# Slip-On Metal Flanges

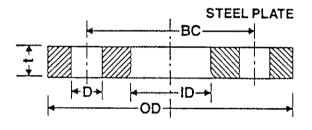
Stock flanges are made from ductile iron. Flanges from other materials can also be supplied for specific applications. The metal flanges are drilled to ANSI B16.5 bolt circles. Flanges can be supplied with corrosion resistant coatings.

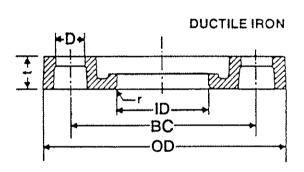
### **Ductile Iron**

# TABLE 8 DIMENSIONS IN INCHES

Nominal Pipe Size	3	4	6	8	10	12	14	16	18	20	22	24	28	32	36	40	42	48	55	63
Outside Diam, 'OD'	7.50	9.00	11.00	13.50	16.00	19.00	21.00	23:50	25.00	27.50	29.50	32:00	36.50	38.75	46.00	53.00	53.00	59.50	66.25	80.00
Bolt Circle 'BC'	6.00	7.50																56.00		
Bore (ID)	4.00	4.75	-7,00	,9.00	11.37	13.13	14.38	16.38	18,38	20,38	22.22	24.38	28.38	32.12	36.38	40.00	42.38	48.00	55.75	64.00
Thickness 't'	0.94	0.94	1.00	1.12	1.19	1.25	1.38	1.44	1.56	1.69	1.79	1.75	2.06	1.88	1.88	1.88	1.88	1.88	2.50	2.50
Number of Bolts 'n'	• 4 %	•∴8. <b>%</b> i	€.8.=	₹8 <b>%</b>	7512八	•1126	×:12३	<b>注16</b> 次	\$16含	320 4	<b>⊊20</b> .5	₹20 ≅	∕28∶	∯28 <i>ċ</i>	132⊁	.⊈36 ;	-36	44	44	52
Diam, of Bolt Holes 'D'	3/4	3/4	7∕8	7/8	1	1	11/8	11/e	11/4	11/4	13/8	13/8	13/8	13/6	15/8	15/8	15/8	15/B	13/a	13/B
Pressure Rating (PSI)	:275	275;	£275;	-275	. 275	275	250 :	2507	250,	2003	;200a	200	150.	·120:	120:	\$100) <sub>:</sub>	3100°	-80	60	:60

NOTES: (1) Metal specification conforms to ASTM A536-80





### **Steel Plate**

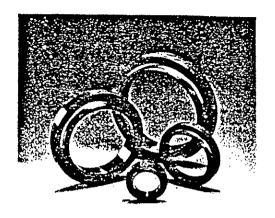
# TABLE 9 DIMENSIONS IN INCHES

Nominal Pi	pe Size	3	4 ~	6	8	10	12	14	16	18	20	22	24	28	32	36	40	42	48	55	63
Outside Dia	ım. <b>'00</b> '	7.50	9.00	11.00	13.50	16.00	19.00	21.00	23.50	25.00	27.50	29.50	32.00	36.50	38.75	46.00	53.00	53.00	59.50	66.25	80.00
Bolt Circle	'BC'	6.00	7.50	9.50	11.75	14.25	17.00	18.75	21.25	22.75	25.00	27.25	29.50	34.00	36.00	42.75	49.50	49.50	56.00	62.75	76.00
Bore ID		4.00	4.75	\$7,00	19.00	13,37	13:13	14.38	16:38,	18,38	20,38	22.67	24.38	28.58	32,12	36,38	40.00	42-38	48.00	55:75	64.00
Plate	Group 1	3/4	3/4	3/4	3/4	11/8	11/2	11/8	11/8	11/4	1¼	11/4	11/2	11/2	11/4	11/4	11/2	11/2	13/4	2	21/2
Thickness	Group 2								11/4	11/2	11/2	11/2	13/4	2	11/2	13/4	13/4	13/4	2	21/2	3
	Group 3															2	2	2	21/4		
Number of	Bolts 'n'க்கசி	월4년	#38 <b>#</b> \$	₹8,	<b>₹8</b> #	<u>ارگ</u> (2.5	بة 12°¢	第12岁	\$16}£	<b>第16</b> 為	₹20₺	£20%	÷20 t	128 7	28.7	<b>432</b> #	<b>3</b> 36⊯	#36 <u>%</u>	44	於44歲	252
Dlam, of Bo	oli Holes 'D'	3/4	3/4	7/8	7/8	1	1	11/8	11/e	11/4	11/4	13/8	13/8	13/8	13/8	15/8	15/e	15/8	11/8	13/8	13/8
Pressure.	Group 1	\$200 S	5200₹	200€	200	√200 ş	200	#160 <sup>3</sup>	:1005	£100 k	£100¶	100	ķi00:	180 k	÷ 80%	<b>※45</b> 件	第45词	£45%	<b>45</b>	≨.45.∺	45%
Rating psi	Group 2	<b>建</b>	*	17 P. F.	经的	4	存取	33×2	₹160 <i>4</i>	M60%	3160}	<b>(125</b> )	£125	125	ដ100≨	260年	1 60 g	<b>3</b> 605	₹60±	⅓60 X	₹60;
[ Psi	Стоир З 😤	3333	775	经验证	<b>X</b> X	THE PARTY	43%	25.2		1230	EXXX	NEW	3.76	-11 e	C 80%	₹80%	780¥	<b>!</b> \$80`;	\$80.5	^ <b>%</b>	7777

NOTES: (1) Metal specification conforms to grade ASTM A36.

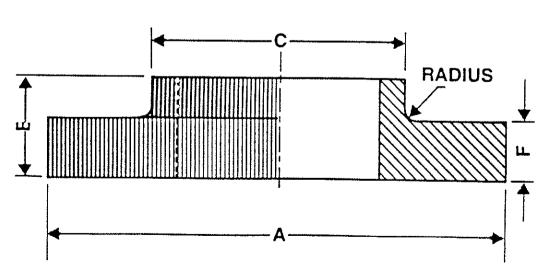
# Polyethylene Stub-Ends

For joining SCLAIRPIPE high-density polyethylene pipe to other piping materials, to ancillary equipment, or to special fittings, a mechanical fitting is usually required. For these types of connections a flange assembly is the preferred method. This assembly consists of a slip-on metal flange and a polyethylene stub end. These stub ends carry the same pressure rating as the pipe and are butt fused to the pipe end. A stub end must be the same DR rating as the pipe to which it is joined. (i.e. a DR 15.5 stub end must be used with DR 15.5 SCLAIRPIPE)



# TABLE 7 DIMENSIONS IN INCHES

Dimension								+	HOM	NAL	PIPE	SIZ	E							
	3	4	6	8	10	12	14	16	18	20	22	24	28	32	36	40	42	48	55	63
'A' Diameter	5.18	6.60	8:50	10.72	為55年 13:13 13:43	15.64	17:27	19.32	2138	23.45 23.45	25:35 25:35	710th 27-70	31.64	34.45	39.27.	43.08	45.00	5,1138	58.30	667/s
'C' Diameter	3.50	4.50	6.63	8.63	10.75	12.75														
'E' Overall Thickness	1.73	3 73 173 173	2.01	30 m. 12 24 11 11 m	2.7.1	78. 78. 75. 75. 75.	3,94	73.94 73.94 73.94	94.53	4772 4772	5511	12.1 25.11	5.51,	1次2元 55:51 101次	\$5.51	\$ 45 \$5.51 \$1578	1 - 5 - 51	6.30	6.89	200 N
'F' Flange Thickness	1.00	1.00	1.06	1.26	1.50	1.85	2.36	2.36	2.75	2.75	2.75	2.75	3.27	3.27	3.35	3.54	3.54	4.01	4.33	4.33



# Joining Sclairpipe to other materials

Because of the many variations of flange styles and dimensions, it would be beyond the scope of this brochure to detail all connections. The line drawing and table below show dimension "A" - the combined thickness of a SCLAIRPIPE stub end and of a standard flange. The designer should supply dimension "B" based on the actual flange thickness being used on the connecting pipe, plus gasket and washer thicknesses. Then

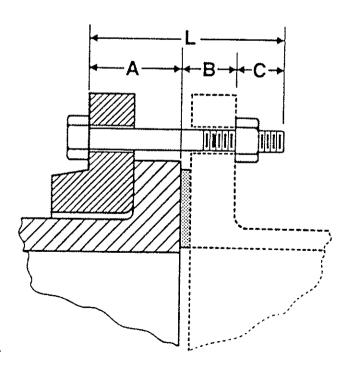
by allowing for the nut and clear thread the bolt length "L" can be determined. The designer should always ensure that dimension "C" is less than the available thread length.

# Flange Assembly

# TABLE 13 DIMENSIONS IN INCHES

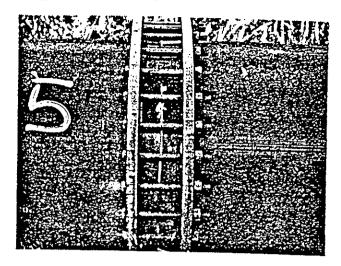
Nominal Pipe Size	3	4	6	8	10	12	14	16	18	20	22	24	20	20	1 00			,	<del>,</del>	<b>y</b>
Number of Bolts 🤫 🔫	7746	24 R 34	* 9₹∞	50.015				654.076	N- 012	20	22	2"	28	32	36	40	42	48	55	63
Diam. of Bolts				& (oFx	한민준은	- 1127	1512)	31/0%	₩ 0.K	120g	€20.3	5;20 <del>§</del>	≰28;€	<b>28</b>	第32架	₹36#	#36.°	144	445	÷52
	5/8	78	7/4	9/4	78	] //B	1 1	1 1	11/a	1 11/4	11/4	1 11/4	11/4	11/4	114	414	411	4	4.4	
Ductile Iron ( )	1.94	1.94	2:06.	2.37	2:69	3.12	3.74	3.80	431	4'44	4 50	4,50	5.13	CERT ET	151221	PERMIT	VE 244	5.07	10 3007	1 74
Steel Plate, GRP.1	1.75	1.75	1.81	2.00	2.63	3.00	3.49	3.49	4.00	4:00	4.00	4.05	4.75	150	17/224	10.4.0	D.41	5.67	0.837	.6.83
Steel Plate, GRP.2		773				0.00	0.43	0.43	4.00	4.00	4.00	4.25	4./5	4.52;	4.60	5.04	5.04	5.75	6.33	6:83
												4.50		4:77	5.10	5.29	15.29	6.00	6.83	7:33
E Greet Flate, BRPS	₹. *`Ju	S 165 .	1.5	+ 5 Tyl	3; ;		e styl	A 15.84.	والد أباداء	بني جاؤرد	62.50	port K	ा करावित इ.स.च्या		5.35	5.54.	5.54	E-0E	200	1.3.

NOTES: (1) Bolt for 48" Ductile Iron Flange is 11/2".



# Sclairpipe to Sclairpipe Flanged Connection

The tables below detail the bolt length "L" requirements for a SCLAIRPIPE to SCLAIRPIPE connection using standard flange assemblies supplied by KWH Pipe. The dimensions supplied are based on the use of carbon-steel bolts and nuts, with the nuts being semi-finished heavy hex and bolt heads being regular heavy hex. An additional allowance of 3 in. of threaded length should be made to bolt lengths for underwater connections for ease of assembly.



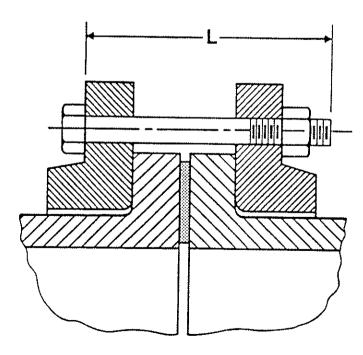
# **Bolt Lengths**

# TABLE 12 ALL DIMENSIONS IN INCHES

Nominal Pipe Size	3	4	6	8	10	12	14	16	18	20	22	24	28	32	36	40	42	40	T ==	
Number of Bolts	4 : 3	- 8 4	8.5	128.5	12 1	123	¥12.6			20	20					I '-	42	48	55	63
Diam, of Bolts	5/B	5/8	3/4	3/4	7∕a	7/8	1	1	41/	11/6	11/4	1 11/4	11/4	11/.	11/4	417	437	3445		
Ductile Iron Sa	5.00	5.00	5.50,	6.50	7.50	8.00	9.50	10.00	1.1:00	11.00	12 00	12 00	13.00	13:00	13.00	13200	11/2	100	11/4	1/4
01001 1 1010, 0111.1,	3.00:	·5:00;	5.00	5.50	·7:50	8.00	9.00	39.00	10.00	10.00	11.00	11.00	12.00	12.00	12:00	13,00	1200	13.00	10100	15:01
Steel Plate, GRP.2 = (	212.24	404.44	63,44	ALL V	1	1.4	3.34	1.9:50	111.00	111.00	11:00	12.00	13.00	12.00	13/00	12/200	14/00	14.00	16:00	47/00
Steel Plate, GRP3 🚟	1,122	135,50	77 (5)	17.47	3,000	100	1.326	1350	2000	31.4		4200	C186.	3200	12/00	13700	13/100	15.00	10,00	17700

NOTES: (1) Bolt Diameter for 48" Ductile Iron Flange is 11/2".

(2) These tables are supplied as an estimating guide. Please verify the required length for your installation.



ر:	REMICALHESI			EDRISCORIPE 640	70°F	1401		70#	140°F
7		19 F	140°F (60°C)	Reagent	(21°C)	(60°C)	Reagent	(21°C)	100 0
e	egent	(Z1°C)	(00 0)	10003			_ u .mmass CAT	8	S
			8	Mathyl Chloride, 100%	U	U	Sodium Bisultate, SAT	S	8
o	well M 133	8	Ü	Methyl Ethyl Ketone, 100%	U	U	Socium Bisultite, SAT	S	Ś
'n	wi Accetana, 100%	M	S	Metrylsulluric Acid	S	\$	Sodium Bontis	8	5
t	ni Alcohol* 100%	S	S U	Nickel Chloride, 6/4"	S	\$	Sodium Brorride Dilute Sol.	Ś	8
'n	M Butyrate	M	_	Niciosi Nitrate Conc.	3	8	Sodium Bromide Oil Solution	8	Š
t	ryi Chloride	M	U	Nickel Sultate, SAT	8	S	Socium Carbonelle Conc.	3	s
: 11	M Ether	U	U	Nicotinic Acid	S	S	Socilum Chiorate, SAT	S	8
:#	wiene Chloride	U	_	Nitric Acid 0-90%	S	5	Sodium Chloride, SAT	S	Š
U	wiene Giycol"	8	S	Nitrio Acid 30-70%	8	M	Sodium Cyanida	8	S
÷	rtic Chioride	S	5	Nitric Acid 95-98%	IJ	U	Sodium Dictromete, SAT	8	8
٠,	ric Nitrate	S	8	Nigrobenzane 190%	IJ	U	Sodium Ferricyanida		5
	mous Chlorids	S	8	Ojeic Acid Conc.	Ü	U	Socium Ferrocyanide	\$	S
	mous Suifate	S	\$		8	\$	Bodium Fluoride, SAT	5	5 5
	Jonne	8	U	Oxelic Acid*	s	8	Sodium Hydroidde Conc.	8	S
-	uorobonic Acid	S	S	Perohionic Acid 10%	U	U	Socium Hypochiorite	S	_
57 H	upsilicie Acid	5	S	Petroleum Ether	Ü	ü	Sodium Nitrate	S	8
-	amaidehyde* 40%	8	N	Phanol 90%	ŝ	S	Sodium Sulfate	S	Ş
r	amic Acki	\$	8	Phosphoric Acid	5	8*	Sodium Sulfide, SAT	8	5
	al Oll	5	IJ	Pickling/Plating Solutions	5	Š	Sodium Sulfite, SAT	5	6
H	Jetural, 100%	M	U	Potassium Bicarbonale	8	S	Stannous Chloride	8	٤
		\$	8	Potassium Borate 1%	-	S	Stannic Chlorida	6	5
_	ellic Acid*	М	U	Potassium Bromate 10%	Ş	S	Stearic Acid*	\$	
Ģ	asoline	S	5	Potessium Bromide	5	_	Sulfurio Acid 0-60%	8	
G	ilycerine (Glycerol)	S	S	Potessium Carbonate	S	8	Sulfurio Acid 70%	8	
G	ilycol*	5	S	Potagum Chicrate	\$	6	Sulfuric Acid B0%	8	1
G	ilyaailo Acid" 30%	9	5	Potassium Chloride	6	8	Sulturic Acid 96-98%	M	
۲	ieranoi, Tert.*	S	S	Potassium Chromate 40%	S	S		Ü	
۲	lydrobromic Acid 50%		S	Potessium Cyanide, SAT	S	Ş	Sulfuric Acid, Furning	S	
ŀ	tydrocyanic Acid	5	S	Potessium Dichromate 40%	5	8	Sulfatous Acid	S	
۴	tvarochiorio Acid	5		Potassium Ferri/			Termic Acid 10%	N	
ŀ	ydroftuoric Acid 0-75%	3	5	Ferro Cyanide	S	\$	Tarteric Actd, SAT	II II	
į	Avdrogen	\$	S	Potassium Fluoride	s	S	Tetrain	_	
i	Auditogen Bromide 10%	5	8	Potassium Hydroxida 20%	5	8	Tetrahydrofurarw	N	
1	-vidrogen Chloride Ges Dry	8	5	Poteschim Nitrate, SAT	8		Toluene	M	
1	Hydrogen Peroxide 30%	Ş	8	Potessium Perborate, SAT	S		Transformer Oil	8	
	Hydrogen Peroxida 90%	5		Potassimi Parociala, 374	S	_	Tretolite K-147	S	
	Hydrogen Phosphide 100%	8		Potassium Perchlorate 10%			Thetolile K-141	S	
	Hydroquinone	S		Potassium Permanganate 2	.70			8	•
	Hydrogen Suffide	S	8	Potessium Suitate Conc.	5			5	•
	Hypochiorus Acid	8	9	Potzasium Sudide Conc.	ě	•		8	3
	Luad Acetate	8	6	Potassium Sulfite Conc.		·		5	3
		ε	M	Potessium Persuitate		_		8	3
	Lube Oil	-	3 8	Propergyl Alcohol*	-	_		ŧ	)
	Magnesium Carbonata, SA	. `	3 \$	Propyl Alcohol*		5 8	a wa	r 8	3
	Magnesium Chloride, SAT		5 5	Propylena Dichioride 100%		y t			j
	Magnecium Hydroxide, SAI	•		Propylene Glycof		8 9			6
	Magneclum Nitrate, SAT			Sea Water		\$ 8			5
	Magnesium Suttate, SAT			Selenic Acid		•	Wetting Agents		M
	Mercuric Chloride, BAT		\$ \$	Silicic Acid		_	3 Xyleno		мі 8
	Mercurio Cyanida, SAT		8 8	Silver Nitrate SOL		6 9	Zino Chiorida, SAT		8 8
	Mercurous Nitrate, SAT		8 6	Socium Acetato, SAT			3 Zinc Suttate, SAT		0
	Mercury		8 8	Socium Acquae, Cris Socium Benzozia 35%		8 8	3		
	Methyl Alcohol*		8 8	PACE IN THE PROPERTY OF THE PACE OF THE PA		-	8		
	Methyl Chloride	1	M U	Sodium Sicurbonate, SAT		•			

<sup>&</sup>quot;To compensate for hydrocarbon saturation effects on long term hydrostatic strength refer to Working Pressure Table, p.fd.

<sup>&</sup>quot;Potassium Dictvomete/Sulfurio Acid Solution

<sup>&#</sup>x27;Sulturic/Nitric Acid Solution is UNSATISFACTORY at 140°F.



### Downhole Inhibitors

The following Environmental Stress Crack Resistance tests were conducted at 73.4°F with the indicated materials as the crack growth accelerator.

Test Material	Use	Solvent	Faiket*
Dowell Carbon 326 Dowell Carbon 325 Tretolite K-147 Tretolite K-141 Dowell M 133 Aliquot 400 Tretolite PD-33 PPC-8 Tretolite R-25 Tretolite F-94 Tretolite XT-39	Corresion Inhibitor Corresion Inhibitor Corresion Inhibitor Corresion Inhibitor Bactericide and Corresion Inhibitor Bactericide and Corresion Inhibitor Paraffin Dispersant Corresion Inhibitor Demuisifier Demuisifier Paraffin Remover	Water Hexane Hexane Water Water Water Water Water Hexane Hexane Water	>1000 >1000 >1000 >1000 >1000 >1000 >1000 >1000 >1000 >1000 >1000 >1000

<sup>\*</sup>Toot terminated with no failures

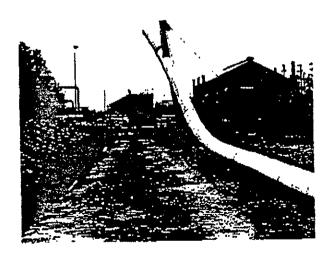
### Toughness

The overall "toughness" of Driscopipe 6400 is an important characteristic of the pipe. "Toughness" is derived from many of the chemical and physical properties of the material. The pipe is not brittle. It flexes, bends and absorbs impact loads over a wide temperature range of —180°F up to its softening temperature of 260°F. Temperature will affect operating conditions. The method of derating is covered in the Environmental Service Factors section.

This inherent resiliency and flexibility of Driscopipe 6400 allows the pipe to absorb surge pressure, vibration and stresses caused by soil movement. Driscopipe can be deformed without permanent damage and with no adverse effect on long term service life.

Driscoplpe 6400 is easily cold bent in the field to a minimum radius of 20 to 40 times the pipe diameter. It is flexible for contouring to installation conditions, and can be heat fused together in one location and pulled into difficult locations to facilitate easy installation. It can be assembled above ground and rolled into less expensive narrow tranches.

Driscopipe 6400 has low notch sensitivity, high tear strength and excellent abrasion resistance. Its high resistance to environmental stress cracking ensures no effect on long term service life from installation scratches. The relative toughness of Driscopipe is one of its outstanding engineering characteristics which permits impovative piping design.





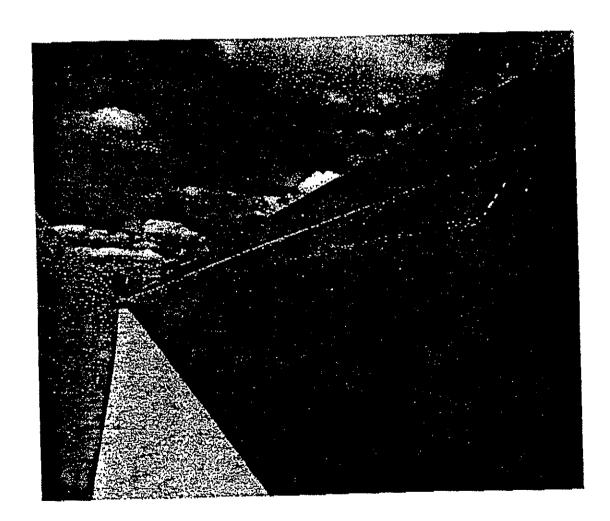
### Flow Factors

Driscopipe polyethylene pipe has a very smooth inside surface. It maintains excellent flow properties moughout its service life due to its excellent chemical and abrasion resistance. Because of smooth walls and the non-wetting characteristic of polyethylene, high flow capacity and reduced friction loss is possible with Driscopipe 6400. In many cases, this high flow capacity may permit the use of smaller dameter pipe. A "C" factor of 155 is used in water flow calculations (Hazen-Williams Formula).

When the system is to handle "wet gas" with up to 5% concentrations of hydrocarbons, it may require higging on a regular basis.

In low pressure systems, such as 20 to 25 psig or in small diameter lines, pigging can be accomplished utilizing a long polyurethane or rubber cylinder. The size of the pig should be determined by the Inside diameter (I.D.) of the line, which will permit it to pass over the internal fusion bead.

Systems which will be operating at higher pressures may use a polyurethane pig. The corrosion resistance of Driscopipe 6400 and its ability to withstand scale buildup preclude the need for an abrasive pig. nor are they recommended. Crude lines which have paraffin buildup may utilize a crisscross pig.





### Vacuum or Suction Pipelines

Driscopipe 6400 may be subjected to internal pressure or internal vacuum. There are three general types of vacuum pipelines: above ground, underwater and underground. Each type must be analyzed differently.

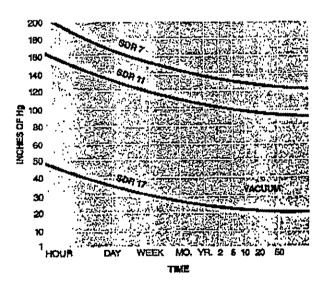
Since most oil-patch applications involve above ground or below ground (buried) piping, these two types will be discussed in this brochure.

Typical cases of vacuum or suction pipelines are gravity flow, downhill siphon lines, pipelines which are cleaned by vacuum and gas gathering lines operating under vacuum. When subjected to a vacuum, a sufficiently heavy wall pipe must be selected to resist the collapsing forces. Basically, the pipe's dimension ratio (DR) governs the amount of vacuum a pipeline can support on a short or long term basis. Selection of thicker wall pipe will allow full vacuum for a long time. The above ground vacuum capabilities given in Chart 1 are the practical.

maximum levels of vacuum that Driscopipe 6400 of a given DR can withstand. The data shown in this chart is based on a maximum of 10% ovality at 73.4% (23°C) and is applicable to environmental conditions which do not affect polyethylene, such as water. Conditions such as ovality, temperature and the presence of liquid hydrocarbons have a significant effect on external pressure loading caused by vacuum conditions. These factors sharply decrease the pipe's vacuum capability. For example, thicker wall pipe will be required to sustain full vacuum at high temperatures.

If the pipe's vacuum rating is exceeded for any length of time, pipeline collapse may be accelerated. Under excessive vacuum, the mode of fallure is not immediate closure or collapse but progressive oval deflection. Unlike other types of pipe, collapse by vacuum is not catastrophic for Driscopipe 6400. It can be compressed to over half its original diameter and then restored to roundness (without damage) by applying internal pressure for a short period of time. However, by property applying Chart 1, the possibility of collapse is minimized.

Chart 1
Vacuum Plus External Load Resistance Inches of Mercury at 79.4°F





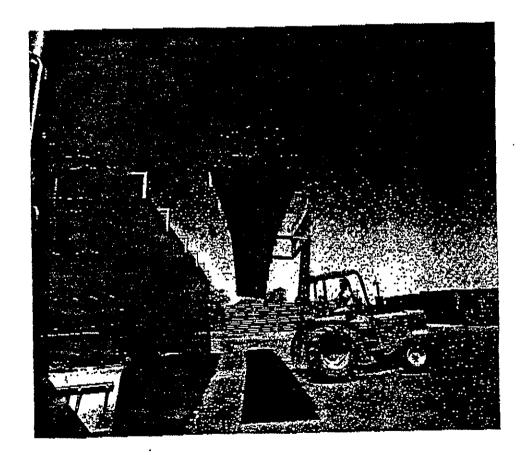
For many cases, as a general rule of thumb, DR 15.5 or lower DR pipe can be used safely at 70°F or lower temperatures to carry full vacuum. For vacuum pipeline fittings, lower DR (thicker wall) is selected for orleating fittings. For example, a buried vacuum peline using DR 17 pipe would use fittings made rom DR 11 pipe.

In below ground or buried pipelines, soil support will provide greater values for external pressures than those in Chart 1. There are many sources of external pressure on a buried pipe such as the static load, the live load and the effective external pressure due to negative internal operating pressure (vacuum).

2 buried pipeline operating under a negative essure (vacuum) not only has the static and live loads acting on the pipe but, also has a vacuum condition which tries to collapse the pipeline. An internal vacuum generates external pressure, expressed in pounds per square foot (psf or lb/ft²), equal in magnitude to the value of the vacuum in psf. The maximum apparent external pressure due to a vacuum inside the pipe is 14.7 psig or approximately 2100 psf.

Generally speaking, when the primary backfill immediately surrounding the pipe is compacted to 85% or better standard proctor density, the pipe soil/ system is capable of sustaining all external loads placed on it, including the vaccum condition.

All design parameters must be reviewed to make sure the performance limitations of Driscopipe 6400 are not exceeded. Safety factors can be calculated to ensure short term and long term performance of the buried pipeline. Further evaluation of external loads on a buried pipeline can be found in the Driscopipe "Systems Design" brochure, available from a Driscopipe representative.





### Weatherability

Driscopipe 6400 is protected against degradation caused by ultraviolet rays from direct sunlight. The raw material contains 2½% of finely divided carbon black . . . which also accounts for the black color of Driscopipe 6400. Carbon black is the most effective single additive for enhancing the weathering characteristics of plastic materials. The protection that even relatively low levels of carbon black impart to the plastic is so great, that it is not necessary to use other UV absorbers.

Weatherability tests Indicate that Driscopipe 6400 can be safely stored outside in most climates for periods of many years without danger of loss of physical properties due to UV exposure.

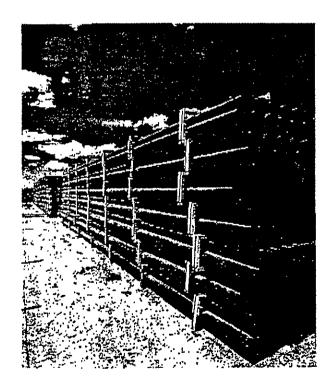
### **Applications**

Driscopipe 6400 is extruded from a Type III, Class C, Category 5, Grade P34 compound as described in ASTM D 1248. It is classified as cell 345434C according to ASTM D 3350 and has the material designation of PE 3408. The pipe is manufactured to meet the requirements of ASTM D 2513 which is necessary to meet the Pipeline Safety Regulations Part 192, Minimum Federal Safety Standards for the transport of natural gas. Driscopipe 6400 also meets the requirements of API 15LE (American Petroleum institute's Standard for Plastic Pipe).

By meeting the requirements of these two important specifications, Driscopipe 6400 is well qualified to meet the demanding needs of the energy market in applications such as oil and gas gathering systems, methane recovery from coal seams and landfills, and water supply lines for oil recovery systems.

The properties discussed in the preceding sections, plus the excellent flow characteristics of high density polyethylene piping, enhance the performance of Driscopipe 6400.

A thorough discussion of installation, design and hydraulic parameters is available through a Driscopipe representative.





### // Fittings

Driscopipe offers a complete line of fittings. Fittings larger than 12" are available as fabricated items made from pipe segments. Molded butt fusion fittings are available up to and including 12". A complete listing of available fittings may be obtained from a Driscopipe representative.

### Working Pressure

The working pressure for Driscopipe 6400 applications are determined as follows.

$$P = \frac{2S}{DR - 1} \times SF \times EF$$
Where:  $S = 1600$  psig (Hydrostatic Design Basis)

P = Pressure Rating, psig

DR = Outside Diameter (inches)
Minimum Wall Thickness (inches)

SF= Design Safety Factor

EF = Environmental Service Factor

### **Design Safety Factor**

The Design Safety Factor is a derating factor to compensate for system variables in a thermoplestic piping installation. A factor of 0.5 is recommended for water or for dry natural gas in areas not affected by Federal regulations.

The Design Safety Factor for dry natural gas in areas under the jurisdiction of the Federal Department Of Transportation (DOT), according to Title 49, CFR, Subchapter D, Part 192123, is 0.32 with a maximum allowable operating pressure of 100 psig. Higher pressure systems may be granted by a waiver from DOT.

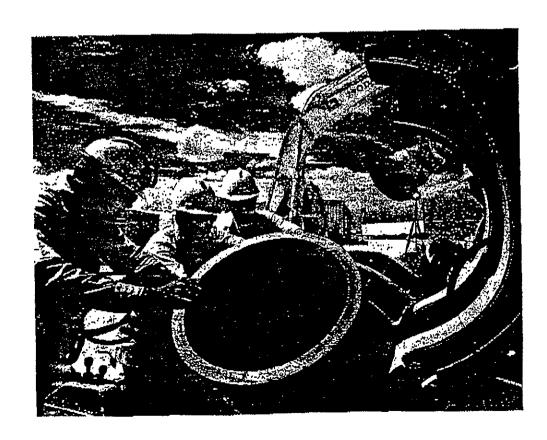
### **Environmental Service Factors**

The Environmental Service Factor is an additional derating factor to compensate for high temperatures or other environmental conditions of the installation. The use of this derating factor is recommended in API Spec 15LE.

Using both the Design Safety Factor (.5) and the appropriate derating factor for each temperature (see table), the following operating pressures may be used for Driscopipe 6400 for water, dry natural gas or *dry* recovered methane.

Working Pressures For PE3408 at Various Temperatures For Water Or Dry Gas (SF = .5 Included) (See Following "CAUTION"):

Temp.	EF Temp.	SDR7	SDR 9	SDR 11	SDR 17
73.4°F	1.00	265 psig	200 paig	160 psig	100 psig
100°F	0.79		158 pslg		
120°F	0.62		125 psig		
140°F	0.50		100 psig		50 psig





# CAUTION: Derating Factor For Wet Gas Or Crude Oil

If polyethylene pipe is to be in continuous contact with crude oil and wet gas (liquid hydrocarbons), the operating pressure selected from these charts should be reduced an additional 50% (EF=0.5) for 73% operation.

Example Calculations:

(a) DR 11 pipe (any size) to move dry gas at 100°F.

$$P = \frac{2 \times 1600}{10} \times .5 \times .79 = 126 \text{ psig}$$

(b) DR 7 pipe (any size) for crude oil line service at 70°F.

$$P = \frac{2 \times 1600}{6} \times .5 \times 1.0 \times .5 = 133 \text{ psig}$$

### PE 3408 Material Designation

Materials designated as PE 3408 have a hydrostatic design basis of 1600 psig for water at 73°F. After applying the 0.5 design safety factor, the design working stress for 73°F is 800 psig. Thus, a Grade P34 polyethylene material is designated as PE 3408. Driscopipe 6400 qualifies for this material designation.

### Life Expectancy

The hydrostatic design basis for Driscopipe 6400 is based on hydrostatic testing data evaluated by standardized industry methods. Life expectancy is estimated conservatively to be in excess of 50 years when proper design and environmental service factors are used to match the pipe design working pressure to the application condition.

### **Joining**

Driscopipe 6400 can be joined by heat fusion, flanging or utilizing mechanical fittings.

But heat fusion joining is the recommended method for joining Driscopipe 6400. Phillips has utilized but heat fusion for over 30 years of Driscopipe's polyethylene piping experience in the oil fields. But heat fusion has proven to be fast, economical and highly reliable. The butt heat fusion joints are stronger than the pipe wall as shown in Fig. 1 where the quick burst test shows the ductile break in the wall and not in the fusion joint. This is also shown in Fig. 2 in a tensile pull test.

Figure 1

Quick Burst Test

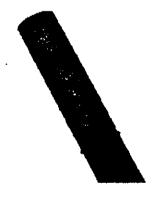


Figure 2
Tensile Pull Test

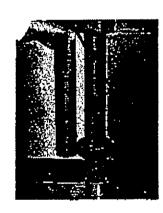


Figure 3
Molded Flange Adapter



Flanged connections, steel to plastic and plastic to plastic, may be made with Driscopipe flange adapters (See Fig. 3).

Iron pipe sized mechanical or compression fittings will also join Driscopipe 6400. Close fitting, properly sized internal stiffeners are recommended. In corrosive applications, the stiffener should be stainless steel or coated steel.

The superior chemical resistance of Driscopipe 6400 will not permit solvent cement Joining. Threading of the pipe is not recommended.

A complete line of steel to polyethylene transition littings are also available.

### Heat Fusion

The heat fusion method is a highly efficient, economical method for joining Driscopipe 6400. The heat fusion method of joining high density polyethylene pipe began shortly after the first commercial production of high density polyethylene pipe in the mid-1950s by Phillips Petroleum Company.

The modern day joint is the same as the joint which was made on the first crude fusion equipment in 1956. However, the equipment has evolved to gain efficiency, reliability and convenience. The many principles learned on that early equipment for making a successful joint are still in use today. Phillips Petroleum Company designed, developed and built many new models of heat fusion equipment from 1956 until the early 1970s. Since that time, Phillips Driscopipe personnel have guided this development by others. Phillips pioneered the idea and development of the heat fusion joining system, and has used it exclusively in polyethylene piping systems sold by Phillips since 1956. There are millions of these joints in service today.

Phillips Driscopipe, Inc. does not manufacture fusion equipment but a Driscopipe representative can supply equipment sources.





The heat fusion method is an uncomplicated, visual procedure with straightforward instructions. No "timing cycles" are necessary. The visual procedure allows the operator to concentrate on his work, rather than a clock. Visually, he knows when the pipe ends have melted to the degree required to fuse them together. He controls fusion pressure by observing the amount and configuration of the fusion bead as it is formed.

