N-12® HDPE (per ASTM F2648) Pipe Installation for Agricultural Drainage

The recommendations presented here detail how to install a dependable subsurface drainage or groundwater control system using ADS N-12 dual wall, recycled-content HDPE pipe manufactured to meet ASTM F2648. These installation practices are not recommended for sanitary or storm sewer applications, commercial applications, road crossings or installations where a higher level of performance is required. While performance requirements can differ depending on a project's specific requirements, this guide is intended to address the common practices used in agricultural installations. For installation conditions outside not addressed in this document (poor soil conditions, high surface loads), please contact an ADS representative for further guidance.

Backfill Selection

Only soils meeting the classifications described in Table 1 are recommended for use. The minimum required compaction level for the respective soil is dependent upon the expected fill height and the trench shape being cut. Reference the Trench Construction section of this installation guide for compaction level and allowable fill height recommendations.

Table 1 – Acceptable Soil Classes for Backfill & Embedment

Soil Description	Soil Classification	
	ASTM D2321	ASTMD2487
Graded or crushed stone Crushed gravel	Class I	-
Well-graded sand, gravels and gravel/sand mixtures; Poorly graded sand, gravels and gravel/sand mixtures; little or no fines	Class II	GW GP SW SP
Silty or clayey gravels, gravels/sand/silt or gravels and clay mixtures, silty or clayey sands, sand/clay or sand/silt mixtures	Class III	GM GC SM SC
Inorganic silts and low to medium plasticity clays; gravelly, sandy or silty clays; some fine sands	Class IVA	ML CL
Inorganic silts and high plasticity clays, fat clays; fine sandy or silty soils; elastic silts	Class IVB	MH CH

Trench Construction

As with any pipe, groundwater or seasonal high water tables may impede installation. De-watering is necessary to maintain stability of backfill materials for a safe and effective installation.

Trenches or ditch bottoms containing bedrock, soft mulch or other material unable to provide long-term pipe support are unacceptable and shall be removed. Unsatisfactory material shall be removed to the extent recommended by the design engineer. Without specific design guidance from a soils expert, the following guidelines may be implemented:

- Unyielding material or rock shall be removed 6" (150 mm) below bottom of pipe grade and 6" (150 mm) on either side of the pipe and replaced with a suitable material
- Soft or unstable soils shall be excavated approximately 24" (600 mm) below grade and three times pipe diameter and replaced with a suitable material

In areas where soil migration is a concern, a non-woven filter fabric (geotextile) shall be used to separate native soil from the backfill material as recommended by the design engineer. Guidance on sizing filter fabric to prevent migration of fines is provided in ASTM D2321. Additionally, when perforated pipe or pipe with soil-tight joints is installed and water levels are expected to vary, either due to seasonal fluctuations, pumping or well-pointing methods, water flow may be sufficient to move sand or silt into the drain, in which case a non-woven filter fabric around the pipe may be necessary to prevent blockage or hydraulic capacity reduction of the pipe. It is recommended that any pipe with more than 8' (2.4 m) of cover be non-perforated; perforated pipe may allow soil infiltration which could undermine the backfill of the pipe. For designs utilizing solid pipe, a watertight joint is available to eliminate soil infiltration into the joint.

To prevent damage to the pipe, a minimum depth of backfill above the pipe should be maintained before allowing vehicles or equipment to travel over the pipe. Following ADS backfill recommendations and based on common large tractors (John Deere 9630 or equivalent), a minimum cover of 24" (610 mm) should be provided. Heavier equipment or shallower cover may be possible and should be evaluated by an ADS representative for specific installation recommendations. Heavy construction equipment or high-impact compaction equipment (e.g. hydrohammer) requires at least 48" (1220 mm) of cover and should be evaluated by the engineer prior to pipe installation and equipment use.

