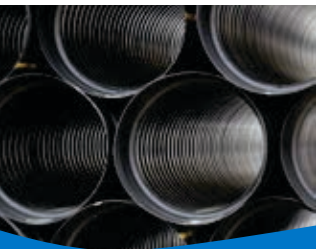




STORMWATER INSTALLATION GUIDE



WATER MANAGEMENT SOLUTIONS

This pocket installation guide is intended to provide guidance for typical installations for corrugated high density polyethylene (HDPE) and polypropylene (PP) pipe for storm drainage applications. Product and project specific exceptions may apply. Contact your local Prinsco Representative for more information.

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Transportation, Handling & Storage

Receiving / Inspection

Prinsco prides itself on being able to provide the complete package – excellent customer service, technical support & quality products. If there are any issues or questions with your order, contact your distributor or the Prinsco customer service department.

Direct the driver to unload & store pipe on a flat area, free of rocks & other debris.

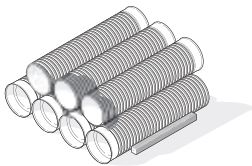


Inspect all pipe & fittings as they are received on the job. Note any damaged or missing items on delivery ticket.

Contact your distributor or Prinsco Customer Service to correct shortages or damaged materials.

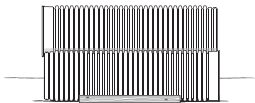
Storage

Care should be taken to ensure that the delivered products are not damaged during jobsite storage. Store pipe, fittings & accessories in a location that will be out of the way.



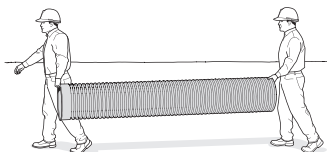
Non-palletized pipe may be stockpiled in an area where it won't be damaged. Pipe should not be stacked higher than 6 feet.

When stacking pipe, alternate bell & spigots for each row so that the bells do not contact other bells or any hard surface.

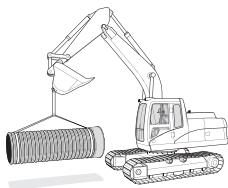
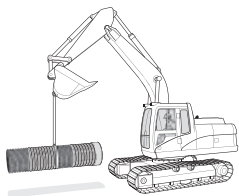


Moving & Stringing

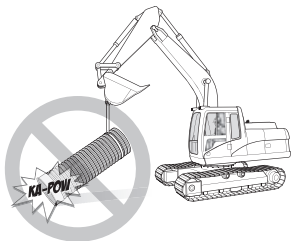
Pipe 18" & less can be moved by hand.



Pipe 24" & larger will require the use of a backhoe & a sling. 24"-30" pipe can be lifted with one lift point. 36" & larger should be lifted with 2 lift points spaced approximately 10' apart.



To prevent damage to bell & spigots, do not drag or drop pipe on the ends.



Trench Excavation

The information provided here is meant to be used as a guide & does not supersede any requirements specified on project plans.

The trench should be excavated in such a matter, then the walls will remain stable under all working conditions.

Trenches should be wide enough to place & compact backfill around the pipe. Refer to Table 1 for recommended trench widths.

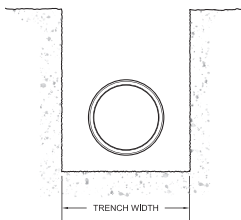


Table 1 – Minimum Recommended Trench Widths

Pipe Diameter (in)	Min. Trench Width (in)
4	21*
6	23*
8	26*
10	28*
12	30
15	34
18	39
24	47
30	56
36	63
42	72
48	80
60	96

* Trench widths for smaller diameter pipe are largely dependent on the smallest backhoe bucket available.

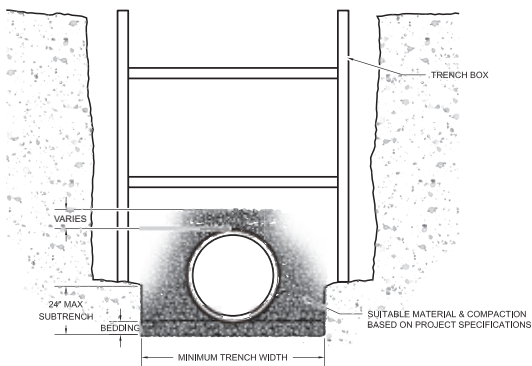
Unstable Trench Walls / Trench Box

Trench walls should be sloped or supported in conformance with all local, state & national safety guidelines.

