INSTALL GUIDE

FRATCO

CONTENTS

INSTALLATION

SCOPE

This provides information on the handling and installation of corrugated polyethylene pipe and fittings in non-pressure applications. All types of pipe, regardless of material, must be installed as specified to perform as expected.

GENERAL

The structural design of a buried pipeline presumes the response to loads of a pipe/soil composite structure. Attention to detail on the part of the contractor, transporter and yard handler is essential to ensure proper performance. This information serves as a general guide for many common applications. Some projects, however, may have specific conditions beyond the scope of this installation guideline. These shall be addressed by the design engineer.

PRINCIPAL INSTALLATION REFERENCES

ASTM D2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications CAN/CSA B182.11: Recommended Practice for the Installation of Thermoplastic Drain, Storm and Sewer Pipe and Fittings AASHTO Section 30: Thermoplastic Pipe Focused on Highway and Airport Drainage Pipelines.

TRENCH INSTALLATION

According to ASTM D2321, the trench width should be no wider than what is required to safely and conveniently compact backfill material on either side of the pipe. Trench widths will reflect the selection of backfill material, ease of compacting backfill in the haunch zone, compaction methods, pipe diameters and the width of the nearest larger size excavator bucket. ASTM D2321 establishes trench widths as the greater of either the pipe outside diameter plus 16” or 1.25 times the pipe outside the diameter plus 12”.

See next page.

Minimum Trench Width*			
INSIDE DIAMETER IN. (MM)	TYPICAL OUTSIDE DIAMETER IN. (MM)	AASHTO SEC 30 MIN. TRENCH WIDTH IN. (MM)	ASTM D2321 MIN. TRENCH WIDTH IN. (MM)
4 (100)	5 (120)	19 (480)	21 (530)
6 (150)	7 (177)	22 (570)	23 (580)
8 (200)	9 (233)	26 (650)	25 (640)
10 (250)	11 (287)	29 (740)	27 (690)
12 (300)	14 (356)	33 (840)	30 (760)
15 (375)	18 (450)	39 (980)	34 (870)
18 (450)	21 (536)	44 (1110)	38 (970)
21 (525)	24 (622)	49 (1240)	43 (1080)
24 (600)	27 (699)	53 (1350)	46 (1180)
30 (750)	34 (866)	63 (1600)	55 (1390)
36 (900)	41 (1041)	73 (1870)	63 (1610)
42 (1050)	48 (1219)	84 (2130)	72 (1830)
48 (1200)	54 (1372)	93 (2360)	80 (2020)
54 (1350)	61 (1577)	105 (2670)	90 (2276)
60 (1500)	67 (1707)	113 (2870)	96 (2440)
72 (1800)	80 (2023)	132 (3350)	112 (2840)

**Also refer to manufacturer's recommendations*

BACKFILL MATERIALS

Materials must provide adequate pipe support and protect the pipe from stones or cobbles in the final backfill. The table on the next page provides a listing and classification of common backfill materials along with a detailed description of each material. The information provided below is based on ASTM D2321 and the backfill materials listed are typically used for all pipe materials operating under similar performance criteria.

