GEO - ENTERPRISES, INC.

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October 27, 2010

RH Plumbing Co. Inc.
11417 E. 191 St. S.
Bixby, OK 74008
918-366-9870

AIR COMFORT INC
517 W "H" Street
Jenks, OK 74037
918-299-9401

Pawhuska Public Schools
Geothermal Heating & Cooling

HDPE Pipe, Pipe Fittings Submittal Data

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Submitted By: Jamie Stokes
Geothermal Sales
GEO Enterprises, Inc.

Centennial
PLASTICS LLC

Product Submittal Sheet

PROJECT NAME: PAWHUSKA PUBLIC SCHOOLS

PROJECT LOCATION; CITY: Pawhuska STATE: OK ZIP: 74056

CONTRACTOR: R H PLUMBING

CenFuse HDPE Pipe, Earth Loops™, and Patented Bullet U-Bend Fittings for Geothermal Heat Pump Systems

SCOPE: This Product Submittal is for CenFuse polyethylene pipe and Centennial Plastics' Earth Loops™ with Centennial Plastics' Bullet U-Bend fitting for Geothermal Heating and Cooling applications.

MATERIAL: CenFuse HDPE and Bullet U-Bend fittings are manufactured from virgin high density polyethylene resin, specifically designed for geothermal applications. Resin cell classification for CenFuse and "Bullet" U-Bend fittings: 345464C per ASTM D 3350. CenFuse pipe is manufactured in accordance with ASTM D 3035. This material contains a minimum 2% Carbon Black as a UV inhibitor to accommodate outside storage.
The material has a 1600 psi Hydrostatic Design Basis at 73°F. per ASTM D 2837 and is listed in Centennial Plastics name in PPI TR4 as a PE 3408 material.

CERTIFICATION: Centennial Plastics certifies that CenFuse polyethylene pipe, Earth Loops and "Bullet" U-Bend fittings meet the specifications and requirements stated here.

WARRANTY: CenFuse polyethylene pipe comes with a limited non prorated warranty of 50 years. Centennial Plastics' Earth Loops™ come with a limited non prorated warranty of 50 years. (See Full Limited Warranty for complete conditions).

Effective April 18, 2005
1830 Centennial Avenue
Hastings, NE 68901
PH: (402) 462-2227
FAX: (402) 462-5529
Toll Free: (866) 851-2227
centennialplastics.com

SPECIFICATIONS
Effective Feb. 1, 2006
Supercedes July 1, 2002
1830 Centennial Ave.
Hastings, NE 68901
Ph: 402-462-2227
Fax: 402-462-5529
Toll Free: 866-851-2227
centennialplastics.com

Centennial PLASTICS LLC

CenFuse

HDPE 3408—ASTM D3035

- Flexible polyethylene pipe
- Produced from only the finest virgin material
- Backed by a **50-YEAR WARRANTY**
- All diameters are IPS, OD controlled and compatible with heat fusion.

ASTM D3035			3/4"	1"	1-1/4"	1-1/2"	2"	3"	4"	6"
100 PSI	SDR 17	O.D.	1.050"	1.315"	1.660"	1.900"	2.375"	3.500"	4.500"	N/A
		I.D.	.926"	1.161"	1.464"	1.676"	2.095"	3.088"	3.970"	N/A
		Wall	.062"	.077"	.098"	.112"	.140"	.206"	.265"	N/A
		Wt/Ft	.082#	.128#	.206#	.269#	.421#	.912#	1.508#	N/A
		Coil Lengths	Multiple Coil Lengths and Straight Lengths Available Upon Request					500'/1000'*	500'*	N/A
110 PSI	SDR 15.5	O.D.	N/A	N/A	1.660"	1.900"	2.375"	3.500"	4.500"	6.625"
		I.D.	N/A	N/A	1.446"	1.654"	2.069"	3.048"	3.920"	5.771"
		Wall	N/A	N/A	.107"	.123"	.153"	.226"	.290"	.427"
		Wt/Ft	N/A	N/A	.223#	.294#	.457#	.994#	1.641#	3.560#
		Coil Lengths	Multiple Coil Lengths and Straight Lengths Available Upon Request					500'/1000'*	500'*	40/20'**
128 PSI	SDR 13.5	O.D.	1.050"	1.315"	1.660"	1.900"	2.375"	3.500"	4.500"	6.625"
		I.D.	.894"	1.121"	1.414"	1.618"	2.023"	2.982"	3.834"	5.643"
		Wall	.078"	.097"	.123"	.141"	.176"	.259"	.333"	.491"
		Wt/Ft	.102#	.159#	.254#	.333#	.520#	1.128#	1.865#	4.048#
		Coil Lengths	Multiple Coil Lengths and Straight Lengths Available Upon Request					500'/1000'*	500'*	40/20'**
160 PSI	SDR 11	O.D.	1.050"	1.315"	1.660"	1.900"	2.375"	3.500"	4.500"	6.625"
		I.D.	.860"	1.077"	1.358"	1.554"	1.943"	2.864"	3.682"	5.421"
		Wall	.095"	.120"	.151"	.173"	.216"	.318"	.409"	.602"
		Wt/Ft	.122#	.191#	.306#	.402#	.627#	1.36#	2.249#	4.873#
		Coil Lengths	Multiple Coil Lengths and Straight Lengths Available Upon Request					500'/1000'*	500'*	40/20'**
200 PSI	SDR 9	O.D.	1.050"	1.315"	1.660"	1.900"	2.375"	3.500"	4.500"	N/A
		I.D.	.818"	1.023"	1.292"	1.478"	1.847"	2.722"	3.500"	N/A
		Wall	.117"	.146"	.184"	.211"	.264"	.389"	.500"	N/A
		Wt/Ft	.146#	.229#	.365#	.479#	.749#	1.626#	2.688#	N/A
		Coil Lengths	Multiple Coil Lengths and Straight Lengths Available Upon Request					500'/1000'*	500'*	N/A
267 PSI	SDR 7	O.D.	1.050"	1.315"	1.660"	1.900"	2.375"	3.500"	N/A	N/A
		I.D.	.750"	.939"	1.186"	1.358"	1.697"	2.500"	N/A	N/A
		Wall	.150"	.188"	.237"	.271"	.339"	.500"	N/A	N/A
		Wt/Ft	.181#	.285#	.453#	.593#	.928#	2.016#	N/A	N/A
		Coil Lengths	Multiple Coil Lengths and Straight Lengths Available Upon Request					500'/1000'*	N/A	N/A

*40/20 Foot Straight Lengths Available
**Straight Lengths

Note: Other coil sizes and/or straight lengths are available upon request.
Note: CenFuse HDPE is suitable for connections by heat fusion or compression fittings of the same SDR.
CenFuse meets AWWA C901 requirements in 3/4"-3", SDR 9, 11 and 13.5

Centennial
PLASTICS LLC

Material and Technical Data Sheet

CenFuse HDPE "Earth Loops" and Patented "Bullet" U-Bend Fittings for Geothermal Heat Pump Systems

Material: **CenFuse HDPE and "Bullet" U-Bend fittings are manufactured from virgin high density polyethylene resin, specifically designed for geothermal applications. Resin cell classification for CenFuse and "Bullet" fittings: 345464C per ASTM D 3350. The material contains a minimum 2% Carbon Black as a UV inhibitor to accommodate outside storage.**

Print Line: All CenFuse HDPE is permanently indent printed with white print stating the following:

1. Identification of Centennial Plastics as the manufacturer.
2. The appropriate SDR and IPS designation and nominal diameter.
3. Product trade name.
4. All relevant ASTM standards to which CenFuse is manufactured.
5. Relevant NSF and AWWA standards.
6. Manufacturing date using the Julian calendar.
7. Incremental footage marking every two feet.
8. Design temperature rating.
9. Production shift designation.
10. Identification of PE 3408 high density resin.

IGSHPA Requirements: CenFuse meets IGSHPA requirements as set forth in Section 1C of the "*Close-Loop/Geothermal Heat Pump Systems Design and Installation Standards*" that is published by the International Ground Source Heat Pump Association.

Recommended Usage: CenFuse HDPE is recommended for use as the piping material for buried or submerged closed loop heat exchangers.

Connections: CenFuse HDPE is manufactured to accommodate heat fusion.
Centennial Plastics pre fabricates "Earth Loops" with the "Bullet" U-Bend fitting.
The "Bullet" U-Bend fitting and CenFuse HDPE are manufactured with identical raw materials, allowing for the entire buried heat exchange system to be constructed from the same resin.
It is recommended that closed loop applications requiring a loop, use Centennial Plastics "Bullet" U-Bend fitting. CenFuse is compatible with the normal butt and socket fusion fittings currently in use in the Geo Thermal industry.

Warranty:
Centennial Plastics' "Earth Loops" come with a non prorated warranty of 50 years.

Centennial
PLASTICS LLC

Material and Technical Data Sheet

CenFuse HDPE Polyethylene Pipe

Material: All CenFuse HDPE is manufactured from virgin high density polyethylene resin with the cell classification of 345464C per ASTM D 3350. The material contains a minimum 2% Carbon Black as a UV inhibitor to accommodate outside storage.

Print Line: All CenFuse HDPE is indent printed with white print stating the following:

1. Identification of Centennial Plastics as the manufacturer.
2. The appropriate SDR and IPS designation and nominal diameter.
3. Product trade name.
4. All relevant ASTM standards to which CenFuse is manufactured.
5. Relevant NSF and AWWA standards.
6. Manufacturing date using the Julian calendar.
7. Incremental footage marking every two feet.
8. Design temperature rating.
9. Production shift designation.
10. Identification of PE 3408 high density resin.

Recommended Usage: CenFuse HDPE is recommended for use as the piping material for buried or submerged closed loop heat exchangers.

Connections: CenFuse HDPE is manufactured to accommodate heat fusion.
Centennial Plastics pre fabricates dual coils with the "Bullet" U-Bend fitting.
The "Bullet" U-Bend fitting and CenFuse HDPE are manufactured with identical raw materials, allowing for the entire buried heat exchange system to be constructed from the same resin.
It is recommended that closed loop applications requiring a dual coil, use Centennial Plastics "Bullet" U-Bend fitting. CenFuse is compatible with the normal butt and socket fusion fittings currently in use in the Geo Thermal industry.

Fluid Capacity per 100'		
Diameter	SDR	Gallons
3/4"	SDR 11	3.02
1"	SDR 11	4.73
11/4"	SDR 11	7.55
11/2"	SDR 11	9.93
2"	SDR 11	15.36
3"	SDR 11	33.47
4"	SDR 11	55.31
6"	SDR 11	119.9

Hydrostatic Design	
Temperature	Hydrostatic Design Basis
73.4^{0} F. (23^{0} C.)	1600 PSI
140^{0} F. (60^{0} C.)	800 PSI

As the temperature of the fluid increases above 73.4^0 F, the pressure carrying capacity of HDPE pipe decreases.

73^{0}F.	80^{0}F.	90^{0}F.	100^{0}F.	110^{0}F.	120^{0}F.	130^{0}F.
Pressure Capacity in PSI						
80	76	72	64	60	56	40
100	95	90	80	75	70	50
125	118	112	100	93	87	62
160	152	144	128	120	112	80
200	190	180	160	150	140	100

CenFuse HDPE for use in Geothermal, ground source heat pump applications.

ASTM Standards that CenFuse HDPE Meets or Exceeds:

D 3035...Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
D 3350...Standard Specification for Polyethylene Plastic Pipe and Fittings Material.

CenFuse HDPE Raw Material Properties

Property	ASTM Test Method		Typical Values English Units	Si Units
Density (Natural)	D 4883		-	0.944 g/cc
Density (Black)			-	0.955 g/cc
Melt Index [1]	D 1238		-	12.5 g/10 min
Tensile Strength				
@ Yield (2 in/min)	D 638		3300 psi	22.8 MPa
@ Break (2 in/min)	D 638		4500 psi	31.0 MPa
Elongation @ Break (2 in/min)	D 638		>800%	>800%
Flexural Modulus [2]	D 790		120,000 psi	827 MPa
Notched Izod Impact Strength	D 256		6.0 ft-lbf/in	0.32 kJ/m
Hardness (Shore D)	D 2240		68	68
Vicat Softening Point	D 1525		259° F	126^0 C
Brittleness Temperature	D 746		<-180^0 F	<-118^0 C
Hydrostatic Design Basis @ 23° C	D 2837		1600 psi	11.0 MPa
@ 60° C	D 2837		800 psi	5.5 MPa
Environmental Stress Crack Resistance [3]	D 1693		>5000 hrs.	>5000 hrs.
Notch Tensile (Pent)	F 1473		>100 hrs.	>100 hrs.
Carbon Black Concentration	D 1603		2.30%	2.30%
Cell Classification	D 3350		345464C	345464C

[1] 190^{0}C21600 g
[2] 2% Secant-Method 1
[3] Condition C

CenFuse is certified by NSF.
CenFuse meets AWWA C901 and C906 Requirements.
CenFuse HDPE is certified by NSF Standards 14 and 61.

