



DENVER

THE MILE HIGH CITY

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS | ENGINEERING DIVISION

Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications

21.0 Sprinkler Systems

21.0.1 General

This section outlines the guidelines and requirements required to construct irrigation distribution lines and sprinkler systems required to complete construction per the Contract Documents.

The work shall include the installation of all line pipes, fittings, valves, and blow-offs, drain valves, controllers, electrical control and supply wires, all fittings and tapped couplings necessary for the connection of the lateral sprinkling system lines to the distribution system lines, etc. Also included will be the plugging and blocking of the cut ends of disconnected existing lines if any, connection to existing park water lines and/or city water mains, meter installation, and all fittings, valves, accessories, etc. necessary for these connections.

The pipe shall be installed to the prescribed lines and grades. All work required for the construction of the water lines, accessories and appurtenances thereto, including excavation, trenching, concrete work, pressure tests and miscellaneous items of work covered by the Plans and these Detail and Technical Specifications shall be preformed.

21.0.2 Proposed Substitutions

Substitutions which will result in any changes in layout, installation, or coverage as designed and shown on the Plans and specified herein shall be accompanied by plans clearly showing the proposed installation including but not limited to materials, spacing, precipitation and scheduling. Such plans must be approved by the Project Construction Engineer before work is to start.

21.0.3 Qualifications of Installers

The sprinkler system contractor shall have had considerable experience and demonstrated ability in the installation of sprinkler irrigation systems of this type. All work shall be installed by skilled persons proficient in the trades as required, in a neat, orderly and responsible manner with recognized standards of workmanship. At least one person shall be present at all times during the execution of this work who shall be thoroughly familiar with the type of materials being installed and the material manufacturers' recommended methods of installation and who shall direct work performed under this section.

21.0.4 Staking

All necessary staking for construction of the sprinkler system shall be done by the Contractor and checked by the City before excavation or installation is begun.

21.0.5 Material

Unless otherwise noted or approved, all materials shall be of the type as shown on the Plans and shall conform to the following specifications. Asbestos Cement Pipe shall not be used.

21.0.5.1 Plastic Pipe

1. Rigid Plastic Pipe

Shall be polyvinyl chloride (PVC) and shall conform to all requirements of Product Standard PS-22 or ASTM D-2241 or PVC 1120 (Type I), SDR-21 (Class 200). Pipe shall be National Sanitation Foundation (NSF) approved. Fittings shall be socket type PVC schedule 40 meeting all requirements of ASTM D-2466 and D-1784. Solvent used for joining pipe & fittings shall meet all requirements of ASTM D-2564 Rigid plastic pipe shall not be threaded except as noted below.

2. Riser and Swing Joint Nipples

Shall be PVC Schedule 80 threaded pipe and shall conform to all requirements of Product Standard PS-21 or ASTM D-1785. Fittings shall be threaded PVC Schedule 40 meeting all requirements of ASTM D-2466 and D-1784. Use teflon tape on all threaded joints.

3. Flexible Plastic Pipe

Shall be polyethylene (PE), 80 psi rated and shall conform to all requirements of Product Standard PS-11 or ASTM D-2239 or PE-2306, SDR-15. Pipe shall be National Sanitation Foundation (NSF) approved. Fittings shall be insert type PVC meeting requirements of ASTM D-2609. Clamps shall be all stainless steel. Flexible plastic pipe shall not be used in any continuous pressure application.

4. Markings

All plastic pipe shall be continuously & permanently marked with the manufacturers name, pipe size, schedule number or SDR number, type of material and code number.

21.0.5.2 Copper Pipe

Copper pipe shall be type K copper, ASTM B-88. Fittings for copper pipe shall be wrought copper or cast bronze, 150 psi class. Joints shall be solder joints with 95-5 tin-antimony.

21.0.5.3 Galvanized Steel Pipe

Galvanized Steel Pipe shall be schedule 40 steel. Fittings shall be malleable galvanized iron, screwed pattern, 150 psi class. Galvanized pipe and fittings shall conform to ASTM A-120. Buried galvanized pipe except risers and casing shall be wrapped with heavy craft paper applied with hot asphalt. Wrap on fittings shall be glass cloth. Use teflon tape on all threaded joints.

