Pipeline (Ft.) 516

DEFINITION

Pipeline having an inside diameter of 8 inches or less.

PURPOSES

This practice may be applied as part of a resource management system to achieve one or more of the following purposes:

- *Convey water from a source of supply to points of use for livestock, wildlife, or recreation.*
- *Reduce energy use.*
- *Develop renewable energy systems (i.e., in-pipe hydropower).*

CONDITIONS WHERE PRACTICE APPLIES

Where it is desirable or necessary to convey water in a closed conduit from one point to another.

CRITERIA

Pipelines shall be planned, designed, and installed to meet all federal, state, local, and tribal laws and regulations.

Capacity. For livestock water, the installation shall have a capacity to provide seasonal high daily water requirements for the number and species of animals to be supplied. Animal water requirements can be obtained from the NRCS conservation practice standard Watering Facility (614).

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

Additional water capacity will be provided for wildlife when applicable.

Sanitary Protection. If water from the pipeline is likely to be used for human consumption, *applicable state and local regulations shall* be met.

When a pipeline serving livestock is supplied from a *well*, an approved method for eliminating backflow *shall be incorporated into the pipeline design*.

Pipe. All pipe must withstand the pressure it will be subjected to, including hydraulic transients, internal pressures, and external pressures. *As a safety factor against surge or water hammer, the working pressure (maximum static pressure, psi) should not exceed 72% of the pressure rating of the pipe and the design flow velocity at system capacity should not exceed 5 ft/sec.* If either of these limits is exceeded, special consideration must be given to flow conditions and measures must be taken to adequately protect the pipeline against surge.

Steel pipe shall meet the requirements of AWWA Specification C-200.

Plastic pipe shall conform to the requirements of the following ASTM specifications, as applicable:

- D 1527 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80
- D 1785 Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120D 2104 Polyethylene (PE) Plastic Pipe, Schedule 40
- D 2239 Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
- D 2241 Poly(Vinyl Chloride) (PVC), Pressure-Rated Pipe (SDR)
- D 2282 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR)
- D 2447 Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
- D 2513 Thermoplastic Gas Pressure Pipe, Tubing and Fittings
- D 2737 Polyethylene (PE) Plastic Tubing
- *D 2672 Joints for IPS PVC Using Solvent Cement*
- D 3035 Polyethylene (PE) Plastic Pipe (SDR-PR), Based on Controlled Outside Diameter
- AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 inches through 12 inches
- AWWA C901 Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inch through 3 inches

Plastic pressure pipe fittings shall conform to the following ASTM specifications, as applicable:

- D 2464 Threaded Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
- D 2466 Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
- D 2467 Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
- D 2468 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40
- D 2609 Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe
- *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
- D 3261 Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

Solvents for solvent-welded plastic pipe joints shall conform to the following ASTM specifications, as applicable:

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

Rubber gaskets for pipe joints shall conform to the requirements of ASTM F477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

Drainage. Valves or unions shall be installed at low points in the pipeline so that the line can be drained as needed. Check valves shall be installed as needed to protect groundwater quality or maintain a full pipeline.

Drainage shall be provided on above ground installations.

Where the pipeline is buried below probable frost depth (4 feet minimum), drains may be omitted.

Vents. Design shall provide for entry and removal of air along the pipeline, as needed, to prevent air locking or pipe collapse.

Vents are typically used on low pressure systems. Vent pipes shall extend above the hydraulic grade line at design capacity.

If parts of the pipeline are above the hydraulic gradient, periodic use of an air pump may be required.

Provisions shall be made for pressure relief, air relief, and vacuum relief, as needed, to protect the pipeline.

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.

Pipe Protection. When steel pipe is used, interior protective coatings shall be provided in accordance with NRCS Conservation Practice Standard 430FF, Steel Pipe. If a coal-tar enamel protective coating is needed for corrosion protection, the coating shall meet the requirements of AWWA Specification C-203.