Listed April, 2002; Updated June, 2005

Hazen-Williams Head Loss and Flow Velocity for SDR 11 CenFuse HDPE

	Flow (US GPM)	Velocity (FPS)	Head Loss (FT/100')
3/4" IPS	1	0.57	0.22
3/4" IPS	2	1.14	0.79
3/4" IPS	3	1.70	1.68
3/4" IPS	4	2.27	2.86
3/4" IPS	5	2.84	4.32
3/4" IPS	6	3.41	6.05
3/4" IPS	7	3.98	8.06
3/4" IPS	8	4.54	10.32
3/4" IPS	9	5.11	12.83
3/4" IPS	10	5.68	15.59
3/4" IPS	15	8.52	33.04
1" IPS	1	0.36	0.07
1" IPS	2	0.72	0.26
1" IPS	3	1.09	0.56
1" IPS	4	1.45	0.96
1" IPS	5	1.81	1.45
1" IPS	10	3.62	5.22
1" IPS	15	5.43	11.06
1" IPS	20	7.24	18.84
1" IPS	30	10.87	39.91
1" IPS	50	18.11	102.79
11/4" IPS	5	1.14	0.47
11/4" IPS	10	2.28	1.68
11/4" IPS	15	3.41	3.57
11/4" IPS	20	4.55	6.08
11/4" IPS	25	5.69	9.19
11/4" IPS	30	6.83	12.88
11/4" IPS	35	7.96	17.13
11/4" IPS	40	9.10	21.94
11/4" IPS	45	10.24	27.28
11/4" IPS	50	11.38	33.16
11/2" IPS	5	0.87	0.24
11/2" IPS	10	1.74	0.87
11/2" IPS	15	2.60	1.85
11/2" IPS	20	3.47	3.15
11/2" IPS	30	5.21	6.67
11/2" IPS	40	6.94	11.36
11/2" IPS	50	8.68	17.18
11/2" IPS	60	10.42	24.08
11/2" IPS	70	12.15	32.03
11/2" IPS	80	13.89	41.02

Hazen-Williams Head Loss and Flow Velocity for SDR 11 CenFuse HDPE

	Flow (US GPM)	Velocity (FPS)	Head Loss (FT/100')
2" IPS	10	1.11	0.29
2" IPS	15	1.67	0.62
2" IPS	20	2.22	1.06
2" IPS	30	3.33	2.25
2" IPS	40	4.45	3.84
2" IPS	50	5.56	5.81
2" IPS	75	8.34	12.31
2" IPS	100	11.12	20.96
2" IPS	125	13.89	31.69
2" IPS	150	16.67	44.42
3" IPS	25	1.28	0.24
3" IPS	50	2.56	0.88
3" IPS	75	3.84	1.87
3" IPS	100	5.12	3.18
3" IPS	125	6.40	4.80
3" IPS	150	7.68	6.73
3" IPS	175	8.96	8.96
3" IPS	200	10.24	11.47
3" IPS	250	12.80	17.34
3" IPS	300	15.36	24.31
4" IPS	50	1.55	0.26
4" IPS	75	2.32	0.55
4" IPS	100	3.10	0.93
4" IPS	125	3.87	1.41
4" IPS	150	4.64	1.98
4" IPS	175	5.42	2.63
4" IPS	200	6.19	3.37
4" IPS	250	7.74	5.10
4" IPS	300	9.29	7.15
4" IPS	350	10.83	9.51
6" IPS	100	1.43	0.14
6" IPS	150	2.14	0.30
6" IPS	200	2.86	0.51
6" IPS	250	3.57	0.78
6" IPS	300	4.28	1.09
6" IPS	350	5.00	1.45
6" IPS	400	5.71	1.86
6" IPS	500	7.14	2.81
6" IPS	600	8.57	3.93
6" IPS	700	10.00	5.23

CenFuse HDPE Earth Loop: 50 Year Warranty

Centennial Plastics L.L.C. warrants to the original retail purchaser that in the event the CenFuse HDPE Earth Loop which includes the Pipe, fitting and fusion joint ("Earth Loop") purchased at the time of delivery of this Limited Warranty fails to perform in accordance with its specifications due to a defect in the materials or workmanship of the "Earth Loop"within fifty (50) years from the date of the original retail purchase of the "Earth Loop", Centennial Plastics L.L.C. will provide to the holder of the Limited Warranty the following:

1. Replacement "Earth Loop" of substantially equivalent or better quality freight prepaid; and

2. The cost of reasonable direct labor charges up to One Dollar ($1.00) per linear foot incurred by the holder of the Limited Warranty for the removal of the defective "Earth Loop" and its replacement.

THIS LIMITED WARRANTY IS THE EXPRESS WARRANTY RELATING TO THE "EARTH LOOP". THE LIMITED WARRANTY IS THE ONLY WARRANTY ISSUED BY CENTENNIAL PLASTICS L.L.C. FOR THE EARTH LOOP AND IS ISSUED IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

The limited Warranty is not applicable in the event of installation and/or use of the "Earth Loop" by the holder of the Limited Warranty or any third party which is not in accordance with the specifications for installation and use of the "Earth Loop", and is not applicable with respect to any failure in performance of the "Earth Loop" which is due in whole or in part to any reason other than a defect in the materials or workmanship of the "Earth Loop".

If the "Earth Loop" fails to perform in accordance with its specifications due to a defect in the materials or workmanship of the "Earth Loop" within fifty (50) years from the date of original retail purchase of the "Earth Loop", the holder of the Limited Warranty shall submit to Centennial Plastics L.L.C. written notice of the defect and a sample of the defective "Earth Loop", clearly identifiable as CenFuse HDPE, Centennial Fitting and fusion joint within thirty (30) days after the defect becomes or should become known to the holder. Written notice and the sample must be sent to:

Centennial Plastics L.L.C.
1830 Centennial Avenue
Hastings, NE 68901

This Limited Warranty is not transferable or assignable by the original retail purchaser of the "Earth Loop".

THIS IS THE SOLE AND EXCLUSIVE REMEDY OFFERED BY CENTENNIAL PLASTICS L.L.C. FOR THE "EARTH LOOP". CENTENNIAL PLASTICS L.L.C. WILL NOT BE LIABLE FOR ANY OTHER COSTS ASSOCIATED WITH FAILURE OR PERFORMANCE OF THE EARTH LOOP. WHICH MAY ARISE, INCLUDING BUT NOT LIMITED TO, ANY SPECIAL, CONSEQUENTIAL OR INCIDENTAL DAMAGES BASED UPON BREACH OF WARRANTY, BREACH OF CONTRACT, NEGLIGENCE, STRICT TORT LIABILITY, OR OTHER LEGAL THEORY.

PRODUCT SUBMITTAL

Project Name: PAWHUSKA PUBLIC SCHOOLS

Project Location: PAWHUSKA, OK

Contractor: R H PLUMBING

DRISCOPLEX™ 5300 CLIMATE GUARD® PIPE AND FITTINGS

Scope:

This Product Submittal is for DriscoPlex™ 5300 Climate Guard® pipe and fittings for geothermal (ground source heat pump) applications.

Reference Documents:

DriscoPlex™ 5300 Climate Guard® pipe is manufactured in accordance with ASTM D-3035. DriscoPlex™ 5300 Climate Guard fittings are manufactured in accordance with ASTM D-2683 for socket fusion fittings, ASTM D-3261 for butt fusion fittings, ASTM F-1055 for electrofusion fittings and ASTM F-1924, Section 3.1.6.1 for Mechanical Fittings.

Materials:

DriscoPlex™ 5300 Climate Guard® polyethylene pipe and heat fused materials are manufactured from high density polyethylene material meeting ASTM D-3350 cell classification 345464C. The material has a 1600 psi Hydrostatic Design Basis at 73°F per ASTM D-2837 and is listed in the manufacturers name in PPI TR4 as a PE3408 compound.

Certification:

Performance Pipe certifies that DriscoPlex™ 5300 Climate Guard® pipe and fittings meet the specifications and requirements identified herein.

Limited Warranty Summary:

Performance Pipe™ warrants, subject to specific conditions, Climate Guard® 5300 Series pipe and fusion fittings for a period of 50 years against rust, rot, electrolytic corrosion and defects in workmanship and materials. This warranty is valid when pipe, tubing and/or fittings are utilized and installed in a closed loop geothermal heat pump system in accordance with accepted and approved industry guidelines and practices. (See Full Limited Warranty for complete terms, conditions and disclaimers).

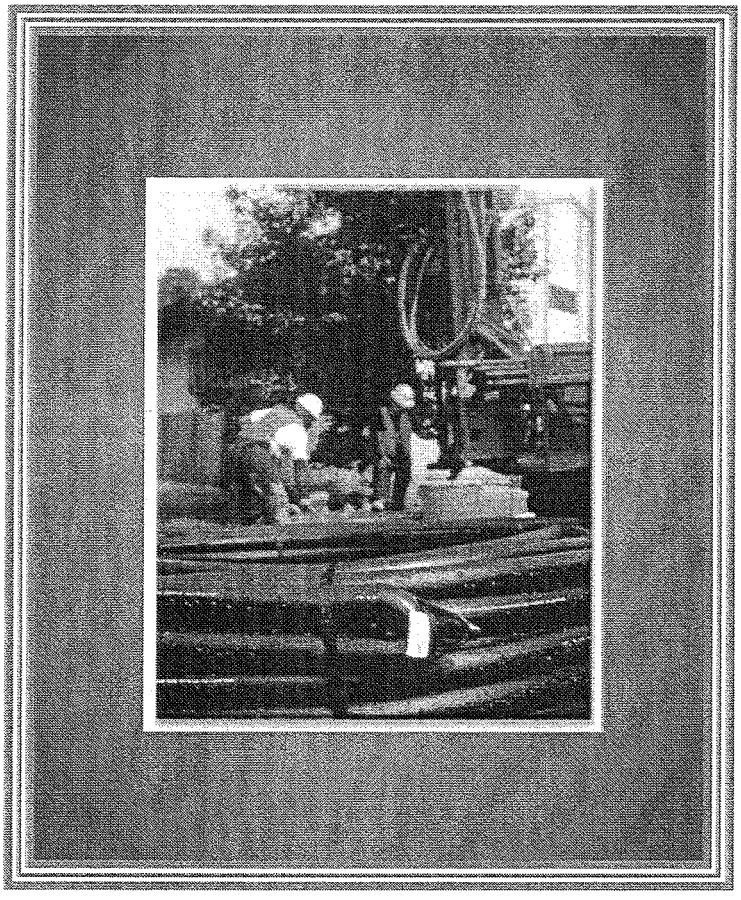
PERFORMANCE PIPE, a division of Chevron Phillips Chemical Company LP
PO Box 269006 / Plano, TX 75026-9006
Phone: 1-800-527-0662 / Fax: 972-599-7348
www.performancepipe.com

April 2002 Supercedes all previous publications

PERFORMANCE PIPE

A DIVISION OF CHEVRON PHILLIPS CHEMICAL COMPANY LP

DRISCOPLEX® 5300 SERIES CLIMATE GUARD® SYSTEMS



DRISCOPLEX® Series 5300 Climate Guard®
HDPE Pipe and Fitting System for
Closed-Loop Ground-Source
Heat Pump Applications

Bulletin: PP 650

PERFORMANCE PIPE
A Division of Chevron Phillips Chemical Company LP

www.performancepipe.com

DRISCOPLEX® 5300 Series Climate Guard®

HDPE Pipe and Fitting System for
Closed-Loop Ground-Source Heat Pump Applications

Performance Pipe

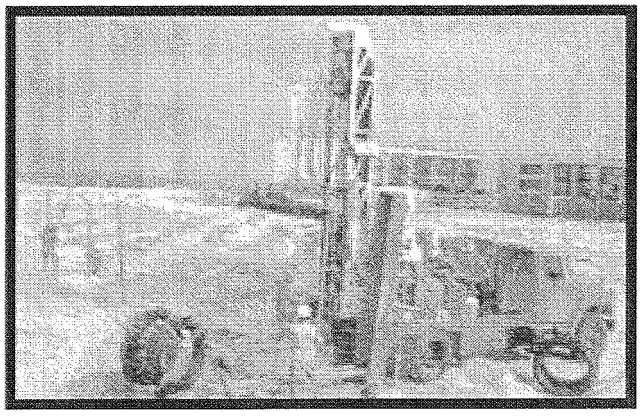
PERFORMANCE PIPE is the functional successor to the operations of Plexco[1] and Driscopipe[2] . On July 1, 2000, Chevron Chemical Company and Phillips Chemical Company were joined to form Chevron Phillips Chemical Company LP. Performance Pipe, a division of Chevron Phillips Chemical Company LP, succeeds Plexco and Driscopipe as North America's largest producer of polyethylene piping products for geothermal, industrial, municipal, mining, oilfield, gas and utility applications.

Performance Pipe offers more than forty years of polyethylene pipe manufacturing experience, nine manufacturing facilities ISO certified in eight states.

The unmatched quality and performance of Performance Pipe polyethylene piping products is enhanced and strengthened with over four decades of quality polyolefin plastic resin production from Chevron Phillips Chemical Company LP.

DRISCOPLEX® 5300 Series Climate Guard® Pipe and Fitting System

DriscoPlex® 5300 Series Climate Guard® high-density polyethylene pipe and fittings are the quality piping system for closed-loop, earth-coupled heat pump applications. DriscoPlex® 5300 Series Climate Guard® pipe and fittings are the system of choice for residential, commercial, institutional and industrial installations. Performance Pipe offers a complete system of DriscoPlex® 5300 pressure-rated pipe and fittings that meet or exceed applicable IGSHPA and ASTM specifications and requirements.



