EARTH SOURCE GEOTHERMAL

Earth Source Geothermal™
High-Density Polyethylene Pipe
PRODUCT SPECIFICATIONS

Residential & Commercial • Coil & Straight
Single- & Dual-Wrapped • Available Pre-Installed U-bends
NSF-GEO certified / IGSHPA compliant

FLYING W PLASTICS, INC.

www.flyingwplastics.com
Flying W Plastics, Inc. | 487 Vanhorn Dr. • PO Box 759 | Glenville, WV 26351
304.462.5779 ph • 800.327.4735 sales • 304.462.7657 fx

OVERVIEW

Geothermal is becoming the heating and cooling method of choice for residential and commercial buildings across the country, and for good reasons:

- *With the implementation of geothermal systems, the cost of heating and cooling a home or business significantly decreases. In fact, the use of a geothermal system results in more cost savings than the most efficient conventional forced-air systems.*

- *Since a geothermal system recycles renewable energy to sustain itself, geothermal systems are more environmentally friendly when compared to traditional heating/cooling systems.*

Geothermal piping is creating a noticeable impact on the polyethylene market, with usage continuing to expand as residential and commercial customers look to reduce their heating and cooling costs while enjoying the benefits of utilizing a renewable energy source. Flying W Plastics is at the forefront in supporting the geothermal industry with its premium line of Earth Source Geothermal pipe. Furthermore, NSF-GEO certification for our Earth Source Geothermal pipe helps us to meet the highest standard for polyethylene geothermal piping in the industry.

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GENERAL PRODUCT INFORMATION

Earth Source Geothermal 3/4", 1" and 1-1/4" DR 9 and DR 11 piping are available in Earth Source Loops with U-bends that are pressurized and feature crimped ends. All resin used is HDPE-PE3608/PE3408 or PE4710 resin listed in PPI TR4 with a Cell Classification per ASTM D 3350 of 345464C for PE3608 or 445576C for PE4710. The materials have a Hydrostatic Design Basis of 1600 psi @ 73.4 degrees F. All Flying W Plastics' Earth Source Geothermal products meet or exceed the specifications set forth by IGSHPA, and are listed by NSF under their NSF Geothermal program. All piping is made to ASTM D3035 or ASTM F714 depending on size, and have sequential footage markings every two feet.

Flying W Plastics recommends joining Earth Source geothermal pipe by heat fusion. Use fusion procedures published by PPI in TN 13-2001 or Flying W Plastics. Flying W Plastics recommends inspecting all piping and fittings for damage prior to installation and hydrostatic testing of the completed installation prior to placing in service. Flying W Plastics recommends following IGSHPS Guidelines for installation and design.

- Available IPS pipe sizes: 3/4" to 18"
- 3/4"- to 6" available in coils or reels
- 3/4" to 18" available in straight lengths
- Piping available in DR 7 to DR 32.5, depending on size

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SPECIAL FEATURES AND AVAILABILITY

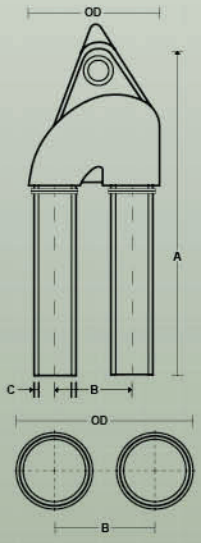
Dual-Wrapped Earth Source Geothermal Coils With Pre-Installed U-Bends

The fastest growing segment of Flying W Plastics' geothermal sales is for pre-fabricated dual-wrapped coils with a pre-installed U-bend. We fabricate the coils on-site using a DR 9 molded U-fitting.

Our Earth Source Geothermal dual-wrapped coils are made from premium HDPE materials, having a cell classification of 345464C for PE3608/3408, or 445576C for PE4710 as per ASTM D3350.

The piping is made to ASTM D3035 specifications, and has NSF-Geo-thermal listing. The coils are butt-fused together to a one-piece U-bend by trained and certified employees. The fitting is specially designed for geothermal well applications with a tapered "spear pointed" head for ease of installation.

Once fabricated and coiled, the coils are pressurized and the ends are crimped to prevent contamination during installation, and to reduce the fear of integrity loss during the transportation, handling and well insertion phases of the installation.



