

# R309-550 Facility Design and Operation: Transmission and Distribution Pipelines

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## **R309-550. Facility Design and Operation: Transmission and Distribution Pipelines.**

### ***R309-550-1. Purpose.***

The purpose of this rule is to provide specific requirements for the design and installation of transmission and distribution pipelines which deliver drinking water to facilities of public drinking water systems or to consumers. It is intended to be applied in conjunction with rules R309-500 through R309-550. Collectively, these rules govern the design, construction, operation, and maintenance of public drinking water system facilities. These rules are intended to assure that facilities are reliably capable of supplying water in adequate quantities, consistently meeting applicable drinking water quality requirements, and not posing a threat to general public health.

### ***R309-550-2. Authority.***

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with Title 63G, Chapter 3 of the same, known as the Administrative Rulemaking Act.

### ***R309-550-3. Definitions.***

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

### ***R309-550-4. General.***

Transmission and distribution pipelines shall be designed, constructed and operated to convey adequate quantities of water at ample pressure, while maintaining water quality.

### ***R309-550-5. Water Main Design.***

#### **(1) Distribution System Pressure.**

(a) The distribution system shall be designed to maintain minimum pressures as required in R309-105-9 at points of connection, under all conditions of flow.

(b) When static pressure exceeds 150 psi in new distribution water lines, pressure reducing devices shall be provided on mains in the distribution system where service connections exist.

***Guidance: The normal working pressure in the distribution system should be between 60 and 100 psi. The requirement for PRV's to be installed when pressures exceed 150***

*psi only applies to new water pipelines. Systems should implement an operation program to protect water users from excessive pressures.*

## **(2) Design Flow Rates.**

Flow rates used when designing or analyzing distribution systems shall meet the minimum requirements in R309-510.

## **(3) Hydraulic Analysis.**

(a) All water mains shall be sized following a hydraulic analysis based on flow demands and pressure requirements.

(b) Where improvements will upgrade more than 50% of an existing distribution system, or where a new distribution system is proposed, a hydraulic analysis of the entire system shall be prepared and submitted for review prior to plan approval.

(c) Some projects require a hydraulic model. The Division may require submission of a hydraulic modeling report and/ or certification, as outlined in R309-511, prior to plan approval.

## **(4) Minimum Water Main Size.**

For water mains not connected to fire hydrants, the minimum line size shall be 4 inches in diameter, unless they serve picnic sites, parks, semi-developed camps, primitive camps or roadway rest-stops. Minimum water main size, serving a fire hydrant lateral, shall be 8 inches in diameter unless a hydraulic analysis indicates that required flow and pressures can be maintained by 6-inch lines.

*Guidance: Generally, velocity in a water main should not exceed 5 fps. Mains should be designed with sufficient excess capacity to provide for anticipated future connections.*

## **(5) Fire Protection.**

When a public water system is required to provide water for fire flow by the local fire code official, or if the system has installed fire hydrants on existing distribution mains for that purpose:

(a) The design of the distribution system shall be consistent with the fire flow requirements as determined by the local fire code official.

*Guidance: The State Fire Marshall's office has stated that "The State- adopted fire code recognizes that water mains intended for firefighting need not become subject to retroactive fire flow requirements. As such, an existing system is*

*considered code compliant as long as it is maintained properly and new construction does not alter the fire flow requirement. Water companies are encouraged to make improvements incrementally to avoid a possible moratorium on development due to lack of water, i.e., fire flow.”*

(b) The location of fire hydrants shall be consistent with the requirements of the State-adopted fire code and as determined by the local fire code official.

*Guidance: Generally, individual hydrant spacing may range from 200 to 500 feet depending on the area being served. The planning of hydrant locations should be a cooperative effort between the water utility and local fire officials.*

(c) The pipe network design shall permit fire flows to be met at representative locations while minimum pressures, as required in R309-105-9, are maintained at all times and at all points in the distribution system.

(d) Fire hydrant laterals shall be a minimum of 6 inches in diameter.

## **(6) Geologic Considerations.**

The character of the soil through which water mains are to be laid shall be considered. Special design and burial techniques shall be employed for Community Water Systems in areas of geologic hazard (e.g., slide zones, fault zones, river crossings, etc.)

*Guidance: Water supply conduits and major service lines crossing known fault areas should be either designed to accommodate significant differential movement of the ground, or be valved immediately above and below the points of the fault crossing to allow control of water flow, in case of pipe rupture during an earthquake event.*

*Guidance: Water systems should be designed to provide alternative flow paths for major conduits in regions of known geologic hazards.*

## **(7) Dead Ends.**

(a) To provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins whenever practical.