DRISCOPLEX® 5300 Climate Guard® Systems - The Key to Performance

Economical - Easy to join, lightweight and flexible to help reduce construction and installation costs.

Tough and Durable - Excellent impact and abrasion resistance. Pressure ratings based on long-term tests. Exceptional resistance to slow crack growth and environmental stress cracking.

[1] Formerly - Plexco, a Division of Chevron Chemical Company
[2] Formerly - Phillips Driscopipe, A Division of Phillips Petroleum Company

January 2007 Supersedes all previous publications

Ductile and Flexible - Flexible DriscoPlex® 5300 Climate Guard® Series pipe follows the "lay of the land" to ease trench and down hole installation.

Resistant to Chemicals and Corrosion - Excellent resistance to most chemical compounds and aggressive soils.

Thermally Conductive - DriscoPlex® 5300 Climate Guard® pipe offers high strength PE 3408 to minimize pipe wall thickness and maximize heat transfer.

Leak-Tight Joining - Long, continuous coils or straight lengths reduce joining requirements. Properly made heat fusion joints are as strong as the pipe itself and do not leak.

Excellent Hydraulics - DriscoPlex® 5300 Climate Guard® pipe offers high volume flows with low flow resistance. The hydraulically smooth, non-wetting surface provides excellent flow properties. A Hazen-Williams C-factor of 150-155 is typically used to estimate flow resistance. DriscoPlex® 5300 Climate Guard® pipe does not rust, rot, corrode, tuberculate or support biological growth.

Sequential Footage Markings on coils to assist with proper depth setting in borehole installations.

DRISCOPLEX® 5300 Climate Guard® Pipe and Fitting Products

Pipe

- PE 3408 DR 11- 3/4" IPS, 1" IPS, 1-1/4" IPS, 1-1/2" IPS, 2" IPS, 3" IPS and 4" IPS standard.
- PE 3408 DR 15.5 - 3" IPS, 4" IPS, 6" IPS and 8" IPS standard.
- Other sizes through 54" IPS, other DR's, and Schedule 40 available upon request.
- DriscoPlex® 5300 Climate Guard® Unicoil™ proprietary twin-coil with patented Polywing™ u-bend for down hole or horizontal loop applications - 3/4" IPS, 1" IPS and 1-1/4" IPS

Fittings and Valves

DriscoPlex® 5300 Climate Guard® molded fittings for butt fusion through 8" IPS and for socket fusion through 4" IPS.

Materials and Standards

DriscoPlex® 5300 Climate Guard® pipe and molded fittings are manufactured from high-density, high molecular weight PE 3408 polyethylene compound that meets or exceeds ASTM D 3350 cell classification 345464C, and is listed by the Plastic Pipe Institute in PPI TR-4 with HDB ratings of 1600 psi (11.04 MPa) at 73°F (23°C) and 800 psi (5.52 MPa) at 140°F (60°C).

DriscoPlex® 5300 Climate Guard® pipe is manufactured in accordance with ASTM D 3035. Molded fittings are manufactured in accordance with ASTM D 3261 (butt outlet) and ASTM D 2683 (socket outlet).

Secure Joining

DriscoPlex® 5300 Climate Guard® pipe and fittings are quickly joined by socket, butt or saddle heat fusion, electrofusion, or mechanical fittings. Climate Guard® 5300 mechanical connection fittings are available for joining to other materials or to itself. Suitable electrofusion fittings may also be used. Heat fusion joining procedures are available upon request.

Unicoil™ U-Bend Coil

Pre-Fused Polyethylene U-Bend Coils for Efficient, Reliable Installation

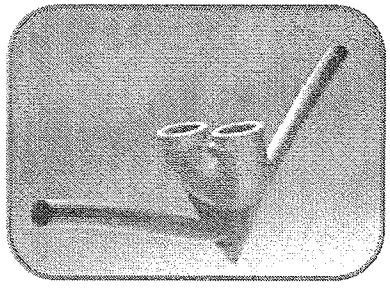
Until now, installers have spent precious field time fabricating u-bends from elbows and making-up u-bend coils for down hole and horizontal heat pump piping loops. But no more - Now there is Unicoil™ u-bend coil from Performance Pipe.

Unicoil™ u-bend coil is the original pre-fused polyethylene u-bend coil system created by Performance Pipe. Unicoil™ u-bend coil features the patented one-piece Polywing Unibend that is pre-fused to two coils of DriscoPlex® 5300 Climate Guard® pipe, all in one convenient package.

Unibend with Polywing - It Goes Down Easy, and Stays Down

Unibend is the first tight radius one-piece u-bend designed specifically for geothermal heat pump applications. The unique Unibend is factory pre-fused to two lengths of DriscoPlex® 5300 Climate Guard® pipe (supply and return) that are coiled together and banded into a single package for easy handling and quick field installation. Unibend features a pointed end for self-guiding installation to slide through the toughest borehole conditions. The one-piece Unibend design eliminates the third fusion where two elbows are fused together, thus fewer joints are buried at extreme depths.

Unibend features the patented Polywing anti-buoyancy attachment port to minimizes the possibility of a loop assembly "floating" out of the borehole. When an anti-buoyancy wing tube is fitted through the Polywing attachment port, the wing tube folds against the Unibend during down-hole insertion, but the wing tube springs out to resist buoyant forces. The Polywing anti-buoyancy port may also be used to connect weights, stiffeners, or other devices without risking damage or compromising Unibend performance.



Configurations

DriscoPlex® 5300 Climate Guard® Unicoil™ piping systems are available in three pipe sizes and two pressure ratings.

• Pipe sizes:	3/4" IPS, 1" IPS or 1-1/4" IPS	
• Working pressure ratings:	SDR 11 160 psi water at 73°F (standard) or SDR 9 200 psi water at 73°F (special order) for deep installations or high static pressures.	
• Outside width across Unibend†:	3/4" IPS & 1" IPS	3 1/4" wide
	1-1/4" IPS	4" wide

† This dimension is the approximate outside width across the Unibend at the end of the Unicoil™ u-bend coil including the fusion beads. When used in downhole applications, appropriate clearance between the borehole and the outside width of the Unibend is required to allow downhole passage.

DriscoPlex® 5300 Climate Guard® Unicoil™ geothermal piping systems sets the standard for reliability, cost-efficiency and ease of installation in the ground source heat pump industry.

General Guidelines for Closed-Loop Ground-Source Heat Pump Applications

- Verify that the total system pressure, operating plus surge, does not exceed the pressure rating of the lowest rated component in the system.
- Carefully inspect the pipe to detect any damage that may have occurred during shipping or handling.
- Conduct hydrostatic leak testing in accordance with Performance Pipe procedures. *Do not test piping with pressurized air.*
- Install DriscoPlex® 5300 Climate Guard® piping products in accordance with accepted standards for water-source heat pump applications and ASTM D 2774 *Underground Installation of Thermoplastic Pressure Piping.*
- When laid in a trench, ensure that the trench bottom is smooth and free from sharp or angular objects. Embedment soils must be free from refuse, organic material, cobbles, boulders, large rocks or stones, and frozen clods. Blocking must be not be used to change pipe grade or to intermittently support pipe across excavated sections.
- When installed down-hole, such as in a vertical loop, be sure any ballast used to facilitate down-hole insertion does not impinge, gouge or cut into the pipe.

Technical Information

Heat Transfer

Heat transfer properties of various materials can be expressed by a "K-Value". A higher K-Value reflects greater heat transfer properties.

Material	*K-Value, BTU-h/ft-°F*
DriscoPlex™ 5300 Climate Guard® PE 3408	0.225
PVC	0.087

Table 1 Approximate Water Volume for 100 Feet of Pipe†

Nominal Pipe Size	*Gallons*	*Nominal Pipe Size*	*Gallons*
3/4" IPS DR 11	2.93	3" IPS DR 11	32.57
1" IPS DR 11	4.60	4" IPS DR 11	53.84
1-1/4" IPS DR 11	7.33	6" IPS DR 15.5	133.47
1-1/2" IPS DR 11	9.60	8" IPS DR 15.5	226.17
2" IPS DR 11	15.00		
* Approximate volume of water in U.S. gallons at 73°F for ASTM D 3035 nominal outside diameter and average wall thickness for pipe.			

Table 2 Climate Guard® 5300 Pressure Rating (psi) vs. Temperature (°F)‡

Temp, °F	*DR 15.5*	*SDR 11*	*SDR 9***
73	110	160	200
80	104	151	189
90	95	138	173
100	87	126	157
110	78	114	142
120	70	102	128
130	63	91	114
140	55	80	100
* PE 3408 pressure ratings for water. PE 3408 HDB = 1600 psi at 73°F and 800 psi at 140°F. Intermediate temperature LTHS interpolated in accordance with PPI TN-18. ** Optional SDR 9 for Unicoil™.			

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Table 3 Estimated Flow Properties for 100 Feet of Pipe - GPM, Pressure Drop (psi), Velocity (fps)†

GPM	3/4" IPS DR 11		1" IPS DR 11		1-1/4" IPS DR 11		1-1/2" IPS DR 11		2" IPS DR 11		3" IPS DR 11		4" IPS DR 11		6" IPS DR 15.5		8" IPS DR 15.5	
	psi	fps	psi	fps	psi	fps	psi	fps	psi	fps	psi	fps	psi	fps	psi	fps	psi	fps
2	0.34	1.14	0.11	0.73	0.04	0.46	0.02	0.35	0.01	0.22								
3	0.73	1.71	0.24	1.09	0.08	0.68	0.04	0.52	0.01	0.33								
4	1.24	2.27	0.41	1.45	0.13	0.91	0.07	0.69	0.02	0.44								
5	1.87	2.84	0.63	1.81	0.20	1.14	0.10	0.87	0.04	0.56	0.01	0.26						
6	2.62	3.41	0.88	2.18	0.28	1.37	0.15	1.04	0.05	0.67	0.01	0.31						
7	3.48	3.98	1.17	2.54	0.38	1.59	0.19	1.22	0.07	0.78	0.01	0.36						
8	4.46	4.55	1.49	2.90	0.48	1.82	0.25	1.39	0.08	0.89	0.01	0.41						
9	5.54	5.12	1.85	3.26	0.60	2.05	0.31	1.56	0.10	1.00	0.02	0.46						
10	6.74	5.69	2.25	3.63	0.73	2.28	0.38	1.74	0.13	1.11	0.02	0.51	0.01	0.31				
12			3.16	4.35	1.02	2.73	0.53	2.08	0.18	1.33	0.03	0.61	0.01	0.37				
15			4.77	5.44	1.54	3.41	0.80	2.60	0.27	1.67	0.04	0.77	0.01	0.46				
18			6.69	6.53	2.15	4.10	1.12	3.13	0.38	2.00	0.06	0.92	0.02	0.56				
21					2.86	4.78	1.48	3.65	0.50	2.33	0.08	1.07	0.02	0.65				
24					3.66	5.46	1.90	4.17	0.64	2.67	0.10	1.23	0.03	0.74				
27					4.56	6.14	2.36	4.69	0.80	3.00	0.12	1.38	0.04	0.84				
30					5.54	6.83	2.87	5.21	0.97	3.33	0.15	1.54	0.04	0.93				
35					7.37	7.96	3.82	6.08	1.29	3.89	0.20	1.79	0.06	1.08	0.01	0.44		
40							4.89	6.95	1.65	4.45	0.25	2.05	0.07	1.24	0.01	0.50		
45							6.08	7.81	2.05	5.00	0.31	2.30	0.09	1.39	0.01	0.56		
50							7.39	8.68	2.49	5.56	0.38	2.56	0.11	1.55	0.01	0.62		
55									2.97	6.11	0.45	2.81	0.13	1.70	0.01	0.69		
60									3.49	6.67	0.53	3.07	0.16	1.86	0.02	0.75		
70									4.65	7.78	0.70	3.58	0.21	2.17	0.02	0.87	0.01	0.52
80									5.95	8.89	0.90	4.09	0.27	2.48	0.03	1.00	0.01	0.59
90									7.40	10.00	1.12	4.61	0.33	2.79	0.04	1.12	0.01	0.66
100											1.36	5.12	0.40	3.10	0.04	1.25	0.01	0.84
110											1.63	5.63	0.48	3.41	0.05	1.37	0.01	0.81
120											1.91	6.14	0.56	3.72	0.06	1.50	0.02	0.88
130											2.21	6.65	0.65	4.02	0.07	1.82	0.02	0.96

†U.S. gallons of water. ASTM D 3035 nominal outside diameter & average wall thickness. Pressure drop estimated using Hazen-Williams C = 150 for water at 60°F.

