INSTALLATION GUIDE FOR

SOLID-WALL PVC SEWER PIPE

PVCPIPE association

SEWER PIPE

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INTRODUCTION:

This document has been developed by the Uni-Bell PVC Pipe Association for use as a field installation guide. General information regarding the correct installation of gasketed-joint solid-wall PVC sewer pipe is included. Relevant product standards are:

- ASTM D3034 “Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings”
- ASTM F679 “Standard Specification for Polyvinyl Chloride (PVC) Large-Diameter Pipe and Fittings”

For more detailed technical information and for information on profile-wall PVC pipes, consult the pipe manufacturer or refer to ASTM D2321, “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications..” The *Handbook of PVC Pipe: Design and Construction* provides additional guidance on PVC pipe design and installation. For information on this publication, please contact Uni-Bell.

The Uni-Bell PVC Pipe Association, formed in 1971, funds PVC pipe research and development, provides technical service and support, develops recommended standards, and promotes proper use of PVC pipe with gasketed joints.

Uni-Bell members are manufacturers who are dedicated to producing high quality PVC pipe products for the industry.

The statements contained in this installation guide are those of the Uni-Bell PVC Pipe Association and are not warranties, nor are they intended to be warranties. Inquiries for information on specific products, their attributes and recommended uses, and the manufacturer’s warranty should be directed to member companies.

SEWER PIPE

RECEIVING:

When a load of pipe arrives at the 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 manufacturer's 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.

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UNLOADING AND HANDLING:

It is also your responsibility to unload the shipment. UNLOAD WITH REASONABLE CARE. Careless unloading can result in damaged product or personal injury.

Use a forklift or a front-end loader with fork attachment, if available. Make sure that the forks are sufficiently long 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.

Follow the following precautions:

- DO NOT drop pipe off the truck.
- DO NOT insert a forklift fork into a pipe end to transport.
- Lower the pipe into the ditch. DO NOT drop.

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The table below is provided for use as a guide in selection of handling equipment:

APPROXIMATE WEIGHT OF PIPE LENGTHS (lbs)

	20-Foot Lengths			14-Foot Lengths		
Pipe Size	**PS 46**	**PS 75**	**PS 115**	**PS 46**	**PS 75**	**PS 115**
(in.)						
4	22	--	30	16	--	21
6	50	--	67	35	--	47
8	89	--	120	62	--	84
10	140	--	190	98	--	130
12	200	--	270	140	--	190
15	290	--	390	200	--	270
18	410	480	650	290	340	460
21	570	670	900	400	470	630
24	720	840	1100	500	590	770
27	970	1100	1500	680	770	1100
30	1300	1500	2000	910	1100	1400
36	1800	2100	2800	1300	1500	2000
42	2400	2800	3800	1700	2000	2700
48	3200	3800	5100	2200	2700	3600

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STORAGE:

If you can unload the shipment in unit packages, the pipe will be easier to store. Stack the packages 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. Do not stack the pipe next to heat sources or engine exhausts. Gaskets should also be protected from heat, oil, and grease.

