

**SECTION 32 84 00
PLANTING IRRIGATION**

PART 1 - GENERAL

1.1 DESCRIPTION

An automatically-controlled lawn irrigation system, complete, including piping, backflow preventer, sprinkler heads, valves, controls, control wiring, fittings, electrical connections and necessary accessories.

1.2 RELATED WORK

- A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.
- C. Protection of Materials and Equipment: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING .

1.3 QUALITY ASSURANCE

- A. Criteria:
 - 1. Manufacturer regularly and presently manufactures the item submitted as one of their principal products.
 - 2. There is a permanent service organization, maintained or trained by the manufacturer, which will render satisfactory service within eight hours of receipt of notification that service is requested.
 - 3. Installer, or supplier of a service, has technical qualifications, experience, and trained personnel and facilities to perform the specified work.
- B. Products Criteria:
 - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units are products of one manufacturer.

2. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
 - a. All components of an assembled unit need not be products of the same manufacturer but component parts which are alike are the product of a single manufacturer.
 - b. Components are compatible with each other and with the total assembly for the intended service.
 3. Nameplates: Nameplate bearing manufacturer's name or identification trademark securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- C. System Requirements:
1. Full and complete coverage is required. Contractor shall, at no additional cost to the Government, make necessary adjustments to layout required to achieve full coverage of irrigated areas without overthrow on roadways, sidewalks, window wells, or buildings and to protect trees from close high spray velocity.
 2. Layout work as closely as possible to drawings. Drawings are diagrammatic to the extent that swing joints, offsets and all fittings are not shown. Lines are to be common trenched wherever possible.
 3. Locations of remote control valves are schematic. Remote control valves shall be grouped wherever possible and aligned at a set dimension back of curb along roads.
 4. Irrigation lines and control wire shall run at boundaries of graves, thru designated utility lanes or beside roadways so that any gravesite may be opened in the future without disruption of the irrigation system.
 5. Connect new system to existing mains. Disconnect and abandon existing irrigation system.
- D. Maintenance and Operating Instructions: Prior to final acceptance, verbal instructions, for a period of not less than 4 hours, shall be provided to the operating personnel. Provide two additional years of software support for one hour each month. Provide four copies of all manuals.

- E. Completely program controller and satellites according to approved irrigation schedule.
- F. Follow manufacturer's instructions for installation.
- G. Manufacturer of Control Systems to certify Control System is complete, including all related components, and totally operational. Submit certificate to COTR.
- H. As-Built Record Drawings: Maintain a complete set of as-built drawings which shall be corrected daily to show changes in locations of all pipe, valves, pumps and related irrigation equipment. Valves shall be shown with dimensions to reference points.
- I. Controller Chart:
 - 1. Prepare a map diagram showing location of all valves, lateral lines, and route of the control wires. Identify all valves as to size, station, number and type of irrigation. "As-built" drawings must be approved before charts are prepared.
 - 2. Provide one controller chart showing the area covered by controller for each automatic controller supplied at the maximum size controller door will allow. Chart shall be a reduced drawing of the actual "as-built" system. If controller sequence is not legible when the drawing is reduced to door size, the drawing shall be enlarged to a size that is readable and placed folded, in a sealed plastic container, inside the controller door.
 - 3. Chart shall be a blackline print with a different color used to show area of coverage for each station. Charts must be completed and approved prior to final inspection of the irrigation system.

1.4 SUBMITTALS

- A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers' Literature and Data:
 - 1. Piping.
 - 2. Jointing materials.
 - 3. Valves.

4. Backflow preventer.
 5. Water meter.
 6. Frames and covers.
 7. Manhole Steps.
 8. Strainers.
 9. Pressure gages.
 10. Automatic control equipment.
 11. Sprinkler heads.
 12. Quick couplers.
 13. Valve boxes.
- C. Complete detailed layout shop drawings covering design of system showing pipe sizes and lengths; fittings, locations, types and sizes of sprinkler heads; controls; backflow preventers; valves; drainage pits; location and mounting details of electrical control equipment; complete wiring diagram showing routes and wire sizes; wiring details and source of current and connections to existing services. Do not start work before final shop drawing approval.
- D. Name and address of a permanent service organization maintained or trained by the manufacturers that will render satisfactory service within eight hours of receipt of notification that service is requested.
- E. Reproducible "as-built" drawings.
- F. After "as-built" drawings have been approved, submit print of controller chart.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):