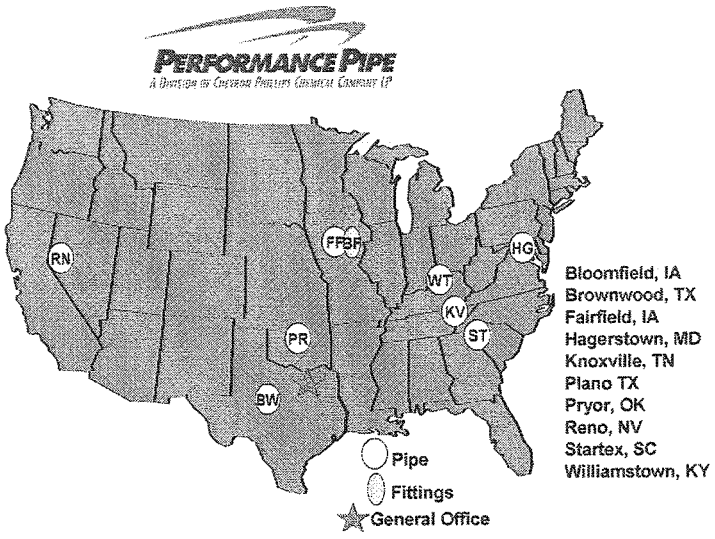
CONTACT INFORMATION:

PERFORMANCE PIPE, a division of
Chevron Phillips Chemical Company
LP
PO Box 269006
Plano, TX 75026-9006

To secure product information
or technical assistance:

Phone: 800-527-0662
Fax: 972-599-7348
www.performancepipe.com

PERFORMANCE PIPE PLANTS



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PERFORMANCE PIPE
Product Literature

Technical Notes & Bulletins*:

PP 102-DS DRISCOPLEX® 5300 Series Climate Guard® Geothermal Piping System Data Sheet

PP 652 Model Specifications for DRISCOPLEX® 5300 Climate Guard® Systems

January 2007 Supercedes all previous publications

PERFORMANCE PIPE
A DIVISION OF CHEVRON PHILLIPS CHEMICAL COMPANY LP

DRISCOPLEX® 5300 Series Climate Guard®
Polyethylene Pipe and Fusion Fittings
Limited Warranty

5300 Series Products:

Performance Pipe warrants DriscoPlex® 5300 Series Climate Guard® pipe and fusion fittings for a period of 50 years against defects in workmanship and materials. This warranty is valid when pipe and/or fittings are utilized and installed in a closed loop geothermal heat pump system in accordance with accepted and approved industry guidelines and practices. This warranty applies only to Performance Pipe DriscoPlex® 5300 Series Climate Guard® pipe and fusion fittings. It does not apply to any fusion joining process or any other method or device used to join the pipe or fusion fitting performed by any other party. It does not apply to the design or installation of the system or any other component of the system.

Subject to the price adjustments described below, Performance Pipe will replace, with a like quantity of new products, any DriscoPlex® 5300 Series Climate Guard® pipe or fusion fittings that were installed and utilized as described above and that subsequently fail within fifty (50) years from the date of purchase due to a defect in workmanship or materials. For warranty claims occurring within one year after the date of purchase, the defective product(s) shall be replaced free of product and freight charges. For warranty claims occurring during the second (2^{nd}) through eleventh (11^{th}) years after the date of purchase, the replacement product cost and freight expense borne by Performance Pipe shall be calculated by reducing the then current price by eight percent (8%) per year. For warranty claims occurring during the twelfth (12^{th}) through the fiftieth (50^{th}) years after the date of purchase, the replacement product cost and freight expense borne by Performance Pipe shall be calculated by reducing the then current price by eighty percent (80%) plus one half percent (0.5%) per year for each year after the 11^{th} year.

SUBJECT TO ANY EXPRESS WARRANTIES CONTAINED IN PERFORMANCE PIPE'S SALES ORDER APPLICABLE TO THE PRODUCT(S) IN QUESTION, THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL, EXPRESS OR IMPLIED, AND PERFORMANCE PIPE DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. PERFORMANCE PIPE SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RELATING TO DEFECTS OF PERFORMANCE PIPE DRISCOPLEX® 5300 SERIES CLIMATE GUARD® PIPE AND FUSION FITTINGS, WHETHER USED SINGULARLY OR IN COMBINATION WITH OTHER PRODUCTS OR MATERIALS. Some states do not allow this exclusion, so it may not apply to you. This limited warranty gives the purchaser specific legal rights and there may be other rights, which vary from state to state.

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www.performancepipe.com

Model Specifications
DRISCOPLEX® 5300 Series Climate Guard® Systems for Geothermal Applications

Scope: This specification designates requirements for geothermal (ground source heat pump) pipe and fittings.

Material: All pipe and heat fused materials shall be manufactured from high density, extra-high molecular weight PE 3408 material. The material shall maintain a 1600 psi Hydrostatic Design Basis at 73.4 degrees F per ASTM D-2837, and shall be listed in PPI TR4 as a PE3408 piping formulation. The material shall have a cell classification of 345464C as specified in ASTM D-3350.

Pipe: The extruded pipe shall conform to the specifications and requirements of ASTM D-3035. Clean rework material from the manufacturer's own production may be used provided the pipe or fittings meet all requirements of this specification. Recycled and reclaimed materials from outside the manufacturer's plant shall not be used. Pipe used for vertical bore applications shall include a factory-fused, single, piece, injection molded U-bend Polywing fitting. The approved pipe product is DRISCOPLEX® 5300 Series Climate Guard® Pipe from Performance Pipe.

Fittings: Molded fittings shall be manufactured to the specifications and requirements of ASTM D-2683 for socket fittings, ASTM D-3261 for butt fittings, ASTM F-1055 for electrofusion fittings and ASTM F-1924 Section 3.1.6.1 for Mechanical fittings. All fittings shall be rated for pressure service equivalent to SDR 11 PE 3408 pipe. The material used in fitting manufacture shall be the same approved base resin material as the connecting pipe.

The approved fittings are DRISCOPLEX® 5300 Series Climate Guard® Systems from Performance Pipe.

Joints: Approved joining methods are heat fusion, electrofusion, flanging, transition fittings and approved mechanical stab fittings. Persons performing heat fusion shall be qualified in accordance with the manufacturer's recommended fusion joining procedures. Electrofusion and mechanical joints shall be made in accordance with the fitting manufacturer's instructions.

March 2006 Supercedes all previous publications

Manufacturer: The pipe and fittings manufacturer shall have in place a functional quality assurance program shall and be ISO (the International Organization for Standardization) Certified.

The approved manufacturer for pipe and fittings is Performance Pipe

Marking: Each pipe shall be durably marked with the manufacturer's name, nominal size, pressure rating, ASTM standard, material designation or cell classification number and date and location of manufacture. Coils shall be marked with footage marks at intervals no greater than two feet. Each fitting shall be identified with the manufacturer's name, nominal size, ASTM standard and lot number.

Installation: Construction and installation shall be in compliance with IGSHPA Standards (as amended from time to time) and all applicable local, state and federal regulations. The Contractor shall observe all appropriate safety requirements in accordance with local, state and federal codes and regulations.

Hydrotesting: The completed system shall be hydrostatically tested at a pressure not greater than 150% of the pipe pressure rating in accordance with Performance Pipe hydrostatic leak testing procedures. Testing with compressed air or a compressed gas is prohibited.

PERFORMANCE PIPE, a division of
Chevron Phillips Chemical Company LP
PO Box 269006
Plano, TX 75026-9006
Phone: 1-800-527-0662
Fax: 972-599-7348

Web:
www.performancepipe.com

March 2006 Supercedes all previous publications

For more information and technical
assistance contact:

Performance Pipe, a division of
Chevron Phillips Chemical Company LP
P.O. Box 269006
Plano, TX 75026-9006
800.527.0662

DriscoPlex® 5300 Series
PE3608 / (PE3408)
Geothermal Systems Data Sheet

Typical Material Physical Properties of DriscoPlex® 5300 Series

High Density Polyethylene Materials

Property	Unit	Test Procedure	Typical Value
Material Designation	---	PPI TR-4	PE3608
Cell Classification	---	ASTM D3350	345464C
Pipe Properties			
Density	gms / cm^3	ASTM D1505	0.955 (black)
Melt Index Condition 190 / 2.16	gms / 10 minutes	ASTM D1238	0.08
Hydrostatic Design Basis 73°F (23°C)	psi	ASTM D2837	1600
Hydrostatic Design Basis 140°F (60°C)	psi	ASTM D2837	800
Color: UV Stabilizer [C] [E]	---	ASTM D3350	Min 2% carbon Black Color UV Stabilizer
Material Properties			
Flexural Modulus 2% Secant - 16:1 span: depth, 0.5 in / min.	psi	ASTM D790	>110,000
Tensile Strength at Yield	psi	ASTM D638 Type IV	3200
Elongation at Break 2 in / min., Type IV bar	%	ASTM D638	>800
Elastic Modulus	psi	ASTM D638	>150,000
Hardness	Shore D	ASTM D2240	62
PENT	hrs	ASTM F1473	>100
Thermal Properties			
Vicat Softening Temperature	°F	ASTM D1525	256
Brittleness Temperature	°F	ASTM D746	-103
Thermal Expansion	in / in / °F	ASTM D696	1.0×10^{-4}

For more information and technical
assistance contact:

Performance Pipe, a division of
Chevron Phillips Chemical Company LP
P.O. Box 269006
Plano, TX 75026-9006
800.527.0662

Members Of: PLASTICS·PIPE·INSTITUTE

NOTICE: This data sheet provides typical physical property information for polyethylene resins used to manufacture PERFORMANCE PIPE polyethylene piping products. It is intended for comparing polyethylene piping resins. It is not a product specification, and it does not establish minimum or maximum values or manufacturing tolerances for resins or for piping products. Some of these typical physical property values were determined using compression molded plaques. Values obtained from tests of specimens taken from piping product can vary from these typical values. Performance Pipe has made every reasonable effort to ensure the accuracy of this data sheet, but this data sheet may not provide all necessary information, particularly with respect to special or unusual applications. The data sheet may be changed from time to time without notice. Contact Performance Pipe to determine if you have the most recent edition.

Material Safety Data Sheet

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

Performance Pipe (PE Pipe and Fittings: Various Colors)

Product Use: Conveyance of liquids, gases and other media.
Synonyms: Polyethylene Plastic DriscoPlex® Pipe and Fittings

Product CAS No.: Mixture

Company Identification:
Performance Pipe, A Division of
Chevron Phillips Chemical Company LP
5085 W Park Blvd, Ste 500
PlanoTX 75093

Product Information:
MSDS Requests: 1 - (800) 852-5530
Technical Information: 1 - (800) 527-0662
Responsible Party: Product Safety Group
Email:msds@cpchem.com

Chevron Phillips Chemicals International N.V.
Brusselsesteenweg 355
B-3090 Overijse
Belgium

24-Hour Emergency Telephone Numbers
HEALTH:Chevron Phillips Emergency Information Center 866.442.9628 (North America) and 1.832.813.4984 (International)
TRANSPORTATION: North America: CHEMTREC 800.424.9300 or 703.527.3887
ASIA: +1.703.527.3887
EUROPE: BIG .32.14.584545 (phone) or .32.14.583516 (telefax)
SOUTH AMERICA SOS-Cotec Inside Brazil: 0800.111.767
Outside Brazil: 55.19.3467.1600

SECTION 2 HAZARDS IDENTIFICATION

****

EMERGENCY OVERVIEW
Colored plastic (various colors)

- FORMALDEHYDE MAY BE PRODUCED AT ELEVATED TEMPERATURE.

****

IMMEDIATE HEALTH EFFECTS:

Eye: Not expected to cause prolonged or significant eye irritation. If this material is heated, thermal burns may result from eye contact.
Skin: Contact with the skin is not expected to cause prolonged or significant irritation. Contact with the skin is not expected to cause an allergic skin response. If this material is heated, thermal burns may result from skin contact. Thermal burns to the skin: may include pain or feeling of heat, discoloration, swelling, and blistering.
Ingestion: Not expected to be harmful if swallowed.
Inhalation: Not expected to be harmful if inhaled. If this material is heated, fumes may be unpleasant and produce nausea and irritation of the upper respiratory tract.

SECTION 3 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENT	CAS NUMBER	AMOUNT	EINECS	SYM	R-PHRASES
Polyethylene	9002-88-4	> 96 % weight	EXEMPT	NA	NA
Polyethylene Hexene Copolymer	25213-02-9	> 96 % weight	EXEMPT	NA	NA
Polyethylene Butene Copolymer	25087-34-7	> 96 % weight	NA	NA	NA
May Include: Carbon Black	1333-86-4	0 - 4 % weight	215-609-9	NA	NA
May Include: Lead Chromate Pigment	1344-37-2	0 - 1 % weight	215-693-7	T, N	R33, R40, R50/53, R61, R62

Occupational Exposure Limits:

Component	Limit	TWA	STEL	Ceiling / Peak	Notation
May Include: Carbon Black	ACGIH	3.5 mg/m3	NA	NA	NA
May Include: Carbon Black	OSHA PEL	3.5 mg/m3	NA	NA	NA
May Include: Carbon Black	German MAK	6 mg/m3	NA	NA	NA
May Include: Lead Chromate Pigment	ACGIH	.01 mg/m3	NA	NA	NA
May Include: Lead Chromate Pigment	German MAK	.1 mg/m3	NA	4	NA
May Include: Lead Chromate Pigment	OSHA SP	.05 mg/m3	NA	NA	NA
Polyethylene	ACGIH	3 mg/m3	NA	NA	NA
Polyethylene	CPCHEM	Not Established	NA	NA	NA
Polyethylene	German MAK	6 mg/m3	NA	NA	NA
Polyethylene Butene Copolymer	CPCHEM	Not Established	NA	NA	NA
Polyethylene Hexene Copolymer	CPCHEM	Not Established	NA	NA	NA

SECTION 4 FIRST AID MEASURES

Eye: If heated material should splash into eyes, flush eyes immediately with fresh water for 15 minutes while holding the eyelids open. Remove contact lenses, if worn. Get immediate medical attention.
Skin: If the hot material gets on skin, quickly cool in water. See a doctor for extensive burns. Do not try to peel the solidified material from the skin or use solvents or thinners to dissolve it. The use of vegetable oil, mineral oil, or petroleum jelly is recommended for removal of this material from the skin.
Ingestion: If swallowed, do not induce vomiting. Give the person a glass of water or milk to drink and get immediate medical attention. Never give anything by mouth to an unconscious person.
Inhalation: Move the exposed person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if breathing difficulties continue.

