PELHAM BAY LANDFILL
BRONX, NEW YORK

Operation and Maintenance Manual
Volume IIa

Prepared for:

City of New York
Department of Environmental Protection

WCC Project No. 92C4087

November 1996

Prepared by:

Woodward-Clyde

Woodward-Clyde Consultants, Inc.
363 Seventh Avenue, 11th Floor
New York, New York 10001

PELHAM BAY LANDFILL
OPERATION & MAINTENANCE MANUAL
VOLUME I

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2.1 E

Tensar

The Tensar Corporation

1210 Citizens Parkway
Morrow, Georgia 30260
(404) 968-3255

JULY 15, 1994

UX 1500 HT Geogrid

BARBELLA ENVIRONMENTAL
TECHNOLOGY

WHITEHOUSE, NJ 08888

REFERENCE: TENSAR ORDER NUMBER: 400669
PURCHASE ORDER NUMBER: 01
BILL OF LADING NUMBER: 07659

SOLD TO: BARBELLA ENVIRONMENTAL
TECHNOLOGY
PO BOX 273

WHITEHOUSE, NJ 08888

SHIP TO: BARBELLA ENVIRONMENTAL
PELLHAM BAY LANDFILL
3599 BRUCKNER BLVD
SEE DIRECTIONS
BRONX, NY 10464

This is to certify that TENSAR UX150095 geogrid as manufactured by the Tensar Corporation, meets the characteristics and properties per the attached specification sheet. Actual lot number(s) shipped are as indicated:

LOT NUMBER	NO. ROLLS	TENSILE MODULUS (lb/ft)	ULTIMATE TENSILES (lb/ft)	% CB
1-3970	7	106,450	7423.4	2.40
1-3973	9	112,276	7423.4	2.70
1-3974	45	113,236	7567.3	2.60
1-3975	9	110,357	7389.1	2.60

Sincerely,

Ron Humpolick
Manager of Continuous Improvement
and Quality Control

Bill Wright
Notary Public, Clayton County, Georgia
My Commission Expires May 10, 1998

Tensar

The Tensar Corporati

1210 Citizens Parkway
Morrow, Georgia 30260
Tel. (404) 968-3255

SHIP DATE: July 14, 1994

SOLD TO: Barbella Environmental

SHIP TO: Pellham Bay Landfill

BILL OF LADING: 07659

PRODUCT CODE: UX150095

LOT NO.	ROLL NO.										QUANTITY
-											
-											
1-3970-	38-43		45								7
-											
1-3973-	116-124										9
-											
1-3974-	35-43		44-52		62-70						45
-	71-79		89-97								
-											
1-3975-	04-12										9
-											
-											
-											
-											
-											
-											
-											
-											
-											
-											
-											70

UNIAXIAL GEOGRID UX1500HT

The geogrid shall be a regular grid structure formed by uniaxially drawing a continuous sheet of select high density polyethylene material and shall have aperture geometry and rib and junction cross-sections sufficient to permit significant mechanical interlock with the material being reinforced. The geogrid shall have high flexural rigidity and high tensile modulus in relation to the material being reinforced and shall also have high continuity of tensile strength through all ribs and junctions of the grid structure. The geogrid shall have high resistance to deformation under sustained long term design load while in service and shall also be resistant to ultraviolet degradation, to damage under normal construction practices and to all forms of biological or chemical degradation normally encountered in the material being reinforced.

The geogrid shall also conform in all respects to the property requirements listed below.

PROPERTY	TEST METHOD	UNITS	VALUE
Interlock			
• open area	COE Method[1]	%	60 (nom)
Reinforcement			
• creep limited strength[6]	GRI GG3-87[2] or (ASTM D5262)	lb/ft	2,700 (min)
• flexural rigidity	ASTM D1388-64[3]	mg-cm	4,700,000 (min)
• tensile modulus-MD	GRI GG1-87[4]	lb/ft	100,000 (min)
• junctions	GRI GG2-87[5]		
- strength		lb/ft	5,000 (min)
- efficiency		%	90 (min)
Material			
- high density polyethylene	ASTM D 1248 Type III/Class A/Grade 5	%	97 (min)
• carbon black	ASTM 4218	%	2.0 (min)
Dimensions			
• roll length		ft	150
• roll width		ft	4.3
• roll weight		lb	84

Notes:

1. Percent open area measured without magnification by Corps of Engineers Method as specified in CWO2215 Civil Works Construction Guide, November 1977.
2. Long term load capacity measured by through the junction tensile creep testing to 10,000 hours as described in Geosynthetic Research Institute test method GG3-87 "Creep Behavior and Long Term Design Load of Geogrids".
3. ASTM D 1388-64 modified to account for wide specimen testing as described in Tensar test method TTM-5.0 "Stiffness of Geosynthetics".
4. Secant modulus at 2% elongation measured by Geosynthetic Research Institute test method GG1-87 "Geogrid Tensile Strength". No offset allowances are made in calculating secant modulus.
5. Geogrid junction strength and junction efficiency measured by Geosynthetic Research Institute test method GG2-87 "Geogrid Junction Strength".
6. The long-term allowable design strength (LTADS) is determined using the method outlined in GRI-GG4 "Determination of the Long Term Design Strength of Stiff Geogrids." The GRI-GG4 method applies various partial factors of safety to account for construction damage, junction strength, connections, chemical and biological degradation.

The Tensar Corporation
1210 Citizens Parkway
Morrow, GA 30260
1-800-845-4453

Product Name	Manufacturing process	Coating Type	Polymer Type[1]	Dimensional Properties: Mass/Unit Area ASTM D 5261-92 g/m² (oz/yd²)	Dimensional Properties: Aperture Size mm (in) MD	Dimensional Properties: Aperture Size mm (in) XD	Wide Width Strip Tensile Strength ASTM D 4595-86 kN/m (lb/ft)/% Strength 5% strain MD	Strength 5% strain XD	Ultimate Strength/% MD	Ultimate Strength/% XD	Long Term Design Strength GRI GG4[2] lb/ft Tallow (in sand)	Manufacturer's Suggested Applications[3]

TENSAR UX 1000SB

Tensar Technologies Inc. (cont.)

BX1300	PSD[N]	NA	PP	247 (7.3)	46 (1.8)	64 (2.5)	11 (740)	17 (1160)	17 (1160)	29 (1970)	NP	B
BX1400 (AR)	PSD[N]	NA	PP	247 (7.3)	46 (1.8)	64 (2.5)	10 (670)	15 (1010)	17 (1150)	25 (1700)	NP	asphalt reinforcement
BX1500	PSD[N]	NA	PP	473 (13.9)	25 (1)	30 (1.2)	17 (1160)	23 (1560)	29 (1990)	39 (2670)	NP	E
BX4100 (SG1)	PSD[N]	NA	PP	184 (5.4)	36 (1.4)	36 (1.4)	10 (650)	12 (850)	13 (900)	16 (1080)	NP	B, E
BX4200 (SG2)	PSD[N]D	NA	PP	260 (7.7)	36 (1.4)	36 (1.4)	13 (890)	18 (1230)	18 (1250)	23 (1570)	NP	B, E
GC1400 (ARC)	PSD[N]	NA	PP/PET	383 (11.0)	46 (1.8)	64 (2.5)	10 (670)	15 (1000)	17 (1150)	25 (1700)	NP	asphalt reinforcement, waterproofing
UX1000SB	PSD[N]	NA	HDPE	371 (10.9)	NP	NP	18 (1270)	NA	35 (2400)	NA	810	W, S, E
UX1400SB	PSD[N]	NA	HDPE	510 (15.0)	NP	NP	28 (1920)	NA	61 (4170)	NA	1335	W
UX1400HT	PSD[N]	NA	HDPE	434 (12.8)	NP	NP	31 (2150)	NA	65 (4430)	NA	1525	W, S, E, L, V
UX1500SB	PSD[N]	NA	HDPE	835 (24.6)	NP	NP	53 (3640)	NA	95 (6580)	NA	2190	W
UX1500HT	PSD[N]	NA	HDPE	635 (18.7)	NP	NP	56 (3850)	NA	103 7070	NA	2525	W, S, E, L, V
UX1600SB	PSD[N]	NA	HDPE	1134 (33.4)	NP	NP	70 (4820)	NA	125 (8540)	NA	2855	W
UX1600HT	PSD[N]	NA	HDPE	922 (27.2)	NP	NP	76 (5210)	NA	132 (9040)	NA	3285	W, S, E, L, V
UX1700HT	PSD[N]	NA	HDPE	1220 (36.0)	NP	NP	96 (6600)	NA	168 (11500)	NA	4000	W, S, E, L, V

(1) PET = Polyester
PP = Polypropylene
PE = Polyethylene

(2) $T_{allow} = T_{UL}\left[\frac{1}{FS_{ID} \times FS_{CR} \times FS_{CD} \times FS_{BD} \times FS_{JNT}}\right]$
where
FS_{ID} = partial factor of safety for installation damage
FS_{CR} = partial factor of safety for creep deformation
FS_{CD} = partial factor of safety for chemical degradation
FS_{BD} = partial factor of safety for biological degradation
FS_{JNT} = partial factor of safety for joints

(3) B = Base Reinforcement
W = Walls
S = Slopes
E = Embankments
(A) Punched sheet drawn laminated NONW geotextile
(B) Punched sheet drawn
NP = Data not provided by manufacturer
NA = Manufacturer determined that this data was not applicable to the product or the data was unavailable

UNIAXIAL GEOGRID UX1000SB

The geogrid shall be a regular grid structure formed by uniaxially drawing a continuous sheet of select high density polyethylene material and shall have aperture geometry and rib and junction cross-sections sufficient to permit significant mechanical interlock with the material being reinforced. The geogrid shall have high flexural rigidity and high tensile modulus in relation to the material being reinforced and shall also have high continuity of tensile strength through all ribs and junctions of the grid structure. The geogrid shall have high resistance to deformation under sustained long term design load while in service and shall also be resistant to ultraviolet degradation, to damage under normal construction practices and to all forms of biological or chemical degradation normally encountered in the material being reinforced.