(b) Where dead-end mains occur, they shall be provided with a fire hydrant if flow and pressure are sufficient, or with an approved flushing hydrant or blow-off for flushing purposes. Flushing devices shall be sized to provide flows that will give a velocity of at least 2.5 fps in the water main being flushed. No flushing device shall be directly connected to a sewer.

## **(8) Isolation Valves.**

Sufficient number of valves shall be provided on water mains so that inconvenience and

sanitary hazards will be minimized during repairs. Valves shall be located at not more than 500foot intervals in commercial districts and at not more than one block or 800 foot intervals in other districts. Where systems serve widely scattered customers and where future development is not expected, the valve spacing shall not exceed one mile.

### **(9) Corrosive Soils and Waters.**

Consideration shall be given to the materials to be used when corrosive soils or waters will be encountered.

### **(10) Special Precautions in Areas of Contamination**

Where distribution systems are installed in areas of contamination:

- (a) pipe and joint materials which are not susceptible to contamination, such as permeation by organic compounds, shall be used; and,
- (b) non-permeable materials shall be used for all portions of the system including water mains, service connections, and hydrant leads.

### **(11) Water Mains and Other Sources of Contamination.**

Caution shall be exercised when locating water mains at or near certain sites such as sewage treatment plants or industrial complexes. Individual septic tanks shall be located and avoided. The Division shall be contacted to establish specific design requirements prior to locating water mains near a source of contamination.

*Guidance: It is recommended that utility lines are clearly identified and visually different from one another. Consideration shall be given to providing appropriate separation between water and other utilities for operational and contamination reasons.*

## **R309-550-6. Component Materials and Design.**

### **(1) ANSI/NSF Standard for Health Effects.**

All materials that may come in contact with drinking water, including pipes, gaskets, lubricants and O-Rings, shall be ANSI-certified as meeting the requirements of ANSI/NSF Standard 61, Drinking Water System Components - Health Effects. To permit field-verification of this certification, all components shall be appropriately stamped with the NSF logo.

### **(2) Asbestos and Lead.**

- (a) The use of asbestos cement pipe shall not be allowed.
- (b) Pipes and pipe fittings installed after January 4, 2014, shall be “lead free” in

accordance with Section 1417 of the Federal Safe Drinking Water Act. They shall be certified as meeting ANSI/NSF 372 or Annex G of ANSI/NSF 61.

*Guidance: The Community Fire Safety Act of 2013 exempts fire hydrants from the lead free requirements of Section 1417.*

### **(3) Standards for Mechanical Properties.**

Pipe, joints, fittings, valves, and fire hydrants shall conform to ANSI/NSF Standard 61, and applicable sections of AWWA Standards C104-A21.4-08 through C550-05 and C900-07 through C950-07.

### **(4) Used Materials.**

Only materials that have been used previously for conveying drinking water may be reused. Used materials shall meet the above standards, be thoroughly cleaned, and be restored to their original condition.

### **(5) Fire Hydrants .**

- (a) Hydrant drains shall not be connected to, or located within, 10 feet of sanitary sewers. Where possible, hydrant drains shall not be located within 10 feet of storm drains.
- (b) Auxiliary valves shall be installed in all hydrant leads.
- (c) Hydrant drains shall be installed with a gravel packet or dry well unless the natural soils will provide adequate drainage.

### **(6) Air Relief Valves and Blow-offs.**

- (a) At high points in water mains where air can accumulate, provisions shall be made to remove air by means of hydrants or air relief valves.
- (b) The open end of the air relief vent pipe from automatic valves shall be provided with a #14 mesh, non-corrodible screen and a downward elbow, and where possible, be extended to at least one foot above grade. Alternatively, the open end of the pipe may be extended to as little as one foot above the top of the pipe if the valve's chamber is not subject to flooding, or if it meets the requirements of (7) Chamber Drainage.
- (c) Blow-offs or air relief valves shall not be connected directly to a sewer.
- (d) Adequate number of hydrants or blow-offs shall be provided to allow periodic flushing and cleaning of water lines.
- (e) The air relief valve shall be installed in a manner to prevent it from freezing. A

shut-off valve shall be provided to permit servicing of an air relief valve.

## **(7) Chamber Drainage**

(a) Chambers, pits, or manholes containing valves, blow-offs, meters, or other such appurtenances to a distribution system, shall not be connected directly to a storm drain or sanitary sewer.

(b) Chambers shall be provided with a drain to daylight, if possible. Where this is not possible, underground gravel-filled absorption pits may be used if the site is not subject to flooding and conditions will assure adequate drainage. Sump pumps may also be considered if a drain to daylight or absorption pit is not feasible.

