Installation Guide for PVC Solid-Wall Sewer Pipe

This installation guide has been developed by North American Pipe Corporation for use as a field installation guide. General information regarding the correct installation of PVC solid-wall sewer pipe and assembly of integral bell gasketed joints is included.

For more detailed technical information, refer to ASTM D2321 *Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications*. This installation guide outlines design and construction practices.

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

RECEIVING

When a load of pipe arrives at a job site, it is your responsibility to check it thoroughly. If possible, inspect each piece for damage. Check quantities against the shipping list. Note that once the pipe leaves the plant, it becomes the property of the trucker. Any damaged or missing items must be documented on the bill of lading. Set aside any damaged items and notify the shipper.

UNLOADING

It is also your responsibility to unload the shipment. DO IT WITH REASONABLE CARE. Careless unloading can result in damaged product or personal injury. PVC pipe is tough, but don't slam it around!

Use a fork-lift or front-end loader with fork attachment, if available. Ensure the fork attachment is long enough to support the bundles. When unloading by hand, remove one piece at a time, and block the shipment to keep pipe from rolling off the truck.

STORAGE

If you can unload the shipment in unit packages, the pipe will be easier to store. Stack it on reasonably level ground. If you unload one piece at a time, place the pipe bevel to bell. Never stack over eight feet in height. Don't stack the pipe next to heat sources such as boilers, steam lines, electrical equipment or engine exhausts. Gaskets should also be protected from heat, oil and grease.

When exposure in excess of two years to direct sunlight is unavoidable, PVC pipe should be covered with an opaque material while permitting adequate air circulation above and around the pipe, as required to prevent excessive heat accumulation.

HANDLING

DO NOT DROP THE PIPE. String pipe close to the trench with the bell ends pointing in the direction of work progress to save extra effort. Be particularly careful in very cold weather.

TRENCHING

Clean trenches save time and money. Don't let the excavated material block sidewalks, drive or utility outlets. Follow all safety rules and regulations. Protect workers with sheeting and trench boxes in hazardous areas and slope walls in dry soils. When sheeting or trench box is moved, make sure the pipe is not moved and the side support material is not disturbed.

DE-WATERING

Keep the trench as dry as possible until the pipe has been installed and enough backfill placed to prevent the pipe from floating. PVC pipe will readily float if not filled with water or weighted down. The height of loose backfill material required to prevent flotation of empty pipe is conservatively equal to 1.5 times the pipe diameter.

FIELD CUTTING

PVC pipe can be easily cut with a hacksaw or power-driven abrasive disc. Be sure you make a square cut. Bevel the end with a beveling tool, wood rasp or power sander to the same angle as provided on the factory-finished pipe. Remark the insertion line on the spigot using a factory marked spigot as a guide.

ASSEMBLY

Remove any mud, sand or 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 area. Do not remove the gasket from the bell.

Make sure the gasket is seated uniformly in the groove by running your finger around the edge of the gasket.

LUBRICATION

Lubricant should be applied to the bevel of the spigot end and approximately mid-way back to the insertion line, and to the gasket surface which makes contact with the spigot end. Only use supplied or approved lubricants.

JOINT ASSEMBLY

Push lubricated end past gasket into the bell until the insertion line on the spigot is even with the edge of the bell. DO NOT OVERINSERT.

PROBLEMS

If you have trouble assembling the joint, disassemble and examine the gasket. Replace if damaged. Be sure the gasket is properly seated and both pipe lengths are in straight alignment. Repeat assembly steps. Correct assembly is achieved when the insertion line on the spigot is lined up with the edge of the bell.

IF NECESSARY

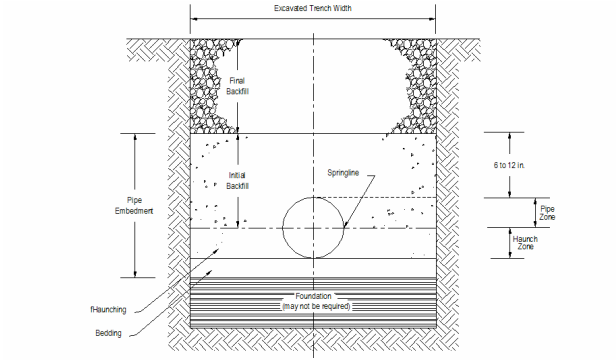
The bar and block method is recommended as a worker is able to feel the amount of force being used and whether the joint goes together smoothly. Larger pipe will require mechanical assistance to apply sufficient force to assemble the joint. Such mechanical devices are available if desired.

Care must be taken to insure that the spigot is NOT OVERINSERTED and that previously assembled pipe joints are not disturbed. This is accomplished by inserting only to the insertion line on the spigot end. In all cases, good alignment of the pipe is essential for proper assembly. If the pipe is misaligned, overinserted or assembled with excessive force, the following are possible consequences:

- rolled gaskets
- split bells
- failure to pass acceptance testing (e.g. low-pressure air testing and mandrel testing)
- or damage to previously assembled joints

EMBEDMENT

Terms used in pipe installation are illustrated in this cross section. The use of proper embedment materials is very important to trouble-free operation of the pipe system. Avoid using rocks larger than 1½ inches for embedment.



FOUNDATION

A foundation is required when the trench bottom is unstable. Any foundation that will support a rigid pipe without causing loss of grade or structural breakage will be more than adequate for PVC pipes.

