PWRib

Rib Pipe Installation

A guide for proper handling, installation and testing of PWRib gravity sewer and drainage pipes.

Installation of Pipe

General Information

Introduction

PWRib is the future of gravity sewer and drainage systems, here for your use today. The best available technology is presented in the form of PWRib. The current benefits of PVC sewer pipe you are so familiar with now are expanded with PWRib. The performance requirements of ASTM D3034 PVC Gravity Sewer pipe are met or exceeded by PWRib ASTM F794 Ribbed Pipe.

Trenches

General

- Trench excavation should comply with all applicable laws and regulations.
- Avoid opening long stretches of trench. This minimizes potential flooding and cave-ins and reduces traffic hazards.
- String the pipe on the opposite side of the trench from the excavated earth.
- It is normal practice to place pipe with the bell ends in the direction of the work in progress.

Trench Bottom

- Uniform and stable support for the pipe, free from irregularities, is necessary for proper installation. When unstable conditions exist a layer of granular bedding material should be used.
- If stones larger than 1½ inches are encountered, a minimum of 4 inches of bedding should be used.
- Coarse sand, crushed stone or shell affords the most economical granular material because necessary compaction is easily attained.
- Of primary importance is the elimination of voids under and around the bottom half of the pipe. Granular materials should be "worked in" until the trench bottom uniformly supports and positions the pipe to final grade.
- Native or excavated soil may be used to bring the undercut to proper grade providing the soil is free of hard lumps, debris, and stones larger than 1½ inches in diameter. It must be properly compacted by tamping.
- In rocky trenches place a minimum 4 inch layer of selected backfill material to provide for the pipe. Any pipe material which rests directly on the rock is subject to breakage under the weight of backfill, live loads, or soil movements.

Narrow Unsupported Vertical Walled Trenches

- The width of the trench need only be wide enough to place the required haunching material.
- Embedment should be compacted all the way to the wall in narrow trenches.

Wide Trenches

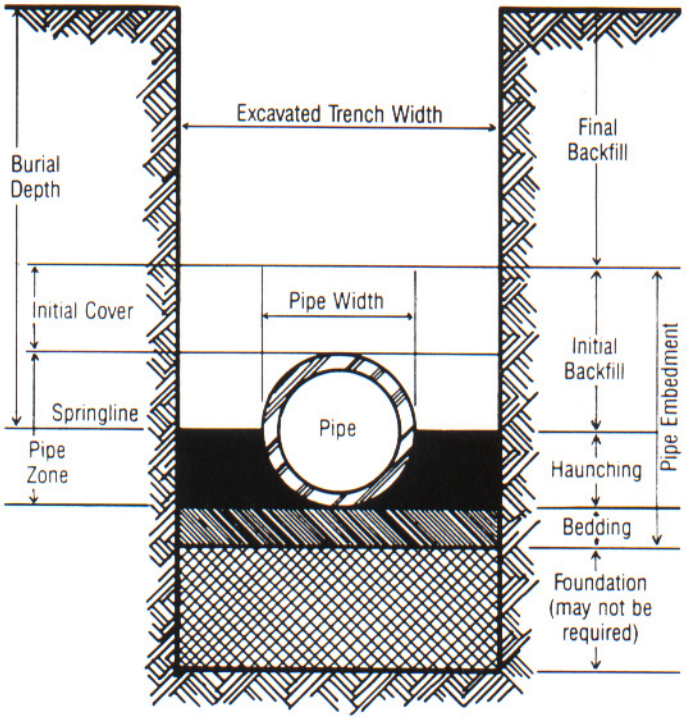
- Wide trenches have a width six times greater than the pipe diameter (2.5 diameters on each side of the pipe).
- Compaction requirements, 4 to 10 inch pipe – compact to 2.5 pipe diameters on both sides; 12 to 24 inches, compact to two feet on both sides of the pipe.

Flexible Pipe Terminology

Pipe Zone Terminology

- Understanding flexible conduit terminology is essential for the installer.
- Over-deflection, when it occurs, is invariably the result of improper compaction in the haunching area.