Trench boxes can be used to provide a safe working environment in deep trenches or in soils that have insufficient stability. Always follow OSHA requirements when using a trench box.

The length of the trench box should be suitable for the length of pipe that is used.

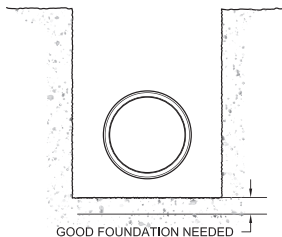
When working with trench boxes, it is critical to prevent disruption of the pipe installation while moving the trench box. The most effective way to achieve this is with the use of a sub trench. The sub trench shall not be greater than 24" from the bottom of the trench. The trench box can be pulled along the edge of the sub trench without disturbing the pipe backfill material.



Foundations

The foundation must be dry, supportive and stable to provide long-term uniform pipe support.

If foundation material is unable to provide adequate pipe support, corrective measures should be taken to remove, displace, or reinforce the soils.

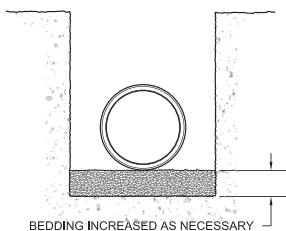


Dewatering

Standing water in an open trench greatly increases the likelihood of reduced structural capacity & make proper pipe placement & backfill compaction nearly impossible. Standing water should always be removed prior to pipe installation to provide a stable trench bottom.

Unyielding / Hard Foundations

If hard or unyielding material cannot be removed, increase the bedding depth to 6"-10" or as directed by a geotechnical engineer.



Bell & Spigot Pipe Assembly

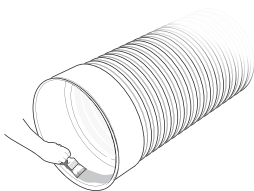
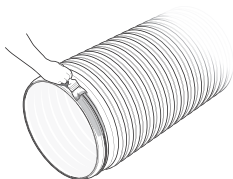
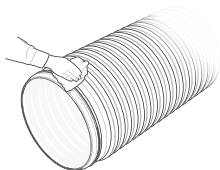
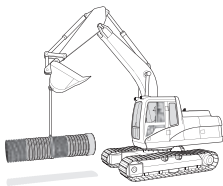
For bell-and-spigot pipe, such as GOLDFLO WT® & ECOFLO® 100, GOLDPRO Storm™, it is imperative that the joints are assembled correctly to ensure that the pipeline meets the expectations. Failure to follow these guidelines may compromise the integrity of the joint.

Before pipe is laid into trench, re-inspect the pipe for any damage. Carefully lift the pipe into the trench with the use of a nylon strap & backhoe.

Clean the inside of the bell and remove any dirt and debris.

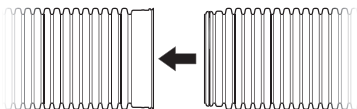
Remove the plastic protective wrap from the gasket on the spigot end.

Use a clean brush, cloth rag, sponge or gloved hand to apply pipe lube to both the gasket and the inside of the bell.

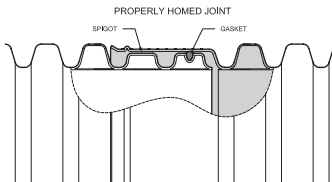


Do not allow the lubricated ends of the pipe to come into contact with any dirt or debris. Any foreign materials adhering to the sealing surface could compromise the joint integrity.

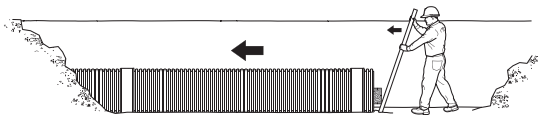
Insert spigots into bells! Pushing bells onto spigots increases the likelihood of forcing bedding material in the joint which could undermine the joint performance.