The principle of heat fusion is to heat two pipe surfaces to the proper temperature, then bring the two surfaces together and allow them to fuse by application of pressure. The pressure causes the melted materials for flow together, effecting mixing and, thus, fusion. On cooling, the original interfaces are gone and the two parts are united. Nothing is added to, or changed chemically, between the two pieces being joined. Fusion demonstrations and training can be arranged through a Driscopipe representative.

### Burial

The high possibility of physical damage and environmental concerns are important factors in recommending that Driscopipe 6400 be buried. Engineering details and other burial considerations are discussed in other Driscopipe brochures.

### Trenching

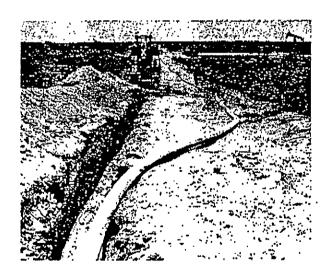
The width of the trench is usually determined by the diameter of the pipe. The pipe should have some slack and the trench should be wide enough to provide for good compaction of soil around the pipe. Detector tapes are available from other sources for pipeline detection.

The depth of the trench should be sufficient to provide a minimum of 30 Inches of cover. In cultivated areas this should be increased to 36 Inches.

Valve locations should be planned so that "bell holes" can be provided which will permit the pipe to lay flat on the trench bottom after being connected and before initial backfill and compaction.

Since gas liquids, including water, will collect in the low spots of any gathering system, it may be desirable to establish "drip pots" at the collecting points to provide for removal of the liquids.

A reasonable distance should be established and maintained from any source of heat.





Where the terrain or topography may dictate, Driscopipe 6400 has been joined in a more practical area, then pulled or pushed into place. This has been done with lengths of 1000 feet or more.

Although fittings are available, the ability to cold bend Driscopipe 6400 in the field to a radius of 20 to 40 times its nominal O.D. eliminates the need for fittings required in other systems.

### Backfill

Prior to any backfilling, the system should be pressure tested. Clean backfill, free of stones, debris, etc., should be placed around the haunches of the pipe, in lifts, and over the pipe to a minimum of 4 inches in depth. After compacting this primary bedding, less suitable material may be used to backfill to grade. Compaction utilizing heavy equipment is not advisable unless a minimum of 15 psi pressure is maintained in the pipe and then only after a minimum of 20 inches of cover has been established.

Due to expansion and contraction, inherent in thermoplastics, it is recommended that sufficient time be provided to permit the pipe to attain the lower ground temperatures before the pipe is joined to other sections or the system is terminated.

### Special Considerations

Polyethylene pipe will develop very high static electricity charges under certain conditions. One of these conditions occurs during the squeeze-off procedure. Special precautions must be taken to accommodate this phenomenon.

Properly designed tools must be used when squeezing off Driscopipe 6400.

Phillips Driscopipe, Inc. has developed Technical Notes which are available upon request, addressing the above items as well as other topics.



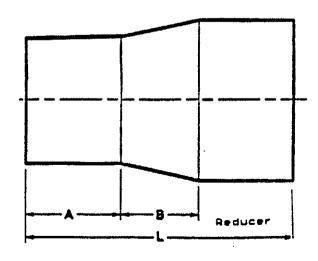


# Reducers

•	ominal Size		Туре	ps i	<u>Dimens</u> A	ions,	inches L	WT. LBS
3x2	SDR	9.3 11	Molded	190 160	2.3	1.2	5.3	.5
4x2	SDR	9.3 11	Molded	190 160	2.3	2.3	6.3	1
4x3	SDR	9.3 11	Molded	190 160	2.3	1.2	5.8	1
	SDR	17	fab¹d	100	4.0	1.9	10.0	2
	SDR	9.3 11	Molded	190 160	3.0	2.3	7.5	3
6x4	SDR	7 11 17	fab*d	267 160 100	3.3	4.0	11.0	7 4 3
6x5	SDR	11	fabid	160	3.3	4.0	11.0	5
8x6	SDR	7 11 17 26	fab'd Molded fab'd	267 160 100 64	5.0	3.5	14.0	15 9 7 6
10×8	SDR	7 11 17 26	fab¹d	267 160 100 64	5.2	4.0	15.0	20 16 11 10
12x8	SDR	11 17	fab'd	160 100	8.0 §.§	9.0 ీ.ీ	22.0	36 24
12x10	SDR	7 11 17 26	fabʻd	267 160 100 64	5.6	3.8	15.0	28 22 16 14
14x12	SDR	7 11 17 26	fabid	267 160 100 64	7.0	2.4	16.4	45 30 22 20
16x14	SOR	11 17 26	fab'd	160 100 64	3.3	3.8	17.8	41 30 22
18x16	SDR	7 11 17 26	fab'd	200 160 100 64	5.5	3.0	17.8	70 52 38 25
20x18	SDR	11 17 26	fabid	160 100 64	<b>*</b> **	3.5	17.8	60 45 36
21.5 x 20	SDR	11 17 26	fab†d	160 100 64	3.3	3.8	17.8	91 65 50
22×20	SOR	11 17 26	fabid	160 100 64	\$	3.8	17.8	91 65 50

Nomir Size		Туре	psi ∔	Dimen:	sions, B	inches L	WT. LBS
24x21.5	11 SDR 17 26	fabʻd	160 100 64	9.0	3.8	21.8	124 89 56
24x22	11 SDR 17 26	fab'd	160 100 64	9.0	3.8	21.8	124 89 56
26×24	11 SDR 15.5 32.5	fabid	160 110 51	9.0	4.0	22.0	150 95 65
28x24	11 SDR 17 26	fabid	160 100 64	9.0 9.3 2.3	6.0	24.0	174 100 75
800mm x28 (31.496)	SDR 17	fabid	100 64	9.0	12.0	30.0	250 150
800mm x30 (31.496)	SDR 17 26	fab'd	100 64	9.0	12.0	28.0	255 155
32x28	SDR 17	fab'd	100 64	9.0	12.0	30.0	250 150
32×30	SDR 17	fab¹d	100 64	9.0	12.0	28.0	255 155
36x800mm (31.496)	SDR 17	fab¹d	100 64	9.0	12.0	30.0	290 200
36x32	SDR 17	fabid	100 64	9.0 4.4	12.0	30.0 %.2	290 200

Non-listed sizes, contact your Driscopipe representative



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16×8 A 16×10 CONCENTAIR Falld

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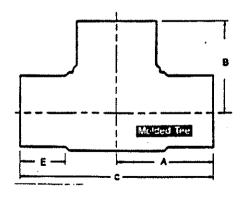
1	ominal Size	Type	psi +	Dir A	nensio B	ns,inc C	hes E	WT LBS.
	SDR 9.1	Molded	190 160	4.8	4.8	9.5	3.0	1
2"	SDR 7	fab'd	200 120	8.0	15.0	16.0	6.8	4 3
3"	9.3 SDR 11 17	Molded	190 160 100	4.8	4.8	9.5	2.3	-2
	SDR 7	fabid	200 120	8.0	15.0	16.0	6.3	5 4
4"	9.3 SDR 11 17 26	Molded	190 160 100 64	5.3	5.3	10.5	3.0	3 3 3 3
	SDR 7	fab'd	200 120	8.0	15.0	16.0	5.8 	8 6
5"	SDR 11	fab¹d	120	8.5	14.0	17.0	5.7	11
6"	9.3 SDR 11 17 26	Molded	190 160 100 64	7.5	7.5	15.0	3.0	10 10 9
	SDR 7	fab¹d	200 120	8.5	14.0	17.0	5.2	21 15
8#	SDR 11 7 SDR 11 17 26	Molded fab¹d	160 200 120 75 48	12.0 14.0	12.0	24.0	6.0 9.7	30 50 30 27 27
10"	SDR 11 7 SDR 11 26	Molded fab <sup>1</sup> d	160 200 120 75 48	13.3 14.0	13.3	26.5 28.0	6.0	51 70 47 34 34
12"	SOR 11 7 SOR 11 17 26	Molded fab1d	160 200 120 75 48	15.5 15.0	15.5	31.0	7.5	90 110 71_ 52 51

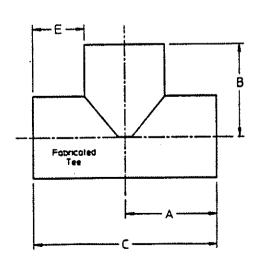
No	minal		Туре	psi	Dia	nens i g	ns, inc		WT.
S	ize		**	+	A	В	С	E	LBS
14"	SDR	7 11 17 26	fab'd	200 120 75 48	16.0	19.5	32.0	9.0	140 90 66 56
16"	SDR	11 17 26	fab'd	120 75 48	16.0	19.5	32.0	8.0	118 86 76
18"	SDR	11 17 26	fab'd	120 75 48	19.0	19.0	38.0	10.0	143 96 64
20"	SDR	11 17 26	fab'd	120 75 48	23.8	25.0	47.5	13.9	267 179 120
21.5	SDR	11 17 26	fab'd	120 75 48	19.0	25.0	38.0	8.2	284 252 120
22"	SDR	11 17 26	fab'd	120 75 48	19.0	25.0	38.0	8.0 ***	290 266 150
24"	SDR	11 17 26	fab¹d	120 75 48	23.8	25.0	47.5	11.8	400 292 185
264	SDR	11	fab'd	120	24.0	25.0	148.0	13.0	460

	28"	SDR	11 17	fab'd	120 75	74.0	26.0	148.0	55.0 ∴	1175 665
I B	800mm (31.4		17 26	fab'd	75 48	74.0	·27.0	148.0	53.0 ∰.∵	1380 760
n 9 e	32"	SDR	17 26	fabid	75 48	74.0	27.0	148.0	53.0 음.공	1400 770
d	36"	SDR	17 26	fab¹d	75 48	79.0	31.0	158.0	56.0	1550 980

FAB'D tees are not fully pressure rated, see "TECHNICAL CONSIDERATIONS".
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Hon-listed sizes, contact your Driscopipe representative.





### • DRISCOPIPE

## 45° Wyes

•		omina	t	psi	Туре	٥	imens	ions,	inche	s	WT.
;:		Size		+		A	В	С	E	F	LBS
	2#	SDR	11	120	TrueLat	18.5	na	25.0	14.6	17.5	2
-		SDR	11	120	TrueLat	17.3	na	25.0	14.4	18.8	4
	3"	SDR	7 11	120	Phillips	11.0	8.0	18.0	11.8	25.5	7 5
		SDR	11 7	120 200	TrueLat	19.5 14.0	na 7.7	26.5 22.0	14.1 12.3	19.5 30.1	8 12
_	4"	SDR	11 17 26	120 75 48	Phillips		200000000000000000000000000000000000000			30.1	8 5 5
		SDR	11	120 200	TrueLat	27.6 16.0	na 7.9	35.5 24.8	19.9	27.9	<u>25</u> 31
-	6#	SDR	11 -17 26	120 75 48	Phillips			24.0		20.0	21 14
-							8*.8				
		SDR	<del>-11</del>	120 200	TrueLat	30.4 18.0	na 15.2	40.2 31.0	20.0	30.4 41.7	<del>- 47</del> 54
	8"	SDR	11 17	120 75	Phillips						36 24
			26	48		चित्र की हिंदा • है	<b>₹•</b> ≸	(§•§•	<b>₩.</b>	\$\$.\$	16
		SDR	11	120 200	TrueLat	32.8 21.0	na 17.1	43.2 35.0	20.0	32.8 44.7	<u>77</u> 89
	10"	SDR	11 17 26	120	Phillips		•	•			60 40 27
		SDR	11	120	TrueLat	35.4	na	46.0	20.0	35.4	118
	12"	SDR	7 11 17 26	200 120 75 48	Phillips	22.0	20.2	36.8	17.5	52.3	171 116 77 52
r		SDR	11	120	TrueLat	38.9	na	49.8			155
	14"	SDR	7 11 17 26	200 120 75 48	Phillips	23.0	19.4	41.0	24.5	57.8	248 167 112 75

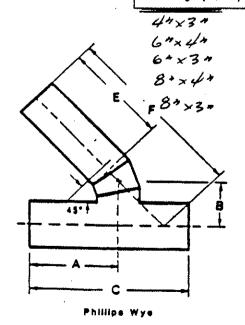
No	mina	ι	ps i	Туре	0	mens i	ons, i	nches		WT.
	ize		+	.,,,,	A	В	С	£	F	LBS
16"	SDR	11 17 26	120 75 48	Phillips	24.0	19.4 	43.0	24.3	58.5	228 153 102
18"	SDR	11 17 26		Phillips	25.0 	31.1	46.0	23.8	76.9	308 207 138
20"	SDR	11 17 26	120 75 48	Phillips	26.0	35.1	47.0	23.5	83.2	405 271 181
21.5	SDR	11 17 26	120 75 48	Phillips	27.0	35.4	49.0	23.3	83.8	496 332 222
22"	SDR	11 17 26	120 75 48	Phillips	27.0	35.5	49.0	23.3	84.0	519 348 232
24"	SDR	11 17 26	120 75 48	Phillips	28.0	35.1	51.0	22.8	83.0	645 428 289

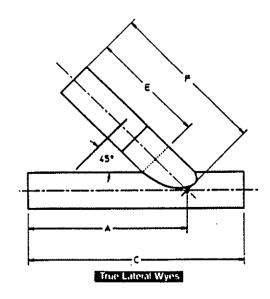
П	26"	SDR	11	120	Phillips	74.0	33.8	148.0	22.8 81.3	1250
F l a	28"	SDR	11 17 26	75	Phillips	74.0		148.0	96.2	878 588 393
C on e d	800 mm	SDR	17 26	75 48	Phillips	74.0	39.7	148.0		744 497
٥	32"	SDR	17 26	75 48	Phillips	74.0	40.0	148.0		768 513
	36"	SDR	17 26	75 48	Phillips	79.0	42.0	158.0		971 649
1	Fl	anged	ž <sub>M</sub> y	es a	26" & up i	netuc	e a s	lipor	n b/u ring	

Wyes are de-rated, see TECHNICAL CONSIDERATIONS.

† PSI 2 73.4 degrees f. () = duplication

### Reducing wyes may be available on special quotes.





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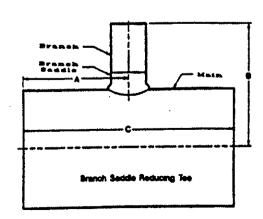


						•		
		MINAL IZE	ps i	D i mer	nsions, B	inches C	WT. LBS	
	3×2	SDR 11	160	12	12	24	3	
2 " outlet	4x2	SDR 11	160	12	12	24	٠ 4	6 " outlet
	6x2	SDR 11	160	13	13	26	6	
	8x2	SDR 11	160 100	14 85	14	28 88	14 10	
	10x2	SDR 11	160 100	14	14 ::	28 ::	16 13	
	12x2	SDR 11	160 100	14	14 ***	28 :::	27 20	
	4x3	SDR 11	160	12	12	24	4	
3 " outlet	óx3	SDR 11	160	13	13	26	6	
	8x3	SDR 11	160 100	14	14	28	14 11	
	10x3	SDR 11	160 100	14	14	28	18 15	
	12x3	SDR 11	160 100	14 (§)	14	28 %	30 22	
	6x4	SDR 11	160	13	13	26	8	
4 " outlet	8×4	SDR 11	160 100	14	14	28	18 13	
	10×4	SDR 11	160 100	14 260 4,8	14	28 ::	20 18	
	12x4	SDR 11	160 100	14	14	28 **	32 25	Non-listed
	18x4	11 SDR 17, 26	160 100 64	19	19	38	65 50 35	

		IZE	ps i	0 ime	ensions 8	in. C	WT. LBS
6 "	8x6	SDR 11	160 100	14	14	28	30 25
outlet	10x6	SDR 11	160 100	14	14	28	32 30
	12x6	SDR 11	160 100	14	14 %	28 33	45 <b>38</b>
	14x6	SDR 11	160 100	15	15 %	30	45 40
	16x6	11 SDR 17 26	160 100 68	16	16	32	59 48 37
	18x6	11 SDR 17 26	160 100 68	19	19	38	66 61 45
	20x6	11 SDR 17 26	160 100 68	19	19	38	91 72 52
	21.5 x 6	11 SDR 17 26	160 100 68	19	19	38	102 80 56
	24x6	11 SDR 17 26	160 100 68	25	25	50	153 118 80
	36x6	SDR 17	100 68	25 3	<b>30</b>	50	503 323

‡ PSI a 73.4° f. (░) = duplication

sizes, contact your Driscopipe representative.



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### Flange Connectors

	ninal ize		TYPE	PSI †	Dimens A	ions,i B	nches C	WT. LBS
18	SDR	11	mfla mfla	190 160	4.0	0.2	2.4	.5
1-1/4	SDR	7.3	mfla mfla	190 160	4.0	0.3 0.2	2.8	.5
1-1/2	SDR	).3 11	mfla mfla	190 160	4.0	0.3 0.2	3.1	.5
2"	SDR	7 11	mfla mfla	267 160	6.0	0.4	4.0	1
۲"	SDR	11	STUB	160	1.8	0.8	4.0	.5
3"	SDR	7 11 17	mfla mfla mfla	267 160 100	6.0	0.6	5.0	2 2 2
4"	SDR	7 11 17	mfla	267 160 100	6.0	0.8	6.6	3 3 3
611	SDR	7 11 -17 26		267 160 100 64	***************************************	1.2 0.8 0.8 0.8	8.5	8 7 7 7
811	SDR	26	was cost.	160 100 64	9.0	1.6 1.0 0.8 0.8	10.6 10.6 10.6	11 10 10 10 10
10"	SDR	7 11 17 26	<b>'</b>   }	267 160 100		1.9 1.3 0.9 0.8	12.8	19 18 17

Stu	b End Co	nnecto	rs				
28"	SDR 17	SsSe	100	4.0	2.1	32.3	35
30"	SDR 26	SsSe	64	4.0	1.8	34.5	40
800mm	SDR 17	SsSe	100	4.0	2.3	36.7	45
32"	SOR 17	SsSe	100	4.0	2.5	36.7	45
36#	SDR 17	SsSe	100	4.0	2.1	40.8	60
1000m	m SDR325	SsSe	51	4.0	1.5	47.4	68
42"	SDR 32.5	SsSe	51	4.0	1.6	47.4	73
48"	SDR 32.	MmSe	51	4.0	2.0	53.9	90

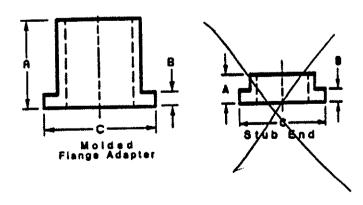
	inal ze		Type	psi †	0 imens A	ions, 8	inchs C	WT. LBS
12"	SDR	7 11 17 26	mfla	267 160 100 64	10.8	2.3 1.5 1.0 0.8	15.0	25 24 23 22
14"	SDR	7 11 17	mfla	267 160 100	11.0	2.6 1.7 1.1	17.5	55 40 40
16"	SDR	7 11 17 26	mfla	267 160 100 64	12.0	3.0 1.9 1.2 0.8	20.0	80 60 45 43
18"	SDR	7 11 17 26	mfla	267 160 100 64	12.0	3.3 2.1 1.4 1.0	21.1	95 68 55 50
20"	SDR	11 17 26	mfla	160 100 64	12.0	2.3 1.5 1.0	23.5	66 64 62
21.5	SDR	11 17 26	mfla	160 100 64	38.3	2.4 1.6 1.0	25.6	68 66 64
22#	SDR	11 17 26	mfla	160 100 64	₩	2.5 1.6 1.1	25.6	67 65 63
24"	SDR 3	9 17 2.5		200 100 51	3.3	3.5 1.8 1.0	27.9	190 140 95

Type mfla = molded flange adapter.

STUB = molded stub end (being discontinued).

SSSe = sheet stock stub end

HmSe = molded machined stub end



If used with butterfly valves, check with the mfgr. for space and/or clearance requirements.



### Stainless Steel #316 Convoluted Back-up Rings.

(dimensions are in inches)

	- 0	0	u	Y / Y1	n	c	٥	
Homina Pipe Size (Inches)	Nominal Outside	Minimum Thickness of ring	Minimum Diameter of Bore	Nomimal Length thru Hub	bolt	Min.Dia. of bolt holes	Dia.of boit circle	Approx. Weight (lbs.)
1	4.25	0.56	1.38	0.22	4	0.625	3.12	1.3
1-1/2	5.00	0.69	1.97	0.22	4	0.625	3.88	1.9
2	6.00	0.75	2.46	0.37	4	0.750	4.75	2.7
3	7.50	0.94	3.60	0.50	4	0.750	6.00	5.2
4	9.00	0.94	4.60	0.50	8	0.750	7.50	6.2
<del>-</del> 6	11.00	1.00	6.75	0.60	8	0.875	9.50	9.0
8	13.50	1.12	8.75	0.60	8	0.875	11.75	14.0
10	16.00	1.19	10.92	0.70	12	1.000	14.25	20.0
12	19.00	1.25	12.92	0.75	12	1.000	17.00	28.0

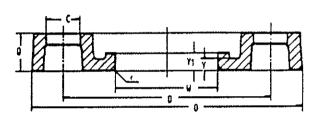
Physical Properties ASTM A351CF8H Tensile Strength 70,000 psi

Yield Strength Elongation in 2"

30,000 psi 30%

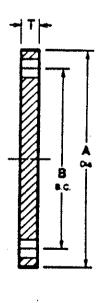
Elongation in 2"

Will Mate with: Forged steel flanges, Class 150 per ANSI B16.5 Plate steel flanges, Class 150 lb. per ANNA C207 Cast iron flanges, 125 lb. per ANSI B16.1



### Blind Steel Flange Plates

	Dimen:	sions, i	nches	# of	Hole	₩t.
Size	A	8	Ī	Holes	dia.	lbs
1	4.25	3.25	0.75	4	0.63	2
1-1/4	4.63	3.50	• 333	4	0.63	2 3 3
1-1/2	5.00	3.88	• 333	4	0.63	3
2	6.00	4.75	•35	4	0.75	5
3	7.50	6.00	•38	4	0.75	8
4	9.00	7.50	• 355	8	0.75	- 11
5	10.00	8.50	- 355 - 355	. 8	0.88	13
6	11.00	9.50	•	8	0.88	18
- 8	13.50	11.75	• 🐉	8	0.88	25
10	16.00	14.25	• 🐉	12	1.00	35
12	19.00	17.00	• 355	12	1.00	50
14	21.00	18.75	•	12	1.13	61
16	23.50	21.25	• 333	16	1.13	70
18	25.00	22.75	•	16	1.25	80
20	27.50	25.00	• 300	20	1.25	100
22	29.50	27.25	•	20	1.38	120
24	32.00	29.50	•#	20	1.38	138
28	36.50	34.00	1.25	28	1.38	250
32	41.75	38.50	<b>3.3</b> 3	28	1.50	375
36	46.00	42.75	3.30	32	1.63	500
42	53.00	49.50	1.4	36	1.63	600
48	59.00	56.00	3 33	44	1.63	750



Blind flanges are drilled to 150# bolt pattern to mate with 150# forged steel flanges - ANSI B16.1, 150# plate, steel flanges - ANNA C207 and 125# cast iron flanges-ANSI B16.1. Special dimensioned flanges and non-ductile iron flanges quoted upon request.

# TECHNICAL CONSIDERATIONS

Pressure Rating

All molded fittings and reducers, flange adapters, stub ends, branch saddles, branch saddle reducing tees, and transition fittings are fully pressure rated to match the pipe SDR pressure rating to which they are made. The shape of fabricated fittings are substantially different than the shape of straight pipe. As a result, stresses imposed on fabricated fittings are higher than those imposed on pipe. Therefore, it is recommended that the pressure rating of fabricated ells, wyes and tres be re-rated to approximately 75% of the pressure rating of the pipe used to fabricate the fitting. If the full pressure rating of the pipe is required. Phillips Driscopipe recommends using a heavier wall fitting (25%) where available. As an alternate measure, when properly designed concrete encasement or other external reinforcement is used on ells, wyes and tees, the pressure rating can be increased to the working pressure of the pipe from which it is fabricated. Specific recommendations for concrete encasement are shown in the Driscopipe Systems Installation brochure.

# **Installation Precautions**

Driscopipe fabricated tees, elbows and wyes are made by butt fusing or sidewall fusing together special cut segments of Driscopipe pipe to obtain the desired fitting. The configuration of these fittingss, and the fact that they are fabricated rather than molded, requires that certain precautions be taken when installing them into a piping system.

The installation procedures should provide the least possible amount of lifting and moving of the assembled pipe and fabricated fittings. If it becomes necessary to pull the assembly along side the ditch to properly position it, the fabricated fitting should never be used as the point of attachment for the pulling.

The fusion joining of a fabricated tee and wys into a system becomes complicated because of the third side. It is not too difficult to keep strain off the fitting when fusing pipe to the running side of the tee and lifting and lowering this much of the assembly into position in a ditch. It is when sufficient pipe is added to the third (branch) side to permit the laying of pipe in this direction, that the assembly becomes very difficult to handle. Final handling and positioning of these assemblies requires extra handling equipment and additional precautions to prevent damage to the fabricated fitting.

Recommended Alternate Method: The need for extra equipment and much of the possibility of damage can be eliminated by altering the method of installing the fabricated tee and wye to include the use of a flanged connection on the branch side. This will allow final positioning to take place before the branch side is connected. There will be some instances where it will prove very advantageous from an installation viewpoint to use flanged connections on two sides of a tee or wye and also one side of the elbow. This allows the pipe to be laid from either direction, pushed or pulled into tight locations, rolled into the ditch, and generally handled much easier and faster, before the final connection is made at the tee, wye, or elbow. From the standpoint of economy, speed and case of installation, and eliminate the occurrence of excessive installation stresses of fabricated fittings, it is recommended that flanged connections always be used on the branch side of tees and wyes and on one end of elbows for larger diameter pipes.

- Driscopipe 1000/6400 Molded fittings are made from the same resin as the Driscopipe 1000<sup>®</sup> & 6400<sup>®</sup> series pipe.
- Driscopipe Fabricated fittings are manufactured from Driscopipe 1000<sup>®</sup> & 6400<sup>®</sup> piping systems. Fabricated ells, wyes and tees are made by butt fusing together mitre cut segments of pipe to obtain the desired shape.
- Fabricated cibows: Due to the nature of polyethylene and the mitered fusion process, the tolerance is generally plus or minus one degree. The broad tolerance typically causes no installation problems due to the flexibility of
- Driscopipe special fittings are custom designed for your specific application through your Driscopipe representative.

Effective date:: October 1, 1990

# 1000 PE3408

# Butt Fusion Procedure for Pipe and Fittings

Clean each pipe with clean cotton cloth.\*

2. Square (face) end of each pipe to be fused.

3. Check line-up of pipe ends. Adjust high-low. Check heater plate for proper temperature, and wipe header surface clean. Thermometer reading:

400°F - 425°F . . . coated plates

375°F - 400°F . . . uncoated plates

- Insert heater plate between aligned ends and bring ends firmly in contact with plate, but DO NOT APPLY PRESSURE while achieving melt pattern. Watch for proper melt.
- 5. Remove heater plate after achieving proper melt bead.
- 6. Bring melted ends together rapidly. Do not slam. Apply enough pressure to form a double roll-back bead.
- 7. Allow the butt fusion joint to cool properly (until finger can remain comfortably on bead).

# Remember

A quality butt-fusion joint has a double bead rolled back to the body of the pipe.

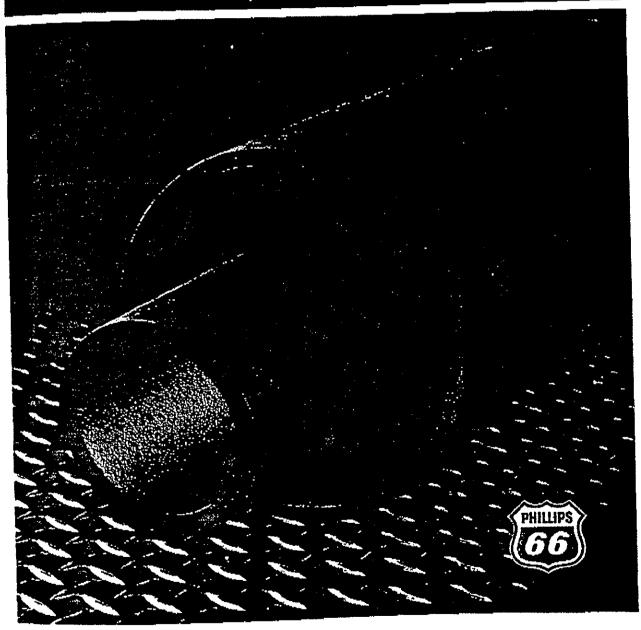
Heater plates should be double checked with a tempilstik or pyrometer for correct **surface** temperature (375°F – 400°F).

\*Avoid polyester type materials which melt and stick to heater plates

O DRISCOPIPE

# Dual Containment

Pipe and Fittings



# Dual Containment Pipe and Fittings

### Introduction

Phillips Driscopipe, Inc. manufactures dual containment piping systems for preventive use in application areas where accidental spills could cause possible leaks into the environment. Driscopipe® polyethylene pipe features a range of pipe sizes, pressures (SDA's) and chemical compatibility. The outer polyethylene casing can withstand external corrosion while providing the needed secondary containment of hazardous fluids should the camer pipe leak. Both leak detection and reporting systems can be installed within Driscopine dual containment piping. Like other Driscopipe piping. these dual containment systems are engineered and factory fabricated with basic components to assure high quality and reduced field installation time and costs, while maintaining system integrity.

Phillips Driscopipe, Inc. offers a complete line of pipe, fittings, accessories, technical and installation services through qualified and experienced distributors.

Millions of feet of Driscopipe polyethylene pipe are installed each year in hundreds of different applications. This outstanding record of success emphasizes the superior engineering properties of Mariex\* polyethylene resins, the quality proprietary production methods of Driscopipe piping systems, and the high integrity and reliability of the butt fusion method for these systems. These features illustrate the successful development of the Phillips family of products.

Driscopipe Piping includes:

- A complete range of pipe and fittings sizes and design pressure ratings.
- · Trained, qualified distributors.
- Technical service assistance for system design, installation and on-the-job consultation through qualified distributors.
- Readily available installation equipment.
- Continuing product research, development and testing.
- Economical product availability through strategically located plants throughout the U.S.
- Quality assurance.
- Custom design and fabrication of non-standard and special components.

### Piping Material

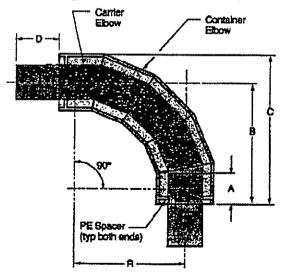
Driscopipe dual containment piping is a high density, very high molecular weight polyethylene pipe with a PPI listing as a PE 3408 materials. Using ASTM D3350, the carrier pipe may be described by the material cell class #355434C or #345434C. The containment pipe is usually designated as a #345434C material.

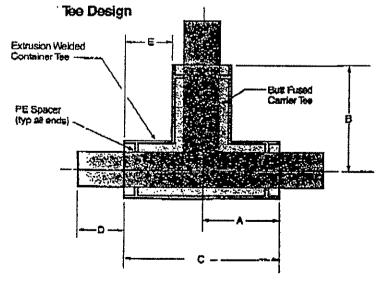
Driscopipe systems are expected to give many years of trouble-free service when exposed to a broad variety of environments and working conditions. Three Marlex® polyethylene pipes, Driscopipe 1000, Driscopipe 6400 and Driscopipe 8600 were developed for these demanding environments.

Polyethylene pipe is:

- · Tough and durable
- Virtually inert
- . Strong and "smooth"
- Reliable
- Chemically resistant
- Impact resistant
- · Weather resistant
- Abrasion resistant
- Fatique resistant
- Weldable (heat-fusion)
- Light weight

### 90° El Design





Onscopipe high density polyethylene plping offers movative new solutions to old material handling troblems. These piping systems give the engineer much solutions to many traditional problems and applications.

### Piping Components

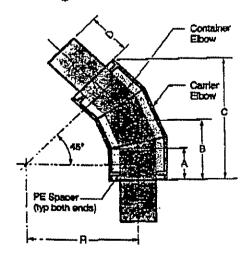
inscopipe dual containment piping offers the components necessary to assemble an engineered system. In addition to the standard pipes and fittings shown below, custom machined and/or fabricated parts are available to meet specific project needs through a Driscopipe distributor.

Carrier Pipe Size	Containment Size*
2"	4"
3"	6"
4"	8*
6*	10"
8*	12"
10"	16"
12"	18"

'Other combinations and sizes quoted upon request,

Fittings: Standard 45° ells, 90° ells, tees, anchors, spacers, manholes, flanged outlets and drain/vents are available to meet project requirements. The sintainment piping may be completely field tribricated from component places. However, pre-labrication services are offered to allow spool pieces to be shipped to the site for final assembly.

### 45° Ell Design



Options: Dual containment piping may be equipped with many other desirable options. Distributors should be consulted on availability of those features needed beyond the pipe, fittings and custom project components offered by Phillips Driscopipe.

### **Design Considerations**

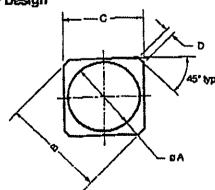
- Piping can be engineered for draining or pressure applications.
- The PE pipe is joined by heat-fusion, a proven welding technique that provides leak-free joints.
- The carrier pipe must be rated to carry the flowstream pressure. The containment piping may be equally rated or of thinner wall depending on system need or design.
- The containment piping may be designed into separate leak containment zones, OR
- The containment piping may be engineered to provide continual drainage via the annular space if desirable.
- Pipe is shipped from one of the five plants to provide rapid nationwide delivery.
- Standard fittings and accessories are shopfabricated near Dallas, Texas to provide rapid service and shipment quoted as per order.
- Design and application assistance is provided by Driscopipe distributor engineering staffs and supported by Driscopipe technical groups.