The geogrid shall also conform in all respects to the property requirements listed below.

PROPERTY	TEST METHOD	UNITS	VALUE
Interlock			
• apertures[1]	I.D. Calipered[8]		
- MD		in	5.70 (nom)
- CMD		in	0.66 (nom)
• open area	COE Method[9]	%	60 (nom)
• thickness	ASTMD1777-64		
- ribs		in	0.020 (nom)
- junctions		in	0.080 (nom)
Reinforcement			
• creep limited strength[5]	GRI GG3-87[1] (or ASTM D5262)	lb/ft	850 (min)
• flexural rigidity	ASTM D1388-64[2]	mg-cm	500,000 (min)
• tensile modulus - MD	GRI GG1-87[3]	lb/ft	35,000 (min)
• junctions	GRI GG2-87[4]		
- strength		lb/ft	2,400 (min)
- efficiency		%	90 (min)
Material			
• high density polyethylene Type III/Class A/Grade 6	ASTM D 1248	%	97 (min)
carbon black	ASTM 4218	%	2.0 (min)
Dimensions			
• roll length		ft	98
• roll width		ft	4.3
• roll weight		lb	32

Notes:

1. Long term load capacity measured by through the junction tensile creep testing to 10,000 hours as described in Geosynthetic Research Institute test method GG3-87 "Creep Behavior and Long Term Design Load of Geogrids".
2. ASTM D 1388-64 modified to account for wide specimen testing as described in Tensar test method TTM-6.0 "Stiffness of Geosynthetics".
3. Secant modulus at 2% elongation measured by Geosynthetic Research Institute test method GG1-87 "Geogrid Tensile Strength". No offset allowances are made in calculating secant modulus.
4. Geogrid junction strength and junction efficiency measured by Geosynthetic Research Institute test method GG2-87 "Geogrid Junction Strength".
5. The long-term allowable design strength (LTADS) is determined using the method outlined in GRI-GG4 "Determination of the Long Term Design Strength of Stiff Geogrids." The GRI-GG4 method applies various partial factors of safety to account for construction damage, junction strength, connections, chemical and biological degradation.

The Tensar Corporation
1210 Citizens Parkway
Morrow, GA 30260
1-800-845-4453

BIAXIAL GEOGRID BX1100 (SS-1)

The geogrid shall be a regular grid structure formed by biaxially drawing a continuous sheet of sele polypropylene material and shall have aperture geometry and rib and junction cross-sections sufficient to perm significant mechanical interlock with the material being reinforced. The geogrid shall have high flexural rigidity and high tensile modulus in relation to the material being reinforced and shall also have high continuity of tensile strength through all ribs and junctions of the grid structure. The geogrid shall maintain its reinforcement and interlock capabilities under repeated dynamic loads while in service and shall also be resistant to ultraviolet degradation, to damage under normal construction practices and to all forms of biological or chemical degradation normally encountered in the material being reinforced.

The geogrid shall also conform in all respects to the property requirements listed below.

PROPERTY	TEST METHOD	UNITS	VALUE
Interlock			
• aperture size[1]	I.D. Calipered[2]		
- MD		in	1.0 (nom)
- CMD		in	1.3 (nom)
• open area	COE Method[3]	%	70 (min)
• thickness	ASTM D 1777-64		
- ribs		in	0.03 (nom)
- junctions		in	0.11 (nom)
Reinforcement			
• flexural rigidity	ASTM D1388-64[4]	mg-cm	250,000 (min)
• tensile modulus	GRI GG1-87[5]	lb/ft	14,000 (min)
• junctions	GRI GG2-87[6]		
- strength		lb/ft	765 (min)
- efficiency		%	90 (min)
Material			
• polypropylene	ASTM D 4101 Group 1/Class 1/Grade 2	%	98 (min)
• carbon black	ASTM 4218	%	0.5 (min)
Dimensions			
• roll length		ft	164
• roll width		ft	9.8 & 13.1
• roll weight		lb	71 & 95

Notes:

1. MD dimension is along roll length. CMD dimension is across roll width.
2. Maximum inside dimension in each principal direction measured by calipers.
3. Percent open area measured without magnification by Corps of Engineers method as specified in CW 02215 Civil Works Construction Guide, November 1977.
4. ASTM D 1388-64 modified to account for wide specimen testing as described in Tensar test method TTM-5.0 "Stiffness of Geosynthetics".
5. Secant modulus at 2% elongation measured by Geosynthetic Research Institute test method GG1-87 "Geogrid Tensile Strength". No offset allowances are made in calculating secant modulus.
6. Geogrid junction strength and junction efficiency measured by Geosynthetic Research Institute test method GG2-87 "Geogrid Junction Strength".

02168
2.1 F

MIRAFI® 140N

RECEIVED
JUN 21 1994
MIRAFI 140N GEOTEXTILE

SUBSURFACE DRAINAGE

Drainage Fabric

Good drainage is essential for soil stability. In order for drainage structures to be effective — along highways, in embankments, under airfields and athletic fields, or anywhere — they must have a properly designed protective filter.

Traditionally, graded-aggregate filter systems have been used with limited success to prevent soil particles from migrating into subsurface drainage structures. However, these aggregate drains have several inherent problems, including high cost and difficult installation.

Mirafi **140N**, a nonwoven filter fabric, provides an effective, cost-efficient alternative to graded-aggregate filters. Among its design features are:

- Easily conforms to the ground or trench surface for fast and trouble-free installation;
- Creates a superior filter media because of its high water flow rate and excellent filtration properties;
- Meets severe stresses of installation with its high puncture and burst resistance.

Mirafi **140N** eliminates many of the problems associated with graded-aggregate filters, including:

- Determining the aggregate gradation required to match soil conditions;
- Finding a convenient and economical source of a specific aggregate gradation;
- Transporting and placing a graded aggregate;
- Assuring that the in-place aggregate gradation provides effective filter performance.

An additional benefit of Mirafi **140N** is that the drain size can often be reduced when Mirafi fabric is installed because the thick, graded-aggregate layer is eliminated. As a result, less excavation and less aggregate will be required.

Mirafi 140N Fabric Properties

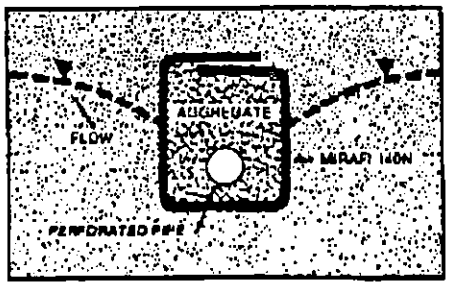
Fabric Property	Unit	Test Method	Typical Values[1]
Grab Tensile Strength	lb	ASTM D-1682-64	120
Grab Tensile Elongation	%	ASTM D-1682-64	55
Burst Strength	psi	ASTM D-3786-80a[2]	210
Trapezoid Tear Strength	lb	ASTM D-1117-80	50
Puncture Strength	lb	ASTM D-3787-80[3]	70
Coefficient of Permeability, k	cm/sec	CFMC GET-2	0.2
Water Flow Rate	gal/min/sf	CFMC GET-2	285

Mirafi 140N Packaging

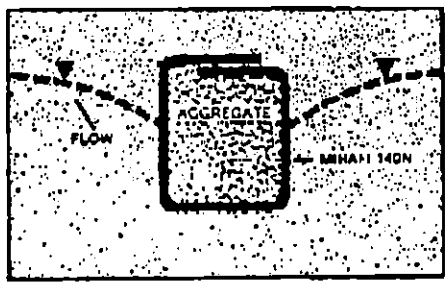
Roll Width (ft.)	Roll Length (ft.)	Roll Wt. (lbs.)
15.0	360	185
12.5	360	175

[1]The values listed are average values. Contact the Mirafi Technical Department for minimum certifiable values.
[2]Diaphragm Bursting Tester.
[3]Tension Testing Machine with ring clamp; steel ball replaced with a 5/16-inch diameter solid steel cylinder centered within the ring clamp.

