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02810 - IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. The following related items of work included under other sections:
   1. Earthwork - Section 02200
   2. Water Distribution - Section 02660
   3. Landscape - Section 02900

1.02 SUMMARY

A. The work required under this Section consists of furnishing all labor materials, equipment, services and related items necessary to complete all irrigation system work, and all related work, complete as indicated on the drawings or specified herein.

B. The major items of work include, but are not limited to the following:
   1. Verify underground utility locations.
   2. Removal, protection and/or restoration of all existing improvements.
   3. Trenching and backfilling.
   4. Furnishing and installing a fully operational automatically controlled irrigation system, including all mains, laterals, fittings, quick coupling valves, gate valves, and drain valves, backflow preventer, etc.
   5. Testing of system and making it operative.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturing irrigation systems materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firms who have successfully completed execution of a minimum of five (5) contracts involving the installation of irrigation and piping work similar in size and scope to that required for this project. Such experience should be able to be demonstrated through references.

C. Codes and Standards:
   1. Comply with all applicable state and local ordinances and codes.
   2. All materials and work shall meet the requirements of the A.W.W.A., A.S.S.E. and the USC Foundation for Cross Connection Control.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for irrigation system materials and products.

B. Record Drawings: At project closeout, submit record drawings of in-

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stalled irrigation system piping and products, in accordance with requirements of Division 1.

C. Maintenance Data: Submit maintenance data and parts lists for irrigation system materials and products. Include these data, product data, shop drawings and record drawings in maintenance manual, in accordance with requirements of Division 1.

1.05 UTILITIES AND PROTECTION

Existing Utilities:

1. Contractor shall acquaint himself/herself with all site conditions. Should utilities not shown on the plans be found during excavations, contractor shall promptly notify the Owner for instructions as to further action. Failure to do so will make Contractor liable for any and all damage there to arising from his/her operations subsequent to discovery of such utilities not shown on plan.
2. Contractor shall necessary adjustments in the Layout as may be required to connect the existing stubouts. Should such stubs not be located exactly as shown, Contractor may be required to work around existing conditions at no increase in cost to the Owner.

1.06 PERMITS AND FEES

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

1.07 DRAWINGS, SPECIFICATIONS AND DETAIL SHEETS

Scale and Dimensions:

1. Consider drawings and specifications as being compatible and therefore work called for by one and not the other shall be furnished and installed as though called for by both. When discrepancies exist between scale and dimension or between the work to be accomplished by each trade, they shall be called to the Project Consultant's attention immediately. The Project Consultant's decision regarding such discrepancies shall be final and binding.
2. Where diagrams have been made to show piping connections, etc., Contractor is cautioned that these diagrams must not be used for obtaining lineal runs or number and type of fittings.
3. All measurements shall be verified at the site. Drawings may not be exactly to scale.

1.08 PIPING ARRANGEMENT

Suggestions for changes in location of piping, etc., advisable in the opinion of the Contractor, shall be submitted to the Project Consultant for approval before proceeding with the work, with written assurance that such changes will not cause any extra cost on their part or alteration of design requirements.

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1.09 GUARANTEE

A. Guarantee all work done for one (1) year from date of acceptance against all defects in material, equipment and workmanship. Guarantee shall cover repair of damage to any part of the premises resulting from leaks, or other defects in material, equipment and workmanship to the satisfaction of the Owner. Repairs, if required, shall be done promptly, at no cost to the Owner.

B. Guarantee will include spring start-up and winterizing of system within the one (1) year time and development of approved water application schedule. Winter damage due to improper winterization is the responsibility of the Contractor.

C. All repairs and servicing required under the guarantee period shall be made under the observation of the maintenance crew to help train them in the proper operation and repair of the system.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:

1. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings and capacities as indicated. Where not indicated, provide proper selection as determine by Installer to comply with installation requirements.
2. All materials throughout the system shall be new and in perfect condition.