Eye: Not expected to cause prolonged or significant eye irritation. If this material is heated, thermal burns may result from eye contact.
Skin: Contact with the skin is not expected to cause prolonged or significant irritation. Contact with the skin is not expected to cause an allergic skin response. If this material is heated, thermal burns may result from skin contact. Thermal burns to the skin: may include pain or feeling of heat, discoloration, swelling, and blistering.
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Polyethylene Hexene Copolymer	25213-02-9	> 96 % weight	EXEMPT	NA	NA
Polyethylene Butene Copolymer	25087-34-7	> 96 % weight	NA	NA	NA
May Include: Carbon Black	1333-86-4	0 - 4 % weight	215-609-9	NA	NA
May Include: Lead Chromate Pigment	1344-37-2	0 - 1 % weight	215-693-7	T, N	R33, R40, R50/53, R61, R62

Occupational Exposure Limits:

Component	Limit	TWA	STEL	Ceiling / Peak	Notation
May Include: Carbon Black	ACGIH	3.5 mg/m3	NA	NA	NA
May Include: Carbon Black	OSHA PEL	3.5 mg/m3	NA	NA	NA
May Include: Carbon Black	German MAK	6 mg/m3	NA	NA	NA
May Include: Lead Chromate Pigment	ACGIH	.01 mg/m3	NA	NA	NA
May Include: Lead Chromate Pigment	German MAK	.1 mg/m3	NA	4	NA
May Include: Lead Chromate Pigment	OSHA SP	.05 mg/m3	NA	NA	NA
Polyethylene	ACGIH	3 mg/m3	NA	NA	NA
Polyethylene	CPCHEM	Not Established	NA	NA	NA
Polyethylene	German MAK	6 mg/m3	NA	NA	NA
Polyethylene Butene Copolymer	CPCHEM	Not Established	NA	NA	NA
Polyethylene Hexene Copolymer	CPCHEM	Not Established	NA	NA	NA

SECTION 4 FIRST AID MEASURES

Eye: If heated material should splash into eyes, flush eyes immediately with fresh water for 15 minutes while holding the eyelids open. Remove contact lenses, if worn. Get immediate medical attention.
Skin: If the hot material gets on skin, quickly cool in water. See a doctor for extensive burns. Do not try to peel the solidified material from the skin or use solvents or thinners to dissolve it. The use of vegetable oil, mineral oil, or petroleum jelly is recommended for removal of this material from the skin.
Ingestion: If swallowed, do not induce vomiting. Give the person a glass of water or milk to drink and get immediate medical attention. Never give anything by mouth to an unconscious person.
Inhalation: Move the exposed person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if breathing difficulties continue.

SECTION 5 FIRE FIGHTING MEASURES

FIRE CLASSIFICATION:
Classification (29 CFR 1910.1200): Not flammable or combustible. This material will burn although it is not easily ignited.

NFPA RATINGS: **Health:** 0 **Flammability:** 0 **Reactivity:** 0
FLAMMABLE PROPERTIES:
Flashpoint: NA
Autoignition: NA
Flammability (Explosive) Limits (% by volume in air): **Lower:** NA **Upper:** NA

EXTINGUISHING MEDIA: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

PROTECTION OF FIRE FIGHTERS:
Fire Fighting Instructions: Material will not burn unless preheated. Clear fire area of all non-emergency personnel. Only enter confined fire space with full gear, including a positive pressure, NIOSH-approved, self-contained breathing apparatus. Cool surrounding equipment, fire-exposed containers and structures with water. Container areas exposed to direct flame contact should be cooled with large quantities of water (500 gallons water per minute flame impingement exposure) to prevent weakening of container structure. If possible, water should be applied as a spray from a fogging nozzle since this is a surface burning material. The application of high velocity water will spread the burning surface layer. For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.
Combustion Products: Incomplete combustion can also produce formaldehyde. Normal combustion forms carbon dioxide, water vapor and may produce carbon monoxide, original monomer, other hydrocarbons and hydrocarbon oxidation products, depending on temperature and air availability. Combustion may form: Carbon Dioxide, Carbon Monoxide

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in vicinity of spilled material.
Spill Management: If heated material is spilled, allow it to cool before proceeding with disposal methods.
Reporting: U.S.A. regulations may require reporting spills of this material that could reach any surface waters. Report spills to local authorities and/or the National Response Center at (800) 424-8802 as appropriate or required.

SECTION 7 HANDLING AND STORAGE

READ AND OBSERVE ALL PRECAUTIONS ON PRODUCT LABEL . REFER TO PRODUCT LABEL OR MANUFACTURERS TECHNICAL BULLETINS FOR THE PROPER USE AND HANDLING OF THIS MATERIAL .

Precautionary Measures: Avoid contact of heated material with eyes, skin, and clothing. Avoid breathing vapor or fumes from heated material.
Unusual Handling Hazards: Potentially toxic/irritating fumes may be evolved from heated material. At temperatures (>350°F, >177°C), polyethylenes can release vapors and gases, which are irritating to the mucous membranes of the eyes, mouth, throat, and lungs. These substances may include acetaldehyde, acetone, acetic acid, formic acid, formaldehyde and acrolein. Based on animal data and limited epidemiological evidence, NTP, IARC (2A), and OSHA have listed formaldehyde as a probable human carcinogen. Following all recommendations within this MSDS should minimize exposure to thermal processing emissions.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:
Consider the potential hazards of this material (see Section 3), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If

engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:
If heated material generates vapor or fumes, use process enclosures, local exhaust ventilation, or other engineering controls to control exposure.

PERSONAL PROTECTIVE EQUIPMENT:
Eye/Face Protection: Wear eye protection such as safety glasses, chemical goggles, or faceshields if engineering controls or work practices are not adequate to prevent eye contact. If this material is heated, wear chemical goggles or safety glasses and a face shield.
Skin Protection: If this material is heated, wear insulated clothing to prevent skin contact if engineering controls or work practices are not adequate to prevent skin contact.
Respiratory Protection: If user operations generate harmful levels of airborne material that is not adequately controlled by ventilation, wear a NIOSH approved respirator that provides adequate protection. Use the following elements for air-purifying respirators: Organic Vapor and Formaldehyde.

Occupational Exposure Limits:

Component	Limit	TWA	STEL	Ceiling / Peak	Notation
May Include: Carbon Black	ACGIH	3.5 mg/m3	NA	NA	NA
May Include: Carbon Black	OSHA PEL	3.5 mg/m3	NA	NA	NA
May Include: Carbon Black	German MAK	6 mg/m3	NA	NA	NA
May Include: Lead Chromate Pigment	ACGIH	.01 mg/m3	NA	NA	NA
May Include: Lead Chromate Pigment	German MAK	.1 mg/m3	NA	4	NA
May Include: Lead Chromate Pigment	OSHA SP	.05 mg/m3	NA	NA	NA
Polyethylene	ACGIH	3 mg/m3	NA	NA	NA
Polyethylene	CPCHEM	Not Established	NA	NA	NA
Polyethylene	German MAK	6 mg/m3	NA	NA	NA
Polyethylene Butene Copolymer	CPCHEM	Not Established	NA	NA	NA
Polyethylene Hexene Copolymer	CPCHEM	Not Established	NA	NA	NA

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOR: Colored plastic (various colors)
pH: NA
Flashpoint: NA
VAPOR PRESSURE: NA
VAPOR DENSITY (AIR=1): NA
BOILING POINT: NA
SOLUBILITY (in water): Insoluble in water.
MELTING POINT: 100°C (212°F) - 135°C (275°F)
SPECIFIC GRAVITY: 0.91 - 1.02
DENSITY: 0.91 - 0.97 g/cm3

SECTION 10 STABILITY AND REACTIVITY

Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.
Conditions to Avoid: heating above recommended processing temperature

Incompatibility With Other Materials: None.
Hazardous Decomposition Products: Carbon Oxides.
Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

IMMEDIATE HEALTH EFFECTS:

Acute Oral Toxicity: LD50 / not known
Acute Dermal Toxicity: LD50 / not known
Acute Inhalation Toxicity: LC50 / not known

Eye Irritation: Polyethylene:This material is not expected to be irritating to the eyes.
Skin Irritation: This material is not expected to be irritating to the skin.
Sensitization: Dermal - not a sensitizer / human

ADDITIONAL TOXICOLOGY INFORMATION:
This product contains POLYMERIZED OLEFINS.
During thermal processing (>350°F, >177°C) polyolefins can release vapors and gases (aldehydes, ketones and organic acids) which are irritating to the mucous membranes of the eyes, mouth, throat, and lungs. Generally these irritant effects are all transitory. However, prolonged exposure to irritating off-gases can lead to pulmonary edema. Formaldehyde (an aldehyde) has been classified as a probable human carcinogen by NTP, IARC (2A), and OSHA based on animal data and limited epidemiological evidence.

Pigments containing carbon black, lead chromate, nickel, antimony,or titanium compounds may have been incorporated into this product. The International Agency for Research on Cancer (IARC) has classified carbon black as a Group 2B carcinogen (possibly carcinogenic to humans) based on sufficient evidence in animals and inadequate evidence inhumans. However, the pigments in this product are bound in a polymer matrix which severely limits its extractability, bioavailability and toxicity. The lead chromate pigment is also silica-encapsulated as well as bound in the polymer matrix. None of these pigments is likely to cause adverse health effects under recommended conditions of use.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY:
This material is not expected to be harmful to aquatic organisms.

ENVIRONMENTAL FATE:
This material is not expected to be readily biodegradable.

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. This material as manufactured is a non hazardous waste but may be contaminated upon use. If this material must be discarded, depending on its use and application, it may meet the criteria of a hazardous waste as defined by the US EPA under RCRA (40 CFR 261) or other State and local regulations. Measurement of certain physical properties and analysis for regulated components may be necessary to make accurate determinations. If this material is subsequently classified as a hazardous waste, federal law requires disposal at a permitted hazardous waste disposal facility.

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

Shipping Descriptions per regulatory authority.

US DOT

NOT REGULATED AS A HAZARDOUS MATERIAL OR DANGEROUS GOODS FOR TRANSPORTATION

ICAO / IATA

NOT REGULATED AS A HAZARDOUS MATERIAL OR DANGEROUS GOODS FOR TRANSPORTATION

IMO / IMDG

NOT REGULATED AS A HAZARDOUS MATERIAL OR DANGEROUS GOODS FOR TRANSPORTATION

RID / ADR

NOT REGULATED AS A HAZARDOUS MATERIAL OR DANGEROUS GOODS FOR TRANSPORTATION

SECTION 15 REGULATORY INFORMATION

SARA 311/312 CATEGORIES:

1.	Immediate (Acute) Health Effects:	NO
2.	Delayed (Chronic) Health Effects:	NO
3.	Fire Hazard:	NO
4.	Sudden Release of Pressure Hazard:	NO
5.	Reactivity Hazard:	NO

REGULATORY LISTS SEARCHED:

01= CA Prop 65	17 = FDA 178	33 = RCRA Waste Appendix VIII
02 = LA RTK	18 = FDA 179	34 = RCRA Waste D-List
03 = MA RTK	19 = FDA 180	35 = RCRA Waste P-List
04 =MN Hazardous Substance	20 = FDA 181	36 = RCRA Waste U-List
05 =NJ RTK	21 = FDA 182	37 = SARA Section 302
06 = PA RTK	22 = FDA 184	38 = SARA Section 313
07 = CAA Section 112 HAPs	23 = FDA 186	39 = TSCA 12 (b)
08 = CWA Section 307	24 = FDA 189	40 = TSCA Section 4
09 = CWA Section 311	25 = IARC Group 1	41 = TSCA Section 5(a)
10 =DOT Marine Pollutant	26 = IARC Group 2A	42 = TSCA Section 8(a) CAIR
11 = FDA 172	27 = IARC Group 2B	43 = TSCA Section 8(a) PAIR
12 = FDA 173	28 = IARC Group 3	44 = TSCA Section 8(d)
13 = FDA 174	29 = IARC Group 4	45 = WHIMS - IDL
14 = FDA 175	30 = NTP Carcinogen	46 = Germany D TAL
15 = FDA 176	31 = OSHA Carcinogen	47 = Germany WKG
16 = FDA 177	32 = OSHA Highly Hazardous	48 = DEA List 1
		49 = DEA List 2

The following components of this material are found on the regulatory lists indicated.

Polyethylene	4
May Include: Carbon Black	1, 3, 4, 5, 6, 27, 45
May Include: Lead Chromate Pigment	1, 3, 4, 5, 6, 25, 26, 30, 34, 38, 39, 45, 46

CERCLA REPORTABLE QUANTITIES(RQ)/SARA 302 THRESHOLD PLANNING QUANTITIES(TPQ):

Component	Component RQ	Component TPQ	Product RQ
May Include: Lead Chromate Pigment	10 lbs	None	1000 lbs

WHMIS CLASSIFICATION:
This product is not considered a controlled product according to the criteria of the Canadian Controlled Products Regulations.