### Summary

When Driscopipe piping systems are chosen and installed, the owner acquires a product whose performance has been proven by long established technology, experience and reliability. A complete team of dedicated personnel are available to help solve sensitive material and piping problems through the Driscopipe national distributor network for these typical applications:

Leachate Collection and Handling Solvent Extract Mining Chemical Process Piping/Chemical Wastes Hazardous Waste Collection Storage Tank Piping

### Spacer Design





### Dimensions & Pressure Ratings 1000 Series Pipe

	<del></del>											-			
1"	111	<b>₹160</b> ₿	,19	1.315	1.075	.120	500 ft.coil	1					ions - in		
1-1/	4 11	<b>ॐ160</b> ई	.30	1.660	1.358	,151	500 ft.coil	Size	SDR	P51 973.4	Weight lbs.	Hominat Q D	Approx.	Min. Wall	Packaging
1-1/	2 11	\$160%	.40	1.900	1.554	.173	500 ft.coil		7	#267 <u>#</u>	12,14	8.625	6.161	1,232	9 its.per
	T	403			4 407				9	267 3200 160	9.80		6.709 7.057	.958 .784	burdle
_	7	267 200 160	.92 .74	Nonether the County	1.697	.339	88 jts.per bundle		11 13.5	1125 110	8.21 6.82	3.3	7.347	.639	10 bundles
.54	11 13.5	160	.62 .52	2.3	1.943	.216 .176	14 bundles	6*	15.5	\$1100 2100	6.00 5.50	7-3	7,513 7,611	.556	per truck
	15.5	128 110	.46	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2.069	.153	per truck		19	857	4.96		7.717	.454	3600 ft.
	17	第100线	.42	8.3	2.095	,140			21 26	100 E 2 3 5 1	4.52 3.68	elesiskasioniskiesioniskiesioniskiesioniskiesioniskiesioniskiesioniskiesioniskiesioniskiesioniskiesioniskiesio	7.803	,411 ,332	per truck
	7	1267 1200	2.00 5à.1	3.500	2,500 2,722	.500 .369	46 jts.per bundle		32.5	§ 513	2.97	\$.\$	8.095	.265	
	11	STATE	1.35	Por serve done a serve ser	2.864	.318			1 -	W047	1 45 44	10,750	7.678	1.536	
3-	13.5 15.5	128 110	1.12	1 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	2.982 3.048	.259 .226	14 bundles per truck		7	267 200	18.86 15.23	#.#	8.362	1,194	per truck
-	17	[[]1000	.91 .82	2	3.055 3,132	.206			111	160	12.75 10.59	THE REPORT OF THE PROPERTY OF THE PARTY.	8.796 9,158	.977 -796	80 jts.per
	21	80	.74		3.166	.167		10*		128 110 100	9.33	1.3	9,362	-694	
	26 32.5	54 51	.61 .49		3,230 3,284	.135 .108	ļ		17 19	89	8.55 7.71	8.3	9.486 9.618	.63Z .566	56 lts.per strip load
-	7	\$267	3.31	4.500	3.214	.643	29 [ts.per	11	21 26	89 80 51	7.01 5.71	2.3	9.726	.512 .413	
	9	200	2.67		3.500	-500	bundle	H	32.5	515	4.62	3.3	10.088	.331	
<u> </u>	111	\$160 \$12B	2.23 1.85	Wednesdanks and seconds second	3.682 3.834	.409 .333	14 bundles	]	· · · · ·				·		, ,
4.	15.5 -17	1100	1.63	35	3.920 3.970	.290 .265	per truck		7	7267 200	26.53 21.44	O PRINCIPAL SERVICE SERVICES	9,108 9,916	1.821	per truck
	19	\$ <b>57</b> \$	1.35	20 Sec. 34	4.026	.237			111	3160	17.94		10.432	1.159	52 jts.per
1	21 26	80 64	1.23	1	4.872 4.154	.214 .173		12"	13.5 15.5	128 110 100	14.89	***	10.862	.944	loose load
	32.5	§ 518	.81	5.8	4.224	.138			17	100	12.03	8.4	11.250 11.408	.750 .671	42 Its.per strip load
	1			1					21	89	9.86	<b>1</b> .1	11.536	.607	oti ip tusc
5.	21 26	80 64 51	1.75 1.43	5.375	4.863 4.961	.256 .207	15 jts.per bundle		26 32.5	89 80 64 51	8.04 6.48		11.770	.490 .392	
3/8°	26 32.5	į 51§	1.15	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	5.045	-145			1	<i>n</i>	<u> </u>	<u> </u>	<u> </u>		
	7	\$267\$	5.05	5.563	-3.973	.795	14 bundles per truck	$\cdot$ I $\Box$	7	267	29.24	13.386	9.562	1.912	per truck
	9	2002	4.08 3.42	and same and an ordered an ordered and an ordered an ordered an ordered an ordered and an ordered anothered an ordered an ordered anothered an ordered an ordered an ordered anothered	4.327 4.551	.615 .506			11	2006 160	23.62 19.78	ALTERNATION PROPERTY.	10.412	1.487	48 lts.per
-	13.5	\$128	2.84	2 2	4.739	.412			13.5	125 110 100	16.43	30.00	11.402 11.658	.992	loose load
5*	15.5 17	1100 100	2.50 2.79	3.3	4.545 4.909	.359 .327	<u> </u>	13*	15.5 17	100	14.46	*****	11.812	.864 .787	42 jts.per
1	19 21	89 80	2.07 1.88		4.977 5.033	.293 .265			19 21	857	11.96 10.86	3.0	11.976 12.112	.705 .637	strip load
	25	£ 64	1.53	3	5.135	.214		11	26 32.5	第 64键	8.87	1	12.356	.515	
	32.5	3 5 译	1.23	为-第	5.221	,171			32.5	第5辑	7,15	3-3	12.562	.412	j
	7 9	2672 200	7.16 5.78	6.625	4.733 5.153	.946	13 jts.per		7	<b>ピンペン</b> 米	31.90	14.000	10.000	2,008	per truck
	111	200 160	4.84	en sonskas osenema imėsininkės irškai eše	5.421	.736 .402	bundle		9	200	25.84	F-1	10.888	1.556	<u> </u>
64	4# =	¥128 ∰110	4.03 3.54	2 3	5.643 5.771	,491 ,427	14 bundles per truck		113.5	1160E	21.64 17.97	eresterrenenenskernen Liukkelederrenen	11.454 11.926	1.273	48 jts.per
	17	0 0 0 0 1 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	3.25		5.843	.390		14"	15.5	<b>110</b>	15.81	3.5	12.194	.903	
	19 21	3 80	2.93	83.5	5.927 5.995	.349			19	89	14,52 13,07	13	12.352 12.526	.824 ,737	30 jts.per
	26 32.5	648	2.17	2.3	6.115	.255			21	80	11.90 9.69	1-5	12.666 12.924	.667 .538	
	135.3	여 기기	1.75	# · \$	6.217	.204	J		32.5	2267 270 160 128 110 2110 89 80 80 80 80 81	7.83		13.138	.431	
	7	\$267\$	8.29	7.125	5.009	1.018	11 Its.per							·	,
	1 8	22678 22008	6.69	# 1	5.541	.792	bundle		9 11	120 120 110 110 1100	33.75 28.27	16.000	12.444 13.090	1.778	per truck
-	13.5 15.5	1252	5.61 4.66		5.829 6.049	.648 .528	12 bundies		13.5	128	23.44	1.5	13.630	1.185	35 jts.per
7"	15.5 17	21109 21008	4.10 3.76	100	6.205 6.287	.460 .419	per truck	16*	15.3   17	211C	20.45 18.95	3:1	13.936	1.032 .941	loose load
	19	89	3,39	2 · 3	6.375	.375		1	19	1 00	17.07		14.316 14.476	.842	30 jts.per
	21 26	# 601 643	3,08 2,51	ereke des konsumentense e einem bestanske bester	6.445 6.577	.340			21 26	8633 57	15.53 12.66	and the state of t	14.476	.762 .615	strip Load
1	32.5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2.02	£.3	6.685	.220		I	26 32.5	是 51装	10.21	第.講	15.016	.492	<u> </u>
ــــــــــــــــــــــــــــــــــــــ	4	<u> </u>	L	<u> </u>			Page 1	-		*****		···			-

Dimensions - inches Nominal Approx. Min. O D I D Wall

Packaging

PSI ibs. a73.4 per ft



# **Dual Wall Fittings**

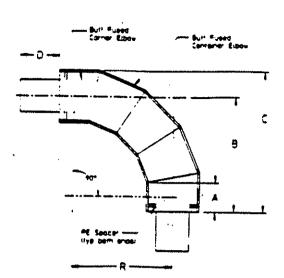
# **Dimensions**

Effective: 4-1-93

1000 series

Dual Wall 90 Degree Elis

1 .	arri Pipe		×	x Container Pipe		er	psi	psi Dimer		ons, c	(inch	es)	Wt.
 2"	SDR	11 -17	×	4"	SDR	26	120 75	6.0	21.4	24.7	6.0	18.4	13 11
3"	SDR	11 17	×	6н	SDR	26	120 75	6.0	21.4	24.7	6.0	18.4	13 11
411	SDR	11 17	x	8"	SDR	26	120 75	6.0	22.4	26.7	6.0	19.4	22 19
6#	SDR	11 17	×	10 <sup>14</sup>	SDR	26	120 75	6.0	23.5	28.8	8.0	20.5	48 40
8"	SDR	11 17	x	124	SDR	26	120 75	6.0	30.5	36.9	8.0	26.5	93 77
12"	SDR	11 17	×	16"	SDR	26	120 75	6.0	30.5	36.9	8.0	26.5	186 148



Dual Wall 45 Degree Ells

	Carrier Pipe		er	×	Container Pipe		psi	Di:	Dimensions, (inc.			es)	Wt. lbs	
	2"	SDR	11 -17	x	4#	SDR	26	120 75	6.0	21.4	24.7	6.0	18.4	13 11
	3"	SDR	11 17	x	6H	SDR	26	120 75	6.0	21.4	24.7	6.0	18.4	13 11
	4H	SDR	11 17	x	8"	SDR	26	120 75	6.0	22.4	26.7	6.0	19.4	22 19
Ī	6#	SDR	11 17	X	10"	SDR	26	120 75	6.0	23.5	28.8	8.0	20.5	48 40
	8"	SDR	11 17	x	12*	SOR	26	120 75	6.0	30.5	36.9	8.0	26.5	93 77
1	12"	SDR	11 17	X	16"	SDR	26	120 75	6.0	30.5	36.9	8.0	26.5	121 96

Suri Aused
Correr Elbov

Container pipe is SDR 26 (outside pipe). Carrier Pipe (inside pipe) psi @ 73.4° F



A subsidiary of Phillips Petroleum Co.



### O DRISCOPIPE

**Dual Wall Fittings** 

1000 series

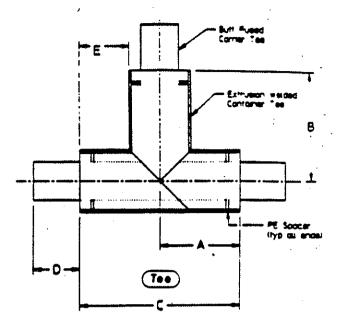
# Dimensions

Effective: 4-1-93

Dual Wall T e e s

	$\overline{}$					,						_		
		arri		L	Con	Container Pipe		psi	Di	mens i	ons,	(inch	es)	]
	<u></u>	Pipe	!	Ĺ	P			ps.	A	8	С	Ð	E	Lbs.
-	Z۳	SDR	11	×	44	SDR	26	120	6.0	21.4	24.7	6.0	18.4	7
	3*	SDR	11 17	×	6#	SDR	26	120 75	8.5	8.5	17.0	6.0	5.2	9
	4=	SDR	11 17	x	8"	SDR	26	120 75	14.0	19.5	28.0	6.0	9.7	28 24
	6*	SDR	11 17	x	10"	SDR	26	120 75	14.0	19.5	28.8	8.0	8.6	53 43
	8*	SDR	11 17	x	12"	SDR	26	120 75	15.0	19.5	30.0	8.0	8.6	83 67
	12*	SDR	11 17	x	16"	SDR	26	120 75	16.0	19.5	32.0	8.0	8.0	150 117

Container pipe (outside pipe) is SDR 26. Carrier Pipe (inside pipe) is psi @ 73.4° F.

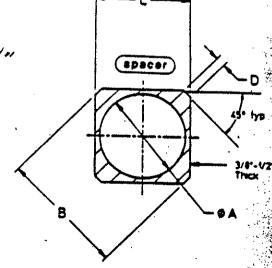


Dual Wall Spacers

NOT SHOWA: 2"×4"

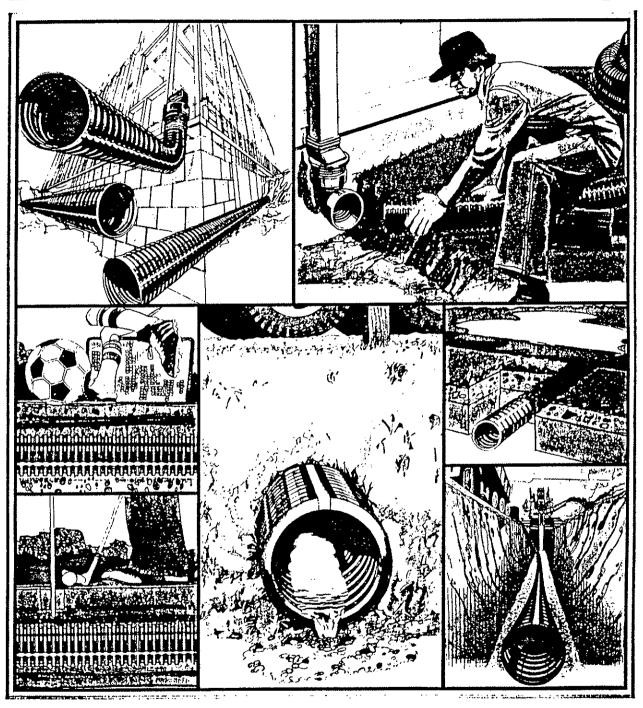
_					Dim				
_ '	Nominal Size				A	В	С	D	Lbs
3	X	6 <b>m</b>	SDR	26	3.6	6.2	4.6	0.4	1
4	×	811	SDR	26	4.6	8.0	5,9	0.4	1
6	×	10 <sup>H</sup>	SDR	26	6.8	10.1	7.5	0.5	1
8	×	12"	SDR	26	8.8	11.8	9.5	1.6	1

3	x	6H	SOR	.11	3.6	5.5	4.6	1.1	1
4	×	8"	SDR	11	4.6	7.1	5.9	1.3	1
6	x	10"	SDR	11	6.8	8.9	7.5	1.7	1
8	X	12"	SDR	11	8.8	10.5	9.5	2.9	1



Due to pipe tolerances, "B" dimensions may be slightly larger than the ID of the container pipe.

# ADS corrugated O2610/ADV BuyLine 0805 Polyethylene tubing



We'll show you dozens of reasons why it's #1 in the land.



# **Choose ADS tubing**

Corrugated polyethylene tubing from Advanced Drainage Systems, Inc. provides years of trouble-free drainage in a wide variety of applications, at a cost of just pennies per foot. Lightweight ADS tubing is available in continuous coiled lengths, or in straight lengths, and is flexible and easy to install, requiring less labor than traditional drainage materials. ADS tubing is manufactured with high density polyethylene resin, a virtually chemically inert material, so it resists corrosion and abrasion, and won't rot, rust or break down during handling.

ADS grain aeration pipe contains specially designed perforations with a durable, knitted polyester "sock" wrap to maximize air flow and prevent restriction of the perforations.

A full line of accessory fittings and couplings help simplify even the most challenging installations.

### Residential and Commercial Construction

Ideal for all homesite and commercial drainage, ADS tubing is lighter, easier to handle, and requires less time and equipment to install than PVC, clay, concrete or corrugated metal. ADS snap-on fittings and couplings keep installation time and labor to a minimum.

Exterior foundation drains are necessary for both residential and industrial buildings, below the level of the lowest floor, where high water tables and rainwater result in wet basements. These drains are placed to collect and channel water away from footers and basement walls to a suitable outlet.

**Interior foundation drains** where ground water is a problem. These drains intercept water that otherwise would gain entry through the basement walls or floor.

Downspout run-off drains using corrugated plastic pipe are used to channel water collected in the roof gutters to areas away from the building. These can be discharged into storm sewers, into the curb at the edge of the street, or into other suitable outlets.

Low-spot drainage in lawns or yards can be accomplished using surface inlets and corrugated polyethylene tubing to collect and carry the water to a storm sewer or other disposal area.

Basement window well drainage prevents rainwater from seeping down the foundation wall and entering the basement. This is accomplished by running a length of non-perforated tubing from the drain in the bottom of the well to the disposal area.

Driveway and sidewalk underdrainage is used to prevent frost damage or pavement deterioration due to unstable bases. Installation of perforated drainage tubing in a bed of gravel allows the water to drain out of the base course and be channeled away from the pavement.

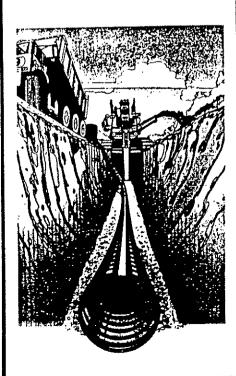
SB2 gravel-less septic system, a recent innovation, is constructed of 8" and 10" tubing encased in a spun/bonded nylon mesh material, Drain Guard protective wrap and eliminates the need for gravel. Alternately, of the most common methods for home wastewater disposal are septic tank leach fields utilizing 4" ADS tubing, which features virtual immunity to the corrosive environment found in septic tank leach fields.

### Highways and Roads

Excess water in the subbase of highway pavements is the leading cause of pavement failures; the adverse effects of inadequate drainage are evident in highways which begin to deteriorate after only two to three years. ADS corrugated polyethylene berm and underdrains collect and remove excess subbase water and reduce pavement damage. Continuous lengths require fewer littings and connections and less labor to install.







# for a variety of applications.

### Culverts

Culverts are easily drained with ADS culvert pipe; it is lighter and easier to handle and install than clay, concrete or corrugated metal, resulting in reduced labor costs. ADS culvert pipe has excellent load bearing strength, meeting the toughest requirements. It is approved by most state departments of transportation, and many county and local regulatory agencies. ADS culvert pipe is available in 10", 12", 15", 18" and 24" diameters, in 20' standard lengths.

### **Parking Lots**

The durability of ADS tubing makes it especially suitable for parking lot applications. Excellent deflection qualities enable ADS tubing to resist critical loading conditions without damage.

### Airpori Runways

Airport runways suffer from the same water-related problems as highways and roads. Whereas corrugated steel, concrete or clay pipe have been widely used in the past, corrugated polyethylene tubing has recently been approved by the Federal Aviation Administration for use as collector systems, culverts and runway underdrains.



### **Golf Courses**

Golf courses are kept lush, green and playable with ADS tubing. ADS tubing resists rot and is flexible, so it follows ground contours and adapts to underground obstacles. It's adaptable to a wide range of soil conditions, including sand traps that collect water or are subject to erosion. Proper installation is an important factor, and ADS provides detailed installation recommendations for every type of soil and topographical condition.

### Athletic/Recreational

Strong and durable ADS tubing provides year after year of reliable drainage with minimal maintenance, to keep landscapes as hardy as they are beautiful. Slope drainage is easy with ADS. In sandy or other problem soils, ADS Drain Guard keeps drains flowing. In the case of athletic fields and other places where it is desirable to use the areas as soon as possible after a downpour, the ADS drainage system provides runoff that keeps up with rainfall.

### **Utility Companies**

Public utilities and manufacturing companies have experienced problems with excess water in coal handling and storage operation. In the winter, freezing of wet coal is a problem, while during the warmer months, coal piles often must be sprayed with water to reduce coal dust and eliminate spontaneous combustion.

The ADS drainage system utilizing corrugated polyethylene tubing under the coal pile is an effective means of removing excess water. Filter protective wrap is required to prevent particles of soil or coal from entering the tubing.



### Mining

ADS tubing offers low cost of installation plus excellent performance in corrosive and abrasive environments, solving mine-related water problems. These include drainage of coal piles, hollow-fills, earth dams, dam overflows, air ducts, deep shaft mines, sedimentation ponds, and roads.

### Railroads

Poor railbed drainage often results in an unstable subbase and unsafe conditions. ADS tubing is used on new projects as well as to correct problems caused by excess water in existing railbeds. ADS performs under severe loading applications, making it ideal for railroad bed drainage.

# Grain/Commodity Aeration

ADS aeration pipe can be easily adapted to all types of grain storage facilities (temporary as well as permanent), including metal buildings, round silos and wooden bins, resulting in uniform air flow.

### Technical Notes

ADS corrugated polyethylene tubing is structurally designed to be used as culvert pipe and for other heavy duty drainage applications. This corrugated pipe may also be adapted to other drainage needs.

### Applicable Specifications and Installation Guidelines

- ASTM F 405, Standard Specification for Corrugated Polyethylene Tubing and Fittings.
- ASTM F 667, Standard Specification for Large Diameter Corrugated Polyethylene Tubing and Fittings.
   AASHTO M 252, Standard Specifi-
- AASHTO M 252, Standard Specification for Polyethylene Corrugated Drainage Tubing.
- AASHTO M 294, Standard Specification for Corrugated Polyethylene Pipe, 12" to 24" diameter.
- ADS Installation Guidelines for Culvert and Other Heavy-Duty Drainage Applications.

Look for th**e ADS** green strip**e.** 

It's your sign of quality— #1 in the land.



# Easy-to-use heavy-duty ADS fittings









Perforated Tubing



-301-300 Colls '-401-250' Colls '-501-165' Colls '-601-100' Colls '-801- 20' Langihs 10"-1001-20" Lengths 12"-1201-20" Lengths 15"-1501-20" Lengths 18"-1801-20" Lengths (301 and 401 also available in bundles of ten-10' lengths.)







Non-Perforated Tubing



31-351-3001 Coils
4*-451-250' Coils
5"-551-165" Coils
6"-651-100" Coils
8"-851-20" Lengths
10*-1051-20* Lengths
12 ~1251~20 Lengths
15"-1551-20" Lengths
18"-1851-20' Lengths
(351 and 451 also available in
bundles of ten-10' lengths )









Protective Wrap



	Sock
Drain Guard	373~300° Coil
3"~372	473-250' Coll
4"-472	573-165' Coil
5"-572	673-100' Coil
6 -672	873-20' Length
8"-872	1073-20' Length
101-1072	12"-1273-20" Length
12"-1272	15"-1573-20" Length



Internal





4"--- 465 (3×41/4)

# Reducing Coupler





### Reducing Tee (Multiple)



644-6" to 6"/6" to 5" 6" to 4"/6" to 3" 844-8" to 8"/8" to 6" 8" to 5"/8" to 4" 1044-10" to 10"/10" to 8" 10" to 6" 1244-12" to 12"/12" to 10" 12" to 8" 1544-15" to 157/15" to 12" 15" to 10"



Heavy Duty Tubing Non-Perf. Port. 8"-801 10"-1001 12"-1201 15"-1501 851-20' Lengths 1051-20' Lengths 1251-20' Lengths 1551-20' Lengths

2451-20' Lengths



90° ELL

Advanced Drainage Systems, Inc., is America's leading manufacturer of quality corrugated polyethylene pipe. Manufactured of selected polyethylene resins, ADS pipe meets the strictest product quality standards and industry specifications.

In addition, ADS manufactures a complete line of fittings and couplings, simplifying installations for highway and construction drainage applications.

From coast to coast, ADS tubing is available through the Industry's most extensive distribution network. For the name of your local distributor, contact the nearest ADS sales office.

### MIR Chatter white the descript Charman Milan, be her ale

NEW ENGLAND Ludlow, MA	1-800-733-9080	MICHIGAN Owosso, MI	1-800-733-5208
NORTHEAST Wilkes-Barre, PA	1-800-733-6564	NORTH CENTRAL Monticello, IL	1-800-733-9449
ATLANTIC COAST	T 1-800-733-6133	MIDWEST Iowa City, IA	1-800-733-3689
SOUTHEAST Longwood, FL	1-800-733-1974	NORTHWEST Washougal, WA	1-800-733-8523
MID SOUTH Brentwood, TN	1-800-733-9987	SOUTHWEST Madera, CA	1-800-733-1993
OHIO London, OH	1-800-733-9554	SOUTH CENTRAL Dallas, TX	1-800-733-8676

Insist on the ADS green stripe.

It's your sign of quality—#1  $\underline{in}$  the land.

Corporate Office 3300 Riverside Drive Columbus, Ohio 43221



# SEAMLESS BLACK STEEL PIPE

Nominal Size	0.D. Inches	Wall Inches	Weight Per Foot	I.P.S. Schedule Ho.	API-5L/A-53	A-106
5"	5.563	.375	20.78	80 XS	2,480.08	2,736.33
		.500	27.04	120	3,914.68	4,278.92
		.625	32.96	160	4,914.80	5,365.90
		.750	38.55	XX-Hvy.	5,748.82	6,276.47
图 6///	6.625	(280)	18.97		, 1,826.51	2,040.63
***		.432	28.57	80 XS	2,793.49	3,117.81
		.562	36.39	120	4,300.25	4,746.88
		.719	45.35	160	5,583.03	6,150.06
Solve the territory		.864	53.16	xxs	6,542.32	7,206.77
1.8%	8.625	322	28.55	40 Std	2,730.46	3,051,92
		.500	43.39	80 XS	4,210.62	4,701.48
		.719	60.71	120	7,464.95	8,223.10
		.875	72.42	XXS	8,903.86	9,808.14
		.906	74.69	160	9,186.56	10,119.56
後10%	<b>∮10,750</b> ®.	365	. 40,48	40 Std 🖔	3,938.11	4,396.57
		.500	54.74	60 XS	5,355.35	5,976.21
		.594	64.43	80	7,976.76	8,783.70
		.844	89.29	120	11,060.65	12,179.58
Sec. 1112		1.125	115.64	160	14,928.80	16,405.03
图12%器	12,750	375	49.56	Std.V	Atr. 4,735.59	5,293.08
		.406	53.52	40	5,167.14	5,771.16
		.500	65.42	XS	6,316.44	7,054.81
		688	88.63	80	10,779.25	11,880.56
		.844	107.32	100	13,054.23	14,387.97
		1.000	125.49	120 XXS	15,268.29	16,828.25
DV Maria (16)		1.312	160.27	160	19,501.94	21,494.47
14	14.000 &	\$375	64.57	14, 30 Std 🔉 🙊	沙5,681.52 沙州	原4果6,316.51
		.500	72.09	XS	7,677.16	8,523.62
	·	.750	106.13	80	13,538.54	14,886.01
VALUE OF THE PARTY		1.406	189.11	160	24,129.23	26,530.80
16/23	#,16.000 <u>*</u>	375	62,68	<b>数</b> do \$td 容,就	, <b>8</b> ,637.99 🔐	7,371,66
		.500	82.77	40 XS	8,616.01	9,578.91
		.656	107.50	60		14,760.83
		.844	136.61	80		18,756.62
		1.031	164.82	100		22,628.80
ALL DE STANKE	Size of the second	1.594	245.25	160		33,681.87
118"	18,000	375第	70.59	Sid Paris	a.⊭x, 7,734.89 √	8,573.62
		.438	82.15	30	9,005.57	9,982.09
		.500	93.45	XS	10,058.47	11,160.82



Tom Connor Nonheas Representative

January 30, 1995

Mr. Brian Dyer Briarwood Contracting Group 1015 Sawmill River Rd., Bldg. 5 Yonkers, NY 10710

RB: Steel Casing for Project in Bronx, NY

12 3/4" O.D. x .687 Wall beveled ends 20'-22' lengths (6 pcs.)

16" O.D. x .656 Wall beveled ends 20' length (1 pc.)

Above pipe is new domestic seamless structural grade steel pipe.

Regards,

Thomas P: Connor

Som Cornor

Northeast Representative

TPC/ja

BRECO MECHANICAL GROUP, INC. 201 Saw Mill River Road YONKERS, NEW YORK 10701  Exti	SHEET NO.  CALCULATED BY  CHECKED BY  SCALE NO Scale   (USION Weld (FUll circu	DATE DATE  DATE  DATE
Water Stop or Flang Anchor	je 4",6",0	r 8" HDPE Collections Pipe
HDPE PIPI	E ANCHORS	

JOB



# Dimensions & Pressure Ratings 1 0 0 0 Series Pipe

	T	T po.	1,,_,,_	Dimens	ions · in		Packaging
Size	SDR	PSI 973.4	Weight lbs.	Nominal OD	Approx.	Min.	per
	ļ	#,3.4	103.			Wall	truckload
	9	200	42.71	18.000	14.000	2.000	
	11	160	35.76	•	14.728	1.636	27 jts.per
1	13.5		29.69		15.334	1.333	loose load
18"	15.5	1.74	26.14		15.678	1.161	
18"	19	100	23.99	8.4	15.882	1.059	
	21	80	19.65		16.106 16.286	0.947 0.857	strip load
	26	64	16.03	**	16.616	0.692	
	32.5		12.94		16.892	0.554	
Щ.	Ц.,	I					
	1	35 a 4 a 35			<u> </u>	i	
	11	160	44.15	20.000	16.364	1.818	20 jts.per
1	13.5	128 110	36.66	•	17.038	1.481	loose load
20#		100	32.27 29.60	. •	17.420	1.290	44 15
	19	89	26.68	***	17.648 17.894	1.176	16 its.per
	21	80	24.26		18.096	0.952	strip load
	26	64	19.79	0 100 10 • 0	18.462	0.769	
	32.5	51	15.96		18.770	0.615	•
L	1						•
	44	84708	£4.0/	24 500	47.500	41	40.4
	11 13.5	160 128	51.04	21.500	17.590	1.955	18 its.per
L	15.5	110	42.38 37.30	<b>*</b> *	18.314 18.726	1.593 1.387	loose load
21.5		100	34.23		18.970	1.265	16 jts.per
	19	89	30.84		19.236	1.132	strip load
	21	80	28.05		19.452	1.024	307 TP (080
	26	64	22.88	3.3	19.846	0.827	
1 1	32.5	51	18.46	•	20.176	0.662	
L		1	J.		I		
	11	160	53.43	22.000	18.000	2 000	
1	13.5	128	44.38	3 8	18.740	2.000	
		110	39.04	•	19.162	1.419	
22"	17	100	35.83		19.412	1.294	
	19	89	32.28	I	19.684	1.158	
	21	80	29.37	****	19.904	1.048	
	26	64	23.95	3.3	20.308	0.846	16 jts.per
	32.5	518	19.32		20.646	0.677	loose load
	11	160	63.59	24.000	19.636	2.182	12 100
		128	52.81		20.444	1.778	12 jts.per strip load
	15.5	110	46.47	•	20.904	1.548	-11 ib 1000
	17	100	42.65		21.176	1.412	_
	19	89	38.41	<b>3.</b>	21.474	1.263	
	21	80	34.95		21.714	1.143	
	26	64 51	28.50		22.154	0.923	
	32.5	51	22.98	<b>8</b> ∙\$	22.524	0.738	
	13.5	128	61.97	26.000	22,148	1.926	12 jts.per
	15.5	110	54.55		22.646	1.677	loose load
	17	100	50.03	<b>#.</b> .	22.942	1.529	
		89	45.07	- 8.9 L	23.264	1.368	9 jts.per
	21	80	41.01	<b>3.</b>	23.524	1.238	strip load
]:	26 32.5	51	33.45		24.000	1.000	
	ا د.ع	\$ 218	26.98	₫•₹	24.400	0.800	. :
							•

				<u></u>			1
		PSI	Weight		ons in		Packaging
Size	SDR	273.4		Nominal OD	Approx.	Min. Wall	per truckload
	13.5		71.86		23.852	2.074	10 jts.per
	15.5	110	63.26		24.388	1.806	loose load
28"	17 19	100	58.04 52.29		24.706	1.647	
	21	8 60	47.55		25.052 25.334	1.474	
	26	64 51	38.80		25.846	1.077	strip toad
	32.5	51	31.31		26.276	0.862	
	13.5	128	82.50	30.000	35 554	7 222	
	15.5	110	72.62		25.556 26.130	1.935	9 jts.per loose load
301	17	100	66.64	1 3.3	26.470	1.765	toose toad
	19	89	60.02	1 3 • 3	26.842	1.579	9 jts.per
	21	80	54.61		27.142	1.429	strip load
	26 32.5	64 51	44.54	%	27.692	1.154	
	32.3	§   ⊃   §	35.92		28.154	0.923	
	15.5		80.04		27.432	2.032	
000	17	100	73.45	•	27.790	1.853	ì
800	1	89	66.17		28.180	1.658	
mn	21 26	80 64	60.19 49.07		28.496	1.500	
	32.5	64 51	39.59		29.074 29.558	1.211 0.969	9 jts.per
		a 2			27.330	V.707	loose load
	15.5		82.64	32.000	27.870	2.065	6 jts.per
32"	17	100	75.79	1.3	28.236		strip load
35		89 80	68.28 62.13		28.632 28.952	1.684	
	26	64	50.68		29.538	1.524	
	32.5	50 64 51	40.89		30.030	0.985	l
		****	ar ra	74 000			
	17 19	100	85.58 77.07	34.000	30.000	2.000	
34"	21	80	70.13		30.422 30.762	1.789	
			57.22	5000	31.384	1.308	6 jts.per
İ	32.5	64 51	46.14		31,908	1.046	loose load
		100	95.96	36.000	31.764	2.118	4 jts.per
		89	86.44	***	32.210		strip load
	21	80	78.61		32.572	1.714	
	26 32.5	51	64.15 51.74		33.230 33.784	1.385	
	1	* - *		10 10			
	19	89	103.36	39.370	35.226	2.072	
	21	80	94.04		35.620	1.875	
	26 32.5	80 64 51	76.69 61.85		36.342	1.514	4 its.per
	32.3	8 7 (8)	01.03	3*3	36.948	1.211	loose load
	26	64	87.27	42.000	38.770	1.615	4 jts.per
	32.5	51	70.39	\$.\$	39.416		strip load
1200			110 /8	47.244	17 (10	<del></del> l	
	32.5	51	110.45 89.11	*/.244	43.610	1.817 1.454	
	<u>_</u>	I.	L				
54#	26 32.5	64	144.30	54.000	49.846	2.077	1 joint
	36.3	§ 71≩	116.42	# · #	50.676	1.662	per trk.

For SIZEs and/or SDRs not listed, contact your Phillips Driscopipe representative.

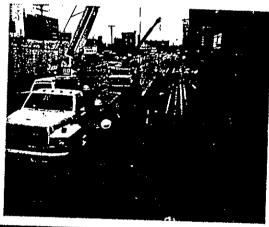
Approximate ID = Nominal CD -- (2 times Min.Wall)

SDR (Standard Dimension Ratio) = OD min. wall

Pressure rating =  $\frac{2 \text{ s}}{\text{SDR-1}}$  = 73.4 deg. F s = hydrostatic design stress (800 psi) O DRISCOPIPE.

# Engineering Characteristics







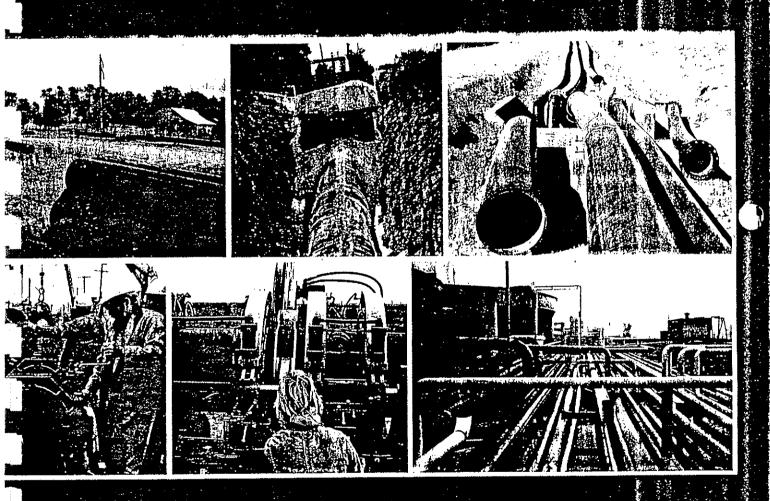








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# Driscopipe Engineering Characteristics

#### Introduction

Driscopipe high density polyethylene piping systems offer the modern engineer the opportunity to take advantage of the unusual characteristics of these materials and use them to solve many old problems and to design systems for applications where traditional materials are either unsuitable or too expensive. When compared to the older traditional piping materials, Driscopipe polyethylene piping systems offer a new freedom in environmental design, extended service life, significant savings for installation labor and equipment costs, and reduced maintenance for pipeline systems where operating conditions are within the pressure and temperature capabilities of the material.

This brochure outlines the Engineering Characteristics of Driscopipe high density polyethylene pipe and fittings and points out many of the advantages and benefits to be realized through the use of these systems. The discussion is directed primarily toward the large diameter (3" through 54") Driscopipe 8600 and Driscopipe 1000 Industrial and Municipal product lines. However, these engineering characteristics are also typical of other Driscopipe polyethylene product lines.

# **Physical Properties**

Driscopipe 8600 is manufactured from Marlex M-8000 very high molecular weight high density PE 3408 resin. Pipe and fittings made from Marlex M-8000 are extremely tough and durable, and possess exceptional long term strength. Marlex M-8000 is a proprietary product and is extruded only by Phillips Driscopipe, Inc.

Driscopipe 1000 is manufactured from Marlex TR-480, a PE 3408 polyethylene pipe resin in a molecular weight range which permits the pipe to be extruded by conventional methods. In this respect, Driscopipe 1000 is comparable to other extra high molecular weight, high density, PE 3408 polyethylene pipes commercially available in North America.

Sheets detailing typical physical properties for Driscopipe 1000 and Driscopipe 8600 are available upon request.

# Long Term Hydrostatic Strength

One of the outstanding engineering characteristics of Driscopipe high density polyethylene pipe is its long term hydrostatic strength under various thermal and environmental conditions. Life expectancy is conservatively estimated to be in excess of 50 years using the standard design basis. This strength is determined by standardized methods and procedures which the plastic pipe industry has used for many years to evaluate the long term strength of all types of plastic pipe.

Pipe hoop stress versus time to failure plots of long term hydrostatic pressure data for thermoplastic pipe have been studied and analyzed for many years. The mathematical equations used to evaluate the test data and extrapolate values to longer periods of time were chosen after careful evaluation of more than 1,000 sets of long term test data representing more than 400 plastic pipe compounds. Continued testing on new compounds and extended testing of older compounds have proven the validity of these test methods. Actual data from more than 11½ years (100,000 hours) of continuous testing shows the industry methods to be slightly conservative in that actual values are slightly higher than those calculated by the industry-accepted ASTM method.

The reduction in strength which occurs with time, as indicated by the stress-life curves, does not represent a strength degradation of the material but is more in the nature of a relaxation effect. Plastic pipe samples which have been on test for periods up to 70,000 hours have been de-pressurized and checked for permanent reduction of strength by using the quick-burst test. No loss has been found when compared to samples previously quick-burst from the same test lot.

All evidence confirms that the methods used to predict the long term strength of plastic pipe are sound methods. Through the years, these policies and procedures, used to develop recommended hydrostatic design strengths, have influenced manufacturers to research and develop improved piping products such as Driscopipe 8600 and Driscopipe 1000.

Typical calculated long term strengths are shown below:

# Long Term Strength @ 73.4°F(23°C)

Time	Hoop Stress, psi
100,000 hrs. (11.43 yrs.)	
438,000 hrs. (50 yrs.)	1635
500,000 hrs. (57 yrs.)	1604
	1601
1,000,000 hrs. (114 yrs.)	1586



The 114-year long term strength has been included to show more about the nature of the method used by the industry to evaluate the long term strength of plastic pipe and to illustrate the very slow reduction in strength as time progresses.