## **(8) Control Valve Stations**

(a) Pressure Reducing Valves (PRV's)

(i) Isolation Valves shall be installed on both sides of the pressure reducing valve.

(ii) Where variable flow conditions will be encountered, consideration shall be given to providing parallel PRV lines to accommodate low and high flow conditions.

(b) Backflow Devices

Installation of Backflow devices shall conform to the State-adopted plumbing code.

(c) Meters

Meter installation shall conform to the State-adopted plumbing code and local jurisdictional standards.

## ***R309-550-7. Separation of Water Mains and Transmission Lines from Sewers.***

### **(1) Basic Separation Standards.**

(a) The horizontal distance between water lines and sanitary sewer lines shall be at least 10 feet. Where a water main and a sewer line must cross, the water main shall be at least 18 inches above the sewer line. Separation distances shall be measured edge-to-edge (i.e., from the nearest edges of the facilities).

(b) Water mains and sewer lines shall not be installed in the same trench.

(c) Where local conditions make it impossible to install water or sewer lines at



separation distances required by subsection (a), the sewer pipes are in good condition, and there is not high groundwater in the area, it may be acceptable if the design includes a minimum horizontal separation of 6 feet and a minimum vertical clearance of 18 inches with the waterline being above. In order to determine whether the design is acceptable, the following information shall be submitted as part of the plans for review:

- (i) reason for not meeting the minimum separation standard;
- (ii) location where the water and sewer line separation is not being met;
- (iii) horizontal and vertical clearance that will be achieved;
- (iv) sewer line information including pipe material, condition, size, age, type of joints, thickness or pressure class, whether the pipe is pressurized or not, etc.;
- (v) water line information including pipe material, condition, size, age, type of joints, thickness or pressure class, etc.;
- (vi) ground water and soil conditions; and,
- (vii) any mitigation efforts.

(d) If the basic separation standards as outlined in subsections (a) through (c) above cannot be met, an exception to the rule can be applied for with additional mitigation measures to protect public health, in accordance with R309-105-6(2)(b).

***Guidance: Consideration should be given to placing warning tape above the water lines and/ or sewer lines***

### **(3) Special Provisions.**

The following special provisions apply to all situations:

- (a) The basic separation standards are applicable under normal conditions for sewage collection lines and water distribution mains. More stringent requirements may be necessary if conditions such as high groundwater exist.
- (b) All water transmission lines that may become unpressurized shall not be installed within 20 feet of sewer lines.
- (c) In the installation of water mains or sewer lines, measures shall be taken to prevent or minimize disturbances of the existing line.
- (d) Special consideration shall be given to the selection of pipe materials if corrosive conditions are likely to exist or where the minimum separation distances cannot be met. These conditions may be due to soil type, groundwater, and/or the nature of the fluid conveyed in the conduit, such as a septic sewage which produces corrosive hydrogen sulfide

(e) Sewer Force Mains

- (i) When a new sewer force main crosses under an existing water main, all portions of the sewer force main within 10 feet (horizontally) of the water main shall be enclosed in a continuous sleeve.
- (ii) When a new water main crosses over an existing sewer force main, the water main shall be constructed of pipe materials with a minimum rated working pressure of 200 psi or equivalent pressure rating.

**(4) Water Service Laterals Crossing Sewer Mains and Laterals.**

Water service laterals shall conform to all requirements given herein for the separation of water and sewer lines.

***R309-550-8. Installation of Water Mains.***

**(1) Standards.**

The specifications shall incorporate the provisions of the manufacturer's recommended installation procedures or the following applicable standards:

- (a) For ductile iron pipe, AWWA Standard C600-10, Installation of Ductile Iron Water Mains and Their Appurtenances;
- (b) For PVC pipe, ASTM D2774, Recommended Practice for Underground Installation of Thermoplastic Pressure Piping and PVC Pipe and AWWA Manual of Practice M23, 2003;
- (c) For HDPE pipe, ASTM D2774, Recommended Practice for Underground Installation of Thermoplastic Pressure Piping and AWWA Manual of Practice M55, 2006; and
- (d) For Steel pipe, AWWA Standard C604-11, Installation of Buried Steel Water Pipe- 4 inch and Larger

***Guidance: Consideration should be given to placing tracer wire on plastic pipe to permit location of the pipe by available detection equipment.***

**(2) Bedding.**

A continuous and uniform bedding shall be provided in the trench for all buried pipe. Stones larger than the backfill materials described below shall be removed for a depth of at least 6 inches below the bottom of the pipe.