TRENCH CROSS-SECTION SHOWING TERMINOLOGY



Bedding

- Bedding is required to bring the trench bottom up to grade and to provide longitudinal support under the pipe. Blocking must not be used to bring the pipe to grade.
- Excavation for the bells (bell holes) is necessary to maintain continuous support for the pipe.
- Bedding thickness of 4 to 6 inches of compacted material is usually adequate to maintain grade.
- Use of well-graded materials is recommended where trench native soil is fine-grained.

Haunching

- Haunching provides side support to the pipe. This area is the most important for controlling pipe deflection.
- Haunching material should be worked under the sides of the pipe to ensure side support.
- Where coarse materials have been used for bedding, the same materials should be used for haunching.
- Haunching should extend to the springline of the pipe.

Initial Backfill

- Initial backfill is placed to protect the pipe from impact damage during final backfill.
- Since initial backfill provides little additional structural support, special compaction is not required.

Final Backfill

- Material – The material used for final backfill need not be as carefully selected as material in the embedment zone, but should not contain boulders, frozen clumps or rubble which could damage the pipe.
- Compaction – Under open fields, natural compaction should be adequate. Under improved surfaces, special compaction (as specified by the design engineer) is required.

Compaction

Saturation

- If saturation methods are used for compaction, the following recommendations should be followed:
  - Prevent flotation of the pipeline.
  - Do not use saturation during freezing temperatures.
  - Exercise care to prevent erosion at pipe sides and bottom caused by water jetting.
  - Apply only enough water to provide complete saturation.
  - Allow each layer to dewater and solidify until it will support the weight of the workers.

Compaction Equipment

- Avoid contacting the pipe with compaction equipment.
- Do not use compaction equipment directly over the pipe until sufficient backfill has been placed to prevent damaging or disturbing the pipe.
- Tamping should be done in 4 inch layers to the height specified by the engineer—but in no case less than to the springline of the pipe.
- With hand tamping, satisfactory results can be accomplished in the damp, loamy soils and sands.
- For more cohesive soils, mechanical tampers may be necessary.
- Water tamping should be limited to trench soil from which water drains quickly.

Soil Information

- The high void ratio of class 1 material limits its use to areas where side support will not be lost due to migration of fines from the trench walls and bottom. Where such migration is possible, the minimum size range should be reduced and the gradation designed to limit void size.
- Class 2 material should be well graded (not uniformly graded or gap graded) to prevent loss of side support. For class 4 materials, caution should be exercised in the design and the method of compaction due to difficulty in controlling moisture content in field conditions.
- Class 5 materials are not recommended for bedding, haunching or initial backfill.

A complete description of embedment material classification is shown at right.

Chart A DESCRIPTION OF MATERIAL CLASSIFICATION

Soil Class	Soil Type	Description of Material Classification
I	—	Manufactured angular, granular material, ¼ to 1½ inches (6 to 40mm) size, including materials having regional significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells.
II	GW	Well-graded gravels and gravel-sand mixtures, little or no fines. Clean.
	GP	Poorly-graded gravels and gravel-sand mixtures, little or no fines. Clean.
	SW	Well-graded sands and gravelly sands, little or no fines. Clean.
	SP	Poorly-graded sands and gravelly sands, little or no fines. Clean.
III	GM	Silty gravels, gravel-sand-silt mixtures.
	GC	Clayey gravels, gravel-sand-clay mixtures.
	SM	Silty sands, sand-silt mixtures.
	SC	Clayey sands, sand-clay mixtures.
IV	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands. Liquid limit 50% or less.
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. Liquid limit 50% or less.
	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts. Liquid limit greater than 50%.
	CH	Inorganic clays of high plasticity, fat clays. Liquid limit greater than 50%.
V	OL	Organic silts and organic silty clays of low plasticity. Liquid limit 50% or less.
	OH	Organic clays of medium to high plasticity. Liquid limit greater than 50%.
	PT	Peat, muck and other highly organic soils.