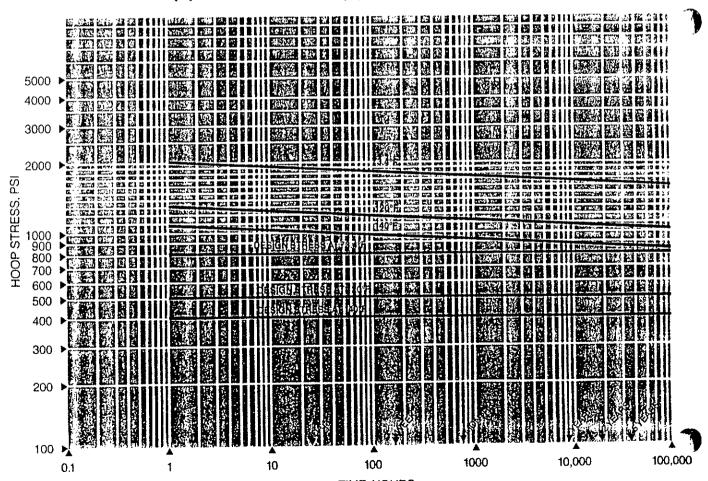
Long term hoop stresses for design purposes are normally selected at a level which is much lower than the long term strength of the materials. This ensures that the pipe is operating in a hoop stress range where creep (relaxation) of the materials is nil and assures service life in excess of 50 years. Design stress levels are discussed further in the next section.

The long term hydrostatic tests are conducted by using ASTM standard test procedures which may be applied to all types of plastic pipe (ASTM D 1598 Test for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure). Stress-life tests are conducted by using numerous pipe samples which are filled with water (or other environmental fluids) and subjected to a controlled pressure at a controlled temperature.

Samples are held on test until they fail. The pressure, temperature and time-to-failure data from all samples are used to calculate and plot stress-life curves for the particular type pipe being tested (ASTM D 2837 Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials). This data is then used to predict the probable safe life of the pipe at various stress levels (working pressures) and various temperatures. Because it is not practical to test at all temperature levels, these tests are generally conducted at temperatures such as 100°F, 120°F and 140°F.

These stress-life curves give a relationship of the expected life span of the pipe when subjected to various internal stress levels (working pressures) at various temperatures. By comparing stress-life curves, one can compare relative long term performance ability of different plastic pipes. Stress-life curves for Driscopipe 8600 and Driscopipe 1000 are shown in Figure 1.

Figure 1
Stress-Life of Driscopipe® 8600 and Driscopipe® 1000



These stress-life curves were obtained using water as the test medium. However, years of laboratory testing and field experience have shown that these same curves may be used to design Driscopipe systems for natural gas, salt water, sewage and hundreds of other industrial and municipal fluids, mixtures and effluents. The long term strength of Driscopipe indicated by these curves must be de-rated in some environmental circumstances, such as in the presence of liquid hydrocarbons or abrasive fluids, although the pipe is very suitable for use in these environments. An outstanding engineering advantage of Driscopipe is its exceptionally long term service life in the presence of internal and external corrosive service conditions.

# **Design Pressure Ratings**

Since plastic pipe was introduced in the late 50s, the safety factor for design of water systems at standard temperature has been 2 to 1. The 2:1 design factor which was officially adopted by the plastic pipe industry in 1963, was based on allowances for many sources of variation. The guiding principle has always been to make the selection on a conservative basis but not to be unreasonably conservative.

The sources of variation for which allowances are made include ... variation in test methods and procedures among laboratories ... variation among lots of the same compound ... variation of lots of pipe from the compound in different plants and from different extruders ... variation in compounds of the same general class ... variations in handling and installation techniques ... variation in operating pressures (water hammer and surge) ... a strength-time allowance to give service life well beyond 50 years ... and, finally, the great unknown. Each of the

factors was judged to reduce the 100,000 hour design strength by 5%-10% or 20% ... for a total of 100% ... or a design factor of 2:1. This is why polyethylene pipe, with a designated 100,000 hour strength of 1600 psi at 73.4°F, has a hydrostatic design strength of 800 psi hoop stress.

The design pressures for Driscopipe are determined by the following equation, adopted internationally by the industry for this purpose:

$$P = \frac{2S}{SDR - 1} \times F \quad \text{or} \quad P = 2S \frac{t}{D - t} \times F$$
Where: 
$$D = \quad \text{Specified Outside Diameter, Inches}$$

$$P = \quad Design Pressure, psi$$

$$S = \quad Long Term Hydrostatic Strength, psi, at the design temperature$$

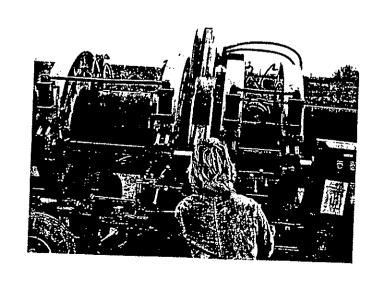
$$t = \quad \text{Minimum Wall Thickness, Inches}$$

$$F = \quad \text{Service Design Factor}$$

$$SDR = \quad \text{Standard Dimension Ratio of D/t}$$

The traditional Service Design Factor for water at standard temperature (73.4°F) is one-half (.5). The Service Design Factor for oil or liquid hydrocarbons is 0.25 @ 73°F. The service design factor may be adjusted by the design engineer to reflect the particular conditions anticipated for the application. The temperature selected for design should consider both internal and external conditions. The design temperature should be based on the temperature of the pipe itself. For practical purposes, it is safer to design to the highest temperature.

The design service factor for water may also be used for solutions of inorganic salts, alkaline fluids, non-oxidizing acids, low concentrations of oxidizing acids and many other solutions. See the discussion on chemical resistance for more information.





All standard design pressure ratings shown in Driscopipe literature are based on water at 73.4°F temperature; ie, a safety factor of 2:1 based on the long term hydrostatic strength of the material. Driscopipe is applicable at pressures from 0 to 265 psi and temperatures from below 32°F up to 180°F. Standard Dimension Ratios (SDR) are available from SDR 32.5 to SDR 7.0

#### Flow Characteristics

Driscopipe polyethylene has excellent flow characteristics as compared to traditional materials. An extremely smooth interior surface offers low resistance to flow. It maintains these excellent flow properties throughout its service life in most applications due to the inherent chemical and abrasion resistance of the material. Because of smooth walls and the non-wetting characteristic of polyethylene, higher flow capacity and less friction loss is possible with Driscopipe. In many cases this higher flow capacity may permit the use of smaller pipe at a lower cost.

A "C" factor of 155 is commonly used in the Hazen-Williams formula for calculating flow in pressure applications. For gravity flow, an "n" factor of .009 is used in Manning's formula.

Experimental test data regarding pumping and pressure drop through Driscopipe is available upon request. This study compares the flow through 8" Driscopipe with and without internal fusion beads using clear water. It also includes flow data for some clay-water slurries and clay-water-sand slurries. Velocities up to 20 fps are studied. Data includes determination of Hazen-Williams "C" factor, Reynolds number, boundry drag, relative roughness, sand grain roughness and friction loss at various velocities.

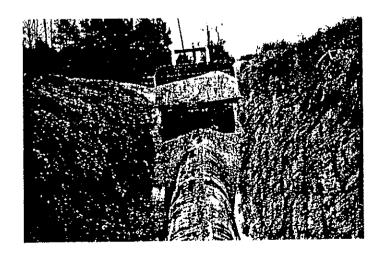
# Lightweight - Flexible

The inherent light weight and flexibility of Driscopipe provides many cost saving benefits related to handling, storage, hauling, unloading, stringing, joining and installation. Because of its light weight, Driscopipe can be moved, handled and placed in the ditch with smaller and less expensive construction equipment. Usually, manpower requirements are also reduced.

Driscopipe weighs less than water; it has a specific gravity of .955-.957. Because it will float, it can be joined in long strings and easily towed into position on job sites where water is encountered. The combination of light weight and flexibility provides opportunity to fusion join the pipe in a convenient work area and pull it into position in difficult work areas where terrain or other obstacles present installation problems. The pipe can be joined above ground and rolled or lowered into the trench thus allowing the use of smaller trench widths and eliminating the necessity of placing men and equipment inside the trench. Such installation methods can dramatically reduce the time required for installation in many instances.

The flexibility of Driscopipe allows it to be curved over, under and around obstacles and to make elevation and directional changes, thus eliminating filtings and reducing installation costs. The pipe can be cold bent as it is installed to a radius of 20-40 times the pipe diameter. This flexibility and the butt fusion joining method make Driscopipe ideally suited for inserting it inside older piping systems to renew and renovate such systems at a much lower cost than would be possible otherwise.

Pipe flexibility and toughness also allow small diameter Driscopipe to be plowed-in or pulled-in with suitable equipment.



# Toughness - "Ductile PE Pipe"

The overall "toughness" of Driscopipe is an important characteristic of the pipe which is derived from many of the chemical and physical properties of the material as well as the extrusion method. The pipe is ductile. It flexes, bends and absorbs impact loads over a wide temperature range of — 180°F up to + 180°F. This inherent resiliency and flexibility allow the pipe to absorb surge pressures, vibration and stresses caused by soil movement. Driscopipe can be deformed without permanent damage and with no adverse effect on long term service life. It is flexible for contouring to installation conditions. The toughness of Driscopipe is one of its outstanding engineering characteristics leading to innovative piping design.

Even though "toughness" has become generally recognized by the industry as a highly desirable characteristic ... there is no standard test which can be used to directly compare the "toughness" among polyethylenes ... as well as among the different plastic materials which are considered suitable for piping.

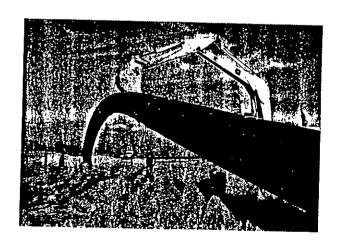
A "toughness" test has not been devised is simply because it is influenced by so many of the physical and chemical properties of the material. The extreme toughness of Driscopipe has been noted as one of its outstanding features since its introduction to the industry ... yet to explain "toughness", many properties are discussed and demonstrated. To obtain a complete evaluation of the toughness of a plastic material, it is necessary to see demonstrations

of tests and to conduct some tests in person in order to compare it with materials which are more familiar, such as cast iron, steel, cement, copper, etc.

Toughness is related to ... Environmental Stress Crack Resistance (ESCR) ... Notch sensitivity ... Resistance to secondary stresses from external loading ... Impact strength ... Tear strength ... Flexibility ... Kink resistance ... Abrasion and scratch resistance ... Flexural strength ... Elongation ... Chemical resistance ... Tensile strength ... Ductility ... Creep resistance ... Temperature resistance ... Density ... Molecular weight ... and the thermoplastic nature of the material. Part of the toughness of any polyethylene material can be attributed to its flexibility, flexural strength and impact resistance as compared to the more rigid thermoplastic materials such as PVC. Polyethylene is ductile and will elongate many times more than PVC. Consequently, it will absorb more impact without damage or failure. PE will flex or elongate and stress relieve itself rather than rupture. Generally, impact strength is greater for the higher molecular weight PE resins. Impact resistance is also important from the standpoint of a piping system being able to absorb energy imposed on it by external forces.

The expansive force of water freezing inside Driscopipe will not damage it.

ESCR is one of the properties closely related to "toughness" and has been studied as a possible means to define and measure toughness. The exceptional resistance of Driscopipe 8600 to environmental stress cracking as compared to other PE materials is discussed further in the next section.



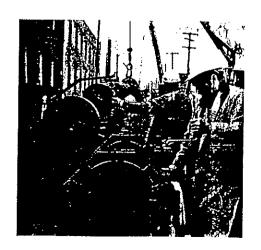


Driscopipe 8600 is unique and differs from Driscopipe 1000 and from all other polyethylene pipes. Driscopipe 8600 exhibits a superior toughness which gives the pipe the highest impact strength, highest tear strength and lowest notch sensitivity of any polyethylene pipe currently available. Driscopipe 8600 offers the highest resistance to cuts, scratches and abrasions which occur when handling and installing the pipe.

These properties are maintained throughout its temperature range without a loss of ductility or reduced resistance to notch sensitivity. Driscopipe has been successfully installed in numerous arctic applications. Some of these applications have included direct burial in the unstable arctic permafrost.

To learn more of the relative toughness of Driscopipe 8600, we encourage you to take a piece of pipe with a butt fusion joint and try to tear it up without using sharp tools. Pound it flat with a sledge hammer ... slam it against a corner of angle iron ... run over it with a truck ... then do the same with steel, copper, PVC, cast iron and the less rugged PEs. It's not very scientific ... but we believe you'll be convinced that Driscopipe 8600 has extremely high toughness. We have evaluated Driscopipe many times in laboratory and field test experiments to demonstrate and prove this toughness.

- One excellent indicator of the relative toughness of Driscopipe 8600, as compared to other polyethylene pipe materials, can be observed in the ASTM Standard Test for determination of flow rate of the thermoplastic materials.
  - When Driscopipe 8600 is heated to 190°C (374°F) to measure the flow rate, it requires 432.5 pounds/sq. in. force, applied for 10 minutes, to flow 1½ grams of 8600 material through the orifice of the test unit! Other commercially available polyethylene pipe materials will flow 10 to 20 times this amount under the same conditions.
- When Driscopipe 8600 is heated to 475-500°F to melt it for fusion joining, it requires 150 pounds pressure per square inch of material to make the melted surfaces flow together. This is another indicator of toughness. Other commercially available polyethylene pipe materials require about one-half that amount of pressure and some competitive pipes require less than 25 psi!
- Driscopipe 8600 has been pressure tested for long periods at temperatures up to 140°F and performance requirements at these high temperatures can be used in purchase specifications to assure that the user is getting the highest performing polyethylene pipe.



# **Environmental Stress Crack Resistance**

The most recent ASTM specification written to identify polyethylene plastic pipe and fittings materials is ASTM D 3350, "Polyethylene Plastics Pipe and Fittings Materials", adopted in 1974. This specification uses six (6) properties to classify PE material ... one of these is ESCR.

ASTM D 3350 lists three cell limits for ESCR classification which use the ESCR test outlined in ASTM D 1693, Test Method for Environmental Stress Cracking of Ethylene Plastics. The cell limits are:

_	Cell Classification Limit	Test Condition ASTM D 1693	Test Duration Hours	Percent of Failures Allowed	Test Temp. ℃
	1	Α	48	50	50°
	2	В	24	50	50°
-	3	С	192	20	100°

Minimum Notch for A is .020"; for B and C is .012". Minimum Thickness for A is .120"; for B and C is .070". A and B use a diluted aqueous solution reagent, C uses full strength reagent.

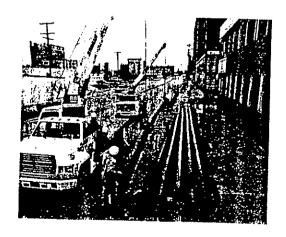
This method of testing for ESCR was first written in 1959 and was developed primarily to evaluate polyethylene as a jacketing material for power and communications cable. Although the method requires the use of laboratory compression molded specimens rather than pipe, it became the generally accepted method for evaluating ESCR of PE materials used for piping. Its wide use was responsible for its inclusion in ASTM D 3550 to describe one of the six primary properties of a PE pipe material.

The test method, ASTM D-1693, is an accelerated lest method to determine the resistance of a polyethylene material to environmental stress cracking. It is a measure of the ability of the polyethylene to withstand secondary stress loadings. These loadings are typically thought of as low-level, long-term, external stresses which may act upon the polyethylene pipe in field installations.

Under conditions of the test, high local multiaxial stresses are developed through the introduction of a controlled imperfection (notch). The notched sample is subjected to an elevated temperature bath of a surface active agent. Environmental stress cracking has been found to occur most readily under such conditions.

A note in the test specifications states that, generally, low density (Type I) polyethylenes are tested under Condition A, medium and high density (Type II and Type III) polyethylenes are generally tested under Condition B and high density resins with high melt viscosity, such as pipe grade P34, are tested under Condition C.

As pipe grade polyethylenes have improved, the testing requirements of ASTM D-1693 have become less stringent for P34 pipe grade polyethylenes such as Driscopipe 8600 and Driscopipe 1000. As a result, a more severe stress crack resistance test has been developed to evaluate high density polyethylene pipe. The ASTM F-1248 stress crack resistance test method was developed by a gas distribution company for quality control purposes and is often referred to as Ring ESCR since it tests actual produced pipe ring samples rather than molded specimens.





ASTM F-1248 utilizes rings cut from a pipe sample. The rings are notched on one side and compressed between parallel plates until the distance between the plates is three times the specified pipe minimum wall thickness. The compressed ring samples are subjected to an elevated temperature bath of a surface active agent and visibly inspected for crack formation or propagation.

The Ring ESCR test provides useful information regarding the different polyethylene pipe grade materials. Driscopipe 8600 shows no tendency for sample failures when tested in excess of 10,000 hours. This further reinforces the unique ability of Driscopipe 8600 to provide the highest degree of resistance to the external stresses inherent to a pipeline installation.

Driscopipe 1000, an extra high molecular weight HDPE pipe, will exhibit a ring ESCR of  $F_{50}$ > 1000 hours. Other lower molecular weight pipes may exhibit lower  $F_{50}$  values.

# **Chemical Corrosion Resistance**

The outstanding resistance of Driscopipe to attack by most chemicals makes it suitable to transport these chemicals or to be installed in an environment where these chemicals are present. Factors which determine the suitability and service life of each particular application include the specific chemical and its concentration, pressure, temperature, period of contact and service conditions which may introduce stress concentrations in the pipe or fittings.

Driscopipe is, for all practical purposes, chemically inert within its temperature use range. This advantageous engineering characteristic is one of the primary reasons for the wide use of Driscopipe in industrial applications. It does not rot, rust, pit, corrode or lose wall thickness through chemical or electrical reaction with the surrounding soil, whether acid, alkaline, wet or dry. It neither supports the growth of, nor is affected by, algae, bacteria or fungi and is resistant to marine biological attack. It contains no ingredients which make it attractive to rodents, gophers, etc.

Information relative to the resistance of Driscopipe to a wide range of chemicals is shown in the following tables. This information is based on results of immersion tests (usually 3 months) at various temperatures. Changes in tensile strength and elongation are evaluated at a rapid strain rate to emphasize any strength decay in the material.

Most acids, bases and other chemicals can be transported by Driscopipe using the same design parameters as would apply to water, natural or manufactured gas and water solutions of inorganic salts. Strong oxidizing agents such as furning sulfuric acid may adversely affect the pipe, depending upon concentration, temperature and period of contact. In many cases, such as gravity flow waste lines, these chemicals can be handled because of dilution and intermittent flow.

Some chemicals, such as all types of liquid hydrocarbons, will mechanically absorb into the wall of the pipe and cause a reduction in hoop stress but this does not degrade the material. This effect is temporary if exposure is intermittent. Where exposure is continuous, it is necessary to derate the pressure capability of the pipe for long term service. This includes such products as gasoline, ethyl alcohol, benzene, carbon tetrachloride, crude and refined oils, etc. Where 5-100% hydrocarbon liquids are continuously present in a pressure system, a service design factor of .25 should be used to calculate design pressures instead of the service design factor of .5 used with water.

$$P = \frac{2S}{SDR - 1} \times F \quad \text{or} \quad P = 2S \frac{t}{D - t} \times F$$
 Where: 
$$D = \quad \text{Outside Diameter, Inches}$$
 
$$P = \quad \text{Design Pressure, psi}$$
 
$$S = \quad \text{Long Term Hydrostatic Strength,}$$
 
$$psi, \text{ at the design temperature}$$
 
$$t = \quad \text{Minimum Wall Thickness, Inches}$$
 
$$F = \quad \text{Service Design Factor}$$
 
$$SDR = \quad \text{Standard Dimension Ratio of D/t}$$



# CHEMICAL RESISTANCE OF DRISCOPIPE

Reagent

Boric Acid Conc.

Bromic Acid 10%

Butanediol 10%

Bromine Liquid 100%

S-Satisfactory U - Unsatisfactory M - Marginal

N - Not known

All concentrations are 100% unless noted otherwise.

Hoted officiwise.			Butanediol 10%	S	S	Dimethylamine	M	Ü
On reagents marked ma	ırdinəl		Butanediol 60%	S	S	Emulsions, Photographic	S	s
chemical attack will be re	ecoani:	red by	Bulanediol 100%	S	S	Ethyl Acetate 100%	м	
a loss of physical proper	ties of t	he pine	Butyl Alcohol 100%	S	s	Ethyl Alcohol 100%	S	U S
which may require a cha	nae in i	desian	Calcium Bisulfide	S	S	Ethyl Alcohol 35%	S	S
factors.	<b>3</b>		Calcium Carbonate Satid	S	S	Ethyl Butyrate	M	U
			Calcium Chlorate Satd	S	S	Ethyl Chloride	M	U
			Calcium Chloride Satd	s	s	Ethyl Ether		•
	70°F	140°F	Calcium Hydroxide	S	s	Ethylene Chloride	U	U
Reagent	(21°C)	(60°C)	Calcium Hypochlorite BL'GH Sc	ol. S	S	Ethylene Chlorohydrin	U	U
	()	(00 0)	Calcium Nitrate 50%	S	S	Ethylene Dichloride	U	U
Acetic Acid 1-10%	S	s	Calcium Sulfate	s	s	Ethylene Glycol	M	U
Acetic Acid 10-60%	s	М	Camphor Oil	N	U		S	S
Acetic Acid 80-100%	s	M	Carbon Dioxide 100% Dry	S	S	Ferric Chloride Satd	S	S
Acetone	М	Ü	Carbon Dioxide 100% Wet	S	\$ \$	Ferric Nitrate Satd	S	S
Acrylic Emulsions	S	Š	Carbon Dioxide Cold Satd	S	S	Ferrous Chloride Satd	S	S
Aluminum Chloride-Dilute			Carbon Disulfide	N	S U	Ferrous Sulfate	S	S
Aluminum Chloride Conc.	S	S				Fish Solubles	S	S
Aluminum Fluoride Conc.	S	S	Carbon Monoxide	S	S	Fluoboric Acid	s	s
Aluminum Sulfate Conc.	S	S	Carbon Tetrachioride	М	ป	Fluorine	s	U
Alums (All Types) Conc.	S	S	Carbonic Acid Castor Oil Conc.	S	S	Fluosilicic Acid 32%	s	s
	S	S		S	S	Fluosilicic Acid Conc.	s	S
Ammonia 100% Dry Gas	S	S	Chlorine Dry Gas 100%	S	М	Formaldehyde 40%	s	N
Ammonium Carbonate	S	S	Chlorine Moist Gas	M	U	Formic Acid 0-20%	s	s
Ammonium Chloride Satd	S	S	Chlorine Liquid	M	U	Formic Acid 20-50%,	S	S
Ammonium Fluoride 20%	S	S	Chlorobenzene	М	U	Formic Acid 100%	S	S
Ammonium Hydroxide 0.88 S.G	s. S	S	Chloroform	М	U	Fructose Sat'd	S	S
Ammonium Metaphosphate Sai	rd S	S	Chlorosulfonic Acid 100%	М	U	Fruit Pulp	S	S
Ammonium Nitrate Sat'd	S	S	Chrome Alum Sat'd	S	s	Fuel Oil		_
Ammonium Persulfate Sal'd	S	S	Chromic Acid 20%	S	S	Furtural 100%	S	U
Ammonium Sulfate Sat'd	S	S	Chromic Acid Up to 50%	S	S	Furfuryl Alcohol	М	U
Ammonium Sulfide Sat'd	S	S	Chromic Acid and Sulfuric Acid	S	М	Gallic Acid Satid	M	U
Ammonium Thiocyanate Sat'd	S	S	Cider	S	s	Gas Liquids*	S	S
Amyl Acetate	М	U	Citric Acid Satd	_		•	S	М
Amyi Alcohol 100%	S	S	Coconut Oil Alcohols	S	S	Gasoline*	M	U
Amyl Chloride 100%	N	U	Cola Concentrates	S	S	Gin	S	U
Aniline 100%	S	N	Copper Chloride Satd	S	S	Glucose	S	S
Antimony Chloride			O	s s	S	Glycerine	S	S
Aqua Regia	S	S	0		S	Glyco!	S	S
Barium Carbonate Sattl	U	U	^	S	S	Glycolic Acid 30%	S	S
Barium Chloride	S	S	_	S	S	Grape Sugar Sat'd Aq.	S	S
Barium Hydroxide	S	S	0. 0.4.	S	S	Hexanol, Tert.	S	S
	S	S	A. n	S	S	Hydrobromic Acid 50%	S	S
Barium Sulfate Sat'd	S	S		S	S	Hydrocyanic Acid Sattl	S	S
Barium Sulfide Sal'd	S	S		S	M	Hydrochloric Acid 10%	s	s
Beer	s	S		S	S	Hydrochloric Acid 30%	s	S
Benzene	М	U		S	S	Hydrochloric Acid 35%	S	S
Benzene Sulfonic Acid	S	S	Maria de la compansión de	VI	U	Hydrochloric Acid Conc.	s	S
Bismuth Carbonate Sat'd	S	S		S	S	Hydrofluoric Acid 40%	S	S
Bleach Lye 10%	s	S	Developers, Photographic	\$	S	Hydrofluoric Acid 60%	s	
Black Liquor	S	s	Dextrin Sat'd		S	Hydrofluoric Acid 75%	S	S
Borax Cold Satid	S	S	Dextrose Satid		S	Hydrogen 100%	S	S S
Boric Acid Dilute	S	s	Dibutylphthalate 5		М	Hydrogen Bromide 10%	s S	S
			Disodium Phosphate 5	3	S	Hydrogen Chloride Gas Dry	S	S
						, 0	J	J

70°F 140°F

(21°C) (60°C)

s

S

U

S

S

М

S

Reagent

Diazo Salts

Diethylene Glycol

Diglycolic Acid

70°F 140°F

(21°C) (60°C)

S

S

s

S

S

S

<sup>\*</sup>HDPE Resin Service Design Factor for hydrocarbons per the formula on page 3 and 8 is F = 0.25to compensate for hydrocarbon saturation effects on long term hydrostatic strength.



continued from page 9

# CHEMICAL RESISTANCE OF DRISCOPIPE

Reagent	70°F (21°C)	140°F (60°C)	Reagent	70°F (21°C)	140°F (60°C)	Reagent	70°F (21°C)	140°F (60°C)	
Hydrogen Peroxide 30%	s	S	Phosphorous (Yellow) 100%	s	N	Sodium Bicarbonate Sat'd	S	s	
Hydrogen Peroxide 90%	S	M	Phosphorus Pentoxide 100%	S	N	Sodium Bisulfate Sat'd	S	S	
Hydrogen Phosphide 100%	s	S	Photographic Solutions	S	S	Sodium Bisultite Satd	S	S	
Hydroquinone	s	S	Pickling Baths			Sodium Borate	S	S	
Hydrogen Sullide	s	S	Sulfuric Acid	S	S	Sodium Bromide Dilute Sol.	S	S	
Hypochlorus Acid Conc.	s	5	Hydrochloric Acid	s	S	Sodium Carbonate Con.	S	S	
Inks	S	S	Sulfuric-Nitric	S	U	Sodium Carbonate	S	S	
lodine (Alc. Sol.) Conc.	S	Ü	Plating Solutions			Sodium Chlorate Sat'd.	S	S	
Lactic Acid 10%	s	S	Brass	s	S	Sodium Chloride Sat'd	S	S	
Lactic Acid 90%	s	5	Cadmium	s	S	Sodium Cyanide	s	S	
Latex	S	S	Chromium	N	N	Sodium Dichromate Sat'd	S	S	
Lead Acetate Satid	š	s	Copper	S	\$	Sodium Ferricyanide	S	S	
Lube Oil*	S	M	Gold	s	s	Sodium Ferrocyanide Salid	S	s	
Magnesium Carbonate Satid	S	S	Indium	s	S	Sodium Fluoride Sat'd	s	s	
Magnesium Chloride Satd	S	S	Lead	S	S	Sodium Hydroxide Conc.	Š	S	
<del>-</del>			Nickel	s	s	Sodium Hypochlorite	S	S	
Magnesium Hydroxide Sat'd	S	S	Rhodium	S	s	Sodium Nitrate	S	S	
Magnesium Nitrate Satd	S	S	Silver	s	S	Sodium Sulfate	S	· S	
Magnesium Sulfate Sat'd	S	S	Tin	S	S	Sodium Sullide 25%	S	S	
Mercuric Chloride Sat'd Mercuric Cyanide Sat'd	S S	S S	Zinc	S	S	Sodium Sulfide Satid Sol.	S	S	
•	_		Potassium Bicarbonate Sat'd	s	s	Sodium Sulfite Satid			
Mercurous Nitrate Satd	S	S	Potassium Borate 1%	S	S	Stannous Chloride Satd	S	S	
Mercury	S	S	Potassium Bromate 10%				S	S	
Methyl Alcohol 100%	S	S		S	S	Stannic Chloride Satd	S	S	
Methyl Bromide	М	U	Potassium Bromide Satd	S	S	Starch Solution Sat'd	S	S	
Methyl Chloride	М	U	Potassium Carbonate	S	S	Stearic Acid 100%	S	s	
Methyl Ethyl Kelone 100%	М	U	Potassium Chlorate Sat'd	S	S	Sulfuric Acid 0-50%	S	S	
Methylsulfuric Acid	S	S	Potassium Chloride Sat'd	S	S	Sulfuric Acid 70%	S	М	
Methylene Chloride 100%	М	U	Potassium Chromate 40%	S	S	Sulfuric Acid 80%	S	U	
Milk	S	S	Potassium Cyanide Sat'd	S	S	Sulfuric Acid 96%	М	U	
Mineral Oils	S	U	Potassium Dichromate 40%	S	S	Sulfuric Acid 98%	М	U	
Molasses Comm.	s	S	Potassium Ferri/			Sulfuric Acid, Furning	U	U	
Nickel Chloride Sat'd	S	S	Ferro Cyanide Satd	S	S	Sulfurous Acid	S	S	
Nickel Nitrate Conc.	s	S	Potassium Fluoride	S	S	Tallow*	S	M	
Nickel Sulfate Sat'd	S	S	Potassium Hydroxide 20%	S	S	Tannic Acid 10%	S	S	
Nicotine Dilute	S	S	Potassium Hydroxide Conc.	S	S	Tanning Extracts Comm.	S	s	
Nicotinic Acid	s	S	Potassium Nitrate Sat'd	s	S	Tartaric Acid Sat'd	N	N	
Nitric Acid 0-30%	S	s	Potassium Perborate Sat'd	S	S	Tetrahydrofurane	N	U	
Nitric Acid 30-50%	s	M	Potassium Perchlorate 10%	S	S	Titanium Tetrachloride Satd	N	U	
Nitric Acid 70%	s	M	Potassium Sulfate Conc.	S	S	Toluene	М	U	
Nitric Acid 95-98%	ū	U	Potassium Sulfide Conc.	S	S	Transformer Oil	s	М	
Nitrobenzene 100%	U	U	Potassium Sulfite Conc.	s	S	Trisodium Phosphate Sat'd	s	s	
Octyl Cresol	S	U	Potassium Persulfate Sattl	s	S	Trichloroethylene	U	Ü	
Oils and Fats*	S	M	Propargyl Alcohol	s	S	Urea Up to 30%	s	s	
Olleic Acid Conc.	S	U	Propyl Alcohol	s	S	Urine	s	s	
Oleum Conc.	บ	U .	Propylene Dichloride 100%	U	U	Vinegar Comm.	s	Š	
	_		Propylene Glycol	s	s	Vanilla Extract	s	s	
Orange Extract	S	S	Rayon Coagulating Bath	S	Š	Wetting Agents	S	S	
Oxalic Acid Dilute	S	S	Sea Water	S	S	Whiskey	s	N	
Oxalic Acid Sat'd	S	S	Selenic Acid	S	S	Wines	S	S	
Dzone 100%	S	U	Shortening	S	S	Xylene	M	U	
Perchloric Acid 10%	S	S	•			•			
Petroleum Ether	U	U	Silicic Acid	S	S	Yeast	S	S	_
	U	U	Silver Nitrate Sol.	S	S	Zinc Chloride Satd	S	S	7
Phenol 90%			On an Onlinking A One of	_	_	The Called Carlot			
Phosphoric Acid Up to 30%	S	S	Soap Solution Any Conc'n	S	S	Zinc Sulfate Sat'd	S	S	
			Soap Solution Any Conc'n Sodium Acetate Sat'd Sodium Benzoate 35%	\$ \$ \$	S S S	Zinc Sulfate Sat'd	S	S	*

#### Temperature Characteristics

Since polyethylene is a thermoplastic material, many of its physical and chemical properties are dependent on temperature and will change as the temperature of the material is increased or decreased. However, the exposure of Driscopipe to temperature variations within the recommended operating range does not result in degradation of the material. As these temperature changes are reversed, the material properties also reverse to their original values.

You will note from the information on physical properties that Driscopipe has a brittleness temperature below — 180°F and a softening temperature of +257°F. The recommended operating temperature is limited only on the higher temperature side to a range of 140-180°F, dependent upon the pressure of the application and other operating and installation considerations. On the lower temperature side, Driscopipe gains strength without becoming brittle and is ideal for use at sub-zero temperatures.

Driscopipe becomes molten at 400-500°F and temperatures in this range are used to fusion join the piping system. Pipe is extruded at about the same temperature. To protect the material against degradation at the higher temperature, it is chemically stabilized. This stabilizer protects the 'I material against thermal degradation which might otherwise occur during manufacture, outside storage and installation.

Driscopipe has been tested for thousands of hours at elevated temperatures of 140°F and 180°F without thermal degradation. These long term pressure tests at the higher temperatures are used to obtain recommended design strengths for the pipe at these temperatures.

Since all thermoplastic piping materials are affected by temperature, it is a general practice to characterize these materials at ambient temperature of 23°C (73.4°F). Nearly all ASTM tests relating to physical, mechanical and chemical properties of thermoplastic materials are conducted at this temperature. If a test is conducted, or a property defined, at other than 73.4°F, it is always noted.

One example of the effect of temperature on Driscopipe is the change in long term strength of the material as shown on the stress-life curves. This type behavior is true for all thermoplastics but there are large differences between the performance of specific materials at the higher temperatures.

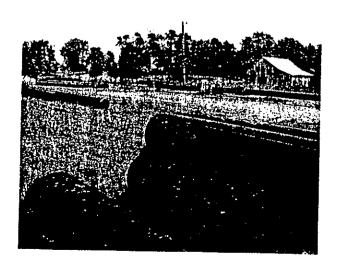
Knowledge of the long term strength of Driscopipe at the various temperatures allows selective design of a system. Accurate interpolations can be made for other temperatures between those which are known when data at three or more temperature levels is available.

Other properties of thermoplastic pipe which change with temperature and can affect system design and installation procedures include the following.

Burst strength – Short term (1 minute) burst tests on Driscopipe at various temperatures show these typical hoop stress values:

Temperature, °F	Hoop Stress, psi
73.4°	3250
32°	4300
0°	5290
20°	5670
<u>-40°</u>	6385

Driscopipe will quick-burst at a pressure approximately four times greater than the rated operating pressure.





Chemical Resistance — The ability of most thermoplastics to resist degradation in the presence of corrosive chemicals is reduced as temperature increases. This is also true for Driscopipe but to a lesser extent because of its high density and high molecular weight. The effect of temperature on Driscopipe in the presence of various chemicals is shown in the chemical resistance tables.

Flexibility – As temperature is decreased, the flexibility of Driscopipe is also decreased. This has very little effect on installation except that at the lower winter temperatures, coiled pipe becomes more difficult, mechanically, to uncoil and stretch out in the ditch. Although Driscopipe becomes stiffer at low temperature, it can be bent, uncoiled or plowed in with sufficient mechanical power and no damage will occur to the pipe because of bending it at cold temperatures.

Other Physical Properties – There is a slight change with temperature of impact strength, notch sensitivity, flexural modulus, hardness and elongation ... but none are of such extent as to affect design parameters or installation procedures over the normal range of temperatures.

Modulus of Elasticity – Typical values for the variance in modulus of elasticity with temperature change is shown below.

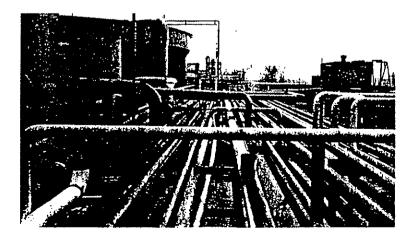
Temperature °F	Modulus of Elasticity, psi
-20°	309,000
0°	260,000
32°	200,000
75°	130,000
100°	105,000
140°	60,000

Thermal Expansion and Contraction — Polyethylene, like other thermoplastics, has a coefficient of expansion higher than metals. This coefficient is usually determined by a standard test method which employs the use of molded specimens. Measurements are made with a quartz dilatometer while the test specimen is held at elevated temperature. Typical coefficient values by this method range from .75  $\times$  10<sup>-4</sup> for Driscopipe 8600 to .83  $\times$  10<sup>-4</sup> for Driscopipe 1000.