AA-60005 Frames, Covers, Gratings, Steps, Sump And Catch Basin,
Manhole

C. American National Standard Institute (ANSI):

B40.1-98..... Gauges-Pressure Indicating Dial Type-Elastic Element

D. American Society of Sanitary Engineers (ASSE):

1013-2005..... Reduced Pressure Principle Backflow Preventers

E. American Society for Testing and Materials (ASTM):

B61-02..... Steam or Valve Bronze Castings

B62-02..... Composition Bronze or Ounce Metal Castings

D1785-04a..... Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120

D2241-04b Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

D2287-96(2001)..... Nonrigid Vinyl Chloride Polymer and Copolymer Molding and
Extrusion Compounds

D2464-99e1 Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings,
Schedule 80

D2466-05 Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

D2564-04 Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping
Systems

D2855-96(2002)..... Making Solvent Cemented Joints with Poly(Vinyl Chloride) (PVC)
Pipe and Fittings

F477-02e1 Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F. American Water Works Association (AWWA):

- C110/A21.10-03..... Ductile-Iron and Gray-Iron Fittings, 3-Inch Through 48-Inch for Water
- C111/A21.11-00..... Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- C115/A21.15-99..... Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
- C151/A21.51-02..... Ductile-Iron Pipe, Centrifugally Cast, for Water C153/A21.53-00 Ductile-Iron Compact Fittings for Water Service
- C500-02..... Metal-seated Gate Valves for Water Supply Service C504-00 Rubber Seated Butterfly Valves
- C600-99..... Installation of Ductile-Iron Water Mains and Their Appurtenances
- G. Manufacturers Standardization Society (MSS):
- SP70-1998..... Cast Iron gate Valves, Flanged and Thread Ends
- H. National Electrical Manufacturers Association (NEMA):
- 250-2003..... Enclosures for Electrical Equipment (1000 Volts Maximum);

PART 2 - PRODUCTS

2.1 PIPING

- A. Irrigation Mains: Provide one of the following materials.
1. Polyvinyl Chloride (PVC) Pressure Pipe, AWWA C900, PVC 1120, working pressure 1025 kPa (150 psi). Pipe shall conform to outside diameters of AWWA 151 cast iron pressure pipe to accommodate cast iron fittings.
- B. Irrigation Laterals: Polyvinyl Chloride, ASTM D2241, PVC 1120, SDR 21, solvent welded.
- C. Threaded Pipe: Polyvinyl Chloride, ASTM D1785, PVC 1120, Schedule 80, for threaded connections, risers and swing joints.

D. Above Grade and in Concrete Pit: AWWA C115, flanged joints and fittings working pressure 1025 kPa (150 psi).

E. Fittings:

1. Irrigation Mains (Ductile Iron and PVC Pipe): Ductile Iron, AWWA 110.
2. Irrigation Laterals: PVC, schedule 40, solvent welded socket type, ASTM D2466.
3. Threaded Pipe: PVC, schedule 80, ASTM D2464.
4. Swing Joints: Threaded fittings with elastomeric seals that allow 360 degree rotation, and designed for minimum 1375 kPa (200 psig) working pressure, may be used in lieu of standard threaded fittings.

F. Jointing Materials:

1. Irrigation Mains: Rubber gaskets, AWWA C111.
2. Irrigation Laterals: Solvent cement, ASTM D2564.

2.2 VALVES (EXCEPT REMOTE CONTROL VALVES)

A. Underground Shut-Off Valves: Provide One of the Following:

1. Gate valves 50 mm (2 inches) and larger: Iron body, bronze mounted, double disc with parallel or inclined seats, non-rising stem turning clockwise to close, 1025 kPa (150 psi) minimum working pressure. AWWA C504.
2. Butterfly valves 80 mm (3 inches) and larger: cast iron body with stainless steel shaft, ductile iron valve disc and resilient rubber coated, 1025 kPa (150 psi) minimum pressure. AWWA C504.
3. Ball valves (for isolation valves 1-1/2" and smaller): Full-port ball valves with bronze body, PTFE seats, and 90 degree on/off handle. Ball valves to have NPT female end connections.