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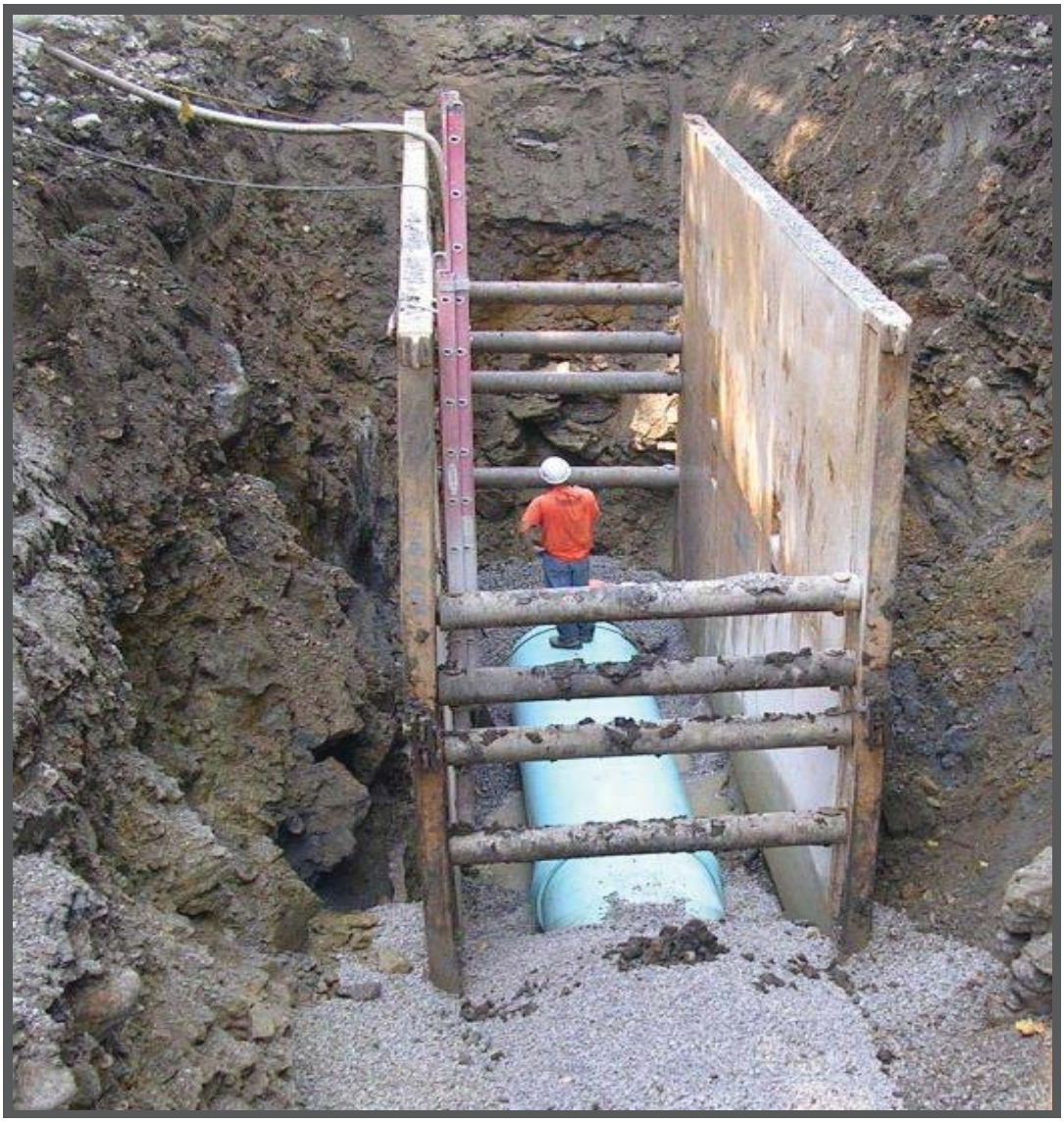
TRENCHING:

Do not let the excavated material block sidewalks, drives, or utility outlets. Follow all safety rules and regulations. Protect workers by using sheeting and trench boxes in hazardous areas and by sloping the trench walls in dry soils. When sheeting or a trench box is moved, make sure that the pipe is not moved and that the side-support material is not disturbed.



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DE-WATERING:

Do 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 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 1½ times the pipe diameter.

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FIELD CUTTING:

PVC pipe can be easily cut with a power handsaw 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 and length as provided on the factory-finished pipe. Redraw the insertion line on the spigot using a factory-marked spigot as a guide.