21.0.5.4 Gate Valves

Gate Valves shall be Class 125 (200 psi w.o.g.), shall open by turning to the left, shall have non-rising stems and shall have a clear waterway equal to the full nominal diameter of the valve. Gate valves (not buried) shall have solid wedges, union bonnets and shall comply with the following materials specifications: Handwheel Nut -Bronze ASTM B-16. Stem -Silicon Bronze ASTM B-371 Alloy A (Rod) or ASTM B-198 Alloy 13B; Packing -Teflon impregnated Asbestos; Packing Gland -Bronze ASTM B-62 or B16 ; Packing Nut, Stuffing Box, Bonnet, Union Nut, Body Wedge and Wedge Holder- Bronze ASTM B-62. These valves shall conform to Federal Specification WW-V-54C Class A, Type I. Buried gate valves 2 and larger shall conform to AWWA C-500, with double-disk wedges and O-ring seals.

21.0.5.5 Valve Boxes

Unless shown or noted otherwise, all underground valves not located in pits shall have cast iron boxes with flared bases. Valve boxes shall be 2 piece screw type.

21.0.5.6 Angle Valves

Angle Valves shall be rated at 150 psi or more, and shall open by turning to the left. Angle valves shall be designed for above or below ground installation with suitable cross wheel for operation with key. Valves shall have removable bonnet and stem assembly with packing gland nut and with replaceable seat washers. Angle valves shall be heavy pattern brass construction of the make and size shown on Plans or approved equal.

21.0.5.7 Drain Valves

Drain Valves shall be rated at 150 w.o.g. or more, shall open by turning to the left, and shall be the make and size as shown on Plans or approved equal. Unless shown or noted otherwise, drain valves shall be 3/4". If valve discharge is not downward, valves shall be provided with elbow for downward discharge.

21.0.5.8 Quick Coupler Valves

Quick Coupler Valves shall be 2 piece all brass construction of the make and size as shown on Plans or approved equal. Quick coupler keys and hose swivels shall be provided as shown on the Drawings.

21.0.5.9 Manual Control Valves

Manual Control Valves shall be either angle valves as described herein or Class 125 bronze globe valves meeting requirements of Federal Specification WW-V-51d Class A, Type I. They shall be of the make and size as shown on Plans or approved equal. Valves shall be key operated.

21.0.5.10 Electric Control Valves

Electric Control Valves shall be brass construction, normally closed, 24 volt AC electrically operated globe valves with slow-opening and slow-closing devices. They shall be of the make, model numbers, and size as shown on the Plans or approved equal.

21.0.5.11 Valve Keys

Two valve keys shall be provided for each type key operated valve installed.

21.0.5.12 Unions

Brass unions shall be provided where shown and/or required to allow removal of all control valves.

21.0.5.13 Valve Pits

Valve Pits shall be constructed as shown in the Valve Pit and Piping Detail. of these Detail and Technical Specifications. Concrete shall conform to the requirements of Item 12 of the Standard Construction Specifications. Precast concrete rings or fiberglass pits and their respective covers may be submitted for approval by the Project Construction Engineer.

21.0.5.14 Automatic Controllers

Automatic Controllers shall be 110 volt input, 24 volt AC value output with both controller and control valves of the same manufacturer, designed to operate as a unit or as otherwise shown on the Plans. Controllers shall be capable of operating the number of valves shown on the Plan and shall be pedestal mounted unless shown otherwise on the Plans. Controllers shall have a 2 hour clock, 14 day calendar wheel and individual station timers from 0 to 30 minutes. Manufacturer and model numbers shall be as shown on the Plans or approved equal. Unless located inside of a building, the controller shall be enclosed in an approved separate weatherproof, vandal resistant cabinet. A lock and 3 keys shall be furnished with each unit.

21.0.5.15 Sprinkler Heads

Sprinkler Heads of the type and size as shown on the Plans shall be furnished and installed as herein specified.

21.0.5.16 Electric Control Wiring

Electric Control Wiring shall be No.14 direct burial type U.F. cable or larger if required to operate the system as designed. Follow the recommendations of the controller manufacturer for sizing wire.

21.0.6 Installation

21.0.6.1 General

Prior to any work described in this section, the Contractor shall carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. The Contractor shall verify that the irrigation system can be installed in strict accordance with all pertinent Permits, codes and regulations, the original design, the referenced standards and the manufacturers recommendation. All necessary field measurements shall be made by the Contractor to ensure precise fit of items in accordance with the original design.