Steel pipe installed above ground shall be galvanized or shall be protected with a suitable protective paint coating, including a primer coat and two or more final coats.

Plastic pipe installed above ground shall be resistant to ultraviolet light throughout the intended life of the pipe using materials with at least 2 percent carbon black.

Above ground pipelines shall be suitable for seasonal use. Protect above ground pipe by placing along perimeter fencing and under cross fences, by shallow burial, or rolling up for the winter months. Shallow buried pipelines shall have at least 1.5 feet of cover unless shallower cover is specified. If shallower cover is specified, there shall be provisions to protect the pipeline from damage by livestock, vehicular traffic, excessive pipe movement, and other hazards.

Water shall not be allowed to freeze in pipelines or appurtenances. If cold weather operation is planned, bury the pipe below frost depth (4 feet minimum). However, parts of the pipeline, such as float valves, connectors, *reduced pressure zone (RPZ) valves, other backflow devices,* etc., may not be freeze-proof.

Winterizing of pipeline systems shall be done prior to freezing temperatures. This can be done by blowing out the system to remove any water within the pipeline or equivalent method.

Install shut off valves in various locations along the pipeline to allow easy repair of broken appurtenances and damage to pipe.

All pipes shall be protected from hazards presented by traffic, farm operations, freezing temperatures, fire, thermal expansion, and contraction. Reasonable measures should be taken to protect the pipe from potential vandalism.

Pipe Size. The pipeline shall be sized to accommodate potential future expansion of the system. Minimum pipe size shall be 1.25 inch nominal diameter, unless justification for a smaller diameter is documented by an engineering analysis or allowed under low pressurized systems.

Overflow pipes for watering facilities shall be a minimum diameter of 0.5 inch larger than the delivery pipe or 2 inch diameter, whichever is larger.

In areas where mineral or biological deposition in pipelines has proven to be a problem, the pipe shall be a minimum of 0.5 inch larger than otherwise required.

Low Pressure Systems. These systems are gravity flow or pumping systems where operating pressure does not exceed 15 psi and length of the pipe is less than 1,500-feet. The minimum pipe size shall be 0.75 inch diameter.

Flow from spring development may need a larger pipe size. Refer to the Engineering Field Handbook (EFH), chapter 12 for gravity system pipe capacities. Pipe capacity is based on Manning's equation. Low-pressure systems may also be designed based on the Hazen-Williams equation. Low pressure pumping systems such as nose pumps, solar pumps, etc. shall be considered if operating pressure does not exceed 15 psi.

Pump Pressure System. Pump pressure system is any system that has working pressures greater than 15 psi. Pump pressure systems shall be designed by an engineer, or approved engineering procedure. The design shall meet site conditions. *For design purposes, head loss for hydraulic grade line computations shall be computed using the* Hazen-Williams *or Darcy-Weisbach* equation*. Equation selection shall be based on the given flow conditions and the pipe materials used.*

For closed, pressurized systems, the hydraulic grade line for all pipelines shall be maintained above the top of the pipeline at all locations for all flows unless specifically designed for negative internal pressures.

Pipeline Appurtenances. Pipeline design shall include details for all needed air release valves, air-and-vacuum valves, pressure relief valves, pressure reducer valves, check valves, vents, drain valves, hydrants, surge chambers, pressure tanks, drains, access enclosures, water source hookups, and other appurtenances.

Maximum pressure shall not exceed the pressure rating of pipe and appurtenances at any point in the pipeline.

Air Valves - Pipelines Operating Pressures Greater Than 10 psi. Pipelines where static or operating pressures exceed 10 psi shall have a *combination* air valve *(a continuous acting air release valve, a vacuum-relief valve, and an air release and vacuum relief valve all in one body)*, or manually operated air vents at all significant high points in the pipeline. A significant high point is defined as a high point in the pipeline more than 10 feet above an adjacent low point.