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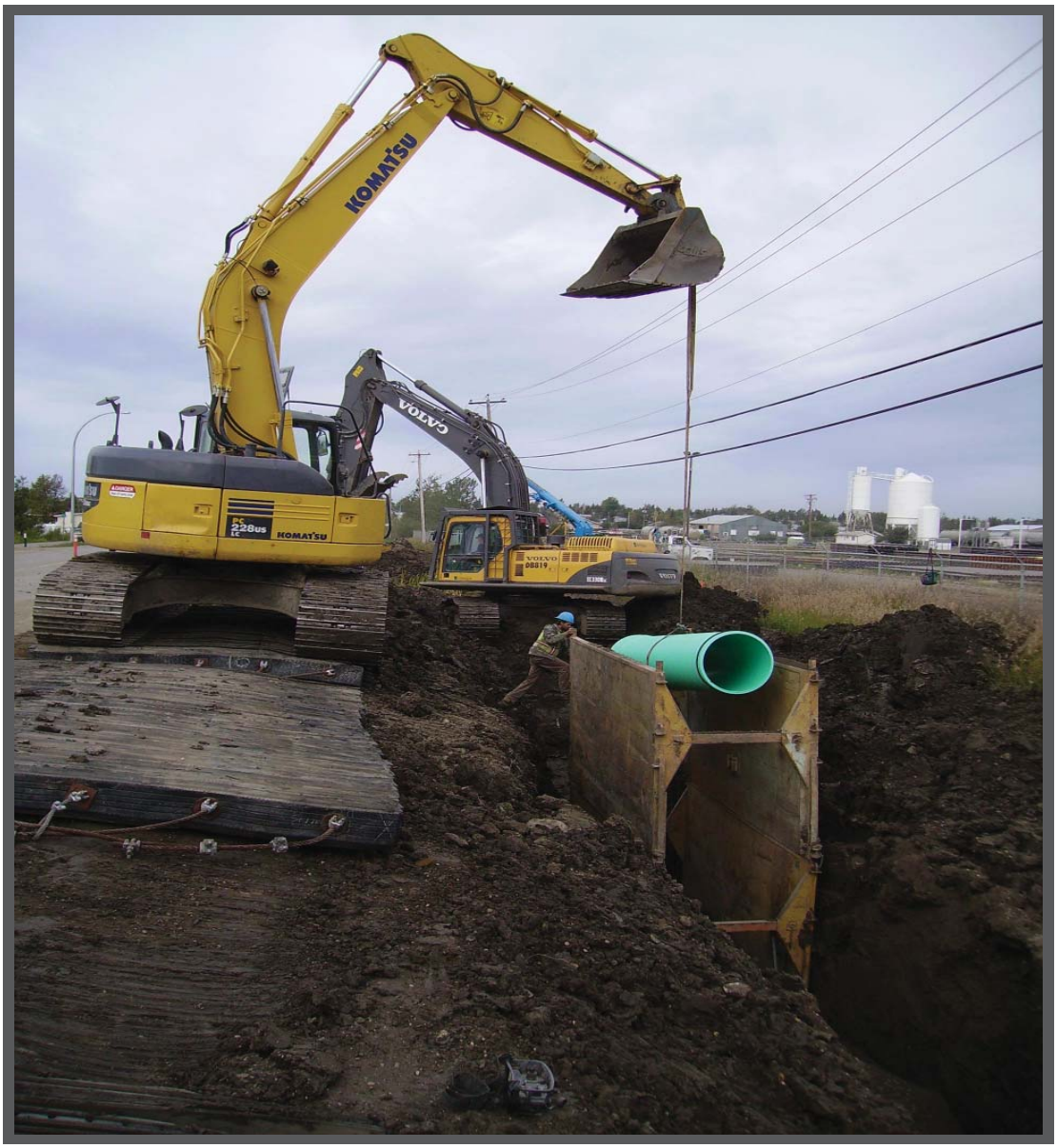
LOWERING PIPE INTO THE TRENCH:

Place the pipe and fittings into the trench using ropes and skids, slings on the backhoe bucket, or by hand. Do not throw the pipe or fittings into the trench or allow any part of the pipe to take an unrestrained fall onto the trench bottom. At this point, the pipe and other accessories are in a good position for final inspection. Ensure there are no damaged materials before assembly begins.



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CLEANING AND INSPECTION:

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 inner edge of the gasket.

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LUBRICATION:

Lubricant should be applied to the bevel of the spigot end and approximately mid-way back to the insertion line. Some manufacturers recommend applying lubricant to the gasket surface which makes contact with the spigot end. Use only the lubricants supplied or recommended by the pipe manufacturer.