Type of Fabric Wrapped Drains

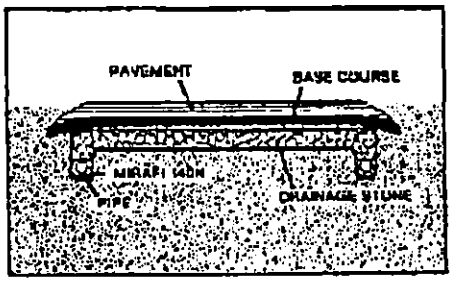


Conventional Drain (with pipe)

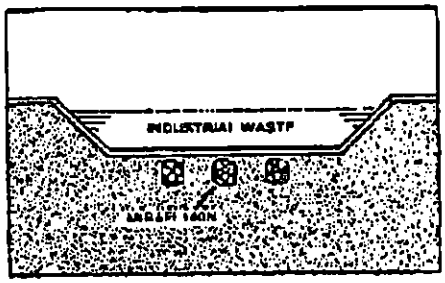


French Drain (without pipe)

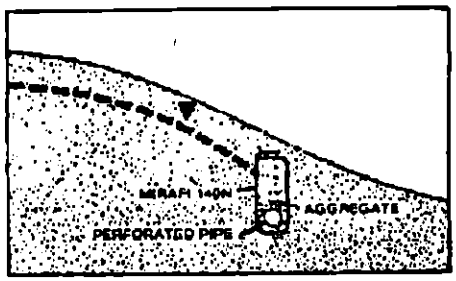
Typical Drain Applications



Blanket Drain & Edge Drain



Pond Underdrain



Interceptor Drain

MIRAFI® INC

A member of the DOMINION TEXTILE group

MIRAFI INC. P.O. BOX 240967/CHARLOTTE, N.C. 28224
(704) 523-7477 or (800) 438-1855/TELEX 216903 MRFI

404 - 447 - 6272

11-87

TREVIRA 1150

Product Description
evira® Spunbond Type 011/350

Technical Fibers Group
Hoechst Celanese Corporation
Spunbond Business Unit
Post Office Box 5650
Spartanburg, SC 29304-5650
803 579 5007
Toll Free 1 800 845 7597
Fax 803 579 5930

Trevira® Spunbond Type 011/350 is a 100% continuous filament polyester nonwoven needlepunched engineering fabric. The fabric is resistant to biological and naturally encountered chemicals, alkalies, acids, and ultraviolet light exposure. Trevira® Spunbond Type 011/350 conforms to the property values listed in the following table:

FABRIC PROPERTY	UNIT	TEST METHOD	TYPICAL VALUE[1]	MINIMUM TEST VALUES[2]
Fabric Weight	oz/yd²	ASTM D-5261	10.5	10.0
Fabric Thickness, t	mils	ASTM D-5199	140	125
Grab Strength (MD/CD)	lbs	ASTM D-4632	420/350	305
Grab Elongation (MD/CD)	%	ASTM D-4632	75/80	60
Trapezoid Tear Strength (MD/CD)	lbs	ASTM D-4533	140/125	100
Puncture Resistance	lbs	ASTM D-4833	155	130
Mullen Burst Strength	psi	ASTM D-3786	560	510
Water Flow Rate	gpm/ft²	ASTM D-4491	120	80
Permittivity, Ψ	sec⁻¹	ASTM D-4491	1.6	1.07
Permeability, k = Ψxt	cm/sec	ASTM D-4491	.57	.34
AOS	Sieve Size mm	ASTM D-4751	100-120 .149-.125	70 .210
Standard Roll Widths[3]	ft	12.5 and 15.0		
Standard Roll Lengths[3]	ft	300		

MD = Machine Direction CD = Cross Machine Direction

[1] The values listed are average values.
[2] These minimum values represent minimum test values as determined from Quality Control (QC) testing.
[3] Other width and length rolls are available upon request.

GEOCOMPOSITE

SYNTHETIC INDUSTRIES
CONSTRUCTION PRODUCTS DIVISION
"Smart Solutions in Synthetics"

Synthetic Industries 801
Nonwoven Geotextile

Synthetic Industries 801 is a polypropylene, staple fiber, needlepunched nonwoven geotextile. The fibers are needled to form a stable network that retain dimensional stability relative to each other. The geotextile is resistant to ultraviolet degradation and to biological and chemical environments normally found in soils. Synthetic Industries 801 conforms to the property values listed below:

PROPERTY	TEST METHOD	MINIMUM AVERAGE ROLL VALUES[1]	
		English	Metric
Mechanical			
Grab Tensile Strength	ASTM D4632	200 lbs	890 N
Grab Elongation	ASTM D4632	50 %	50 %
Puncture Strength	ASTM D4833	130 lbs	580 N
Mullen Burst	ASTM D3786	400 psi	2756 kPa
Trapezoidal Tear	ASTM D4533	85 lbs	380 N
Hydraulic			
Apparent Opening Size (AOS)	ASTM D4751	80 US Std. Sieve	0.180 mm
Permittivity, Ψ	ASTM D4491	1.50 sec^{-1}	1.50 sec^{-1}
Permeability, $k = \Psi \cdot t$	ASTM D4491	0.38 cm/sec	0.38 cm/sec
Water Flow Rate	ASTM D4491	110 gpm/ft^2	4482 l/min/m^2
Endurance			
UV Resistance (% retained @ 500 hours)	ASTM D4355	70 %	70 %

Notes:

1 Values shown are in weaker principal direction. Minimum average roll values represent a 95 percent confidence level, calculated as the mean minus two standard deviations.

Standard Roll Size Information: 15.0' x 300' = 500 sq. yds.

Gcom-3-02.03.94

4019 Industry Drive • Chattanooga, TN 37416 • 615/899-0444 FAX 615/899-[illegible]

RDB PLASTOTECNICA SpA
Via Dell'Industria, 3
22060 Vigano (CO) Italy
Telefono 039/92191
Telefax 039/9219290
Telegrammi RDB - VIGANO

Cap. Soc. 10.000.000.000 i.v.
CCIAA Como 176025
Reg. Trib. Lecco Soc. 6071 v. 20
Pos. Meccanografico n. CO 034471
Codice Fiscale 04484870157
Partita IVA 01283300137

7 December 1994
FMgf

Messrs
NICOLON / MIRAFI GROUP
3500 Parkway Lane, Suite 500
Norcross, GEORGIA 30092

Fax n° 001-404-7291829

Attention Mr. Tom Stephens

DECLARATION OF CONFORMITY # 071294/2

Goods TENAX MS 1000 / MIRAFI MIRAGRID MX-1
TENAX MS 2000 / MIRAFI MIRAGRID MX-2

TO WHOM IT MAY CONCERN

We hereby certify that the above mentioned goods are manufactured using the following components:

Polypropylene Group 1 - Class 1 - Grade 2 (ASTM D 4101): 98 % min. in weight
Carbon Black (ASTM D 4218): 0.5 % min. in weight

The manufacturing process is controlled to guarantee the above properties according to our Quality System procedures, that have been implemented and certified in accordance to ISO 9002.

Best regards.

Quality Assurance Manager
Eng. Filippo [illegible]

TENAX

University of Alaska Fairbanks
Fairbanks Alaska
Torsional Rigidity Test Results
12/17/94

907- 474-6126

Client:
Material:

Data
Sample #

Load	Moment	1	2	3	Average
Kg	cm-kg	Rotation on Initial Loading - Deg			
0	0	0	0	0	0
0.67	3.98	1.9	1.4	2	1.77
1.67	9.91	6.4	4.2	5.9	5.50
2.67	15.85	11.9	10.7	10	10.87
3.67	21.77	17.4	13.4	14.7	15.17
4.67	27.7	22.4	18.5	19.9	20.27
5.67	33.63	26.3	21.4	26.5	24.73

Secant Modulus
Sample #

Load	Moment	1	2	3	Average
Kg	cm-kg	Secant Modulus on Initial Loading - cm-kg/deg			
0	0				
0.67	3.98	2.09	2.84	1.99	2.31
1.67	9.91	1.55	2.36	1.68	1.86
2.67	15.85	1.33	1.48	1.59	1.47
3.67	21.77	1.25	1.62	1.48	1.45
4.67	27.7	1.24	1.50	1.39	1.38
5.67	33.63	1.28	1.57	1.27	1.37

Interpolated Average Secant Modulus @ 20 cm-kg: 1.456 cm-kg/deg

Miragrid MX 1 Technical Data

Product Description

Miragrid **MX 1** is a bi-directional grid with comparable strength in both the machine direction and cross-machine direction. Miragrid **MX 1** is manufactured by extruding and orienting U.V. stabilized polypropylene to form a monolithic grid structure. Miragrid **MX 1** features high tensile strength and modulus with excellent resistance to construction and environmental damage. Miragrid **MX 1** conforms to the property values listed in the following table.

Grid Property	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Ultimate Tensile Strength	GRI GG-1	lb/ft	950	1,350
Secant Modulus @ 2% Strain	GRI GG-1	lb/ft	14,000	21,000
Junction Strength	GRI GG-2	lb/ft	855	1,215
Junction Efficiency	GRI GG-2	%	90	90
Flexural Rigidity	ASTM D 1388	mg-cm	750,000	
Open Area	COE-02215	%	80	
Rib Thickness	ASTM D 1777	in	0.10	0.08
Junction Thickness	ASTM D 1777	in	0.17	
Grid Aperture Size	Measured	in	1.2	1.6
Weight	ASTM D 3776	oz/yd^2	7	

Tensile ~~[illegible]~~ modulus

Miragrid MX 1 Packaging

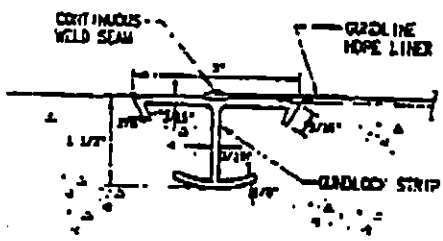
STYLE NUMBER	832690
ROLL DIMENSIONS	13.1' x 164'
SQUARE YARDS PER ROLL	238.7
ESTIMATED ROLL WEIGHT	125 lbs

MD - Machine Direction
CD - Cross-machine Direction

GUNDLOCK INSTALLATION GUIDE

Gundlock is a High Density Polyethylene (HDPE) extruded shape designed to provide a mechanical anchor attachment for Gundline HD (High Density Polyethylene liner). Gundlock is designed to embed in any face of new cast-in-place or precast concrete construction and can be fabricated to maneuver around shapes and corners.

Any thickness of Gundline HD can be welded to the Gundlock. If unexpectedly high tensile loads are experienced by the liner, the liner is designed to yield before the Gundlock yields or pulls out of the concrete. The Gundlock profile is detailed in Figure 1.