B. Operations:

1. Underground: furnish valves with 50 mm (2 inch) nut for T-Handle socket wrench operation.

2. Above ground and in pits: MSS SP70, with handwheels.
 3. All butterfly valves 150 mm (6 inches) and above shall have enclosed gear drive operators.
 4. Ends of valves shall accommodate the type of pipe installed.
- C. Check: Swing.
1. Smaller than 100 mm (4 inches): Bronze body and bonnet, ASTM B61 or B62, 850 kPa (125 pound) WSP.
 2. One hundred mm (4 inches) and larger: Iron body, bronze trim, vertical or horizontal installation, flange connection, 1375 kPa (200 pound) WOG.
- D. Pressure Reducing Valve: Cast steel body with renewable seats, with stainless steel trim. Flow passages and all parts designed to withstand high velocity applications, flange connected.

2.3 VALVE BOX

- A. Gate and Butterfly Valve: Valve boxes shall be precast concrete (from Rigid Cast Iron Forms) with compressive strength of the concrete in excess of 30 Mpa (4000 psi). Box shall be of such length to be adapted to depth of cover required over pipe at valve location. Mark box cover to differentiate between lawn irrigation system and domestic water supply system and set flush with finished grade. Provide two "T" handle socket wrenches of 15 mm (5/8 inch) round stock with sufficient length to extend 600 mm (2 feet) above top of deepest valve box cover.
- B. Remote Control Valves: When in pavement, valve boxes shall be precast concrete (from Rigid Cast Iron Forms) with compressive strength of the concrete in excess of 30 MPa (4000 psi). In planter areas, valve boxes shall be HDPE structural foam Type A, Class III, green in color. Box shall be minimum 475 mm (19 inches) long by 350 mm (14 inches) deep with key-lockable hinged cast iron cover.
1. After installation, label boxes with two 80 mm (3 inch) size stencils designated controller and circuit numbers with permanent white epoxy paint. Numbers shall be placed at center of valve cover and shall face nearest main road or service road.
 2. Furnish four 750 mm (30 inch) long valve adjustment keys.

- C. Drip zone Lateral Flush Cap Assembly: Round reinforced plastic valve box and lid constructed from HDPE. Opening at top of access box to be 14.5 cm (5-3/4") diameter, minimum. Height of access box to be 23cm (9-1/16"), minimum. Lid to have lift-hole for opening.

2.4 BACKFLOW PREVENTER

Provide reduced pressure principle backflow preventer in each new connection to existing water distribution system, ASSE 1013, except pressure drop at design flow shall not exceed 70 kPa (10 psi).

2.5 WATER METER

- A. Furnish and install meter approved by Public Service Company. Forward approval before installation.

2.6 PRESSURE GAUGES:

ANSI B40 1, 114 mm (4-1/2 inch) diameter, all metal case, bottom connected. Dial shall be either dead black or white lacquered throughout. Provide shut-off cocks. Maximum graduations of 10 kPa (2 psi).

2.7 AUTOMATIC CONTROL EQUIPMENT—INDEPENDENT ELECTRIC CONTROLLER WITH NO FLOW SENSING (FOR SMALLER INSTALLATIONS)

- A. Overall control concept: The electric automatic control system shall consist of one controller which operates individual remote control valves in accordance with timing schedules programmed into the independent unit. The location of the controller is shown on the drawings. Toro Custom Command Series, or equal.
- B. 4 independent programs.
- C. Seven (7) day calendar, odd/even day or day interval options of one (1) to thirty (30) days.
- D. Exclude a day option to allow for the selection of specific day(s) not to water.
- E. Three hundred sixty-five (365) day clock/calendar.
- F. Station run times of one (1) minute to ten (10) hours in one (1) minute increments.
- G. 16 total start times.

- H. Start time stacking within each program.
- I. Season adjust setting from ten (10) to two hundred (200) percent in ten (10) percent increments.
- J. Rain delay setting from one (1) to seven (7) days
- K. Automatic, semi-automatic, and manual and timed-manual operation.
- L. 10 position programming dial and LCD display.
- M. Lightning surge protection.
- N. Self-diagnostic circuit breakers that identify and override electrical malfunction of valves.
- O. Non-volatile memory to retain power during power failures of any duration.
- P. Battery backup to maintain accurate time for up to ninety (90) days.
- Q. Sensor hook-up with sensor override switch on faceplate.
- R. Weather-resistant, locking metal cabinet with heavy duty internal transformer.