Nominal Size	O.D.	"A" Length	"B" Center Space	"C" Min. Wall	"C" Max. Wall
3/4" IPS	3.09"	per customer	1.75"	.095"	.115"
1" IPS	3.12"	per customer	1.82"	.120"	.140"
1-1/4" IPS	3.83"	per customer	1.91"	.151"	.171"

Flying W Plastics is a member of the IGSHPA, and all of our Earth Source Geothermal products fully comply with IGSHPA guidelines.

We use the same high quality NSF-Geo certified pipe as in the rest of our geothermal product line. The coils are available to ASTM D3035 specifications in ¾",1", & 1¼", with DR 11 and DR 9 piping.

We stock DR 11 dual-wrapped coils in many sizes and lengths. Coils using DR 9 piping and custom lengths normally have fast turnaround on special orders.

Applications
Commercial, institutional, and residential wells and other installations where a complete loop with a U-bend is needed.

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NORMALLY-STOCKED COILS

Flying W Plastics normally stocks both single-wrapped coils and dual-wrapped coils of our Earth Source Geothermal Pipe in a variety of sizes and lengths.

SINGLE-WRAPPED COILS

Single-wrapped coils are capped and banded to skids, then shrink-wrapped. Our ¾" through 1¼" pipe can be furnished with crimped ends and pressurized on request.

Size	Lengths Available
3/4" IPS	300', 400', 500', 600', 800'
1" IPS	300', 500'
1-1/4" IPS	150', 300', 500'
2" IPS	300', 500'

DUAL-WRAPPED COILS WITH U-BENDS

Dual-wrapped coils are fitted with a one-piece molded DR 9 U-bend, then crimped and pressurized. They are banded to pallets and shrink-wrapped.

Size	Total Coil Lengths Available
3/4" IPS	310', 410'
1" IPS	310', 410', 610'
1-1/4" IPS	610', 810', 1010'

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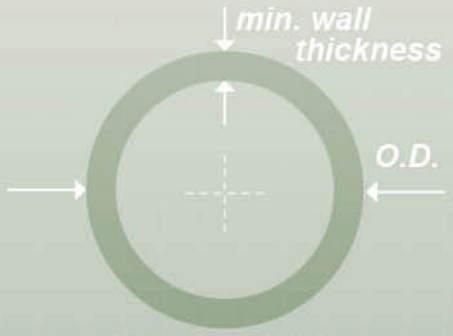
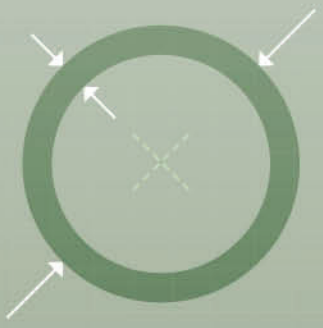
STANDARD DIMENSION RATIO AVAILABILITY

DR 9 250 PSI PE4710

IPS Pipe Size	Nominal OD	Min. Wall	Avg. ID (in.)*	Weight lbs/ft
3/4"	1.050	.117	0.80	.15
1"	1.315	.146	1.01	.235
1-1/4"	1.660	.184	1.27	.374
1-1/2"	1.900	.211	1.45	.49
2"	2.375	.264	1.82	.766
3"	3.500	.398	2.68	1.66
4"	4.500	.500	3.44	2.75
6"	6.625	.736	5.06	5.96
8"	8.625	.958	6.59	10.10
10"	10.750	1.194	8.22	15.68
12"	12.750	1.417	9.75	22.06
14"	14.00	1.556	10.70	26.60
16"	16.00	1.778	12.23	34.74
18"	18.00	2.000	13.76	43.97



DR = O.D. / min. wall thickness

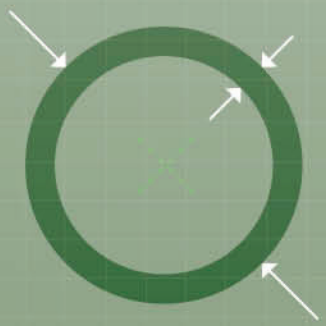


DR 11 200 PSI PE4710

IPS Pipe Size	Nominal OD	Min. Wall	Avg. ID (in.)*	Weight lbs/ft
3/4"	1.050	.095	0.85	.125
1"	1.315	.120	1.06	.197
1-1/4"	1.660	.151	1.34	.313
1-1/2"	1.900	.173	1.53	.411
2"	2.375	.216	1.92	.642
3"	3.500	.318	2.83	1.39
4"	4.500	.409	3.63	2.30
6"	6.625	.602	5.35	4.99
8"	8.625	.784	6.96	8.46
10"	10.750	.977	8.68	13.14
12"	12.750	1.159	10.29	18.49
14"	14.00	1.273	11.30	22.29
16"	16.00	1.455	12.91	29.12
18"	18.00	1.636	14.53	36.85

