

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE GENERAL SPECIFICATION

**IRRIGATION WATER CONVEYANCE  
LOW-PRESSURE, UNDERGROUND, PLASTIC PIPELINE**

(ft.)  
**CODE 430EE**

**1. Scope**

*The work shall consist of furnishing and installing low-pressure underground plastic pipe, fittings, and appurtenances as specified.*

**2. Location**

*The pipeline shall be located as shown on furnished drawings or as staked in the field.*

**3. Public and Private Utilities**

*Utilities are defined to be overhead and underground power or communication lines, and pipelines. All utilities discovered to be in the work area are shown on the drawings or sketches. However, the absence of indicators on the drawings or sketches does not assure the nonexistence of utilities in the work area. The contractor is alerted to conduct his/her own search and discovery for utilities in order to lessen or avoid potential damages. The owner/operator shall complete TX-ENG-80, UTILITIES INVENTORY prior to layout or any ground disturbance and return it to an NRCS representative.*

**4. Installation**

**Minimum Depth of Cover**

Pipe shall be installed at sufficient depth below the ground surface to provide protection from hazards imposed by traffic crossings, farming operations, freezing temperatures, or soil cracking. The minimum depth of the cover shall be 30 inches, but in soils subject to deep cracking, cover shall be a minimum of 36 inches. The maximum depth of cover for all pipe sizes shall be 4 feet.

In areas where the pipe will not be susceptible to freezing and vehicular or cultivation hazards and the soils do not crack appreciably when dry, the minimum depth of cover may be reduced to 18 inches for pipes 4 inches through 6 inches in diameter and 24 inches for pipes more than 6 inches in diameter.

At low places on the ground surface, extra fill may be placed over the pipeline to provide the minimum depth of cover. The top width of the fill shall be no less than 10 feet and the side slopes no steeper than 6 horizontal and 1 vertical. The fill material shall be placed and compacted before the trench is excavated. If extra protection is needed at vehicular crossings, encasement pipe or other approved methods may be used.

### **Trench Construction**

The trench at any point below the top of the pipe shall only be wide enough to permit the pipe to be easily placed and joined and to allow the initial backfill material to be uniformly placed under the haunches and along the sides of the pipe. The maximum trench width shall be 30 inches greater than the diameter of the pipe. If the trench is precision excavated and has a semicircular bottom that closely fits the pipe, the width shall not exceed the outside diameter of the pipe by more than 10 percent.

The trench bottom shall be uniform so that the pipe lies on the bottom without bridging. Clods, rocks, and uneven spots that can damage the pipe or cause non-uniform support shall be removed.

If there are rocks, boulders, or any other material that might damage the pipe, the trench bottom shall be undercut a minimum of 4 inches below final grade and filled with bedding material consisting of sand or compacted fine-grained soils.

Provisions shall be made to insure safe-working conditions if unstable soil, trench depth, or other conditions can be hazardous to personnel working in the trench.

### **Placement**

Care shall be taken to prevent permanent distortion and damage when handling the pipe during unusually warm or cold weather. The pipe shall be allowed to come within a few degrees of the temperature it will have after it is completely covered before placing the backfill, other than that needed for shading, or before connecting the pipe to other facilities.

The pipe shall be uniformly and continuously supported over its entire length on firm stable material. Blocking or mounding shall not be used to bring the pipe to final grade.

For pipe with belled ends, bell holes shall be excavated in the bedding material, as needed, to allow for unobstructed assembly of the joint and to permit the body of the pipe to be in contact with the bedding material throughout its length.

### **Joints and Connections**

All joints and connections shall be capable of withstanding the design maximum working pressure for the pipeline without leakage and shall leave the inside of the line free of any obstruction that can reduce its capacity below design requirements.

All fittings, such as couplings, reducers, bends, tees, and crosses, shall be installed according to the recommendations of the pipe manufacturer.

Fittings and appurtenances made of steel or other metals susceptible to corrosion shall be adequately protected by wrapping them with plastic tape or applying a coating having high corrosion preventative qualities. If plastic tape is used, all surfaces shall be thoroughly cleaned and then coated with a primer compatible with the tape before wrapping them.

### **Thrust Blocks**

Thrust blocks must be formed against a solid unexcavated earth undamaged by mechanical equipment. They shall be constructed of concrete, and the space between the pipe and the trench wall shall be filled to the height of the outside diameter of the pipe or as specified by the manufacturer.

## **Testing**

The pipeline shall be thoroughly and completely tested at the design pressure for pressure strength and leakage while uncovered or only partly backfilled. If it is necessary to partly backfill the line before testing to hold the pipeline in place, backfilling shall be according to the specifications under "Initial Backfill." All joints and connections shall be left uncovered for inspection; only the body of the pipe sections shall be covered.

