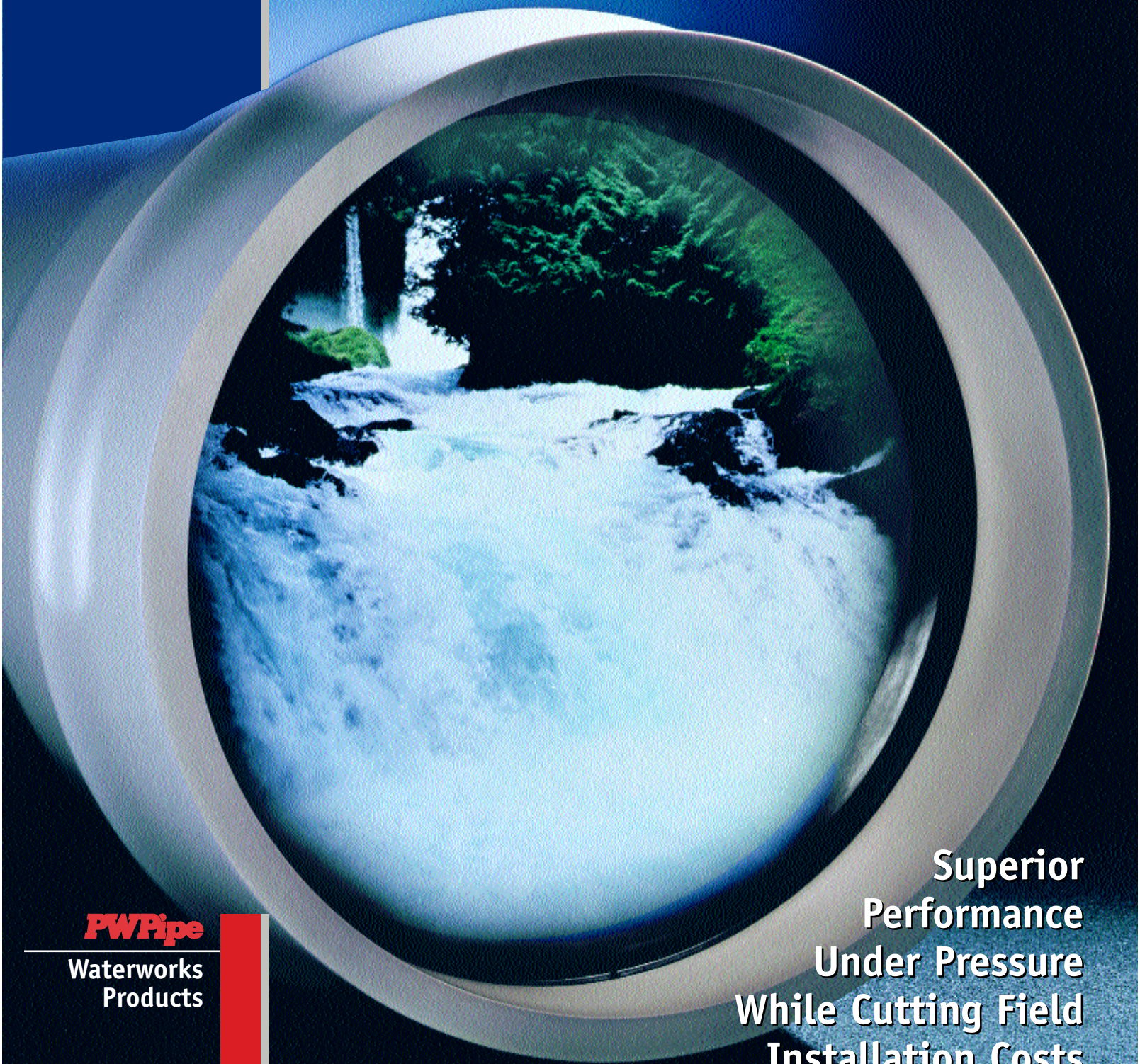
PWPipe®

PVC C905 Large-Diameter Transmission Pipe



Superior Performance Under Pressure While Cutting Field Installation Costs

PWPipe
Waterworks Products

www.pwpipe.com

Why more specifiers choose PWPipe C905 large-diameter pipe for water transmission systems.