The coefficient of linear expansion may also be determined by measuring the change in length of unrestrained pipe samples at different temperatures. The calculated coefficient is somewhat higher on extruded pipe than on molded test specimens. This appears to be true for all polyethylene pipe. The average coefficient calculated from measurements made on Driscopipe in the temperature range 0°F to 140°F, is  $1.2 \times 10^{-4}$  in/in/°F.

The circumferential coefficient of expansion and contraction for Driscopipe is approximately .6 × 10<sup>-4</sup> in/in/°F in the range of 0° to 140°F ... or about ½ the linear coefficient. This circumferential change with temperature rarely presents any problems in system design. There may be need to consider this factor if compression fittings are used.

The expansion or contraction for Driscopipe can be stated in an easy rule of thumb ... the pipe will expand or contract approximately 1.4" per 100 feet for each 10°F change in temperature. Thus a 1000 foot unrestrained line which undergoes a 20°F increase in temperature change will increase in length 28 inches. The relatively large amount of expansion and contraction of plastic pipe generally presents no real problems in installation. The pipe has a relatively low elastic modulus and consequently there is less stress build-up. These stresses, caused by temperature change, are easily dissipated due to the thermoplastic nature of the material which relaxes and adjusts with time.



Tests have been conducted wherein the temperature of more than 100 feet of unrestrained pipe was changed 130°F in a period of a few minutes. The total force created by contraction was measured and proved to be about (½) one-half the theoretical calculated value. Thermoplastic materials are unique in their ability to stress-relieve themselves. Actual changes in temperature in most applications take place slowly over an extended period of time. The total stresses imposed will vary but are generally much lower than the calculated values.

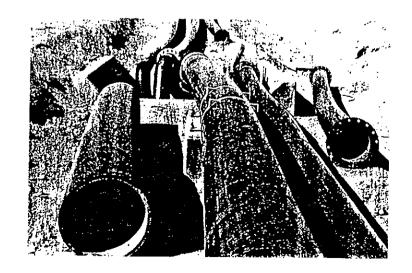
Direct buried pipe will generally have ample soil friction and interference to restrain movement of the pipe under normal application temperature changes. It is a good idea to make the final tie-ins on a system at a temperature which is as close to operating temperature as possible. This is particularly true for insert liner systems where there is no soil restraint.

Normal good direct burial installation practices which include snaking the pipe in the ditch, proper backfill and compaction, making the tie-in at the proper temperature, etc. should be used at all times and will substantially reduce the possibility of pull out at tie-in connections on such installations. However, planning the transition tie-in becomes more important when Driscopipe is used for insert renewal inside another pipe because there is no restraint from earth loading. Any contraction of the pipe due to reduction in temperature is freely transmitted to the transition connection and may result in pull-out if proper design

precautions are not taken. In those cases, it may be necessary to provide additional anchoring at the terminations of the insert liner. Concrete anchors poured into undisturbed soil and cast around anchor projections in the Driscopipe line will restrict movement at the end of the line. Anchor projections on the Driscopipe liner can be made by fusing a blind tee into the line or by the use of two reducers, to the next larger size of pipe, fused together in the line.

Thermal Conductivity – This property of Driscopine is lower than that for metals and can sometimes be exploited in the design of the system. It may eliminate or reduce the need for insulating pipe which carries water or other fluids through freezing temperatures. Thermal Conductivity of Driscopipe is 2.7 BTU per hour per sq. ft. per °F per inch of thickness. The slow heat transfer inhibits freezing and, if normal burial precautions are used, accidental freezing is usually eliminated. If the pipe does freeze, it does not fracture but fluid flow will be stopped. It will resume its function upon thawing. Direct application of intense heat should not be used to thaw a line. Antifreeze compounds such as methanol, isoproponol and ethylene glycol can be used without detrimental effect on the pipe.

Ignition Temperatures – The flash point for high density polyethylene using the Cleveland open cup method (ASTM D92) is 430°F. The flash ignition and self ignition temperatures using ASTM D1929 are 645°F and 660°F.





#### Weatherability

Two principal factors influence the weathering of plastic pipe in outside above ground applications ... temperature changes caused by seasonal variations and solar heating and solar radiation of ultraviolet rays. Effects of temperature variations on Driscopipe were discussed in the preceding section. Expansion and contraction of a line above ground, due to differential heating, will cause the line to move laterally, particularly if it is empty. This movement can easily be controlled within desired limits through the use of restraints.

Driscopipe is also protected against degradation caused by ultraviolet rays when exposed to direct sunlight. The material contains 2½% of finely divided carbon black which also accounts for the black color of Driscopipe. Carbon black is the most effective single additive capable of enhancing the weathering characteristic of plastic materials. The protection even relatively low levels of carbon black impart to the plastic is so great that it is not necessary to use other light stabilizers or UV absorbers.

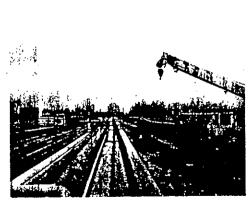
Weatherability tests indicate that Driscopipe can be safely used outside in most climates for periods of many years without danger of loss of physical properties due to UV exposure. Phillips has done extensive testing of polyethylene compounds containing 2 to 3% carbon black and compared these to other UV stabilizers to determine their effectiveness for protection against UV degradation in outdoor exposure. Samples were aged in outdoor exposure in three geographical locations: Phoenix,

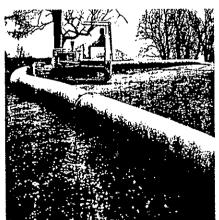
Arizona, Bartlesville, Oklahoma (Phillips 66 headquarters) and Akron, Ohio. From these actual tests, it was determined that one year exposure in Arizona was equivalent to at least two years in Bartlesville and greater than three and one-half years in Akron.

Weather-Ometer tests were run under standard conditions as set out in ASTM D 1499-64 and compared with the actual test samples in the three locations described above. From this test work, it was determined, conservatively, that 5000 hours (approximately 7 months) in the Weather-Ometer compares to greater than 42 months exposure in Arizona. Samples containing 2 to 3% carbon black and thermal stabilizers as used in Driscopipe have been tested for greater than 25,000 hours (2.85 years) in the Weather-Ometer without any brittleness or loss of physical properties. This is equivalent to over 17 years in Arizona and over 60 years in Akron, Ohio.

## Permeability

The permeability of gases, vapors or liquids through a plastic membrane is generally considered to be an activated diffusion process. That is, the gas, vapor or liquid dissolves in the membrane and then diffuses to a position of lower concentration. The permeation rate is determined by the functional groups of the permeating molecules and by the density of the plastic ... the higher the density, the lower the permeability. Listed below are typical permeability rates for HDPE.





Gas	Permeability Rate*
Carbon Dioxide	345
Hydrogen	321
Oxygen	111
Helium	247
Ethane	236
Natural Gas	113
Freon 12	95
Nitrogen	53

\*Cubic centimeters per day per 100 sq. inches per mil thickness at atmospheric pressure differential.

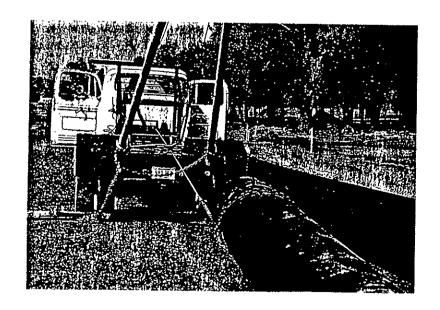
These permeation rates are considered very low. They result in negligible loss of product and create no hazard. For example, polyethylene piping systems are the predominant material used to construct new gas distribution systems and to renew old deteriorated systems. The permeation rate will vary in direct proportion to the differential pressure applied.

If the internal operating pressure is 60 psi, for example, the permeability rate would be approximately 4 times that shown above but volume losses would still be extremely low. Calculated volume loss in one mile of SDR 11 pipe (any size) in one day, for natural gas, would be ½ of one cubic foot. At 120 psi, it would be ½ cubic foot per day.

#### **Abrasion Resistance**

One of the many outstanding characteristics of Driscopipe polyethylene is its resistance to abrasion. The inherent resilience and toughness of Driscopipe allows the mining industry to use this pipe in numerous surface applications where more conventional materials would be unsatisfactory, either because of the terrain encountered or the abrasiveness of the slurry to be moved. Quite often, a Driscopipe system offers substantial economic advantage as a means of transport over more conventional transportation methods used in the mining industry. Some of the more common applications include tailings lines and the transport of gypsum, limestone, sand, slimes and coal.

Due to its unique toughness, as indicated by low melt flow values, Driscopipe 8600 provides improved abrasion resistance over all other polyethylene piping materials. Controlled pipe loop pumping tests have demonstrated that Driscopipe can outlast steel pipe by as much as 4 to 1. One such test, performed by Williams Brothers Engineering, Tulsa, Oklahoma, compared Driscopipe to steel in pumping a coarse particle size magnetite iron ore slurry. At 13½ tl/sec velocity, Driscopipe was better by a factor of 4:1 and at 17 ft/sec by a factor of 3:1.





#### **Heat Fusion Joining**

The heat fusion joining technique has a long history of use for joining polyethylene pipe materials. The heat fusion method of joining PE pipe began shortly after the first commercial production of high density polyethylene in the early 1950s ... both developed by Phillips 66.

The integrity and superiority of heat fusion are now recognized universally. The modern day heat fusion ioint is the same joint made in 1956 ... only the fusion equipment has evolved to gain efficiency, reliability and convenience. The principles learned on early equipment for making a successful joint are still in use today. Phillips designed, developed and built many models of heat fusion equipment from 1956 until the early 1970s. Since that time, Phillips has guided this development by others. The extensive line of high quality, efficient fusion equipment offered by McElrov Manufacturing, Inc., Tulsa, Oklahoma is one of the results of this long history of development. Phillips pioneered the idea and development of heat fusion and has used it exclusively in every high density polyethylene piping system sold by Phillips since 1956. There are millions of these joints in service today. In fact, 92% of all natural gas distribution pipe to homes, farms and factories is installed with polyethylene pipe and fittings. Heat fusion joints are industry accepted and field proven.

The heat fusion joining system has been so successful that it is the "standard" joining system for polyethylene. There are many reasons ... here are some.

Heat fusion joining ideally meets the requirements for a fast joining method to facilitate all phases of construction work in a safe and reliable manner.

The heat fusion joint is structurally superior to the socket fusion joint by configuration and, therefore, better meets the requirements of service. The heat joint configuration allows it to better disperse stresses initiated by pipe deflection and external loading. Stress concentration is minimized when the joint is placed in a strain and the joint is more "forgiving" when ground settlement occurs. In a socket joint, there is an extremely high ratio of "joint wall" to "pipe wall", resulting in stress intensification from external loading.

The Driscopipe heat fusion joining system is a simple, visual procedure with straight forward instructions. No "timing cycles" are necessary. The visual procedure allows the operator to concentrate on his work rather than a clock. Visually, he knows when the pipe ends have melled to the degree required to fuse them together. Visually, he observes and controls fusion pressure by observing the amount and configuration of the fusion bead as it is formed.

In the course of this work, the fusion operator is faced with a wide variety of job conditions. Changes in air temperature, material temperature, wind velocity, sun exposure, humidity, as well as condition of the terrain and the equipment all influence the joining requirements. Quality work under field conditions is more consistent with a simple, straight-forward, visual procedure.



One heat fusion operator, with equipment, typically does the whole operation himself, sometimes using a second person as a helper. Pipe tolerances, ovality and curvature are no problem and "melt" is easily controlled by the visual procedure.

Heat fusion joints offer a large advantage over socket coupled joints for plow-in installation and for insert renewal applications. Socket coupled pipe requires larger size plow chutes and bore holes. Heat fused pipe one size larger can usually be handled and installed through bore holes and plow chutes selected for socket coupled pipe. Larger sizes of heat fused pipe can be used inside old mains for insert renewal because it does not require the extra space for the coupling.

Heat fusion joints may easily be cut out and re-done. This fact has a bearing on the quantity and quality of training necessary and favorably affects operator attitude toward quality in the field. These joints can be easily cut out and destructively tested in the field to check joining proficiency and equipment condition and it's inexpensive. There is no coupling to destroy and throw away.

The heat fusion joining system is especially effective with Driscopipe 8600. The melt of this material is very viscous and tough. The operator can apply ample pressure to form the heat fusion joint with little danger of forcing the molten material from between the two ends of the joint, as can be done with the softer, less viscous, high density materials.

Driscopipe 8600 can be fusion joined to other polyethylene piping materials when necessary. Special joining techniques are required to achieve good joints. Phillips Driscopipe technical personnel are available to instruct and demonstrate the fusion joining procedure for joining Driscopipe to other polyethylene materials.

#### **Fatigue Resistance**

Driscopipe 8600 very high molecular weight, high density polyethylene has superior resistance to fatigue failure caused by cyclic loading. Independent laboratory tests were conducted to determine the suitability of Driscopipe 8600 for use as the cold water supply pipe and the barge mooring leg of the Mini-OTEC Project (Hawaii, 1979). In that application, 2150' of 24" 60 psi Driscopipe 8600 was deployed vertically in a deep ocean trench just offshore Keahole Point and was subject to cyclic distortion caused by wave action, current, and barge motion.

Cyclic tests showed that Driscopipe 8600 very high molecular weight PE could endure more than 100,000 cycles at a stress of 1800 psi without failure. Copies of this test report are avialable upon request.

Driscopipe 1000 offers good fatigue service life also, but not equal to 8600. Neither requires de-rating like PVC AWWA C-900 pipe. In fact, per AWWA C-906 for 4" to 63" HDPE pipe, no water hammer or fatigue derating factor need be applied to Driscopipe 8600 or Driscopipe 1000 ductile PE pipe.

The Driscopipe performance team offers you innovative solutions to your piping requirements. Contact your nearest Driscopipe Sales Representative. He'll give you personalized technical service, installation assistance and all the cost-saving advantages of a Driscopipe Piping System. Engineered for Performance!



# Atlantic ATLANTIC STATES CAST IRON PIPE COMPANY

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P.O. Box 479 Coshocton, Ohio 43812 Ph. 614-622-6651 FAX 614-622-8551

DUCTELE IRON PIPING



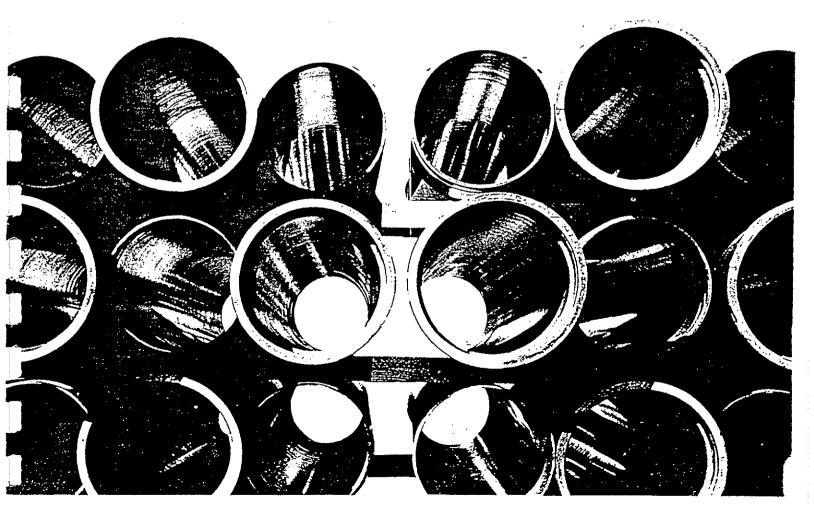
## McWANE CAST IRON PIPE COMPANY

P.O. Box 607 Birmingham, AL 35201 Ph. 205-322-3521 FAX 205-324-7250



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# NOMINAL THICKNESS FOR STANDARD PRESSURE CLASSES OF DUCTILE-IRON PIPE

		1								
Cina	Out the	Pressure Class*								
Size in.	Outside Diameter	150	200	250	300	350				
	in.		Nomi	nal Thickness	— in.					
1	3.96	製作業院		<b>100</b>	_	180.25				
-1	4.80			10000000000000000000000000000000000000	_	\$\$0.25°				
(s	6.90	<b>後がご覧機</b>		<b>100</b>		\$80.25 to				
- 8	9.05	<b>***</b>		<b>62</b> - 251		€ 0.25 ±				
10	11,10	<b>美工资</b>		600年	_	\$ 0.26 g				
12	13.20	多多个人	'	<b>建设工作</b>		<b>2</b> 10:2840				
1-1	15.30			280:28	0.30	<b>33</b> 03138				
16	17.40	355		第030次	0.32	2034至				
18	19.50	が出		<b>建</b> 0.2月2%	0.34	\$103633				
20	21.60	200 m		(60)33356	0.36	9038章				
24	25.80	数完二级	0.33	0037 <b>52</b>	0.40	#210.43.95				
30	32.00	数0.34%	0.38	<b>2034292</b> 3	0.45	¥0.0!49∌				
36	38.30	第038数	0.42	\$60347 <i>E</i> 6	0.51	££0565				

- Pressure Classes are defined as the rated water pressure of the pipe in psi. The thicknesses shown are adequate for the rated water working pressure plus a surge allowance of 100 psi. Calculations are based on a minimum yield strength of 42,000 and a 2.0 safety factor times the sum of the working pressure and 100 psi surge allowance.
- \*\* Calculated thicknesses for these sizes and pressure ratings are less than those shown above. Presently these are the lowest nominal thicknesses available in these sizes.

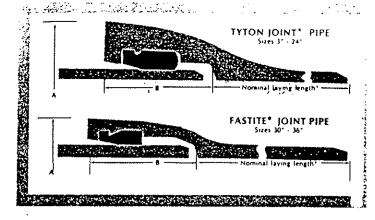
NOTE: Per ANSI/AWWA C150/A21.50 the thicknesses above include the 0.08" service allowance and the casting tolerance listed below by size ranges:

es)

# STANDARD DIMENSIONS AND WEIGHTS OF 3" THROUGH 36" PUSH-ON-JOINT DUCTILE IRON PIPE

7. T.			ALIA MATERIAL		Foot Length
Size Inches	Pressure Class	Thickness	Outside Diameter*	Weight Per Length†	Avg. Weight Per Foot††
		* Inc	ies	Pos	nds
**3	350	第50.25数据	3.96	数数185数30	9.2
1	350	《40.25全点	4.80	是至225世纪	11.3
**6	350	0.25	6.90	<b>等是3005</b> 原表	16.6
8	350	等20.25全量	9.05	3952 W	22.0
10	350	第20.26 少文	11.10	多是"510AC"	28.4
12	350	<b>建設0.28</b> 200	13.20	655.00	36.4
14	250 300 350	0.28 0.30 0.30 0.31	15.30 15.30 15.30	825 850	42.9 45.8 47.2
16	250 300 350	0.30 0.32 0.34	17.40 17.40 17.40	9498 1000 1000	52.3 55.5 58.8
18	250 300 350	\$0.031.550 0.34 \$0.366.31	19.50 19.50 19.50	7 1090 45 1185 5 1250	60.5 65.9 65.9
20	250 300 . 350	033 036 038	21.60 21.60 21.60	1290 £ 1395 1470 £	71.6 77.6 81.6
24	200 250 300 350	033 00 0374 040 040	25.80 25.80 -25.80 25.80	15.0 17.25 18.55 19.05	86.1 95.8 103.0 110.2
30	150 200 250 300 350	024 038 042 045 045	32.00 32.00 32.00 32.00 32.00	22000 2220 2235 2595 42810	111.2 123.2 135.2 144.2 156.1
36	150 200 250 300 350	0385 042 0474 051 1056	38.30 38.30 38.30 38.30 38.30	2975 2925 260 3570 3870	148.7 163.1 181.1 195.5 213.4

<sup>\*</sup>Tolerance of O.D. of spigot end: 3-12 in., ±0.06 in., 14-24 in., +0.05 in., -0.08 in., 30-36 in., +0.08 in., -0.06 in.

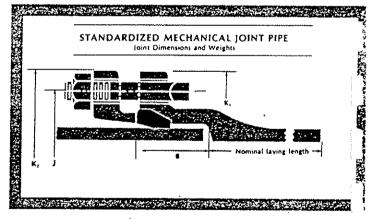


Size Inches	*Pipe Ir	Thickness iches	Outside Diameter	Dimensions in Inches		
Wiches	From	To	Inches	Α	13	
3	.25	4022年	3.96	£5.80%	3.00	
4	.25	教学的深刻	4.80	6.86	3.1!	
6	.25	<b>建</b> 43 基金	6.90	28.75 di	3.3i	
8	.25	\$5245 <b>\$2</b> 0	9.05	数11:05度量	3.69	
10	.26	547475935	11.10	@13715 <b>33</b>	3.71	
12	.28	577-49-11	13.20	#15:30)	3.75	
14	.28	<b>第251次</b> 数	15.30	第17.8526	5.00	
- 16	.30	\$4.52 · 4.4	17.40	終20.00景業	5.00	
· 18	.31	**X**53.54	19.50	S22.10(n)2	5.00	
20	.33	最55466定	21.60	送24.25至	5.00	
24	.33	<b>第数563223</b>	25.80	爱2850超过	5.00	
30	.34	15.63 Mark	32.00	#34.951#	6.50	
36	.38	731.2	38.30	41574	6.50	

<sup>\* 3&</sup>quot; - 4" Nominal 20' laying length. - 6" Nominal 18' or 20'

8" - 36" Nominal 18' laying length.

Dimensions subject to manufacturing tolerances.



Size	Hin	pr krask hes	Out- side Dis-	Dimensions in Inches		· Holis · ·			Bell Glad Weight Gas			
lin he-	Frents	Ēэ	meter faction	Ħ	Ţ	K.	ĸ	No.	Size Inches	Length Inches	Pennds	**
į:	.25	¥408	3.96	2.50	6.19	62	7.69	1	3/8	多数	11 .	207
4	.26	新田	4.80	250	7_50	19.06	9.12	127	7/4	影况课	16	97
6	.25	"第	6.90	250	9.50	11:06	11.12	16	1/4	57	18	
11	.27	£451	9.05	250	11.75	1331	13.37	66	3/4	劉波	24	<b>\$</b> 25:4
10	.29	47.	11.10	250	14.00	15:623	15.62	8.	3/4	松松	31	307
17	.31	2493	13.20	250	16,25	19/58)	17.88	183	3/4	<b>173</b> 3	37	44
14	.33	起後	15.30	330	18.75	20.25	20.25	ijŌΪ	3/4	四77年	61	
16	.34	527	17.40	3501	21.00	22.50	22.50	552	3/4	14/3K	74	AGS W
1#	.35	₹53X	19.50	350	23.25	<b>24</b> .75	24.75	120	3/4	X16*	85	<b>2</b> /65\$
20	.36	2544	21.60	330)	25.50	27.00	27.00	72	3/4	南沙路	98	81
24	.38	(56)	25.80	350]	30.00	37.50	31.50	16	3/4	₹\$*¥₹	123	410

\* 3" - 4" Nominal 20' laying length. -6" nominal 18' or 20'

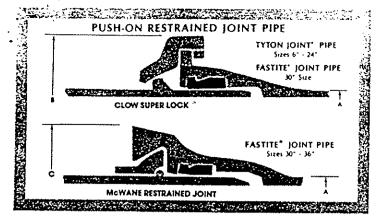
8" - 24" Nominal 18' laying length.

Dimensions subject to manufacturing tolerances.

<sup>\*\*</sup>Available in 20' lengths.

fincluding bell; calculated weight of pipe rounded off to nearest 5 lbs.

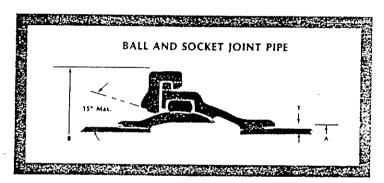
<sup>†#</sup>Including bell; average weight, per foot, based on calculated weight of pipe before rounding.



Nominal Pipe			effection	Α	8	C
Size Inches	Rating* psi	In . Degrees	Inches in 18 feet	Pipe O.D. Inches	Retainer O.D. Inches	Bell O.D. Inches
6 8 10 12	350 350 350 350		15 15 15 15	6 90 1 19 05 7 11 10 2 13 20 5	11.75 14.38 16.75 19.13	
14 16 18 20	350 350 350 350		11 11 11 11	1550 17408 1950 721601	21.75 24.00 26.38 28.63	
24 30 36	350 250 250	22.5 22.5 22.5	11 7 7	25.80 32.00 338.30	33.75 40.13 —	38:75 45.63

 In the 14" and larger sizes, pressure rating is limited to the rating of the pipe barrel thickness selected.

Dimensions subject to manufacturing tolerances.



71.	Thick	1055		3 B 🕭	Full Ler	gth Weigh	ıt - Lb.**	1
	Class		4		As	Under		Safe End
Size	(A21.51)	T	Pipe O.D.	Retainer O.D.	Shipped	Full of Air	Fell of Water	Pull (Lb.)
6	55	<b>₹</b> :40∴	6.90	9413小途	545	£ 240,5	465	#50,000£
8	55	₩42 °	9.05	黎16/6英	770	羹240€	655	第70,000%
10	55	表44%	11.10	\$19%限	1005	施220条	860	<b>3</b> 95;000;
12	55	<b>2.</b> 46≈	13.20	₹22 <b>8</b> €	1270	均約155篇	1080	£120,000¥
14	56	\$516	15.30	排24/2英	1655	数1160多	1410	145,000
16	56	₹52%	17.40	至270万年	1990	#345點	1685	\$1,65,000
81	56	<b>\$</b> 53\$	19.50	25分2	2375	程学7.0萬	2015	195,000
- "	58*	第59岁	15.50		2560	(4)10万	2170	444
20	56	第54次	21.60	经济办法	2810	200萬	2375	EXPORT HALLS
	59*	€63\$	27.00	86365E	3110	数100数	2635	210,000
24	56	<b>2</b> 563	25.80	387岁	3700	620等	3110	
-	62*	<b>5</b> 74	25.00	影響	4415	#\$95岁	3715	260,000
.30	58	2/1/2	32.00	#X2734	5855	第900篇	4920	200000
	61*	2483 <sub>%</sub>	32.00		6435	第180章	5360	B357000
36	57	與78岁	38.30	きのでは	8145	#1300 <b>\$</b>	6880	DESCRIPTION AND ADDRESS OF THE PERSON ADDRESS OF THE PERSON AND ADDRESS OF THE PERSON ADDRESS OF THE PERSON ADDRESS OF THE PERSON ADDRESS OF THE PER
	59•	₹887	30.30	表供等	8725	7257	7330	

- \* Thickness required to overcome buoyancy.
- \*\* Weights listed are for 18'-0" laying lengths. Nominal full lengths vary by size.
  Pipe, Bell, Ball and Retainer are ductile iron.

Dimensions and weights subject to manufacturing tolerances.

- 6"-24" pressure rating: 350 psi.
- 30"-36" pressure rating: 250 psi.

# RATED WORKING PRESSURE AND MAXIMUM DEPTH OF COVER

				į, v.	inn Cons	liti	
				Laty	ing Cond	illion	
Size	Pressuret Class psi	Nominal Thickness in.	Type 1 Trench	Type 2 Trench	Type 3 Trench	Type 4 Trench	Type 5 Trench
			M	laximum l	Depth of	Cover‡ –	- it
3	350	6 0.25	78	88.	99	10058	100§
4	350	<b>2025</b>	53	<b>3613</b>	69	85	100§
6	350	0.25	26		37	趋落	65
8	350	0.25 C	16	20	25	1341	50
10	350	0.26	11**	15	19	\$28 R	45
12	350	30.28 m	10**	第5元	19	2882	44
14	250 300 350	0.28 3	†† †† ††	11.00 13.00	15 1 <i>7</i> 19	23 ± 26 2 27 ± 27 ±	36 42 44
16	250 300 350	0.30 \$\\ 0.32 \$\\\ 0.34 \$\\\\	†† †† ††	57 13 13 15 15 15 15 15 15 15 15 15 15 15 15 15	15 17 20	24 × 24 × 24 × 26 ± 228 € 2	34 39 44
18	250 300 350	5031C 0346 6036	•	500 E	14 17 19	¥22 1-26 228 228 328 328	31 36 41
20	250 300 350	0.33 % 2.036 % 2.038 %	†† †† ††	100 103 103 103 103 103	14 17 19	222 SA 226 SA 228 SA	30 35 38
24	200 250 300 350	903345 03725 04022 04324	†† †† ††	8 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	12 15 17 19	17.57 20 - 7. 24 228 - 8.	25 29 32 37
30	200	0.34 0.38 9 0.42 0.45 0.45	†† ††	8 1 11 2 12 15 2	15 16 19	14 & 16 & 219 & 21 & 25 & 21 & 25 & 25 & 25 & 25 & 25	22 24 27 29 33
36	150 200 250 300 350	0.38 0.42 0.47 0.516 0.56	++ ++ ++ ++ ++	8 • • • • • • • • • • • • • • • • • • •	14 16	14 3 15 \$2 18 2 20 5 24 2	21 23 25 28 32

†Ductile-iron pipe is adequate for the rated working pressure indicated for each nominal size plus a surge allowance of 100 psi. Calculations are based on a 2.0 safety factor times the sum of working pressure and 100 psi surge allowance. (See ANSI/AWWA C150/A21.50 for design formulae.) Ductile-iron pipe for working pressures higher than 350 psi is available.

‡An allowance for a single H-20 truck with 1.5 impact factor is included for all depths of cover.

\$Calculated maximum depth of cover exceeds 100 ft.

\*\*Minimum allowable depth of cover exceeds 100 ft.

††For pipe 14 in. and larger, consideration should be given to the use of laying conditions othern than Type 1.

# Type 5 Trench 100§ 100§ 65 50 45 44 36 42 44 34 39 44 31 36 41 30 35 38 25 29 32 37 22 24

ed for each in a 2.0 safety ANSI/AWWA higher than

27

29

33

21

23 25 28

32

or all depths

se of laying

#### **ASSEMBLY INSTRUCTIONS**

#### TYTON AND FASTITE PUSH-ON JOINTS

THE PROCEDURES DESCRIBED BELOW SHOULD BE FOLLOWED TO ASSURE PROPER JOINT ASSEMBLY. SUPPLEMENTAL INFORMATION IS OVER IN THE ATLANTIC STATES INSTRUCTIONS FLYER.

THERE ARE SEVERAL DIFFERENT DESIGNS OF PUSH-ON JOINTS FOR DUCTILE IRON PIPE AND FITTINGS. BE SURE THAT THE CORRECT GASKET IS USED.

IT IS ESPECIALLY IMPORTANT THAT THE GASKET IS INSTALLED IN A CLEAN BELL.

THE GASKET GROOVE IN THE TYTON OR FASTITE BELL SHOULD NOT BE LUBRICATED PRIOR TO GASKET INSERTION.

#### **IOINT ASSEMBLY PROCEDURE**

- STEP 1. BELL CLEANING: Thoroughly clean out the bell. Remove all foreign matter: dirt, sand, mud, ice or excess paint.
- STEP 2. PLAIN END PREPARATION: Clean off the plain end, removing any dirt, foreign matter or excess paint. Make sure that the plain end is beveled. File smooth any sharp edges which might damage the gasket.
- STEP 3. GASKET INSERTION: Insert the gasket in its recess in the bell, with the large end of the gasket entering first. Make sure that the gasket faces in the correct direction and is properly seated as illustrated below.
- STEP 4. LUBRICATION: Apply a thin coating of lubricant to the inside surface of the installed gasket just prior to join assembly. Make certain the entire inner surface of the gasket is coated. Also apply a thin coating of lubricant to the beveled portion of the plain end.
- STEP 5. JOINING: Guide the plain end into the bell and compress the gasket by pushing the plain end all the way into the bell socket. Keep the bell and plain end in reasonably straight alignment during assembly. Any deflection should be taken after the joint is assembled.

#### MECHANICAL JOINT

THE PROCEDURES DESCRIBED SHOULD BE FOLLOWED TO ASSURE PROPER JOINT ASSEMBLY.

THERE ARE SEVERAL DIFFERENT SIZES OF BOLTS. CHECK TO SEE YOU HAVE PROPER SIZE AND NUMBER.

- STEP 1. BELL AND SPIGOT CLEANING AND LUBRICATION:
  Thoroughly clean bell gasket area and spigot of pipe of all foreign material. Lubrication and additional cleaning should be provided by brushing both the gasket and plain end with soapy water or pipe lubricant just prior to slipping gasket into the plain end.
- STEP 2. GLAND AND GASKET: Place gland with lip extension toward the plain end, and the gasket with the narrow edge toward the plain end of the pipe.
- STEP 3. JOINING: Insert the pipe into the bell and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during assembly. Make deflection after joint assembly but before tightening bolts. (Lubrication as in Step #1 will help facilitate gasket seating)
- STEP 4. BOLTS: Push the gland toward the bell and center around the pipe with the gland lip against the gasket. Insert bolts and hand-tighten nuts.
- STEP 5. TIGHTENING: Tighten bolts to normal range of bolt torque as indicated in table. Maintain approximately the same distance between gland and the face of the bell flange. This is done by partially tightening the bottom bolts first then the top bolts next bolts on either side finally the remaining bolts. This is repeated as many times as required.

#### ASSEMBLY OF FIELD CUT PIPE

When pipe are cut in the field, the cut end may be readily conditioned so that it can be used to make up the next joint. The outside of the cut end should be beveled about 1/4-inch at an angle of about 30 degrees (Figure 1). This can be quite easily done with a coarse file or a portable grinder. The operation removes any sharp, rough edges which otherwise might injure the gasket.

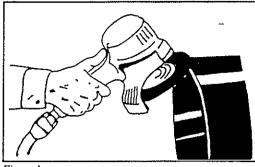


Figure 1

When ductile iron pipe 14" and larger is to be cut in the field, the material should be ordered as "GAUGED FULL LENGTH". Pipe that is "gauged full length" is specially marked to avoid confusion. The ANSI/AWWA standard for ductile iron pipe requires factory gauging of the spigot end. Accordingly, pipe selected for field cutting should also be field gauged in the location of the cut and found to be within the tolerances shown in Table 1. In the field a mechanical joint gland can be used as a gauging device.

Table 1. Suitable Pipe Diameters for Field Cuts and Restrained Joint Field Fabrication

Nominal Pipe Size In.	Min. Pipe Diameter In.	Max, Pipe Diameter In.	Min. Pipe Circumference In.	Alax Pipe Circumference In.
3 % 4 6 8 10 12	3:90 4.74 6.84 8.99 11.04 13.14	402 186 1696 1701 1711 1711 1711 1711 1711 1711 171	12 <sup>1</sup> / <sub>4</sub> 14 <sup>29</sup> / <sub>32</sub> 21 <sup>1</sup> / <sub>2</sub> 28 <sup>1</sup> / <sub>4</sub> 34 <sup>31</sup> / <sub>16</sub> 41 <sup>9</sup> / <sub>32</sub>	25/15/15/15/15/15/15/15/15/15/15/15/15/15
14 16 18 120 24	15.22 17.32 19.42 21.52 25.72	1535 1745 1955 2165 22585	47 <sup>13</sup> / <sub>16</sub> 54 <sup>13</sup> / <sub>32</sub> 61 67 <sup>19</sup> / <sub>32</sub> 80 <sup>13</sup> / <sub>16</sub>	487/32 5419/65 6119/324 68 5 817/32
30 36	31.94 38.24	332.08 3838 3	100 <sup>11</sup> /32 120 <sup>1</sup> /8	29-1002/52 3-1209/16

#### THE BACKHOE METHOD OF ASSEMBLY

A backhoe may be used to assemble pipe of intermediate and larger sizes. The plain end of the pipe should be carefully guided by hand into the bell of the previously assembled pipe. The bucket of the backhoe may then be used to push the pipe until fully seated. A timber header should be used between the pipe and backhoe bucket to avoid damage to the pipe.

Standards Applicable
Thickness Design of Ductile Iron
Ductile Iron Pipe for Water and
Ductile Iron Pipe for Gravity Flo
Ductile Iron Fittings for Water an
30° through 36°.

Ductile Iron Compact Fittings
3° through 24°.

Flanged Fittings.

Ductile Iron Pipe with Threaded
Coatings and Linings:
Asphaltic.

Cement Lining.
Various Epoxy Linings and C
Exterior Polyethylene Encass
Joints — Pipe and Fittings
Push-On and Mechanical R:
Flanged

Grooved and Shouldered
Pipe Threads
Installation.

