Ultra-Pure HDPE

Submittal Data Sheet

Job or Customer: .....

Engineer: .....

Contractor: .....

Submitted by: ..... Date

Approved by: ..... Date

Order No: ..... Date

Specification: .....

< STANDARDS >

ASTM D2737
ASTM D2239

NSF 14 & 61

AWWA C901
Ultra-Pure Blue

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

www.nsf.org

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

Ultra-Pure HDPE can be used as a water service line from meter or well to the house.

Ultra-Pure HDPE pipe is made from high density polyethylene (HDPE) 4710 resin with a cell classification of 445574(C/E). The material complies to NSF 14 & 61.

Ultra-Pure HDPE pipe is offered in CTS SDR-9, 3/4" through 2", with coil lengths of 100' to 1000' size dependent.

Ultra-Pure Blue pipe meets the requirements of AWWA C901.

Material Properties

Properties	Ultra-Pure	Standards
Cell classification	445574(C/E)	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-ft²-°F 3.1	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 under pressure 140°F		

Pipe Availability

CTS SDR 9, Blue

Nominal Size	Inside Diameter	Min. Wall Thickness	Outside Diameter	Max Working Pressure at 73°F	Wt/100′	Lengths Available				
						100′	200′	300′	500′	1000′
3/4″	0.677	0.097	0.875	250 PSI	10	x	x	x	x	
1″	0.870	0.125	1.125	250 PSI	17	x	x	x	x	x
1-1/4″	1.063	0.153	1.375	250 PSI	26	x		x	x	
1-1/2″	1.256	0.181	1.625	250 PSI	36	x	x	x	x	
2″	1.644	0.236	2.125	250 PSI	61	x	x	x	x	

CTS SDR 9, Black

Nominal Size	Inside Diameter	Min. Wall Thickness	Outside Diameter	Max Working Pressure at 73°F	Wt/100′	Lengths Available				
						100′	200′	300′	500′	1000′
3/4″	0.677	0.097	0.875	250 PSI	10	x	x	x	x	
1″	0.870	0.125	1.125	250 PSI	17	x	x	x	x	x
1-1/4″	1.063	0.153	1.375	250 PSI	26	x		x	x	
1-1/2″	1.256	0.181	1.625	250 PSI	36	x		x	x	
2″	1.644	0.236	2.125	250 PSI	61	x	x	x	x	

Handling & Installation Procedures

Installation

CTS pipe made to ASTM D2737 is an OD-controlled product designed for use with 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 table below shows common fitting types for joining polyethylene pipe.

Mechanical Fittings

HDPE Pipe Category	Pipe	Fitting Type
CTS SDR PE Pipe (OD-controlled, D2737)	Ultra-Pure	Compression Stab

Ensure all mechanical fittings are intended for use with the applicable pipe (ASTM D2737) by the fitting manufacturer.

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.

Handling & Installation Procedures

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.

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

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.

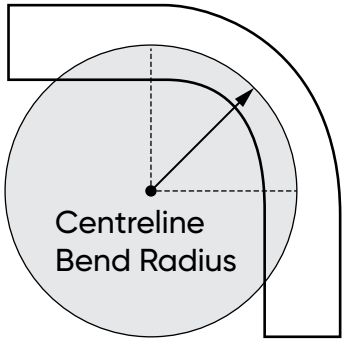
Nominal Size	ASTM D2737
	CTS SDR 9 (250#)
3/4"	273
1"	452
1-1/4"	675
1-1/2"	944
2"	1,611

Handling & Installation Procedures

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



Other sources such as Chapter 7 of PPI's Handbook of PE Pipe, say that the minimum bend radius of OD-controlled pipe should be based on its dimension ratio (OD/wall). This covers Silver-Line pipe made to ASTM D2737 and D3035.

Dimension Ratio (OD-controlled)	Pressure Rating, psi	Minimum Bend Radius
DR 9	250	20 x Pipe OD
Fitting or flange present in the bend	–	100 x Pipe OD

Handling & Installation Procedures

Flow Performance

Polyethylene CTS SDR-9 pipe is made to ASTM D2737 and is OD-controlled.