DR 15.5 138 PSI PE4710

IPS Pipe Size	Nominal OD	Min. Wall	Avg. ID (in.)*	Weight lbs/ft
3/4"	1.050	.068	0.91	.092
1"	1.315	.085	1.14	.144
1-1/4"	1.660	.107	1.43	.229
1-1/2"	1.900	.123	1.64	.30
2"	2.375	.153	2.05	.469
3"	3.500	.226	3.02	1.02
4"	4.500	.290	3.88	1.69
6"	6.625	.472	5.72	3.65
8"	8.625	.556	7.45	6.19
10"	10.750	.694	9.28	9.62
12"	12.750	.823	11.01	13.53
14"	14.00	.903	12.09	16.31
16"	16.00	1.032	13.81	21.30
18"	18.00	1.161	15.53	26.96



* Avg. I.D.'s are calculated using nominal O.D.'s and minimum wall thicknesses plus 6%.

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EARTH SOURCE GEOTHERMAL

PE3608/3408 PRODUCT SPECS

Flying W Plastics certifies its Earth Source Geothermal Pipe to be manufactured from select PE3608/PE3408 high-density polyethylene copolymers (see typical properties below), and to meet specifications set forth in ASTM D-3035, ASTM D-3350 and ASTM F-714. This material meets all of the requirements of ASTM 1248-81A for type PE34 Class C Product. It has outstanding properties of a high hoop stress and a high level of environmental stress crack resistance.

Typical Properties[1]	English Values	SI Values	ASTM Method
Density (Black)	-	0.955 g/cc	D 4883
Melt Index[2]	-	8.75 g/10 min.	D 1238
Tensile Strength			
@ Yield (2 in/min)	3300 psi	22.8 MPa	D 638
@ Break (2 in/min)	4500 psi	31.0 MPa	D 638
Elongation @ Break (2 in/min)	>800%	>800%	D 638
Flexural Modulus[3]	120,000 psi	827 MPa	D 790
Notched Izod Impact Strength	6 ft-lbf/in	0.32 kj/m	D 256
Hardness (Shore D)	66	66	D 2240
Vicat Softening Point	259 °F	126 °C	D 1525
Brittleness Temperature	<-180 °F	<-118 °C	D 746
Hydrostatic Design Basis			
@ 23 °C	1600 psi	11.0 MPa	D 2837
@ 60 °C	800 psi	5.5 MPa	D 2837
Minimum Required Strength	-	8.0 MPa	ISO 9080
Environmental Stress Crack Resistance[4]	>2000 hrs	>2000 hrs	D 1693
Environmental Stress Crack Resistance[5]	>5000 hrs	>5000 hrs	D 1693
Pipe ring ESCR[6]	>5000 hrs	>5000 hrs	F 1248
Notch Tensile (PENT)	>100 hrs	>100 hrs	F 1473
Carbon Black Concentration	2.3%	2.3%	D 1603
Cell Classification	345464C	345464C	D 3350

[1]Typical properties will vary within specification limits
[2]190 degrees C/21,100g
[3]2% Secant-Method 1
[4]Condition B, 10%
[5]Condition C
[6]Two inch, IDR 19

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PE4710
PRODUCT SPECS

Flying W Plastics certifies its PE4710 Earth Source Geothermal Pipe to be manufactured from select PE4710/PE100 high-density polyethylene copolymers (see typical properties below), and to meet specifications set forth in ASTM D-3035, ASTM D-3350 and ASTM F-714. This material has NSF 14 and AWWA C901 certifications, complies with ANSI/NSF Standard 61 health requirements, and is recognized by the Plastics Pipe Institute as having a pipe material designation code of PE4710 and PE100.