Type 1† Flat-bottom trench.\* Loose backfill. Type
Flat-botton
trench.\* Ba
lightly con
ted to cent
of pipe.





Notes:

Consideration of the by factors other than ANSI/AWWA C600.

- For nominal pipe size conditions other than 5
- Flat bottom is define . .
- \* Loose soil or select n ate foreign materials, and re
- American Association o Suite 225, Washington.

# Mechanical Joint Pipe Maximum Allowable Joint Deil

Size of Pipe	Y-Maximum Joint Deflection in Degrees
• ;	8-18'
-1	8-18'
<b>'</b> 6	7*- 7'
8	5211
. 10	5*-211
12	5-21
14	3*-35
16	3:-35
18	3 0.
_0	3 - 0
24	223'

\*20 - Ft. Length

Push-on Joint Pipe
Maximum Deflection Full Lengi

Size of Pipe	Maximum   Joint Delection in Degrees
: .	5.
	5.
6	5,
8	5•
10	5.
12	5-
14	5-
16	5.
18	ş-
20	5·
24	5.
10	5.
14.	3.
120 ft 1	

•20 • Ft. Length

Standard's Applicable to Ductile Iron	Pipe and Fittings
ckness Design of Ductile Iron Pipe calle Iron Pipe for Water and Other Liquids	ANSI/AWAWA (*150/A 21.50
Juctile Iron Pipe for Gravity Flow Service Juctile Iron Fittings for Water and Other Liquids	ANSI/ASTM A746
30" through 36"	
3° through 24°	ANSI/AWWA C153/A21.53 ANSI/AWWA C110/A21.10
ructile Iron Pipe with Threaded Flanges	ANSI B16-1
etings and Linings: Asphaltic	
Asymmetric Control of the Control of	ANSI/AWWA C110/A21.10 ANSI/AWWA C153/A21.53
Cement Lining	ANSI/AWWA C104/A21.4
Exterior Polyethylene Encasement  ss — Pipe and Fittings	ANSI/AWWA C105/A21,5
Push-On and Mechanical Rubber-Gasket Joints	ANSI/AWWA C111/A21,11 FEDERAL WWP421D
Flanged	
Grooved and Shouldered	ANSI/AWWA C606

allation			NSI/AWWA C600	
	LAYI	NG CONDITIO	NS	
Type 1†	Type 2	Type 3	Type 4	Type 5
it-bottom .unch.* Loose packfill.	Flat-bottom trench,* Backfill lightly consolida- ted to centerline of pipe.	Pipe bedded in 4-in. minimum loose soil.** Backfill lightly consolidated to top of pipe.	Pipe bedded in sand, gravel or crushed stone to depth of 1/8 pipe diameter, 4-in. minimum. Backfill compacted to top of pipe. (Approximately 80% Standard Proctor, AASHTO§ T-99.)	Pipe bedded in compacted granular material to centerline of pipe. Compacted granular or select* material to top of pipe. (Approximately 90% Standard Proctor, AASHTOS T-99.)

Consideration of the pipe-zone embedment conditions included in this figure may be influenced by factors other than pipe strength. For additional information on pipe bedding and backfill, see ANSVAWWA C600.

- For nominal pipe sizes 14 in, and larger, consideration should be given to the use of laying conditions other than Type 1.
- Flat bottom is defined as undisrurbed earth.
- Loose soil or select material is defined as native soil excavated from the trench, free of rocks, foreign materials, and frozen earth.
- American Association of State Highway and Transportation Officials, 444 N. Capitol St. N.W., Suite 225, Washington, DC 20001.

echanical Joint Pipe

Maximum Allowable foint Deflection



123-27 B SEEN 1 3/8/15/2003

Mire Tyrillian golffinnish

· FL Length

sh-on Joint Pipe ximum Deflection Full Length Pipe

2 -- 23'



340

450

Size of Pipe	Alaximum Joint Deflection in Degrees		in Inches 📜	Approximate Radius in Feet of Curse Produced by Succession of Joints 3" same as 4"		
	. m refleces	18 foot length	20 foot length	18 ft. length	20 ft. length	
	5,	2342 W. S.	21	SHEET COLOR	230	
	5.	EXECUTE ALL	21	ACTION OF STREET	-230	
6	2.	13 E221936	21	206 10 KK	230	
- ::	5.	<b>中华经过1979</b>		### SET 206 ###		
10	5.	APPENDING S		<b>经</b> 联系统约606 <b>第</b> 位性		
12	5.	名がから はんかん		\$68500 206 <b>90%</b>		
14	5.	<b>1986</b>		A40,263 206 H64		
16	5.	KAKELWI 978X		NEWS CONTROL		
18	5*	<b>学院319報</b> 學		1500 DE 206 CHILL		
20	5.	(Carbatt910)		<b>本和代表206 編集</b>		
23	51	1948		5106000 2060000		
<b>311</b>	5.	x 4.729.19 = 4.		<b>にかない。206米級</b>		
ir,	3,	198%		· 外对206号时		

#### Ft. Length

#### DIMENSIONS AND WEIGHTS FOR SPECIAL CLASSES OF PUSH-ON-JOINT AND MECHANICAL JOINT DUCTILE IRON P

Pipe manufactured in accordance with ANSI/AWWA C151/A21.51-91 under method  $\epsilon$  design outlined in ANSI/AWWA C150/A21.50

0031					30/12	Pastson J	, '		e banica	loint
Size In.	Thick- ness Class	Hick- ness In.	In.	Wt. of Bauel Per Ft. Tb,	Wt. of Bell 1b.	Wt. Per Lgth.† 1b.			Wt. Per Lgth.t Lb.	Avg. Wi. Per H. 1 Ub.
**********	51 52 53 54 55 56	225 220 240 240 240	3.96 3.96 3.96 3.96 3.96 3.96	8.92 19.93 10.9 117.8 12.8 213.57		\$2052 \$2052 \$2253 \$2453 \$2653 \$2853	9.4 10.4 11.4 12.2 13.2 14.2		190 210 230 245 265 285	\$10.4 \$11.4 \$12.4 \$13.4 \$14.2
777777	51 52 53 54 55 56	226 229 332 335 538 411	4.80 4.80 4.80 4.80 4.80 4.80	113; 216; 13.8; 15.0; 15.0; 20 73;	11 11 11 11 11	235) 2651 2856 23101 3355 3551		16. 16. 16. 16. 16. 16. 16. 16. 16. 16.	240 270 290 315 340 360	712.1 713.4 714.65 15.85 716.9 7218.1
6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	50 51 52 53 54 55 56	225 X 228 2 311 324 327 327 327 327 327 327 327 327 327 327	6.90 6.90 6.90 6.90 6.90 6.90	116.0 117.8 119.6 121145 123.27 125.0 126.7	15 15 15 15 15 15	305 2 335 0 370 1 400 0 435 2 465 6 495 2	16.8 18.6 20.4 22.2 24.0 25.8 27.5	18 18 18 18 18 18 18 18	305 340 370 405 435 470 500	217.0 218.8 220.6 222.4 224.29 226.0 27.7
# # # # #	50 51 52 53 54 55 56	27/ 230 2336 236 236 242 245	9.05 9.05 9.05 9.05 9.05 9.05	322.8 255.2 27.7 30.1 32.5 34.8 37.2	22 22 22 22 22 22 22 22 22	430.8 475.6 520.6 2565.7 6650.7 690.3	24.0 26.4 28.9 31.3 33.7 36.0 38.4	24 24 24 24 24 24 24	435 480 525 565 610 650 695	24.1 26.5 29.0 31.4 33.8 36.1 38.5
10 10 10 10 10 10	50 51 52 53 54 55 56	#229 #3224 #3355 #444 #444 #444	11.10 11.10 11.10 11.10 11.10 11.10 11.10	130.1% 733.24 36.28 39.25 142.12 45.14 48.01	29 29 29 29 29 29 29	\$4570 \$625 \$1680 \$735 \$785 \$40 \$895 \$895 \$895 \$150	31.7 34.8 37.8 40.8 43.7 46.7 49.6		575 630 685 735 790 845 895	31.8 34.9 37.9 40.9 43.8 46.8
STEED STEEDS	50 51 52 53 54 55 56	2110 441 2372 401 438 467 467 467	13.20 13.20 13.20 13.20 13.20 13.20 13.20	42.07 45.6 49.27 552.8 563 559.9	35 35 35 35 35 35	725t 77907 9855 9204 9855 10504 11155	40.3 43.9 47.5 51.1 54.7 58.2 61.8	37.77.75.75.75.75.75.75.75.75.75.75.75.75	730 795 860 925 985 1050	\$40.5 244.15 247.75 351.3 254.9 158.4 262.0
122222	50 51 52 53 54 55 56	336 9124 513 316 9124 518 316 114 124 515	15.30 15.30 15.30 15.30 15.30 15.30 15.30	475 517 5559 6672 684 7725	66 66 66 66 66 66	9151 9908 10658 11402 12158 12908 813658	50.8 55.0 59.2 63.4 67.5 71.7 75.8	661 11 164 164 164 164 164 164 164 164 1	915 990 1063 1145 1215 1290	50.9 55.1 55.3 63.5 67.5 71.8
16 16 16 16 16	50 51 52 53 54 55 56	34* 374 40* 443 745 745 745 752 752 752 752	17.40 17.40 17.40	\$65.83 \$60.63 \$65.41 \$70.11 \$74.9 \$79.71	68 68 68 68	\$1070 \$1160 \$1245 \$1330 \$1415 \$1505 \$1585 \$1585	59.6 64.4 69.2 73.9 78.7 83.5 88.2	74 74 74 74 74 74 274 274	1080 1165	259.92 259.92 3.64.7. 3.69.5 274.2 7.79.0 883.8 88.5%
18 18 18 18 18 18	50 51 52 53 54 55 56	055871 <u>4</u> 275304 4475304 443535	19.50 19.50 19.50 19.50 19.50 19.50 19.50	1644 693 7525 180.6 86.0 913 19672	78 78 78 78 78 78 78	1235 11335 11335 11430 11530 11625 11220 11820 11820	68.7 74.1	85. 85. 85. 85. 85. 85. 85. 85. 85. 85.	1245 1340 1440 1535 1635 1730 1825	\$69:17 74.5 779.9 85:3 790.7 796.0 10143
20 20 20 20 20 20 20 20 20 20 20 20 20 2	50 51 52 53 54 55 56	200 200 200 200 200 200 200 200 200 200	21.60 21.60 21.60 21.60 21.60 21.60 21.60	373.54 679.53 885.51 897.59 103.4 109.3	87	#1410 #1520 #1625 #1735 #1840 #1950 #2055 #2055	78.3 84.3 90.3 96.3	2498 988 989 988 988 988 988 988 988 988	1420	78.9 84.9 90.9 96.9 102.9 114.7
ব্রব্র্র্র্র	50 51 52 53 54 55 56	13 14 14 15 15 15 15 15 15 15 15 15 15 15 15 15	25.80 25.80 25.80 25.80 25.80 25.80 25.80 25.80	192.93 10011: 107.34 114.45 1121:64 128.85	105 105 105 105 105 105 105	11775 p 11905 p 22035 p 2165 p 22295 p 2425 p 2550 p	98.7 105.9 - 113.1 120.2 127.4 134.6 141.7	123 - 123 - 123 - 123 - 123 - 123 - 123 -	1795 1925 2035 2180 2310 2440 2570	299.74 106.94 114.10 121.27 128.42 135.64
30 30 30 30 30 30 30	50 51 52 53 54 55 56	473 473 555 596	32.00 32.00 32.00 32.00 32.00 32.00 32.00	1185 1305 1425 154 4 1668 17872 190.0	170 170 170 170 170 170	2305 0 2520 8 2725 2 2725 3 2150 3 3165 0 2180 3	127.9 139.9 151.9 163.8 175.7 187.6 199.4			
16 16 16 16 16 16 16 16 16 16 16 16 16 1	50 51 52 53 54 55 -	43.2 48.2 550.2 60.2 60.2 60.2	38.30 38.30 38.30 38.30 38.30 38.30 38.30	156.58 174.58 192.41 210.35 228.18 225.9 263.78	239 239 239 239 239 239 239 239	30558 3380 97001 4025 43458 46653 49851	169.8 187.8 205.7 223.6 241.4 259.2			
t Incl						rounded	off to ne	arest 5 l	bs.	

- † Including Bell; calculated weight of pipe rounded off to nearest 5 lbs.
- ‡ Including Bell; average weight per foot, based on calculated weight of pipe before

Weights and dimensions are nominal per above standards.

- \* Tolerances of OD of spigot end: 3-12 in.,  $\pm 0.06$  in., 14-24 in.,  $\pm 0.05$  in., -0.08 in., 30-36 in.,  $\pm 0.08$  in., -0.06 in.
- 3" 4" Nominal 20' laying length. 6" Nominal 18' or 20'
- 8" 36" Nominal 18' laying length.



183 Sitgreaves Street Phillipsburg, NJ 08865 908-454-1161 FAX 908-454-1026

# GENERAL CERTIFICATION

SOLD TO: DATE: May 3, 1994 Barbella Environmental Technology, Inc. S.O.: P.O. Box 273 Salem Industrial Park - Bldg. #8 CUSTOMER'S P.O.# Whitehouse, N.J. 08888 DATE OF SHIPMENT: SHIP TO: B/L # Pelham Bay Landfill CARRIER: Bronx, N.Y. We certify that the material as listed below was manufactured, tested, and inspected in accordance with the most recent revision of the following standard(s) and meets all the requirements thereof:

scandard(s) and meers are the	requirements thereof:	
MATERIAL	NOM.L/L	CLASS
1,070' - 6" Tyton Joint Pipe 415' - 4" Ditto	18' 20'	56 54
Plus Various MJ Fittings	, entre de la companya del companya de la companya del companya de la companya de	DI

STANDARDS: DUCTILE IRON PIPE **JOINTS** X ANSI/AWWA C151/A21.51 X Push-On: ANSI/AWWA C111/A21.11 Fed. WW-P-421D, Grade C X MJ: ANSI/AWWA C111/A21.11 Flange: ANSI/AWWA C115/A21.15 (NO ACCESSORIES) FITTINGS LINING (Per ANSI/AWWA C104 A21.4) X ANSI/AWWA C110/A21.10 X Asphaltic coated inside & outside ANSI/AWWA C153 (DI CL. 350 Standard Cement Lining Compact) X Double Cement Lining Other

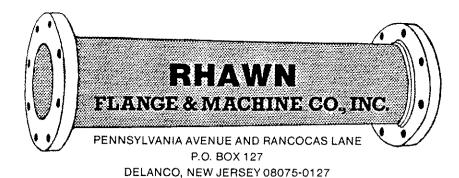
Sworn to and subscribed before me this 3rd day Qf May, 1994

Notary Public of New Jersey

ATLANTIC STATES
CAST IRON PIPE COMPANY

Wilma Mains
Title: Sales Assistant

EWELL W. 1	FINLEY &	JOB NUMBER.
PARTNERS	, INC.	SUBMITTAL
		NO. 15000-1.5
XA. APPROVED		D. NOT APPROVED
☐ B. APPROVED AS	CORRECTED []	E. NO ACTION REQUIRED
C. REVISE AND RE	ESUBMIT D	OTHER:
DATE RECEIVED:	REVIEWED BY	
5.10.94	CUP	5.25.94
DURING THIS REVIEN PLIANCE WITH REQL TIONS. THIS SUBMIT FORMANCE WITH TI GENERAL COMPLIAN CONTRACT DOCUME CONFIRMING AND CO SELECTING FABRICAT STRUCTION, COORDI	N DO NOT HELIE' IJREMENTS OF THI TAL REVIEW IS HE DESIGN CONG ICE WITH THE I NTS. THE CONTR RRELATING ALL QI TION PROCESSES NATING HIS WOF	ADE ON THE SUBMITTALS VE CONTRACTOR FROM COM- E DRAWINGS AND SPECIFICA- ONLY FOR GENERAL CON- CEPT OF THE PROJECT AND  INFORMATION GIVEN IN THE  RACTOR IS RESPONSIBLE FOR  UANATITIES AND DIMENSIONS,  AND TECHNIQUES OF CON- RK WITH THAT OF ALL OTHER  K IN A SAFE AND SATISFAC-



15000 -2.1

July 8,1994

Barbella Enviromental Technology, Inc.

24 Tannery Road

Somerville, NJ 08876

Re: Pelbam Bay Landfill remediation Contract 875-HP

We certify that the pipe and fittings we will supply meet all of the requirements of the following specifications.

FLEXIBLE COUPLING:

Mechanical Joint Solid Sleeve TRETAINER GLANDS

ANSI A21.10, AWWA C110

FLANGE PIPE:

Ductile iron class 56 thickness with ductile iron 125# flanges

domestic.

Pipe:

ANSI A21.51, AWWA C151

Fabrication: ANSI A21.15, AWWA C115

FLANGE FITTINGS:

Cast Iron or Ductile Iron class 250 with 125# flange drilling.

ANSI A21.10, AWWA C110, B16.1

COATING:

1 mil Bituminous

LINING:

Double Cement Lined with bituminous seal coat

ANSI A21.4, AWWA C104

Sincerely,

W.C.Krout

W.C.Kar

and subscribed before me this 8th day of July, 1994

JAY D. RHAWN

JAY PUBLIC OF NEW JERSEY

Tunisaion Expires April 1, 1996

# RHAWN FLO. & MACH. INC.

## MECHANICAL JOINT FITTINGS-Dimensions and Weights

ANSI SPECIFICATIONS A 21.10 (AWWA C 110) AND A 21.11 (AWWA C. 111) FOR USE WITH CAST IRON OR DUCTILE IRON PRESSURE PIPE FURNISHED COMPLETE WITH JOINT ACCESSORIES & RETAINER GLAND

FURNISHED WITH BITUMINOUS COATING UNLESS OTHERWISE SPECIFIED

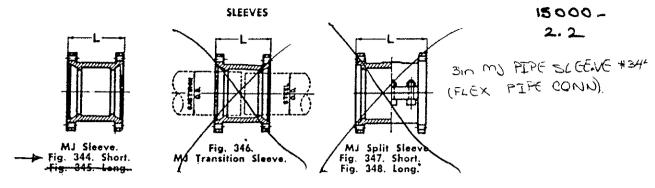
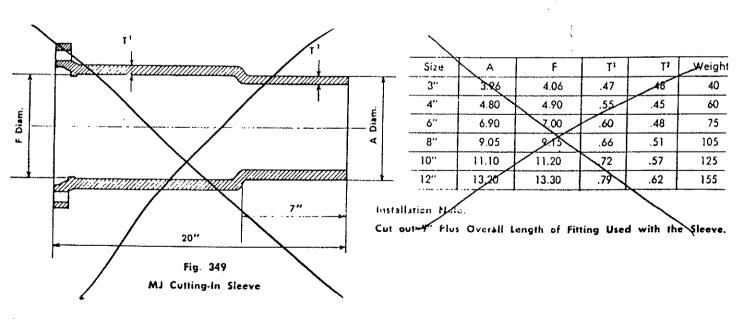


Table No. 234

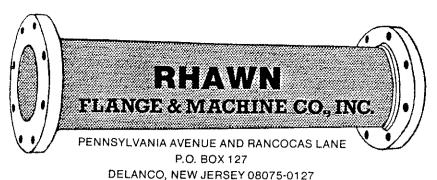
			WJ	Sleeve		MJ Tr	ansition		MJ Sp	it Sleeve	
Size	Pressure Rating		344	3	45	Si	eeve		347	1 3	348
3126	psi	Short		Long		3	46		hort	Long	
	ρυ.	L	Wt.	L	Wt.	L	Wt.	L	W1.	Ĺ	Wt.
3	250	7.5	25	12	30	12	30	10	65	15	90
4	250	7.5	35	12	45	12	45	10	90	15	115
6	250	7.5	45	12	65	12	65	10	125	18	165
8	250	7.5	65	12	85	12	85	10	150	18	215
10	250	7.5	85	12	115	12	115	10	190	18	270
12	250	7.5	110	12	145	12	145	10	235	18	335
14	250	9.5	165	15	225	15	235	11	425	18	530
16	250	9.5	200	15	275	15	285	<b>}</b> }	490	, 18	620
18	250	9.5	240	15	330	15	340	11	560	18	715
20	250	9.5	275	15	380	15	390	1) . 1	655	16	840
24	250	9.5	360	15	. 505	15	520	11	915	18	1150

Weights shown for split sleeves include-side bolts and gaskets, and end bolts, guskets and glands. Standard sleeves are manufactured to fit 3.96" standard B-C-D pattern for 3" pipe only; A.W.W.A. A patterns in sizes 4"-6"; A.W.W.A: A-B patterns in sizes 8"-24".



ANSI SPECIFICATION A 21.11 (AWWA C. 111)

NOTE: Weight does not include accessories weight.



15000\_

July 13,1994

FLANGE BOLTS AND

Barbella Enviromental Technology, Inc.

24 Tannery Road

Somerville, NJ

08876

Re: Pelbam Bay Landfill remediation Contract 875-HP

We certify that the gaskets and bolts we will supply meet all of the requirements of the following specifications.

FLANGE GASKETS:

Cloth inserted rubber ring gasket 1/16" thick

FLANGE BOLTS:

Carbon steel bex bead bolt with beavy bex bead nut

Sumberged bolts and nuts will be 304 S/S

ANSI B18.2.1, ANSI B18.2.2, B16.1

Sincerely,

W.C.Krout

W. C. Kart

AND JAY D. RHAWN
NOTARY PUBLIC OF NEW JERSEY
AND Contribution Expires April 1, 1698

Sworn to and subscribed before me this 13th day of July, 1994

D-19

# NEWBURGH WHOLESALE DISTRIBUTOR OF PIPE VALVES I FITTINGS AND PIPING SPECIALTIES

STAINLESS STEEL PIPE

han	193504 PRINTE BALLS ALAMA OF THE STATE
	THE FAX AND UNLY THE FAXIIIIIII
	10 MARK SAN Angelo
	LOCATION Breco Mech
	FRUM Dean A CUEPS
	DATE 5/11/95
	OF PAGES INCLUDING COVER BUBET
	5-5, MEBBAGEI  Svomittals
Spec 150 Pava 2	
pg 1socs	
Durg	GS.Z

QUALITY PHODUOTS • DEPENDABLE BERVICE • COMPETITIVE PRICES

855 HTE, 82 EAST • WALDEN, NEW YORK 12586 TEL: 814-778-8187 • FAX 814-778-3881

# STANDARD STAINLESS STEEL TUBING GENERAL CHARACTERISTICS

STAIN ESE STEEL TYPES	CHI	MICAL	COM L EI,EA	POSITION MENTS %	ME	CHANIC	AL PROP	ERTIES	
11749	CR	M	,c	ELEMENTS	TENSILE		ELONG. %	HARDNESS ROCKWELL	TYPICAL CHARACTERISTIC
304	18.00-	11.00	0.08 max		85,000 105,000	35,000 73,000	55 20	B80 Ann B95 VaHd	General purpose "300" series
304L	18.00- 20.00	\$.00- 13.00	0.035 Max	-	\$6,600	30,000	55	875	grade for jubing applications.  Low carbon type 304 where greater resistance to carbide
<b>3</b> 04N	18.00- 20.00	9.00- 11.00	0.()4- 0,10	-	85,000	35,000	\$5	B80	Carbon mortified for inner
310	24.00- 26.00	19.00-	0.15 m.bx	_	98,000	45,000	45	B65	High resistance to community
316	18.00-	11.00- 14.00	Ö.Då Mest	Mo 2.00-3.00	85,000	35,000	50	880	Editer commission resistances at a
316L	16.00-	10.00- 15.00	0.035 muu	Ma 2.00-3.00	75,000	30,000	50	875	hi-temp strength.  Low carbon type 318 where
316H	16.00-	11.00-	0.04-	Mo				#/D	percipitation is desired;
<del></del>	18.00	11.00-	0.10	2.00-3.00	85,000	35,000	50	880	Carbon modified for improved temperature strength.
317	20.00	14.00	0.08 Mex	3.00-4.00	90,000	40.000	45	B65	Similar to type 316 but with better corrosion resistance and creep strength.
321	17.00- 20.00	13.00	O.Os mex	7) 5XC-0.60	90,000	35,000	\$5	Beo	Titanium stabilized against
347	17.00- 20.00		0.08 MAT	Cb + Ta 10XC-1.00	95,000	40,000	50	885	properties to type 304. Columbian and tentalum stabilized equinst carbide precipitation.

TYPE	DENSITY LBS/CU, IN.	SPECIFIC ELECT, RESIST OHMS	SPECIFIC HEAT STU/LE.	THERMAL CONDUCT FTU/HR.SQ.FT./	MEAN CO OF EXP	PEFFICIENT ANSION "F	TENSION PSI	MAGNETIC PREMEABILITY	
		CM/CM	DEG. F	DEG. F (212')	32-212	32-1200	MODULUS OF ELASTICITY		
304L	0.29	72	0.12	9.4	9.6 × 10 **	10.4 × 10 -4	28.0 × 10°	1.003	
310 316	0.29 0.28	78	0.12	<b>4.</b> 2	8.8 × 10 ~4	9.7 × 10 -+	29.0 × 10*	1,003	
316L	5.4	74	D.12	9.4	4.\$ × 10 -*	10.5 x 10 -4	28.0 × 10"	1.003	
317	0.29	74	0.12	9.4	8.9 x 10 -4	10.3 × 10 -+			
321	0.29	72	0.12	9.3	9.3 × 10 ^4	10.7 × 10-4	26.0 × 10*	1.003	
347	0.29	מ	0.12.	9.3	8.3 x 10 -4	10.6 × 10 -4	26.0 x 10 <sup>4</sup>	1.003	
11-6-9	0.20	<u> </u>	0.12	9.6	7.3 × 10 -4	10.8 × 10 · ·	28.6 × 10° 28.5 × 10°	1.003 1.002	

The information and data precented herein are hydical or average values and are not a discretize of maximum or minimum values. Applications aspecifically suggested for metal-described haven are made solely for the purpose of illustration to enable the reader to make his own avaluation and are not intended as warranties, either express or implied, of fitness for these or other purposes.

# PIPE SCHEDULES

				V	1/2						•						
Pipe	O.D. In inch	5.	8	10.	10	20	30	40a 8TD	40	60	50a 4	80	100	1.00			- La
	.405		.03:	.1863			1	.068	.068	1	.095	.09	5	120	140	160	E
<b>y</b>	.540		.049	065	.065		1	.086	.088		.3145	.11		<del>                                     </del>	-		+ .
34	.675		.049	.085	.065		1	.091	.091		.5351	,126	5	+	-	-	-
15	.840	.065 .5363	.065	.083	.083		<del>                                     </del>	.109	.109		.7388	.147	,	<del>-</del>	+	,188	+ ;
*	1.050	.065	.065	.083	.083		<b>—</b>	.8510	.113		1.088	.154		<del> </del>	<b></b>	1.504	1 1.7
1	1.315	.065	.065	.109	.109 1.404		<del> </del>	1,131	.133		1.474	1.474			<del> </del>	1.937	
114	1.660	1.107	.065	109	.109 1.806	-	<del>                                     </del>	1.579	.140		2.172	.191	1	<del> </del>	<b>├</b>	2.844	1 3.c
11/2	1.900	1.274	.065 1.274	109	109		<del>                                     </del>	2.273	2.273 ,145	<b></b>	2.997	.200	A		<del> </del>	3.765	1
2	2.375	1.604	.065 1.604	.109 2.638	.109 2.636	<b> </b>	<del>                                     </del>	2.718	.154	-	3.631	3.631	<del> </del>		-	4.859	6.4
214	2.875	.083 2.475	.083 2.475	.120 3.531	.120 3.531		<del>                                     </del>	3.653	.203	<del> </del>	5.022	5.022 .276	<del> </del>		<del> </del>	7.444	$\coprod \cup$
3	3.500	.083 3.029	.083 3.029	.120 4.332	.120 4.332		-	5.793	5.793 218	<del> </del> -	7.661	7.661 .300	<del> </del> -	<b></b>	<del> </del>	10.01	13.
31/2	4.000	.083 3.472	.083 3.472	.120 4.873	120		<b> </b>	.226	7.576 .226		10.25	10.26 .318		<del> </del>	-	14.32	₽.
4	4.500	.083 3.915	.083 3.915	.120	.120			9.109	9.109	.261	12.51	.337	ļ	.438		.531	22
41/2	5.000	3.315	3.913	8.613	5.613			.247	10.79	12.66	.355	14.98	ļ	19.01	<del> </del>	22.51	-
5	5.563	.109 6.349	.109	-134	134		<del> </del>	12.53	.258	<del></del>	17.61	.375		.500	<del> </del>	.625	32.1
0	6.625	.109 7.585	6.349 .109 7.585	7.770	7.770	7	<b></b>	.280	14.62		20,78	.432		27.04		32.96	3
7	7.625	7.005	7.003	9.290	₹ <b>).289</b>			18.97 .301	18.97		28.57 .500	28.57		36.39		45.30	43.1
8	4.625	,109	109	.148	.148	.250	.277	.322	.322	.406	38.05	.600	.594	.719	,612	.906	6
•	9,625	9.914	9.914	13.40	18.40	22.36	24,70	.342	28.55	35.64	43.39 .500	43.39	50.87		67.76	74.69	72.4
10	10.750	.134	.134	/ .105	.165	.250	.307	33.90 .365	.365	.500	48.72 .500	.594	.719	.844	1.000	1,125	_
	11.750	15.19	15.19	18.65	.\a.70	26.04	34.24	40.48 .375	40.48	54,74			76.93	89.20	104.1	115.7	
12	12.750	.156	.165	.180	.150	,250	.330	45.55 .375	.408	.562	60.07 ,600	.688	844	1.000	1.125	1,312	<del></del> ;
14	14,000	.156	22.18	.188	.250	33.\$8 .312	43.77 .375	49.56 .375	.438	73.18 .594		88.51 .750	107 2	125.5 1.094	139.7 1.250	180.3	
18	16.000	.165		.188	36.71 ,250	45.68	54.57 .375			64.91 .656		106.1	130.7	150.7	170.2	1,406	
18	18,000	.165		31.75	.250	\$2.36 .312	.438			107.6 .750		136.5	104.8	192.5	1.438 223.5	1.594 245.1	
20	20,000	.188		.210	.250	59.03 -375					93.45	170.8	208.0	244.1	1.562 274.2	308.5	
24	24 000	.218		46,05 .250		78.60 .375	.562			166.4	104.1	208.9	258.1	295.4		1.969 379.0	
	******	55.37				94.62				238.1	125.5	296.4	1.531 367.4		2.062 483.1	2.343 541.9	

UPPER FIGURES
Wall Thickness
In Inches

DIMENSIONS AND WEIGHTS OF SEAMLESS AND WELDED STEEL PIPE

LOWER FIGURE
Weight Per Fcin Pounds

# ALLOWABLE WORKING PRESSURES FOR A-312 WELDED PIPE

# TYPE 316L Schedules 10S

·FΚ	JK	A	-31	X W	ELD	ED I	PIPE	i															<del></del>	<del></del>	-
L			LE "F.	- 328 YD 340	400	500	690	£118	700	150	800	859	900				1100 1100	. 1		1		1	1		
-	_	. \$18	131	14200	13200	12250	11450	11:100	19950	10700	10500	10200	10000	MOUL	TOUL	8230		-		1000		00			
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	×	55 105	.065	1608 2079	1494 1932	1387 1793	1296 1676	1268 1640	1239 1603	1211 1566	1189 1537	1168 1508	1132 1464	1109 1435	1075 1391		$\vdash$	873 1141	638 834	468 612	345 451	246 321	187 245	17.	130
1		25 201	.065 .109	1272 2186	1182 2012	1057 1686	1025 1763	103 1724	981 1686	958 1647	940 1615	\$22 1586	896 1539	878 1509	851 1462	828 1424	786 1360	685 1202	SP I	368 645	271 476	339 339	147 258	105 185	78
1	34.	5\$ 103	065 109	1000 1710	930 1589	863 1475	806 1379	789 1348	271 1318	753 1268	739 1264	725 1240	704 1204	1180 1180			617 1040	536 930	392 551	287 499	Z12 368	151 262	115 199	143	106
	15/4	55 105	.065 .109	\$70 1485	1380	751 1281	702 1197	286 1171	671 1145	658 1119	1098	1077	513 1045	501 1025	582 993	567 967	536 919	465 804	340 588	249 431	318	131 226	99 172	71 124	91
	2	35 105	.065 .169	133	644 1095	598 1015	559 950	546 129	534 908	522 887	512 8/1	502 854	488 829	813	781	767	727	369 633	270 463	340	145 251	178	136	56 97	72
	25%	59 103	.083 .120	732 1068	680 993	831 831	590 861	877 142	564 823	551 805	541 790	531 774	515 762	505 737	71	691	659	390 573	285 419	307	154 227	161	123	50 88	65
	1	55 109	.083 .120	599 872	337 811	515 753	483 703	472 688	462 573	451 657	443 545	434 633	422 514	413 602			+	318 466		_	184	┪	100	72 72	
	31/2	55 105	.083	\$23 61	488 707	451 658	421 614	412 600	403 587			379 552	368 530			9 49	469		203 297	218	160	┿	87	62	46
	4	55 100	.083	464 675	431 627	400 582	374 544		354 520					32 46				-		<del> </del>	142	101	77	55	41
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7	24	1	53 2 03 2	1 22 0 20	7 21 0 24	1 19 2 22	5 16 4 21	3 .17 0 :10	19 17 15 21	75 17 01 19	1 16	7 10 2 18	9 1	39 1 33 1	56 79 1	51 1 74 1	47 13 69 10	9 11	7 10	7 5 XO 7	4 4	7 3	3 2	2	1 11

The Allowable Street Values used are at ahows in ippendix "A" of ANSI 231 3— 2473 for welded also to ASTM A-312 having a weld laint factor of AS. Allowable Working Pressures shown for each size refrect the minus 2242% amountaclusies well telespoon.

FU DUH'T

San Page 58 for calculation details. All dimensions are in inches.

(continued on east pag-

# Compressed Gasketing BLUE-GARD°

The BLUE-GARD compressed asbestos-free gasketing family eliminates the need for asbestos. It is designed specifically to outperform and seal more effectively than virtually any other nonmetallic gasketing material. BLUE-GARD gasketing provides superior scalability and excellent torque retention. BLUE-GARD gasketing provides superior results because of our unique blends of synthetic fibers, fillers and elastomeric binders developed specifically for this asbestos-free gasketing family.

Features	Benefits
Sealability	Provides superior sealability over abbestos gasketing Offers virtually the lowest amount of leakage over any competitive non-metallic gasketing
Greep relaxation	Provides improved torque retention resulting in lower leakage than the majority of competitive fibrous type nonmetallic gasketing; both asbestos and asbestos-free
Wide choice of elastomers	Handles a wider range of fluids than virtually any other competitive librous type of nonmetallic, expestos-free gasketing

Typical	Physical	<b>Properties</b>

ASTM Test Method	Physical Properties	3000	BLUE-GA/ 3200/3400	D STYLES			
F37	Spalability Milliliters/Hour Leakage, ASTM Fuel A (isooctane): Gasket load, 500 psi (3.5 N/mm²) Internal pressure, 9.8 psi (.7 bar)	0.2	0.1	0.2	3766 0.1	CP-9900 0.3	CP-392
	Nitrogen; Gasket load, 3000 psi (20,7 N/mmt) Internal pressure, 30 psi (2 bar)	0.6	0.4	1.0	0.7	0.1	T.0
F38	Creep Relexation Percent:	20.3	18.4	18.2	24.5	30.0	20.0
F35	Receivery		***********	,	4411	30.0	30.0
	Percent:	.60	50	50	40	40	40
F36	Compressibility Percent:	7-17	7-17	7-17	7-17	15-30	15-30
	Fluid Resistance after Five Hour Immensions ASTM #1 Of @ +300° F (+150°C), Thickness Increase, Maximum, Weight Increase, Maximum, ASTM IRM #903 @ +300°F (+150°C), Thickness Increase Range, %: Tensile Loss, Maximum;	0-6 8 0-15	0-10 20 15-30	0-6 15 15-30	20 min.	0-5 25 0-15	0-15 45 0-40
	ASTM Fuel A @ +70-85°F (+21-28°C), Thickness Increase Range, %: Weight Increase, Maximum: ASTM Fuel B @ +70-85°F (+21-29°C), Thickness Increase Range, %:	35 0-5 8	70 0-15 25	50 0-10 20	10 min.	40 0-10 20	65 0-15 30
rica	Weight Increase, Maximum:	0-10 15	5-20 30	5-20 20	20 min.	<b>0</b> -15 . 30	0-25 45
Fi52	Tensile Strength Across Grain psi (N/mm²);	2500 (17)	2800 (19)	2800 (19)	2500 (17)	2000 (14)	1500
	Density (1/16" this. 1.5mm) lbs./fl.>; (grams/cm³);	100 (1.60)	100 (1.60)	100 (1.60)	100 (1.60)	65	(10) 85
DIN 3535 Part 4	Gas Permeability cc/min, Nitrogen: Internal pressure: 580 psi (40 ber) Gasket load: 4840 psi (32 N/mm²)	.05	.63	.08	.04	.001	.001

This is a general guide and should not be the sole makes of selecting of rejecting this material, ASTM test results in accordance with ASTM F-104; properties based on 0.8mm (1/02\*) sheet thickness (except as noted).

