HDPE and PP AG Mains

**New Installation Guidelines** (2014)

Rex Ollenburg
Regional Engineer
Advanced Drainage Systems, Inc.
- Eagle Grove, IA
- Hampton, IA
- Oelwein, IA
- Iowa City (yard only)
- Waterloo, IA (Resin Plant)
- Mendota, IL
- Fairmont, MN
What is HP (PP) Pipe?

- Made out of Polypropylene
- Much Stiffer than HDPE
- Dual Gasket Joint - Extended In-Line Bell
- Gray in Color
- Used extensively in stringent Sanitary Sewer Market
What About HP for Ag Mains?

- HP can be used as a viable alternative to HDPE in AG main installations
  - Increased structural capacity
  - Deeper Installations
  - Pipe is typically used in more stringent Sanitary market
FAA Approval for HP

• PP is now in the FAA spec

FAA Approves Polypropylene Pipe for Civilian Airport Water Collection and Disposal

HILLIARD, Ohio--(BUSINESS WIRE)--

Advanced Drainage Systems, Inc. (WMS) (“ADS”), a leading global manufacturer of water management products and solutions for commercial, residential, infrastructure and agricultural applications, applauds the recent
A-Lok premium gaskets ensure a watertight insertion into precast concrete manholes.

Though his firm had installed Advanced Drainage Systems’ black, corrugated HDPE pipe, this was contractor Darin Keller’s first experience with the company’s triple-wall SaniTite HP. After installation, he crawled through the entire mile-long line with a mandrel to confirm the integrity of the pipe’s shape.
Standard Practice

Designation: F 449 - 93

Standard Practice for Subsurface Installation of Corrugated Thermoplastic Tubing for Agricultural Drainage or Water Table Control

This standard is issued under the fixed designation F 449; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of lastRevised. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1. Scope

1.1 This practice is recommended for and limited to gravity flow subsurface drainage systems or water table but not recommended for sanitary or storm sewer lines. Procedures are outlined to minimize tubing or structural damage during and after the installation. These installation procedures are in accordance with "good conduct" principles. This practice applies to all agricultural subsurface or water table control installations. The standard does not purport to address all of the hazards, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

ASTM Standards

F 405 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
F 409 Specification for Corrugated Polyethylene (PE) Tubing and Fittings
F 412 Terminology Relating to Plastic Piping Systems
F 667 Specification for Large Diameter Corrugated Polyethylene Tubing and Fittings
F 660 Specification for Corrugated Poly(Vinyl Chloride) Tubing and Compatible Fittings

3. Terminology

3.1 Definitions are in accordance with Terminology F 412 and abbreviations are in accordance with Abbreviations D 1600, unless otherwise specified.

3.1.1 backfill—materials used to fill the trench following installation of the tubing and bedding.

3.1.2 bedding—material which provides stable bottom support for the tubing including the trench bottom groove, support angle or select material placed around the tubing and envelope or filter materials where used during installation.

3.1.3 bedding—the placement of soil, bedding material over and on the sides of the tubing or envelope to ensure proper grade, alignment, support, and protection of tubing during backfilling and after installation.

3.1.4 boot (also called "shovel")—the protecting apparatus linked to the rear of the installation machine in a manner which allows placement of the tubing on the trench bottom, protection of the workman, or placement of envelope or filter material, or both.

3.1.5 cradle—a prefabricated rigid structure designed to provide trench bottom support for the tubing when soil support is inadequate.

3.1.6 envelope—porous material placed around the tubing to provide bedding, improve the flow of ground water into the drain, or function as a filter.

3.1.7 filter—an envelope of natural or synthetic materials placed completely around a drain to permit free water movement into the drain, provide stabilizing support at the soil-filter interface, and restrict movement of silt and sand into the drain.

3.1.8 grade—the slope of the tubing invert.

3.1.9 groove support angle—angle between the radius of the tubing at points of contact with the formed groove of undisturbed soil or a cradle.

3.1.10 mineral soils—soil containing (1) less than 30% organic matter by weight provided the mineral fraction is 60% or more clay, or (2) less than 20% organic matter by weight provided the mineral fraction has no clay, or (2) less than a proportional content of organic matter between 20 and 30% if the clay content of the mineral fraction is between 0 and 60%.

3.1.11 natural granular envelope—an envelope of granular material, usually highly permeable well-graded sand and gravel.

3.1.12 organic soil—soil containing (1) 30% or more organic matter provided the mineral fraction is 60% or more clay, or (2) 20% or more organic matter provided the mineral fraction has no clay, or (3) a proportional content of organic matter between 20 and 30% if the clay content of the mineral fraction is between 0 and 60%.

3.1.13 pipe cutters—tools per unit length, per unit deformation as defined in Test Method D 2412.

3.1.14 power feeders—mechanism that applies force to the tubing as it passes through the boot or shield to reduce trench during installation.

3.1.15 propping—the practice of making a pass with the...
Standard Practice for Installation of Annular Corrugated Profile Wall Polyethylene Pipe for Agricultural Drainage or Water Table Control
Why New Guidelines??

• Help Ensure Long-Term Product Performance

• Eliminate Misconceptions Contractors/End Users Have Regarding Plastic Pipe

• The current grooved trench specs are lacking for all pipe materials and Engineers have been requesting guidelines for several years.
NEW GUIDELINES! - CAD DETAIL

SHAPED TRENCH FOR AGRICULTURAL INSTALLATION

COVER HEIGHT

<1" BETWEEN PIPE OD AND SPOON TRENCH SIDEWALL

COMPACTED FILL MATERIAL

SPOOL LINE

STABLE NATIVE SOIL

CORRUGATED HDPE OR PP PIPE

DRAWING NUMBER: STD-112

ADVANCED DRAINAGE SYSTEMS, INC.