21.0.6.2 Excavation

Plastic pipe up to 2" in diameter may be direct bore if approved by the Project Construction Engineer. All other lines shall be installed in open cut trenches. The width of the trench in which the pipe will be placed shall be sufficient to allow thorough tamping of suitable backfill material under, around and over the pipe. All excavated material shall be deposited at least two feet away from any trench side. Tunneling will be permitted only where pipe must pass under any obstruction which cannot be removed. In backfilling the tunnel, the final density of the backfill must match that of the surrounding soil. It shall be acceptable to use a casing of suitable diameter which shall be installed first by tunneling or jacking, and the pipe shall then be laid through the casing, observing the same precautions as though it were installed in open trench. Any trench deeper than 6 feet shall be adequately shored and/or braced for safety considerations. If ground water is encountered during trench excavation above the elevation of the bottom of the pipe bell, such water shall be removed until the pipe has been installed and the trench backfilled. The Contractor shall take all necessary measures to insure that no ground water enters the pipe.

21.0.6.3 Piping and Control Wiring Depth

All lines shall be installed with the following minimum depths of cover unless noted otherwise on the drawings:

- a. Pressure Lines 30"
- b. Distribution Lines (Laterals) 6" to 18"
- c. Lines to Drinking Fountains 30"
- d. Lines to Quick Couplers 30"
- e. Electrical Lines 24"

21.0.6.4 Piping

All pipes shall be installed according to the following specifications.

1. Rigid Plastic Pipe

Exercise care in handling, loading unloading and storing plastic pipe and fittings; store plastic pipe and fittings under cover until ready to be installed; transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load. Repair all dented and damaged pipe by cutting out the dented or damaged section and rejoining with a coupling. In jointing, use only the specified solvent and make all joints in strict accordance with the manufacturer's recommended methods; give solvent welds at least 15 minutes set-up time before moving or handling; and 24 hours curing time before filling with water. If manufacturers recommendations do not cover all aspects of jointing, the recommendations of Plastics Pipe Institute Technical Report TR10 shall be followed. Piping shall be snaked in the trench, centerload the pipe with a small amount of backfill to prevent arching and deflection under pressure. All piping shall be sloped to drain and shall not be installed when air temperature is below freezing.

2. Flexible Plastic Pipe

Shall be installed in strict accordance with the manufacturer's recommendation. If the manufacturer's recommendation does not cover all aspects of installation the recommendations of the Plastics Pipe Institute Technical Report TR8 shall be followed. Piping shall be sloped to drain. Saddle tee connections shall not be used. Pipe shall not be installed when air temperature is below freezing.

3. Copper Pipe

Shall be installed according to manufacturer's recommendations. When copper pipe is jointed to any metal pipe or equipment other than copper it shall be by means of dielectric unions. Pipe shall be sloped to drain.

4. Galvanized Steel Pipe

Make all cuts in galvanized pipe square. Cuts shall be thoroughly reamed with all rough edges and burrs removed. Use joint tape on male threads only. Pipe shall be sloped to drain.

21.0.6.5 Valves and Valve Boxes

Installation of Valves and Valve Boxes shall be in accordance with the following:

1. Gate Valves

Shall be installed where shown on the Plans and shall be set plumb. Gate valves 6. and larger shall be anchored to a block of concrete to insure stability of the valve in an upright position. Anchor valve in such a manner that it may be removed and re-installed without breaking the concrete block.

2. Valve Boxes

Shall be installed where shown on the Plans and shall be set plumb. Gate valves 6" and larger shall be anchored to a block of concrete to insure stability of the valve in an upright position.

Anchor valve in such a manner that it may be removed and re-installed without breaking the concrete block.

3. Angle Valves and Drain Valves

Shall be installed where shown on the Plans and also at other low points in the system as necessary to insure complete drainage of the system. Each valve not in a valve pit shall be provided with a C.I. Valve box with the lid set flush with the ground. Drain valves set below valve pits shall have PVC sleeves for key operation. Sleeves shall project a minimum of 12" from the pit bottom and shall have removable caps. A drainage sump shall be provided for each drain valve and shall contain a minimum of 4 cubic feet of gravel. See "Valve & Pit Piping Detail" of these Detail and Technical Specifications.

4. Quick Coupler Valves

Shall be installed where shown on the plans and as shown in "Valve Pit & Piping Detail". Risers for quick couplers shall be schedule 40 galvanized. In lawn areas install quick coupling valves using a double swing joint top flush to final grade. In planting areas install with top 2" above grade.