Joints must be adequately “homed” to ensure joint performance. To ensure that joints are properly “homed”, measure the depth of the bell & mark the appropriate depth on the spigot end.

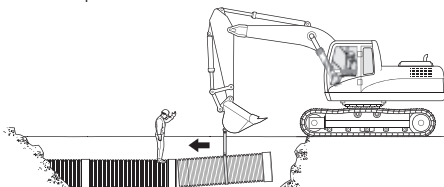


Small diameter pipe can typically be pushed together by hand or leveraged together using a spanner block & lever.

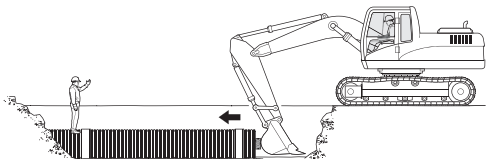


Large diameter pipe typically requires more force to assemble which necessitates the use of machinery.

Using a backhoe & sling, the pipe can be slid together to the “home” position.



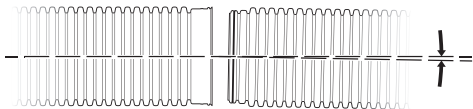
Pipe can also be pushed together using a sacrificial spigot or installation stub.



During assembly, it is critical to ensure the pipe lengths are aligned both vertically & horizontally.

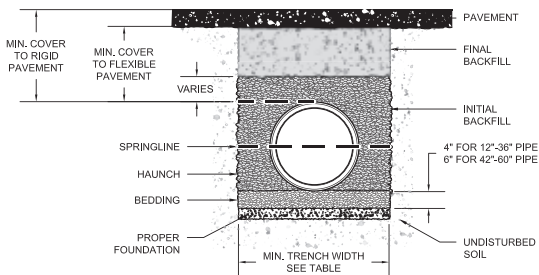
A maximum misalignment of 1° is recommended for bell & spigot connections.

A spotter should inspect spigot insertion to ensure that the pipe is not “over-homed.”



Backfill Material Selection & Placement

The backfill & pipe function together as a structural system to support the soil overburden & vehicular live loads. Proper installation is critical to ensure long trouble free service for all pipe systems.



Backfill selection & placement should be done according to the plans provided that it meets the minimum requirements of Table 2. Refer to Table 2 for acceptable backfill material & compaction requirements.

Table 2 – Acceptable Backfill Material & Compaction Requirements

Soil Classification		Min.	Max.*	Description
ASTM D2321	ASTM D2487	Compaction Standard Density (%)	Layer Height (in)	
Class I	–	Dumped**	18	Graded or crushed stone Crushed gravel
Class II	GW GP SW SP	85%	12	Well-graded sand, gravel & gravel/sand mixtures Poorly graded sand, gravel & gravel/sand mixtures Little or no fines
Class III	GM GC SM SC	90%	9	Silty or clay-like gravel Gravel/sand/silt or gravel/clay mixtures Silty or clay-like sands Sand/clay or sand/silt mixtures

* Lifts should not exceed one-half the pipe diameter. Layer heights may also need to be reduced to accommodate compaction method.

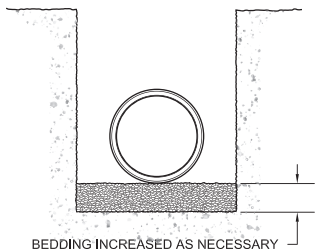
** Material shall be “knifed” into the haunch area of the pipe by use of a shovel or similar means.

Bedding

Bedding allows for uniform longitudinal support & also distributes the load from the bottom of the pipe.

The outer thirds of the bedding should be compacted & the middle one third portion should be loosely placed to provide uniform support for the pipe invert.

Minimum bedding thickness is 4" for 4"-36" pipe & 6" for 42"-60" pipe.



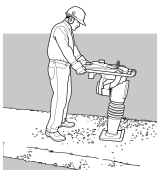
Bedding material should be a Class I, II, or III material as shown in Table 2.

Class I materials can be dumped around the pipe. Ensure that the material is adequately knifed into the haunch area of the pipe to eliminate voids.