PWPipe is the largest producer of PVC pipe in western North America and our products are available from distributors throughout this geographic region. Our water works products are distributed primarily in the states West of the Rockies.

PWPipe products include PVC and polyethylene pipe and tubing for a variety of applications servicing the potable water, well casing, sewer, turf, agriculture, plumbing, communications, and electrical markets. Our manufacturing facilities in Oregon, Washington, California, Utah, and Nebraska assure on-time delivery.

PWPipe C905 high pressure water pipe combines superior materials with the latest manufacturing technology.

PWPipe products meet or exceed industry standards because of our rigorous quality-control program.

PWPipe supports the PVC pipe industry's efforts to maintain the highest design and manufacturing standards. We are members of the Uni-Bell PVC Pipe Association and American Water Works Association (AWWA).

Advantages

Reliability
C905 is immune to nearly all types of internal and external corrosion. Since PVC is a non-conductor, it is not affected by electrolysis. Nor is it susceptible to alkaline or acid soil conditions. Since it never corrodes, cement liners, encasement bags, and poly linings are unnecessary. Smooth inner walls prohibit bacteria build-up, pitting, and tuberculation. As a result, it provides trouble-free service for decades.

Ease of Installation
PWPipe transmission pipe is much lighter than rigid pipe materials, making handling and installation faster and less expensive. Field-cutting, beveling, and assembly in the trench are easy. With 20-foot laying lengths and cast iron O.D. sizes, you can use standard fittings, valves, and couplers.

Smooth Flows
A Hazen-Williams flow coefficient of C=150 means our transmission pipe puts less burden on pumps, because there's less friction between moving water and pipe walls. The result is greatly reduced pumping costs.

Durability and Flexibility
Made from 12454 PVC compound, this pipe is not affected by most chemicals and is highly resistant to impact and abrasion.

The ability of PVC to bend without breaking allows the joint and pipe assembly to compensate for minor earth movement, which can cause problems in more rigid, non-PVC assemblies. Our integral bell gasketed joint meets the strict dimensional requirements and demanding test criteria of ASTM D 3139.

Quality Control
PWPipe transmission pipe meets or exceeds the exacting requirements of AWWA C905. Our listing with Underwriters Laboratories (UL) ensures that our pipe is manufactured precisely as specified. Extractant water purity tests performed by independent test laboratories ensure that our pipe meets the requirements for water purity as specified by ANSI/NSF Standard 61.

All PWPipe C905 products undergo additional in-plant quality-assurance tests, including impact resistance, flattening, joint integrity, hydrostatic proof, and acetone immersion.

Symbol of Excellence
Uni-Bell PVC Pipe Association
MEMBER

American Water Works Association **MEMBER**

UL LISTED

ASTM

Basic Assembly Instructions

1. Clean all debris from the bell end of the pipe. Check the gasket position. Be sure it's completely seated in the groove, with no raised areas.

2. Lubricate the spigot end, using only the PWPipe recommended lubricant supplied with the pipe.

3. Place the pipes in straight alignment. Assemble to the insertion line on the spigot—**but no farther**.

See PWPipe's installation guide for more detailed instructions.


1.


2.


3.

Factors Affecting Design

Hydraulics
PWPipe transmission pipe has an extremely smooth energy-efficient pipe wall. The Hazen-Williams coefficient is C=150.

Pressure Rating
You have a choice of two pressure ratings. Our conservative design theory allows you to use DR 25 (165 psi) or DR 18 (235 psi) which incorporate a safety factor of 2. By permitting variation of safety factors and surge pressure allowances, you can fine-tune the pipe design for your system. See AWWA C905 Section 4.6.

Deflection
The stresses that result from internal pressure and external load are not additive in the design of a flexible PVC pipe. A maximum deflection of 5 percent is recommended for a design limit.

Excessive Surge Pressures
Excessive surge pressures should be prevented by eliminating the causative condition (such as entrapped air) or providing reliable automatic surge-pressure controls and devices.