The line shall be slowly filled with water. Adequate provision shall be made for air release during filling operations; taking care to bleed all entrapped air. The pressure shall be slowly built up to the maximum design working pressure of the system. While this pressure is maintained, all exposed pipe, fittings, valves, hydrants, joints, appurtenances, and covered parts of the line shall be examined for leaks. Any leaks shall be repaired and the system retested.

It shall be demonstrated by testing that the pipeline will function properly at design capacity. At or below design capacity there shall be no objectionable flow conditions such as water hammer, continuing unsteady delivery of water, damage to the pipeline, or detrimental discharge from control valves, vents or stands.

## **Initial Backfill**

The pipeline shall be filled with water and maintained near design working pressure during backfilling.

The initial backfill material shall be selected soil or sand free from rocks or stones larger than 1 inch in diameter and earth clods greater than about 2 inches in diameter. The material shall be placed so that the pipe will not be displaced, excessively deformed, or damaged.

Water packing shall be used when possible to consolidate the initial backfill around the pipe. The initial backfill, before wetting, shall be of sufficient depth to insure complete coverage of the pipe after consolidation occurs. Water packing is accomplished by adding enough water to diked reaches of the trench to saturate the initial backfill thoroughly without excessive pooling. After the initial fill is saturated, the pipeline shall remain full until after final back filling. The waterpacked backfill shall be allowed to dry until firm enough to walk on before final backfill is begun.

If conditions do not permit water packing, the initial backfill shall be placed in layers and compacted around and about 6 inches above the pipe by hand or mechanical methods to the soil density required to provide adequate lateral support to the pipe.

An exception to water packing or to completely compacting the initial backfill is permitted if the trench is precision excavated and has a semicircular bottom that closely fits the pipe and the width does not exceed the outside diameter of the pipe by more than 10 percent. With this type of trench construction, all other initial and final backfill requirements shall apply, including having the pipe under water pressure during backfilling.

## **Final Backfill**

Final backfill material shall be free of large rocks, frozen clods, and other debris greater than 3 inches in diameter. The material shall be placed and spread in approximately uniform layers so that there will be no unfilled spaces in the backfill and the backfill will be level with the natural ground or at the design grade required to provide the minimum depth of cover after settlement takes place. Rolling equipment shall not be used to consolidate the final backfill.

All special backfilling recommendations of the pipe manufacturer shall be met.

### Basis of Acceptance

The acceptability of the pipeline shall be determined by inspection to check compliance with all the provision of this standard, including the design of the line, the pipe and pipe markings, the appurtenances, and the minimum installation requirements.

### Certification and Guarantee

*All materials shall conform to these minimum requirements and to the tests prescribed in the applicable ASTM Specification.*

*The installing contractor shall certify to the purchaser that the materials and installation comply with the requirements of these specifications. He shall furnish the purchaser a written guarantee against defective workmanship and materials to cover a period of not less than one year. He shall record on the guarantee the manufacturer's name and markings of the installing high pressure underground plastic pipe used.*

A written guarantee shall be furnished that protects the owner against defective workmanship and materials for not less than 1 year, and that identifies the manufacturer and markings of the pipe used.

*The installing contractor shall furnish the Natural Resource Conservation Service a copy of his certification and guarantee, which will be made a part of the supporting records of the pipeline.*

## 5. Materials

### Quality of Plastic Pipe

The compound used in manufacturing low-pressure plastic irrigation pipe shall meet the requirements of one of the following materials and have an established long- term hydrostatic design stress rating as listed:

### **Polyvinyl chloride (PVC) as specified in ASTM-D-1784**

Material	Code classification	Hydrostatic design stress <i>lb/in<sup>2</sup></i>	Designation
Type I, Grade 1	12454-B	2,000	PVC 1120
Type I, Grade 2	12454-C	2,000	PVC 1220
Type II, Grade 1	14333-D	1,000	PVC 2110
Type II, Grade 1	14333-D	1,250	PVC 2112
Type II, Grade 1	14333-D	1,600	PVC 2116

### Acrylonitrile-butadiene-styrene (ABS) as specified in ASTM-D-1788

Material	Code classification	Hydrostatic design stress <i>lb/in<sup>2</sup></i>	Designation
Type I, Grade 2	5-2-2	1,000	ABS 1210
Type I, Grade 3	3-5-5	1,600	ABS 1316
Type II, Grade 1	4-4-5	1,250	ABS 2112

### Polyethylene (PE) as specified in ASTM-D-1248

Material	Code classification	Hydrostatic design stress <i>lb/in<sup>2</sup></i>	Designation
Grade P23, Class C	IIC-P23	630	PE 2306
Grade P33, Class C	IIC-P33	630	PE 3306
Grade P34, Class C	IVC-P34	630	PE 3406

Clean, rework material generated from the manufacturer's own pipe production, may be used by the same manufacturer if the pipe produced meets all requirements of this standard.