2.8 REMOTE CONTROL VALVES:

- A. Each sprinkler section shall be automatically operated by a remote control valve installed underground and operated by a 24-volt AC electric solenoid. Valves shall be globe type of heavy duty construction and shall have manual shut-off and flow control adjustment and provide for manual operation. Install valves with unions on each side to allow for easy removal. Valves shall have a minimum of 1025 kPa (150 psi) working pressure.
- B. Valves shall be of all brass construction furnished as straight or angle pattern type, or valve body shall be cast-iron with brass bonnet, trim and renewable seat and have two inlet tappings (furnished with one plugged) to allow installation as either a straight or angle pattern valve.
- C. Valves shall be diaphragm type designed to operate in water containing sand and debris and shall have a self cleaning type contamination filter to filter all water leading to the solenoid actuator and the diaphragm chamber. Valve shall incorporate a non-adjustable type opening and closing speed control for protection against surge pressures, or valves shall operate by

means of a slow acting direct drive thermal hydraulic motor without ports, screens or diaphragms.

- D. Valves shall be completely serviceable from the top without removing valve body from the system. Furnish four 750 mm (30 inch) long adjustment keys. Valves to operate at no more than 50 kPa (7 psi) pressure loss at manufacturers maximum recommended flow rate.

2.9 SPRINKLER HEADS

- A. Shall be of make, type and performance as indicated on drawings. The entire internal assembly including filter screen, to be capable of removal from the top without removing the sprinkler case from the riser.
- B. Rotary Pop-up Sprinklers: To be gear-driven.
 - 1. Full Circle Sprinklers: To be a dual or tri-nozzle combination type with positive drive by means of a water-driven gear assembly. Sprinkler head to rotate uniformly and to be driven by means of a train of gears. Sprinklers to be equipped with an integral anti-drain valve to be self-closing at pressures of 3.0m (10 feet) of head or less. Gears and pinions shall be assembled on stainless steel spindles in a water-lubricated sandproof gear case. An inlet screen shall prevent debris from entering the sprinkler and shall be removable with the internal assembly. Sprinklers outer case shall be constructed of corrosion resistant, impact resistant, heavy-duty ABS.
 - 2. Part circle sprinklers to be variable arc type as required with same type drive used for full circle heads.
- C. Shrub Spray Heads: Nozzle shall be pop-up or fixed spray type of standard, undersize or oversize configuration as noted on plans. The sprinkler body, stem, nozzle and screen shall be constructed of heavy-duty, ultraviolet resistant plastic. It shall have a heavy duty stainless steel retract spring and a ratcheting system for alignment of the pattern. The sprinkler shall have a soft elastomer pressure-activated comolded wiper seal for cleaning debris from the pop-up stem. The sprinkler shall have a plastic or brass nozzle with an adjusting screw capable of regulating the radius and flow. The sprinkler shall be capable of housing protective, nonclogging filter screens or pressure compensating screens (PCS) under the nozzle.

2.10 QUICK COUPLERS

- A. Shall have all parts contained in a two-piece unit and shall consist of a coupler water seal valve assembly and a removable upper body to allow the spring and key track to be serviced without shut down of the main.
- B. Metal parts shall be brass.
- C. Lids shall be lockable vinyl covered and have springs for positive closure on key removal.
- D. Furnish four hose swivels and operating keys for each size coupler to the COTR.

2.11 LOW VOLTAGE CONTROL VALVE WIRE

Wire: Solid copper wire, Underwriters Laboratories Inc. approved for direct burial in ground. Size of wire shall be in accordance with manufacturer's recommendations, but in no case less than No. 14.

2.12 SPlicing MATERIALS: EPOXY WATERPROOF SEALING PACKET. LOW VOLTAGE CONTROLLER CABLE

Multi-strand cable, Underwriters Laboratories Inc. approved for direct burial in ground. Size and type of wire shall be in accordance with manufacturer's recommendations.