Temperature
For operation at temperatures 80˚F or higher, multiply the pressure rating by these derating factors:

Temperature	Derating Factor
80˚	0.88
90˚	0.75
100˚	0.62
110˚	0.50
120˚	0.40
130˚	0.30
140˚	0.22

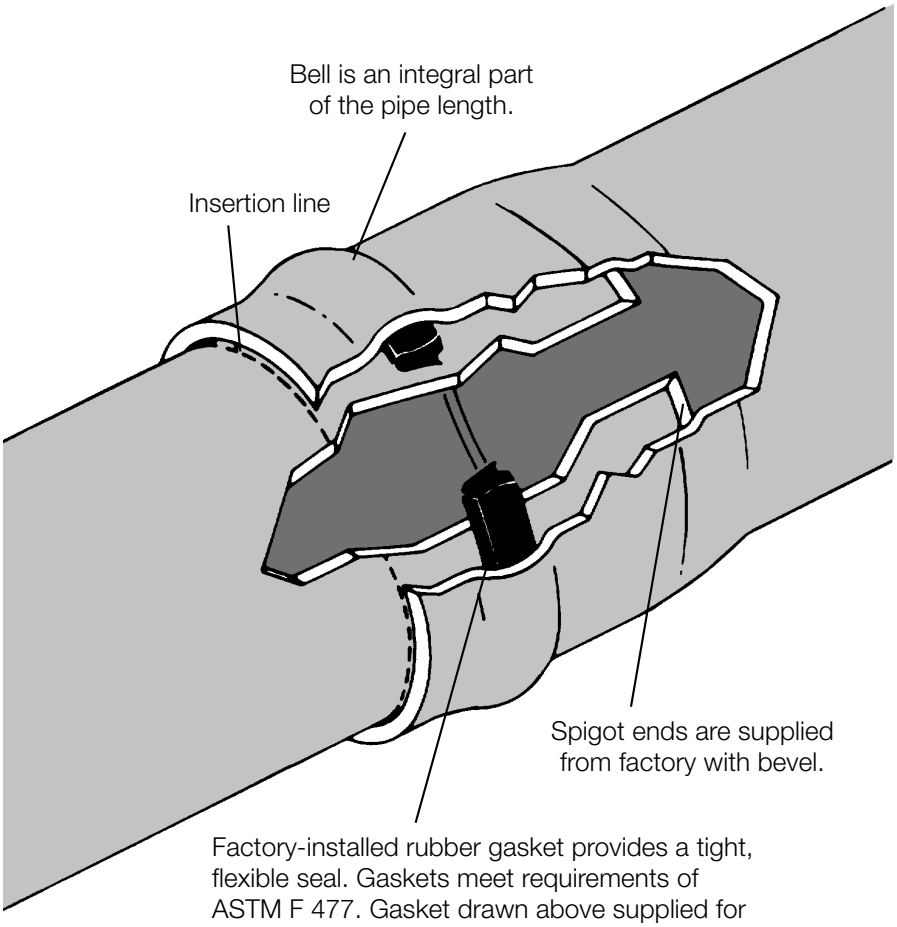
165 psi DR 25

Nominal Pipe Size (inches)	Average Outside Diameter (inches)	Approximate* Inside Diameter (inches)	Minimum Wall Thickness (inches)	Approximate Weight (lbs/100 ft)
14	15.300	13.99	0.612	1950
16	17.400	15.91	0.696	2560
18	19.500	17.83	0.780	3230
20	21.600	19.75	0.864	4000
24	25.800	23.59	1.032	5630

235 psi DR 18

Nominal Pipe Size (inches)	Average Outside Diameter (inches)	Approximate* Inside Diameter (inches)	Minimum Wall Thickness (inches)	Approximate Weight (lbs/100 ft)
14	15.300	13.48	0.850	2670
16	17.400	15.33	0.967	3510
18	19.500	17.18	1.083	4440
20	21.600	19.03	1.200	5490

*These figures allow for manufacturing tolerances.



Product Description Standard Specifications

Material
PVC compound meets cell class 12454 per ASTM D 1784 and is certified to ANSI/NSF Standard 61 for potability.

Pipe
Meets AWWA C905 and is UL listed.