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JOINT ASSEMBLY:

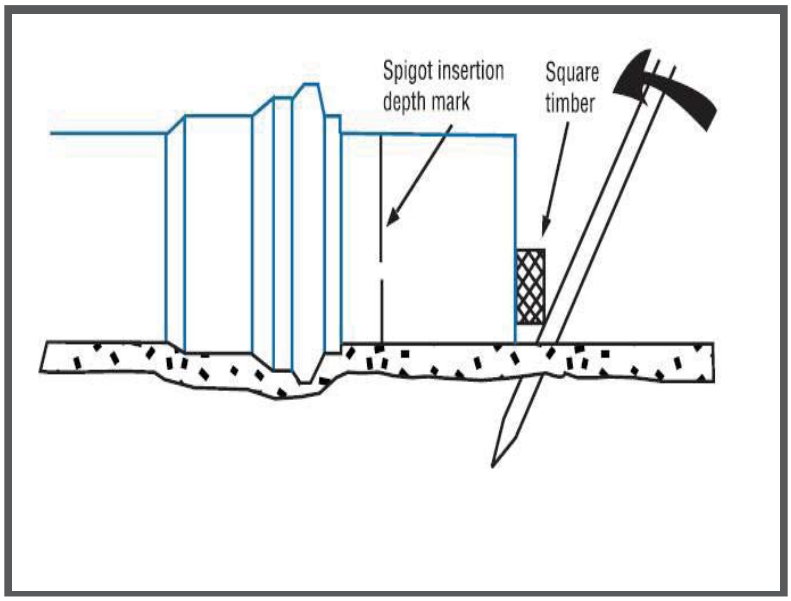
Push the lubricated spigot end past the gasket into the bell until the insertion line on the spigot is even with the edge of the bell. DO NOT OVERINSERT.

If you have trouble with assembly, disassemble the joint and examine the gasket. If the gasket is removable, replace if damaged. If non-removable gaskets are damaged, cut off the bell, bevel the new edge, and use a coupling to assemble. Be sure that the gasket is properly seated and that both pipe lengths are in straight alignment. Repeat assembly steps above. Correct assembly is achieved when the insertion line on the spigot is lined up with the edge of the bell. If multiple insertion lines exist, insert until only one line is visible.

The bar-and-block method of joint assembly is recommended, as the installer is able to feel the amount of force being used and whether the joint goes together smoothly. Larger pipe may require mechanical assistance to apply sufficient force to assemble the joint.

When mechanical devices are used, care must be taken to ensure that the spigot is inserted to the proper depth and that previously assembled pipe joints are not disturbed. This is accomplished by inserting only to the insertion line on the spigot end. If the spigot is over-inserted, back the pipe out until the insertion line is visible. In all cases, straight alignment of the pipe is essential for proper assembly. If the pipe is misaligned, over-inserted, or assembled with excessive force, the following are possible consequences:

- rolled gaskets
- failure to pass acceptance testing (e.g., low-pressure air testing and deflection-mandrel testing)
- over-insertion of previously assembled joints