2.13 SLEEVE MATERIAL

PVC-1120-5DR 17, Schedule 40.

2.14 WARNING TAPE

Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape, non-detectable type blue with black letters (if potable water), or purple with black letters (if reclaimed or untreated well water), and imprinted with "CAUTION BURIED IRRIGATION WATER LINE BELOW".

A. TRACER WIRES

No. 14, Green, Type TW plastic-coated copper tracer wire shall be installed with non-metallic irrigation main lines.

PART 3 - EXECUTION**3.1 PIPE LAYING - GENERAL**

- A. Do not lay pipe on unstable material, in wet trench or when, in the opinion of COTR, trench or weather conditions are unsuitable for the work.
- B. Concrete thrust block shall be installed where the irrigation main changes direction as at ells and tees and where the irrigation main terminates. Pressure tests shall not be made for a period of 36 hours following the completion of pouring of the thrust blocks. Concrete thrust blocks for supply mains shall be sized and placed in strict accordance with the pipe manufacturer's specifications and shall be of an adequate size and so placed as to take all thrust created by the maximum internal water pressure.
- C. Allow a minimum of 80 mm (3 inches) between parallel pipes in the same trench.
- D. Hold pipe securely in place while joint is being made.
- E. Do not work over, or walk on, pipe in trenches until covered by layers of earth well tamped in place to a depth of 300 mm (12 inches) over pipe.
- F. Full length of each section of pipe shall rest upon the pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipe on wood blocking.
- G. Install sprinkler lines to avoid heating trenches, electric ducts, storm and sanitary sewer lines, and existing water and gas mains, all of which have right of way.
- H. Clean interior of pipe of foreign matter before installation. Keep pipe clean during laying operations by means of plugs or other methods. When work is not in progress, securely close open ends of pipe and fittings to prevent water, earth, or other substances from entering.
- I. Each sprinkler section shall drain to waste valves placed at lowest points in the system. Waste valves shall discharge to drainage pits composed of 3 foot long vertical sections of 600 mm (24 inch) diameter sewer pipe placed under the lawn areas. Fill pipe with gravel and cover with 50 mm (2 inch) precast concrete cover before backfilling. Waste valves may also discharge to storm sewers, where available.

- J. Minimum cover over water mains shall be 750 mm (30 inches). Control valves shall never be less than 80 mm (3 inches) below finished grade. Cover laterals to minimum depth of 600mm (24 inches).
- K. Existing sidewalks and curbs shall not be cut during trenching and installation of pipe. Install pipe under sidewalks and curbs by jacking, auger boring, or by tunneling. Repair or replace any concrete that cracks, due to settling, during the warranty period.
- L. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- M. Warning tape shall be continuously placed 300 mm (12 inches) above sprinkler system water mains and laterals.

3.2 LAYING PLASTIC PIPE

- A. Shall be snaked in trench at least 1 meter to 100 meters (1 foot per 100 feet) to allow for thermal construction and expansion and to reduce strain on connections.
- B. Joints
 1. Solvent Welded Socket Type: ASTM D2855.
 2. Threaded Type: Apply liquid teflon thread lubricant of teflon thread type. After joint is made hand tight (hard), a strap wrench should be used to make up to two additional full turns.
 3. Elastomeric Gasket: ASTM F477.
 - a. Immediately before joining two lengths of PVC pipe, the inside of the bell or coupling, the outside of the spigot and the elastomeric gasket shall be thoroughly cleaned to remove all foreign material.
 - b. Lubrication of the joint and rubber gasket shall be done in accordance with the pipe manufacturer's specifications.
 - c. Care shall be taken that only the correct elastomeric gasket, compatible with the annular groove of the bell, is used. Insertion of the elastomeric gasket in the annular

groove of the bell or coupling shall be in accordance with the manufacturer's recommendations. Pipe that is not furnished with a depth mark shall be marked before assembly to assure that the spigot end is inserted to the full depth of the joint.

- d. The spigot and bell or coupling shall be aligned and pushed until the reference line on the spigot is flush with the end of the bell or coupling. Pushing shall be done in a smooth, steady motion.