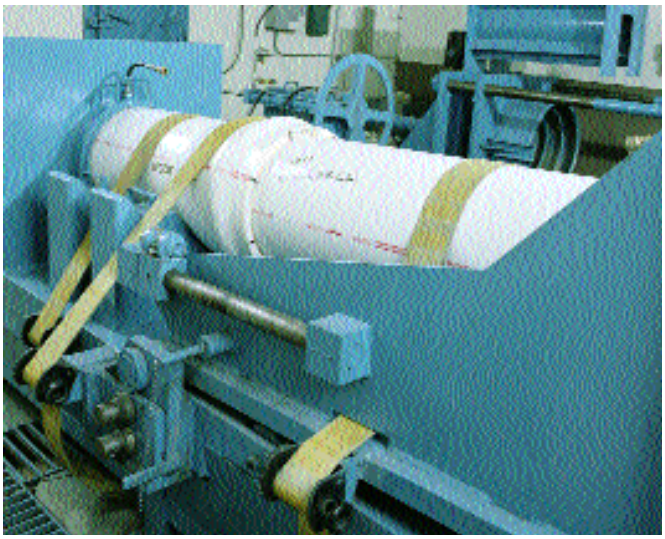
Elastomeric Seal
Integral bell pipe provided with factory-installed gaskets meeting requirements of ASTM F 477.

Gasketed Joint Assembly
Meets requirements of ASTM D 3139.

Quality Assurance

All PWPipe plants conduct daily quality-assurance tests, as well as pipe and joint inspections. Testing is in strict accordance with ASTM specifications as referenced by AWWA C905.

During the hydrostatic proof tests, each length of pipe is tested at twice the pressure rating of the pipe for a minimum dwell of 5 seconds.



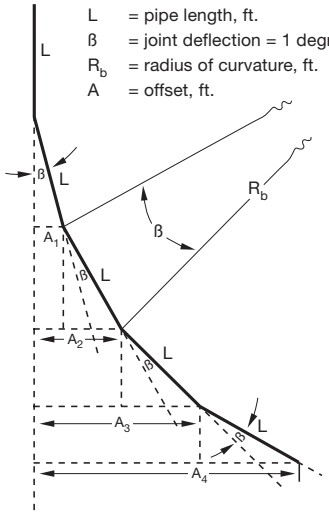
JOINT INTEGRITY

HYDROSTATIC PROOF TEST

Longitudinal Bending

Due to the large diameter and thick walls of AWWA C905 pipe, it is very difficult to curve the barrel of the pipe. Therefore, slight changes in direction are best accomplished by axial deflection at the pipe joints. A maximum of one degree of deflection is allowed at each joint. The equivalent radius of curvature for 20-foot pipe lengths is 1150 feet. For changes in direction greater than one degree per joint, fittings should be used.

See PWPipe's Technical Bulletin "Longitudinal Bending of PVC Pipe" for more details.



For 20-Foot Lengths

Number of Joints	Total Offset "A" (feet)
1	0.3
2	1.0
3	2.1
4	3.5
5	5.2
6	7.3
7	9.8
8	12.5
9	15.7
10	19.1

Installation

Trench
The bottom must be stable, smooth, and free of frozen material, dirt clods, or stones. Use bell holes for easy assembly and uniform support. Remove large rocks to provide at least 6 inches of clearance around the pipe and accessories.

We recommend at least 12 inches of cover. Where frost is common, the pipe should be 6 inches deeper than the record frost penetration.

Use of Mechanical Equipment to Assemble Pipe
For some conditions, use of heavy equipment (such as a backhoe bucket) may be necessary for assembly of large-diameter pipe. When this equipment is used, extra care must be taken because the installer loses the "feel" of the assembly. Conditions such as rolled gaskets or overinsertion could go unnoticed. For a list of precautions, refer to PWPipe's "Installation Guide—PVC Water Pipe."

Embedment
Install our transmission pipe with proper bedding for uniform longitudinal support. Work backfill materials under the sides of the pipe to provide satisfactory haunching. Place the initial backfill to a minimum depth of 6 inches above the pipe.

Select and place embedment material carefully. Exercise proper compaction and bedding procedures to provide soil densities as specified by the design engineer.

Refer to AWWA Standard C605 for embedment requirements. Make sure your backfill procedures are in accordance with applicable requirements.

Final Backfill
After placement and compaction of embedment materials, you can place the remaining backfill materials by machine. They should contain no large stones or rocks, frozen material, or debris. Exercise proper compaction procedures to provide required densities.