CHEMICAL INVENTORY LISTINGS:
PEOPLE'S REPUBLIC OF CHINA: This product is subject to special EXEMPTION for use.
EUROPEAN UNION (EU): This product is exempt from inventory listing requirements..
KOREA: This product is exempt from inventory listing requirements.
PHILIPPINES: This product is exempt from inventory listing requirements.
AUSTRALIA: This product is exempt from inventory listing requirements.
CANADA: This product is exempt from inventory listing requirements.
UNITED STATES: This product or a component of this product is not on the TSCA inventory, but is subject to an EXEMPTION and maybe used in Commerce.

EU Symbols: NA - Not Applicable

SECTION 16 OTHER INFORMATION

NFPA RATINGS: Health: 0 Flammability: 0 Reactivity: 0 Special: NA

(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *- Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA).

REVISION STATEMENT: The following sections have been updated: 2,15

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV	- Threshold Limit Value	TWA	- Time Weighted Average
STEL	- Short-term Exposure Limit	PEL	- Permissible Exposure Limit
ACGIH	- American Conference of Government Industrial Hygienists	OSHA	- Occupational Safety & Health Administration
NIOSH	- National Institute for Occupational Safety & Health	NFPA	- National Fire Protection Agency
WHMIS	- Workplace Hazardous Materials Information System	IARC	- Intl. Agency for Research on Cancer
EINECS	- European Inventory of existing Commercial Chemical Substances	RCRA	- Resource Conservation Recovery Act
SARA	- Superfund Amendments and Reauthorization Act.	TSCA	- Toxic Substance Control Act
EC50	- Effective Concentration	LC50	- Lethal Concentration
LD50	- Lethal Dose	CAS	- Chemical Abstract Service
NDA	- No Data Available	NA	- Not Applicable
<=	- Less Than or Equal To	>=	- Greater Than or Equal To
CNS	- Central Nervous System	MAK	- Germany Maximum Concentration Values

This data sheet is prepared according to the latest adaptation of the EEC Guideline 67/548.
This data sheet is prepared according to the OSHA Hazard Communication Standard (29 CFR 1910.1200).
This data sheet is prepared according to the ANSI MSDS Standard (Z400.1).
This data sheet was prepared by EHS Product Stewardship Group, Chevron Phillips Chemical Company LP, 10001 Six Pines Drive, The Woodlands, TX 77380.

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

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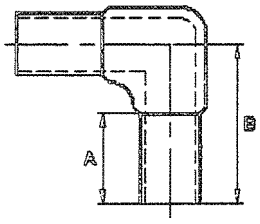

Molded Butt 90

PRODUCED TO ASTM D2513 and D3261

2" AND LARGER PE 3408 ARE ALSO PRODUCED TO AWWA C906-99

Butt 90 Degree Ells	DR/Wall	Dimensions A x B (in)	Package Weight (lbs.)	CSA[1]	IAPMO[1]	FM 150	FM 200	Reference Number
1/2" CTS	DR 0.090	1.69 x 1.79	0.4	x				*M.50*L90D*
3/4" CTS	DR 0.090	1.72 x 2.94	0.8					*M.75*L90D*
1" CTS	DR 0.102	1.69 x 2.94	0.9					*M010*L90D*
	DR 0.125							
3/4" IPS	DR 11	1.72 x 2.94	0.9	x				*M.75*L90D*
1" IPS	DR 9	1.72 x 3.06	1.3		x			*M010*L90D*
	DR 11			x				
1 1/4" IPS	DR 9	2.50 x 3.88	3.2					*M1.25*L90D*
	DR 10	3.13 x 4.50		x				
	DR 11			x				
1 1/2" IPS	DR 11	3.00 x 4.50	5.0	x				*M1.50*L90D*
	DR 9							
2" IPS	DR 7	2.88 x 5.06	10.8					*M020*L90D*
	DR 9		9.3				x	
	DR 11		7.6	x	x	x		
	DR 17		7.6					
3" IPS	DR 7	3.00 x 6.00	11.7					*M030*L90D*
	DR 9						x	
	DR 11 / 11.5	3.00 x 5.63	7.3	x	x	x		
	DR 13.5			x				
	DR 17							
4" IPS	DR 7	3.00 x 6.00	16.2					*M040*L90D*
	DR 9						x	
	DR 11 / 11.5	3.00 x 6.75	16.3	x	x	x		
	DR 13.5			x				
	DR 17							
6" IPS	DR 7	4.25 x 8.63	27.2					*M060*L90D*
	DR 9		26.8				x	
	DR 11 / 11.5	4.00 x 8.25	17.3	x	x	x		
	DR 13.5		16.6	x				
	DR 17							
8" IPS	DR 7	6.00 x 11.81	26.5					*M080*L90D*
	DR 9						x	
	DR 11		20.2	x		x		
	DR 13.5			x				
	DR 17							

[1] - CSA and IAPMO available as DriscoPlex™ 6500 PE2406 materials ONLY.
x - Indicates certification/approval for appropriate application or test.
- Fittings produced at Bloomfield, Iowa
- Drawing No. CU70B255 for 1-1/4" IPS thru 8" IPS & CU70B247 for 1/2" CTS thru 1" IPS
- Packaging - 10 per box 2" IPS and smaller
  - 4 per box 3-4" IPS
  - 2 per box 6" IPS
  - 1 per box 8" IPS

April 2004 Supercedes all previous publications

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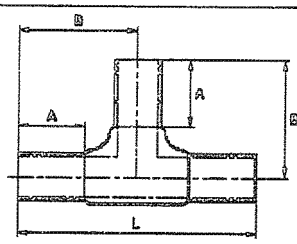

MOLDED BUTT TEE

PRODUCED TO ASTM D2513 and D3261

2" AND LARGER PE 3408 ARE ALSO PRODUCED TO AWWA C906-99

Molded Butt Tee	DR/Wall	Dimensions A x B x L (in)	Package Weight (lbs.)	CSA[1]	IAPMO[1]	FM 150	FM 200	Reference Number
1/2" CTS	0.090	1.69 x 2.83 x 5.65	0.6	x				*M.50*TSTR*
3/4" CTS	0.090	1.72 x 2.94 x 5.88	1.1					*M.75*TSTR*
1" CTS	0.102	1.72 x 2.94 x 5.88	1.3					*M010*TSTR*
	0.125							
1/2" IPS	DR 9.3	1.72 x 2.94 x 5.88	0.8					*M.50*TSTR*
3/4" IPS	DR 11	1.72 x 2.94 x 5.88	1.2	x				*M.75*TSTR*
1" IPS	DR 9	1.72 x 3.06 x 6.12	1.8					*M010*TSTR*
	DR 11			x				
1 1/4" IPS	DR 9	2.50 x 3.90 x 7.80	4.4					*M1.25*TSTR*
	DR 10	2.75 x 4.53 x 9.25	5.2	x				
	DR 11			x				
1 1/2" IPS	DR 11	3.02 x 4.62 x 9.24	6.6	x	x			*M1.50*TSTR*
	DR 9							
2" IPS	DR 7	2.88 x 5.125 x 10.25	14.0					*M020*TSTR*
	DR 9		11.8				x	
	DR 11		10.4	x	x	x		
	DR 17		10.0					
3" IPS	DR 7	3.00 x 6.06 x 12.13	15.3					*M030*TSTR*
	DR 9		14.9				x	
	DR 11 / 11.5	3.00 x 5.72 x 11.44	10.4	x	x	x		
	DR 13.5			x				
	DR 17							
4" IPS	DR 7	3.00 x 6.22 x 12.44	23.0					*M040*TSTR*
	DR 9		22.0				x	
	DR 11 / 11.5	3.00 x 6.75 x 13.50	21.0	x	x	x		
	DR 13.5		20.0	x				
	DR 17		19.9					
6" IPS	DR 7	4.25 x 8.63 x 17.25	16.7					*M060*TSTR*
	DR 9						x	
	DR 11 / 11.5	4.06 x 8.31 x 16.62	11.6	x	x	x		
	DR 13.5			x				
	DR 17							
8" IPS	DR 7	6.00 x 12.09 x 24.18	37.6					*M080*TSTR*
	DR 9		36.6				x	
	DR 11		27.5	x		x		
	DR 13.5		26.3	x				
	DR 17							

[1] - CSA and IAPMO available as DriscoPlex™ 6500 PE2406 materials ONLY.
x - Indicates certification/approval for application or test.
- Fittings produced at Bloomfield, Iowa
- Drawing No. CU70B256 for 1-1/4" IPS thru 8" IPS & CU70B246 for 1/2" CTS thru 1" IPS
- Packaging - 10 per box 2" IPS and smaller
- 4 per box 3 - 4" IPS
- 1 per box for greater than 4" IPS

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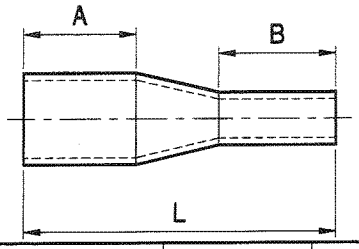

Butt Reducer IPS x IPS

Produced to ASTM D2513 and D3261 and AWWA C901-02 & C906-99

Butt Reducers IPS X IPS	DR	Dimensions L x A x B (in)	Package Quantity	Package Weight (lbs.)	Box Quantity	CSA[1]	IAPMO[1]	FM 150	FM 200	Reference Number
1" IPS x 1/2" IPS	DR 11 x 9.3	4.72 x 1.65 x 1.76	10	0.7	200					*M*RSTI*
1" IPS x 3/4" IPS	DR 11 x 11	4.74 x 1.71 x 1.76	10	0.8	150	x				*M*RSTI*
1 1/4" IPS x 1" IPS	DR 10 x 11	4.78 x 1.70 x 1.76	10	1.2	100	x				*M*RSTI*
	DR 11 x 11					x				
1 1/2" IPS x 3/4" IPS	DR 9 x 9	6.38 x 2.50 x 3.00	10	2.3	10					*M*RSTI*
	DR 11 x 11					x				
1 1/2" IPS x 1" IPS	DR 9 x 9	6.38 x 2.50 x 3.00	10	2.5	10					*M*RSTI*
	DR 11 x 11					x				
2" IPS x 1" IPS	DR 11 x 11	7.15 x 2.90 x 3.60	10	3.0	10	x				*M*RSTI*
2" IPS x 1 1/4" IPS	DR 9 x 9	6.88 x 2.88 x 3.25	10	3.5	10					*M*RSTI*
	DR 11 x 10					x				
	DR 11 x 11									
2" IPS x 1 1/2" IPS	DR 9 x 9	6.25 x 2.63 x 2.00	10	3.0	10					*M*RSTI*
	DR 11 x 11					x				
3" IPS x 2" IPS	DR 7 x 7	6.88 x 2.94 x 3.00	10	9.7	10					*M*RSTI*
	DR 9 x 9						x		x	
	DR 11 x 11†	8.00 x 3.12 x 2.81		8.5		x		x		
	DR 13.5 x					x				
	DR 17 x 11†									
4" IPS x 2" IPS	DR 7 x 7	7.38 x 3.00 x 2.88	10	16.3	10					*M*RSTI*
	DR 9 x 9			15.3					x	
	DR 11 x 11†	7.75 x 3.06 x 2.81		11.6		x	x	x		
	DR 13.5 x					x				
	DR 17 x 11†									
4" IPS x 3" IPS	DR 7 x 7	6.88 x 3.00 x 3.00	10	17.3	10					*M*RSTI*
	DR 9 x 9								x	
	DR 11 x 11†	7.88 x 3.12 x 3.00		14.6		x	x	x		
	DR 13.5 x					x				
	DR 17 x 17									
6" IPS x 4" IPS	DR 7 x 7	8.00 x 3.00 x 3.00	6	24.6	6					*M*RSTI*
	DR 9 x 9			23.0			x		x	
	DR 11 x 11†	11.50 x 4.12 x 4.12		27.1		x		x		
	DR 13.5 x			26.2		x				
	DR 17 x 17			24.8						
8" IPS x 6" IPS	DR 7 x 7	11.62 x 4.37 x 4.50	1	9.9	1					*M*RSTI*
	DR 9 x 9								x	
	DR 11 x 11†			7.5		x		x		
	DR 13.5 x					x				
	DR 17 x 17									

† - Fittings 3" DR 11 and larger also meet DR 11.5 criteria.
[1] - CSA and IAPMO available as DriscoPlex® 6500 MDPE materials ONLY.
x - Indicates certification/approval for application or test at additional charge.
- Drawing No. CU70B249 for 1" IPS x 1/2" IPS, 2" IPS x 3/4" IPS, and 1-1/4" IPS x 1" IPS.
- Drawing No. CU70B319 for 1-1/2" IPS x 3/4" IPS thru 8" IPS x 6" IPS

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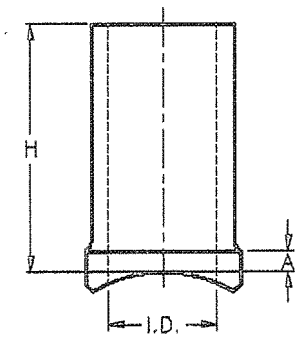
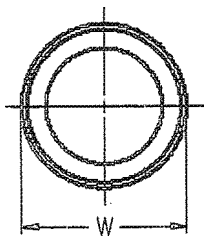
MOLDED Branch Saddles / Butt Outlet / Round Base
PRODUCED TO ASTM D2513 and D3261





