AWWA C900/IB PVC Pressure Pipe | Gasketed Integral Bell

INTRODUCTION

The PVC pipe industry has published consensus standards that represent the most comprehensive documents for installation requirements and best practices. NAPCO promotes the use of AWWA C605, *Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings*, as the primary source of installation guidelines for AWWA C900 gasketed integral bell pipe.

For more detailed technical information, refer to AWWA M23, PVC Pipe – Design and Installation, or the PVC Pipe Association's *Handbook of PVC Pipe Design and Construction*.

When necessary, we have presented additional information specific to our product offering.

The statements contained in this installation guide are those of NAPCO and are not warranties, nor are they intended to be warranties.

RECEIVING, HANDLING, & STORAGE

Follow AWWA C605, Section 5.

UV PROTECTION

AWWA M23, pg. 7 states, "UV degradation of PVC pipe formulated for buried use will not have significant adverse effect with up to two full years of outdoor weathering and direct exposure to sunlight."

When PVC pipe is properly covered and not exposed to sunlight, the allowable storage time is unlimited. The two year criteria is a cumulative value of the time the pipe is in exposed storage and is not based on the date of manufacture.

It is important for the gasket in each pipe to be checked for hardening or cracking prior to assembly and installation. If a gasket has become hard or cracked, the product should not be used.

TEMPERATURE CONSIDERATIONS

PVC will display a variation in physical properties with changes in temperature. Colder temperatures result in increases in pipe stiffness and tensile strength and decreases in impact strength. The decrease in impact strength requires care in handling during installation in freezing temperatures.

The actual rate of expansion/contraction for PVC is 0.36 inch per 100 feet of pipe per 10°F temperature change. Stresses caused by thermal changes are rarely ever generated in PVC pipe due to properly installed gasketed joints absorbing any thermal movement.

TRENCH PREPARATION & CONSTRUCTION

Follow AWWA C605, Section 7.

BURIAL DEPTH

Minimum burial depth is governed by a few criteria. ASTM D2774, *Standard Practice for Underground Installation of Thermoplastic Pressure Piping*, Section 6.4.2 states that "a minimum of 24 in. for pipe shall be required when subjected to heavy overhead traffic. In areas of light overhead traffic, a minimum of 12 to 18 in. is required." NAPCO recommends that this requirement is followed during project design and construction.

AWWA C605, Section 7.2.8, recommends the following depths of cover to prevent pipe flotation:

- SDR 32.5 and Thicker Pipe – Depth of Cover of 1.5 pipe diameters
- SDR 41 & 51 – Depth of Cover of 2.0 pipe diameters

Earth loads, from soil above a buried pipe, and live loads, from vehicles and objects on the surface, place vertical loads on the pipe that attempt to deform the pipe from a circle to an oval. The strength of the pipe wall, known as pipe stiffness, and the support afforded to the pipe by surrounding embedment soils counteracts these earth and live loads.

The Modified Iowa formula is widely used to calculate the expected in-situ deflection of PVC pipe at various depths and installation conditions. AWWA C605, Section 8.3, states that "the vertical cross-section long-term ring deflection of the pipe should not exceed 7.5 percent." We recommend that an engineer familiar with the Modified Iowa equation be consulted to determine if the embedment soil and pipe stiffness is adequate to counterbalance the loading conditions at specific burial depths.

PIPE ASSEMBLY, INSTALLATION, & EMBEDMENT

Follow AWWA C605, Sections 8.1 – 8.5.

