

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**PIPELINE**

(Ft.)  
CODE 516

**DEFINITION**

Pipeline installed for conveying water for livestock or for recreation.

**PURPOSE**

To convey water from a source of supply to points of use.

**CONDITIONS WHERE PRACTICE APPLIES**

Where conveyance of water in a closed conduit is desirable or necessary to conduct water from one point to another, to conserve the supply, or for reasons of sanitation.

**CRITERIA**

**Capacity.** For supply livestock water, the installation shall have a capacity to provide at least 12 gal per head per day for beef cattle and horses, 25 gal for dairy cattle, and 1.5 gal for sheep and goats.

For recreation areas, the capacity shall be adequate for all planned uses of the water, such as drinking, fire protection, showers, flush toilets, and irrigation of landscaped areas.

**The minimum delivery pipe diameter shall be three quarter (3/4) inch.**

**For design purposes, friction head losses shall be no less than those computed by using the following roughness coefficient:**

**Steel or Iron Pipe Manning's (n) = 0.012**

**Hazen Williams C = 110**

**Thermoplastic Pipe Manning's (n) = 0.009**

**Hazen Williams C = 150**

**Pressure: The maximum static pressure shall not be more than:**

**Steel Pipe - 700 psi for 3/4 and 1 inch diameter pipe, 1,000 psi for 1-1/4 inch diameter pipe, 1,200 psi for 3-1/2 and 4 inch**

**diameter pipe.**

**Thermoplastic pipe - Certified pressure stamped on the pipe.**

**The maximum allowable working pressure when surge pressures are not known is shown in Table 1 for steel pipe. For thermoplastic pipe, the maximum allowable working pressure, when surge pressures are not known, shall be 72 percent of the rated pressure stamped on the pipe.**

Table 1

**Maximum allowable working pressure in (psi) for steel pipe when surge pressures are not known.**

VELOCIT Y (Ft/Sec)	PIPE 3/4 - 1	DIAMET ER 1-1/4 - 3	(inches) 3-1/2 - 4
2	580	880	1,080
4	450	760	960
6	330	630	840
8	210	510	720

**The maximum allowable velocity in steel pipelines shall not exceed eight (8) feet per second and plastic pipeline velocities should be less than (5) feet per second. When velocities exceed five (5) feet per second in PVC pipe, special design considerations will be required to determine the maximum allowable working pressure.**

**Sanitary protection.** If water from the pipeline is likely to be used for human consumption, the requirements of the state health department for materials and installation must be met.

**Pipe conveying water destined for human consumption shall bear the National Sanitary Foundation Seal (NSF) and will meet all local and state rules and regulations.**

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resource Conservation Service.

**Pipe.** Steel pipe shall meet the requirements specified in ASTM-A-120 or in AWWA Specification C-200. If because of local conditions, a coal-tar enamel protective coating is needed for steel pipe, the coating shall meet the requirements of AWWA Specification C-203. Plastic pressure pipe shall be suitable for underground use. The pipe shall conform to the requirements of the following ASTM specifications:

- D 1785 Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
- D 2104 Polyethylene (PE) Plastic Pipe, Schedule 40
- D 2241 Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR)
- D 1527 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80
- D 2282 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR)
- D 2239 Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Inside Diameter
- D 3035 Polyethylene (PE) Plastic Pipe (SDR-PR), Based on Controlled Outside Diameter
- D 2447 Polyethylene (PE) Plastic Pipe Schedules 40 and 80, Based on Outside Diameter
- D 2737 Polyethylene (PE) Plastic Tubing
- D 2672 Bell-End Polyvinyl Chloride (PVC) Pipe
- D 2740 Polyvinyl Chloride (PVC) Plastic Tubing

Pressure pipe fitting shall conform to the requirements of the following ASTM specifications:

- D 2466 Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
- D 2467 Socket-Type Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
- D 2464 Threaded Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
- D 2611 Butt Fusion Polyethylene (PE) Plastic Pipe Fittings, Schedule 80 (for IPS Pipe)
- D 2610 Butt Fusion Polyethylene (PE) Plastic Pipe Fittings, Schedule 40 (for IPS Pipe)
- D 3036 Socket-Type Polyvinyl Chloride (PVC) Plastic Line Couplings
- D 2468 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40
- D 2469 Socket-Type Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 80