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PIPE EMBEDMENT MATERIAL					E1, PSI (KPA) FOR DEGREE OF EMBEDMENT COMPACTION					
ASTM D2321*		ASTM D2487		AASH TO M43 NOTATION	MIN. SID. PROCTOR DENSITY (%)	LIFT PLACEMENT DEPTH	DUMPED	SLIGHTLY < 85%	MODERATE 85%–95%	HIGH > 95%
CLASS	DESCRIPTION	NOTATION	DESCRIPTION							
1A	Open-graded clean manufactured aggregates	N/A	Angular crushed stone or rock crushed gravel, crushed slag; large voids with little or no fines	5	Dumped	18" (0.45 m)	1000 (6,900)	3000 (20,700)	3000 (20,700)	3000 (20,700)
1B	Dense-graded clean manufactured, processed aggregates	N/A	Angular crushed stone or other Class 1A material and stones/sand mixtures; little or no fines	56						
II	Clean, coarse-grained soils	GW	Well-graded gravel, gravel/sand mixtures; little or no fines	57	85%	12" (0.30 m)	N/R	1000 (6,900)	2000 (13,800)	3000 (20,700)
		GP	Poorly graded gravel, gravel/sand mixtures; little or no lines							
		SW	Well-graded sands, gravelly sands; little or no fines	6						
		SP	Poorly graded sands, gravelly sands; little or no lines	67						
III	Coarse-grained soils will fines	GM	Silty gravels, gravel/sand/silt mixtures	Gravel & sand w/ <10% fines	90%	9" (0.20 m)	N/R	N/R	1000 (6,900)	2000 (13,800)
		GC	Clayey gravels, gravel/sand/clay mixtures							
		SM	Silty sands, sand/silt mixtures							
		SC	Clayey sands, sand/clay mixtures							
IVAA**	Inorganic fine-grained soils	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, silts w/ slight plasticity				N/R	N/R	N/R	1000 (6,900)
		CL	Inorganic clays of low to medium plasticity; gravelly, sandy or silty clays; lean clays							
IVB	Inorganic fine-grained soils	MH	Inorganic silts, macaceous or diamaceous fine sandy or silty soils, elastic soils				N/R	N/R	N/R	N/R
		CH	Inorganic clays of high plasticity, fat clays							
V	Organic or highly organic soils	OL	Organic silts and organic silty clays of low plasticity							N/R
		OH	Organic clays of medium to high plasticity, organic silts							
		PT	Peat and other high organic soils							

N/R: Use not recommended by ASTM D2321 for part of the backfill envelope
* Refer to ASTM D2321 for more complete soil descriptions.
**Use under the direction of a soils expert.

DETENTION SYSTEMS

GENERAL

Detention systems shall be installed in accordance with the latest edition of ASTM D2321 and the manufacturer's installation guidelines. A non-woven geotextile filter fabric or other measures should be taken to prevent native soil from migrating into the initial backfill material, when required.

FOUNDATION

Unstable trench bottoms or rock or unyielding material shall be excavated to a depth directed by the engineer and replaced with suitable material. For unstable materials, geotextile may be used to stabilize the trench bottom, if directed by the engineer.

BEDDING

Suitable material shall be Class I or II, as specified by ASTM D2321. Minimum bedding thickness shall be 4".

INITIAL BACKFILL

Suitable material shall be Class I or II, as specified by ASTM D2321. Compaction and backfill lifts shall be in accordance with ASTM D2321. Initial backfill shall extend to no less than 6" above the top of the pipe.

MINIMUM COVER

For up to H-25 traffic applications a minimum of 12" for pipe up to 36" diameter, 18" for 42" and 48" diameter, and 24" for 60" diameter. Minimum cover, V, shall be measured from the top of the pipe to the bottom of flexible pavement or to the top of rigid pavement. Additional cover may be required for construction loads, for vehicles over 75 tons or to prevent floatation.

FINAL BACKFILL

Suitable materials directed by the engineer shall be used in landscape or non-traffic applications. For areas subjected to traffic a higher degree of compaction is required and a separation layer of non-woven geotextile may be required. Compaction levels shall be specified at the discretion of the design engineer.

PHYSICAL PROPERTIES

FITTINGS

Available in watertight configurations. Custom fittings can be tailored to meet project requirements.

DESCRIPTION

SmoothCorr is a high-density polyethylene plastic pipe manufactured to the stringent requirements of AASHTO M294 and F2306 to ensure you receive a quality, high performance product to meet your demands. SmoothCorr is available with a soiltight joint configuration in 12”–36” and with a watertight joint configuration in 12”–60”.

APPLICATIONS

- Storm Sewers
- Highway Drainage
- Parking Lot Drainage
- Storm Water Retention Systems
- Culverts
- Ventilation
- Aeration
- Industrial Applications
- Ditch Enclosures

Recommended Minimum Spacing			
Pipe Diameter	Minimum “X”	Minimum “M”+	Minimum “V”
12″	8”	12”	12”
15″	8”	12”	12”
18”	9”	12”	12”
24”	10”	12”	12”
30”	18”	15”	12”
36”	18”	18”	12”
42”	18”	21”	18”
48”	18”	24”	18”
60”	18”	30”	24”

FITTINGS

Fratco stocks a complete line of standard SmoothCorr fittings. Ask about specific fittings you may require.