Chart B PIPE DIMENSIONS & WEIGHTS: 13 ft. laying lengths

Nominal Pipe Size (in.)	Average Outside Diameter (in.)	Average Inside Diameter (in.)	Minimum Wall Thickness (in.)	Approx. Wt. (lb/100 ft.)
8	8.800	7.891	.060	230
10	11.000	9.864	.070	310
12	13.100	11.737	.085	440
15	16.070	14.374	.105	600

PWRIB GASKET SYSTEM

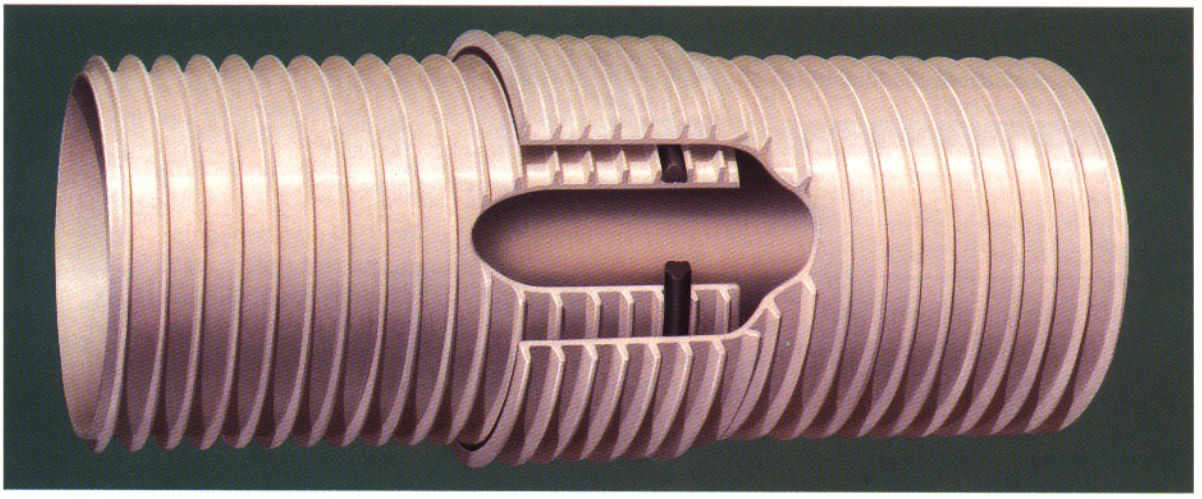


Chart C LONG TERM DEFLECTIONS OF SDR-35 PVC PIPE (Percent)

Pipe Stiffness 46 psi minimum (Loading — Soil Load Only)

ASTM Embedment Material Classification	Density (Proctor) AASHTO T-99	Height of cover (feet) 3	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	40	45	50
Class I	>95%																				
	85-95%																				
	<85%																				
	Loose															■	■	■	■	■	■
Class II	>95%																				
	85-95%																				
	<85%															■	■	■	■	■	■
	Loose				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Class III	>95%																				
	85-95%																		■	■	■
	<85%						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Loose		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Class IV	>95%																		■	■	■
	85-95%								■	■	■	■	■	■	■	■	■	■	■	■	■
	<85%				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Loose		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

□ Maximum 7.5% deflection ■ This zone not recommended

Note: The minimum recommended burial depth for PWRib under highway loading is one foot. Contact PWPipe for further details.

Deflection

Deflection is the reduction of the vertical diameter of a flexible pipe due to an imposed load. The deflection that occurs after installation is a function of:

1. Pipe stiffness (F/△Y)
2. Soil stiffness (density) in the pipe zone.
3. Load imposed on the pipe.

Deflection is controlled primarily by soil density, not soil class. Soil stiffness in the pipe zone, especially in the haunching area, is most important. Adopting the 7½% maximum deflection for SDR 35 pipe, the chart above will inform you of your burial depths.

NOTE: PWRib has greater stiffness than D3034, making the above deflection values conservative.

Deflection testing: Occasionally it will be required to test for deflection in a difficult job to insure proper installation. The engineer will determine locations and methods for the testing. The recommended method is a mandrel sized for allowable deflection per the following base I.D. chart.

Chart D PW RIB BASE I.D.*

Pipe size (in.)	Base I.D. (in.)	7.5% mandrel sizing (in.)
8	7.665	7.09
10	9.563	8.85
12	11.361	10.51
15	13.898	12.85

*Base inside diameter is a minimum pipe I.D. calculated by subtracting a statistical tolerance package from the pipe's specified inside diameter.

Pipe Assembly

PWRib seamless gasketed pipe is an Integral Bell product. All gaskets are installed at the factory.