The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign matter, or other defects. The pipe shall be as uniform in color, opacity, density, and other physical properties as is commercially practicable.

#### Pipe Requirements

Plastic irrigation pipe (PIP) installed under this specification shall be classified in one of the following categories:

1. Low-head irrigation pipe shall meet the applicable dimensional requirements listed in Table 3. The maximum working pressure for this pipe shall be 50 feet of head or 22 lb./in.<sup>2</sup>.
2. 50-lb./in.<sup>2</sup> plastic irrigation pipe (pip) shall meet the dimensional requirements listed in Table 4 for the appropriate PVC and ABS plastic materials. The maximum allowable working pressure for this pipe shall be 50 lb./in.<sup>2</sup>.

In addition, the pipe shall meet the requirements specified in the sections of the ASTM designations listed below, except that the dimensions and tolerances in Tables 3 and 4 of this specification shall apply.

1. For PVC pipe, ASTM-D-2241 sections pertaining to dimensions and tolerances, flattening, extrusion quality, conditioning, test conditions, and sampling.
2. For ABS pipe, ASTM-D-2282 sections pertaining to dimensions and tolerances, conditioning, test conditions, and sampling.
3. For PE pipe, ASTM-D-2239 sections pertaining to dimensions and tolerances, bond, carbon black, density, conditioning, test conditions, and sampling.

Iron Pipe Size (IPS) (outside diameter same as that for iron pipe sizes) manufactured, tested, and marked according to one of the following ASTM specifications and having a pressure rating for water of at least 50 lb./in.<sup>2</sup> but less than 80 lb./in.<sup>2</sup> shall be acceptable under this standard. However, the maximum operating pressure for such pipe shall be 50 lb./in.<sup>2</sup>.

ASTM	Standard specification for--
D-1785	Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
D-2241	Polyvinyl Chloride (PVC) Plastic Pipe, (SDR-PR).
D-2672	Bell-End Polyvinyl Chloride (PVC) Plastic Pipe.
D-1527	Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80.
D-2104	Polyethylene (PE) Plastic Pipe, Schedule 40.
D-2447	Polyethylene (PE) Plastic Pipe, Schedules 40 and 80. Based on outside diameter.

**Markings**

Markings on the pipe shall include the following, which shall be spaced at intervals of not more than 5 feet:

1. Nominal pipe size (for example, 10 inches).
2. Type of plastic material according to the designation code (for example, PVC 1120).
3. Maximum allowable working pressure:

- a. For low-head plastic irrigation pipe (50-ft. head or 22 lb./in.<sup>2</sup>).
  - b. For the 50-lb./in.<sup>2</sup> plastic irrigation pipe (50 lb./in.<sup>2</sup>)
  - c. For IPS pipe, the appropriate pressure rating (for example, 63 lb./in.<sup>2</sup>).
4. Specification designation with which pipe complies:
    - a. For plastic irrigation pipe, the designation PIP.
    - b. For IPS-size pipe, the ASTM designation (for example, D-2241).
  5. Manufacturer's name (or trademark) and code.

### **Fittings and Couplers**

All fittings and couplers shall equal or exceed the same pressure rating of the pipe with which they are used. They shall be made of material that is recommended for use with the pipe.

The pipe shall be furnished with belled ends or separate couplers and fittings that are suitable for joining the pipe and appurtenances by means of a solvent cement joint, rubber gasket- type joint, or other methods recommended by the pipe manufacturer. Belled ends, sleeves, or plastic fittings shall be made of the same type of plastic material as the pipe.

Fittings or belled ends for solvent cement joints shall have tapered sockets with socket lengths of at least 40 percent of the inside diameter of the pipe or 3 inches, whichever is greater. Sleeves for clamp-type joints shall provide a minimum of 4 inches overlap between the sleeve and the pipe or fitting.

### **Solvent Cement Joints**

Solvent for solvent cement joints shall conform to ASTM specifications D-2564 for PVC pipe and fittings and D-2235 for ABS pipe and fittings.

### **Rubber Gasket Joints**

Rubber gasket joints shall conform to the following:

1. Push-On Type--A joint in which an elastomeric ring gasket is compressed in the annular space between a belled end or socket and spigot end of pipe.
2. Mechanical Joint--A joint in which a seal or gasket is compressed by application of pressure through a mechanical device. The pipe spigot shall have a wall thickness sufficient to withstand, without deformation or collapse, the compressive force exerted when the fitting is tightened.
3. Dimensions of the coupling and spigot end shall be according to the manufacturer's standard design dimensions and tolerances. Such dimensions shall be gaged at sufficiently frequent intervals to insure dimensional control and satisfactory joint assembly. The method for measuring these dimensions shall be according to ASTM Method D-2122.
4. Gasket dimensions shall be according to the manufacturer's standard design dimensions and tolerances. The size and shape of the gasket must insure an adequate compressive force against the spigot and socket after assembly to effect a positive seal under all combinations of joint and gasket tolerances when tested according to Items 12 and 13.