5. Manual Control Valves

Shall be installed where shown on the Plans and in accordance with manufacturer's recommendations. All manual control valves shall be in valve pits or valve boxes.

6. Electric Control Valves

Shall be installed as shown in "Valve Pit & Piping Detail". Valves shall be installed in such a way that they are accessible for repairs and/or removal.

21.0.6.6 Valve Pits

Install valve pits where shown on the Plans and as shown in "Valve Pit & Piping Detail".

21.0.6.7 Automatic Controllers

Install controllers where shown on the Plans and in accordance with the manufacturer's recommendations and, if pedestal type, as shown on "Controller Pedestal Detail" of these Detail and Technical Specifications.

21.0.7 Flushing

Before sprinkler heads are set, the lines shall be thoroughly flushed in order to make sure that there is no foreign matter in lines which could cause stoppage of the sprinklers. When the system has been fully completed, it shall be tested and the operation thereof demonstrated to the City.

21.0.8 Inspection

No work shall be covered up or enclosed until it has been inspected, tested and approved by the City. The Contractor shall thoroughly clean, adjust and balance all systems. The Contractor shall demonstrate the entire system to the City proving that all remote control

valves are properly balanced, that all heads are properly adjusted for radius and arc of coverage and that the installed system is workable, clean and efficient.

21.0.9 Testing

The Contractor shall furnish all necessary testing equipment and personnel and test the system as follows:

- a. make all necessary provisions for thoroughly bleeding the line of air.
- b. Before testing, fill the line with water for a period of at least 24 hours.
- c. After valves have been installed, test all live water lines for leaks at a hydrostatic pressure of 150 psi for a period of two hours with all couplings exposed and with all pipe sections centerloaded.
- d. Correct all leaks, and replace damaged or faulty pipe and retest until accepted by the City.

21.0.10 Backfilling

Trenches shall be carefully backfilled with suitable materials free from clods of soil or stones larger than three inches (3.) in maximum dimension. Deposit the backfill materials equally on both sides of the pipe in 6" layers and compact thoroughly. Puddling or "ponding" shall be required. An excess of water shall be avoided in order to prevent disturbance of the earth under and around the pipe and also to prevent undue pressure upon the pipe. Likewise, the amount of water used shall be controlled so as not to risk "floating" the pipe out of position. Adequate dikes shall be constructed along the trench to retain and guide the water.

When jetting is used, jets shall be of an approved design and of sufficient length to reach the bottom of each layer and the water supply shall be continuous. All costs incurred in getting the water to the point of use for the above purposes shall be borne by the Contractor. Excavated material will generally be considered satisfactory for backfill purposes. All backfill material shall be free from rubbish, vegetable matter, frozen materials, or stones larger than three inches (3.) in maximum dimension. Any material not suitable for backfill or not used shall be removed from site by the Contractor. Backfill shall not be done in freezing weather except with written approval from the City. All trenches shall be left slightly mounded to allow for settlement after the backfilling is completed. The site of the work shall be continuously cleaned up of excess and/or waste materials as the backfilling progresses and shall be left in a neat and workmanlike condition to the satisfaction of the City. Any undue settling which results within one year after final acceptance of work shall be corrected by the Contractor and at the Contractor's expense including resurfacing as required.

21.0.11 Area Restoration

Where trenches and lines cross existing roadways, paths, curbing, etc., damage to these shall be kept to a minimum and they shall be restored to as near original condition as possible. Match existing road section for blacktop paving thoroughly compacted sub-base, base course, bituminous course matching grades of existing paving. Blacktop curbs hot mix bituminous course material tamped and shaped to match adjoining curbs. Concrete paving or

curbs concrete to match adjoining concrete work. The quality of the materials used in this restoration shall be equal to or better than the material which was removed, or as shown on the Plans or specified

21.0.12 Water Service

21.0.12.1 Scope

This work consists of providing water service for the sprinkler system by connecting the system to existing park water lines and/or city water mains. The work includes the furnishing of all labor, supervision, construction equipment and materials including piping, valves, meters, meter pits and backflow prevention devices. All work required to complete the water service in conformance to the Plans and Specifications including excavation, trenching, concrete work pressure tests, and miscellaneous items of related work shall be preformed.