- D 2465 Threaded Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Threaded, Schedule 80
- D 2609 Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe
- D 3261 Butt Heat Fusion Polyethylene (PE) Plastic Fittings, for Polyethylene (PE) Plastic Pipe and Tubing
- D 2683 Socket-type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
- D 3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

Solvents for solvent-welded pipe joints shall conform to the following ASTM specifications:

- D 2564 Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings
- D 2235 Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
- D 2855 Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings

Rubber gaskets for pipe joints shall conform to the requirements of ASTM Specification F 477, Elastomeric Seals (Gaskets) for joining Plastic Pipe.

***HDPE Plastic Pipe (above ground). When above ground installation is required because of shallow soils, rock or for other reasons, the pipe and installation shall meet the following requirements:***

***The pipe material used shall be PE 3408 as per ASTM D3350 and pipe shall be manufactured in accordance with ASTM D2239 Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Inside Diameter or, ASTM D3035 Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter. The design working pressure of the pipeline shall not exceed 50% of the pressure rating of the pipe. The pipe shall be Class C Polyethylene pipe compound as described in ASTM D2239 or D3035.***

***Piping shall be joined in accordance with the manufacture's recommendations for the particular pipe to be installed. Piping can be joined either mechanically or thermally. The preferred method is to use butt fusion welding. Metal insert fittings shall be used for all clamp and band type fittings to prevent pipe collapse. The inserts shall be galvanized steel, brass, stainless steel or***

**plastic meeting ASTM D2609 requirements. Double banding or double clamping, with the clamp adjustment heads offset 90 to 180 degrees, shall be used for all insert fittings. Pipe ends can be heated to ease the installations of fittings. The ends shall be heated either with hot water or a hot air gun. Avoid excessive heating (above 240 degrees F) or open flame contact with the pipe. All damaged pipe ends shall be removed before joining. The pipe shall be allowed to cool before the clamps or bands are installed.**

**Thermal expansion shall be considered in the design of high-density polyethylene pipe systems laid on the ground surface. The pipe shall be restrained in areas where pipe movement is likely to cause damage to the pipe itself. When the pipe is to be connected to a trough, it shall be anchored to the ground near the trough. Anchors may be earth berms or embankment, pipe burial, or concrete or timber blocks.**

**The pipe shall be anchored and "snaked" at intervals along its length, The pipe shall be allowed to deflect laterally between the anchors. The amount of the lateral deflection is to be calculated using the following equation:**

$$W = 0.0067 (L)(T)$$

**where: W = Lateral deflection of the pipe in feet**

**L = Length of pipe between anchors in feet**

**T = Square root of (the maximum expected temperature variation during the life of the installation in degrees Fahrenheit)**

**The total length of the pipe needed shall be determined using the following equations:**

$$d = 0.00144 (D)(t)$$

**where d = the contraction length loss of pipe from its manufactured length when the temperature is below 73 degrees Fahrenheit**

**D = surface length of pipe in feet (not counting "snaking")**

**t = Square root of (73 degrees Fahrenheit - lowest anticipated temperature of the pipe over its expected life).**

**Total length = D + d**

**Drainage.** Valves or unions shall be installed at low points in the pipeline so that the line can be drained as needed.

**Pipelines installed below frost line will not require special drain appurtenances. All other pipelines will require drain provisions at all low points along the line. Positive grade will be provided from all drain locations.**

**Vents.** For design velocities lower than 8 ft/s, some provision shall be included in the design for removing air. If parts of the line are above the hydraulic gradient, periodic use of an air pump may be required.