The joint is engineered to provide problem-free service for the life of the pipe, but proper procedures must be followed to ensure its effectiveness:

1. Make certain that both the bell and spigot are clean and have no foreign matter which could prevent an effective seal between the gasket and bell surfaces. PWRib gaskets are shipped on the spigot to prevent loss of the gasket.
2. Check the gasket. Make sure the gasket is not twisted and is inserted uniformly.
3. If for any reason the gasket must be placed on the pipe spigot in the field, place it between the second and third ribs.
4. Carefully lower the pipe into the trench to avoid getting dirt into the bell or onto the gasket. If foreign material is allowed to adhere to the lubricated surface, it may become lodged between the gasket and the bell sealing surface causing a leak in the joint.
5. Lubricate the inside of the bell. Be sure to cover the full circumference. Lubricant coating should be as thick as a fresh coat of enamel paint. Lubricant can be applied with a brush, cloth pad, sponge or gloved hand.

   WARNING: Use only those lubricants supplied by PWPipe. The use of other lubricants may cause deterioration of the pipe gasket or pipe.
6. Keep lubricated areas clean. If dirt or sand adhere to lubricated areas, clean and re-lubricate.
7. Insert the spigot end into the bell so that the rubber ring is in contact with the bell end. The pipe may be allowed to sit in this position while the puller or come-along is attached for final assembly. If a joint is overassem-

bled causing the spigot to jam into the neck of the bell, flexibility of the joint is lost. Uneven settlement of the trench may cause this type of assembly to leak.

CAUTION: Do not assemble beyond the stop mark.

8. While assembling the pipe, be sure the lengths are in straight alignment and not deflected vertically or horizontally. Improper alignment will cause a difficult or impossible assembly. If pipe must be deflected in linear grade, it can be done after assembly is completed. Such deflection should be accomplished in the body of the pipe, not at the joint.

9. PWRib can be assembled by using the bar and block method. With the pipe properly supported, drive the steel bar into the trench bottom. Then, place a wood block at the end of the pipe and shove the pipe home. The wood block protects the pipe against damage by the bar. No matter which method of assembly is used be sure to push the spigot into the bell until the factory-applied stop mark on the pipe barrel is flush with the end of the bell.

   WARNING: Do not use backhoe bucket for assembly. The action of the bucket can damage bells or dislodge gaskets.

10. Do not assemble pipe beyond the stop mark. By doing so, there may not be enough clearance in the bell for possible expansion of the pipe due to temperature changes. If pipe is accidentally assembled beyond the stop mark, it should be pried out flush with the mark before the next pipe is installed.

    If undue resistance to the pipe insertion is encountered, or if the pipe cannot be inserted to the reference mark, disassemble the joint and check the position of the gasket.

    a. If the gasket has been dislodged, inspect the pipe and gasket for damage, replace damaged items, clean components and repeat the assembly steps, assuring straight alignment.

    b. If the gasket is still properly positioned, verify proper positioning of the stop mark. Relocate the mark if it is not correctly positioned. In general, fittings allow less pipe insertion than do pipe bells.

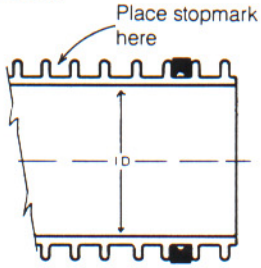
       If the pipe still cannot be inserted properly, call PWPipe for assistance.

    c. To assemble PWRib, use the lubricant furnished with the pipe. Chart E gives the number of pipe joints that can be assembled using one quart of lubricant. Extra lubricant needed for adverse conditions must be ordered separately. ONLY lubricant supplied by PWPipe should be used in assembling PWRib.

Chart E
LUBRICANT REQUIREMENTS
One Quart Container

Pipe size (in.)	No. Joints
8	30
10	20
12	15
15	12

11. If assembling a field cut spigot, it will be necessary to first locate a reference "stop" mark between the *sixth* and *seventh rib* from the spigot end as shown below:



    Mark the field-cut section with a pencil, crayon, tape or marking pen.

12. Field cutting of PWRib: It is easier and safer to cut pipe to the exact length before it is placed in the trench. A hand saw with "cross cut" teeth is recommended for cutting PWRib.

    Because of the unique design of PWRib, it is possible to get exact cuts between the ribs. Simply measure the required length from the pipe end and cut at the mid-point between the ribs.