21.0.12.2 Workmanship

All materials and equipment shall be installed in a first class, workmanlike manner using workmen who are skilled and certified in their respective trades.

21.0.12.3 Building Code

All work shall be in accordance with the Denver Building Code, latest revision.

21.0.12.4 Connection to Existing Park Water Lines

Connection to Existing Park Water Lines shall be made by tapping sleeves, tees or crosses. All fittings shall have a design working pressure of 150 psi; all material shall conform to the requirements herein specified

21.0.12.5 Connections to City Water Mains

Connections to City Water Mains shall be done in accordance with Denver Water Board Requirements and regulations.

21.0.12.6 Materials

Unless otherwise noted or approved, all material shall conform to the following Specifications .

1. Copper Pipe

Shall be Type k copper, ASTM B-88. Fittings for copper pipe shall be wrought copper or cast bronze, 150 psi class. Joints shall be solder joints with 95-5 tin -antimony.

2. Cast Iron Pipe

Shall meet the requirements of AWWA Standards C-101 and C-I06 for 150 psi working pressure. Unless otherwise noted, cast iron pipe shall have push on type joints approved by the Project Construction Engineer and installed in strict accordance with manufacturers recommendations. Cement lining shall conform to AWWA Standard C-104. Rubber gasket joints shall conform to AWWA Standard C-111.

3. Curb Valves

All curb valves between the main and the meter shall be rated at 175 psi w.o.g., and shall open by turning to the right. Curb valves shall be all bronze with "O" ring seals. Curb valves shall have cast iron curb boxes complete with lid and foot piece designed for use with the curb valve. Make and size shall be as shown on the Plans. Curb valves must be approved by the Denver Water Board.

4. Gate Valves

All gate valves used in conjunction with water meters shall be as approved by the Denver Water Board.

5. Water Meter

The size shall be as shown on the Meter and shall be of the type approved by the Denver Water Board.

6. Backflow Preventer Device

Shall be of the type as shown on the Plans. The backflow prevention device must be approved by the Denver Water Board and shall be furnished with inlet and discharge shut-off valves.

7. Pit for Water Meter

Shall be as per Denver Water Board requirements. Water Service installation shall conform to the following specifications.

a. Excavation. The width of the trench in which the pipe will be placed shall be sufficient to allow thorough tamping of suitable backfill material under, around and over the pipe. All excavated materials shall be deposited at least two feet away from any trench side. Any trench deeper than 6 feet shall be adequately shored and/or braced for safety considerations. If ground water is encountered during trench excavation above the elevation of the bottom of the pipe bell. All water shall be removed until the pipe has been installed and the trench backfilled.

b. Cast Iron Pipe shall be installed in accordance with the recommendations of the manufacturer. Unless noted otherwise or approved by the Project Construction Engineer, cast iron pipe shall be embedded in and covered by a minimum of 6 inches of pea gravel; max. 3/8" dia.

c. Copper Pipe shall be installed in accordance with the manufacturer's recommendations. When copper pipe is jointed to any metal pipe or equipment other than copper, brass or bronze, it shall be by means of dielectric unions.

d. Testing required for this portion of the system shall be the same as that described in Section 21.3 of these Detail and Technical Specifications.

e. Backfilling requirements shall be the same as those described in Section 21.3 of these Detail and Technical Specifications.

f. Restoration. Requirements for restoring area shall be the same as those described in Section 21.3 of these Detail and Technical Specifications.

21.0.13 Electrical Service

21.0.13.1 Scope

This work consists of providing electrical service to the automatic sprinkler controllers. The work includes the furnishing of all labor, supervision, construction equipment and materials including wire, conduit, devices and appurtenances. All work required to complete the electrical service in conformity with the Plans and specifications including excavation, trenching and miscellaneous items of related work shall be performed.

21.0.13.2 Workmanship

All materials and equipment shall be installed in a first class, workmanlike manner, using workmen who are skilled and certified in their respective trades.

21.0.13.3 Code

All work shall be done in accordance with the Denver Building Code and the National Electrical Code, latest edition.

21.0.13.4 Materials and Installation

Material and Installation shall conform to the following specifications.

1. Wire

Shall be as shown on the Plans.

2. Sleeves

Shall be Schedule 40 galvanized steel All wires buried in roadways shall have sleeves.

3. Service Connections

Coordinate with Public Service Company, Street Lighting Division for electrical service connection.