

Geo-Stripe® Geothermal Polyethylene

Submittal Data Sheet



Job or Customer:

Engineer:

Contractor:

Submitted by: Date

Approved by: Date

Order No: Date

Specification:

< STANDARDS >



ASTM D3035
ASTM D3350

Polyethylene is flexible and easy to join, requiring minimal labor to install. It has strong chemical resistance and is not susceptible to rust, rot, or electrolysis.

Geo-Stripe Geothermal Polyethylene (PE) is used in Geothermal heating and cooling systems. Our unique Geo-Stripe® product is identified by a tri-red stripe on pipe. Geo-Stripe utilizes a "pointed" u-bend, allowing the pipe to "pay off" down the Geothermal well.



NSF/ANSI-358-1

Geo-Stripe pipe is made from high density polyethylene (HDPE) 4710 resin with a cell classification of 445574C. The material complies to ANSI/NSF Standard 358-1.

Geo-Stripe pipe is offered in DR-11, 3/4" through 2" with coil lengths of 20', 100', 300', and 500' depending on nominal size.

Please see our listing on agency websites for NSF compliant pipe and fittings.

www.nsf.org
www.CSAGroup.org

ipexna.com
Toll Free: 800 463-9572



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Material Properties

Properties	Gas Pipe	Standards
Cell classification	445574C	ASTM D3350
Density, g/cc	0.947 - 0.955	ASTM D1505
Tensile strength at yield, psi at 73°F	3,500 - 4,000	ASTM D638
Hydrostatic Design Basis (HDB), psi @ 73°F	1,600	ASTM D2837
Flexural Modulus, psi @ 73°F	110K - 160K	ASTM D790
Coefficient of thermal expansion in./in./°F (x 10 ⁻⁵)	8.0	
Specific Heat, BTU/lb-°F	0.46	
Thermal Conductivity, BTU-in/hr-ft ² -°F	3.1	
Melt Index, g/10min (190°C / 2.16kg)	< 0.15	ASTM D1238
Slow Crack Growth Resistance, PENT (hours)	500	ASTM F1473
Maximum operating temperature 140°F		

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Pipe Availability

DR 11, Black

Nominal Size	Inside Diameter	Min. Wall Thickness	Outside Diameter	Max Working Pressure at 73°F	Wt/100'	Lengths Available					
						20'	100'	200'	300'	500'	600'
3/4"	0.856	0.095	1.050	200 PSI	12		x			x	
1"	1.052	0.120	1.315	200 PSI	20	x	x			x	
1-1/4"	1.358	0.151	1.660	200 PSI	31	x	x		x	x	
1-1/2"	1.554	0.173	1.900	200 PSI	41	x			x		
2"	1.943	0.216	2.375	200 PSI	64				x		

NOTES: 3/4", 1", and 1-1/4" are also available in U-bends.

U-Bend Loop assemblies are made to order (in any length) for sizes up to and including 1-1/4". Fittings are permanently fused to the pipe and each coil is pressure tested prior to shipping.

Footage markings are located along the pipe at every foot, with the counter starting at the fitting (000').



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Handling & Installation Procedures

Installation

Geo-Stripe DR 11 pipe is made to ASTM D3035 and is an OD-controlled product, designed for use with heat fusion, mechanical compression fittings, and other appropriate joining methods.

Make sure to understand and follow the joining equipment manufacturer's instructions and guidelines to ensure safe operation and quality joints.

Common Fitting Types

The tables below show common fitting types for joining Geo-Stripe polyethylene pipe along with information on which manufacturers carry these products.

Mechanical Fittings

HDPE Pipe Category	Fitting Type
Geothermal Pipe (OD-controlled, D3035)	Compression
	Stab

Ensure all mechanical fittings are intended for use with the applicable pipe (ASTM D3035) by the fitting manufacturer.

Fusion Fittings

HDPE Pipe Category	Fitting Type (Ref ASTM Standard)
Geothermal Pipe (OD-controlled, D3035)	Socket Fusion (ASTM D2683)
	Butt Fusion (ASTM D3261)
	Electrofusion (ASTM F1055)

NOTE:

When using mechanical fittings, consult the fitting manufacturer's installation instructions for the particular fitting being used. Some models require the use of an insert stiffener/liner, which are sold separately. If you experience difficulty inserting the fitting into the pipe, try placing the end of the pipe in hot water to soften it slightly. Never use oil or soap on pipe or fittings.

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Pressure Rating vs. Temperature

Temperature (°F)	Pressure De-Rating Factor
73	1.00
80	0.95
90	0.87
100	0.80
110	0.72
120	0.65
130	0.57
140	0.50

Safe Pull Stress

The safe pulling force of Polyethylene 4710 pipe is based on the duration of the stress.