GUNDLOCK
NOT TO SCALE

FIGURE-1

Attachment of Gundline HD to Gundlock is performed by grinding the Gundlock and Gundline HD and then extrusion welding the Gundline HD to the Gundlock.

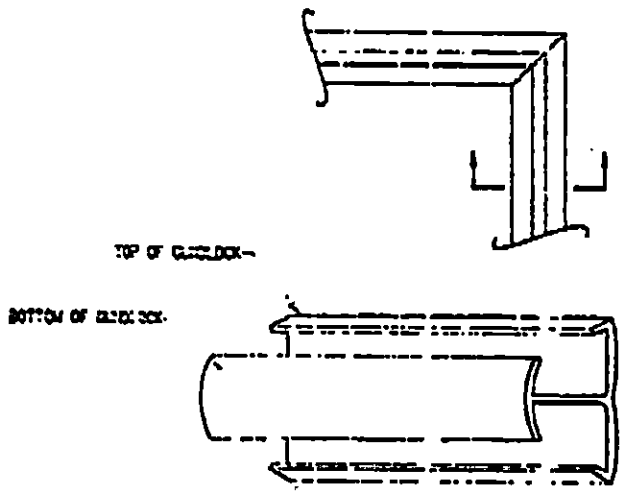
Gundlock should not be used as a waterstop for most installations although it may be utilized as such in special

applications. Please consult Gundle Lining Construction for further information.

Proper installation techniques must be observed to insure a secure embedment of the Gundlock and a sound weld to the Gundline HD sheeting.

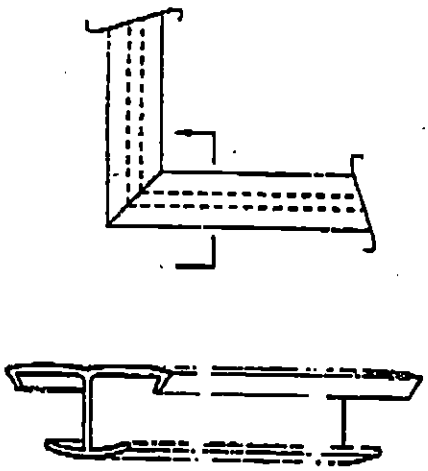
GUNDLOCK INSTALLATION

Gundlock must be cut and butt welded together to fit corners and shapes. (Figures 2 - 4) This cutting and welding, if performed correctly will provide a continuous support for the liner, and secure a seal. Suggested procedures can be found on page 5. Corners and "T" connections can be supplied pre-fabricated.



MITERED FLANGE CONNECTION SECTION

FIGURE-2



MITERED WEB CONNECTION SECTION

FIGURE-3

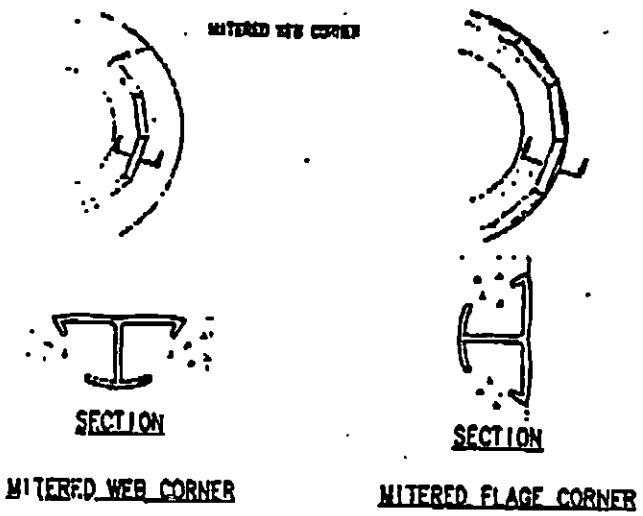


FIGURE 4

ATTACHMENT OF GUNDLOCK TO FORMS

Gundlock is attached to the inside of a concrete form by finishing nails prior to concrete placement. (Figure 5). The size of the finishing nails must be 1" long or shorter. The nails must be driven flush with the back of the Gundlock to allow for their easy removal when the forms are wrecked. The Gundlock should be attached at sufficient points to insure a flush fitting with the form. Alternate methods of

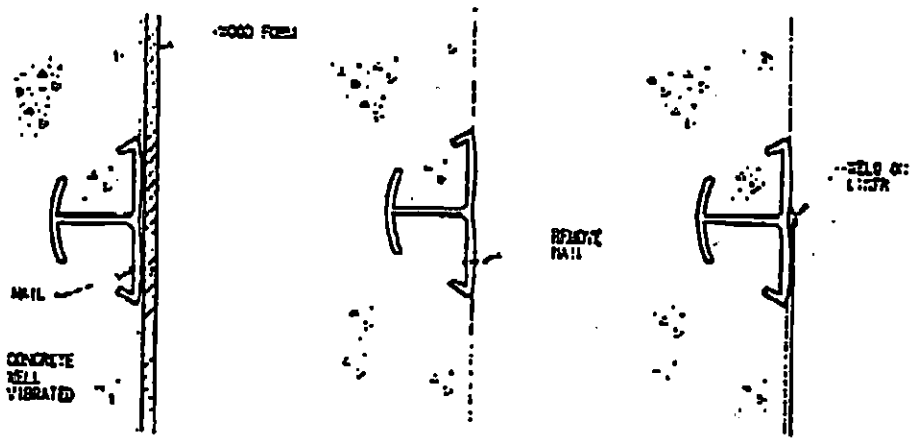


FIGURE-5

attachment are staples or shot in anchors. Examples are shown in figures 6 and 7. Any of the aforementioned methods will provide a proper attachment of the Gundlock to wood, steel, concrete, or plastic. Other materials may require special methods of attachment.

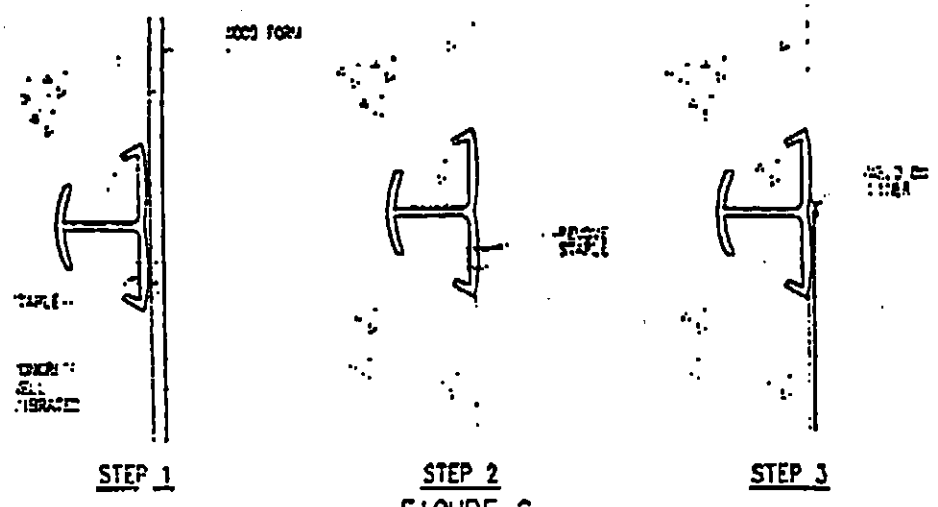


FIGURE-6

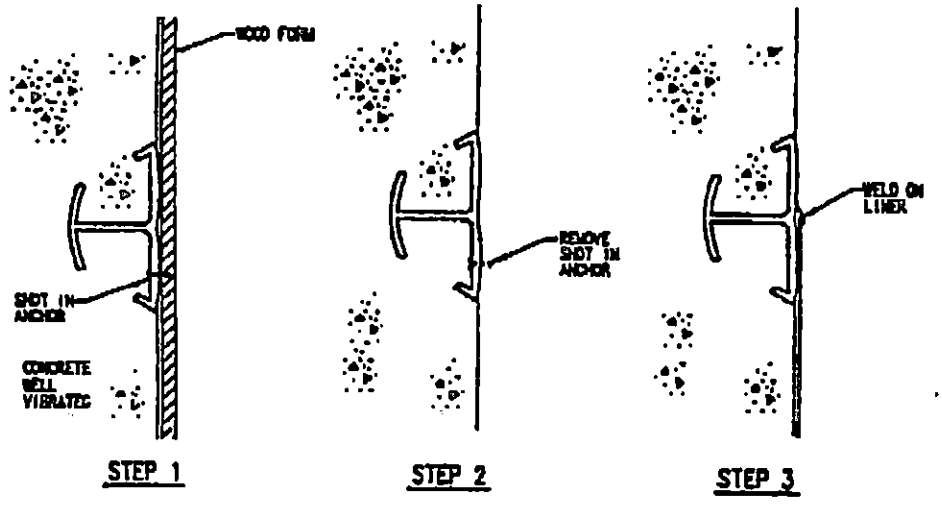


FIGURE-7

EMBEDMENT OF GUNDLOCK

Proper embedment of the Gundlock requires careful attention. The "T" shape of the section can entrap air if sufficient consolidation of the concrete is not achieved. Concrete placed around Gundlock must be properly vibrated to ensure

the concrete fills void spaces. Caution: If the concrete surrounding the Gundlock is not consolidated (vibrated), the Gundlock cannot develop the full pull out strength of the lock.