Table 1. Thrust Developed per 100 psi Pressure
AWWA C905 PVC Pressure Pipe (C.I.O.D.)

Nominal Pipe Size (inches)	Fitting 90° Elbow (lbs force)	Fitting 45° Elbow (lbs force)	Valves, Tees, Dead Ends (lbs force)
14	22,000	12,000	15,600
16	28,400	15,400	20,100
18	35,800	19,400	25,300
20	43,800	23,800	31,000
24	62,600	33,800	44,200

Table 2. Estimated Soil Bearing Capacity

Soil Type	Allowable Bearing Pressure (psf)
Muck, Peat, Etc.	0
Soft Clay	500
Sand	1,000
Sand and Gravel	1,500
Sand and Gravel With Clay	2,000
Sand and Gravel Cemented With Clay	4,000
Hard Pan	5,000

Note: Values are estimated for horizontal thrusts at depths of burial which exceed 2 feet.

Note: These values should be used only for estimating purposes. Values for design should be determined by an engineer familiar with site soil conditions.

Table 3. Dimension Ratio vs. Pressure Surge
In response to 1 fps instantaneous flow velocity change

Dimension Ratio DR	Pressure Surge (psi)
25	14.7
18	17.4

Thrust Restraint

Adequate thrust restraint is necessary for all gasketed joint systems. The "push on" features of our joints provide many installation advantages, but without adequate thrust restraint they can become "push off" problems. The large thrust forces present in water-distribution systems (see Table 1) require thrust restraints designed to handle test and peak operating pressures.

Concrete Thrust Blocks
If concrete thrust blocks are used, the size and type of thrust blocking must be based on the load-bearing capacity of the soil, pressure in the pipe, and diameter of the pipe. Table 2 provides conservative estimates of load-bearing values for various soil types. When soil conditions are not known, samples should be tested to determine soil properties.

Mechanical Restraints
If mechanical thrust restraint devices are used, they should be a type designed for use with PVC pipe. The devices should meet the test requirements of Uni-Bell's Specification Uni-B-13 "Joint Restraint Devices for Use with PVC Pipe." Design manuals and computer software are available from the restraint manufacturers.

For typical thrust blocking and mechanical thrust restraint examples, see Figures 1 through 6.