Manual Bar-and-Block Method

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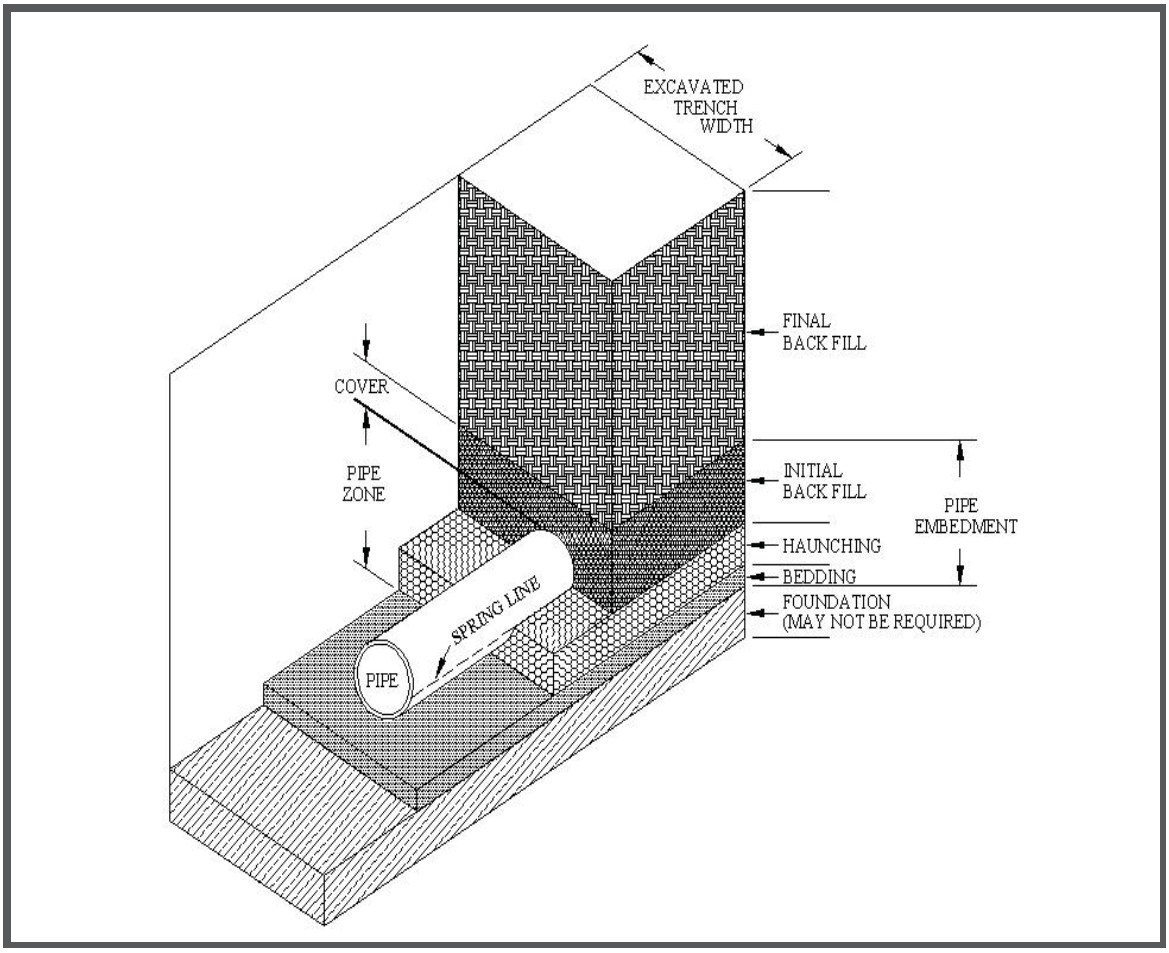
TRENCH CONSTRUCTION:

Terms used in pipe installation are illustrated in the trench cross-section below. The use of proper embedment materials is very important to trouble-free operation of pipe systems. The particle size of material in contact with the pipe shall not exceed 1½ inches.



FOUNDATION:

A foundation is required when the trench bottom is unstable. The bottom of the trench is over-excavated and brought back up to grade with suitable material. Where over-excavation occurs, ensure that the elevation under the entire length of the pipe is brought up (rather than only at the bells). Proper replacement of over-excavated materials will provide proper support of the pipe and will prevent sagging between joints.

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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 bedding is required, a maximum compacted depth of 4 to 6 inches is typical. Holes for pipe bells should be provided at each joint to ensure uniform support for the pipe. Bell holes should be no larger than necessary for pipe assembly.

HAUNCHING:

Placement and compaction of the haunching material are the most important factors affecting pipe performance and deflection. Proper placement and compaction of material in the haunch reduce voids and increase 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 material is properly compacted. DO NOT DISTURB SIDE SUPPORT WHEN MOVING SHEETING OR TRENCH BOX.

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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 final backfill. Machine compaction 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.