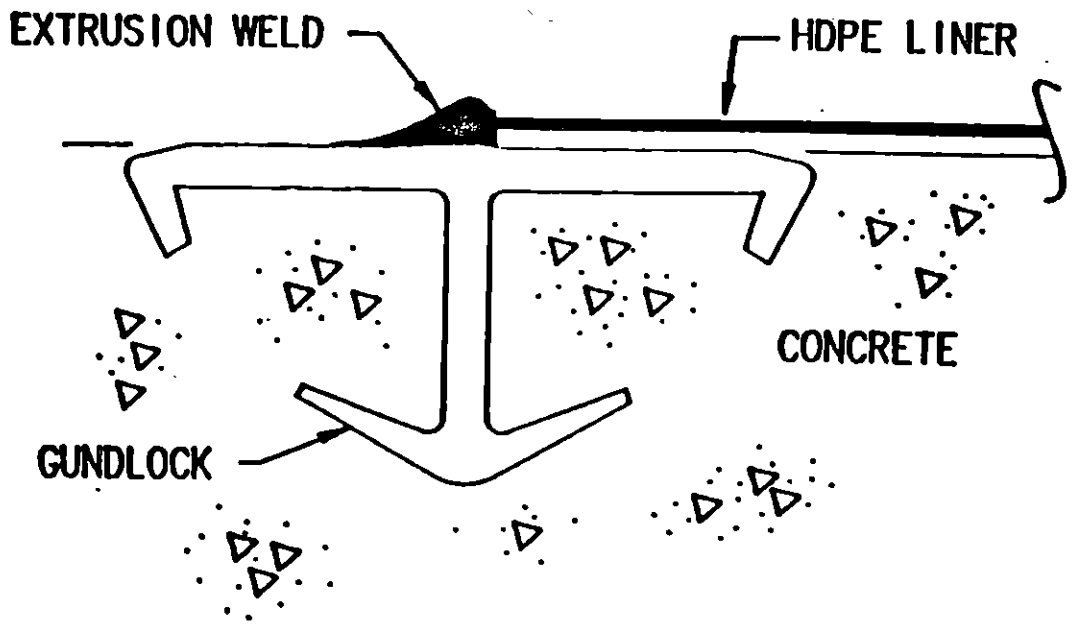
GUNDLOCK PREPARATION

After the concrete has set and the forms wrecked, the finising nails, staples or anchors can be removed. Occasionally concrete will get between the Gundlock and the form and must be chipped away to reveal the Gundlock. The sharp edges thus created by the chipping back of the concrete must be beveled to prevent possible cutting or puncturing of the liner.

SUGGESTED METHOD: HEAT FUSION WELDING OF GUNDLOCK

The recommended method of butt welding HDPE Gundlock is the heat fusion welding method which yields a continuous strip of material. The following is a list of tools and procedures required to perform the heat fusion welding method:

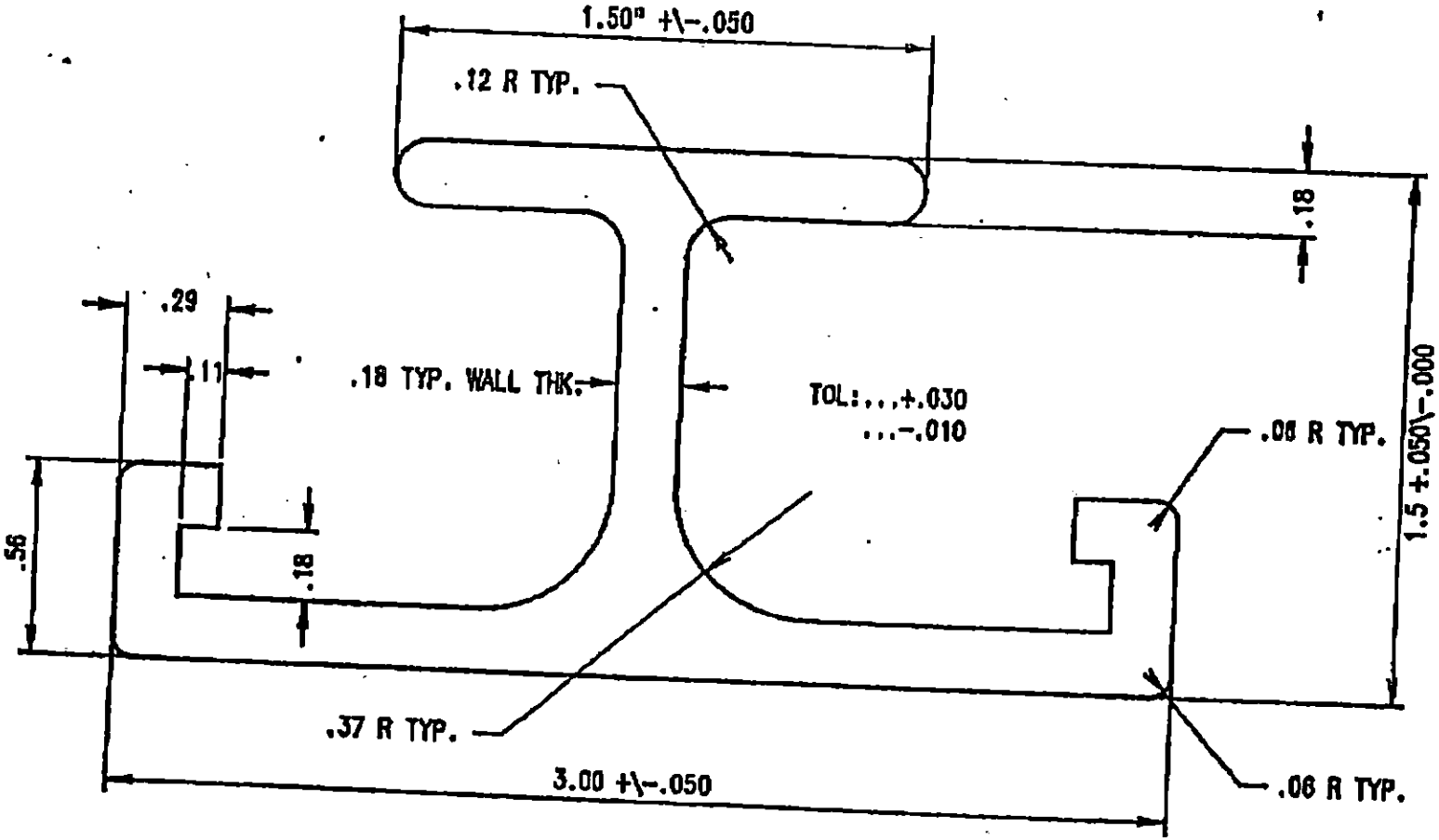
1. Carpenters Power Chop Saw or any saw which can cut material squarely. (Note: A handsaw or hacksaw will not cut it squarely.)
2. Utility Knife
3. 110V Leister Triac
4. 135MM Welding Mirror



TYPICAL GUNDLOCK DETAIL

(not to scale)