B. Piping: Provide pipes of one of the following materials of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated.

1. Polyvinyl Chloride (PVC): Sized as shown on the drawings. All PVC pipe shall be continuously and permanently marked with manufacturer's name, material and schedule or type. Pipe shall conform to U.S. Department of Commerce Commercial Standard CS 256-63, or latest revision. All PVC pipe shall be SDR 21.
2. Fittings: Schedule 40, polyvinyl chloride (PVC) weight as manufactured by Spears or approved equal. Solvent weld or insert fittings are acceptable. No saddle type clamping or fittings shall be used. Fittings to conform to ASTM D-2466.

C. Valves:

1. Gate/Drain Valves: Shall be sized for mains. The valves shall be all bronze solid wedge, screw bonnet rated at 200 WOG.
2. Quick Coupling Valves: Shall be as noted on drawings and shall be 1" brass with locking top, and located up stream of all remote control valves.
3. Remote Control Valves: Electrically operated solenoid valves installed in valve boxes of appropriate size and type for valves specified with manual shut-off valve to match pipe size.

D. Dripperline and Integral Dripperline Components:

The dripperline shall be Techline pressure compensating dripperline or Techlite 17mm, 12mm, or 8mm non-pressure compensated dripperline

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as manufactured by Netafim Irrigation, Inc. Dripper flow rate and spacing shall be as indicated on drawings.

1. Techline/Techlite 17mm, 12mm or 8mm Fittings: All Techline/ Techlite connections shall be made with approved Techline/ Techlite insert fittings.
2. Soil Staples (TLS6): All on-surface/under mulch Techline/Techlite installations shall be held in place with Techline Soil Staples spaced evenly every 3' to 5' on center, and with two staples on each change of location.
3. Line Flushing Valves: All Techline/Techlite systems shall be installed with Netafim Automatic Line Flushing Valves as indicated on drawings.
4. Air/Vacuum Relief Valves: Each independent subsurface irrigation zone shall be installed with an Air/Vacuum Relief Valve at the zone's highest point(s).
5. Pressure Regulator: A pressure regulator shall be installed at each zone valve or on the main line to ensure operating pressures do not exceed system requirements. The pressure regulator shall be a Netafim Pressure Regulator. Model number as indicated on drawings.
6. Disc Filter: A disc filter shall be installed at each zone valve or on the main line to ensure proper filtration. The filter shall be a Netafim Disc Filter. Model number and mesh as indicated on drawings.

D. Reduced Pressure Backflow Prevention Units: Reduced pressure backflow prevention units shall be provided as indicated on drawings and shall be in compliance with local codes. Febco 825Y or approved equal.

F. Solvent Cement: Compatible with PVC pipe and or proper consistence ASTM D-2564.

G. Control Wires: 24-Volt solid wire, UL approved for direct burial in ground. Minimum wire size shall be 18 gauge. All wire to be Paige wire or approved equal.

H. Expansion Curls: Expansion curls shall be provided within three (3') feet of each wire connection to solenoid and at least every three hundred (300') feet in length. (Expansion curls are formed by wrapping at least five (5) turns of wire around a rod or pipe 1" or more in diameter, then withdrawing the rod).

I. Sleeves for Control Wires: Under all walks and paving and where indicated on drawings, PVC 1220-160 PSI pipe or galvanized heavy wall steel conduit. Minimum size 1½" I.D.

J. Sleeves for Irrigation Pipe: Under all walks and paving and where indicated on drawings, Schedule 80 PVC pipe or as otherwise approved by the Project Consultant. To be two (2) times the O.D. of sleeved pipe.

K. Valve Boxes: Valve boxes shall be of appropriate size and type for valves specified, or as otherwise indicated on the drawings. All valve boxes in roadways or sidewalks shall be cast iron construction with locking lid. All valve boxes to have 6" pea gravel; with blocking, and wrapped with filter fabric.

L. Drains: Air hose connections of approved design shall be provided for

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winterizing at several locations so that the entire system can be drained by blowing it out with compressed air. The compressor shall be capable of varying pressures.

M. Rubber Hose: A quantity of two (2) approved heavy duty rubber hoses, 100 feet long, for use with quick coupling valves shall be furnished by the Contractor.