Main Size (Nominal) (IPS / DIPS)	Outlet Size	DR	Dimensions (in)				Package Weight (lbs.)	CSA[1]	Reference Number
			H	W	ID	A			
1 1/4" - 18"	3/4" IPS	DR 9	3.10	1.50	0.76	0.50	1.6		*M*BSDL*
		DR 11	3.10	1.50	0.81	0.50	1.4		
	1" IPS	DR 9	3.10	1.75	0.95	0.50	1.7		
		DR 11	3.10	1.75	1.02	0.50	1.5	x	
2" - 18"	1 1/4" IPS	DR 11	3.30	1.81	1.29	0.25	2.0		
	1 1/2" IPS	DR 11	3.50	2.15	1.47	0.35	2.4	x	
	2" IPS	DR 9	3.68	2.61	1.73	0.35	3.1		
		DR 11	3.34	2.61	1.85	0.35	3.1	x	
4" - 18"	3" IPS	DR 7	4.13	5.00	2.48	0.63	9.0		
		DR 9			2.68				
		DR 11			2.86		9.0	x	
6" - 18"	4" IPS	DR 7	4.13	5.00	3.24	0.63	11.0		
		DR 9			3.44				
		DR 11			3.68		11.0	x	
8" - 24"	6" IPS[2]	DR 11	5.85	7.00	4.30	0.75	5.0	x	
10" - 24"	8" IPS[2]	DR 11	8.00	9.43	5.75	0.75	6.0		

[1] - CSA Available as DriscoPlex™ 6500 PE2406 Materials ONLY up thru 8" mains.
[2] - Not available in DRISCOPIPE® 8100 Series.
x - Indicates certification/approval for application or test.
- Fittings produced at Bloomfield, IA .
Refer to Bulletin PP 32.4 if Protective Sleeves are required.
Drawing Nos. CU70B714 and CU70A304-305
Standard Package Quantity - 10 for 4" IPS and smaller
1 for 6" IPS and larger

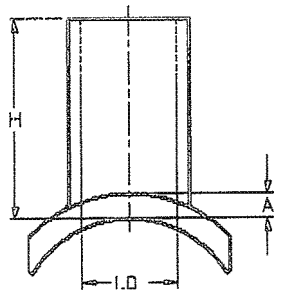
April 2004 Supercedes all previous publications

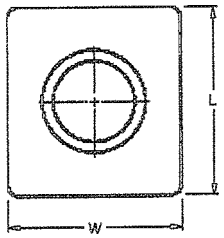
Performance Pipe, a division of Chevron Phillips Chemical Company LP
PO Box 269006 Plano, TX 75026-9066
Phone: 800-527-0662
Fax: 972-599-7348

PERFORMANCE PIPE
A Division of Chevron Phillips Chemical Company LP

www.performancepipe.com

MOLDED Branch Saddles / Butt Outlet / Rectangular Base
PRODUCED TO ASTM D2513 and D3261





Main Size (Nominal) (IPS/ DIPS)	Outlet Size	DR/ Wall	Dimensions (in)					Package Weight (lbs.)	CSA[1]	Reference Number
			H	W	L	ID	A			
1 1/4" - 12"	1/2" CTS	0.090	3.10	1.82	2.30	0.44	0.50	2.0	x[2]	*M*BSDL*
	1/2" IPS	DR 9.3	3.10	1.97	2.40	0.66	0.50	2.0		
	3/4" IPS	DR 9	3.10	1.97	2.40	0.76	0.50	2.0		
		DR 11	3.10	1.97	2.40	0.81	0.50	2.0	x	
	1" IPS	DR 9	3.10	1.97	2.40	0.95	0.50	2.0		
		DR 11	3.10	1.97	2.40	1.02	0.50	2.0	x	
2" - 12"	1 1/2" IPS	DR 11	2.47	2.35	2.68	1.47	0.51	2.5		
	2" IPS	DR 9	2.75	3.92	4.32	1.73	0.63	6.0		
		DR 11	3.88	3.92	4.32	1.85	0.63	6.0	x[2]	

[1] - CSA Available as DriscoPlex™ 6500 PE2406 Materials ONLY up thru 8" mains.
[2] - 1/2" CTS .090, 2" IPS DR11 CSA approved through 6" mains only.
- Refer to Bulletin PP 32.4 if Protective Sleeves are required.
- Fittings produced at Bloomfield, IA .
- Standard Package Quantity - 10
- Drawing No. CU70B720 (1/2" CTS thru 1" IPS)
  - CU70B311 (2" DR 9 and 11)
  - CU70A530 (1 1/2")

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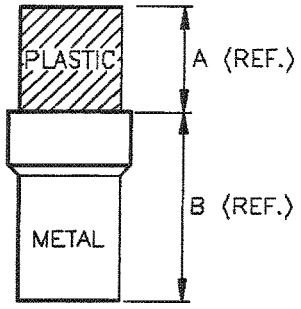
Transition Fittings
Butt Fusion - PE
Weld End - Steel



Nominal Size	Dimension* (in)		Weight (lbs)	
	A	B	Threaded	Weld End
3/4"	12.0	10 3/8	1.0	1.0
1"	12.0	10 1/2	1.5	3.0
1 1/4"	12.0	13 5/8	2.5	4.0
2"	12.0	13 7/8	3.3	5.5
3"	12.0	13 7/8	10.0	19.0
4"	12.0	14 1/2	14.5	27.5
6"	18.0	15 1/2	45.0	45.0
8"	24.0	16 3/4	-	80.0
10"	22.5	27.0	-	122.0
12"	20.5	27 7/8	-	150.0

*Dimensions apply to Weld End ONLY

- The steel end is Sch 40 steel pipe, type API 5L
- The weld end transition fittings are externally epoxy coated on steel end.
- The threaded transition fittings are internally epoxy coated on steel end. & BRASS

Size / DR	6400 Series		6500 Series	8100 Series	8300 Series
	Weld End	Threaded	Weld End	Weld End	Weld End
1/2" CTS 0.090 x 3/4" IPS Steel	N/A	N/A	1050845	N/A	N/A
3/4" IPS / DR 11	N/A	N/A	1005467	1011124	N/A
1" IPS / DR 11	C.F.Q.	1015742	1005471	1011125	1053931
1" CTS 0.090 x 1" IPS Steel	N/A	N/A	1050847	N/A	N/A
1 1/4" IPS / DR 11	C.F.Q.	C.F.Q.	N/A	1011424	1053866
1 1/4" IPS / DR 10	N/A	N/A	1005476	N/A	N/A
2" IPS / DR 11	1004970	1004971	1005479	1006471	1061331
2" IPS / DR 7	1004966	1004968	N/A	C.F.Q.	N/A
3" IPS / DR 11	1004977	1004978	1005481	1011590	1039124
3" IPS / DR 7	1004973	1004975	N/A	N/A	N/A
4" IPS / DR 11	1004981	1004983	1005483	1006473	1039125
4" IPS / DR 7	1004979	1004980	N/A	N/A	N/A
6" IPS / DR 13.5	N/A	N/A	1005488	C.F.Q.	C.F.Q.
6" IPS / DR 11	1004985	1004986	1005485	1006474	1053869
6" IPS / DR 7	1047011	C.F.Q.	N/A	N/A	N/A
8" IPS / DR 13.5	N/A	N/A	1005495	C.F.Q.	C.F.Q.
8" IPS / DR 11	C.F.Q.	C.F.Q.	1005493	1011847	1053906
10" IPS / DR 11	C.F.Q.	C.F.Q.	C.F.Q	1012300	C.F.Q.
12" IPS / DR 11	C.F.Q.	C.F.Q.	1011703	1012301	C.F.Q.

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Performance Pipe , a division of
Chevron Phillips Chemical Company LP
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Fax: 972-599-7348

PRODUCT SPECIFICATION

BUTT FUSION FITTINGS (IPS)
PE3408 / PE4710 HDPE
BLACK

FAMILY:	BUTT FUSION
PRODUCT:	PE FITTING
TYPE:	SPECIFICATION
DOC:	PS-102
REV:	3
FILE:	PE BF FIT-PE3408
DATE:	4/17/2009
PAGES:	2

SCOPE:

This document describes the standard specifications and features related to Georg Fischer Central Plastics' injection molded PE4710 (formerlyPE3408) Butt Fusion Fittings for pressure piping systems.

SIZES:

1/2" CTS through 2" CTS.	TEE, 90 DEGREE ELBOW, REDUCER, CAP,
1/2" IPS through 12" IPS.	TEE, 90 DEGREE ELBOW, 45 DEGREE ELBOW, REDUCER, CAP, PURGE FITTING,

REQUIREMENTS:

ASTM D2513	Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D3350	Specification for Polyethylene Plastic Pipes and Fittings Materials
ASTM D3261	Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastics Pipe and Tubing

REFERENCE DOCUMENTS:

PPI TR-19	Thermoplastics Piping for the Transport of Chemicals
PPI TR-31	Underground Installation of Polyolefin Pipe
PPI TR-33	Generic Butt Fusion Procedure for Polyethylene Gas Pipe
ASTM D2657	Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings

CERTIFICATIONS/LISTINGS:

FM 1613	Approval Standard: Plastic Pipe and Fittings for Underground Fire Protection Service
AWWA C906	Standard for Polyethylene Pressure Pipe and Fittings, 4 in. Through 63 in., for Water Distribution

MATERIALS:

PE Resin: Pre-blended black high density virgin resin. Recognized by the Plastic Pipe Institute as having a PE3408 / PE4710 / PE100 rating and a Hydrostatic Design Basis of 1600 psi @ 73°F. This resin has a cell classification of 445574C* in accordance with ASTM D3350.

Note* Previous editions of ASTM D3350 resulted in cell classifications of 345464C and 345564C.

TEST METHODS:

ASTM D1598 Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.
Must exceed 170 hours in 80°C bath @ 670psi Hoop Stress, or
Must exceed 1000 hours in 80°C bath @ 580psi Hoop Stress, or
Must exceed 1000 hours in 23°C bath @ 1600psi Hoop Stress.
(All methods are considered equivalent)

ASTM D1599 Short-Term Hydraulic Pressure Failure of Plastics Pipe, Tubing, and Fittings.
Uniform pressurization until failure between 60 and 70 seconds from start of test. Most result in ductile failure at a pressure great enough to create a 2520psi Hoop Stress.

ASTM D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
Determination of diameter, wall thickness, and length dimensions including procedures for dimensioning molded thermoplastic pipe fittings.

FEATURES:

Made in USA from pre-blended virgin materials. These fittings are availabe in various configurations and DR and are primarily intended for use in pressure piping applications. These fittings are compatible for heat fusion to any PE material made from a like or similar resin. Select sizes can be supplied with AWWA or FM marking. Designed for use on pipe conforming to ASTM

F714, D2513, and D3035

PRESSURE RATING:

PE4710 Butt Fusion Fittings are pressure rated in accordance with industry and regulatory guidelines for natural gas or water @73°F. Pressure ratings are subject to change depending on ambient temperatures. Pressure ratings vary according to wall thickness and the design factor for the intended application, see below for ratings:

Fitting SDR	Pressure Rating (PSI) @ 73° F (23° C)			
	Water (.63 DSF)	Water (.5 DSF)	Natural Gas (.32 DSF) US	Natural Gas (.4 DSF) Canada
7	335	265	170*	215*
9	250	200	125*	160*
11	200	160	100	125
13.5	160	125	80	100
17	125	100	65	80
21	100	80	50	65
26	80	65	40	50
32.5	65	50	30	40

* Subject to maximum operating pressure limits of regulatory requirements.

Minimum wall thickness for plastic piping gas distribution systems is limited to .062".

Above listed pressure ratings based on 73°F ambient temperature. Pressure ratings subject to derating depending on temperature.

PRESSURE TESTING:

Pressure testing can be conducted in accordance with the recommendations of the pipe manufacturer, or as described in ASTM F2164 *STANDARD PRACTICE FOR FIELD LEAK TESTING OF POLYETHYLENE (PE) PRESSURE PIPING SYSTEMS USING HYDROSTATIC PRESSURE,* typically 1.5 x's the rated working pressure not exceeding 8 hours in duration for a single test.

MAXIMUM OPERATING TEMPERATURE:

The maximium operating temperature of PE4710 Butt Fusion Fittings is 140°F. Pressure de-rating factors should be considered when operating systems above the 73°F stated pressure rating, to maintain the 50 year substantiated long-term hydrostatic strength of the polyethylene material.

STORAGE/SHELF LIFE:

Black high density polyethylene resin contains a minimum of 2% of a finely dispersed concentration of carbon black which provides protection from UV effects. Even so, it is recommended that fittings which are stored for extended periods (two years or greater) be stored indoors in their original packaging. Fittings stored indoors in their original packaging have a virtually unlimited shelf-life.

CHEMICAL RESISTANCE:

Polyethylene generally exhibits strong resistance to many chemical compounds. Known chemical resistance characteristics at specified temperatures can be found in PPI Technical Report TR-19.