Gundle	DATE: 10-23-89
	DRAWING No. STDR-82
	APPROVED BY: PSP
GUNDLOCK STRIP	BY: PP

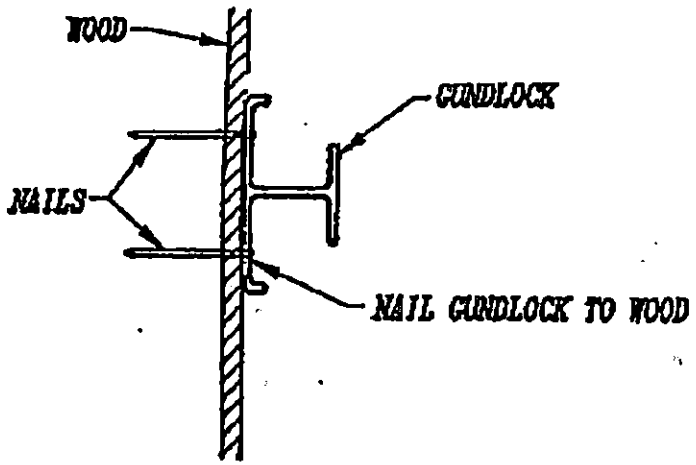


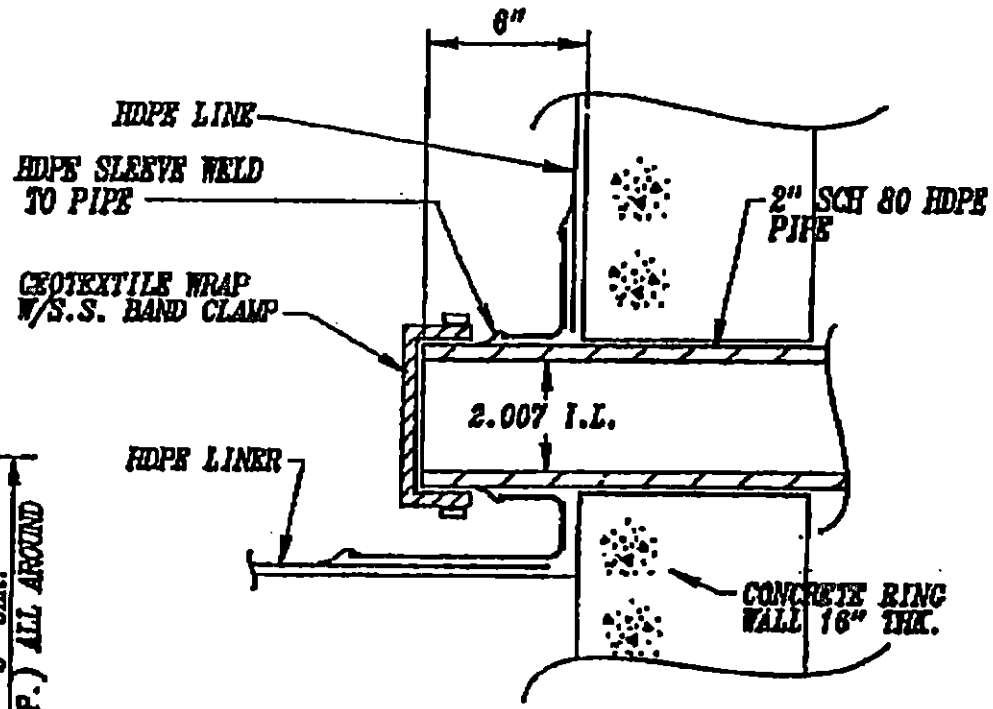
Gundle

DATE: 09-20-89

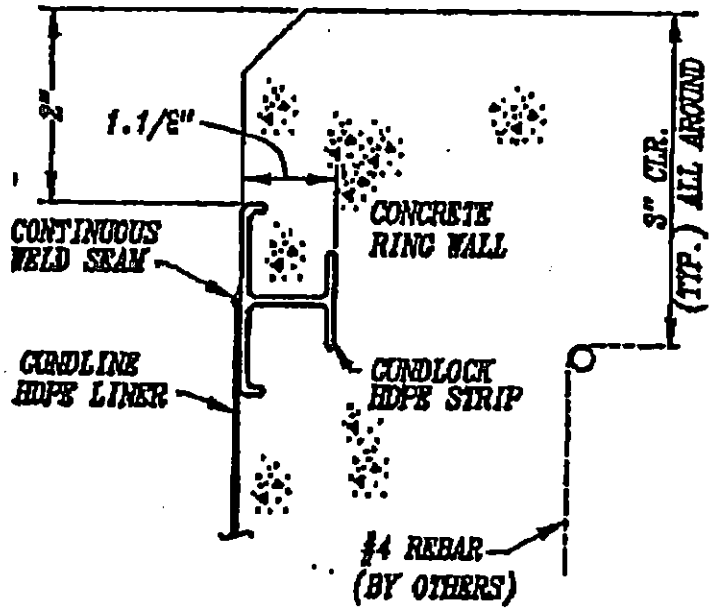
DRAWING No. STDR-16

APPROVED BY: P





DETAIL-2
(not to scale)



GUNDLOCK
(not to scale)
DETAIL-1

PREPARED BY:
GUNDLE LINING CONSTRUCTION
HOUSTON, TEXAS
FOR: ROCK REFINING

DATE	REV.	DESCRIPTION	APPROVED BY	BY
04-13-89	2	GENERAL		FP
04-13-89	1	GENERAL		FP

Gundle

DATE: 02-10-89
DRAWING No. STPP-24
APPROVED BY:

NEW YORK TRAP ROCK CORPORATION
162 OLD MILL ROAD
WEST NYACK, NY 10994
U.S.A.
914-358-4500

120194

Aggregate Blend

WEST NYACK DIABASE

AGGREGATE BLEND -- MANUAL

CRUSHED STONE BASE

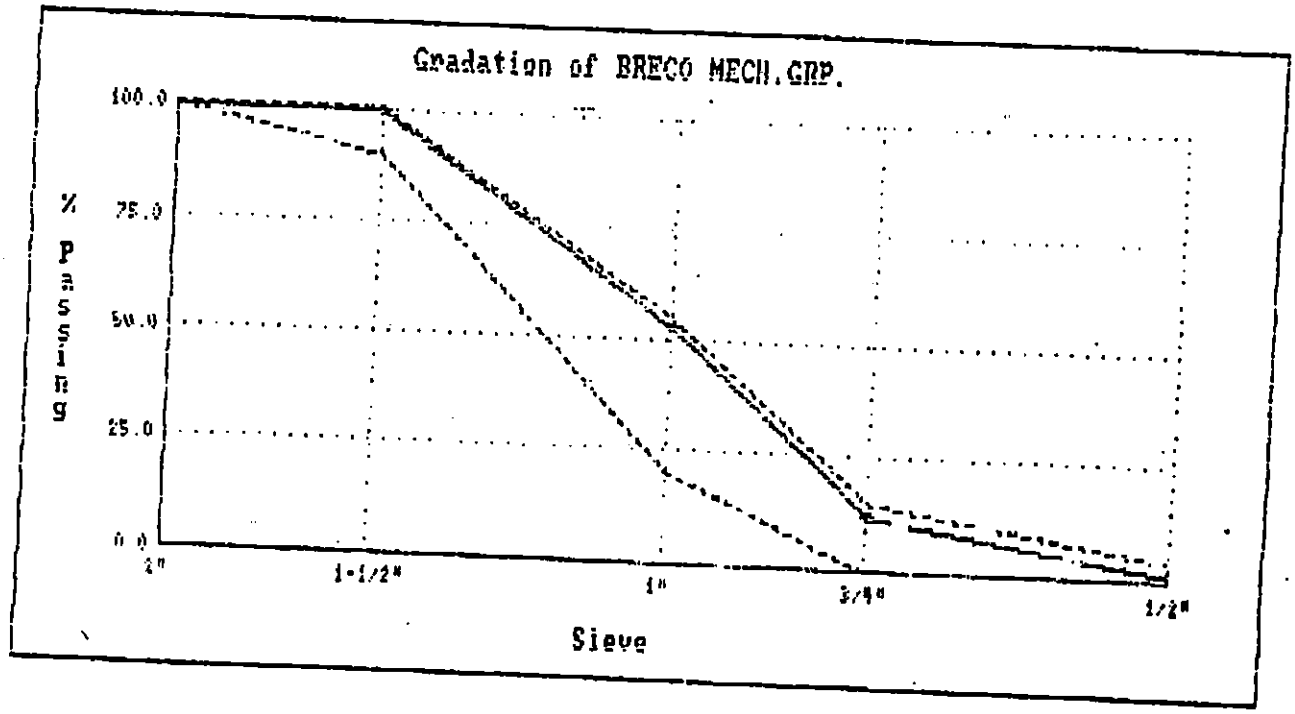
Specification ID : CRUSHED.ST.BASE Blend ID : BRECO MECH.GRP.

1 1/4"

Sieve	Low	High	% Pass	Aggregate	Pct
2 "	100.0	100.0	100.0	0400W	100.0
1-1/2 "	90.0	100.0	99.7		
1 "	20.0	55.0	53.1		
3/4 "	-	15.0	11.8		
1/2 "	-	5.0	1.6		

Approx. Average Grading

Cost - Fineness modulus 7.88



WEST NYACK QUARRY
N. Y. S. D. O. T. SOURCE NO. ((8-8R)
N. Y. S. D. O. T. TEST NO. = 93AR9
SPECIFIC GRAVITY = 2.91

162 OLD MILL ROAD
WEST NYACK, NY 10994
U.S.A.
914-358-4500

Gas Extraction Well
1½ Crushed Stone

120194

WEST NYACK
DIABASE

Aggregate Blend

AGGREGATE BLEND -- MANUAL

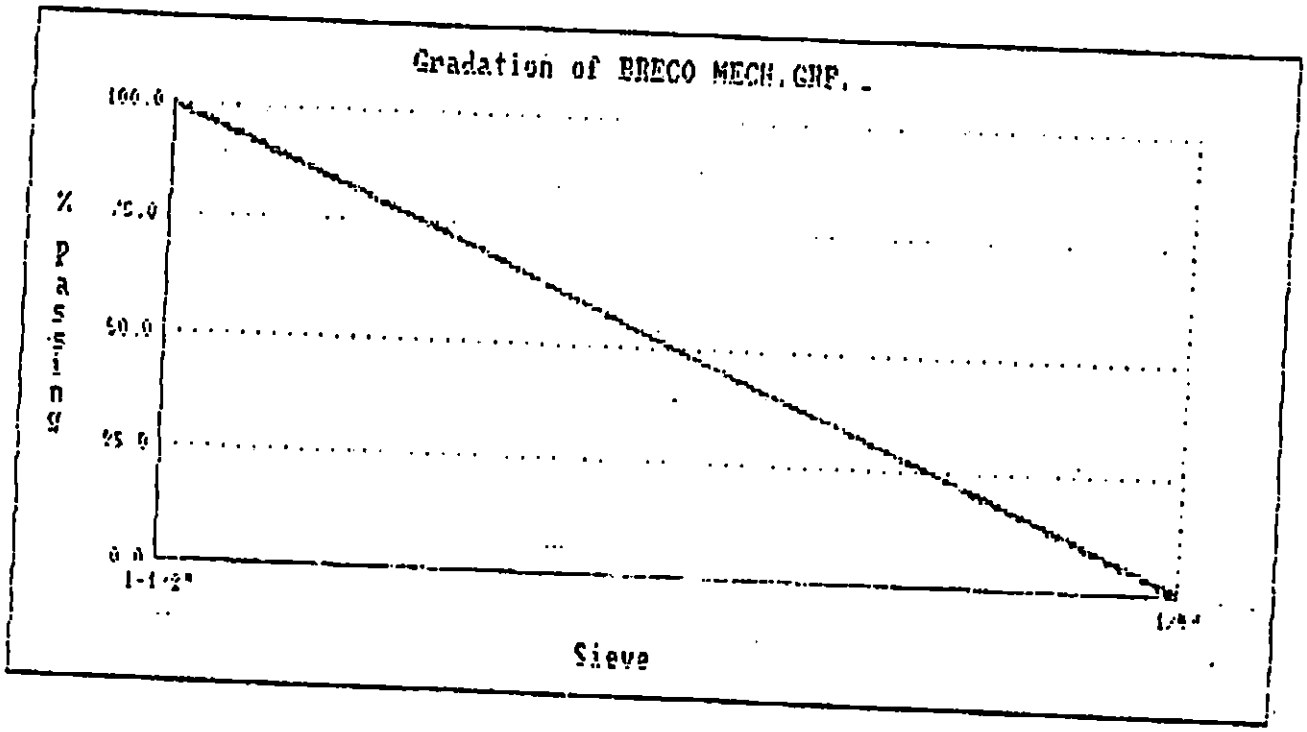
Specification ID : STONE BEDDING Blend ID : BRECO MECH.GRP.