PART 3 - EXECUTION

3.01 INSPECTION

General: Examine areas and conditions under which irrigation system's materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION OF IDENTIFICATION

General: Maintain all warning signs, shoring, barricades, flares and red lanterns as required by safety orders of the Division of Industrial safety and local ordinances.

3.03 INSTALLATION OF PIPING AND FITTINGS

A. Excavating and Trenching:

1. The Contractor shall perform all excavations as required for the installation of the work included under this section, including shoring of earth banks to prevent cave-ins. The contractor shall trench, each day, only as much as required for that day's work.
2. Trenches shall be made wide enough to allow minimum of two (2") inches between parallel pipe lines. Trenches for pipelines shall be made of sufficient depth to provide minimum cover from finish grade as follows:
   a. 15" minimum cover over main lines.
   b. 12" minimum cover over control lines from controller to valves.
   c. 4" – 6" cover over dripperline.

B. Pipe and Assembly:

1. Install remote valves where shown and group together where practical. Place valves no closer than six (6") inches to walk edges, buildings and walls. Locate all valve boxes in planting beds unless otherwise directed or noted.
2. No pipe shall be laid when, in the opinion of the Project Consultant, trench or weather conditions are unsuitable. When pipe laying is not in progress, the open ends of the installed pipe shall be closed by approved means to prevent entrance of trench water and other foreign material into the line(s). Enough backfill shall be placed in the center sections of the pipe to prevent floating. Any pipe that has floated shall be removed from the trench and re-laid.
3. PVC pipe and fittings shall be solvent welded using solvents and methods as recommended by the manufacturer of the pipe, except where screwed connections are required. Pipe and fittings

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shall be thoroughly cleaned of dirt, dust and moisture before applying solvent with a non-synthetic bristle brush.

4. Pipe may be assembled and welded on the surface. Snake pipe from side to side in the trench to allow for expansion and contraction.
5. Make all connections between plastic pipe and metal valves or steel pipe with threaded fittings using plastic male adapters.

C. Dripperline Installation:

1. Install all dripperline as indicated on drawings. Use only Teflon tape on all threaded connections.
2. Clamp Techline/Techlite fittings with Oetiker clamps when operating pressure exceeds specific dripperline fitting requirements.
3. When installing Techline/Techlite dripperline on-surface, install soil staples as listed below:
   a. Sand Soil - One staple every three (3') feet and two (2) staples on each change of direction (tee, elbow, or cross).
   b. Loam Soil - One staple every four (4') feet and two (2) staples on each change of direction (tee, elbow, or cross).
   c. Clay Soil - One staple every five (5') feet and two (2) staples on each change of direction (tee, elbow, or cross).
4. Cap or plug all openings as soon as lines have been installed to prevent the entrance of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.
5. Thoroughly flush all water lines before installing valves and other hydrants.
6. Test in accordance with Paragraph on Hydrostatic Tests.

F. Automatic Controllers: Connect remote control valves to controller in a logical sequence to correspond with specification of the Owner or Project Consultant.

G. Automatic Control Wiring:

1. Install control wires, sprinkler mains and laterals in common trenches whenever possible.
2. Install control wires at least six (6") inches below finish grade and lay to the side and below main line. Provide expansion curls as described herein.
3. Control wire splices will be allowed only in runs more than five hundred (500') feet. Connections of all underground wires shall by the use of wire nuts, covered with waterproof splice for each wire per installation instructions provided by the manufacturer, or as otherwise required by local ordinance.
4. All wires passing under existing or future paving, construction, etc., shall be encased in plastic or galvanized steel conduit extending at least twelve (12") inches beyond edges of paving or constructions.

H. Backfilling and Compacting:

1. After the system is operating, and required tests and inspections have been completed, backfill excavations and trenches with clean soil free of rubbish.

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2. Backfill for all trenches, regardless of type of pipe covered, shall be compacted to minimum ninety (90%) percent density.
3. Compact trenches in areas to be planted by thoroughly flooding the backfill.
4. Dress off all areas to finish grades.