INSTALLATION:

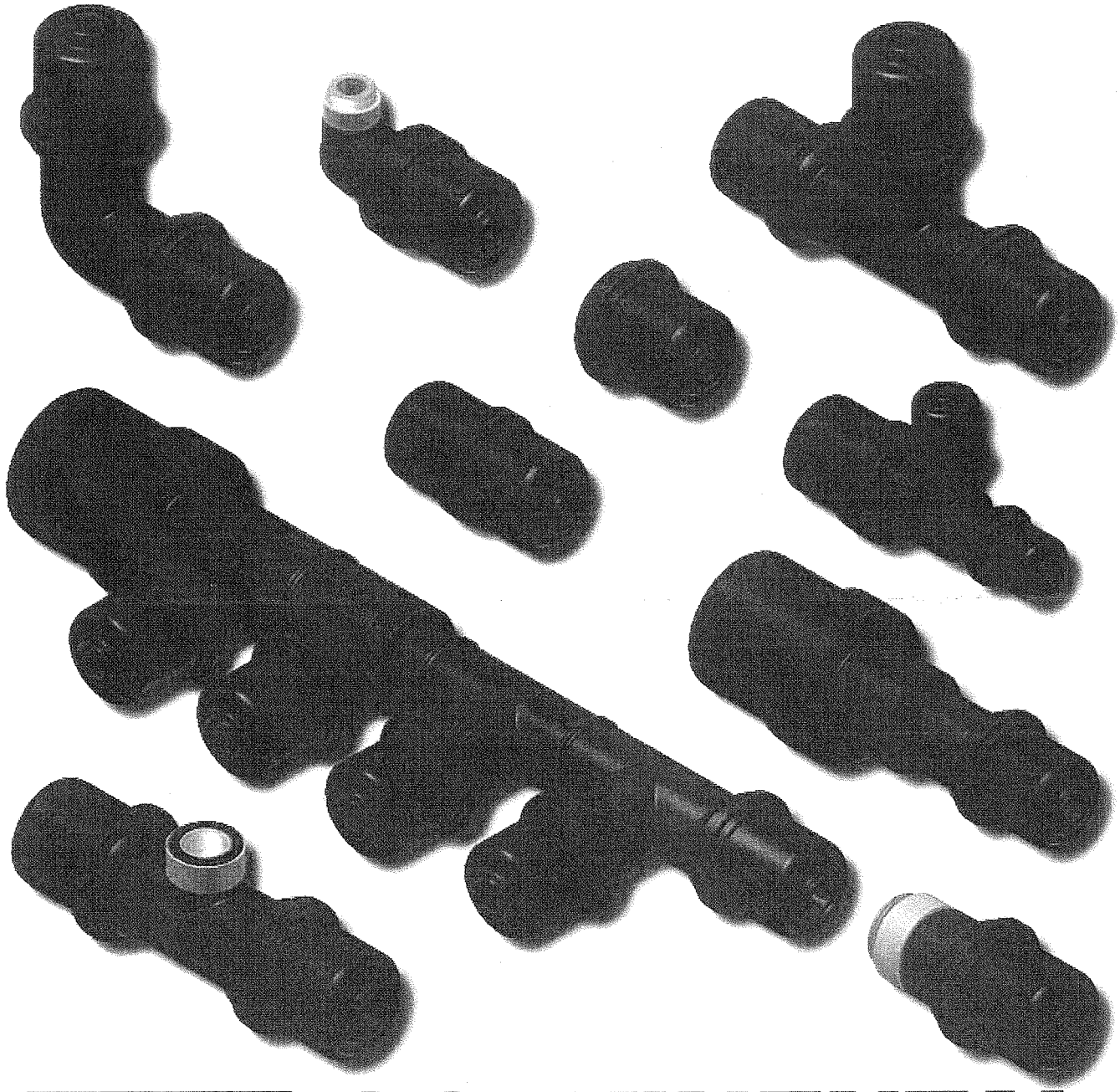
These fittings are compatible for heat fusion by butt, socket, or electrofusion joining products. They can be heat fusion joined to pipe or fittings manufactured from like or similar resin. Qualified mechanical joining products can be used to join these fittings, consult the manufacturer for recommendations. Fusion jointing should only be attempted by persons who have been trained and have qualified joints through destructive testing.

Note: This Specification supercedes all previous Product Specifications and is subject to change without notice.

Approved By:

Jeff Wright
Director of Product Management

GEO-STAB®
Geothermal Fittings



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GEOTHERMAL SERIES

MODEL SPECIFICATION
Stab-Type Fittings for Geothermal Applications

Scope: This specification covers requirements for mechanical connectors for polyethylene (PE) pipe for geothermal applications.

Material: All heat fused materials shall be manufactured from high density, PE3408 or PE4710 material. The PE material shall maintain a 1600 psi Hydrostatic Design Basis at 73.4 degrees F per ASTM D 2837, and shall be listed in PPI TR4 as a PE3408 or PE4710 material.

For stab type connectors, the stiffener, and PE overshoot shall be PE4710 material as described above. The shell shall be injection molded thermoplastic with a Hydrostatic Design Basis greater than or equal to 1600 psi at 73.4 degrees F per ASTM D 2837. The gripper shall be acetel. The elastomer sealing elements shall be nitrile or EPDM.

Pipe: Stab type connectors have been designed for polyethylene pipe meeting the requirements of ASTM D 3035.

Fittings: Stab type connectors shall be rated for pressure service equivalent to SDR 11 PE 3408 and PE 4710 pipe. Mechanical connectors shall be manufactured to the specifications and requirements of ASTM F 1924 Section 6.2.2.1. Mechanical connectors shall have a non-metallic internal tubular stiffener. Mechanical connectors shall not contain metallic support rings. Mechanical connectors must be designed to provide a seal on the interior surface of the polyethylene pipe.

Joints: Stab style joints shall be made in accordance with the fitting manufacturer's instructions.

Manufacturer: The fitting manufacturer shall have in place a functional quality assurance program and shall be ISO 9001 2000 certified.

Marking: Stab type connectors shall be marked with the manufacturer's name, nominal size, ASTM standard F 1924, and lot number. Mechanical connectors shall be permanently marked with a date code.

Installation: Construction and installation shall be in compliance with IGSHPA Standards and all applicable local, state and federal regulations.

Hydrotesting: The completed system shall be hydrostatically tested at a pressure not greater than 150% of the pipe pressure rating. For SDR 11 PE pipe, the test pressure shall not be greater than 240 psi.

Flow coefficient: C_v values have been obtained through tests conducted by NSF in accordance with ISO/ISA S75.02-1996. For further information regarding flow coefficients, contact Continental.

Referenced Standards:

- ASTM D 3035 "*Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter*"
- ASTM F 1924 "*Standard Specification for Plastic Mechanical Fittings for Use on Outside Diameter Controlled Polyethylene Gas Distribution Pipe and Tubing*"
- ASTM D 2837 "*Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products*"
- TR-4 Plastic Pipe Institute (PPI) "*Listing of Hydrostatic Design Basis (HDB), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe*"

CLOSED-LOOP/GEOTHERMAL HEAT PUMP SYSTEMS
Design and Installation Standards

The IGSHPA standards included below are updated periodically by IGSHPA. They are provided as a convenience; however, any comments and questions regarding the standards should be directed to IGSHPA. In addition, IGSHPA should be contacted for the latest version of the standards.

Forward by IGSHPA: "The Closed-Loop/Geothermal Heat Pump Systems Design and Installation Standards manual is intended as a source of precise standards and guidelines for the design and installation of Closed-Loop/Geothermal Heat Pump Systems. It is a necessary tool for product developers and manufacturers, contractors, architects, engineers, utility representatives, or anyone else concerned with proper and efficient design and installation. It was designed to be an important part of the complete set of guides and manuals available through the International Ground Source Heat Pump Association, including the *Closed-Loop/Ground Source Heat Pump Installation Guide, Soil and Rock Classification for the Design of Ground Coupled Heat Pump Systems Field Guide, Grouting Procedures for Ground Source Heat Pump Systems, and the Closed-Loop/Geothermal Heat Pump Systems SLINKY™ Installation Guide.*"

"This manual was developed with funds from members of the International Ground Source Heat Pump Association. Through the strength of its membership, which now numbers 1200, IGSHPA has consistently played a vital leadership role in the GHP industry."

With regards to stab type mechanical fittings, reference Section 1D (1996) "Pipe Joining Methods" of the 2009 Design and Installation Standards as shown below.

1D. (1996) PIPE JOINING METHODS

1D.1 (2008)The only acceptable methods for joining buried polyethylene pipe systems are: 1) a heat fusion process or 2) stab-type fittings quality controlled to provide a leak-free union between pipe ends that is stronger than the pipe itself.

1D.2 (1997) Polyethylene pipe shall be heat fused by butt, socket, sidewall or electrofusion in accordance with the pipe manufacturer's procedures.

1D.3 (2008) Polyethylene fusion transition fittings with threads must be used to adapt to copper. Polyethylene fusion transition fittings with threads or barbs must be used to adapt to high strength hose. Barbed fittings utilizing mechanical clamps are not permitted to be connected directly to polyethylene pipe, with the exception of stab-type fittings as described above. All mechanical connections must be accessible.

1D.4 (2008) PEXa tubing may not be butt-fused or socket-fused to fittings. Polymer electrofusion fittings may be used with PEXa tubing when installed in accordance with manufacturer's published procedures. Cold-expansion compression-sleeve fittings may be used for all PEXa connections when installed according to the manufacturer's published procedures and is permitted to be direct buried with manufacturer approved corrosion covering.

For the complete 2009 Design and Installation Standards, go to the IGSHPA Web site at: www.igshpa.okstate.edu/publication/manuals.htm

GEOTHERMAL SERIES

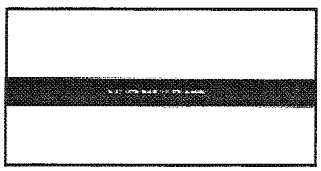
GEO-STAB® ASSEMBLY INSTRUCTIONS

IMPORTANT
For use on:
Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter meeting the requirements of ASTM D 3035

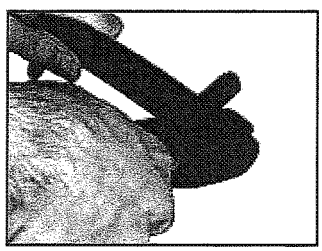
Pressure Rating: 160 psig MAOP

Operating Temperature: 20° to 140° F

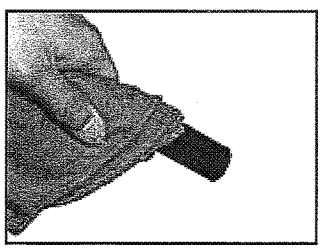
1 Verify the stab fitting is the correct size for the polyethylene (P.E.) pipe. Verify the SDR (or wall thickness) of the pipe matches the SDR (or wall thickness) printed on the fitting label.



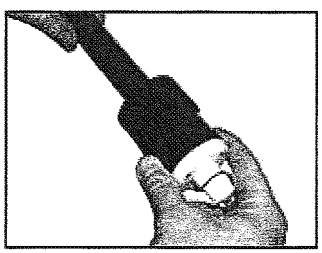
2 Cut pipe ends square.

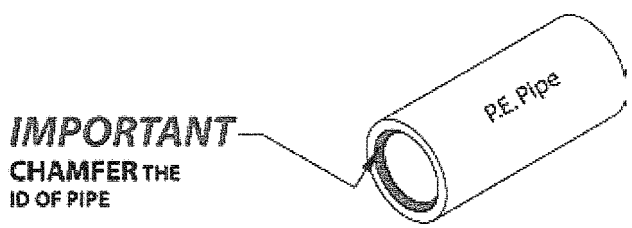


3 Clean piping thoroughly to assure there is no dirt, grease or oil in assembly area.

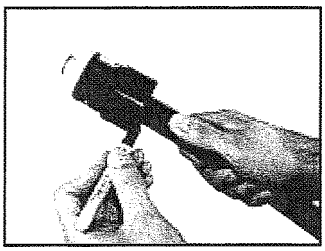


4 Chamfer end of pipe using Continental's ID chamfering tool with ID gauge.

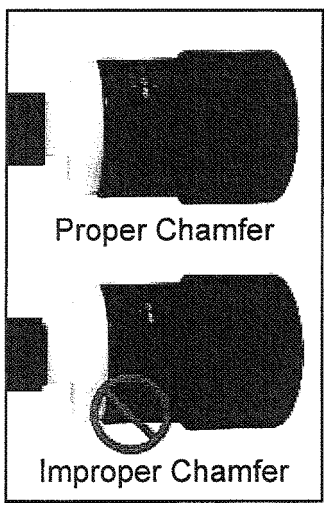




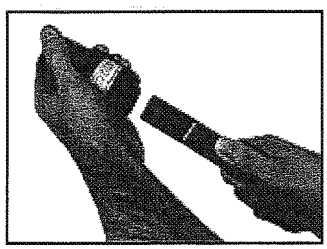
5 Mark the stab depth by inserting pipe into ID chamfer tool and marking the pipe at the entrance as shown.



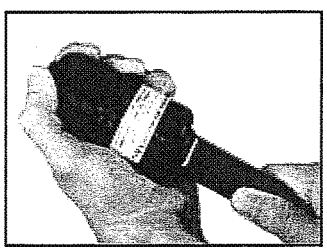
6 If using ID chamfer tool with gauge, check for proper chamfer by inserting pipe on gauge up to the o ring. With proper chamfer, o ring will begin to enter pipe.



7 Stab pipe completely into fitting entrance.



8 Stab pipe completely into fitting so that the mark on the pipe is within 1/8" from the fitting entrance.



9 Repeat steps 1 thru 8 for all Geo-Stab® joints.