NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

IRRIGATION WATER CONVEYANCE

HIGH-PRESSURE, UNDERGROUND, PLASTIC PIPELINE

(ft)

CODE 430DD

DEFINITION

A pipeline and appurtenances installed in an irrigation system.

PURPOSE

To prevent erosion or loss of water quality or damage to the land, to make possible proper management of irrigation water, and to reduce water conveyance losses.

CONDITIONS WHERE PRACTICE APPLIES

Pipelines shall be part of an irrigation water distribution or conveyance system designed to facilitate farm soil and water conservation use and management. All areas served by pipelines shall be suitable for irrigation with available water supplies.

Pipelines shall be placed only in soils where bedding and backfill requirements can be met.

DESIGN CRITERIA

Laws and regulations. This practice must conform to all federal, state, and local laws and regulations.Polluted liquids may not be discharged to Waters of the United States at any time during start-up, operation, or shut down.

Working pressure and flow velocity. The minimum acceptable pipe working pressure rating shall be 80 psi.

As a safety factor against hydraulic surge or water hammer, working pressure should not exceed 72 percent of the pipe pressure rating, and design flow velocity at system capacity should not exceed 5 feet/second. If either of these limits is exceeded, special consideration must be given to flow conditions and measures taken to adequately protect the pipelinePlastic pipe pressure rating normally is based on a water temperature of 73.4 degrees F. Factors for adjusting allowable working pressure for higher water temperature are given in Table 1.

Table 1. Pressure rating factors for PVC and PE pipe for water at elevated temperatures.

Degrees F	PVC	PE
73.4	1.00	1.00
80	.88	.92
90	.75	.81
100	.62	.70
110	.50	—
120	.40	—
130	.30	—
140	.22	—

Note: To obtain reduced pipe pressure rating, multiply the normal pipe pressure rating by the appropriate factor from table.

Capacity. Pipeline design capacity shall:

1. Meet crop peak-period consumptive uses;
2. Meet applicable irrigation method needs.

Friction losses. Design friction head losses shall be no less than those computed by the Hazen-Williams equation, using roughness coefficient (C), equal to 150.

Outlets. Pipes and outlets shall have capacity to deliver the design flow at operating pressure.

Check valves. Where backflow may occur, a check valve shall be installed between the pump discharge and pipeline.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service **State Office**, or visit the **electronic Field Office Technical Guide**.

Pressure-relief valves. A pressure relief valve shall be installed between the pump discharge and the pipeline when excessive pressures can be developed by operating with all valves closed. Pressure relief valves shall be installed on the discharge side of the check valve where a reversal of flow may occur and at the end of the pipeline when needed to relieve surge at the end of the line.

Pressure-relief valves shall be no smaller than one-quarter-inch nominal size for each pipeline diameter inch and shall be set to open at five lb./in. two or less above the pipe pressure rating.

The pressure at which the valves start to open shall be marked on each pressure-relief valve. Adjustable pressure-relief valves shall be sealed or otherwise altered to prevent changing the adjustment from that marked on the valve.

Manufacturers of pressure-relief valves marketed for use under this standard shall provide capacity tables, based on performance tests that give discharge capacities of the valves at maximum permissible pressure and differential pressure settings. Such tables shall be the basis for design of pressure setting and acceptance of these valves.

Air-release valves. The three basic types of air-release valves for irrigation pipelines are:

1. An air-release valve is a continuously acting valve that has a small venting orifice, generally ranging between 1/16 and 3/8 inch in size. This valve releases pockets of air from the pipeline once the line is filled and under working pressure.
2. An air-and-vacuum valve, has a large venting orifice, exhausts large quantities of air from the pipeline during filling and allows air to reenter the line and prevents a vacuum from forming during emptying. This valve is also called an air-vacuum-release valve or air-vent-and-vacuum-relief valve. It is not continuous acting because it does not allow further escape of air at working pressure after the valve closes.
3. A combination air valve is sometimes called a combination air-release and air-vacuum valve or combination air-and-vacuum-relief valve. It is continuous acting and combines the functions of both the air-release valve and the air-and-vacuum valve. Both valves are housed in one valve body.

If needed to provide positive means for air escape during filling and air entry while emptying, air-and-vacuum valves or combination air valves shall be installed at all summits, at the entrance, and at the end(s) of the pipeline.

The ratio of air-release valve diameter to pipe diameter for valves intended to release air when filling the pipe should not be less than 0.1. Provide adequate vacuum relief.

Air release valves or combination air valves shall be used as needed to permit air to escape from the pipeline while the line is at working pressure. Small orifices of these types of valves shall be sized based on the working pressure and venting requirements according to the manufacturer's recommendations.

Air-release valve and combination air valve sizes must meet manufacturer's recommendations.

Drainage. Provision shall be made for draining the pipeline if a freezing hazard exists.

Flushing. Provisions for flushing sediment and debris, shall be installed at the distal end of the pipeline where required.

Thrust control. Provide needed thrust control at abrupt changes in pipeline grade, horizontal alignment, reduction in pipe size, pipeline ends, and inline control valves. Thrust blocks and anchors must withstand the forces tending to move the pipe, including momentum, pressure, expansion, and contraction.

Pipe manufacturer's recommendations for thrust control shall be followed. In absence of pipe manufacturer's requirements, use the following:

A = (98HD2 / B)(sin (a / 2))

Where:

A = Area of thrust block required in feet
H = Maximum working pressure in feet
D = Inside diameter of pipe in feet
B = Allowable passive pressure of the soil in lb/ft2
a = Deflection angle of pipe bend

Area of thrust blocks for dead ends and tees shall be 0.7 times the block area for a 90°-pipe angle.

If adequate soil tests are not available, the passive soil pressure may be estimated from Table 2.

Table 2 – Allowable soil bearing pressure, lb/ft^2

Soil	Depth of cover to center of thrust			
	2 feet	3 feet	4 feet	5 feet
Sound bedrock	8,000	10,000	10,000	10,000
Dense sand and gravel Ø=40o	1,200	1,800	2,400	3,000
Dense fine to course sand Ø=35o	800	1,200	1,650	2,100
Silt, clay mix Ø=25o	500	700	950	1,200
Soft clay or organic Ø=10o	200	300	400	500

MATERIALS

All materials shall meet or exceed the minimum requirements of the material specification.

PLANS AND SPECIFICATIONS

Plans and specifications shall meet this standard and describe requirements achieving the purpose.

OPERATION AND MAINTENANCE

An operation and maintenance plan must be prepared for use by the owner/operator. Provide specific instructions for proper function, periodic inspection, and repair.

REFERENCES

1. National Engineering Handbook, Part 650, Chapter 3, Hydraulics and Chapter 15 Irrigation.
2. ASAE S376.1 Design, Installation, and Performance of Underground Thermoplastic Irrigation Pipelines.