3.04 FIELD QUALITY CONTROL

Hydrostatic Test:

1. Request the presence of the Owner and/or Project Consultant at least forty-eight (48) hours in advance of testing.
2. Testing to be accomplished at the expense of the Contractor, and in the presence of the Owner.
3. Center load piping with small amount of backfill to prevent arching or slipping under pressure.
4. Apply a continuous and static water pressure of sixty (60) PSI when welded plastic joints have cured at least twenty-four (24) hours and with the risers capped as follows:
   a. Main lines and sub mains to be tested for one (1) hour.
   b. Lateral lines to be tested for one (1) hour.
5. Repair leaks resulting from tests.
6. The lines shall then be retested until satisfactory.

3.05 INSTRUCTIONS

After completion and testing of the system, the Contractor will instruct the Owner's personnel in the proper operation and maintenance of the system.

3.06 PROTECTION

Contractor shall be responsible for work until finally inspected, tested and accepted. After delivery, and before and after installation, protect work against theft, injury or damage. Protect open ends of work with temporary covers or plugs during construction, to prevent entry of obstruction material.

END OF SECTION 02810

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Netafim Bid Specifications

Sample Only

Section 02905

PART 1

1. **SUBMITTALS** *(fill in the appropriate paragraph number)*
Submit (qty) copies of manufacturer's catalog cuts or current catalog of the following listed items:

1._._ Manufacturer's Catalog Data
a. Dripperline
b. Barbed insert fittings
c. Disc filter
d. Pressure regulators
e. PVC or Poly pipe
f. Line flushing valves
g. Air/Vacuum relief valves
h. Stainless steel clamps
i. Remote control valves
j. PVC threaded and inserts fittings
k. Metal ground stakes
(add or subtract to the following list as necessary)

1._ **SPARE PARTS**
Upon completion of the installation, turn over the following spare parts and specialty tools to the owner's authorized representative. Include with the following quantities of items a list of each part with appropriate part number (for ordering replacement products) and local supply store of where these parts can be purchased.

- (1) Plastic handled 5mm and/or 8mm punch depending on size of holes made
- (10') of dripperline for each dripper interval and discharge rate
- (10') of blank dripperline tubing if used
- (6) barbed couplings
- (6) barbed 90° elbow fittings
- (6) barbed tee fittings
- (6) 180° 2-way adapter tees
- (6) male adapters w/3/4" FPT
- (1) spare filter element of the mesh size indicated on the irrigation legend
- (1) line flushing valve
- (2) regulator springs of the color and regulating pressure indicated on the irrigation legend
- (6) dripper plug rings

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- (6) dripper micro-tubing adapters

PART 2. MATERIALS

2.1 PIPING MATERIALS

2.1.1 Dripperline with Pressure Compensating Emitters

Dripperline shall be of nominal sized one-half (½") inch low density, ultra-violet-resistant, linear polyethylene tubing with internal pressure-compensating, continuous self-cleaning, integral drippers at a specified interval. The tubing shall be brown in color and shall conform to an outside diameter (O.D.) of 0.66" and an inside diameter (I.D.) of 0.57". The dripperline shall be capable of a discharge rate of 0.4, 0.6 or 0.9 gallons per hour (GPH) between operating pressures of 7-70 PSI for each individual dripper.

The individual continuous self-cleaning, pressure compensating drippers shall be welded to the inside of the tubing wall. The drippers shall be constructed of three individual pieces:

1) a black-colored dripper containing a filtration system on the inlet side,
compensation cell, and recessed chamber with a water outlet,
2) a hard plastic diaphragm retainer with color denoting discharge rate, with chamfered edges and a recessed groove in the center extending the full length of the diaphragm and,
3) a flexible black elastomer diaphragm that allows pressure to build up within the chamber to purge sediment or other debris that may not have been captured by the disc filter.

Dripper spacings shall be available in the following on-center intervals - 12", 18", and 24".