    NOTE: If an abrasive saw is used to cut PWRib, safety goggles should be worn by the saw operator to protect his eyes from pipe chips.

Making Repairs and Tie-ins

If PWRib is damaged at the job site, and it becomes necessary to replace a full length of PWRib, you will need the following materials:

1 – 3'3" bell x spigot quarter length
1 – 6'6" spigot x spigot half length
1 – 3'3" spigot x spigot quarter length
2 – PWRib repair couplings
6 – Gaskets

First, cut out and remove the damaged length of pipe, being careful not to disturb the bell or spigot of adjacent pipes. Then install the repair pieces. See diagrams at bottom of this page.

Underwater Pipe Assembly

Normally the spigot end of the pipe is inserted into the bell during assembly. The spigot should be thoroughly double lubricated above the water surface before assembly. After the initial lubrication, wait for a period of 4-5 minutes before the second lubrication. The pipe should be assembled immediately after the second lubrication.

Chart F STOP MARK LOCATIONS

Pipe Size (in.)	Rib Location
8	Between 6th and 7th Rib
10	Between 6th and 7th Rib
12	Between 6th and 7th Rib
15	Between 6th and 7th Rib

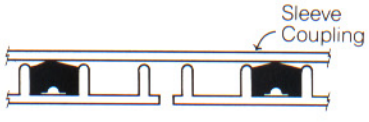
Making Repairs and Tie-ins

Diagram A

1. Install the quarter lengths and position the half length for installation after loosely placing the repair couplings on the pipe.

Diagram B

2. Move the half length into line and grade and pisition the couplings for final tightening.



Appurtenances

Saddle Installation
Smooth I.D. PVC saddles and "inserta-tee" hubs are approved for use with PWRib.

Note: When using saddles for service connections, liberally apply silicone sealant to the surface of the pipe under the saddle gasket. Also apply it between the saddle and the saddle gasket. The silicone sealant acts much like threaded pipe dope on iron pipe and helps assure a tight seal. When using the "inserta-tee" hubs be sure that pipe wall is between the O.D. and I.D. stops on the rubber sleeve to assure a tight seal.

Fittings and Adapters
A complete line of fittings and adapters are available from a number of manufacturers. Consult your PWPipe-authorized distributor for more information.

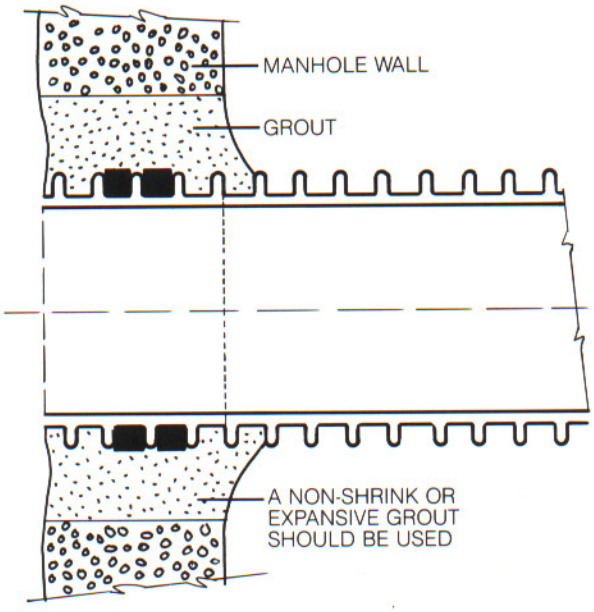
Manholes
The interval between sewer manholes is typically 300 to 500 feet. Manholes provide access to sewer lines for inspection and maintenance, and provide control of hydraulic flow at flow discontinuities. A stable foundation is essential to prevent settlement which could damage the pipe/manhole connection.