Knowing the duration of the stress and the cross-sectional area of the pipe (in²), you can calculate the Safe Pull Load (in pounds) for that condition.

If the pipe will be used at temperatures above 73°F, derating factors must be used.

Note: More information available in Chapter 12, Table 1 of PPI's Handbook of PE Pipe.

The safe pull load for a **12 hour** duration is given in the table below for a variety of pipe sizes. Exceeding these values may lead to permanent deformation of the pipe.

Duration	Typical Safe Pull Stress (psi) @ 73°F
0.5 hr	1,500
1 hr	1,400
12 hr	1,150
24 hr	1,100
1,000 hr	830
1 year	720
10 years	620
50 years	522

Nominal Size	ASTM D3035 DR11
1/2"	210
3/4"	328
1"	518
1-1/4"	823
1-1/2"	1,079
2"	1,685

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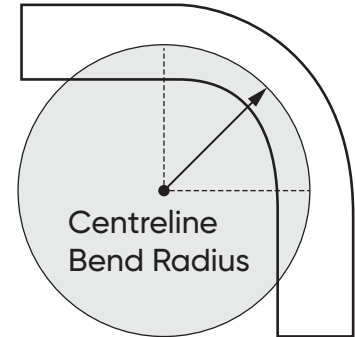
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Installation Considerations - Bending

When bending polyethylene pipe:

- Minimum bending radius shall be not less than 30 pipe diameters, or the minimum coil radius, whichever is greater
- When bending against the curvature of the coil, do not go beyond straight
- No bends within 10 pipe diameters of any fitting or valve



Note: Other sources, such as Chapter 7 of PPI's Handbook of PE Pipe, say that the minimum bend radius of OD-controlled (D2737 & D3035) pipe should be based on its dimension ratio (OD/wall).

Geo-Stripe Flow Performance

Polyethylene DR-11 pipe is made to ASTM D3035 and is OD-controlled. It is produced under the Geo-Stripe® name.

Flow Velocity (ft/s) is calculated using the following equation:

$$v = 0.4085 \times (Q/d)$$

Where:

Q = flow rate in gallons per minute (GPM)

d = inside diameter of the pipe

$$h_f = 0.2083 \times \left(\frac{100}{C}\right)^{1.85} \times \frac{Q^{1.85}}{d^{4.87}}$$

$$\Delta P \text{ (psi)} = h_f / 2.31$$

Where:

h_f = head loss in feet of water per 100' of pipe

Δp = pressure loss in psi per 100' of pipe

C = Hazen-Williams Friction Factor (equal to 150 for HDPE)

DR-11 Poly Pipe Capacity

Pipe Size	Length in Feet per Gallon
1/2"	51.8
3/4"	33.1
1"	21.2
1-1/4"	13.3
1-1/2"	10.2
2"	6.50

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Geo-Stripe Flow Performance

Velocity of Flow (in. ft/sec) for Poly DR-11 Pipe

Flow GPM	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
1						
2	1.73	1.10				
3	2.59	1.66	1.06			
4	3.45	2.21	1.41			
5	4.32	2.76	1.77	1.11		
6	5.18	3.31	2.12	1.33	1.01	
7	6.04	3.87	2.47	1.55	1.18	
8	6.90	4.42	2.83	1.77	1.35	
9	7.77	4.97	3.18	1.99	1.52	
10		5.52	3.53	2.22	1.69	1.08
12		6.63	4.24	2.66	2.03	1.30
14		7.73	4.95	3.10	2.37	1.51
16			5.66	3.54	2.71	1.73
18			6.36	3.99	3.04	1.95
20			7.07	4.43	3.38	2.16
25				5.54	4.23	2.71
30				6.65	5.07	3.25
35				7.75	5.92	3.79
40					6.77	4.33
50						5.41
60						6.49
70						7.57
80						

Pressure Loss (in. lbs per square inch) per 100 feet of Poly DR-11 Pipe

Flow GPM	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
1						
2	0.95	0.32				
3	2.01	0.68	0.23			
4	3.42	1.15	0.39			
5	5.17	1.74	0.59	0.19		
6	7.24	2.44	0.82	0.26	0.14	
7	9.63	3.25	1.10	0.35	0.18	
8	12.33	4.16	1.40	0.45	0.23	
9	15.33	5.17	1.74	0.56	0.29	
10		6.28	2.12	0.68	0.35	0.12
12		8.81	2.97	0.95	0.49	0.17
14		11.71	3.95	1.27	0.66	0.22
16			5.06	1.62	0.84	0.28
18			6.29	2.02	1.05	0.35
20			7.64	2.45	1.27	0.43
25				3.70	1.92	0.65
30				5.19	2.69	0.91
35				6.90	3.58	1.20
40					4.58	1.54
50						2.33
60						3.27
70						4.34
80						

Use with Caution: Flow Velocity above 5 ft/second may cause turbulence or create damaging surge pressures.