1 1/4"

Sieve	Low	High	% Pass	Aggregate	Pct
1-1/2 "	100.0	100.0	99.8	0400W	100.0
1/4 "	-	-	1.4		
Cust		-			

Approx. Average Grading

Fineness modulus -



WEST NYACK QUARRY
N. Y. S. D. O. T. SOURCE NO. ((8-8R)
N. Y. S. D. O. T. TEST NO. = 93AR9
SPECIFIC GRAVITY = 2.91

FAIRWAY

Quality Assurance

November 7, 1994

CRUSHED STONE BALE COURSE

client — ConAgg Recycling Corp.
980 East 149th Street
Bronx, NY 10455
Attn: Ed Cicalese

project — Barbella Environmental
Pelham Landfill

subject — Gradation Analysis

On this date, three samples of special blend material was delivered to this laboratory by the client. Test results are shown below.

Sieve Size	Percent Passing by Weight 1	2	3	Specs
2"	100	100	100	100
1/4"	60	57	62	30-60
No. 40	35	25	27	
No. 200	7.8	7.7	7.6	10-20

OK

FAIRWAY TESTING CO., INC.

F. J. Aguanno, P.E.

Smith Street • Stony Point, N.Y. 10980 • 914-942-2088

NEW YORK TRAP ROCK CORPORATION
162 OLD MILL ROAD
WEST NYACK, NY 10994
U.S.A.
914-358-4500

120194

WEST NYACK DIABASE

Aggregate Blend

AGGREGATE BLEND -- MANUAL

RIP RAP
BEDDING
MATERIAL

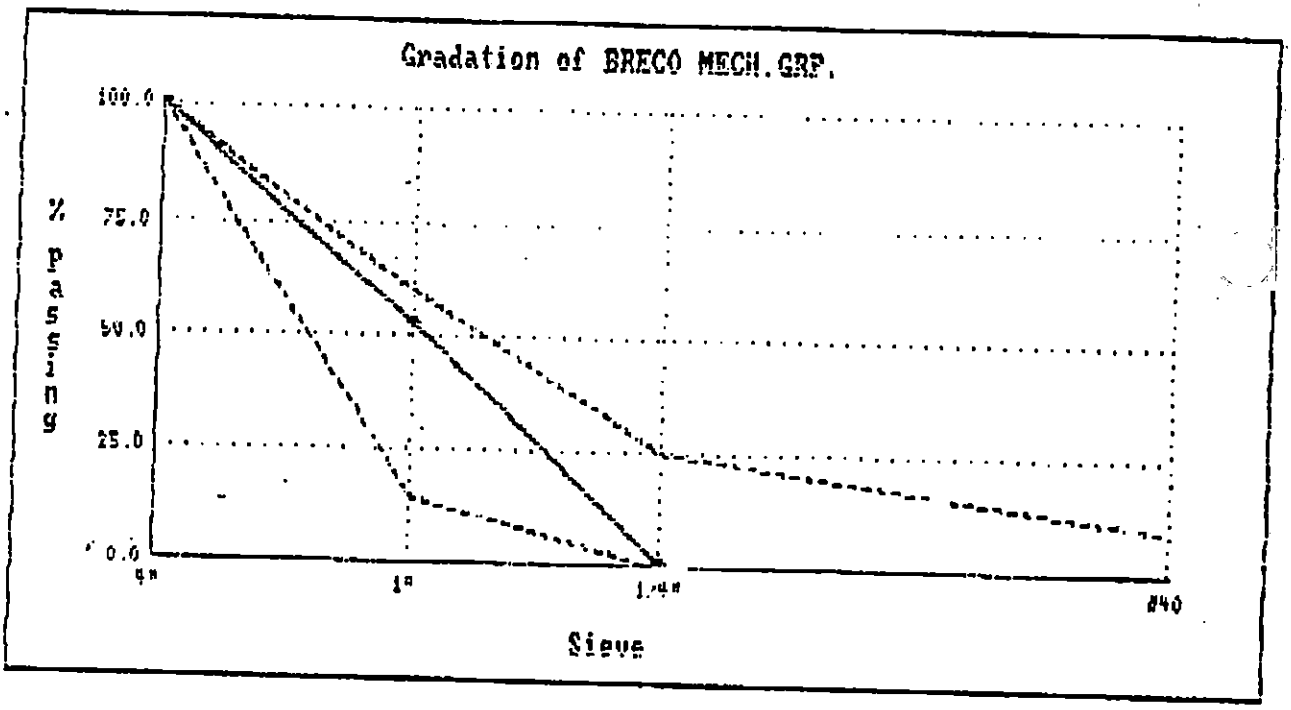
Specification ID : BEDDING MATER. Blend ID : BRECO MECH.GRP.

Sieve	Low	High	% Pass	Aggregate	Pct
4 "	100.0	100.0	100.0	0400W	100.0
1 "	15.0	60.0	53.1		
1/4 "	-	25.0	1.4		
# 40	-	10.0	0.7		

Approx. Average Grading

1 1/4"

Cost - Fineness modulus -



WEST NYACK QUARRY
N. Y. S. D. O. T. SOURCE NO. ((8-8R)
N. Y. S. D. O. T. TEST NO. = 93AR9
SPECIFIC GRAVITY = 2.91

NEW YORK TRAP ROCK CORPORATION
162 OLD MILL ROAD
WEST NYACK, NY 10994
U.S.A.
914-358-4500

RECEIVED DEC 5 1994

120194

WEST NYACK DIABASE

Aggregate Blend

AGGREGATE BLEND -- MANUAL

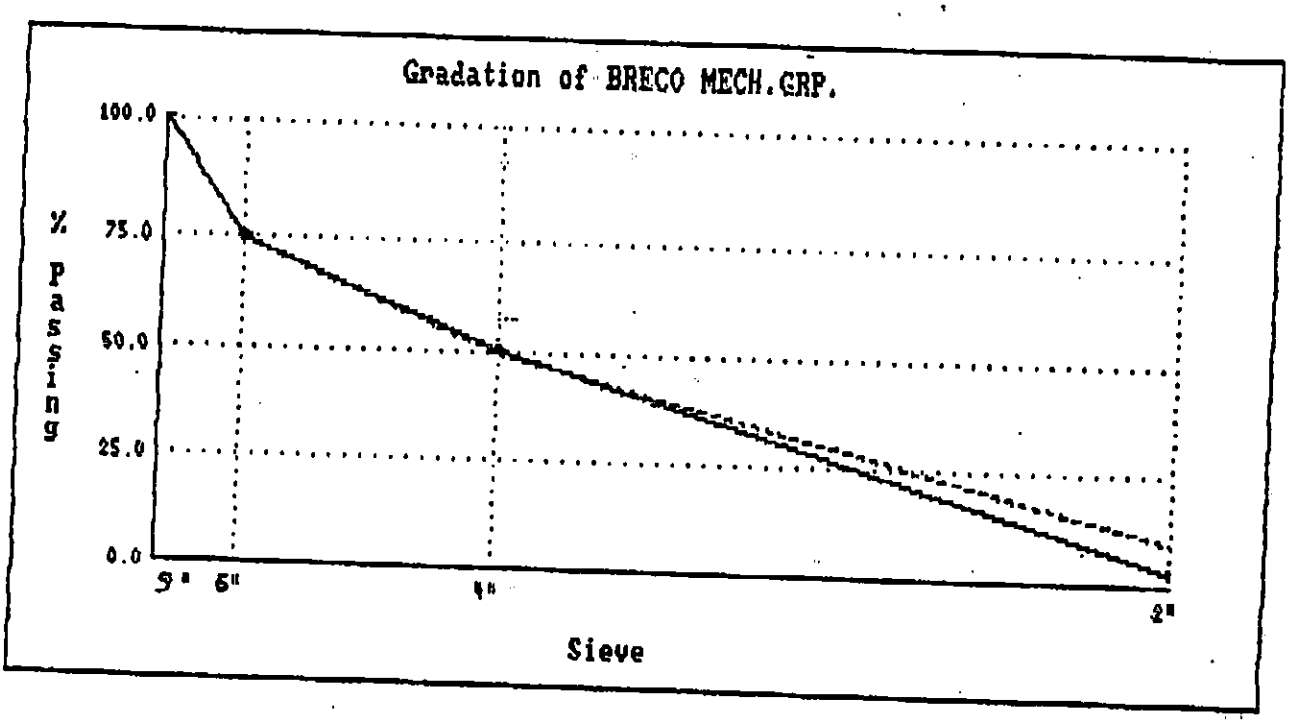
RIP RAP-CLASS I

Specification ID : RIP RAP CLASS 1 Blend ID : BRECO MECH.GRP.