CTS SDR-9 Poly Pipe Capacity

Pipe Size	Length in Feet per Gallon
1/2″	103.3
3/4″	52.9
1″	32.0
1-1/4″	21.5
1-1/2″	15.4
2″	8.97

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 (Target ID for ID-controlled pipe or Target OD – Min Wall for OD-controlled pipe)

Friction loss per 100′ of 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)

Handling & Installation Procedures

SDR Pipe Flow Performance

Velocity of Flow (in ft/sec) for Poly CTS SDR-9 Pipe

Flow GPM	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
1	1.72					
2	3.44	1.76	1.07			
3	5.17	2.64	1.60	1.07		
4	6.89	3.52	2.13	1.43	1.02	
5		4.40	2.67	1.79	1.28	
6		5.29	3.20	2.14	1.54	
7		6.17	3.73	2.50	1.79	1.05
8		7.05	4.27	2.86	2.05	1.20
9		7.93	4.80	3.22	2.30	1.35
10			5.34	3.57	2.56	1.50
12			6.40	4.29	3.07	1.79
14			7.47	5.00	3.59	2.09
16				5.72	4.10	2.39
18				6.43	4.61	2.69
20				7.15	5.12	2.99
25					6.40	3.74
30					7.68	4.49
35						5.23
40						5.98
50						7.48
60						
70						
80						

Pressure Loss (in lbs. per square inch) per 100 feet of Poly CTS SDR-9 Pipe

Flow GPM	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
1	1.42					
2	5.10	1.00	0.29			
3	10.81	2.11	0.62	0.23		
4	18.40	3.59	1.06	0.40	0.18	
5		5.43	1.60	0.60	0.27	
6		7.61	2.25	0.85	0.38	
7		10.12	2.99	1.13	0.50	0.13
8		12.96	3.82	1.44	0.64	0.17
9		16.12	4.75	1.79	0.80	0.21
10			5.78	2.18	0.97	0.26
12			8.09	3.05	1.36	0.37
14			10.77	4.06	1.80	0.49
16				5.20	2.31	0.62
18				6.46	2.87	0.77
20				7.85	3.49	0.94
25					5.27	1.42
30					7.38	1.99
35						2.65
40						3.39
50						5.12
60						
70						
80						

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

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:Increase the system pressure to the stages 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 or PEX 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 Water Pipe

- Additional information and best practices are provided in the Plastic Pipe Institute's TN-46 "Guidance for Field Hydrostatic Testing of High Density Polyethylene Pressure Pipelines: Owner's Considerations, Planning, Procedures, and Checklists".

References:

- American Water Works Association
  - M55 PE Pipe - Design and Installation
- International Mechanical Code, Chapter 12 "Hydronic Piping"
- Plastic Pipe Institute
  - Handbook of Plastic Pipe, 2nd Edition

Specifications

Ultra-Pure HDPE

Scope

This specification sheet covers the manufacturers' requirements for Ultra-Pure HDPE CTS SDR-9 pipe. The pipe meets or exceeds all applicable ASTM and NSF standards and is suitable for a water service line from meter or well to the house.

Materials

High density polyethylene resin used in Ultra-Pure HDPE pipe complies with the material requirements of ASTM D3350 and has a material designation of 4710 and a cell classification of 445574(C/E). The compounds used are listed to the requirements of NSF 14 & 61 for use in potable water service.

Dimensions

Physical dimensions and properties of Ultra-Pure HDPE SDR-9 pipe shall meet the requirements of ASTM D2737.

Marking

Ultra-Pure HDPE pipe is marked as prescribed in ASTM 2737 and NSF 14 & 61. The marking includes the following: Nominal size, Ultra-Pure, Material Classification, Dimension ratio and pressure rating, applicable ASTM & NSF standards.

About IPEX

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