# **Gasketing Products**

#### **BLUE-GARD** gasketing in command

BLUE-GARD asbestos-free gasketing is monitored and tested from start to finish using the most modern procedures and aquipment. This high level of quality assurance continues to produce a full range of compressed assessor-free gaskeling that consistently shows a much better SEALABILITY level and a lower level of CAEEP RELAXATION than the competition.

#### **Style 3000**

Colors

Binder: Service: Nitrile (NBR) Water, alliphatic hydrocarbons, oils,

Temperature:

gasoline, mild acids and alkalies\*
max. \*700°F (+370°C)†; min. -40°F (-40°C)
Continuous oper, temp. +400°F (+205°C)

norversal particulativity on the Educativity equation

Pressure, max.:

P x T, max.:

1000 pai (70 par) 350,000 (12,000)\*\* (1/32" and 1/16" thick) 250,000 (7,290)\*\* (1/8" thick)

A good general purpose gasketing material

### Style 3200/Style 3400

Color:

Style 3200 - Off White Style 3400 - Grey-black

Binder: Service: SAR Water, saturated steam, mild acids and

Temperature:

aikalies, inert gases\* max, +700°F (+370°C)1; min\_ -40°F (-40°C)

Continuous oper, temp. +400°F (+205°C)

Pressure, max.: 1200 psi (83 bar)
P x T, max.: 350,000 (12,000)\*\* (1/32" and 1/16" thick)
250,000 (7,290)\*\* (1/8" thick)
For saturated steam and other severe service conditions. Style 3200 meets requirements of MIL-G-24696A.

#### **Style 3300**

Color:

Black

Binder

Neoprene (CR)

Service:

Water, saturated steam, refrigerants, oils, fuels, mild acids and alkalies

Temperature:

max. +700°F (+370°C)1; min. -40°F (-40°C) Continuous oper, temp. +400°F (+205°C)

Preseure, max.:

PxT, max.

1200 psi (83 bar) 880,000 (12,000)\*\* (1/32\*\* and 1/16\*\* thick) -250,000 (7,290)\*\* (1/8\*\* thick)

For use against oils, fuels and refrigerants.

#### **Style 3700**

Calor: Binder. Light Grey EPDM

Service:

Water, saturated steam, acids and

Temperature:

caustics of moderate concentrations\*
max. +700°F (+370°C)†; min. -40°F (-40°C)
Continuous oper. temp. +400°F (+205°C)

Pressure, max.;

Px T. max.: .

1200 pal (83 bar) 350,000 (12,000)\*\* (1/32" and 1/16" thick) 250,000 (7,250)\*\* (1/8" thick)

١,

The EPOM binder increases serviceability in saturated steam and many alkalles. Also adds exceptional resistance to both weather aging and ozone.

#### WARNING:

Responders is philableful shabum directory/dead two procedures and sprices. You'd specific depolitation encode rud but underthist the eclimate interpretated study and betalanders are unablated. For applicit depolitation and commissioned Consult Controll. Editions to refer from respet production about record to proceeding express of the record possible and the specific possible and the controller and the contr

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# CP-3900/CP-3920

#### highly compressible gasketing

Styles CP-3900/OP-3920 compressed gasketing materials are designed and manufactured to offer high compressibility characteristics. These premium grade gasketing materials are monitored and tested from start to finish using the most modern procedures and equipment. They exhibit ASTM F36 compressibility test results up to 30%, for high performance in applications in architecture. tions involving cast iron or other soft metallic flanges often found in pipe lines, valves, strainers, filters and pump casings. A unique blend of synthetic fibers and high temperature fillers in an elastomeric matrix provide superior sealability and forque retention in a large number of mediums.

## Specifications

# Style CP-3900

Color:

Pinder:

Niule (NBR)

Service:

Water, aliphatic hydrocurbons, oils, gasoline, mild acids and alkalies!

Temperature:

PxT, max.:

max. +700°F (+370°C)1; min. -40°F (-40°C) Continuous oper, temp, +400°F (+205°C)

Pressure, max.:

1000 pst (70 bar) 350,000 (12,000)\*\* (1/32" and 1/16" thick)

250,000 (7,290)\*\* (1/8" thick)

#### Style CP-3920

Color:

Off White

Binder:

SBR

Service:

Water, saturated steam, mild acids and

alkalies, inert gases max. +700°F (+370°C)1; min. -40°F (-40°C)

Temperature: Continuous oper, temp, +400°F (+205°C)

Pressure, max.: P x T, max.:

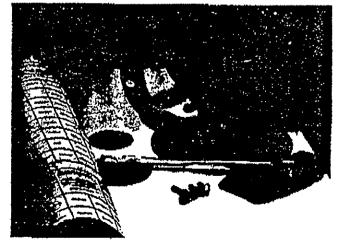
1000 psi (70 bar) 350,000 (12,000)\*\* (1/32\* and 1/16\* thick)

250,000 (7,290)\*\* (1/8" thick)

25mm = approx, 1", 1m = approx, 40"

TWhen approaching maximum temperature consult the Gariock Engineering Department
'Consult General Chamical Resistance of Compressed Gesketing

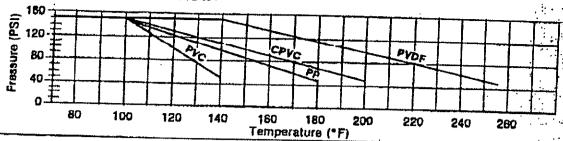
Products catalog
"P x T max. = psi x \*F (bar x \*C)



# PRESSURE (PSI) - TEMPERATURE (°F) GUIDELINES

The maximum pressure rating of any TVI Thermoplastic Valve is 150 PSI @ 72°F - water, nonshock. With temperature increase, the pressure capability of each type valve and size must be derated as charted below.

Ball Valves:
Compact Style,
True Union,
Econo-Pro.
Ball Check &
Foot Valves,
Gauge Valves.



PUC BUTTERFLY VALVES

#### Globe Valves

BODY	TEMP (15)	1707		~,, ~,			• •
	777 77	1/2"	3/4"	1"	1 1/4"	1 1/2"	
PVC	32 70	150	150	150	150	150	460
1 110		105	105	106	105	105	100
<u> </u>	120	105	105	105	105	105	<u>wa</u>
PP	140	105	105	105	105	105	30
! • • • · ·	190	80	90	90	90	900	
L	180	65	65	65	- 65		
				▼▼ <u>L</u>		65 1	40 (

Sight Glasses

		310000	
	SIZE JEMP. ("F) PYC	CPVC & DD	· · ·
	32 - 70   120   140	32 - 100   140   175   -4 - 100   140   105	
	1/2" - 1" 150 100 50	160 100 100 140 185	215
1	11/2 2   85   50	1 100 1 100	85
- (	2 1/2" - 4" 60 60 50	85 85 85 85 60 60 55 85	AS.
		60 55 60 60 60	60

**Butterfly Valves** 

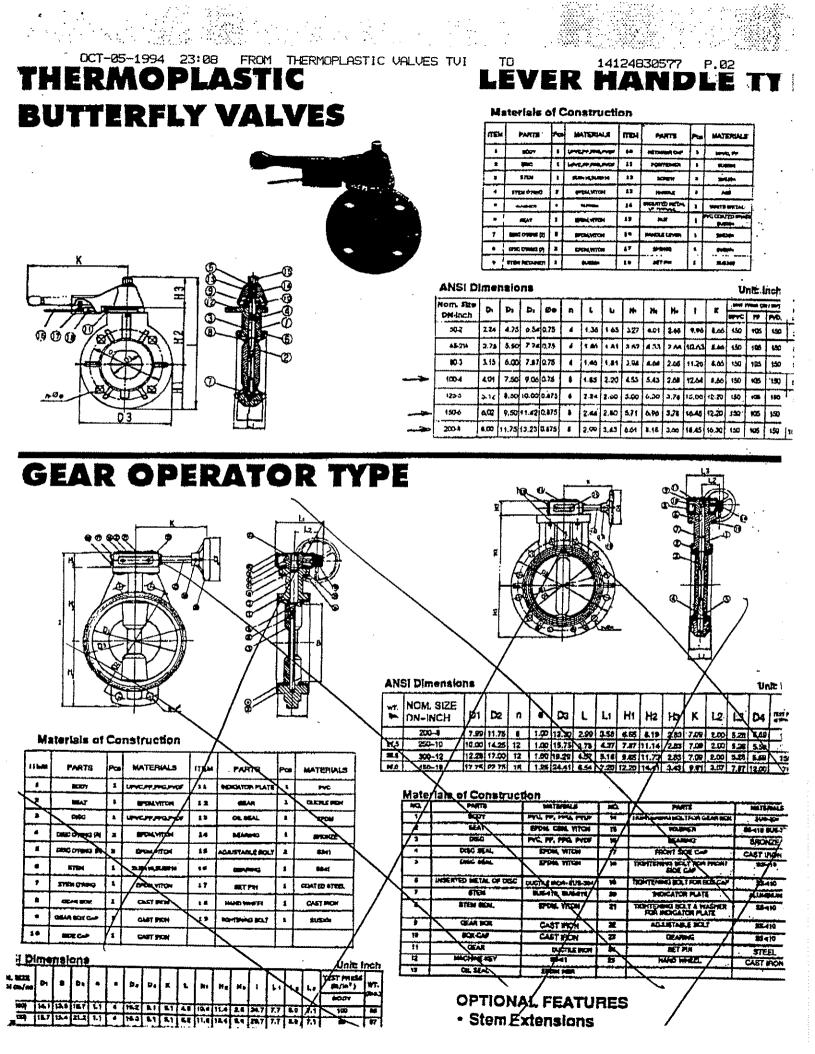
BODY	DISC	TEMP. (°F)	2" 2 1/2"	311	4"	i én	F	D*		· · · · · · · · · · · · · · · · · · ·					:	٠.
		32 - 70	150 150	1	14	1 3 1	- 5	6	1.10"	12"	14"	16"	18"	20"	24"	ľ
(PVC)	(qq)	190		150	150		150	150	150	100	100	85	70	50	50	ŀ
		120	100 100	100	100	100	100	100	100	60	60	60	30			١,
PVDF	PVDF	140	70 70	70	45	45	45	40	30	30	30	30		30	30	
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	I FIDE	<u>-40 — 250</u>	150 150	150	150	150	150	100	60				50		20	ľ.
				<u> </u>	1		7	- 4		60	40	40	40	40	40	ĺ.

Horizontal Swing Check Valve

TEMP.	L	Pί	IC										•
SIZE ('F)		EPDM	*	TEFLON		EPDM	Υ	T-001 AT			PVDF	***************************************	<del></del>
	32 - 70	110	120	32 - 120	-5110			TEFLON		EPC	M	·····	TEFLON:
3/4"	150	150	100	40	150	140	180	-5 110	-5 - 140	180	195	210	5 - 210
1"	150	150	100	40	150	100	90	40	150	120	100	85	85
1 1/2"	150	150	100	40	150	100	90	40	150	120	100	85	85
2"	150	150	100	40	150	100	90	40	150	120	100	70	85
2 1/2"	150	100	100	40	100	85	80 70	40	150	120	90	65	86
3"	150	100	100	40	100	70	60	35	150	100	80	50	85
	100	70	70	30	70	65	40	30	150	100	80	40	70
<u>5"</u>	100	70	70	30	70	50	35	30	100	85	60	35	70 ·
<u>0</u>	100	70	60	25	70	40	30	30 20	100	85	60	30	60
8"	70	40	40	20	40	35	25		100	70	50	30	40
					·····			15	70	50	40	30	40

Diaphragm Valves

		C		APHRAGI		7		1	EFLON (	DIAPHRAC	214	
SIZE	/U'F	140°F		YC		DF	PI	/C		VC		
1/2"	150		70°F	200°F	70°F	260° F	_70°F	1404F	70°F	200°F	70°F	VDF
3/4"		120	150	100	150	90	150	100	150	100		260°F
411	150	120	150	100	150	90	150	100			150	90
1 1/2"	150	120	150	100	150	80	150		150	100	150	90
3"	150	120	150	100	150	酚	150	100	150	100	150	90
	150	120	150	100	150	90	The second second		150	100	150	90
2 1/2"	150	120	150	100	150	90	150	100	160	100	120	75
9"	150	120	150	90	150		150	100	150	100	120	75
4"	150	120	150	90 "	150	90	90	75	90	75	190	60
5"	100	90	100	60	100	90	80	75	90	75	90	ÉÓ
6"	100	80	100	60		60	60	50	60	50	80	50
6"	60	50	60	45	100	60	<u> 60  </u>	50	60	50	80	- <del>5</del> 0 ·
TEFLON IS A	60	NI -	- 60	4 /	60	45	. 45	35	45	35	60	45



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IMPROVED PIPING (IPP) PRODUCTS, INC.

50 VASHELL WAY, SUITE 400, ORINDA, CA 94563-3020 PHONE 510/254-0962 • FAX: 510/254-9031 • TOLL FREE: 1-800-969-0962

We will rate the Lightweight 316 Stainless Steel Back Up Rings for the following:

2"	183psi
3"	125psi
<b>4"</b>	115psi
6"	135psi
<b>&gt;</b> 8"	125psi (
10"	135psi
12"	115psi
14"	105psi
16"	95psi
18"	85psi
20"	75psi
22"	<b>75</b> psi
24"	65psi

Please keep in mind that IPP has designed a safety factor of two into all of its products!!!

**BRANCH OFFICES** 

4538 FLORES AVE. ROHNERT PARK, CA 94928 PHONE: 707/584-0752 TOLL EDEE: 1.800\_488\_0759

642 OLD BALLWIN ROAD BALLWIN, MO 63021 PHONE: 314/227-1777

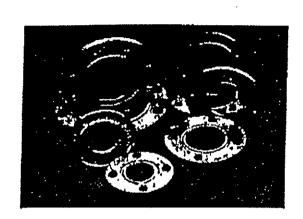
# IMPROVED PIPING PRODUCTS, INC.

# DELTAFLEX® BUPP-SS

The high performance, lightweight, stainless steel back-up flange

## THE MANUFACTURE PLENT PRODUCTARES

e have specialized in flange design since 1979 and furnish our products to a broad cross-section of industrial and municipal users. IPP flanges are made to exacting specifications and conform to the highest standards of customer service and quality assurance.



DELTAFLEX BUPP-SS' is the most unique and cost effective light weight stainless steel flange connection system in the world... and its available only from IPP'.

DELTAFLEX, in sizes 2" – 24", is a computer designed flange with a configuration engineered for minimum weight and maximum performance standards.

investment-cast from the highest grade of ASTM A351 stainless steel, DELTAFLEX conforms to a 150 psi drilling template. It's made to be retained by a thermoplastic or steel, stub-end fastened to the pipe by plastic fusion bonding or butt-weiding, ideal for low to medium pressure applications, DELTAFLEX BUPP-SS can be considered for virtually any service requiring stainless steel flanges.

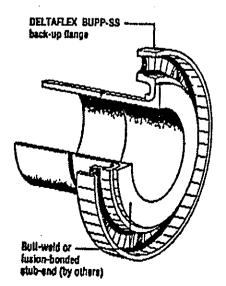
- \* Light weight / convoluted flange
- Palent applied for
- For full class 150 pressure/temperature service see our filerature on DELTAFLEX LI-SS

#### A STATE OF THE STA

- M Cast staliness steet flange conforms to A351 material space
- Designed for use with buit-welded, thermoplastic, or sleet stub-ends
- EDELTAFLEX is 60% of the weight of a comparable carbon steel flange
- m Rated for 110 psi operating pressure: 150# drilling!
- #Flange is reusable... It is not welded to the pipe !...
- Flexible structure is superfor where vibration and thermal attesses exist
- intercliangeable with conventional alloy steel flanges

DELTAFLEX eliminates the labor cost and hassle of the two-holing process required during fabrication

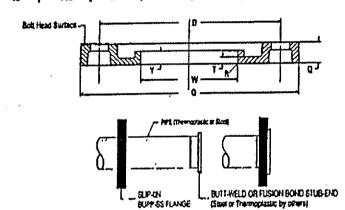
Because the flange is free to rotate on the stub-end, it is easy to fit up to mating flanges during assembly and installation. No more trying to match the boit holes... simply slip the flange over the pipe, weld or bond the stub-end to the pipe, and just turn the DELTAFLEX flange until the boit holes are aligned — install the boits, nuts, and washers — one man can do it efficiently.



10723		THE PARTY	TELLY	FLEX BUP	P. 53 8 FATE	TALL BIA	BULKU	FILM	推進開	即於	拉達
Pipe Siza	٥	a	w	Y	T		ε.	0	R	Weight (the.)	Operaling Pressure
t*	4.25	.4ŏ '	1.38	3	.20	14	.82	· 8.12 ·	.08	.98	110 pal *
114"	5.00	.40	1.97	.5	.20	4	.62	3.87	.08	1.26	110 psi
2	6.00	.40 '	· 2.48	45.4		::4:	17-11.78	: 4.75	.18 '	1.78	110 psi .
3"	7.50	.40	3.60	.4	.20	4	.75	6.00	.13	2.50	110 psi
r	9.00	.50	4.60	147	.20	1 "	.75	7.50	.18	8.56	110 psi
	11.00	.60	<b>8.</b> 75	.5	.25	1	.87	9.50	.13	6.08	110 psi
	13.50	.70	6.75	.5	.25	8	1.87	11.75	.18	1.61	110 psi
10'	16.00	.90	10.92	5	.25	12	1.00	14.25	.13	12.41	110 psi
12	19.00	1.05	12.92		.30	'. 12	1,00	17.00	1,25	20.88	110 psi
14"	21.00	1.13	14.18	.6	.30	12	1.12	18.75	.25	25.71	110 psi
16'	23.50	1.25	16.19	.6	30 ·	· 16	1.12	21.25	.25	31.71	110 psi '
18"	25.00	1.34	18.20	.5	.30	15	1.25	22.75	.25	33.88	110 psi
20'	27.50	1.47	20.25	· .6	.30	20	1.25	25.00	.25	40.77	110 p <del>s</del> l
22*	29.60	1.54	22.25	7	.35	20	1.37	27.25	.25	52.00	110 psi
24'	32.00	1.60	24.25		.40	20	1.27	29.50	.25	59.14	110 psi

MATEHIAL PROPĖR	ties 💢 🐪
ÁSTM ÁBST ÉFÓM 🚶	
Tensile Strength	70,000 pşl
. Yield Strength	30,000 pši
Elongation in 2°	30%
Carbon	.08%
Manganese	1.50%
Sillcon	1.50%
Sulphur	01%
Phosphorous	.04%
Chromium	18.0 - 21.0%
Nickel	9.0 - 12.0%
Molybdenum	2.0 - 3.0%
PRESSURE-TEMPER	ATURE

MPERATURE UPP-SS FLANGES
Opëraling Presiurë
i io
36
86
76
84
55
. 60
, 44-)



# EXPENSATION FATER SAMPLE SPECIFICATION FATER FATER SAMPLES

- 1.0 The flange shall be of the convoluted design and cast from ASTM A351 CF8M passivated stainless steel. Cast equivalent of 316 SS.
- 2.0 The finish shall be as-cast with flash removed from all edges and bolt holes.
- 3.0 The flange shall be marked with size, bolt hole template, material and type of flange.
- 4.0 The flange shall mate with: ANSI B16.5, B16.1, AWWA C207 and MSS-SP 43
- 5.0 The flange shall be DELTAFLEX BUPP-SS as manufactured by Improved Piping Products.

Warrandy: If any IPP Ring is believed to be defective, and if on examination IPP Rinds to R4 satisfaction that such ring is in fact defective, it will repair an appace such ring at its option without cost. In addition, on IPP Rings, IPP will pay to apply on the cost of installing replacement ring a sum equal to 20% of IPP's published Net Price in effect at the time the defective ring was purchased by the latinate use or the installing contractor, or the sum of \$5.00, whichever sum as greater.IPP shall not be stable for any consequence that damages (resulting from any defect to material or worknessing, THIS GLUTTATTER IS EXPRESSLY IN LIEU OF ANY AND ALL OTHER GUARANTEES AND/OR WARRANTEES.



50 Vasheli Way, Sulle 400 • Orinda, CA 94563-3020 Toll Free 800/969-0962 • Telephone 510/254-0962 • Fax 510/254-7253

Specifications subject to change without notice @1993 improved Ploing Products, Inc. Catalog Printed in U.S.A.

DELTAFLEX BUPP-SS ©1894 3M 94-2

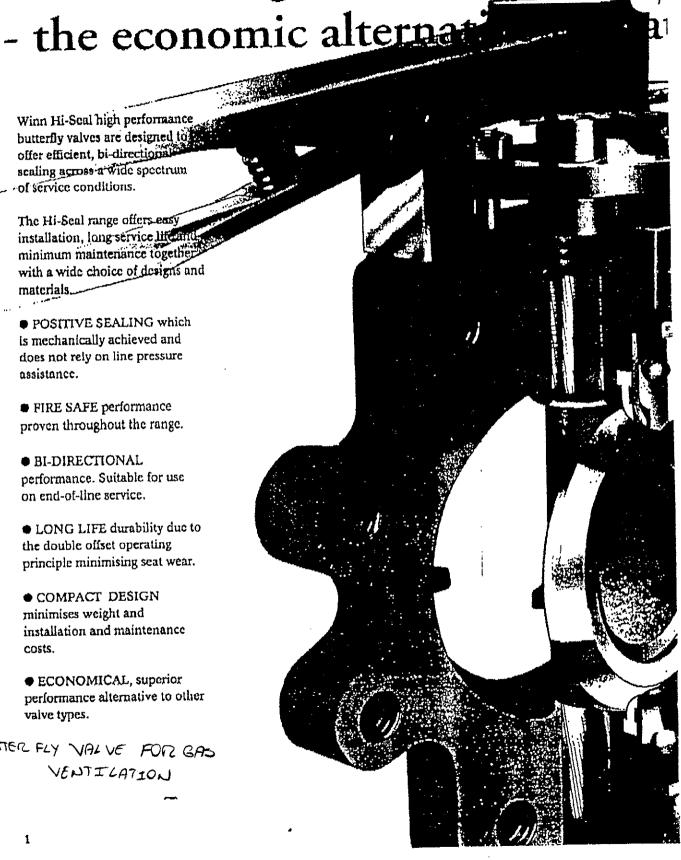
Hi Seal, the High Performance Bu

Winn Hi-Scal high performance butterfly valves are designed to offer efficient, bi-directional scaling across a Wide spectrum of service conditions.

The Hi-Seal range offers easy installation, long service life and minimum maintenance together with a wide choice of designs and materials...

- POSITIVE SEALING which is mechanically achieved and does not rely on line pressure assistance.
- FIRE SAFE performance proven throughout the range.
- BI-DIRECTIONAL performance. Suitable for use on end-of-line service.
- LONG LIFE durability due to the double offset operating principle minimising seat wear.
- COMPACT DESIGN minimises weight and installation and maintenance costs.
- **◆ ECONOMICAL**, superior performance alternative to other valve types.

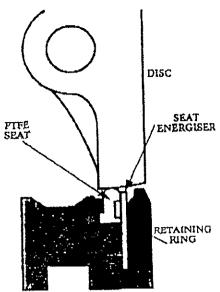
BUTTER FLY VALVE FOR GAS VENTILATION!



# erfly Valve with built-in reliability, Ball and other valve types.

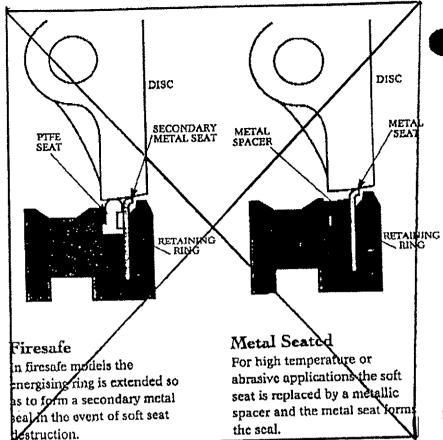
		The Rang	e:	
	*	Wafer	Clamped between flanges w	ith spanning bolts or studs
10	-	Wafer Lugged	Tapped or clearance holes a	vailable
		Double flanged	Suitable for ANSLand DIN	Standards
	ľ	esign Types		
	* [	Soft Seated	for general purpose applicat	ions.
	• -	Firesafe	for process industry use wh	era superior safety is required.
The second second	_	Metal Seated	for high temperature and/o	-abrasivo-survises.
	S	lize Range		
DE TE		Pressure class	ANSI 150 DIN PN 10/16	ANSI 300 DIN PN 25-410
	10	Sizes inch	-2-48 0" -50 1300 10"	2 · 2A 50 · 600
	P	Body Materials		
		Standard *	Carbon Steel (ASTM A 216 Stainless Steel (ASTM A 53 Aluminium Bronze (BS 14	<del>11 CF8M)</del>
			Duplex Stainless Steels	
		Alternatives	6 Mo Inconel Ferralium Hastelloy Titantium	
			Monel Other materials on request	
		Seat Materials		
	*	Standard (Soft Seat & Firesafe)	PTPE	
		-Alternative Seat Materials	RTFE (Reinforced PTFE) UHMPE (Ultra high Mole	cular Weight Polyethelene)
		Metal Seated Valves	Inconel	
		Disc Mater		

# Design Features

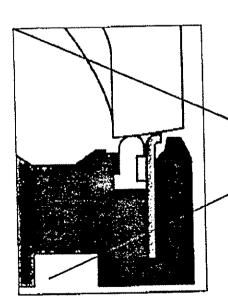


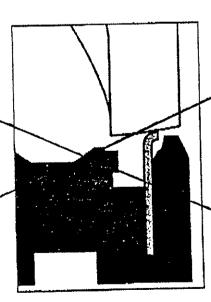


In soft seated models the PTFE seat is mechanically forced onto the disc by means of the seat energiser which acts as a disc spring.



Benefit: A choice of seating types offers excellent sealing across the whole pressure/temperature range.



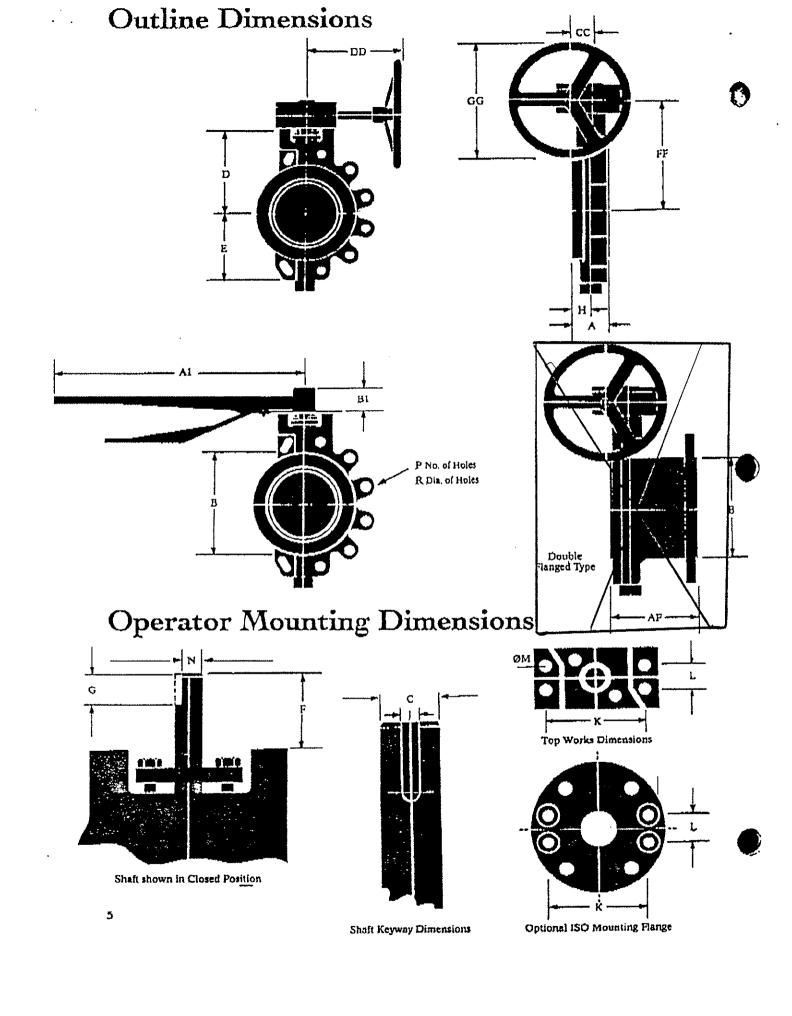


Piresafe Designate Destruction of the soft seat due to devated temperature will allow the metal seat to spring onto the disc and effect a secondary bi-directional metal to metal seal.

Benefit
Compliance with
International Firesafety
specifications.
(See Page 10.)

,	Features		Benefits
′•	Bi-	The disc/shaft assembly is doubly offset from centre causing the disc to move into the seat with a camming action.  This provides the mechanical	Low operating torque.  Positive sealing in either
	Directional Scal	principle which ensures a seal in either direction.	direction.
		As the valve begins to open the disc swings away from the seat eliminating wear points and extending seat life.	Long seat life. Lugged valves ideal for end-of- line service.
/	0 11	Single piece shaft design ensures rigidity and stability of the shaft/disc assembly.	Long life operation.
•	One Piece Shaft	The input drive is a key, designed to fail mechanically should abnormal torques be applied thus protecting the internal disc/shaft assembly.	To maximise safety.
1	Gland Adjustment	Gland packing compression is maintained by a bolted gland. Adjusting nuts are always accessible whatever operating method is fitted.	Accessible packing adjustment without operator removal.
/	Seat replacement	Without removing the disc/shaft assembly, seat rings may be replaced by simply removing the retaining ring.	Fast, easy maintenance.
	How do	∌ butterfly valves compare wi	th other valve types?
		Butterfly valves are COMPACT	Requires less space. Less weight. Less raw material. Less costly than other
			valve types.
		Butterfly valves are QUARTER TURN valves	Easy operation by lever, gearbox or actuator. Superior gland integrity.
		Butterfly valves have FEWER PARTS	Easier to maintain.
•		Butterfly valves are SUITABLE FOR CONTROL PURPOSES	Linear flow charactéristics between 30° and 70° of opening

Gate valves cannot claim ANY of these advantages.



ANSI Class 150	ANSI	Class	150
----------------	------	-------	-----

SI	ZE.			BOI Incl	NCT					In	LATOR ches			LU	œ			SHAF Inche mm			MQUI I	nches		WASER S	3 3	PLANCED 25
1	T		В	m C	n H	E	AF	ΑI	Bi	FF	DO	cc	œ	P	R	Ċ	G	j	F	N	K	ı	м			3
lre.	10 Th	149	4.02	4.53	0.98	2.91	425	7.84	1.65	5.79	8.66	492	236	1	H° UNC	0.50	0.55	Q),3	151	0.43	0.72 81:	•	L'SC	13	13	-
3	80	1.89	102 5.43	5.43	108	74 4.92	108	250 9.84	1.65	147 5.69	220 8.66	125	<u>ω</u> 236	4	34"	0.63	0.55	0.19	L61	051	0.32 81.5	-	174	IS N	20	44
4	IW	48	138 538	136 5.96	1.15	썦	500	250 14.90	1.55	7.24	220 B.66	787	236	8	INT.	039	079	019	161	037	032 N.1	-	IN:	24	31	48
		54	737	152 6.97	138	136 5.94	551	380 14.96	1.65	823	9.29	787	2.36	8	UNC	0.69	0.79	0.19	I.Ol	0.57	Q3Z	-	iX.	29 11	10	-
3	125	2.24 57	180	177	"	131 6.73	140 551	380 19.69	72 2.05	9.09	9.29	9.84	1.61	8	LNC	0.94	20 138	025	205	079	#2.5 402		**	35	51	66
6	150	2.24 51	8.50 2(6	7.46 190	3.38	171	140	500	32	9.65	9.29	984	67 264	-6	LNC 14	138 23B	138	0.4 1325	52 205	0.79	4.02	•		- 14 - 23	25	99
ð	300	1.32 64	10.63	803 204	1.5.3	1.75 191	5.90 152	-	-	245	236	150	67	12	UNC	73A 1,25	1.69	6.4 0.31	12 205	1.07	500	1.00	₹N.	₹4 88	106	143
10	250	2.80 71	12.76 37.4	9.76 143	3.75 44.5	9.37 736	6.50 163	-	-	11.38 289	12.01	17.72	2.64		UVC	316 138	1.97	0.37	120	27.2 1.15	127 598	1.63	17.X.	117	154	209
12	w	319 81	1500 381	31.54 193	1.89	1071 171	7.01 178	-	<u>-</u>	1331	1201 305	19.91 760	1,39 86	12	UNC	35	30	9.5	#6 2.76	29.5	7.01	11.1	1 N.	51 191	70	275
14	350	302 91	17.24	12.72	120	11.85	7.48	-	:	14.57	17.01 XX	29.92 760	4.37	12	CVC	(A)	2.52 64	044 111	307	149	178 7.76	177	LÍÚ.	139	374	440
16	400	102	19.29	14.41	2.44	13,23	8.50 -16	=	:	16.54	16.61	29.92 760	5.43 134	16	UNC	200 101	1.57	0.0 (27	78	41.5	7.76	111	UNK.	111	150 660	550
18	450	447	21.65		2.76	15.00	8.74 222	1 :	-	461	11591	117.71 150	138	16	1/A,	2.25 57.2	1,57	0.63	3.07 ;n	1.89	107	1.97	1,50 34"	501	636	682
20	500	3.00	2402 610			16.18	9.02	-	-	22.1. 562	17.X 437	17.71	3.43 135	20	IX IX	2.50 53.7	2.56	0.63 16	354	2.15 345	8.27 210	ξį1	UNC	110	141	935
24	600	6.06	28.54	22.05	3,70	1823	1051	-	•	24.5				20	IV.	1.87	1.77	0.75	194 701	2.44 62	9.49 241	2.99 76	17X	594 \$7\	880	+15
26	650	151 6.50	725 29.25		3.94	20.51	1150	<del>  -</del>	-	25.0			_	20	IN'	3,25 \$25	254 45	0.87	433	2.76	11.22 285	4.33	#\ LNL	733 111	990 191	1342
Z8	700	505	713 31.26		100 3.94	21.42	1150	-	-	26.10				28	1): 0 UN	3.25 87.5	2.56 65	0.87 22	4.33	2.76 70	11,22 285	1.33	1.74C	395 3(1)	1210 531	1804
30	750	9.02	794 33.74		3.94	22.65	292 11.50	-	<del>  :</del>	27.3	5 21.4	2362	9.33	28	17.* 81.\	3.25 82.5	256	0.87	433	176	11,22	4.33	1754	1056 pti	n-IR	2112
32	800	9.49	857 35.75	623 25.63	433	24.29	1252	<del>  -</del>	<del>  -</del>	28.3			933	Z8	174	150	2.76	0.87	4.97	300	11.22	4.33	*	1269	1716 20	1400
	900	9.49	905	651	110 5.12	26.93	318 12.99	-	<del>  -</del>	721 33.4	3 20.7	136		32	81.N	3,94	3.65	1.00	591	340	1121			1929		3243
<b>*</b>		241	1022	779	130	28.74	330		<del>  -</del>	35.2	520	236	9.33	16	11/2	100	3.65	1.00	1 <u>X1</u> 591	140		433	γ,	2330	+	4147
+0	1000	9,49 241	1124	815	100	L N	410	<u> </u>	ـَــا	37.1	526	600	237	36	817	100	3.65		1 <u>80</u> 591	140			1/4	3221	3705	1532
42	10,0	11.51	47.01 1194	34.41 674	\$.12 130	30.63 778	+10	<u> </u>	-	914	611	600	237		303	492	91.7	15.4	4.33	4.21	11.2		1/4"	4101		
48	1200	13.78	53.50	40.94	6.10	36.26	18.50	) -	-	144.7		7 LVD		'l '``	H US		1175	318	110	107	235	110	<u> 1120</u>	134	1:510	1177

ANSI Class 300

W/A	31 V	1800	200										LU	~e			HAFT			MOL	NTIN	CAT	WEK	CHICAGO
-2E	E		1	BODY nches mm				!	OPERA Incl m	hea				ω 			nche				Inche mm		¥ VEE	3
Îna	080	~	- R.	р	н	Ε	A1	81	FF	סמ	GG	œ	P	R	С	G	J	F	N	K	1	M	3 /	
2	50	169	3.62	35.	0,98	2,91	9.84 250	165	5.79 147	8.56 210	492	2.36 60	δ	7. 7.	0.50	0.55	013 12	1.61	0.43	325 825		# LNC	6,	13
3	80	189	9? 5.00	543	1.08	2	9.84	165	6.69	8.06	4.92	236	8	JA* UNC	0.63	0.55	0.19	157	0.51 110	325 125	-	150	18 8	20
4	100	48 21)	6.18	5.98	175	125 528	17%	165	170_ 124 184	8.66 220	7.87 300	136	В	UNC	0.69	079	0.19	161 41	0.57	1,25 02.5	-	#" (NC	24 11	31 14
5	125	<u>H</u>	157	157	30	- 13-	J80 -	-	10.		-	-	-		7	-		- 1		-		1	-	-
6	150	2.24	8.50	7.48	1.38	673	-	-	9.09	929	804	2.64	سثل	INC.	0.94	1,38	025	205	201	102	:	13V	35 14	57 35
-8-	200	280	10.63	8.86	163	8.58		=	10.17	1201 1201 305	177	**	12	UNC	1.25	169	031	205	1,07	500 127	1.00	127.	6Z	95 4)
10	250	3.23	12.76	1043	1.75	1031	<del>  -</del>		12.20	1201	29.92	3.39	16	UNC	1.38	1.97	037	220	1,13	258 15	103	LN:	12l 55	154 (i)
12	300	3.62	15.00	263 1201	1.89	267 1Z05	=	سخر	13.86		760 29.92	4.37	16	IH. BUN	143	252	0.44	2.76	137	701 171	1.63	y. UNC	165.	220 101
14	350	461	16.26	13.39	146 220	X06   13.1	مير	-	15.51	303 1661	760 29.92	5.43	20	1%*	200	157	050	307	1.71	7.76	1.77	I.M.	251 114	330
10	+00	324	18.30	1496	255	1496	<del> </del> -	-	394 17.09		760 17.72	5.43	20	UNC	5/4 225 572	L57	0.63	30	180	7.76 19	1.57	UNC:	508 231	610 210
18	130	133	20.98	380	257	180 [62]	-	<del> </del> -	21.22				24	1// 1//	250	256	0.63	35	2.15 54.5	832 210		1.X.	623	770 181
20	500	149	12.99	2020	73 305	17.28	┿÷	<del>  -</del>	339 22.12				24	SUN JW	635 7.87	1.77	<del>1175</del>	394 100	244	9.49	299	17.6	834	990 141
-	100	127	77.24 27.24	23.70	77.5 170	119 20.79	-	1	26.46				24	11/2	325	2.56	0.87	133	2.76	1122		IN.	1. S. W.	1540
	1.~~	181	192	rioz	94	528	<u> </u>		071	512	(00	1.)7	. —	10 UN	123	63	1 25	I UV	<u> </u>	1 14	1			~

ISO Mounting Flange

Note: All weights refer to bare shaft valve only.