AGRICULTURE INSTALLATION GUIDE

Corrugated HDPE pipe, as with all buried pipe, functions as a buried structure where the performance of the structure is dependent on the quality of the embedment backfill and installation. Varying degrees of performance may be required depending on specific project details. This installation guide specifically addresses common installation methods for corrugated HDPE in agricultural applications to ensure adequate performance is achieved. Since agricultural installations do not involve pipe buried under public roadways, allowable pipe deflection may extend beyond what is typically acceptable in commercial applications.

The recommendations presented here detail proper backfill and installation methods for single-wall and dual-wall pipe to achieve a dependable subsurface or groundwater control system. This document should not be used for commercial applications, storm sewer applications, road crossings or where greater service performance is required. For any application outside of these basic guidelines (such as poor soils, high loads, or other factors that may affect performance), please contact your local Fratco representative or visit www.fratco.com for more comprehensive installation information.

SHAPED BOTTOM TRENCH

For burial depths of 8’ or less, a shaped trench bottom shall be used, provided the native soil can be cut to a stable shaped trench. For trencher installations, trenches shall be overfilled to allow consolidation. For backhoe installations, the backfill should be compacted to reduce the amount of settling. Most plow installations require minimal backfilling; however, care should be taken to ensure the trench is filled and bridging does not occur. Native soil may be used as backfill provided that it can be compacted around the pipe and that all voids are removed. If native soil is not suitable for backfilling, a granular material shall be used.

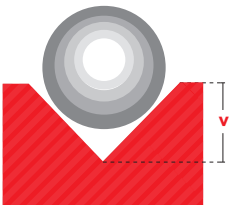
“V” GROOVE TRENCH

- The 90-degree “V” groove trench bottom as shown in Figure 1 is acceptable for pipe with diameters less than or equal to 8”. A “V” groove trench bottom is typically formed with a pull type or tractor mounted plow. Refer to Table 1 for approximate dimensions for a “V” groove trench.
- A trapezoidal groove or rounded trench bottom may also be used for pipe diameters less than or equal to 8”.

FIGURE 1: 4” - 8” DIAMETER PIPE “V” GROOVE TRENCH

TABLE 1
“V” GROOVER TRENCH DIMENSIONS

Pipe Dia. (in)	Depth “V” (in)
3	5.1
4	6.1
5	7.2
6	8.3
8	11.1



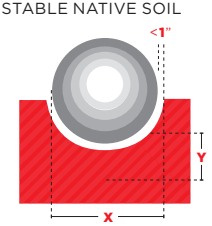
ROUNDED TRENCH BOTTOM

- For pipe diameters of 8” and greater, a rounded trench bottom should be used as shown in Figure 2. The rounded trench bottom should closely fit the outside of the pipe, with <1” gap on either side of the pipe, to provide sufficient pipe support. Recommended dimensions are found in Table 2.
- A rounded trench bottom may be formed with the use of a shaped trencher or with a backhoe with a half-circle shaped bucket, also referred to as a “spoon”.
  An example of a “spoon” is shown in Figure 3.

FIGURE 2: 8” - 60” DIAMETER PIPE ROUNDED TRENCH

TABLE 2 **ROUNDED TRENCH DIMENSIONS**

Pipe Dia. (in)	Max Width “X” (in)	Min. Depth “Y” (in)
8	11.3	4.8
10	13.4	6.8
12	16	7.1
15	20.1	8.2
18	23.3	10.4
24	30.2	14.2
30	36.8	17.4
36	42.8	20.5
42	40.8	23.8
48	56.2	27.2
60	68.3	33.3



Maximum width is based on < 1” gap on either side of the pipe’s springline. Wider trench widths may adversely affect the pipe’s performance.