5. Elastomeric compounds must be noncrazing to pipe. The gasket in the cured state shall not cause craze marks, pits, or blisters when in contact with the plastic pipe. The plastic pipe can be stained in the area of gasket contact.
6. Lubricant, if required, shall be suitable for lubricating the parts of the joints in the assembly. The lubricant shall have no deteriorating effects on the gasket and pipe materials.
7. The joint shall be designed to provide a permanent seal.
8. The gasket shall be the sole element depended upon to make the joint flexible and watertight. The gasket shall be a continuous elastomeric ring.
9. The joint design may provide for the axial deflection of a pipe joint by permitting one side of the outside perimeter of the joint to open wider than the compressed position without reducing its watertightness. If greater deflections than provided by the joint design are required, suitable fittings must be provided.
10. The joint components shall be of such design that they will withstand the forces caused by the compression of the gasket when joined without cracking or fracturing when tested according to items 12 and 13.
11. All surfaces of the joint upon or against which the gasket may bear shall be smooth, free of cracks, fractures, or imperfections that could adversely affect the performance of the joint.
12. Pipes in straight alignment- Laboratory hydrostatic pressure tests on joints shall be made on an assembly of two sections of pipe properly connected according to the joint design. After the pipe sections are fitted together with the gasket or gaskets in place, the assembly shall be subjected for the minutes shown to an internal hydrostatic pressure of:

	<i>min.</i>
0 pressure	5
1/4 working pressure	5
1/2 working pressure	5
3/4 working pressure	5
1.0 working pressure	10
2-1/2 working pressure	60
13. Pipes in maximum deflected position-Using a pipe and joint system, similar to that described in 12, deflect the test sections axially to the maximum deflection specified by the manufacturer and subjected to the pressures indicated under 12.
14. Two specimens of any one size shall pass the tests. Retest of two other specimens shall be required if one of the first two fails. Three of the four shall pass the tests.

**Table 3. Dimensions of low-head plastic irrigation pipe (PIP)**

Nominal size	PVC and ABS materials				PE materials			
	Outside diameter		Wall thickness		Inside diameter		Wall thickness	
	Average	Tolerance	Minimum	Tolerance	Average	Tolerance	Minimum	Tolerance
<i>in</i>	----- <i>in</i> -----							
4	4.13	+0.009	0.065	+0.020	4.00	+0.020	0.085	+0.020
6	6.14	±.011	.070	+0.020	7.00	±.025	.095	+0.020
8	8.16	±.015	.080	+0.020	8.00	±.040	.120	+0.020
10	10.20	±.015	.100	+0.020	10.00	±.040	.135	+0.020
12	12.24	±.015	.120	+0.020	12.00	±.040	.155	+0.020
14	14.28	±.015	.140	+0.020	14.00	±.040	.185	+0.022
15	15.30	±.015	.150	+0.020	15.00	±.040	.200	+0.024
18	18.70	±.028	.200	+0.024				
21	22.04	±.033	.236	+0.028				
24	24.80	±.037	.266	+0.032				

**Table 4. Dimensions of 50-lb/in.<sup>2</sup> PVC and ABS plastic irrigation pipe (PIP)**

Nominal size	Outside diameter		Allowance	Wall thickness			
	Average	Tolerance		PVC 1120 PVC 1220	PVC 2116 ABS 1316	PVC 2112 ABS 2112	PVC 2110 ABS 1210
<i>in</i>	----- <i>in</i> -----		----- <i>in</i> -----				
4	4.13	0.009	Minimum tolerance	0.065 .020	0.065 .020	0.08 .020	0.101
6	6.14	.011	Minimum tolerance	.076 .020	.096 .020	.120 .020	.150 .020
8	8.16	.015	Minimum tolerance	.101 .020	.128 .020	.160 .020	.199 .024
10	10.20	.015	Minimum tolerance	.126 .020	.159 .020	.200 .024	.249 .030
12	12.24	.015	Minimum tolerance	.151 .020	.191 .023	.240 .029	.299 .036
14	14.28	.015	Minimum tolerance	.176 .021	.223 .027	.280 .034	.348 .042
15	15.30	.015	Minimum tolerance	.189 .023	.239 .029	.300 .036	.373 .045
16	16.00	.015	Minimum tolerance	.198 .024	.250 .031	.313 .038	.390 .048
18	18.70	.028	Minimum tolerance	.230 .027	.292 .033	.367 .042	.456 .054

**6. MEASUREMENT**

*The amount of pipeline completed as specified will be determined by measuring the length, in feet, of each size and kind of pipe installed.*

**7. CONSTRUCTION DETAILS**