

NATURAL RESOURCES CONSERVATION SERVICE
 CONSERVATION PRACTICE STANDARD AND SPECIFICATIONS

IRRIGATION WATER CONVEYANCE

HIGH-PRESSURE, UNDERGROUND, PLASTIC PIPELINE SPECIFICATIONS
 (Feet)

CODE 430-DD

INSTALLATION

Minimum depth of cover. Pipe shall tubing 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 cover for pipe susceptible to any of these hazards shall be:

Pipe diameter <i>in.</i>	Depth of cover <i>in.</i>
1/2 through 2-1/2.....	18
3 through 5.....	24
6 or more.....	30

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:

Pipe diameter <i>in.</i>	Depth of cover <i>in.</i>
1/2 through 1-1/2....	6
2 through 3.....	12
4 through 6.....	18
More than 6.....	24

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 then be no less than 10 ft and the side slopes no steeper than 6:1. If extra protection is needed at vehicle crossings, encasement pipe or other approved methods may be used.

Trench construction. Trench at any point below the top of the pipe line shall be only 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 36 in. 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 lays on the bottom without bridging. Clods, rocks, and uneven spots that can damage the pipe or cause non-uniform support shall be removed.

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

Pipelines having a diameter of 1/2 through 2-1/2 in. that are to be placed in areas not subject to vehicular loads and in soils that do not crack appreciably when dry may be placed by using "plow-in" equipment instead of conventional trenching.

Provisions shall be made to insure safe working conditions where unstable soil, trench depth, or other conditions can be hazardous to personnel working 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

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shall not be used to bring the pipe to final grade.

for pipe with bell joints, 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 designed and constructed to withstand the design maximum working pressure for the pipeline without leakage and to leave the inside of the line free of any obstruction that may tend to 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 made of steel or other metals susceptible to corrosion shall be adequately protected by wrapping them with plastic tape or by applying a coating having high corrosion-preventative qualities. If plastic tape is used, all surfaces to be wrapped shall be thoroughly cleaned and coated with a primer compatible with the tape before wrapping.

Thrust blocks. Thrust blocks must be formed against a solid hand-excavated trench wall undamaged by mechanical equipment. They shall be constructed of concrete, and the space between the pipe and 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 tested for pressure strength, leakage, and proper functioning. The tests may be performed before backfilling or anytime after the pipeline is ready for service.

Tests for pressure strength and leaks shall be accomplished by inspecting the pipeline and appurtenances while the maximum working pressure is maintained and all joints and connections are uncovered, or by observing normal operation of the pipeline after it is put into service. Partial backfills needed to hold the pipe in place during testing shall be placed as

specified in "Initial Backfill." Any leaks shall be repaired and the system retested.

The pipeline shall be tested to ensure that it functions properly at design capacity. At or below design capacity there shall be no objectionable flow conditions. Objectionable flow conditions shall include water hammer, continuing steady delivery of water, damage to the pipeline, or detrimental discharge from control valves.

Initial backfill. Hand, mechanical, or hand packing methods may be used.

The initial backfill material shall be soil or sand that is free from rocks or stones larger than 1 in. in diameter. At the time of placement, the moisture content of the material shall be such that the required degree of compaction can be obtained with the backfill method to be used. The initial backfill material shall be placed so that the pipe will not be displaced, excessively deformed, or damaged.

If backfilling is done by hand or mechanical means, the initial fill shall be compacted firmly around and above the pipe as required to provide adequate lateral support to the pipe.

If the water packing method is used, the pipeline first shall be filled with water. The initial backfill before wetting, shall be of sufficient depth to insure complete coverage of the pipe after consolidation. Water packing is accomplished by adding water to diked reaches of the trench in sufficient quantity to thoroughly saturate the initial backfill without excessive pooling of water. After the backfill is saturated, the pipeline shall remain full until after the final backfill is made. The wetted fill shall be allowed to dry until firm before beginning the final backfill.

Final backfill. The final backfill material shall be free of large rocks, frozen clods, and other debris greater than 3 in. in diameter. The material shall be placed in 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. Rolling equipment shall not be used to

consolidate the final backfill until the specified minimum depth of cover has been placed.