2.1.1a Dripperline with Non-Pressure Compensating Emitters

Dripperline shall be low density, linear, ultra-violet-resistant, polyethylene tubing with internal non-pressure compensating integral drippers at a specified interval. The tubing shall be brown in color and shall conform to an outside diameter (O. D.) and an inside diameter (I.D.) as follows:

17mm dripperline – 0.67" O.D., 0.57" I.D.
12mm dripperline – 0.48" O.D., 0.42" I.D.
8mm dripperline – 0.26" O.D., 0.24" I.D.

The dripperline shall be capable of individual dripper discharge rates in gallons per hour (GPH) as follows:

17mm - 0.5 or 1.0 GPH @ 15PSI
12mm - 0.6 or 0.9 GPH @ 25PSI

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8mm - 0.3 GPH @ 10 PSI

The individual drippers shall be welded to the inside of the tubing wall. Dripper spacings shall be available as follows:

17mm – 12" or 18"
12mm – 12" or 18"
8mm – 6" or 12"

2.1.2 Barbed Insert Fittings

All barbed insert fittings shall be constructed of molded, ultra-violet-resistant, brown colored plastic (17mm) or black colored plastic (12mm and 8mm) having a nominal inside dimension (I.D.) as follows:

17mm - 0.57"
12mm - 0.42"
8mm - 0.24"

Each fitting shall have a minimum of two ridges or barbs per outlet with a raised barb nearest the fitting outlet. All fittings shall be of one manufacturer and shall be available in one of the following end configurations:

- barbed insert fittings,
- male pipe threads (MPT) with barbed insert fittings, or
- female pipe threads (FPT) with barbed insert fittings.

2.1.3 Non-Pressure PVC Pipe

Class 200 PVC

Non-pressure (downstream of the remote control valve) PVC pipe shall be rigid, un-plasticized polyvinyl chloride PVC 1220, (Type 1, Grade 2), conforming to ASTM D 1785. Pipe shall have the following markings continuously along one side of the pipe:

- pipe O.D.
- type and grade
- NSF rating
- burst pressure rating
- product standard ps-21-70 & ASTM number
- date of manufacture

2.1.4 PVC Insert and Threaded Fittings

All PVC fittings shall be un-plasticized polyvinyl PVC I, or PVC II material for threaded or slip fitting tapered socket solvent weld fittings. The type of plastic material and schedule size shall be indicated on each fitting or coupling with raised or recessing markings. Fittings and couplings shall comply with the following specifications:

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	Socket Fittings		Threaded Fittings	
Schedule 40	ASTM D2466	Schedule 40	ASTM D2464
Schedule 80	ASTM D2467	Schedule 80	ASTM D2464

2.2 LINE FLUSHING VALVE

The line flushing valve shall be constructed of brown molded plastic and shall be a normally open hydraulic valve which flushes based on volumetric quantities of water. Inlet and outlet configurations shall be of one of the following configurations:

- ½" MPT, or
- barbed insert fitting with collar

The line flushing valve shall be serviceable by removing a threaded cover from a base, exposing the internal components. The internal components of the line flushing valve shall consist of:

- a molded diaphragm retainer,
- a high density plastic flush regulator, and
- a diaphragm 2" in diameter.

The line flushing valve shall be capable of automatically operating during initial system pressure build-up to discharge approximately one gallon of water. One line flushing valve shall be used for each 15 GPM of zone flow, and be able to operate at 57 PSI maximum, or 1.5 PSI minimum pressure at line ends.

2.3 PRESSURE REGULATOR VALVES

The pressure regulator valve(s) shall be a spring-operated piston type with an externally accessible regulation unit that can be serviced without removing the valve from the system. The valve shall be constructed from molded black plastic with six different colored tops with interchangeable springs denoting different pressure regulation and flow ranges. The regulator shall have a built-in indicator that shows when the proper outlet pressure is reached. Operating ranges for the valves shall be from 15-50 PSI in 5-PSI increments. Inlet and outlet ports of the valve shall be a combination of male/female threads.

2.4 DISC FILTER

The disc filter body shall be molded of black plastic with male pipe threads (MPT) for both the inlet and outlet ports. A threaded cap on one end of the body shall be capable of periodic servicing by unscrewing the cap or releasing the latched band from the main filter body. On one ¾" model, a manual shut-off valve shall be co-molded to the opposing end of the removable cap as part of the main body. This device shall be capable of closing off the inlet port so the disc element can be removed when the main line is still pressurized.