Other materials will require greater compaction effort. Refer to Table 3 for a summary of backfill material soils & its associated equipment type & effort required to achieve compaction.

Table 3 – Compaction Effort & Equipment

	Soil Classification(1)			
	Class I	Class II	Class III	Class IV
Effort Required	Low	Moderate	High	Very High
Equipment Type	Hand Knifing in Haunch, Vibratory or Impact	Vibratory or Impact	Impact	Impact
Moisture Control	None	None	Near optimum to minimize compaction effort	Near optimum to achieve required density
Maximum Lifts(2)	18"	12"	6"	N/A



Notes:

1. See ASTM D2321 or Table 2 for a detailed description & classification of material.
2. Lifts should not exceed one half the pipe diameter & may need to be reduced depending on the compaction method.

Minimum Cover Height

Minimum covers are dependent on the backfill material used & the expected live loads. With the minimum covers in Table 4, Prinsco pipe will withstand H-25 traffic loading.

Table 4 – Minimum Cover Heights

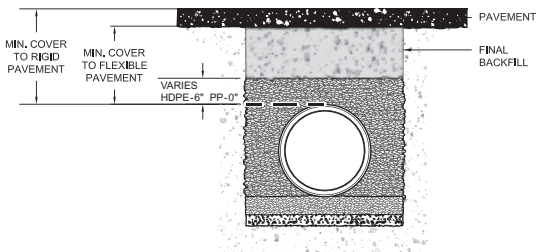
Pipe Diameter (in)	Minimum Cover Required(1)
12"-48"	12"
60"	18"

Note:

1. Minimum cover is measured from the top of the pipe to bottom of flexible pavement or to the top of rigid pavement.

These cover heights assume backfill is placed & compacted according to Prinsco recommendations with a minimum of 6" of structural fill over the top of HDPE pipe. For PP pipe, no structural fill is needed over the top of the pipe.

Cover heights in green areas may be reduced to 12" for all diameters.



Construction Loading

It is occasionally necessary to reduce cover heights for construction activities, such as paving. Cover heights are governed by the surface pressure based on the tire contact areas. Refer to Table 5 for Temporary Minimum Cover Heights.

Table 5 – Minimum Cover for
Temporary Construction Loads

Type of Vehicle	Allowable Surface Pressure for Construction Vehicle (psi)	Temporary Minimum Cover by Diameters	
		4" to 48" Diameter Pipe (1)	60" Diameter Pipe (1)
Semi-Tractor w/o Trailer	75	9"	12"
Loaded Pick-up Truck	50	6"	9"
Skid Steer Loader	25	3"	6"

Note:

1. Vehicles exceeding surface pressures must not be allowed over the installation with these temporary minimum covers.

For heavy construction loads, between 30 to 60 tons, minimum cover should be increased to 3' to top of pipe. For loads exceeding 60 tons, the minimum cover will be dependent on the footprint of the equipment. Contact your local Prinsco Representative for additional information.

Maximum Cover Height

Maximum cover heights are largely dependent on the load carrying capacity of the soils as well as the quality of the installation. Refer to Table 6 for dual-wall HDPE maximum cover heights.

Table 6 – Maximum Burial Depth for Dual Wall HDPE

Diameter (in)	Dual Wall Maximum Burial Depth (ft)				
	Class 1	Class 2		Class 3	
	Compacted	95%	90%	95%	90%
4	> 65*	38	21	22	11
6	> 65*	40	22	23	11
8	> 65*	41	22	23	11
10	> 65*	41	22	23	11
12	54	33	19	20	10
15	61	36	20	21	10
18	56	33	19	20	10
24	58	34	19	20	10
30	42	26	17	18	9
36	44	27	17	18	9
42	53	31	18	19	9
48	39	24	16	16	8
60	42	26	16	16	8

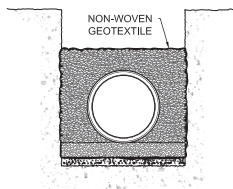
Notes:

1. Special design considerations should be made for these burial depths. Contact your local Prinsco representative for more information.
2. Calculations assume no hydrostatic pressure and a density of 120 pcf (1926 kg/m³) for overburden material. Hydrostatic pressure will result in a reduction of allowable cover heights.
3. Backfill materials as defined by ASTM D2321 & compaction levels are standard proctor densities.
4. Installation assumed to be a trench installation in accordance with ASTM D2321 & Prinsco's Installation Guide & as outlined in the Structures Design Guide.
5. Contact your local Prinsco Representative for special designs or deeper burial depths.
6. Cover heights for uncompacted Class 1 provide a large degree of variation & are conservatively assumed to be equivalent to Class 2, 90% SPD.
7. See PP Minimum & Maximum Burial Depth per AASHTO Tech Note on website

Other Considerations

Geotextiles

To prevent the migration of fine soil particles into the pipe/soil envelope, the use of a geotextile may be considered. The geotextile acts as a filter to keep in-situ soils from migrating into the course backfill, resulting in a loss of pipe support.



Pipe Flotation

Pipe flotation, due to buoyancy, may be a concern for pipe systems installed in areas where seasonal or permanent water extend beyond the pipe. Minimum cover heights to resist flotation are shown in Table 7.

Table 7 – Minimum Cover Required to Prevent Flotation

	Nominal Dia (in)	Min Cover (in)
	4	3
	6	4
	8	5
	10	7
Dual	12	8
Wall	15	10
HDPE	18	13
& PP	24	17
	30	21
	36	24
	42	28
	48	32
	60	40

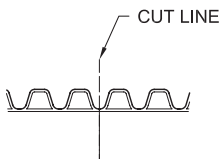
Table 7 – Minimum Cover Required to Prevent Flotation
(cont.)

	Nominal Dia (in)	Min Cover (in)
Single Wall HDPE	3	2
	4	3
	5	3
	6	4
	8	6
	10	7
	12	8
	15	10

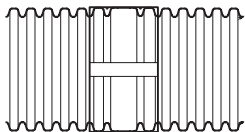
Field Modifications/Plain-end Fittings

Since all projects are different, factory supplied pipe lengths may need to be altered in the field to comply with site requirements.

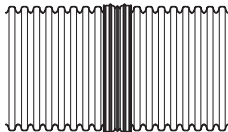
Prinsco HDPE & PP pipe can easily be cut to the desired length with a hand saw, reciprocating saw or equivalent tool. Cuts should always be made in the corrugation valley.



To join field cut sections of pipe and/or fittings, split couplers may be used to make a soil-tight connection for 4"-36" diameter pipe. GOLDLOK couplers in 12"-60" diameters are available for watertight connections.



SPLIT COUPLER



GOLDLOK COUPLER

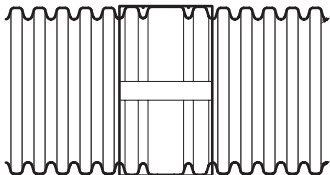
Repair Methods

Depending on the severity of the damage and type of pipe, several repair options can be considered. A few of the common repair methods for external and internal repairs to pipe are listed below. For further information, contact your local Prinsco Representative.

FOR EXTERNAL DAMAGE:

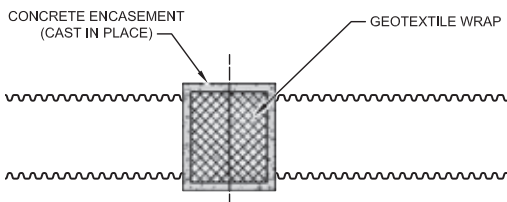
Split Couplers

For 4"-36" pipe with minimal damage, split couplers can be used to provide a soil-tight repair. Split couplers are only recommended for repairs in non-trafficked areas. The split coupler can be placed directly over the damaged area, or the damaged section of pipe can be removed and replaced with a short section of pipe and connected with split couplers.



Concrete Collar

For 4"-60" pipe with minimal damage, a concrete collar around the pipe can be used to cover the damaged area to provide a soil-tight repair. Prior to pouring concrete, a non-woven geotextile fabric should be placed over the damaged area to prevent concrete from seeping in. The concrete collar should extend 6" around the pipe.