BEDDING

Bedding may be used to bring the trench bottom up to grade before the pipe is installed. Its purpose is to provide continuous and uniform support. Where required, a maximum depth of 4 to 6 inches is normal.

HAUNCHING

Placement of the haunching material is the most important factor affecting pipe performance and deflection. Proper placement of material in the haunch reduces voids and increases pipe support. Granular materials may be properly placed using techniques such as shovel slicing. Place material under the haunches and at least halfway up the pipe to provide side support. Make sure the material is properly compacted. CAREFUL: DON'T MOVE THE PIPE. DON'T DISTURB SIDE SUPPORT WHEN MOVING SHEETING OR TRENCH BOX.

INITIAL BACKFILL

Keep the initial backfill free from rocks which could damage the pipe during final backfill. Depth of the initial backfill should be at least 6 inches over the top of the pipe. Initial backfill protects the pipe from damage during the final backfill. Machine compaction

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of initial backfill directly over the pipe is not desirable unless adequate cover has been provided to protect the pipe. Adequate cover will depend on the type of compaction equipment. For adequate cover to prevent pipe damage or deflection, consult the project engineer.

For a pipe under a road surface at shallow depths between 1 and 3 feet, specific embedment materials and compaction levels are recommended. The embedment material should be Class I (crushed rock) or Class II (clean sand and gravel) as described in ASTM D2321. This material should be installed from the bottom of the trench up to the bottom of the pavement and compacted to 95 percent of proctor density.

FINAL BACKFILL

In the final backfill, avoid using rocks over 4 inches, clumps of frozen soil, rubble and other such material. In general, the material which was originally excavated can be used, and it must be compacted to suit the engineer.

OVERNIGHT PRECAUTIONS

At the end of each workday, be sure that all installed pipe ends are covered to keep dirt, debris and animals from entering the pipe.

SPECIAL CONSIDERATIONS

Allowable Bending: Some changes in direction may be accomplished without the use of elbows, sweeps or other fittings. Controlled bending within acceptable limits can be accommodated by PVC pipe. A general rule of thumb for the minimum bending radius (R_b) calculation is R_b = 300 O.D. Tighter bending radii may be achieved for certain products. Block or brace pipe joints to ensure that bending of the pipe does not result in axial deflection of the joint. Excessive axial deflection may result in damaging stresses or leakage. In most cases, if bending is required, it can and should be accomplished manually.

Joint Deflection: Changes in direction may also be accomplished through joint deflection. Either joint deflection or longitudinal bending may be used for changes in direction, BUT NOT BOTH, on the same length of pipe. Maximum joint deflection for all sizes is 1°

Manhole Connection: Proper manhole connections are essential to good system performance. The following precautions are recommended:

- Insure stable foundation and bedding for the manhole and connecting pipe to prevent shifting which could damage connection.
- Use a water stop gasket produced from elastomeric material which prevents leakage while allowing longitudinal pipe movement.
- Use a nonshrinking or expansive type grout for making connections of pipe and waterstop to manhole walls.

Acceptance Testing: Low pressure air testing has been an acceptable method of insuring integrity of the installed sewer system. Infiltration testing is an alternative method which is accurate only when the pipe is completely under water. Exfiltration testing can be complicated by entrapped air. Uni-Bell PVC Pipe Association publication UNI-B-6, “Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe,” describes testing procedures and is available at http://www.uni-bell.org.

Thermal Effects: PVC will display a variation in physical properties with changes in temperature. Extremely cold 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 cold temperatures.

Increases in temperature above 73.4 °F result in decreases in tensile strength and pipe stiffness and increased impact strength. Decreases in pipe stiffness require that more care be taken during installation to avoid excessive deflection.

Risers: Sewer risers or vertical stacks may be required in deep sanitary sewers to minimize excavation for service lines. Risers are generally permitted where the main sewer line is deeper than 7 ft. (2 m).

The vertical riser pipe creates a load scenario not common in other sewer installations. Any settlement of material alongside the riser produces a “drag-down” load due to the frictional forces at their interface. Additionally, settlement

of the lateral fitting assembly produces the same drag down load. These loads must be mitigated or transferred harmlessly off the stack to prevent such things as over-

insertion, fittings' fracture, main sewer line deflection or misalignment, etc.

The following practices are considered appropriate for all riser installations:

- Transitions from horizontal to vertical should be smooth and well supported. This may be accomplished with fitting combinations, gradual bends and/or trench geometry.
- Service laterals from the main sewer should exit at an angle no greater than 45 degrees from the horizontal.
- A single joint of lateral pipe should be used for the riser section whenever possible (up to 13 feet).
- In order to minimize or eliminate settlement and the resulting loading, compaction is critical beneath the main line sewer, elevation fitting and any horizontal portion of the assembly (top and bottom).

Deep risers (13 ft. (4 m.) or greater) may require special design.

Soil Migration: Where conditions are such that running or standing water occurs in the trench, or substantial seasonal water table changes are expected, consideration must be given to preventing soil migration. Materials used for underdrains, bedding or haunching should be of proper gradation and thickness to prevent migration of material between the underdrain, pipe embedment and native soils in the trench below and at the sides of the pipe.

Overexcavation: Maintaining proper grade is essential to good system performance. Where overexcavation does occur, care must be taken that the elevation under the entire length of the pipe is brought up, rather than at the bells only, to insure proper support of the pipe and prevent sagging between joints.