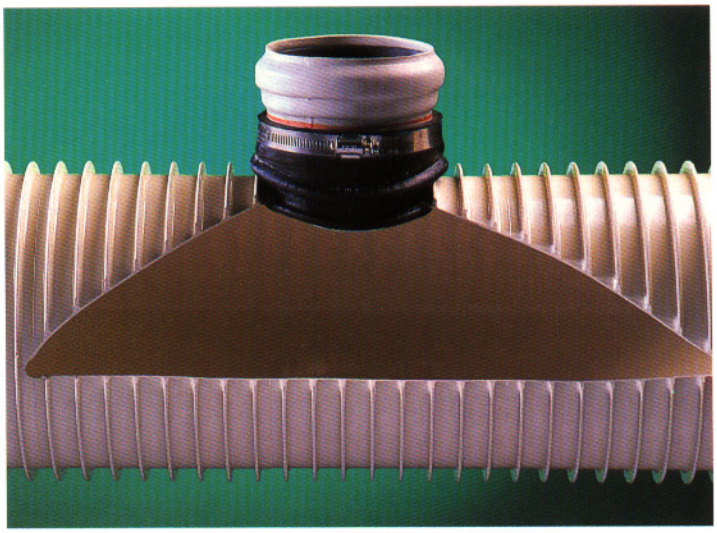
Manhole Connections
Use of pre-cast concrete manhole sections are preferred because of their superior strength, watertightness and more economical installation features. Concrete does not bond to PVC pipe. This means that some form of seal or water stop is required to allow watertight connections between PWRib and concrete structures. The gaskets installed on spigot ends of PWRib pipe will serve this function.

There are several other accepted methods of connecting PWRib to manholes and other rigid structures. The effects of possible manhole settlement may be minimized by using quarter lengths (3'3") of PWRib at both the in and out manhole entry points. Consult PWPipe for more information.

Sewers on Steep Slopes
Sewers on steep slopes of 20 percent or greater should be anchored securely with concrete collars cast immediately downhill from bells to prevent downhill movement of the pipe.

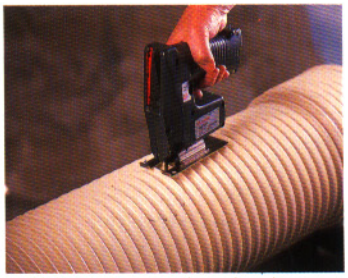
GROUT ONLY PWRIB MANHOLE ENTRY



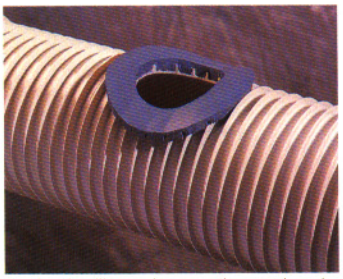


"INSERTA-TEE" HUB SERVICE

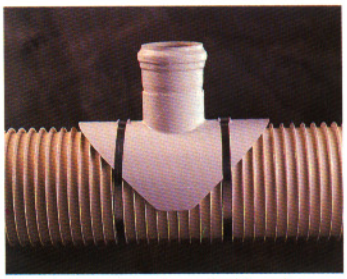
Tapping: Installation Of Service Saddle



1. Hole can be cut using a hand saw or a sabre saw.



2. Apply silicone in a continuous bead as shown to both sides of the gaskets.



3. Attach two stainless steel bands as shown.

General

General

The following are PWPipe's recommendations for project testing, but the final authority on testing requirements is the project engineer. Prior to the start of testing, all sewer lines should be cleaned.

Leakage Testing

The most common method of testing is air tightness. Only those lines which pass the air test after backfilling to final grade should be accepted.

- Air Test
  - Safety – All plugs and caps should be secured to prevent blowouts. All pressurizing equipment should include a relief valve set no higher than 9 psig to avoid overpressurizing.
  - Line Pressurization – Low pressure air should be slowly introduced into the test section until air pressure reaches 4.0 psig greater than the average external pressure of any groundwater above the pipe. Maintain this internal pressure for at least two minutes to allow pressure stabilization, and then shut off the air supply.

    A chart is available in the PVC Sewer Pipe Installation Guide for pressure drop information.

Longitudinal Bending

- The ability of PVC pipe to bend is a significant advantage over rigid pipes.
- Longitudinal bending may be done deliberately during construction or may be the result of changes that occur in the pipe-soil system after construction.
- Longitudinal bending is accomplished by axial flexure of the pipe combined with deflection of the gasketed joints:
  - Axial flexure – The minimum bending radius is recommended to be 160 times the pipe OD.
  - Joint deflection – For design purposes, joint deflection should be zero; in the field the maximum allowable joint deflection is one degree.
- Where bending is required, it should be done manually. The use of mechanical equipment may cause damage to the pipe or joining system.