In addition, a combination air valve or manually operated valve shall be located at changes of grade in downward direction of flow in excess of 10 degrees, to ensure adequate air release during filling.

Combination air valves shall be used as needed to permit air to escape while the line is at working pressure. Small orifices of this valve type shall be sized according to the design working pressure and venting requirements recommended by the valve manufacture.

If needed to provide positive means for air escape during filling and air entry while emptying, a combination air valve or manually operated valve shall be installed at all high points, upstream and downstream of all inline valves as needed, at the entrance, and at the end(s) of the pipelines. Proper use of the combination air valve or manually operated valve must be identified in the Operation and Maintenance Plan.

Air Valves and Vent - Pipelines Operating at 10 psi or Less. Pipe shall be laid to grade such that all high points are well defined and can be vented. An open vent or continuous action air-release valve shall be installed at all high points (greater than 10 feet in elevation above an adjacent low point) in the pipeline.

Air valves shall only be used where pressures are high enough at high points to operate a valve properly.

Vegetation. Disturbed areas shall be established with vegetation or otherwise stabilized as soon as practical after construction. Seedbed preparation, seeding, fertilizing, and mulching shall conform to Michigan NRCS Standard 342, Critical Area Planting.

Use vegetation adapted to the site that will accomplish the desired purpose. Preference shall be given to native species in order to reduce the introduction of invasive plant species; provide management of existing invasive species; and minimize the economic, ecological, and human health impacts that invasive species may cause. If native plant materials are not adaptable or proven effective for the planned use, then non-native species may be used. Refer to the Field Office Technical Guide, Section II, Invasive Plant Species for plant materials identified as invasive species.

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

Additional Criteria Applicable to Reduce Energy use. *Provide analysis to demonstrate reduction of energy use from practice implementation.*

Reduction of energy use is calculated as average annual or seasonal energy reduction compared to previous operating conditions.

Additional Criteria Applicable to Develop Renewable Energy Systems. *Renewable energy systems shall meet applicable design criteria in NRCS and/or industry standards, and shall be in accordance with manufacturer's recommendations. Hydropower systems shall be designed, operated, and maintained in accordance with the Microhydropower Handbook, Sections 4 and 5, as appropriate.*

CONSIDERATIONS

Potential effects of installation and operation of the pipeline on cultural, historical, archeological, or scientific resources at or near the site need to be considered in planning.

Vegetation should be allowed to grow over the pipe to shade it from the sun. Where fire is to be used as a management tool, specific provisions must be made to protect the pipe from fire.

The impact of water available at remote sites is 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.

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. If the pipeline is a component of a system that includes additional conservation practices, the information necessary to construct these additional practices will also be conveyed on the plans.

Support data documentation requirements are as follows:

- Inventory and evaluation records
  - CONS-6 notes or special report
- Survey notes, where applicable
  - Design survey
  - Construction layout survey
  - Construction check survey
- Design records
  - Physical data, functional requirements, and site constraints, where applicable
  - Soils/subsurface investigation report, where applicable
- Design and quantity calculations
- Construction drawings/specifications with:
  - Location map
  - "Designed by" and "Checked by" names or initials
  - Approval signature
  - Job class designation
  - Initials from pre-construction conference
  - As-built notes
- Construction inspection records
  - CONS-6 notes or separate inspection records
  - Construction approval signature
- Record of any variances approved, where applicable
- Record of approvals of in-field changes affecting function and/or job class, where applicable

OPERATION AND MAINTENANCE

An Operation and Maintenance (O&M) plan shall be developed for this practice. The O&M plan shall be consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for the design.

REFERENCES

McKinney, J.D. et al. Microhydropower Handbook, IDO-10107, Volumes 1 & 2. U.S. Department of Energy, Idaho Operations Office.

USDA-NRCS, National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 5, Preparation of Engineering Plans, and Chapter 12, Springs and Wells.

USDA- NRCS - National Range and Pasture Handbook.