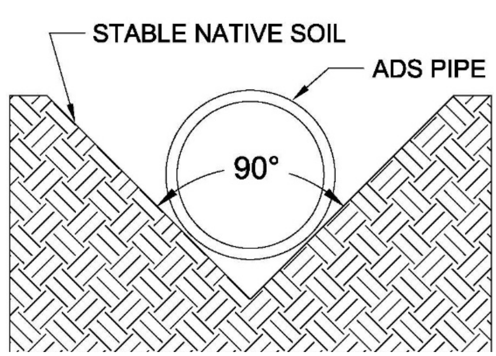
Parallel pipe installations require adequate space be maintained between the pipes in order to allow for proper compaction of the backfill material. Minimum spacing shall not be less than half of the pipe diameter for pipes larger than 24" (600 mm) and not less than 12" (300 mm) for pipe diameters 24" (600 mm) and smaller; narrow spacing may be possible depending on the pipe diameter, trench shape and the backfill material.

The shape of the trench can vary based on excavation equipment, type of fill being used for embedment and compaction methods. Independent of the trench shape, however, successful installation of flexible pipe relies on the quality of the embedment. The following subsections outline recommendations for shaped-trench construction and pipe installation. When installing any pipe material, shaped trench bottoms should only be used when the exiting soils are stable enough to withstand the cut without sloughing.

V-Bottom (4" - 8" Diameter Pipe)

A V-shaped trench bottom is best used for pipe diameters 8" (200 mm) or smaller per ASTM F449-02; however, fittings should be installed using a rectangular trench. The shape of the "V" should be at a 90° angle and is typically formed using a plow attachment, see Figure 1. The pipe is pressed into the V-shaped void and provides adequate support to reduce horizontal deflection. Often times the native soils are placed over top the pipe to bring the excavation up to the final grade. Soil classes 1-4 are suitable backfill materials for this trench construction. Fill heights, measured from top of pipe to surface, should be limited to 8' (2.4 m) when utilizing this trench type.

Figure 1: V-Bottom Trench



Rounded Trench Bottom (10” - 60” Diameter Pipe)

A rounded trench bottom is best used for pipe diameters 10” (250 mm) or greater, however, fittings should be installed using a rectangular trench. A rounded trench bottom is commonly created using a shaped trencher or using a “spoon” attachment on the excavator bucket. Performance of the pipe in this type of trench is greatly dependent on the trench walls conforming as closely as possible to the outside of the pipe. The width of the spoon should be sized to accommodate the diameter of the pipe being installed. For spoon widths that greatly exceed the pipe diameter, the pipe will be allowed to deflect a greater amount until a point at which the sidewalls of the pipe are adequately supported by the trench walls or backfill material. The trench should be cut to a depth such that the bottom 180° (half) of the pipe is supported. See Figure 2 and Table 2 for trench dimensions.

For any pipe material placed in a shaped trench, the invert pipe elevation is dependent on the elevation of the excavated trench bottom. When the trench is cut, the pipe will follow the line and grade of the trench and any deviations in the design slope can affect pipe hydraulics.

Allowable fill heights based on the backfill material and compaction level are provided in Table 3.

Figure 2: Rounded Trench

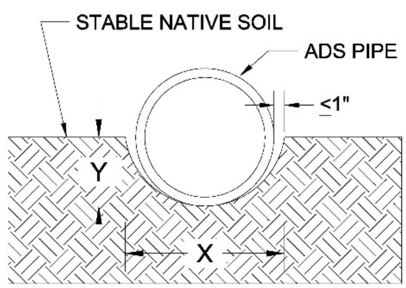


Table 2: Rounded Trench Dimensions

Pipe Diameter in (mm)	Maximum* Width “X” in (mm)	Depth “Y” in (mm)
10 (250)	13.5 (343)	5.7 (145)
12 (300)	16.5 (419)	7.3 (185)
15 (375)	19.6 (498)	8.8 (224)
18 (450)	23.3 (592)	10.6 (269)
24 (600)	29.9 (759)	14.0 (356)
30 (750)	37.2 (945)	17.6 (447)
36 (900)	43.2 (1097)	20.6 (523)
42 (1050)	49.8 (1265)	23.9 (607)
48 (1200)	55.7 (1415)	26.9 (683)
60 (1500)	68.6 (1742)	33.3 (846)

*Maximum width based on ≤1” gap on either side of the pipe at the Springline. Wider trench widths may adversely affect pipe performance.