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System Testing with Water

Polyethylene pipe will slowly dilate in diameter (creep-strain) when pressure tested. When the internal volume of the pipe increases with the amount of water being fixed, the pressure will drop. This pressure drop doesn't mean that the pipe is leaking. This also means that if you were to hold the pipe at a constant pressure, you would need additional make-up water to maintain this pressure.

Pressure test methods have been developed to account for this creep-strain behavior, such as ASTM F2164 "Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure". In this test, the pipe is conditioned at a constant pressure for 4 hours (adding make-up water as necessary) before dropping the test pressure to inhibit (and slightly reverse) the diametric expansion and then monitoring for leakage. A summary of this method is below:

- Determination of Test Pressure
 - Maximum pressure may be set by the AHJ
 - Do not exceed the pressure rating of the lowest rated component in the system. Remove or isolate from the test section if needed.
 - Do not exceed more than 1.5x the pressure rating of PE piping. Account for temperatures above 73°F accordingly.
- Test Duration
 - If test pressure is between 1x and 1.5x the system design pressure, total time should not exceed 8 hours
 - If test pressure is 1x or less than the system design pressure, the total time should not exceed 72 hours.
 - If retesting, leave the system depressurized for 8 hours minimum
- Test procedure
 - Fill the test section slowly, making sure to purge all air from the system. Entrapped air can cause inaccurate test results, as well as safety concerns due to the large amount of energy released during a rupture/failure. Allow the system to come to thermal equilibrium.

- Initial Expansion – Gradually bring the pipe up to the test pressure. Add make-up water as necessary to maintain this pressure for 4 hours.
- Test phase – Reduce the test pressure by 10psi & monitor for 1 hour. If no leakage is detected and the pressure stays within 5% of the test phase pressure during that 1 hour period, the section passes.

Notes for HDPE Geothermal Pipe

- The International Mechanical Code, Chapter 12, Section 1210.10, discusses tests for "Plastic Pipe Ground-Source Heat Pump Loop Systems". This calls for testing with water at 100psi for 15 minutes.
- IGSHPA 2017 Standards recommends following F2164 with a test pressure of 1.5x the design static pressure, or 100psi if this value is not known.

References

- American Water Works Association
 - M55 PE Pipe - Design and Installation
- International Ground Source Heat Pump Association (IGSHPA) 2017 Design and Installation Standards
- Plastic Pipe and Fittings Association
 - UB-19 Recommendations for Geothermal Ground Loop Piping Systems
- Plastic Pipe Institute
 - Handbook of Plastic Pipe, 2nd Edition
 - TN-46/2013a Guidance for Field Hydrostatic Testing Of High Density Polyethylene Pressure Pipelines: Owner's Considerations, Planning, Procedures, and Checklists

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Specifications

Geo-Stripe

Scope

This specification sheet covers the manufacturers' requirements for Geo-Stripe DR-11 polyethylene pipe. The pipe meets or exceeds all applicable ASTM and NSF standards and is suitable for use geothermal heating and cooling systems.

Materials

High density polyethylene resin used in Geo-Stripe DR-11 pipe complies with the material requirements of ASTM D3350 and has a material designation of 4710 and a cell classification of 445574C. The Geo-Stripe product complies with the requirements of NSF/ANSI 358-1 "Polyethylene Pipe And Fittings For Water-Based Ground-Source "Geothermal" Heat Pump Systems"

Dimensions

Physical dimensions and properties of Geo-Stripe DR-11 pipe shall meet the requirements of ASTM D3035 and NSF/ANSI 358-1.

Marking

Geo-Stripe pipe is marked as prescribed in ASTM 3035 and NSF/ANSI 385-1. The marking includes the following: Nominal size, Geo-Stripe, Material Classification, DR-11 and pressure rating, applicable ASTM & NSF standards.

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About IPEX

About the IPEX Group of Companies

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- Plumbing and DWV and water supply
- Irrigation
- Electrofusion PE for gas and water
- Industrial, plumbing and electrical cements
- PVC, CPVC, PVCO, ABS, PE, PEX, PP and PVDF pipe and fittings

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