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FINAL BACKFILL:

Final backfill is often specified by the project engineer based on site design. Material selection, placement, and compaction should meet the project requirements.

ACCEPTANCE TESTING:

After the installed PVC pipeline is thoroughly cleaned, one or more of the following tests may be performed:

- Visual inspection
- Deflection test
- Leakage test

Visual Inspection: Sewer pipelines can be inspected visually to verify accuracy of alignment and freedom from debris and obstructions. The test is typically performed by closed-circuit TV.

Deflection Testing: Deflection testing is usually performed with a properly sized "go/no-go" mandrel. Mandrel sizes for 7½% deflection of the base inside diameter are found in the ASTM product standards (D3034 and F679) and are also given in the *Handbook of PVC Pipe: Design and Construction*.

Leakage Testing: Low-pressure air testing is an acceptable method of insuring integrity of the installed sewer system. ASTM F1417 "Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air" provides procedures for leakage testing of plastic sewer lines. UNI-B-6 "Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe" describes testing procedures and is available on the Uni-Bell website. Water-infiltration testing is an alternative method which is accurate only when the pipe is completely under water. Water-exfiltration testing is a rarely used method that can be complicated by entrapped air.

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SPECIAL CONSIDERATIONS:

Changes in Direction:

1. Pipe bending – Some changes in direction may be accomplished without the use of bends, 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 = 200 OD. Tighter bending radii may be achieved for certain products. Consult the manufacturer for specific product information. In most cases, bending should be accomplished manually. It is not recommended to attempt bending pipes greater than 12 inches in diameter due to the forces required.

2. Joint deflection – Changes in direction may also be accomplished through joint deflection. Allowable joint deflection is dependent on pipe size and joint design. Joint deflection limits should be obtained from the pipe manufacturer.

3. Combined pipe bending and joint deflection – Either joint deflection or longitudinal bending may be used for changes in direction, BUT NOT BOTH on the same length of pipe.

Manhole Connections: 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 the connection.

- Use a water-stop gasket produced from elastomeric material which prevents leakage while allowing longitudinal pipe movement.

- Use a non-shrinking or expansive type grout for making connections of pipe and water-stop to manhole walls.

Cold Weather Installation: 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.

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

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 the pipe/soil interface. Additionally, settlement of the lateral fitting assembly produces a similar drag-down load. These loads must be mitigated or transferred harmlessly off the stack to prevent problems such as over-insertion, fitting fracture, main sewer line deflection/misalignment, etc.

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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 length of lateral pipe should be used for the riser section whenever possible.

- To minimize or eliminate settlement and the resulting loading, compaction is critical beneath the main line sewer and lateral connections.

Soil Migration: Where running or standing water occurs in the trench or substantial seasonal water table changes are expected, consideration must be given to preventing soil migration. Migration could cause loss of soil support for installed pipe. Materials used for underdrains, bedding, and haunching should be of proper gradation and thickness to prevent migration of material from fine-grained native soils.

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CHECKLIST:

- Take all precautions necessary to protect workers and materials.
- Plan ahead for fittings.
- Use trench boxes or shoring in unstable conditions.
- Do not disturb installed pipe when moving trench boxes or shoring materials.
- Properly assemble pipe joints by inserting the spigot end until the insertion line is even with the bell lip.
- Insure watertight seals at manhole connections.
- Keep the trench bottom as dry as possible.
- For detailed installation recommendations, see ASTM D2321 “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.”
- Consult the pipe manufacturer for specifics regarding gaskets and lubricants.
- Check with the project engineer regarding specifications and procedures.

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UNI-BELL LITERATURE:

Recommended Standards

UNI-B-1 “Recommended Specifications for Thermoplastic Pipe Joints, Pressure and Non-Pressure Applications”

UNI-B-6 “Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe”

Technical Reports

UNI-TR-1 “Deflection: The Pipe/Soil Mechanism”

UNI-TR-3 “Maintenance of PVC Sewer Pipe”

UNI-TR-5 “The Effects of Ultraviolet Radiation on PVC Pipe”

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JM EAGLE

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