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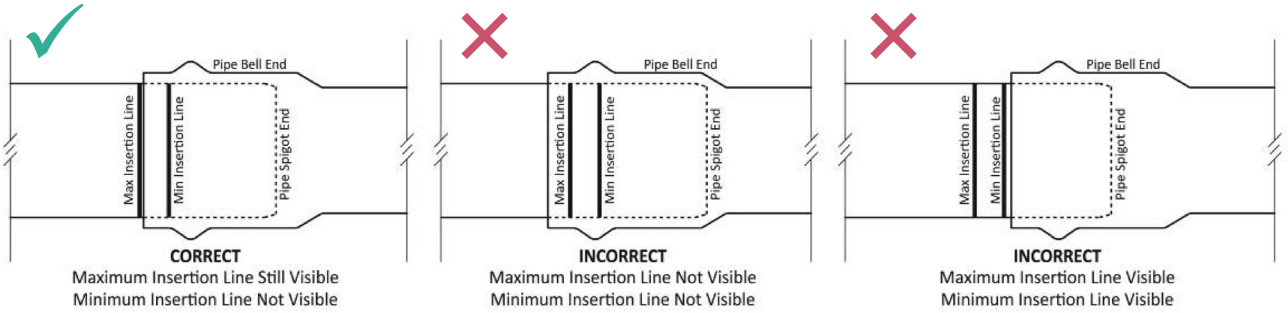

NAPCO-SPECIFIC GUIDELINES ON PIPE JOINT ASSEMBLY

1. Inspect & Clean

Remove all dirt and other foreign material from the bell interior and spigot exterior that could prevent an effective seal between the bell and spigot. Carefully clean the gasket and the groove area around the gasket.

Inspect each gasket to ensure that it is seated uniformly in the groove by running your finger around the edge of the gasket. Look to see if the gasket has been damaged, cut, torn, or become brittle. Set aside any questionable pieces of pipe.

DO NOT REMOVE THE GASKET FROM THE GROOVE FOR CLEANING. The gasket is not removable and will be damaged by attempts to remove it.

2. Lubricate

Lubricant should be applied to the bevel and exterior pipe wall of the spigot approximately mid-way back to the insertion line. Additionally, apply lubricant to the inside surface of the gasket in the bell. Only use supplied or approved lubricants. Lubricants for use with potable water pipelines must also be safe for potable water usage.

3. Assemble

Prior to joint assembly, both pipe segments must be in straight alignment to prevent gasket tearing or rollout during insertion.

Push the lubricated spigot end into the bell beyond the gasket. The bar and block method of assembly is recommended as the worker is able to the feel the amount of force being used and whether the joint slides together smoothly. Larger pipe will require mechanical assistance to apply sufficient force to assemble the joint.

Pipe spigots are marked with two insertion lines that indicate how far the spigot is to be inserted in to the bell. DO NOT OVERINSERT THE JOINT. Correct assembly of the pipe joint is shown above.

Ensure that previously joined pipe segments are not disturbed or overinserted as the pipeline assembly progresses.

For dual insertion line products, the spigot should be pushed into the adjoining bell until the edge of the bell is between the two insertion lines. One line should be hidden by the bell, and one line should still be visible.

JOINT ASSEMBLY PROBLEMS

If there is difficulty assembling the joint, disassemble and examine the gasket. Be sure the gasket is properly seated and both pipe segments are in straight alignment. If the gasket is damaged, cut off the bell, bevel the new edge, and use a coupling to assemble the two pipe segments.

If the pipe is misaligned, over-inserted, or assembled with excessive force, the following are possible consequences:

- Rolled or torn gaskets,
- Split bells,
- Acceptance testing failure (e.g. hydrostatic pressure test),
- Leaky joints after temperature changes or earth movement,
- Damage to previously assembled joints.

BELL & SPIGOT ORIENTATION

NAPCO recommends that the pipe's bell end points in the direction of work progress. When joining pipe, it is easier to insert the spigot into the bell than it is to push the bell over the spigot. This also reduces the risk of soil or rubble being scooped under the gasket during assembly.

The direction of the pipe bell relative to the flow direction does not affect the performance of the pipe joint or system hydraulics.

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INSTALLING PIPE THROUGH CASINGS

Follow AWWA M23, pg. 86-88.