Thermal Expansion and Contraction

- All materials expand and contract with changes in temperature. The rate of thermal expansion or contraction is not dependent on pipe size or wall thickness.
- Allowance for thermal movement:
  - 0.36 inch of length variation for every 100 feet of pipe for each 10°F change in temperature.
- Gasketed joints – When gasketed joints are used, thermal movement is not a significant design factor as long as:
  - Pipe temperatures are kept within accepted limits for PVC pipe.
  - Joints are properly installed with the pipe spigots inserted into the bells to the stop line.

WARNING: IF PIPE SPIGOTS ARE INSERTED PAST THE STOP LINE, THERMAL EXPANSION MAY CAUSE SIGNIFICANT STRESSES IN THE PIPE BELLS.

Thermal Effects on PVC Properties

The physical properties of PVC vary with changes in temperature. The rated values for PVC properties are established at 73.4 F (23 C).

- As temperature decreases below 73.4 F, pipe stiffness and tensile strength increase while impact strength decreases. This decrease in impact strength requires that more care be taken during installation in cold temperatures.
- Conversely, as temperatures increase, pipe stiffness and tensile strength decrease while impact strength increases. Decreases in pipe stiffness require that more care be taken during installation in hot weather.

Ultraviolet (UV) Radiation

Like most plastics, PVC can experience degradation when exposed to UV radiation. This degradation occurs only on surfaces exposed to the sun and penetrates only about .001 inch into the pipe wall. The affected areas often turn a yellow color. When the pipe is no longer exposed to the sun, further degradation does not occur.

Ultraviolet exposure does not significantly affect pipe stiffness or tensile modulus properties. PVC pipe's high initial impact strength minimizes the effect of reduction in impact strength values due to UV radiation.

ASTM D2412 calls for pipe diameter to be reduced 60 percent of the original size between parallel plates without any cracking, breaking or separation of ribs and wall. (See photo.) The specimen passes if no defects are found under normal light and an unaided eye.

Pipe damage will not be a problem if good practices are followed in unloading, handling and installation.

WARNING: DO NOT USE PVC PIPE FOR PRESSURIZED AIR SYSTEMS, AS INJURY MAY RESULT.

PWPipe Receiving, Unloading and Warranty

Specifications
PWRib *seamless* gravity sewer and drainage pipe and fittings shall conform to ASTM F 794, AASHTO M304 and Uni-Bell Uni-B-9 Specifications.

Limited Warranty
PWPipe has a limited warranty on PWRib. A copy of the limited warranty may be obtained by writing to PWPipe at the address listed in this brochure.

Receiving
Each pipe shipment should be inventoried and inspected upon arrival. Be sure you have received all items listed on the bill of lading. The carrier is responsible to deliver the product in good condition. The receiver is responsible to ensure there has been no loss or damage. Any problems should be documented with the carrier, then inform your PWPipe customer service representative of the circumstances. Over tightening of the tie-down chains may damage the vertical ribs of PWRib Pipe. Inspect to insure that the wall of the pipe below the rib is not damaged.

Unloading
The means by which the pipe is unloaded is the responsibility of the receiver. These recommendations should be followed:

1. Use fork lift or front-end loader with chisel forks.
2. If the above is not available use a spreader bar with fabric straps spaced approximately eight feet apart.
3. Do not handle units with individual chains or single cables.
4. Do not unload by hand.
5. Warning – Do not stand or climb on crates.

Chart G. PWRIB — TYPICAL 40-FT. TRUCKLOAD

Pipe Size	Ft./Per Crate		Pieces/Per Crate		Crates Per Truck		Footage Per Truck	
	13′	20′	13′	20′	13′	20′	13′	20′
8″	312/260	300/360	24/20	15/18	18	16	5148	5280
10″	156	240	12	12	18	12	2808	2880
12″	156/208	120/160	12/16	6/8	24	16	2184	2240
15″	78	120	6	6	18	12	1404	1440

Truck load quantities may vary based on availability of wide and narrow crates.

Note
PWPipe product specifications and warranties are continually updated. If more than 12 months have passed since the date of this brochure, call your PWPipe representative and ask about changes.

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