Typical Properties[1]	English Values	SI Values	ASTM Method
Density (Black)	-	0.959 g/cc	D 4883
Melt Index[2]	-	8.0 g/10 min.	D 1238
Tensile Strength			
@ Yield (2 in/min)	3625 psi	25.0 MPa	D 638
@ Break (2 in/min)	5500 psi	38.0 Mpa	D 638
Elongation @ Break (2 in/min)	>600%	>600%	D 638
Flexural Modulus[3]	150,000 psi	1035 MPa	D 790
Notched Izod Impact Strength	9 ft-lbf/in	0.49 kj/m	D 256
Hardness (Shore D)	66	66	D 2240
Vicat Softening Point	259 °F	126 °C	D 1525
Brittleness Temperature	<-180 °F	<-118 °C	D 746
Hydrostatic Design Basis			
@ 23 °C	1600 psi	11.0 Mpa	D 2837
@ 60 °C	1000 psi	6.9 MPa	D 2837
Minimum Required Strength	-	100 MPa	ISO 9080
Environmental Stress Crack Resistance[4]	>5000 hrs	>5000 hrs	D 1693
Environmental Stress Crack Resistance[5]	>5000 hrs	>5000 hrs	D 1693
Pipe ring ESCR[6]	>5000 hrs	>5000 hrs	F 1248
Notch Tensile (PENT)	75,000 hrs	75,000 hrs	F 1473
Carbon Black Concentration	2.3%	2.3%	D 1603
Cell Classification	445574C	445574C	D 3350

[1]Typical properties will vary within specification limits
[2]190 degrees C/21,100g
[3]2% Secant-Method 1
[4]Condition B, 10%
[5]Condition C
[6]Two inch, IDR 19

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EARTH SOURCE GEOTHERMAL

50-YEAR LIMITED WARRANTY

Flying W Plastics warrants its Earth Source Geothermal pipe against rot, rust, material flaws, structural weaknesses and electrolytic corrosion and warrants it to be free from defect in materials and workmanship for a period of fifty (50) years from date of purchase by and to the original installer only. Flying W Plastics expressly limits its responsibility under this Limited Warranty to the following:

Flying W Plastics Inc., will provide an equivalent amount of plastic pipe of like size and grade to that amount which it acknowledges to be defective, to the original installer only.

Flying W Plastics, Inc., will pay up to one dollar ($1.00) per lineal foot for labor charges actually incurred by the original installer in replacement of pipe warranted hereby, which pipe is acknowledged to be defective within five (5) years of the date of purchase by the original installer only, with a pro rata reduction of said amount thereafter for the remaining forty-five (45) years of this Limited Warranty.

A sample measuring a minimum of twenty-four inches (24") in length, bearing the Flying W Plastics trademark, for any segment of pipe alleged by the original purchaser only to be defective, must be submitted to Flying W Plastics for inspection and testing. Any plastic pipe of Flying W Plastics thereafter acknowledged to be defective shall be exchanged as aforesaid, and Flying W Plastics shall assume the reasonable costs of transportation thereof to the point of the original delivery.

Purchaser assumes all risk and liability for loss, damages or injury to persons or property of buyer or other parties arising out of use or possession of materials and products of Flying W Plastics, Inc.

Exclusions:

There are no warranties which extend beyond the description on the face thereof. Flying W Plastics disclaims any express or implied warranties of merchantability and fitness for a particular purpose. Flying W Plastics shall not be liable for special, indirect, incidental or consequential damages related to a defect of the pipe.

For the warranty to be valid pipe must be installed in accordance with accepted and approved industry guidelines and procedures. (PPI, ASTM, IGSHPA)

Warranty does not apply to any fusion joining process or any other method or device used to join the pipe.

Warranty does not apply to the design or installation of the system or any other component of the system.

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PRODUCT SUBMITTAL

PROJECT NAME_____

PROJECT LOCATION_____

CONTRACTOR_____

SCOPE: This Product Submittal is for Flying W Plastics Earth Source Geothermal Pipe and U-Bend Loops for Ground Source Heat Pump Systems.

MATERIALS: Flying W Plastics Earth Source Geothermal Pipe and Loops are manufactured from select virgin HDPE (high-density polyethylene) resins. These resins are listed with the Plastic Pipe Institute (PPI TR 4), are NSF 14 certified and comply with ANSI/NSF Standard 61. The resin cell classification per ASTM D-3350 is 345464C (for pipe marked PE3608/PE3408) and 445576C (for pipe marked PE4710). These materials have a Hydrostatic Design Basis of 1600 psi at 73 °F per ASTM D-2837. This material contains a minimum of 2% Carbon Black as a UV inhibitor to allow for pipe to be stored outside.

REFERENCE DOCUMENTS: Flying W Plastics Earth Source Geothermal Pipe is manufactured in accordance with ASTM D-3035 for pipe sizes ½" through 3" and ASTM F-714 for pipes 3" and larger.

