.

9-15.1 Pipe, Tubing, and Fittings

Pipe shall be copper, galvanized iron, PVC, or polyethylene, as specified in the Plans or in the Special Provisions.

Copper pipe or tubing shall be annealed, seamless, and conform to the requirements of ASTM B 88, and shall be a minimum of Type L rating.

Threaded cast brass or bronze fittings shall meet the requirements of Section 9-30.6(6).

9-15.1(1) Galvanized Pipe and Fittings

Pipe shall be standard weight, hot-dip galvanized iron or steel pipe, threaded and coupled. Pipe shall meet the requirements of ASTM A 53.

All pipe fittings shall be standard threaded galvanized malleable iron fittings.

9-15.1(2) Polyvinyl Chloride Pipe and Fittings

PVC pipe and fittings shall be of PVC compound Type 1, Grade 1, conforming to ASTM D 1784 Specifications. The pipe and fittings shall be approved and certified by the National Sanitation Foundation. Pipe and fittings shall be free from defects in materials, workmanship, and handling. The Engineer may require dimensional and quick burst tests of pipe and fittings after arrival at the job site. Acceptance of the materials shall be subject to passing the designated tests per ASTM Standards.

PVC solvent weld pipe shall be of PVC 1120 material and shall have 200-psi minimum pressure rating with SDR 21 walls which conform to ASTM D 2241. PVC pipe with walls heavier than SDR 21 shall be installed when noted in the Plans and specified in the Special Provisions. PVC threaded pipe shall be of PVC 1120 material and shall be schedule 80 which conforms to ASTM D 1785.

PVC pipe fittings shall conform to ASTM D 2466, Type I, Grades 1 or 2. Pipe may be belled on one end with the dimensions of the tapered bell conforming to ASTM D 2672.

Each length of PVC pipe is to be marked with an identifying extrusion “run” number and the manufacturer’s name or trade name plus the pipe size and schedule.

9-15.1(3) Polyethylene Pipe

Polyethylene pipe shall be Class 80, SDR 15, medium density polyethylene pipe, meet the requirements of ASTM D 2239, conform to U.S. Commercial Standard CS-255, and be National Sanitation Foundation (NSF) approved.

Thick walled polyethylene (poly) pipe shall be used in conjunction with fittings recommended by the manufacturer of the poly pipe to produce a flexible swing joint assembly between the lateral line and the irrigation head. The pipe shall be manufactured from high quality, low density virgin polyethylene material and have a minimum wall thickness of 0.10-inch and a minimum inside diameter of 0.49-inch. The pipe shall be capable of withstanding 80-psi operating water pressure at 110°F. The length of thick walled poly pipe at each flexible swing joint assembly shall be 18-inches minimum to 36-inches maximum.

9-15.2 Drip Tubing

Drip tubing shall be manufactured from specially formulated, chemical resistant, low to medium density virgin polyethylene or polybutylene selected for excellent weatherability and stress cracking resistance and designed specifically for use in drip irrigation systems. Drip tubing shall have a minimum wall thickness of 0.045-inch.

9-15.3 Automatic Controllers

Automatic controller pedestals or container cabinets shall be installed on a concrete base as shown in the Plans or per manufacturer's recommendations. Provide three 1-inch diameter galvanized metal or PVC electrical wire conduits through the base and 3-inches beyond the edge or side of the base. The automatic controller clock shall be an electrically timed device for automatically opening and closing control valves for predetermined periods of time and mounted so that all normal adjustments will be conveniently located for use by the operator. The automatic controller clock shall be enclosed in a weatherproof, painted, metal housing fabricated from 16 gage sheet aluminum alloy 6061-T6, or from 16 gage sheet steel metal or unpainted, non-rusting industrial grade stainless steel.

The automatic controller clock housing shall have hasp and lock or locking device. All locks or locking devices shall be master keyed and three sets of keys provided to the Engineer. The controller shall be compatible with and capable of operating the irrigation system as designed and constructed and shall include the following operating features:

1. Each controller station shall be adjustable for setting to remain open for any desired period of time, from five minutes or less to at least one hour.
2. Adjustments shall be provided whereby any number of days may be omitted and whereby any one or more positions on the controller can be skipped. When adjustments are made, they shall continue automatically within a 14-day cycle until the operator desires to make new adjustments.
3. Controls shall allow any position to be operated manually both on or off whenever desired.
4. Controls shall provide for resetting the start of the irrigation cycle at any time and advancing from one position to another.
5. Controllers shall contain an on-off switch and fuse assembly.
6. Output shall be 24 volt AC with battery back up.
7. Both normally-open or normally-closed rain sensor compatible.

