NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

IRRIGATION WATER CONVEYANCE ALUMINUM TUBING PIPELINE

(Ft.)

CODE 430AA

DEFINITION

A pipeline and appurtenances installed in an irrigation system.

PURPOSE

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

CONDITIONS WHERE PRACTICE APPLIES

This standard applies only to buried aluminum pipelines coated with plastic tape on the exterior surface.

All pipelines shall be planned and located to serve as integral parts of an irrigation water distribution system designed to facilitate the conservation of water on a farm or group of farms.

All areas served by the pipelines shall be suitable for irrigation.

CRITERIA

General Criteria Applicable to All Purposes

The water supply, water quality, and rate of irrigation delivery for the area served by the pipeline shall be sufficient to make irrigation practical for the crops to be grown and the irrigation water application methods to be used.

Laws, rules, and regulations. This practice shall conform to all federal, state, and local laws, rules, and regulations. Laws, rules, and regulations of particular concern include those involving water rights, land use, pollution control, property easements, wetlands, preservation of cultural resources, and endangered species.

Working pressure. The maximum permissible working pressure in the line shall be determined by the following equation:

$$P = 2St/d$$

Where:

$S = 7{,}500$ lb/in^2
P = Maximum working pressure in lb/in^2
d = Inside diameter of tube in inches
t = Tube nominal wall thickness inches

Capacity. Design capacity shall be based on whichever of the following is greater:

1. The capacity shall be adequate to deliver the volume of water required to meet the peak consumptive use of the crop.
2. The capacity shall be adequate to provide an adequate irrigation stream for all methods of irrigation planned.

For design purposes, Manning's equation roughness coefficient "n" value shall be considered to be 0.01, except where joints, connections, and condition of the pipe indicate that a higher value is required.

Stands for low pressure lines open to the atmosphere. Stands shall be used when water enters the pipeline to avoid entrapment of air, to prevent surge pressures and collapse because of vacuum failure, and to prevent pressure from exceeding the design working stress of the pipe. The stand shall be designed to:

1. Allow a minimum of 1 foot of freeboard - The maximum height of the stand above the centerline of the pipeline must not exceed the maximum working head of the pipe.

2. Have the top of each stand at least 4 feet above the ground surface except for surface gravity inlets which shall be equipped with trash racks and covers.

3. Have a downward water velocity in each stand not in excess of 2 ft/s - The inside diameter of the stand shall not be less than the inside diameter of the pipeline.

The cross-sectional area of stands may be reduced above a point 1 foot above the top of the upper inlet, but the reduced cross-section shall not be such that it would produce an average velocity of more than 10 ft/s if the entire flow were discharging through it.

If the water velocity of an inlet pipe exceeds 3 times the velocity of the outlet, the centerline of the inlet shall have a minimum vertical offset from the centerline of the outlet at least equal to the sum of the diameters of the inlet and outlet pipes.

A sand trap, when combined with a stand, shall have a minimum inside dimension of 30 inches and shall be constructed so that the bottom is at least 24 inches below the invert of the outlet pipeline. The downward velocity of flow of the water in a sand trap shall not exceed 0.25 ft/s. Suitable provisions shall be made for cleaning sand traps.

The dimensions of gate stands shall be adequate to accommodate the gate or gates required and shall be large enough to make the gates accessible for repair.

The size of float valve stands shall be adequate to provide accessibility for maintenance and to dampen surge.

Stands must be constructed in a manner to ensure that vibration from the pump discharge pipe is not carried to the stand.

Vents for low pressure lines open to the atmosphere. Vents must be designed into the system to provide for the removal of air and the prevention of vacuum collapse. They shall:

1. Have a minimum freeboard of 1 foot above the hydraulic gradeline - The maximum height of the vent above the centerline of the pipeline must not exceed the maximum working head of the pipe.

2. Have a cross-sectional area at least one-half the cross-sectional area of the pipeline (both inside measurements) for a distance of at least 1 pipeline diameter up from the centerline of the pipeline - Above this elevation, the vent may be reduced to 2 inches in diameter.

3. Vents shall be located:

   a. At the downstream end of each lateral.

   b. At summits in the line.

   c. At points where there are changes in grade in a downward direction of flow of more than 10 degrees.

   d. Immediately below the pump stand if the downward velocity in the stand exceeds 1 ft/s.