The filter elements shall be disc-type. The disc-type filter rings shall be color-coded and available in one of four colors denoting filtration of 80, 120, 140, or 200 mesh.

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2.5 AIR/VACUUM RELIEF VALVES

Air/vacuum relief valves shall be constructed of grey and/or black plastic with an internal sliding poppet valve that is capable of venting air or preventing vacuum. The main body shall have a 1/2" male pipe thread (MPT). Operating pressure range for the air/vacuum relief valve shall be 7 PSI minimum to 140 PSI maximum.

2.6 STAINLESS STEEL CLAMPS

Tubing clamps shall be constructed to 304 AISI stainless steel and shall be one "ear" type. This "ear" shall be capable of being pinched with a pinching tool to secure the tubing around the barbed insert fitting. Interior clamp wall shall be smooth to prevent crimping or pinching of tubing. Wall thickness of clamps shall be .0236" (0.6 mm) with an overall band width of ¼" (7 mm).

PART 3 - EXECUTION

3.1 STAKING

Lateral Dripperline Layout

Verify existing field dimensions of the area to be irrigated with the irrigation plans for accuracy. Begin dripperline layout 2" away from hard surfaces; i.e., concrete sidewalks, curbs, asphalt, and/or undefined edges; i.e., shovel-cut headers, and 4" away from softscape transitions. Mark tubing intervals on the ground with flags, paint, or some other method that can be maintained throughout the installation.

3.2 INSTALLATION

3.2.1 Piping Installation

3.2.1.1 Methods of Installing Dripperline

Dripperline can be installed in one of the four following methods:

1. Over-excavation: Over-excavate the entire area to a depth of 4" – 6" below finish grade. Plant all specimen trees and shrubs 15 gallon size and larger, then place dripperline at the row spacing interval indicated on the plans.
2. Pipe Pulling: Where ground disruption is to be minimized, pneumatic tire, pipe-pulling machinery shall be used. Potholes shall be used at the ends of each run for making connection to supply and exhaust headers of rigid PVC pipe or polyethylene pipe.
3. Trenching: Hand or mechanically trench to the pipe depth indicated on the plans or in these specifications and backfill flush with finish grade. Avoid mechanically trenching within the dripline of existing trees. Hand-trench around existing tree roots when roots of 2" and larger are encountered. Remove all rock 1½" and larger when excavating and remove from site. Do not backfill trenches with rock that will come in direct contact with tubing or rigid PVC piping.

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4. On-Grade Installation: For on-surface or under mulch installation, place tubing at the lateral spacing indicated on the plans and place soil staples on 3'-5' intervals depending on terrain. Do not install tubing on surface without soil staples. Backfill with mulch or topdressing as noted in the Section 029__, "Landscaping".

3.2.1.2 Polyvinyl Chloride Pipe (PVC)

3.2.1.2.1 Solvent-Welded Joints
Shall conform to ASTM D2855

3.2.1.2.2 Threaded Joints
Full-cut with a maximum of three threads remaining exposed on pipe and nipples. Make threaded joints tight without recourse to wicks or filters, other than polytetrafluoroethylene (Teflon) tape. Avoid over-tightening of PVC-threaded connections.

3.2.1.2.3 Placement of Rigid PVC Piping
Install pipe in a serpentine (snaked) manner to allow for expansion and contraction in trench before backfilling. Install pipes at temperatures over 40° F. Pipe markings shall face upward out of the trench whenever possible.

3.2.1.2.4 Dripperline
Dripperline can be installed with the water outlets facing up, down, or sideways. In irregular areas, some water outlets could end up too close to fixed improvements and may have to be capped off with a dripper plug ring.

3.2.2 Cover
Install underground piping horizontally and as evenly as possible to a maximum depth of 6", unless otherwise specified. (Typical pipe depth is 4" unless periodic aeration is anticipated, and then pipe depth should be lowered to 6".)