4840 TRUENMAN BLVD
HILLIARD, OHIO 43028
# Table 1: Rounded Trench Dimensions

<table>
<thead>
<tr>
<th>Pipe Diam.</th>
<th>X</th>
<th>Y</th>
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<tbody>
<tr>
<td>10&quot;</td>
<td>13.5&quot;</td>
<td>5.7&quot;</td>
</tr>
<tr>
<td>12&quot;</td>
<td>16.5&quot;</td>
<td>7.3&quot;</td>
</tr>
<tr>
<td>15&quot;</td>
<td>19.6&quot;</td>
<td>8.8&quot;</td>
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<tr>
<td>18&quot;</td>
<td>23.3&quot;</td>
<td>10.6&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>29.9&quot;</td>
<td>14.0&quot;</td>
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<td>30&quot;</td>
<td>37.2&quot;</td>
<td>17.6&quot;</td>
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<tr>
<td>36&quot;</td>
<td>43.2&quot;</td>
<td>20.6&quot;</td>
</tr>
<tr>
<td>42&quot;</td>
<td>49.8&quot;</td>
<td>23.9&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>55.7&quot;</td>
<td>26.9&quot;</td>
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<tr>
<td>60&quot;</td>
<td>68.6&quot;</td>
<td>33.3&quot;</td>
</tr>
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</table>
EXTENSIVE INSTALL GUIDE

INSTALLATION GUIDE
HP Storm Pipe Installation for Agricultural Drainage

IG 1.03HP
November 2014

PP (HP STORM) OR HDPE

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

IG 1.03DW
November 2014
### Table 3
Maximum Fill Height, ft (m) for Rounded Trench Construction

<table>
<thead>
<tr>
<th>Pipe Diameter in (mm)</th>
<th>Soil Classification (see Table 1)</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Class 2 (GW, GP, SW, SP)</td>
<td>Class 4A (ML, CL)</td>
</tr>
<tr>
<td></td>
<td>@ 85%</td>
<td>@ 80%</td>
</tr>
<tr>
<td>12 (300)</td>
<td>21 (6.4)</td>
<td>12 (3.7)</td>
</tr>
<tr>
<td>15 (375)</td>
<td>21 (6.4)</td>
<td>12 (3.7)</td>
</tr>
<tr>
<td>18 (450)</td>
<td>22 (6.7)</td>
<td>12 (3.7)</td>
</tr>
<tr>
<td>24 (600)</td>
<td>19 (5.8)</td>
<td>11 (3.4)</td>
</tr>
<tr>
<td>30 (750)</td>
<td>21 (6.4)</td>
<td>11 (3.4)</td>
</tr>
<tr>
<td>36 (300)</td>
<td>18 (5.5)</td>
<td>10 (3.0)</td>
</tr>
<tr>
<td>42 (1050)</td>
<td>16 (4.9)</td>
<td>8 (2.4)</td>
</tr>
<tr>
<td>48 (1200)</td>
<td>16 (4.9)</td>
<td>8 (2.4)</td>
</tr>
<tr>
<td>60 (1500)</td>
<td>12 (3.7)</td>
<td>6 (1.8)</td>
</tr>
</tbody>
</table>

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.
48” HP Ag Main - Palo Alto County
Drainage Ditch #20 Hardin County, IA

- 2000 LF of 36" TW
  - Project had areas with 20' of cover
  - Installed with native clay backfill and spoon trench
  - Video Inspected
36” HDPE Ag Main - Kossuth Co.
Finite Element Analysis

- Traditional LRFD Bridge Design standards assume a flat bottom trench
- CANDE
  - Culvert ANalysis and DEsign
  - FEA software for structural analysis and design of buried structures
  - First released in 1976, sponsored by FHWA and AASHTO
  - Available for public download on TRB website (NCHRP Project 15-28)
• Dr. Michael Katona has been and still is the primary author and architect of CANDE since 1972
  • Recently retired as Chair of Civil/Environmental Engineering at Washington State University
  • Specializes in numerical analysis techniques applied to soil-structure interaction including culverts, tunnels, pipelines and long-span soil bridges
• Numerous contributors since project started in 1972
  • Dr. Tim J. McGrath, Simpson Gumpertz & Heger, Inc. (key contributor to LRFD methodology)
  • Ernest T. Selig, Univ. of Massachusetts, Amherst
CANDE Finite Element Analysis

• CANDE
  – Developed for structural design & analysis of buried structures
    • All shapes and materials
  – Uses LRFD methodology for conservative results
    • Additional factors are applied to actual service load conditions entered by user
    • E.g. Factor of 2.05 applied to dead loads, 1.75 applied to live loads
Finite Element Analysis

FEA allows for detailed analysis of shaped trench bottoms
Finite Element Analysis

Void space caused by oversized bucket
30” HDPE W/TRAPEZOIDAL TRENCH
- 10’ COVER
- NATIVE BACKFILL (CL)
- MINIMAL LONG TERM DEFLECTION
ADS Capabilities

- ADS has the ability to analyze a variety of pipe types and installation conditions
  - Pipe Type (HDPE, PP, RCP, CMP)
  - Pipe Size
  - Backfill Material Type
  - Backfill Compaction Level
  - Trench Bottom (Flat, Half Moon, “V”, Trapezoid)
When America Moves Water, It Relies On ADS

Thank you!