TABLE 3: ACCEPTABLE BACKFILL MATERIAL AND COMPACTION REQUIREMENTS

DESCRIPTION	SOIL CLASSIFICATION		MINIMUM	MAXIMUM
	ASTM D2321	ASTM D2487	Compaction Standard Density (%)	Layer Height (in.)
Graded or crushed stone, crushed gravel	CLASS I	---	Dumped**	18
Well-graded sand, gravel and gravel/sand mixtures; Poorly graded sand, gravel and gravel/sand mixtures; little or no fines	CLASS II	GW GP SW SP	85%	12
Silty or clayey gravel, Gravel/sand/silt or gravel and clay mixtures, silty or clayey sands, sand/clay or sand/silt mixtures	CLASS III	GM GC SM SC	90%	9
Inorganic silts and low to medium plasticity clays; gravelly, sandy, or silty clays; some fine sands	CLASS IVA	ML CL	90%	6

*Layer Heights 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

FLAT BOTTOM TRENCH CONSTRUCTION

- For burial depths greater than 8', a flat bottom trench or ditch, shown in Figure 4, should be used. The middle portion of the bedding equal to 1/3 the pipe's OD shall be loosely placed. The remainder shall be compacted in accordance with Table 3.
- The trench should be just wide enough to place and compact backfill around the entire pipe. Widths should be within a minimum of the pipe OD plus 6" to a maximum of the pipe OD plus 24".
- For parallel pipe installations, allow space between pipe runs for proper compaction. Spacing shall be no less than 1/2 of the pipe OD between the parallel pipe runs.
- Trench bottoms containing bedrock, soft muck or refuse, or other material unable to provide long-term pipe support are unacceptable. Poor material shall be removed and replaced with acceptable materials, excavating soft areas approximately 2' below grade and three times pipe width.
- Remove rock or unyielding material 1' below grade and a minimum of 6" on either side of pipe.
- Where soil migration is a concern, a non-woven filter fabric (geotextile) shall be used to separate the backfill from the native soil.

BACKFILL MATERIAL SELECTION

- Selection of proper backfill materials is critical to ensuring adequate pipe support. Native soil may be used provided it meets the classification descriptions provided in Table 3.
- Non-cohesive sand, sand/gravel mixes and other Class II or III materials must be compacted to remove voids.
- Class IVA materials provide reduced structural support, compared with Class I, II, & III. Therefore, additional pipe deflection may be experienced in applications utilizing Class IVA backfill materials. The additional deflection is anticipated and shall not compromise service performance, provided the compaction and maximum burial depth criteria are followed as outlined in this document and in ASTM F449.

BACKFILL PLACEMENT AND COMPACTION

- Place and compact backfill in layers, meeting requirements of ASTM F449 and as outlined in Table 3.
- Place and compact initial backfill in layers around pipe and at least 6” above the crown as shown in Figure 4.
- Avoid impacting pipe with compaction equipment.

- The final minimum cover shall be 2’ over the crown of the pipe where live vehicular or equipment loading is present and shall be no less than 1’ in areas not subjected to live loading.
- The maximum allowed pipe deflection is limited to 10% of the pipe

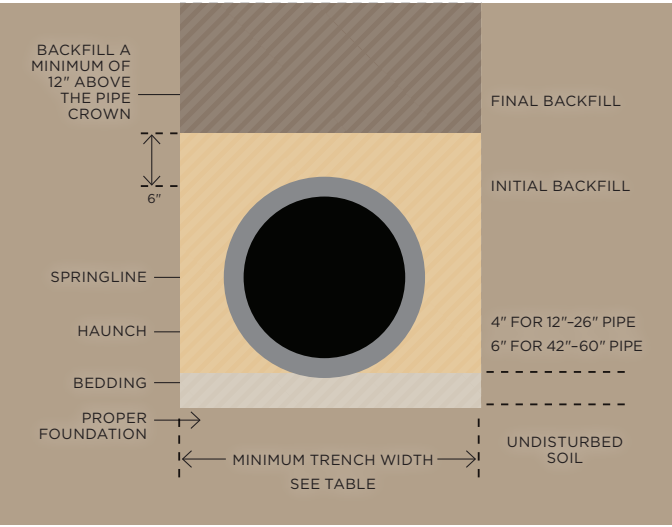
DESIGN CONSIDERATIONS

- To achieve optimum performance, it is important to consider factors such as pipe connections, field conditions, potential negative pressures, and outlet protection. Failure to consider all design aspects may result in reduced flow capacity or system failure. For more information, contact your local Fratco representative.
- Connecting Dissimilar Pipe Drainage systems occasionally require pipe connections between HDPE and other pipe materials such as concrete, corrugated metal, or clay tile. For dissimilar pipe connections, adapters, couplers, or other fittings may be used.
- Soil and Water Table for effective drainage, it is necessary to understand the soil and water table characteristics at the depth the pipe will be installed. Sand or fine silt may move into the system and restrict flow in areas with sandy soils or fluctuating water tables (due to seasonal variations, pumping, or well-pointing methods). In these situations, a non-woven filter fabric

surrounding the pipe is recommended. Site specific conditions shall be determined by a geotechnical or design engineer.