3.3 INSTALLATION OF SPRINKLERS AND QUICK COUPLERS

- A. Sprinkler heads and quick couplers shall be placed on temporary nipples extending at least 80 mm (3 inches) above finished grade. After turf is established, remove temporary nipples, ensuring that no dirt or foreign matter enters outlet, and install sprinkler heads and quick couplers at ground surface as detailed.
- B. Place part-circle rotary sprinkler heads no more than 150 mm (6 inches) from edge, of and flush with top of adjacent walks, header boards, curbs, and mowing aprons, or paved areas at time of installation.
- C. Install all shrub sprays, sprinklers and quick couplers on swing joints as detailed on plans.
- D. Set shrub heads 200 mm (8 inches) above grade and 300 mm (1 foot) from edge of curb or pavement. Place adjacent to walls. Stake heads prior to backfilling trenches. Stakes to be parallel to riser.
- E. Install sprinklers and quick coupling valves on a swing joint assembly.

3.4 INSTALLATION OF CONTROL WIRING

- A. Wiring from master controllers to satellites and stub-cuts for future extension shall be located in trench with new mains or in separate trench at back of curb, unless cross-country route is shown. Locate in trench with mains when possible on cross-country routes.
- B. Wiring bundles located with piping shall be set with top of the bundle below top of the pipe. No two wires in any bundle shall be of the same color. Wires shall be bundled, and tied or taped at 4.5 m (15 foot) intervals. A numbered tag shall be provided at each end of a wire, i.e., at valve, at field located controllers and at master controller. The number at each end of wire to be the same.

- C. Splicing shall be held to a minimum. A pullbox shall be provided at each splice. No splices will be allowed between field located controllers and remote control valves.
- D. Provide 300 mm (12 inch) expansion loops in wiring at each wire connection or change in wire direction. Provide 600 mm (24 inch) loop at remote control valves.
- E. Power wiring for the operation of irrigation system shall not be run in same conduit as control wiring.

3.5 Tracer Wire installation

- A. Tracer wire shall be installed on bottom of trench, adjacent to vertical pipe projections, carefully installed to avoid stress from backfilling, and shall be continuous throughout length of pipe with spliced joints soldered and covered with insulation type tape.
- B. Tracer wire shall follow main line pipe and branch lines and terminate in yard box with gate valve controlling these main irrigation lines. Provide sufficient length of wire to reach finish grade, bend back end of wire to make a loop and attach a Dymo-Tape type plastic label with designation "Tracer Wire."
- C. Record locations of tracer wires and their terminations on project record documents.

3.6 SETTING OF VALVES

- A. No valves shall be set under roads, pavement or walks.
- B. Clean interior of valves of foreign matter before installation.
- C. Where pressure control valves are installed adjacent to remote control valve, they shall be housed in the same valve box.
- D. Set valve box cover flush with finished grade.

3.7 SLEEVING

- A. Furnish and install where pipe and control wires pass under walks, paving, walls, and other similar areas.
- B. Sleeving to be twice line size or greater to accommodate retrieval for repair of wiring or piping and shall extend 300 mm (12 inches) beyond edges of paving or construction.

- C. Bed sleeves with a minimum of 100 mm (4 inches) of sand backfill above top of pipe.

3.8 TEST AND FLUSHING

- A. Pressure Test: Pressure test lines before joint areas are backfilled. Backfill a minimum of 300 mm (12 inches) over the pipe to maintain pipe stability during test period. Test piping at hydraulic pressure of 1025 kPa (150 psi) for two hours. Maximum loss shall be 3 L/25 mm pipe diameter/300 m (0.8 gallons/inch pipe diameter/1000-feet). Locate pump at low point in line and apply pressure gradually. Install pressure gage shut-off valve and safety blow-off valve between pressure source and piping. Inspect each joint and repair leaks. Line shall be retested until satisfactory.
- B. Flushing: After testing, flush system with a minimum of 150 percent of operating flow passing through each pipe beginning with larger mains and continuing through smaller mains in sequence. Flush lines before installing sprinkler heads and quick couplers.
- C. Operation Test: Upon completion of the final adjustment of the sprinkler heads to permanent level at ground surface, test each sprinkler section by the pan test and visual test to indicate a uniform distribution within any one sprinkler head area and over the entire area. Operate the entire installation to demonstrate the complete and successful operation of all equipment.

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