Valve Size	ANSI 150 PN10/16	ANSI 300 PN25/40
Z-6"	F10	F10
8*	FIO	F12
10"	F12	F1+
12"	F14	F16
14"	F16	

For sizes 14" class 300 (PNZ5/40) and above consult

6

Parts List Firesafe or Soft-scated, Wafer, Lug and Double Flanged Valves. Firesafe Models Body Plug on sizes above 12' iệ r u Soft-seated Models 🕌 Body Plug on sizes above 12"

# Materials of Construction.

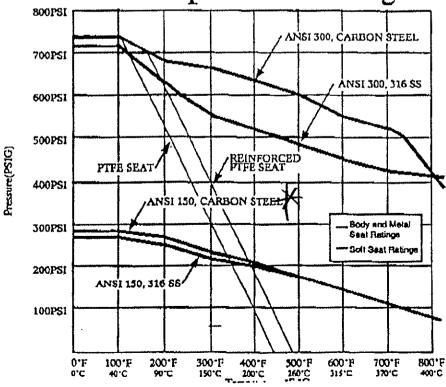
Standard materials for FIRESAFE models.

TTEM	Description	Cardon Steel Valves	STAINLESS STEEL VALVES	ALLMINIUM BRONZE VALVES
		ASIM AZIGWCC	. ASTM A351 CP8M	BS 1400 AB2
( <u>i</u> )	· DISC	ASTM A331 CP8M ENP	astm assi CPBM Enp	BS 1400 AB2
(i)	Let the second	ASTM ASSA G1 650 (17: 4PH)	'ASTM A364 Gr630 (17-4PH)	KMONEL
(1)	retaining ring	BS 4360 43A	RS 1501 316 \$31	DS 1400 AB2
(3)	the desired the second	TE NCONEL 625	INCONEL 625	INCONEL 625
(6)	SOPT SEAT	VIRGIN PTFE	VIRGIN PAFE	ytrgin PTFE
1	n in the second	AUSI XOZ	∴ A\\\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	· KMONEL
(8)	RETAINING RING SCREW	HIGH TENSILE STEEL	BS 4882 Gr D8X	KMONEL
9	Fig. 5 Service for the	PIPECOMPOSITE	PITE COMPOSITE	PTPE COMPOSITE
(0)	SHAFT BEARING -BOTTOM	Pipe composite	PIFE COMPOSITE	PIFE COMPOSITE
11)	ROUNTINGUE PLANTE	OKCHITE TO	Oraphite	GRAPHITE
(12)	GLAND PACKING	GRAPHITE	GRAPHTEE	GRAPHITE
(13)	THE WAY TO SERVE THE PARTY OF T	BS 970 316 831	BS970 316 S31	-₹ `,BS970 316 S31
(1)	GLAND POLLOWER FLANGE	astm assi cr8m	ASTM A351 CF8M	ASTM A351 CP8M
(5)	GLANDSTOD -	BS 4882 Gr B7	· DS 4882 Or D8X	BS 4882 Gr B8X
(6)	SLAND NUT	BS 4882 Gr 2H	BS 4882 Gr 8X	DS 4882-Gr 8X
17	ANTI BLOWOUT PIN	STAINLESS STEEL	STAINLESS STEEL	MONEL
18	IDENTIFICATION PLATES	STAINLESS STEEL	STAINLESS STEEL	STAINLESS STEEL

Standard materials for SOFT-SEATED models.

2	DDC	ASTM A351 CP8M	ASTM A351 CF8M	BS 1400 AB2
(3)	SEAT ENERGISER	INCONEL 825	INCONEL 825	INCONEL 625
(8)	retaining ring spring '	STAINLESS STEEL	Stainless Steel	PHOSPHOR BRONZE
(12)	GLAND PACKING	VIRGIN PIFE	VIRGIN PTPE	VIRGIN PTFE

Pressure/Temperature Ratings



The maximum working capability of any valve is either the body rating or the seat shut-off capability, whichever is the lower.

The seat ratings shown are based on data from API609.

The body ratings shown are from ANSI BL6.5/BS 1560 Pt 2.

NOTE: Consult Factory for metal seat applications above 800°F

# Operation Methods

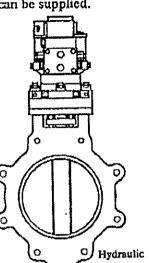
#### Handlever

The Winn lever operator incorporates a lockable spring loaded release arm allowing the valve to be set in intermediate positions for throttling service. A patented, cam adjusted, lever stop plate ensures perfect alignment between lever and disc in the closed position.

Levers are fitted as standard on valves up to 6" class 150 and 4" class 300.

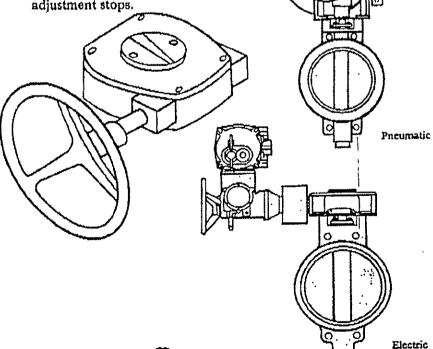
#### Powered Operation/Control

Pneumatic, electric or hydraulic actuators with ancillary equipment such as solenoid valves, limit switches, positioners etc. can be supplied.



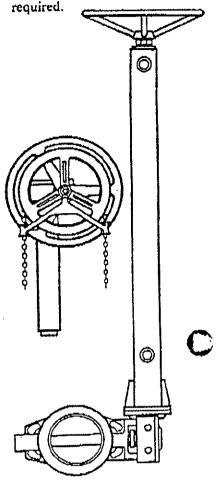


On larger valves requiring manual operation, a gearbox is mounted directly onto the valve yoke. The gearbox incorporates position indication and travel adjustment stops.

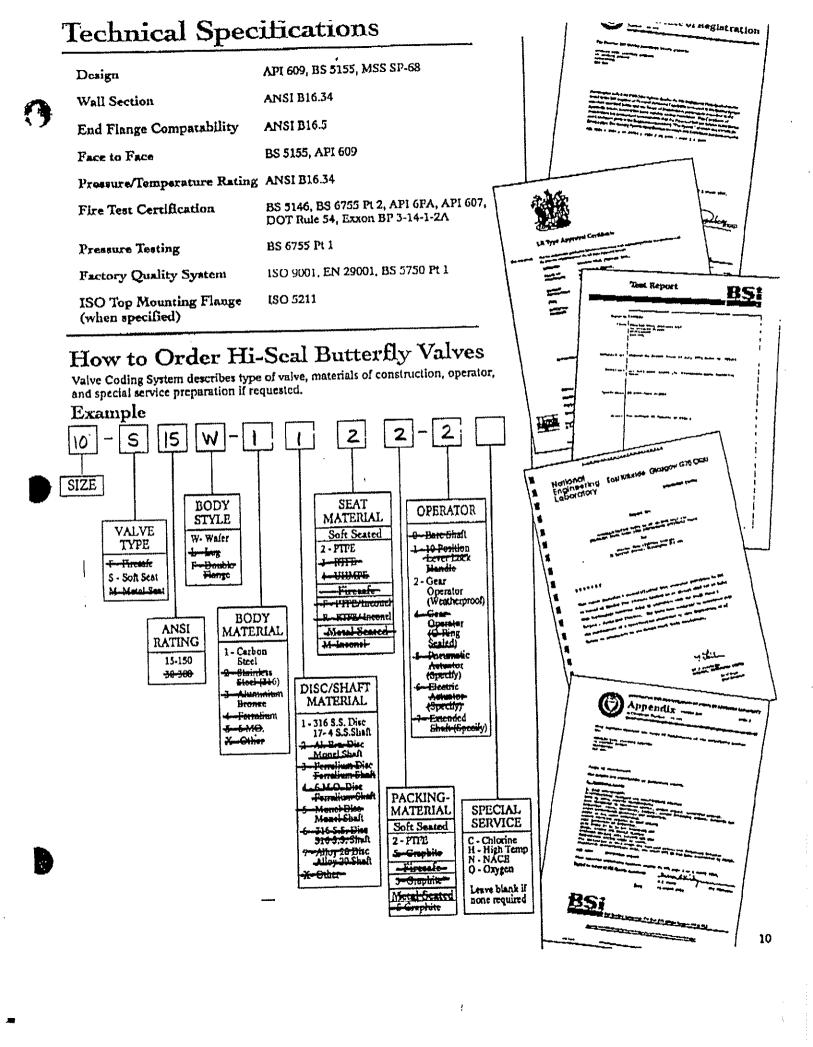


#### Adaptions

Extended stem operation, chain wheel operation and other adaptions are available as



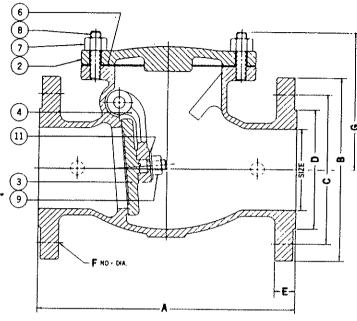
I.S.O. Mounting Flange. The operator mounting yoke may be adapted, by the addition of a mounting flange, to provide compatability with I.S.O. 5211. (See drawing on page 5.)



# Stainless Steel Swing Check Valves

#### Dimensions/150 Lb/Figure No. S151F6-316

1	J	4:	A.	\$B(ØC)	(D)	% <b>E</b> 1	7% F	Forth E. C.	wi/lbs
	1/2	Ħ	41/4	31/2 234	134	::	2.4X	5⁄a ≥ 2¾	8 🐍
	3/4	"	45%	378 234					
	1	Ħ	5	4/4 3/6	2.	沙水	34X	3/8/11/13/2	
-	11	<u>⁄2"</u>	61/2	5 374	12%	£%6	ZAX	96 1 34	161/2
	2	"	8	6 47	3%	16	4 ×	%30 5 €	22
	2½	<u>'2"</u>	81/2	7 7 512	\$418°	S K	(* 4 ×	<b>%</b> 5	33,5
_;	3	"	9½	71/2 6 着	<b>75</b> 33	34	<b>E4X</b>	343 × 61/4	45
_ '	4	"	111/4					<b>%</b>	<b>71%</b>
	<b>6</b> .	.1.	11472	21 18 3 E 9 F					2123.
_ {	8	**	191/2	131/2 11/4	105%	1 163	<b>学8</b> 文	% ≥10 °	220
10	0_	"	241/2	16。法14次	1129/3	1910	22×	13: 12%	330 🖭
12	2	"	271/2	19 3 17 2	15	1/4%	12×	1. 14	500
14	1	**	31	21 181/2					685
16	5	77	34	23/2 21/4	181/2	17/16	116 X	11/8 : 18%	
18	3_	"	381/2	25 次 22%	2135	19/18/	16X	1/4 20%	1510
20	)	"	381/2	27/2/25	23 👙	111/18	20 X	1/4 221/2	2020
24	1	"	51	32 291/2	27%	1783	20 X	1% 24%	2900



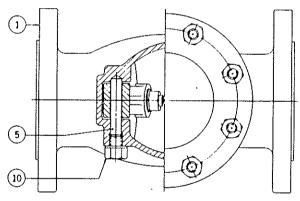
#### **Part**

#### Material

and the best of the first state of the

1 Body ASTM A 351 CF8M 2 Cover ASTM A 351 CF8M 3 Disc ASTM A 351 CF8M 4 Hanger ASTM A 351 CF8M 5 Hinge Pin ASTM A 182 F316 6 Gasket Teflon 7 Cover Nut ASTM A 276 GR 304 8 Cover Bolt ASTM A 276 GR 304 9 Disc Nut ASTM A 276 GR 316 10 Side Plug ASTM A 276 GR 316 11 Washer ASTM A 276 GR 316

Grapholl gaskets are available for temperatures above 500°F.



#### Applicable Standards

Shell Wall Thickness: MSS-SP-42; ANSI B16.34 Face-to-Face or End-to-End: ANSI B16.10

Flange Dimensions: ANSI B16.5 Weld End Dimensions: ANSI B16.25

Note: API 600 Design (renewable seat rings & heavy wall)

available upon request

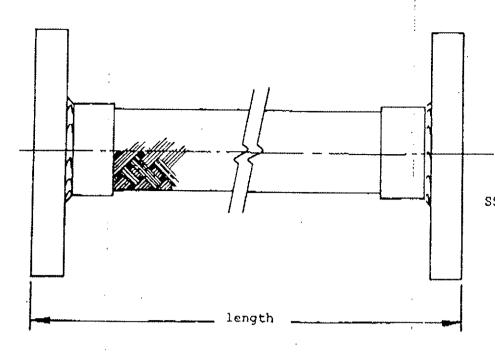
#### **Tests**

Class 150

Shell: 425 psi Seat: 80 psi Air\* \*Optional high pressure seat test per API 598 available upon request



38-52 Review Avenue Long Island City, NY 11101 718-392-1660 1-800-221-1115 FAX: 718-729-5106



HOSE & BRAID Stainless Steel FLANGE SS T-3n4 plate with 150# drilling

******			SIZE	WORKING PRESSURE	
ITEM	QUANT.	MODEL NO.	ID & LENGTH	70°1°	
******		PCS 250 FIG	2-1/2 X 9 ·	400#	
		PCS 300 FLG	3 X 9	288#	
		PCS 400 FLG	· 4 X 9	285#	1
		PCS 500 FLG	5 X 11	225/	
		PCS 600 FLG	A CONTRACTOR OF THE PARTY OF TH	200#	
		PCS 800 FLG	8 X 12	185#	
		PCS 1000 FLG	( Contract	175#	
		PCS 1200 FLG	12 X 14	160#	
·····		PCS 1400 FLG	14 X 14	130#	
		PCS 1600 FLG	16 X 14	110#	

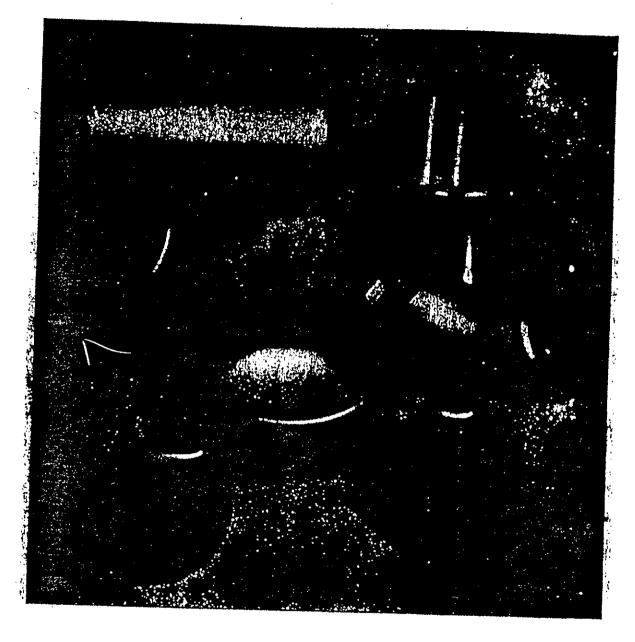
:USTOMER. PROJECT NGINEER RCHITECT

PRO/P.O.No.

TUM ELECNINDE TOR SE EN COM

32-900

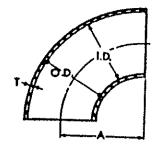
# WELD FITTINGS



WELD FIETINGS—Are generally manufactured to ASTM-A403 with dimensional tolerances in accordance with MSS SP-43 for schedules 5s and 10s and with ANSI B16.9 for schedules heavier than schedule 10s.

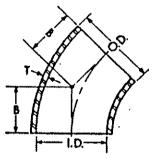
As-welded" or "paper mill grade" fittings are supplied in the as-welded, pickled and passivated condition.

# 190° ELBOWS



NOM.	OUTSIDE	CENTER	SCHE	DULE 5S	SCHED	ULE 10S	SCHED	ULE 40S	SCHED	ULE 80S	
PIPE	"DIAMETER (0 D )	TO FACE	INSIDE DIAMETEH (1 D )	WALE THICKNESS (T)	INSIDE DIAMETER (I D I	WALL THICKNESS (T)	INSIDE DIAMETEIL (1 D )	WALL THICKNESS (T)	INSIDE DIAMETER (I D )	WALL THICKNESS (T)	NOM. PIPE SIZE
1/2	.840	11/2	.710	.065	.674	.083	.622.	.109	.546	.147	1/2
3/4	1.050	11/2	.920	.065	.884	.083	.824	.113	742	.154	3/4
1_1	1.315	11/2	1.185	.065	1.097	.109	1.049	,133	.957	.179	1
11/4	1.660	17/6	1.530	.065	1.442	.109	1.380	.140	1.278	.191	11/4
11/2	1.900	21/4	1.770	.065	1.682	.109	1.610	,145	1.500	.200	1 1/2
2	2.375	3	2.245	.065	2.157	.109	2.067	.154	1.939	.218	2
21/2	2.875	334	2.709	.083	2.635	.120	2.469	.203	2.323	.276	21/2
3	3.500	41/2	3.334	.083	3.260	.120	3.068	.216	2.900	.300	3
31/2	4.000	51/4	3.834	.083	3.760	.120	3.548	.226	3.364	.318	31/2
4	4.500	6	4.334	.083	4.260	.120	4.026	.237	3.826	.337	4
5	5.563	71/2	5.345	.109	5.295	.134.	5.047	.258	4.813	.375	5
6 - `	6.625	9	6.407	.109	6.357	.134	6.065	.280	5.761	.432	6
8	8.625	12	8.407	.109	8.329	.148	7.981	.322	7.625	.500	8
10	10.750	15	10.482	.134	10.420	.165	10.020	.365	9.750	.500	10
12	12.750	18	12.438	.156	12.390		12.000	.375	11.750	.500	12

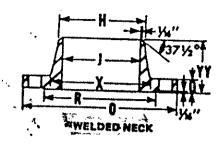
45° ELBOWS LONG RADIUS

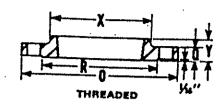


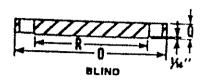
					4,4	<b>'</b>					
NOM. •PIPE size	OUTSIDE DIAMETER (O.D.)	CENTER TO FACE : (B)	1 SAMEIRE	ULE 55 WALL THICKNESS (T)	animum e	ULE 105 WALL THICKNESS	INSIDE	ULE 40S WALL THICKNESS	SCHEDI INSIDE DIAMETER (I.D.)	GUAL 1	NOM. PIPE SIZE
V <sub>2</sub>	.840	5%	.710	.065	.674	.083	.622	.109	.546	.147	1/2
3/4	1.050	7/16	.920	.065	.884	.083	.824	.113	.742	.154	3/4
1	1.315	7/4	1.185	.065	1.097	.109	1.049	.133	.957	.179	1
11/4	1.660	1	1.530	.065	1.442	.109	1.380	.140	1.278	.191	11/4
11/2	1.900	17	1.770	.065	1.682	.109	1.610	.145	1.500	.200	1 1/2
2	2.375	134	2.245	.065	2.157	.109	2.067	.154	1.939	.218	2
21/2	2.875	13/4	2.709	.083	2.635	.120	2.469	.203	2.323	.276	21/2
3	3.500	2	3.334	.083	3.260	.120	3.068	.216	2.900	.300	3
31/2	4.000	21/4	3.834	.083	3.760	.120	3.548	.226	3.364	.318	31/2
, 4	4.500	21/2	4,334	.083	4.260	.120	4.026	.237	3.826	.337	4
5	5.563	31/4	5.345	.109	5.295	.134	5.047	.258	4,813	.375	5
6	6.625	374	6.407	.109	6.357	.134	6.065	.280	5.761	.432	6
8	8.625	5	8.407	.109	8.329_	.148	7.981	.322	7.625	.500	8
10:3	10.750	61/4	10.482	.134	10.420	165 €	10.020	.365	9.750	.500	10
17	12 750	715	12 438	158	12 380	189	12 000	375	11 750	500	12

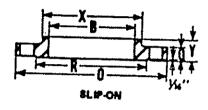
#### ASA B16.5

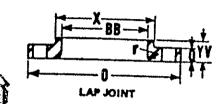
# ASA 150 POUND FORGED FLANGES







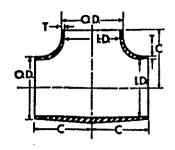




									Á	AGINE	<b>VCCIKI</b>					
	NOMINAL PIPE SIZE			CL W	YUN EIMENSI			•	•	Mittint	NEEP	Inetact	L Sub Co		(8)	
	13576		Q.	R	X	BURN BULT	BER AP PETER I	it Gircit	YYA	1 H		74 YA	B	. 1		88
	1/2	31/4	7/16	13%	1 3/14	4	- %	. 23%	11/4	.84	.69	*	.88	1/6	*	.90
	3/4	374	1/4	1144	11/4	4	₩	214	21/16	1.05	.82	5%	1.09	1/6	3%	1.11
	1	41/4	<b>Y</b> 16	2	113/16	4	*	31/4	23/16	1.32	1.05	11/14	1.36	1/6	11/14	
	11/4	4%	3%	21/4	25/16	4	*	31/4	21/4	1.66	1.38	13/16	1.70	7/10	13/14	1.72
1	11/2	5	1416	274	2%6	4-	<b>%</b>	3 7/1	27/16	1.90	1,61	₹,	1.95	14	74	1.97
ŀ		6	3/1	3%	31/14	4-	*	4%	21/2	2.38	2.07	1	2.44	7/16	1	2.46
2	21/2	7	7%	41/6	3 %16	4.	*	. 51/4	234	2.88	2.47	11/6	2.94	3/16	11/6	2.97
	3	71/4	1916	<del> </del>	41/4	4-	*	6	234	3.50	3.07	1 1/14	3.57	34	1716	3.60
	231/2	81/4	13/16	51/4	413/16	8-	*4	7	217/16	4.00	3.55	11/4	4.07	3%	11/4	4.10
	.4	9	15/16	67/16	54/6	8-	<b>¾</b>	71/2	3	4.50	4.03	1%	4.57	7/16	15/16	4.60
	5	10	1716	7414	61/16	8-	74	81/4	31/4	5.56	5.05	1 7/16	5.66	7/16	1 1/16	5.69
_	6	11	1	81/4	79:4	8-	¥	9/	沙莲	26.63	16.07	1 %16	6.72	<b>1/4</b>	1 1/14	6.75
	8	131/4	11/4	10%	911/16	8-	<b>¾</b>	1114	4	8.63	7.98	11/4	8.72	1/4	114	8.75
•		18	1 3/14	121/4	12	12-1		14/2	Azara	10775	10.03	113/16	10.88	1/4	115/16	10.99
	12	19	114	15	14%	12-1		17	41/2	12.75	12.00	23/16	12.88	14	2716	12.92



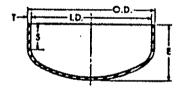
Figures conform to ASA 816.3.
If I coincid face is lariade f in thirt exp C2 and for





# STRAIGHT-TEES

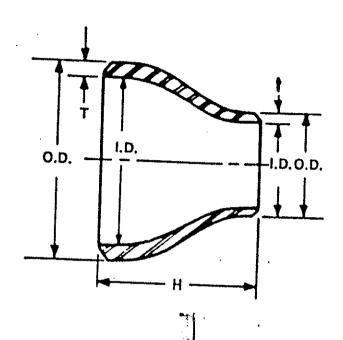
			00000	-							
NOM. PIPE	OUTSIDE DIAMETER	CENTER TO END	SCHED (HSIDE DIAMETER	ULE 55 WALL THICKNESS	INSIDE	JLE 10S WALL THICKNESS	SCHEDL INSIDE DIAMETER	JLE 40S WALL THICKNESS	SCHEDI INISDE DIAMETER	JLE BDS WALL THICKNESS	NOM. PIPE
SIZE	(0 D )	(C)	(I D.)	<b>(1</b> )	(l D )	(1)	(t D )	(-)	(i D )	(1)	SIZE
1/2	.840	1	.710	.065	.674	,083	.622	.109	.546	.147	1/2
74	1.050	11/1	.920	.065	.884	.083	.824	.113	.742	.154	<del>/</del> 4
1	1.315	11/2	1.185	.065	1.097	.109	1.049	.133	.957	.179	1
11/4	1.660	17/4	1.530	.065	1.442	.109	1.380	.140	1,278	.191	11/4
11/2	1.900	274	1.770	.065	1.682	.109	1.610	.145	1.500	.200	11/2
2	2.375	21/2	2.245	.065	2.157	.109	2.067	.154	1.939	.218	2
21/2	2.875	3	2,709	.083	2.635	.120	2,469	.203	2.323	.276	21/2
3	3.500	376	3.334	.083	3.260	.120	3.068	.216	2.900	.300	3
31/2	4.000	334	3.834	.083	3.760	.120	3.548	.226	3.364	.318	31/2
4	4.500	41/8	4.334	.083	4.260	.120	4.026	.237	3.826	.337	4
5	5.563	47/4	5.345	.109	5.295	.134	5.047	.258	4.813	.375	5
6	6.625	5%	6.407	.109	6.357	.134	6.065	.280	5.761	.432	6
8	8.625	7	8.407	.109	8.329	.148	7.981	.322	7.625	.500	8
\$10.3	10.750	81/2	10.482	.134	10.420	1.165	10.020	.365	9.750	.500	10
12	12.750	10	12.438	.156	12.390	.180	12.000	.375	11.750	.500	12



# CAPS

: \$\delta^{\tau}	30,200,00	LENGTH (E)	SCHEE	ULE 5S	SCHED	ULE 10S	VSCHED	ULE 40S	SCHED	ULE BOS	
	OUTSIDE OUTSIDE OUTSIDE OUTSIDE OUTSIDE	TANGENT LENGTH (S)	INSIDE DIAMETER (I O )	WALL THICKNESS (T)	INSIDE DIAMETER (I D )	WALL THICKNESS (T)	INSIDE DIAMETER II D )	WALL THICKNESS (T)	HISIDE HISIDE	WALL THICKNESS (T)	NOM. PIPE SIZE
1/2	.840	E 1 S .74	.710	.065	.674	.083	.822	.109	.546	.147	1/2
3/4	1.050	E 1 S .68	.920	.065	.884	.083	.824	.113	.742	.154	3/4
1	1.315	E 11/2 S 1.10	1.185	.065	1.097	.109	1.049	.133	.957	.179	1
11/4	1.660	E 11/2 S 1.02	1.530	.065	1.442	.109	1.380	.140	1.278	.191	11/4
11/2	1.900	£ 11/2 S .95	1.770	.065	1.682	.109	1.610	.145	1.500	.200	11/2
2	2.375	E 11/2 S .83	2.245	.065	2.157	.109	2.067	.154	1.939	.218	2
21/2	2.875	E 11/2 S .68	2.709	.083	2.635	.120	2.469	.203	2.323	.278	21/2
3	3.500	E 2 S 1.02	3.334	.083	3.260	.120	3.068	.216	2.900	.300	3
31/2	4.000	E 272 8 1.40	3.834	.083	3.760	.120	3.548	.226	3.364	.318	31/2
4	4.500	E 21/2 S 1.26	4.334	.083	4.260	.120	4.026	.237	3.826	.337	4
5	5.563	E 3 S 1.48	5.345	.109	5.295	.134	5.047	.258	4.813	.375	5
6	6.625	£ 3½ \$ 1.70	6.407	.109	8.357	.134	6.065	,280	5.761	.432	8
8	8.625	E 4 8 1.88	8.407	.109	8.329	.148	7.981	.322	7.625	.500	8
10	10.750	E 5 8 2.13	10.482	134	10.420	.165	10.020	.365	9.750	.500	10
12	12.750	E 6 8 2.63	12.438	.156	12.390	.180	12.000	.375	11.750	.500	12

# ÉCONCENTRIC REDUCERSI(CONT'D)



100	. ¡ OUTSID	E DIAMETER		SCUEDULE CO	, Y					
			39	SCHEDULE 5S	SCHEDULE 1		LE 4DS	SCHEDUL	FAIIS	
NOM. PIPE	THE EARLIE	SMALL	& LENGTH	DIAM THICK LI DI NESS LARGE END E END E END SMALL SMALL	ENER E	WALL INSIDE INIER DIAM NESS (ED) ANGE LANGE NO END EE MALL SMALL	ENU 1	PASIDE STANDARD STANDARD STANDARD SE	HALL THICK NISS	NOM.
6x31/2	6.625	4.000	51/2	LE 6.407 7 .109 SE 3.834   083	LE 6.357 T	134 LE 6.065	SMALL ENG 1 T ,280	SMALL.	SMALL ENU L	SIZE
6x4	6.625	4.500	5 ½	LE 6.407 T .109	SE 3.760 t	120 SE 3.548	t .226	LE 5.761 SE 3.364	T .432 t .318	6x31/2
6x5	6.625	5.563	51/2	LE 6.407 T .109	SE 4.280 1 LE 6.357 T	.120 SE 4.026	1 .237 T .280	LE 5.761 SE 3.828 LE 5.761	T .432 1 .337	6×4
8x31/2	8.625	4.000	6	LE 8.407 T .109	SE 5.295 1 LE 8.329 T	.134 SE 5.047	t .258 T .322	LE 5.761 SE 4.813 LE 7.825	T .432 1 .375	6x5
8x4	8.625	4.500	6	LE 8.407 T .109	LE 8.329 T	.120 SE 3.548	1 .226 T .322	SE 3.364 LE 7.825	T .500 1 .318	8x31/2
8x5	8.625	5.563	6	LE 8.407 T .109	LE 8.329 T	.120 SE 4.026	1 .237 T .322	SE 3.826 LE 7.625	7 .500 1 .337	8x4
8x6	8.625	6.625	6	SE 5.345   .109 LE 8.407   T .109 SE 8.407   T .109	LE 8.329 T .	.134 SE 5.047	1 258 T 322	SE 4.813 LE 7.625	7 .500 -375	8x5
10x4	10.750	4.500	7	LE 10.482 T 134 SE 4.334 1 083	LE 10 420 T.	165 LE 10.020	1 280 T 365	SE 5.761	T .500 I .432 T 500	8×6
10x5	10.750	5.563	7	LE 10.482 T .134 SE 5.345 1 .109	LE 10.420 T.	120 SE 4.028	1 .237 T .365	SE 3.826	.337	10x4
≛10x6	10.750	6.625	7	LE 10.482 T .134 SE 6.407 L .109	LE: 10.420 . Ta	****	1 .258 T .365	SE 4.813 1 LE 9.750	7 .500 .375 7 .500	10x5
10x8	10.750	8.625	7	LE 10.482 T .134 SE 8.407 t .109	LE 10.420 T .1	166 LE 10.020	1 .280 T .365	SE 5.761 LE 9.750	.432	10x6
12x5	12.750	5.563	8	LE 12.438 T .156 SE 5.345 t .109	LE 12.390 T .1	148 SE 7.981 160 LE 12.000	T 375	SE 7.625 1	500	10x8
12x6	12.750	6.625	8	LE 12.438 T .156	LE 12.390 T .1	34 SE 5.047	.258	SE 4.813 (	.500	12x5
12x8	12.750	8.625	8	LE 12.438 T .158	LE 12.390 T.1	34 SE 8.065 80 LE 12.000	.280	SE 5.761 1	.432	12x6
12x10	12.750	10.750	8	SE 8.407   1.109 LE 12.438   T.158	SE 8.329 1 .1. LE 12.390 T .1	48 SE 7.981	.322	LE 11.750 T SE 7.625 1	.500 .500	12x8
		<u> </u>		SE 10.482   1 .134	SE 10.420   1 .11			LE 11.750 T SE 9.750 t	.500 .500	12x10

# UNATIC FLAP GATES CIRCULAR OPENING

# HEAVY DUTY TYPE

These flap gates may be installed on the face of a concrete wall with anchor bolts; attached, by means of studs, to the face of a wall thimble embedded in the concrete wall; or bolted to a pipe

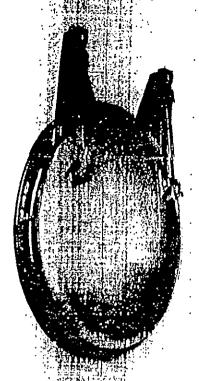
The gate has two adjustment features: at the top laterally and at the center for any misalignment. Hinge points have lubrica-

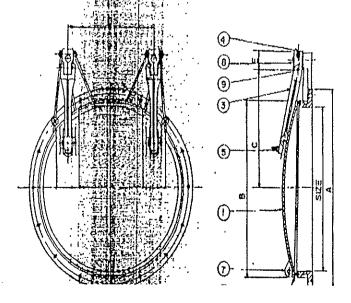
The flap opens on minimum differential head.

# DIMENSIONS - INCHES

٨	В	C	D	E
25	21)/	17%	<del> </del>	5
271/4	231/4			5
281/2			-	5
32		18		5
381/4	35	2614	24	6
46	41	·		61/1
53	47	~		71/3
591/	531/1	30		7%
661/4	59	4014		715
73	65	45		71/3
80	71	48	-	71/1
861/4	77	5834		7兆
93	81	64		8
9934	92	69		8
106%	98	74	65	8
1131/4	101	79	70	8
	25 27½ 28½ 32 38½ 46 53 59½ 66½ 73 80 86½ 93 99¾ 106½	25 21½ 27½ 23½ 28½ 24½ 32 27½ 38½ 35 46 41 53 47 59½ 53½ 66½ 59 73 65 80 71 86½ 77 93 81 99½ 92 106½ 98	25   21½   17½   27½   23½   20   28½   24½   20½   32   27½   18   38¼   35   26½   46   41   27   53   47   31½   59½   53½   30   66½   59   40½   73   65   45   80   71   48   86½   77   58¾   93   81   64   99¾   92   69   106¼   98   74	25   21½   17½

18" to 24" sizes have a single hinge. Dimensions are approximate.





#### CONSTRUCTION

1-Flap - Cast iron

2—Frame — Cast iron

3-Hinge link - Cast steel

4-Hinge - Bronze

5-Adjusting screw - Bronze

6-Seat - Neoprene

7-Lifting eye - Cast iron

8—Hinge post - Bronze

9-Pins - Bronze ·