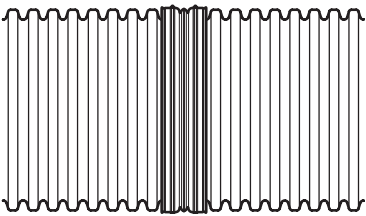
Mastic Banding

For 4"-60" pipe, an external mastic band can be used to wrap a small damaged section of pipe or to connect two lengths of pipe together after removing the damaged section. Mar Mac® Polyseal couplers feature a rubberized band that adheres to pipe and is then tightened with steel straps to provide a positive seal.

Refer to the manufacturer's installation recommendations for further detail.

GOLDLOK Couplers

For 12"-60" pipe, a damaged section of pipe can be removed and a GOLDLOK coupler can be used to connect two lengths of pipe together. The GOLDLOK coupler features an integrated gasket and reinforcing bands with a bell – bell connection to provide a positive seal.



FOR INTERNAL DAMAGE:

Chemical Grouting

For 4"-60" pipe with improperly assembled joints, chemical grouting can be used to repair the joints. Chemical grouting utilizes a chemically activated gel or grout to seal the joints to provide minimal joint leakage.

Internal Sealing

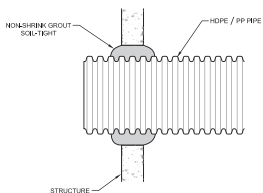
For 18"-60" pipe with internal damage or improperly assembled joints, a NPC Internal Joint Seal can be used to provide a watertight connection. NPC Internal Joint seals feature a metal band with a rubber gasket that expands to conform to the interior of the pipe.

Refer to the manufacturer's installation recommendations for further detail.

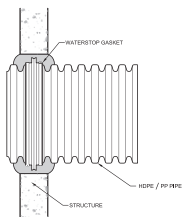
Connections to Manholes / Catch Basins

Connections to structures can be made in a number of ways depending on the joint performance requirements.

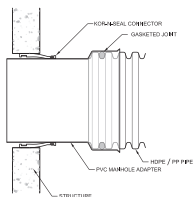
Soil-tight Non-Shrink Grout Connection



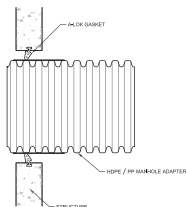
Watertight WATERSTOP Gasket with Non-Shrink Grout



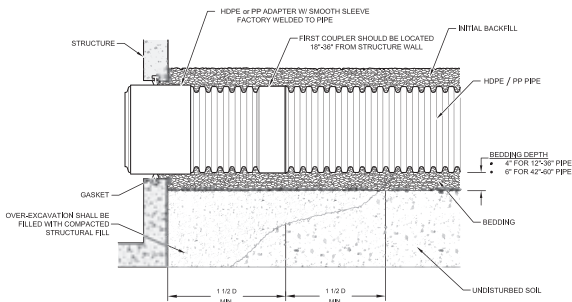
PVC Manhole Adapter with A-Lok or KOR-N-SEAL Gasket SEAL Gasket



Fabricated Manhole Adapter with A-Lok or KOR-N-SEAL Gasket



Connections to structures will require the foundation to be built to grade with compacted structural fill or a controlled low strength material (CLSM).

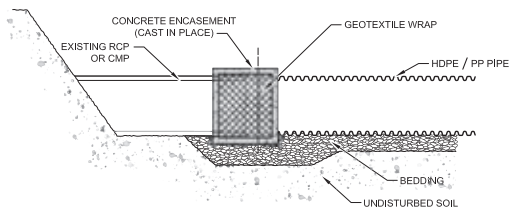


Connections to Different Pipe Types & Sizes

Occasionally drainage systems will require a connection between HDPE / PP & another pipe material.

Connections to RCP or CMP of the same size can be made in a variety of ways & will be limited by the joint quality required.

Typically the connections are made by butting the pipes together, wrapping with a non-woven geotextile & pouring a concrete collar around the connection. This will provide a soil-tight connection.



Use of fittings or adapters specifically designed for the application can be used as well and may be available upon request. These types of connections may provide a higher performance joint than a concrete collar.