4. A combined air-release and vacuum-release valve may be used instead of an open vent. An air-release and vacuum-release valve shall have a minimum diameter of 2 inches. For lines 6 inches or less in diameter, 2-inch valves shall be used; for lines 7 inches through 10 inches in diameter, 3-inch valves shall be used; and for lines 12 inches in diameter, 4-inch valves shall be used.

Outlets. Appurtenances to deliver water from a pipe system to the land, a ditch, or any surface pipe system are known as outlets. Outlets shall have a capacity to deliver the required flow to (1) the hydraulic gradeline of a pipe or ditch or (2) a point at least 6 inches above the field surface.

Drainage. Provisions shall be made to completely drain the pipeline. Drainage outlets should be provided at all low points in the system and may either discharge into a dry well or to a point of lower elevation. If these gravity discharge points are unavailable, provisions shall be made to empty the line by pumping.

Check, pressure-relief, air-release, and vacuum-release valves for high-pressure closed systems. A check valve shall be installed between the pump discharge and the pipeline if detrimental backflow may occur.

A pressure-relief valve shall be installed at the pump location if excessive pressure can build up when all valves are closed. Also, a surge chamber or a pressure-relief valve shall be installed in a closed system in which a check valve protects the line from reversal of flow and excessive surge pressure may develop. Pressure-relief valves shall be no smaller than

25 percent of the nominal pipeline diameter and shall be set at a maximum of 5 lb/in^2 above the pressure rating of the pipe. If needed to relieve surge, pressure-relief valves or surge chambers shall be installed at the end of the pipeline.

Air-release and vacuum-release valves shall be placed at all summits in the pipeline and at the end of the line if needed to provide a positive means of air release or escape. Air-release and vacuum-release valve outlets of at least ½-inch nominal diameter shall be used in lines 4 inches or less in diameter, at least 1-inch outlets shall be used in lines 5 to 8 inches in diameter, and at least 2-inch outlets shall be used in lines 10 to 16 inches in diameter.

Joints and connections. All connections shall be constructed to withstand the working pressure of the line without leakage and to leave the inside of the line free of any obstructions that could reduce the line capacity below design requirements. All fittings, such as risers, ells, tees, and reducers, should be of similar metal. If dissimilar metals are used, the fittings shall be protected against galvanic corrosion. Dissimilar metals shall be separated with a rubber or plastic insulator. The connection between the pump discharge pipe and the aluminum line shall be made of suitable insulating material, such as rubber or plastic.

Quality of water. Water quality tests shall be made for all aluminum pipeline installations. A copper content in excess of 0.02 ppm produces nodular pitting and rapid deterioration of the pipe if water is allowed to remain stagnant.

Thrust control. Abrupt changes in pipeline grade, horizontal alignment, or reduction in pipe size normally require an anchor or thrust blocks to absorb any axial thrust of the pipeline. Thrust control may also be needed at the end of the pipeline and at in-line control valves.

Thrust blocks and anchors must be large enough to withstand the forces tending to move the pipe, including those of momentum and pressure as well as forces due to expansion and contraction.

The pipe manufacturer's recommendations for thrust control shall be followed. In absence of the pipe manufacturer's requirements, the following equation must be used in designing thrust blocks:

$$A = [98HD^2)/B]\sin(a/2)$$

Where:

A = Area of thrust block required in ft^2
H = Maximum working pressure in feet
D = Inside diameter of pipe in feet
B = Allowable passive pressure of the soil in lb/ft^2
a = Deflection angle of pipe bend

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

If adequate soil tests are not available, the passive soil pressure may be estimated from Table 1.

Table 1 - Allowable soil bearing pressure

Natural Soil Material	Depth of Cover to Center of Thrust Block			
	2 ft.	3 ft.	4 ft.	5 ft.
	lb/ft^2			
Sound bedrock	8,000	10,000	10,000	10,000
Dense sand and gravel mixture (assumed Ø = 40°)	1,200	1,800	2,400	3,000
Dense fine to coarse sand (assumed Ø = 35°)	800	1,200	1,650	2,100
Silt and clay mixture (assumed Ø = 25°)	500	700	950	1,200
Soft clay and organic soils (assumed Ø = 10°)	200	300	400	500

Materials. Pipe and coating materials shall equal or exceed the physical requirements specified under "Plans and Specifications."

PLANS AND SPECIFICATIONS

Plans and specifications for constructing aluminum tubing irrigation pipelines shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.