THRUST BLOCKS

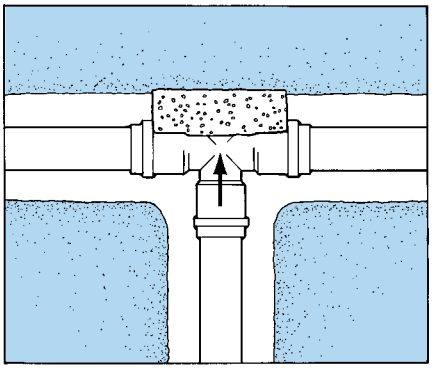


FIGURE 1: Through line connection, tee

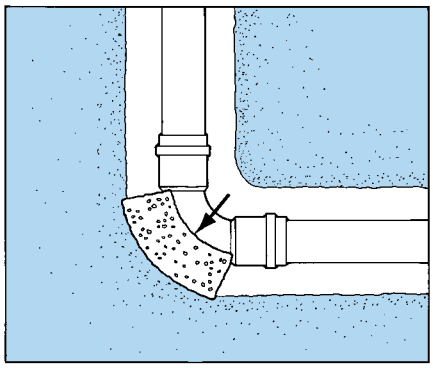


FIGURE 2: Direction change, elbow

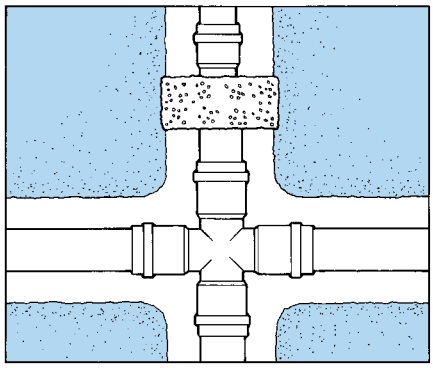


FIGURE 3: Change line size, reducer

MECHANICAL THRUST RESTRAINT DEVICES

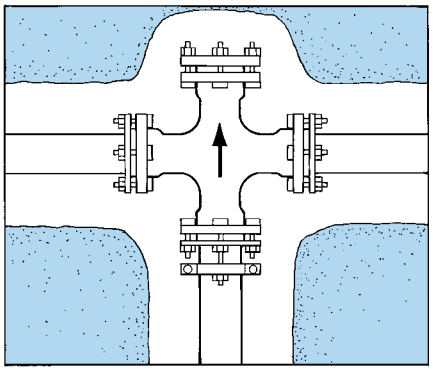


FIGURE 4: Through line connection, cross used as tee

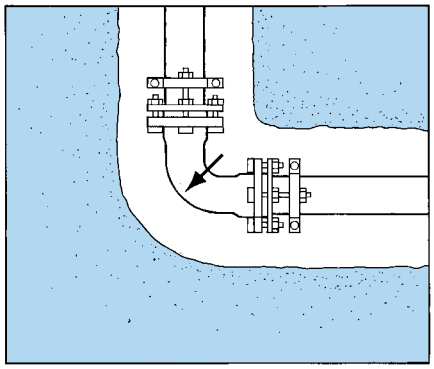


FIGURE 5: Direction change, elbow

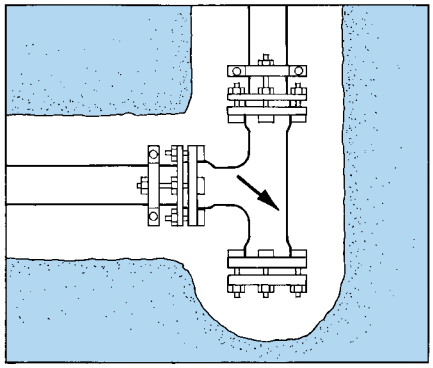


FIGURE 6: Direction change, tee used as elbow

Testing of Installed Systems

Place sufficient backfill before pipe filling and field testing. Under conditions requiring immediate backfilling of trenches, test after backfilling but prior to placement of permanent surface. Testing short lengths of pipe first will verify proper installation and joint assembly. If concrete thrust blocks are required, allow sufficient curing before testing.

Separate tests for pressure and leakage may be performed. If separate tests are done, the pressure test should be done first. See Table 5.

Procedure

While the line is under pressure, check for leaks in all exposed pipe, fittings, valves, and hydrants. Repair or replace all defective elements. Repeat the test until all visible leaks stop and the allowable leakage requirements are met, per Table 6. For detailed pressure-testing requirements, consult your engineer or the PWPipe installation guide.

WARNING: Do not use PVC pipe for pressurized air systems. Injury or death may result due to the catastrophic nature of pipe failure should failure occur. Rapid expansion of compressed air could propel shards of plastic throughout the area.

WARNING: Expel all air from the pipeline during filling and again before testing for pressure or leaks. Automatic air-release valves are recommended. Compressed entrapped air can greatly amplify surges or pumping pressures. Also, compressed air might leak through a joint that will not leak water.

Table 4. Volume of Water Required for Testing

Nominal Pipe Size (inches)	Volume (U.S. gal/100 ft)
14	800
16	1030
18	1300
20	1600
24	2300

Table 5. System Test Methods

Procedure	Pressure	Test Duration
Simultaneous pressure and leakage tests	150% of working pressure at point of test, but not less than 125% of normal working pressure at highest elevation*	2 hr
Separate pressure test	150% of working pressure at point of test, but not less than 125% of normal working pressure at highest elevation*	1 hr
Separate leakage test	150% of working pressure of segment tested*	2 hr

Source: Underground Installation of PVC Pressure Pipe and Fittings for Water, AWWA C605.

*In no case should the test pressure be allowed to exceed the design pressure for pipe, appurtenances, or the thrust restraints.

Table 6. Allowable Leakage per 50 Joints
U.S. Gallons per Hour

Nominal Pipe Size (inches)	Average Test Pressure (psi) 50	100	150	200	250
14	0.67	0.95	1.16	1.34	1.50
16	0.76	1.08	1.32	1.53	1.71
18	0.86	1.22	1.49	1.72	1.92
20	0.96	1.35	1.66	1.91	2.14
24	1.15	1.62	1.99	2.29	2.56

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