### **(3) Backfill.**

Backfill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe. The material and backfill zones shall be as specified by the standards referenced in Subsection (1), above. As a minimum:

- (a) for plastic pipe, backfill material with a maximum particle size of 3/4 inch shall be used to surround the pipe; and
- (b) for ductile iron pipe, backfill material shall contain no stones larger than 2 inches.

### **(4) Dropping Pipe into Trench.**

Under no circumstances shall the pipe or accessories be dropped into the trench.

### **(5) Burial Cover.**

All water mains shall be covered with sufficient earth or other insulation to prevent freezing, unless they are part of a non-community system that can be shut-down and drained during winter months when temperatures are below freezing.

*Guidance: Pipe should be buried at least 12 inches below maximum expected frost penetration. The following is a list of reported pipe burial depths in Utah that may serve as a guide in this respect:*

- (A) Logan - 5ft.*
- (B) Salt Lake City - 3.5 ft. (5 ft. in high benches)*
- (C) Alta/Snowbird - 6 ft. (7 ft. if under roadway)*
- (D) St. George - 3ft.*
- (E) Park City - 5ft. (7 ft. above 7000 ft. elevation)*
- (F) Richfield - 4 ft.*
- (G) Moab - 4 ft.*

### **(6) Thrust Blocking.**

All tees, bends, plugs, and hydrants shall be provided with thrust blocking, anchoring, tie rods, or restraint joints designed to prevent movement. Restraints shall be sized to withstand the forces experienced.

### **(7) Pressure and Leakage Testing.**

All types of installed pipe shall be pressure tested and leakage tested in accordance with AWWA Standard C600-10.

## **(8) Surface Water Crossings.**

*Guidance: Surface water crossings, whether over or under water, present special problems. The Division should be consulted before final plans are prepared.*

### (a) Above Water Crossings

The pipe shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair or replacement.

### (b) Underwater Crossings

(i) A minimum cover of 2 feet or greater, as local conditions may dictate, shall be provided over the pipe.

(ii) When crossing water courses that are greater than 15 feet in width, the following shall be provided:

(A) Pipe with joints shall be of special construction, having restrained joints for joints within the surface water course and flexible restrained joints at both edges of the water course.

(B) Isolation valves shall be provided on both sides of the water crossing at locations not subject to high ground water or flooding, so that the section can be isolated for testing or repair.

(C) A means shall be provided, such as a sampling tap, not subject to flooding, to allow for representative water quality testing on the upstream and downstream sides of the crossing.

(D) A means shall be provided to pressure test the underground water crossing pipe.

## **(9) Sealing Pipe Ends During Construction.**

The open ends of all pipelines under construction shall be covered and effectively sealed at the end of the day's work.

## **(10) Disinfecting Water Lines.**

All new water mains or appurtenances shall be disinfected in accordance with AWWA Standard C651-05 or a method approved by the Director. The specifications shall include detailed procedures for the adequate flushing, disinfection, and microbiological testing of all water mains. On all new and extensive distribution system construction, evidence of satisfactory disinfection shall be provided to the Division. Samples for coliform analyses shall be collected after disinfection is complete and the system is refilled with drinking water. A standard heterotrophic plate count is advisable. The use of water for public

drinking water purposes shall not commence until the bacteriologic tests indicate the water is free from contamination.

### ***R309-550-9. Cross Connections and Interconnections.***

#### **(1) Physical Cross Connections.**

There shall be no physical cross connections between the distribution system and pipe, pumps, hydrants, or tanks that may be contaminated from any source, including pressurized irrigation.

#### **(2) Recycled Water.**

Neither steam condensate nor cooling water from engine jackets or other heat exchange devices shall be returned to the drinking water supply.

#### **(3) System Interconnects.**

The interconnections between different drinking water systems shall be reviewed and approved by the Director.

*Guidance: In some situations, hydraulic modeling or capacity development calculations may be required when proposing a system interconnect.*

### ***R309-550-10. Water Hauling.***

#### **(1) Community Water Systems.**

Water hauling is not an acceptable permanent source for drinking water distribution in Community Water Systems.

#### **(2) Non-community Systems.**

The Director may allow water hauling for Non-Community Public Water Systems by special approval if:

- (a) consumers can not otherwise be supplied with good quality drinking water; or,
- (b) the nature of the development, or ground conditions, are such that the placement of a pipe distribution system is not justified.

Proposals for water hauling shall be submitted to, and approved by, the Director.

### **(3) Emergencies.**

Water hauling may be a temporary means of providing drinking water in an emergency. Water systems shall notify the Division as soon as possible of such emergencies.