Table 3: Rounded Trench Maximum Fill Height ft. (m)

Pipe Diameter in (mm)	Soil Classification (see Table 1)	
	Class 2 (GW, GP, SW, SP) @ 85%	Class 4A (ML, CL) @ 80%
10 (250)	18 (5.5)	10 (3.0)
12 (300)	18 (5.5)	10 (3.0)
15 (375)	18 (5.5)	9 (2.7)
18 (450)	19 (5.8)	10 (3.0)
24 (600)	16 (4.9)	9 (2.7)
30 (750)	16 (4.9)	9 (2.7)
36 (900)	13 (4.0)	7 (2.1)
42 (1050)	14 (4.3)	7 (2.1)
48 (1200)	12 (3.7)	6 (1.8)
60 91500)	10 (3.0)	5 (1.5)

Fill heights are measured from top of pipe to ground surface.
Unit weight of soil = 120pcf
For deeper installations or installations below groundwater table, contact an ADS representative for recommendations.

Flat Trench Bottom (4” - 60” Diameter Pipe)

When greater fill heights are required for any pipe diameter, a rectangular trench may be necessary, in combination with improved soil embedment or additional compaction effort; for any fittings, a rectangular trench, in lieu of a shaped bottom trench, shall be used. The trench should be wide enough to place and compact backfill material around the pipe. Increasing the trench width increases the soil load on the pipe. Where trench walls are stable or supported, provide a width sufficient, but not greater than necessary, to ensure working room to properly and safely place and compact embedment materials. The minimum trench width should be no less than pipe OD +6”, but no greater than pipe OD+24”. Refer to Figure 3 for rectangular trench construction.

Any soil types listed in Table 1 may be used as backfill. Non-cohesive sand or sand/gravel mixtures (Class 2 and 3) require compaction in order to remove voids and minimize long-term settlement that can lead to excessive deflection. Cohesive materials (Class 4) also require compaction efforts, but are inherently more difficult to compact compared to non-cohesive soils. In order to minimize compactive effort, the moisture content of cohesive soils should be near optimum and should only be used where water is not present in the trench during placement. Cohesive soils can provide adequate pipe support, but may not be suitable under high fills, surface-appplied wheels loads or with high-energy vibratory compactors.

Table 4 provides allowable fill heights using sand/gravel mixture, well compacted; allowable fill heights using other materials or other compaction levels not listed are available from your ADS representative or referencing ADS Technical Note 2.01.

Figure 3: Rectangular Trench Installation

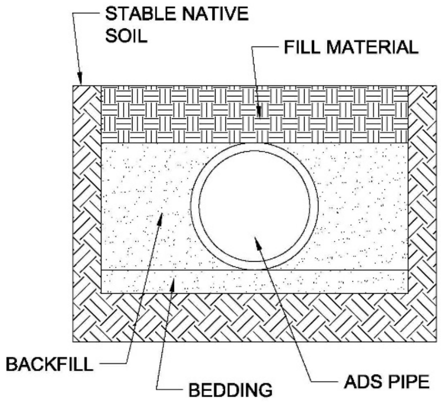


Table 4: Maximum Fill Height for Rectangular Trench Construction

Pipe Diameter in (mm)	Class 2 (GW, GP, SW, SP) at 95% ft (m)
4 (100)	23 (7.0)
6 (150)	27 (8.2)
8 (200)	21 (6.4)
10 (250)	23 (7.0)
12 (300)	24 (7.3)
15 (375)	25 (7.6)
18 (450)	22 (6.7)
24 (600)	18 (5.5)
30 (750)	16 (4.9)
36 (900)	18 (5.5)
42 (1050)	17 (5.2)
48 (1200)	16 (4.9)
60 (1500)	18 (5.5)

Fill heights are measure top of pipe to ground surface.
Unit weight of soil = 120pcf
For deeper installations or installations below groundwater table, contact an ADS representative for recommendations.