**An air release valve shall be located on the first summit from the water source. Air release valves should be located at all summits in the line where an accumulation of air will cause excessive head loss. Special care shall be taken in the pipeline layout to eliminate grade changes that cause minor high points between the air release valves. In no case shall the air release valves be more than one mile apart.**

**To avoid the requirement of expensive valves, manually operated air release cocks, hydrants, globe valves, ball valves or brass stop and drain valves may be used. The minimum size of valve shall be 1/2 inch. If manual valves are used, the operation of the valve shall be discussed with the owner and a record of the discussion included in the operators file.**

**Automatic vacuum relief valves shall be designed for pipelines subject to extreme surge flow conditions such as in pumping, fluctuating flow, or high velocity flow.**

**Pressure relief valves (or surge chambers) are required in the line at points where the combination operating pressure and surge exceeds the maximum working pressure of the pipe. Such points are generally associated with check valves or other quick-closing valves. The pressure relief valve will have the ability to discharge the line capacity at 1.5 times the maximum working pressure of the line and shall not permit leakage at the maximum working pressure.**

**Check valves may be required in pipelines delivering water to points of higher elevation to protect against flow reversal.**

**Check valves shall be used in the pump discharge and pipeline wherever the potential backflow from the pipeline would be excessive or would be sufficient to damage the pump. To prevent backflow through the outlet into a residence, two spring actuated check valves shall be installed at all outlets on pipelines supplying water for human use.**

**Surge chambers or pressure relief valves shall be installed adjacent to check valves, if the pressure rating of the pipe is less than the static head plus 200 feet.**

**Valves smaller than the nominal size of the pipeline may be used to control the flow. In no case shall the valve be less than one nominal size smaller than the pipeline it controls.**

**Suitable screens, strainers, or other entrance protection shall be installed on all pipelines.**

**Joints.** Watertight joints that have a strength equal to that of the pipe shall be used. Couplings must be of material compatible with that of the pipe. If they are made of material susceptible to corrosion, provisions must be made to protect them.

**All connections and fittings shall be constructed to withstand the maximum pressure of the line without excess leakage and leave the inside of the line free of any obstruction which would reduce the line capacity below design requirements. All cutting, joining, and installing shall be in accordance with manufacturer's recommendations.**

**All ferrous pipefittings shall conform to Federal Specification WW-P-521. All steel accessories used in the line where soil may cause excessive corrosion shall be adequately protected from corrosion by wrapping with plastic tape or coating with high quality corrosion preventatives. When plastic tape is used, all surfaces to be wrapped shall be coated with a primer compatible with the tape, prior to wrapping.**

**Vegetation.** Disturbed areas shall be established to vegetation or otherwise stabilized as soon as practicable after construction. Seedbed preparation, seeding, fertilizing, and mulching shall conform to the instructions provided in technical guides.

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**Visual resources.** The visual design of pipelines in areas of high public visibility and those in fragile areas shall be carefully considered.

**State regulations. All applicable state laws or water rights must be complied with. It shall be the owner's responsibility to comply with state laws and water rights.**

## CONSIDERATIONS

### Water Quantity

1. Effects on the water budget, especially on volumes and rates of runoff and infiltration. Compare to centralized water facilities that has increased soil compaction because of traffic livestock, vehicles, and humans.
2. Effects on surface and ground water of broken pipelines.

### Water Quality

1. The impact of water available at remote sites as a factor in keeping livestock out of streams and lakes, with the resulting reduction in bank erosion, sediment yield, and the direct deposit of manure in water courses.
2. Effects of bacteria, nutrients, salts and organic matter on surface and ground water because of increased recreation activity caused by the availability of water.
3. Effects of erosion and sediment yield from disturbed areas during construction.

**Distribution of stock watering facilities should be such that livestock need not travel more than one mile between forage and dependable water on gentle relief. On rough relief, the greatest travel distance from forage to water should not exceed one-half mile. Stock water facilities will not be planned at closer intervals than one-half mile on gentle relief or one-quarter mile on rough relief.**

## PLANS AND SPECIFICATIONS

Plans and specifications for installing pipelines shall be in keeping with this standard and shall

describe the requirements for applying the practice to achieve its intended purpose.

#### **OPERATIONS AND MAINTENANCE**

*The items requiring operation may include but are not limited to periodic opening of*

*manual air release valves and opening the drain valves and manual air release valves prior to winter (shallow lines). Valves may require maintenance such as tightening the packing cap to reduce leakage. Valves and other appurtenances will require periodic replacement.*