3.2.3 Barbed Insert Fittings
Connect dripperline to barbed insert fittings by pushing the tubing on and over both barbs of the fitting until the tubing has seated against another piece of tubing or has butted against another portion of the barbed fitting. For water pressures in excess of the 45 PSI, or the maximum stated system pressure for the dripperline, whichever is less, use stainless steel clamps as noted in paragraph 3.2.4, "Pipe Clamping" on all barbed fittings.

3.2.4 Pipe Clamping
When design operating pressure exceeds 45 PSI, or maximum stated system pressure for the dripperline, whichever is less, stainless steel pipe clamps shall

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be used. Slip clamps over tubing before slipping tubing over barbed insert fitting. Place clamp between the first and second ridge of the barbed fittings and crimp the "ear" of the clamp tightly. Crimp the "ear" twice to ensure proper seating.

3.2.5 Pressure Regulators

Install a pressure regulator below grade, in-line with, and downstream of the remote control valve. Whenever possible, place the pressure regulator in the same valve box to allow for periodic inspection. Place the regulator with the arrow (molded into the side of the body) pointing in the direction of the flow of water. Provide straight piping on the outlet side of regulator for a dimension not less than three lengths of the overall body dimension.

3.2.6 Remote Control Valves

Install remote control valves level and below grade with a minimum of 4" clearance to the top of the inside of the valve box cover. The arrow cast or molded into the side of the remote control valve should be pointing in the direction of the flow of water. Place a minimum of 1 cubic foot of ¾" gravel in the bottom of the valve box before backfilling with native soil around the exterior of the valve box. Support the four corners of the valve box with a common red brick (wood blocks tend to decay and allow valve boxes to settle over time) on each corner. At finish grade, the top of the valve box shall be 2" above surrounding grades in turf areas or in shrubs where a mulch layer is specified.

3.2.7 Disc Filter

Install the disc filter, horizontally level, below grade, and either before or after the remote control valve as indicated in the installation details. The position of the disc filter in the valve box shall be off-center to allow for removal of the disc element for periodic servicing. Refer to the installation details for the size of the valve box. Include a minimum of 1 cu. ft. of ¾" gravel in the bottom of the valve box. Valve box support and placement shall conform to the installation methods described in paragraph 3.2.5, "Remote Control Valve".

3.2.8 Air/Vacuum Relief Valve

Install the air/vacuum relief valve below grade and at the highest elevation(s) within each zone of subsurface dripperline. Depending on the site conditions and tubing layout, more than one air/vacuum relief valve may be required. Place the valve in a round valve box with a locking cover and a sump of 1 cubic foot of ¾" gravel as noted on the details. Additional Techline Blank Tubing may be necessary when placing Techline dripperline on mounds or berms with more than a 3' elevation difference. Techline, or Techline Blank Tubing shall be connected perpendicular to the dripperline with barbed tees and crosses from the lowest elevation of dripperline to the highest point of the mound berm where the

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air/vacuum relief valve is located. The air/vacuum relief lateral serves to collect and transport trapped air bubbles or relieve vacuum in lower elevation dripperline parallel to the dripperline located at the highest point in the system. Locate an air/vacuum relief lateral for each berm (high point) in the zone.

3.2.9 Flushing

Prior to backfilling and before connection of the line flushing valves, flush the entire system to remove any dirt or sediment that may have entered the system during the installation.

3.2.10 Line Flushing Valve

Install the line flushing valve(s) below grade at the hydraulic termination point(s) in each system, normally at the point farthest away from the source. Locate in a valve box with the top of the line flushing valve facing horizontally or vertically. Include a minimum of 1 cubic foot of ¾" gravel in the bottom of the valve box. Valve box support shall conform to the installation methods described in paragraph 3.2.5 "Remote Control Valve".

3.2.11 Testing

Prior to backfilling, open the remote control valve and operate each circuit to check for leakage around both barbed and threaded PVC fittings. Make necessary corrections to stop leaks.

3.2.12 Retest

Retest those systems where leaks were corrected before commencing backfilling operations.

END OF SECTION