- Negative Pressure Relief Areas with abrupt changes in elevation may result in negative pressure, resulting in blowouts. To ease any potential negative pressure, the flatter section shall have a 25% greater flow capacity than the steep section. Relief wells shall be installed where the pipe changes from steep to flat without an increased flow capacity.
- Outlet Protection Protecting the outlet against animals, fire and erosion extends the life of the system. Animal guards, rip-rap or other erosion protection, and fire resistant material in areas subject to burning are recommended at the outlet.

Figure 4: Trench Construction for Burial Depths Greater than 8’



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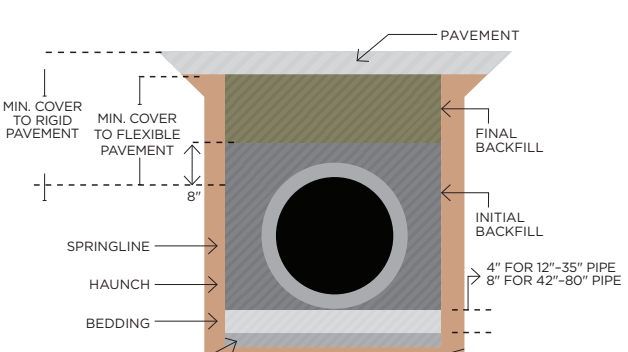
MINIMUM RECOMMENDED TRENCH WIDTHS	
PIPE DIA.	**MIN. TRENCH WIDTH**
3″	5″
4″	21″
6″	23″
8″	25″
10″	28″
12″	30″
15″	34″
16″	40″
24″	50″
30″	59″
36″	65″
42″	84″
48″	90″
50″	102″

NOTES:

Install all pipe in accordance with ASTM D2321–Standard practice for underground installation of flexible thermoplastic sewer pipe. Latest edition.

Foundation: Trench bottoms with unstable or unyielding material shall be excavated to a depth directed by the engineer and replaced with suitable material. For unstable materials, geotextile may be used to stabilize the trench bottom, if directed by the engineer.

Bedding: Appropriate bedding is required to provide uniform support for the pipe and to sustain grade. Bedding material shall be Class I, II, or III. Avoid blocking to bring the pipe to grade and do not allow rocks over 1.5 inches to come in contact with pipe surfaces. A shovel or rake should be used to level the surface.



Haunching: Adequate haunch support is critical to the installed performance of buried pipe. The haunch area encompasses the bedding zone up to the springline of the pipe. If compaction is necessary, avoid disturbing pipe alignment during compaction operations. Always work enough material under the haunch to provide adequate compaction.

Backfilling: Class I, II, or III material shall be used in the pipe zone and extending a minimum of 6" above the pipe crown. Material shall be installed as required in ASTM D2321, latest edition. During backfill placement, care should be taken to prevent rocks larger than 1.5 inches from entering the

backfill material immediately around the pipe.

Minimum Cover: To withstand H-25 loading, the amount of cover above the pipe crown should be less than 12” for 12”-48” diameter pipe and 18” for 60” diameter pipe. Special care should be taken to reroute heavy construction traffic to ensure the pipe is protected from temporary overloading and damage. If heavy construction traffic cannot be rerouted, and the pipe is buried rather shallow, additional compacted soil should be mounded over the pipe to create at least 3 feet (1M) of cover over the pipe crown. This mound can then be graded at the end of construction when heavy traffic is no longer present.

MINIMUM COVER FOR H-25 LOADING*	
PIPE DIA.	**H-25**
12–48″	12″
60″	18″

PLEASE CONSULT A FRATCO ENGINEER FOR APPLICATIONS WHERE LOADS EXCEED H-25

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