CONNECTING PIPE TO APPURTENANCES & FITTINGS

Follow AWWA C605, Section 8.5. Follow the instructions of the appurtenance or fitting manufacturer including pipe trimming, pipe insertion, and bolt tightening guidelines. Appurtenances & fittings must be compatible with AWWA C900 PVC pipe sizes using the Cast Iron Outside Diameter (CIOD) standard.

Mechanical restraint rings typically have grooved pads that bite into the pipe. These grooved pads place acceptable indentations into the pipe. In the event of removing the restraint ring from the pipe, the section of PVC pipe with the indentations should be cut-off and discarded. The same area of PVC pipe should not be re-indented.

FIELD CUTTING

Pipe can be easily cut with a power saw using an abrasive disc. Other cutting tools may be appropriate, depending on the size of the pipe. It is recommended that the pipe be marked around its entire circumference prior to cutting to ensure a square cut. Both portions of the pipe on either side of the cut line should be supported from below such that neither portion of pipe pulls at the other while it is being cut.

If inserting into a gasketed joint, the newly cut pipe will need to be beveled and have the insertion marks redrawn. Use a factory-finished beveled spigot end as a guide for proper bevel angle and depth. Draw new insertion marks at the same distance as the original.

PIPE BENDING & JOINT ANGULAR DEFLECTION

See AWWA C605, Section 8.6. Some changes in direction may be accomplished without the use of elbows, sweeps or other fittings. Changes in direction can be accomplished by pipe bending or through angular joint deflection, BUT NOT BOTH, on the same segment of pipe.

Angular Joint Deflection

The maximum angular joint deflection for all NAPCO AWWA C900/IB PVC pipe sizes and pressure classes is 1°. Table 1 provides the maximum offset at the end of the deflected pipe for various lay lengths.

Longitudinal Bending

Due to the flexible nature of PVC, longitudinal bending of PVC pipe is possible as long as the flexural stress limitsof the pipe are observed.

Table 1: AWWA C900/IB Angular Deflection Maximum Offset

Lay Length	Maximum Offset	
ft.	ft.	ft.
20	0.35	4-3/16
40	0.70	8-3/8

We recommend that only manual force be used to bend PVC pipe in open-cut trench installations. Using mechanical equipment could easily surpass the allowable flexural stress limits of the pipe. For this reason, longitudinal bending of pipe sized larger than 12" is not recommended due to the large forces required.

Table 2 displays the minimum bend radius, maximum angle of lateral deflection, and the maximum distance offset at the end of a flexed, solid wall pipe.

Table 2: Longitudinal Bending of AWWA C900 Pipe – 20' Lay Length

Nom. Size	Min. Bend Radius	Max. Deflection Angle	Max. Offset of Flexed Pipe
	ft.	deg.	ft.
4	100.00	5.7	1.99
6	143.75	4.0	1.39
8	188.54	3.0	1.06
10	231.25	2.5	0.86
12	275.00	2.1	0.73

THRUST RESTRAINT

Follow AWWA C605, Section 8.7. Follow all thrust restraint manufacturer's requirements for installation methods especially bolt tightening specifications. Improper installation of external restraints can result in loss of joint seal or fracture of the pipe wall.

BACKFILL

Follow AWWA C605, Section 8.8.

APPURTENANCE PLACEMENT

Follow AWWA C605, Section 9.1 to 9.3.

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SERVICE CONNECTIONS

Follow AWWA C605, Section 9.4. Failure to use proper equipment made for drilling & tapping PVC pipe, sharp shell cutters, or correct technique may overstress and fracture PVC pipe. For more detailed information, we recommend consulting the PVC Pipe Association's UNI-PUB-08, *Tapping Guide for PVC Pressure Pipe*, available for free on www.uni-bell.org.

ACCEPTANCE TESTING

Follow AWWA C605, Section 10.2 and 10.3. Test pressures anywhere in the line must never exceed the temperature-corrected working pressure rating of the pipe. Only water should be used to test, never air.

DISINFECTION OF POTABLE WATER LINES

Follow AWWA C651, *Disinfecting Water Mains*.