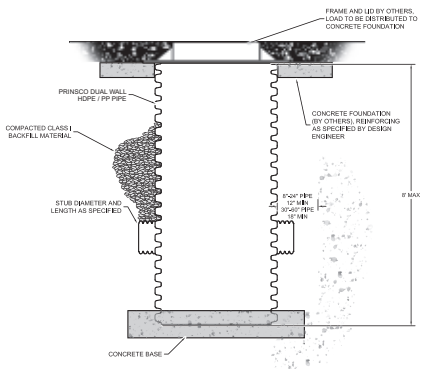
Field Gasket Installation

Field assembly of gaskets may be necessary for HDPE / PP pipe connections to oversized bells or Integrity Tees. Contact your local Prinsco Representative for the most recent installation instructions.

Vertical Installations

Prinsco HDPE / PP pipe is sometimes installed in vertical applications for use as a catch basin or manhole.

Compacted Class I backfill material should be used for all vertical installations. Backfill should extend a minimum of 12" around the circumference of the pipe.



Height of the vertical structure should not exceed 8' without prior approval from a Prinsco Representative.

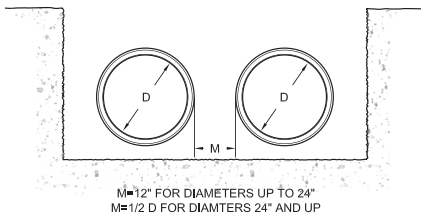
All vertical installations of pipe must be securely covered at the ground level to prevent injury associated with falling into the pipe.

For traffic applications, a concrete collar should be placed around the pipe. Metal grates and lids should rest on a concrete collar and not on the vertically installed pipe to transfer the loading to the surrounding soil.

All vertical installations of Prinsco fittings should be reviewed for suitability by a Prinsco Representative. Special installation considerations may be necessary.

Parallel Pipe Installation

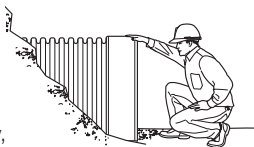
For parallel pipe installations, allow enough space in between the pipes for proper backfill placement & compaction. Spacing between retention/detention systems will differ due to fitting configurations.



Post-Installation Inspection

Visual Inspection

Typically a visual inspection is all that is necessary to determine the quality of a pipeline installation. If additional testing is necessary, deflection testing and/or low-pressure testing may be used.



Deflection Testing

When necessary, deflection testing of pipe may be performed within 30 days of installation by pulling a mandrel or using another method.

Testing approximately 10% of the installed pipe provides a reasonable indication of the overall installation quality.

Prinsco recommends a conservative maximum deflection of either 7.5% or 5% of the base inside diameter. Table 8 should be used as a reference when using measurement devices such as mandrels or lasers.

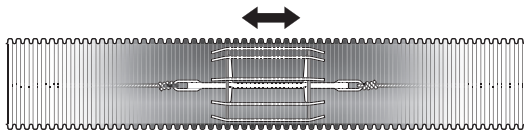


Table 8 – Deflection Dimensions for Base Diameter

Deflection Dimensions for Base Diameter		
Nominal Diameter (in)	Vertical Height w/ 7.5% Deflection (in)	Vertical Height w/ 5% Deflection (in)
4	3.57	3.67
6	5.36	5.51
8	7.15	7.35
10	8.93	9.18
12	10.73	11.02
15	13.41	13.77
18	16.09	16.53
24	21.46	22.04
30	26.81	27.54
36	32.18	33.05
42	37.54	38.56
48	42.91	44.07
60	53.64	55.09

Results obtained from deflection testing can be easily misinterpreted; findings should be thoroughly analyzed before corrective measures are taken.

Leakage Testing

When necessary, watertight HDPE/PP pipe may be tested by water infiltration or exfiltration. The test method must be in accordance with ASTM F2487. Contact your local Prinsco Representative for additional information.



Prinsco is built on family values and focused on the future. Our products are designed, manufactured and tested to meet and exceed the high performance needs and expectations of the construction market. Prinsco's engineering, quality control and production teams are committed to a continuous process of innovation, product development and quality improvement. We are focused on current and future market needs centered around environmental sustainability, water quality, water management and performance advancement.

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