CERTIFICATION: Flying W Plastics certifies that our Earth Source Geothermal Pipe and Loops meet the specifications and requirements identified herein. All Earth Source Geothermal Pipe and Loops are NSF-Geo certified.

WARRANTY: Flying W Plastics warrants its Earth Source Geothermal Pipe and Loops for a period of 50 years against rust, rot, electrolytic corrosion and defects in workmanship. This warranty is valid when the pipe and/or loops are utilized and installed in accordance with accepted and approved industry guidelines and practices. See warranty sheet for complete terms and conditions.

NOTES

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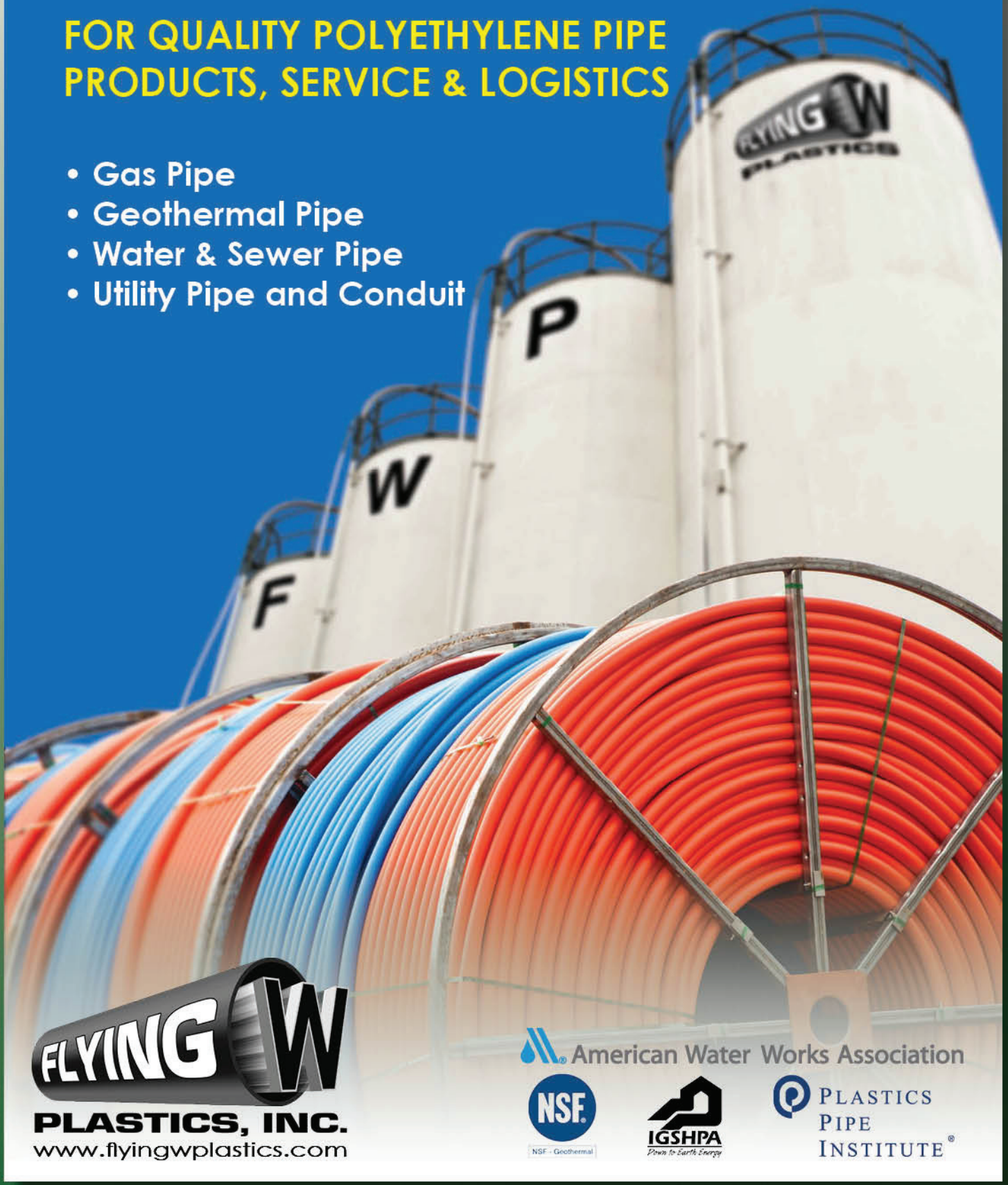

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