9-15.4 Irrigation Heads

Irrigation heads shall be of the type, pattern, and coverage shown in the Plans at rated operating pressure specified, discharging not more than the amount of gallons per minute listed.

Sprinkler heads shall be designed so that spray adjustments can be made by either an adjustment screw or interchangeable nozzles. Watering cores shall be easily removed without removing the housing from the pipe.

9-15.5 Valve Boxes and Protective Sleeves

All automatic control valves, flow control valves, and pressure reducing valves shall be provided with valve boxes. Valve boxes shall conform to the Plans and shall be extendible to obtain the depth required. All manual drain valves and manual control valves shall be equipped with a protective sleeve and cap as shown in the Plans.

9-15.6 Gate Valves

Valves shall be of the same size as the pipes on which they are placed and shall have union or flange connections. Service rating (for nonshock cold water) shall be 150-psi. Valves shall be of the double disk, taper seat type, with rising stem, union bonnet and hand wheel or suitable cross wheel for standard key operation. Manufacturer's name, type of valve, and size shall be imprinted or printed on the valve.

9-15.7 Control Valves

9-15.7(1) Manual Control Valves

Manual valves shall be angle type. Service rating shall be not less than 150-psi nonshock cold water. Valves shall be designed for underground installation with suitable cross wheel for operation with a standard key. The Contractor shall furnish three suitable operating keys per Contract. Valves shall have removable bonnet and stem assembly with adjustable packing gland and shall house long acme threaded stem to ensure full opening and closing. Valve discs shall be full floating with replaceable seat washers.

9-15.7(2) Automatic Control Valves

Automatic remote control valves shall be globe pattern with flanged or screwed connections as required. The valve shall be constructed so as to allow all internal parts to be removable from the top of the valve without disturbing the valve installation.

Valves shall be of a normally closed design and shall be electric solenoid operated, having maximum rating of 6.5 watts utilizing 24 volt AC power. Solenoids shall be directly attached to the valve bonnets or body with all control parts completely internal. Valves shall be of 200-psi heavy duty glass filled nylon and a standard product of a reputable manufacturer of irrigation valves and equipment. The opening and closing speed of the valve shall be a minimum of five seconds for closure and a minimum of three seconds for opening with a constant rate of opening and closing. A manual control bleed cock shall be included on the valve to operate the valve without the requirement of electric current. A manual shutoff stem with cross handle for wrench operation is required for manual adjustment from fully closed to wide open. Once the manual adjustment is set, the valve shall operate automatically in the adjusted position. Water flow shall be completely stopped when the control valve is closed either manually or automatically. Automatic control valves and automatic controllers need not be from the same manufacturer.

9-15.7(3) Automatic Control Valves With Pressure Regulator

The automatic control valve with pressure regulator shall be similar to the automatic control valve and shall also reduce the inlet pressure to a constant lower pressure regardless of supply fluctuations. The regulator must be fully adjustable.

9-15.8 Quick Coupling Equipment

Quick coupler valves shall have a service rating not less than 125-psi for nonshock cold water. The body of the valves shall be of cast leaded semi-red brass alloy No. C84400 conforming to ASTM B 584. The base of the valve shall have standard female pipe threads. The design of the valve shall be such that it will open only upon inserting a coupler key and will close as the coupler is removed from the valve. Leakage of water between the coupler and valve body when in operation will not be accepted. The valve body receiving the coupler shall be designed with double worm slots to allow smooth action in opening and closing of the valve with a minimum of effort. Slots shall be

notched at the base to hold the coupler firmly in the open position. Couplers shall be of the same material as the valve body with stainless steel double guide lugs to fit the worm slots. Couplers shall be of one piece construction with steel reinforced side handles attached. All couplers shall have standard male pipe threads at the top. Couplers shall be furnished with all quick coupler valves unless otherwise specified.