*Guidance: The guidelines for water hauling are contained in the bulletin entitled “Recommended Procedures for Hauling Culinary Water” available from the Division.*

## **R309-550-11. Service Connections and Plumbing.**

### **(1) Service Taps.**

Service taps shall not jeopardize the quality of the system's water.

### **(2) Plumbing.**

(a) Water services and plumbing shall conform to the State-adopted Plumbing Code.

(b) Pipes and pipe fittings installed after January 4, 2014, shall be “lead-free” in accordance with Section 1417 of the federal Safe Drinking Water Act. They shall be certified meeting the ANSI/NSF 372 or Annex G of ANSI/NSF 61.

### **(3) Individual Home Booster Pumps.**

Individual booster pumps shall not be allowed for individual service from the public water supply mains. Exceptions to the rule may be granted by the Director if it can be shown that the granting of such an exception will not jeopardize the public health.

*Guidance: Public water systems are being required to develop and operate a program to protect their systems from contaminations. An individual home booster pump, if installed so that the suction side of the pump draws directly from the system’s water main rather than through an intermediate holding tank, may reduce the pressure in the main to less than 20 psi (perhaps even creating a vacuum). This will increase the potential for contaminated water to enter the distribution system through minor undetected leaks that may exist.*

*We cannot regulate the individual homeowner, but we do not want to encourage public water systems to proliferate the use of such pumps. Rule R309-105-6(2)(b) (“exceptions”) will still be available for individual cases where there is no other acceptable alternative. Each public water system shall review language included in their service agreements with customers and perhaps modify them as needed to make it clear to the homeowner and plumbing inspector that such pumps are not allowed, without the permission of the public water system and authorized by the Director.*

*Fire sprinkler systems are increasingly required by local fire protection agencies for new buildings, including residential units. As the number of these systems increases, there will likely be instances where the water main pressure is inadequate to operate fire sprinklers at the desired flow rate. The fire sprinkler industry has developed booster pumps integral with the sprinkler piping to meet low pressure circumstances. These integral booster pumps will only operate during fire emergencies and will not affect normal distribution system pressures. During a fire emergency, the pump should not decrease line pressure any more than a fire hydrant. Accordingly, the Division considers these fire sprinkler booster pumps outside the intent of R309-550-11(3), and does not require their installation to be approved by the Division Director, if their installation conforms to the Utah adopted Plumbing Code and National Fire Protection Association (NFPA) 13 D, Standard for the Installation of Sprinkler Systems in one and two-family dwellings and manufactured homes.*

#### **(4) Service Lines.**

(a) Service lines shall be capped until connected for service.

(b) The portion of the service line under the control of the water system is considered to be part of the distribution system.

#### **(5) Service Meters and Building Service Line.**

Connections between the service meter and the home shall be in accordance with the State -adopted Plumbing Code.

### ***R309-550-12. Transmission Lines.***

#### **(1) Unpressurized Flows.**

Transmission lines shall conform to all applicable requirements in this rule. Transmission line design shall minimize unpressurized flows.

#### **(2) Proximity to Concentrated Sources of Pollution.**

A water system shall not install an unpressurized transmission line less than 20 feet from a concentrated source of pollution (e.g., septic tanks and drain fields, garbage dumps, pit privies, sewer lines, feed lots, etc.). Furthermore, unpressurized transmission lines shall not be placed in boggy areas or areas subject to the ponding of water.

## **R309-550-13. Operation and Maintenance.**

### **(1) Disinfection After Line Repair.**

The disinfection procedures of Section 4.7, AWWA Standard C651-05 shall be followed if a water main is cut or repaired.

### **(2) Cross Connections.**

The water system shall not allow a connection that may jeopardize water quality. Cross connections shall be eliminated by physical separation, an air gap, or an approved and properly operating backflow prevention assembly

The water system shall have an ongoing cross connection control program in compliance with R309-105-12.

### **(3) ANSI/NSF Standards.**

All pipe and fittings used in routine operation and maintenance shall be ANSI-certified as meeting NSF Standard 61 or Standard 14.

### **(4) Seasonal Operation.**

Water systems operated seasonally shall be disinfected and flushed according to AWWA Standard C651-05 for pipelines and AWWA Standard C652-11 for storage facilities prior to each season's use. A satisfactory bacteriologic sample shall be obtained prior to use. During the non-use period, care shall be taken to close all openings into the system.

#### ***Guidance:***

*Water systems are encouraged to develop contingency plans for obtaining pipe and appurtenances in an emergency. The stockpiling of material shall be considered.*

**KEY: drinking water, transmission and distribution pipelines, connections, water hauling**

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