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

Basis of acceptance. The acceptability of the pipeline shall be determined by inspections to check compliance with all the provisions of the this standard with respect to the design of the line, the pipe, and pipe marking, the appurtenances, and the minimum installation requirements.

Certifications and guarantee. If requested by the state conservation engineer, a qualified testing laboratory must certify with supporting test results that the pipe meets the requirements specified in this standard. The seal of approval of a recognized laboratory on pipe bearing one of the ASTM designations listed in this standard may be accepted for this certification.

The installing contractor shall certify that his installation complies with the requirements of this standard. He shall furnish a written guarantee that protects the owner against defective workmanship and materials for not less than 1 year. The certification identifies the manufacturer and markings of the pipe used.

Materials

Quality of plastic pipe. The compound used in manufacturing the pipe shall meet the requirements of one of the following materials:

1. Polyvinyl chloride (PVC) as specified in ASTM-D-1784.

<u>Material</u>	<u>Code classification</u>
Type I, Grade 1.....	12454-B
Type I, Grade 2.....	12454-C
Type II, Grade 1.....	14333-D

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

<u>Material</u>	<u>Code classification</u>
Type I, Grade 2.....	5-2-2
Type I, Grade 3.....	3-5-5
Type II, Grade 1.....	4-4-5

3. Polyethylene (PE) as specified in ASTM-D-1248.

<u>Material</u>	<u>Code classification</u>
Grade P14, Class C.....	IC-P14
Grade P23, Class C.....	IIC-P23
Grade P33, Class C.....	IIIC-P33
Grade P34, Class C.....	IVC-P34

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. All pipe installed under this standard shall be pressure rated for water.

The relationship between standard dimension ratios, dimensions, hydrostatic design stresses, and pressure ratings shall be determined by one of the following formulas:

For PVC, ABS, and PE pipe with outside diameter controlled:

$$\frac{2 S}{P} = \frac{D_o}{t} - 1 \text{ or } \frac{2 S}{P} = R - 1$$

For PE pipe with inside diameter controlled:

$$\frac{2 S}{P} = \frac{D_i}{t} + 1 \text{ or } \frac{2 S}{P} = R + 1$$

Where:

S = hydrostatic design stress, in lb/in.2

P = pressure rating in lb/in.2

Do= average outside diameter in in.

Di= average inside diameter in in.

t = minimum wall thickness in in.

R = standard thermoplastic pipe dimension ratio (SDR)

Hydrostatic design stresses for the plastic pipe material are given in table 1.

IPS-size (outside diameter same as that for iron pipe sizes) and I.D. controlled PE pipe manufactured, tested, and marked to meet one of the following ASTM specifications shall be acceptable under this standard. Water pressure ratings and pertinent dimensions for this pipe are given in tables 3, 4, 5, 6, and 7.

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ASTM-	Standard specification for-
D-1785	Poly (vinyl chloride) (PVC) Plastic Pipe, Schedules 40, 80, 120
D-2241	Poly (vinyl chloride) (PVC) Plastic Pipe, (SDR-PR)
D-2672	Bell-End Poly (vinylchloride) (PVC) Pipe
D-2740	Poly (vinyl chloride) (PVC) Plastic Tubing
D-1527	Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80
ASTM-	Standard specification for-
D-2282	Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR)
D-2104	Polyethylene (PE) Plastic Pipe, Schedule 40
D-2239	Polyethylene (PE) Plastic Pipe (SDR-PR)
D-2447	Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, based on outside diameter
D-2737	Polyethylene (PE) Plastic Tubing
D-3035	Polyethylene (PE) Plastic Pipe (SDR-PR), based on controlled outside diameter

PIP-size (plastic irrigation pipe) pipe shall meet the requirements of ASTM-D-2241 or of ASTM-D-2282 except that::

1. The outside diameters, wall thicknesses, and tolerances given in table 2 shall apply.
2. the sustained pressure test shall not be required.
3. The burst pressure tests shall be performed according to the procedures listed in ASTM-D-2241 or D-2282 and shall meet the applicable requirements given in these ASTM's or those listed below for the standard dimension ratios (SDR's) currently not included in ASTM-D-2241 or D-2282.