9-15.9 Drain Valves

Drain valves may be a ½ or ¾ inch PVC or metal gate valve as manufactured for irrigation systems. Valves shall be designed for underground installation with suitable cross wheel for operation with a standard key, and shall have a service rating of not less than 150-psi nonshock cold water. The Contractor shall furnish three standard operating keys per Contract.

On potable systems, drain valves shall be allowed only in the downstream side of approved cross connection control devices.

9-15.10 Hose Bibs

Hose bibs shall be constructed of bronze or brass, angle type threaded to accommodate a ¾-inch hose connection, and shall be key operated. Design shall be such as to prevent operation by wrench or pliers.

9-15.11 Cross Connection Control Devices

Atmospheric vacuum breaker assemblies (AVBAs), pressure vacuum breaker assemblies (PVBAs), double check valve assemblies (DCVAs), and reduced pressure backflow devices (RPBDs), shall be of a manufacturer and product model approved for use by the Washington State Department of Health, Olympia, Washington.

9-15.12 Check Valves

Adjustable spring check valves shall be PVC and shall be pressure rated at 200-psi. Valves shall be adjustable from 5 to 15-pounds spring tension, but shall not cause pressure loss in excess of 5-psi for flows up to 30-gpm. Valves shall have angled seats, Buna-N seals and threaded connections, and shall be installed in 6-inch Schedule 40 PVC sleeves with removable caps or 6-inch round plastic valve boxes.

9-15.13 Pressure Regulating Valves

Pressure regulating valves shall have a minimum of 150 psi working pressure with an adjustable outlet range of 20 to 70-psi. The valves shall be factory set as shown in the Plans. Pressure regulating valves shall be rated for safe operation at 175-psi nonshock cold water.

9-15.14 Three-Way Valves

Three-way valves shall be tight closing, three port, ball or plug type, constructed to permit straight through and 90 degree flow only. The valve shall be of bronze or approved corrosion resistant body materials and shall have a minimum of 150-psi working pressure. The head of the valve, or handle when applicable, shall be permanently marked to indicate port position. Whenever handles are included as an integral part of the valve, the Contractor shall remove the handles and give them to the Engineer for ultimate distribution to the Maintenance Division.

9-15.15 Flow Control Valves

Valve body materials shall be plastic or metal. Internal parts shall be stainless steel. Valves shall be factory set to Plan flows. Valves shall have no external adjustment and be tamper-proof when installed. One-quarter inch and smaller flow control valves shall have a minimum pressure absorption range of 2 to 32-psi. One and one half inch and larger flow control valves shall have a minimum pressure absorption range of 3 to 50-psi.

Flow shall be controlled to 5 percent of Plan volumes.

9-15.16 Air Relief Valve

The air relief valve shall automatically relieve air and break a vacuum in the serviced pipe. Body materials shall be installed exactly at all high points.

9-15.17 Electrical Wire and Splices

Electrical wire used between the automatic controller and automatic control valves shall be copper AWG No. 14 minimum size, Type USE Chemically Cross Linked Polyethylene , Type UF, and shall be color coded or marked with number identification.

Low voltage splices shall be made with a kit containing a “T” shaped open cell centering device and a plastic bag of urethane and hardener which is mixed at the time of installation or heat shrinkable insulating tubing. Heat shrinking insulating tubing shall consist of a mastic lined heavy wall polyolefin cable sleeve. The resin used with the “T” shaped open cell centering device shall be a quick curing flexible compound with an approximate set-up time of 4 minutes at 72°F.

9-15.18 Detectable Marking Tape

Detectable marking tape shall consist of inert polyethylene plastic that is impervious to all known alkalis, acids, chemical reagents, and solvents likely to be encountered in the soil, with a metallic foil core to provide the most positive detection and pipeline locators.

The tape shall be color coded and shall be imprinted continuously over its entire length in permanent black ink. The message shall convey the type of line buried below and shall also have the word “Caution” prominently shown. Color coding of the tape shall be as follows:

Utility	Tape Color
Water	Blue
Sewer	Green
Electrical	Red
Gas/Oil	Yellow
Telephone/CATV	Orange

The width of the tape shall be as recommended by the manufacture for the depth of installation.

9-15.19 Wye Strainers

Wye strainers shall be bronze or brass with screwed end connections, 20 mesh Monel or stainless steel screen, and standard tapped bronze retainer cap and closure plug. Service rating shall be not less than 150-psi nonshock cold water.