Burst pressure requirements for water at 23 degrees C (73.4 degrees F) for PVC 1120 and PVC 1220 plastic pipe are:

SDR	Minimum burst pressure ¹ lb/in.2
51	260

¹ The design stress levels used to derive these test pressures are PVC 1120--6,400 lb/in.²; PVC 1220--6,400 lb/in.².

Burst pressure requirements for water 23 degrees C (73.4 degrees F) for ABS plastic pipe are:

SDR	Minimum burst pressure ¹	
	ABS 2112 lb/in.2	ABS 1316 lb/in.2
32.5	420	380
41	---	300

¹ The fiber stresses used to derive these test pressures are ABS 2112--6,600 lb/in.2; ABS 1316--6,000 lb/in.2. To simply testing, minor adjustments have been made to deep the test pressures uniform.

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

1. Nominal pipe size (for example, 2 in.)
2. Type of plastic pipe material, by designation code (for example, PVC 1120).
3. Pressure rating , in lb/in.2, for water at 23o C (73.4o F) (for example, 160 lb/in.2).
4. Specification designation with which the pipe complies:
 - a. For IPS-size pipe, the ASTM designation (for example, D-2241).

Pipe meeting one of the ASTM designations listed for IPS-size pipe and intended for the transport of potable water shall also be marked with the seal of a recognized laboratory making the evaluation for this purpose.

- b. For plastic irrigation pipe, the designation PIP.

5. Manufacturer's name (or trademark) and code.

Fittings and couplers. All fittings and couplers shall meet or exceed the same strength requirements as those of the pipe and shall be made of material that is recommended for use with the pipe.

Listed below are the ASTM standard specifications for fittings suitable for use with IPS-size pipe and inside diameter controlled PE pipe covered by this standard:

ASTM	Standard specification for
D-2466	Socket-type Poly (vinyl chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
D-2467	Socket-type Poly (vinyl chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
D-3036	Poly (vinyl chloride) (PVC) Plastic Line Couplings, Socket type.
D-2468	Socket-type Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe fittings, Schedule 40.
D-2469	Socket-type Acrylonitrile-Butadiene-Styrene (ABS) Plastic fittings, Schedule 80.
D-2609	Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
D-2610	Butt Fusion Polyethylene (PE) Plastic Pipe Fittings, Schedule 40 (for PS pipe).
D-2611	Butt Fusion Polyethylene (PE) Plastic Pipe Fittings, Schedule 80 (for IPS pipe).
D-2683	Socket-type Polyethylene Fittings for SDR 11.0 Polyethylene pipe.
D-3139	Standard Specification for Plastic Pressure Pipe using Flexible Elastomeric Seals.

Plastic irrigation pipe (PIP) shall have belled ends or separate couplers and fittings that are suitable for joining the pipe and appurtenances by solvent cement, rubber gaskets, or other methods recommended by the pipe manufacturer. Such fittings and joints shall be capable of withstanding a working pressure equal to or greater than that for the pipe.

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

Solvent cement joints shall be used and constructed according to the recommendations of the pipe manufacturer.

Rubber gasket joints. Rubber gasket joints shall conform to ASTM Specification D-3139.

Table 1.--Hydrostatic design stress and designation--plastic pipe

Plastic pipe material	Hydrostatic design stress lb/in.2	Designation
PVC Type I, Grade 1	2,000	PVC 1120
PVC Type I, Grade 2	2,000	PVC 1220
PVC Type II, Grade 1	1,000	PVC 2110
PVC Type II, Grade 1	1,250	PVC 2112
PVC Type II, Grade 1	1,600	PVC 2116
ABS Type I, Grade 2	800	ABS 1208
ABS Type I, Grade 2	1,000	ABS 1210
ABS Type I, Grade 3	1,600	ABS 1316
ABS Type II, Grade 1	1,250	ABS 2112
PE Grade P14	400	PE 1404
PE Grade P23	500	PE 2305
PE Grade P23	630	PE 2306
PE Grade P33	630	PE 3306
PE Grade P34	630	PE 3406

(Tables 2-8 are under construction)