Sieve	Low	High	% Pass	Aggregate	Pct
9 "	100.0	100.0	100.0	SMALL SURGE	100.0
6 "	75.0	75.0	75.0		
4 "	50.0	50.0	51.0		
2 "	10.0	10.0	3.0		

Approx Average Grading

Cost - Fineness modulus -



WEST NYACK QUARRY
N. Y. S. D. O. T. SOURCE NO. ((8-8R)
N. Y. S. D. O. T. TEST NO. = 93AR9
SPECIFIC GRAVITY = 2.91

FAIRWAY

Quality
Assurance

RECEIVED MAR 1 3 1996

March 8, 1996

client Breco Mechanical Group, Inc.

project Pelham Landfill

On March 5, 1996 a representative from this firm visited the jobsite and picked-up a soil sample labeled "3" Minus Star Recycling, 5000 cy". Test results are shown below.

Sieve Size	Percent Passing by Weight Sample	Spec.02210-3.C.1
3"	100	100
1"	100	
3/4"	97	
3/8"	92	
No. 4	85	
No. 10	73	
No. 40	45	
No. 200	19.1	
Plasticity Index	NP	
Classification	SM	

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Assurance

March 8, 1996

client Breco Mechanical Group, Inc.

project Pelham Landfill

On March 5, 1996 a representative from this firm visited the jobsite and picked-up a soil sample labeled "3" Minus, Morris Park". Test results are shown below.

Sieve Size	Percent Passing by Weight Sample	Spec.02210-3.C.1
3"	100	100
1"	100	
3/4"	93	
3/8"	87	
No. 4	82	
No. 10	75	
No. 40	37	
No. 200	13.2	
Plasticity Index	NP	
Classification	SM	

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FAIRWAY

Quality
Assurance

March 8, 1996

client Breco Mechanical Group, Inc.

project Pelham Landfill

On March 5, 1996 a representative from this firm visited the jobsite and picked-up a soil sample labeled "3" Minus Durante, 5000 cy". Test results are shown below.

Sieve Size	Percent Passing by Weight Sample	Spec.02210-3.C.1
3"	100	100
1"	100	
3/4"	96	
3/8"	90	
No. 4	85	
No. 10	78	
No. 40	53	
No. 200	23.0	
Plasticity Index	NP	
Classification	SM	

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P. J. Aguanno, P.E.

FAIRWAY

Quality
Assurance

March 8, 1996

client Breco Mechanical Group, Inc.

project Pelham Landfill

On March 5, 1996 a representative from this firm visited the jobsite and picked-up a soil sample labeled "3" Minus ConAgg". Test results are shown below.

Sieve Size	Percent Passing by Weight Sample	Spec.02210-3.C.1
3"	100	100
1"	95	
3/4"	93	
3/8"	87	
No. 4	82	
No. 10	75	
No. 40	51	
No. 200	22.3	
Plasticity Index	NP	
Classification	SM	

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FAIRWAY

Quality
Assurance

March 8, 1996

client Breco Mechanical Group, Inc.

project Pelham Landfill

On March 5, 1996 a representative from this firm visited the jobsite and picked-up a soil sample labeled "3" Minus Star Recycling, 10,000 cy". Test results are shown below.

Sieve Size	Percent Passing by Weight Sample	Spec.02210-3.C.1
3"	100	100
1"	100	
3/4"	98	
3/8"	93	
No. 4	86	
No. 10	74	
No. 40	44	
No. 200	17.3	
Plasticity Index	NP	
Classification	SM ✓	

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FAIRWAY

Quality
Assurance

March 8, 1996

client Breco Mechanical Group, Inc.

project Pelham Landfill

On March 5, 1996 a representative from this firm visited the jobsite and picked-up a soil sample labeled "3" Minus Durante Loamy Soil, 10,000 cy". Test results are shown below.

Sieve Size	Percent Passing by Weight Sample	Spec.02210-3.C.1
3"	100	100
1"	100	
3/4"	97	
3/8"	91	
No. 4	85	
No. 10	78	
No. 40	53	
No. 200	23.3	
Plasticity Index	NP	
Classification	SM	

FAIRWAY TESTING CO., INC.

P. J. Aguanno, P.E.

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FAIRWAY

Quality
Assurance

March 8, 1996

client Breco Mechanical Group, Inc.

project Pelham Landfill

On March 5, 1996 a representative from this firm visited the jobsite and picked-up a soil sample labeled "1" Minue Durante, 30,000 cy". Test results are shown below.

Sieve Size	Percent Passing by Weight Sample
1"	100
3/4"	95
3/8"	90
No. 4	83
No. 10	72
No. 40	41
No. 200	15.2
Plasticity Index	NP
Classification	SM

FAIRWAY TESTING CO., INC.

P. J. Aguanno, P.E.

FAIRWAY

Soils Test Report

February 14, 1996

client Breco Mechanical Group

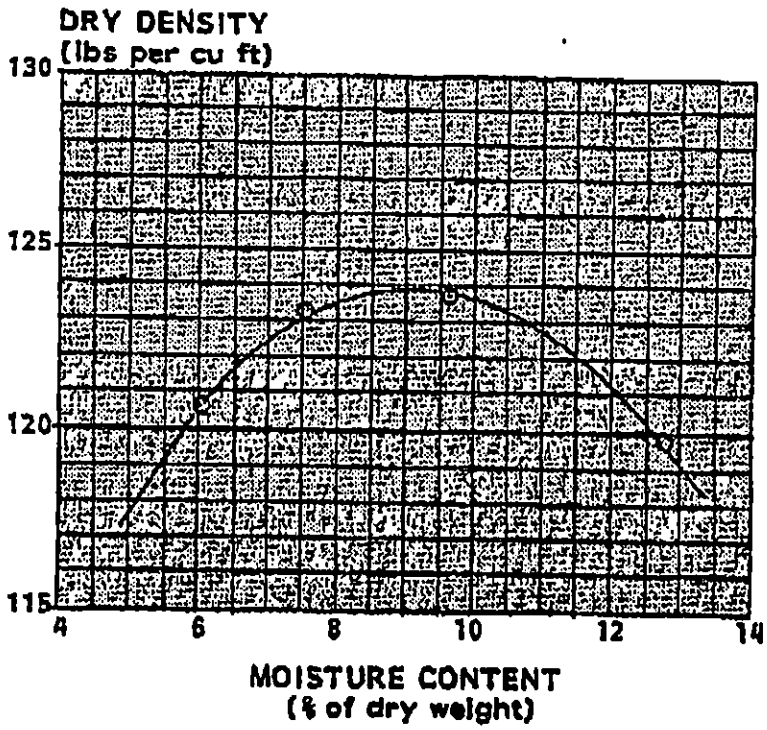
project Pelham Landfill

subject Moisture-Density Curve Analysis and Gradation Analysis

Compaction ASTM Method D698

Maximum Dry Density 123.9 pcf
Optimum Moisture Content 9.1 %

On February 12, 1996 a 3" minus soil sample was delivered to this laboratory by the client. The sample was labeled "Preconstruction: Morris Park", with test results shown below.



Sieve Size	% Passing by Weight 3"
Actual	100
Specification	100

FAIRWAY TESTING CO., INC.

P. J. Aguanno, P. E.

RECEIVED AUG 25 1995

FAIRWAY

Soils
Test Report

August 23, 1995

client Breco Mechanical Group, Inc.

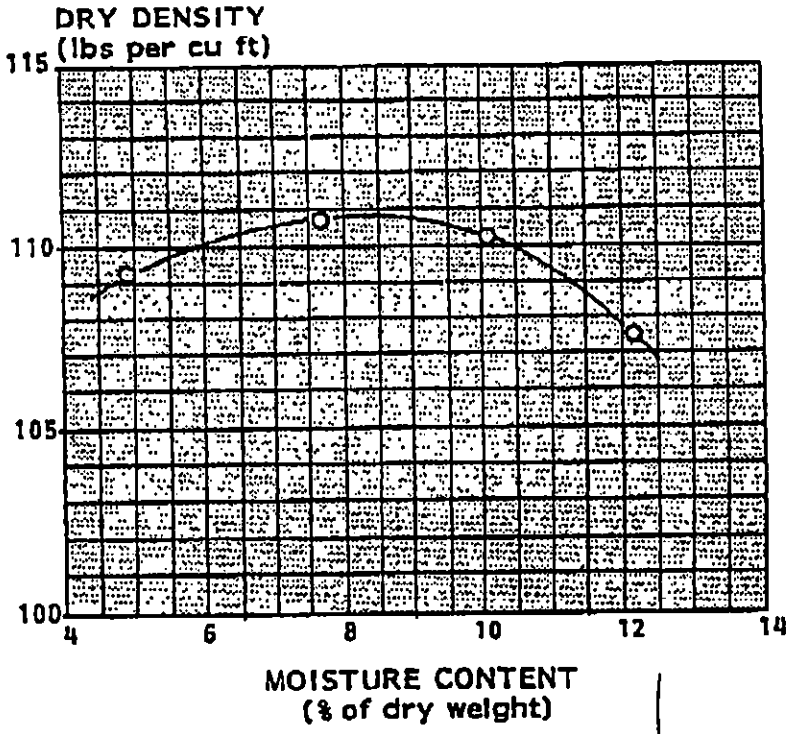
project Pelham Landfill

subject Moisture-Density Curve Analysis

Compaction Method ASTM D698

Maximum Dry Density 110.9 pcf
Optimum Moisture Content 8.5 %

On this date, a representative from this firm visited the jobsite and picked-up a sample of material labeled. Santilli #2 1" minus sampled 8-22-95. Test results are shown below.



100% passing 1" sieve.

FAIRWAY TESTING CO., INC.

P. J. Aguanno, P. E.

Aug. 30 '95 11:02

Un minus Confes

FAIRWAY

Soils
Test Report

March 6, 1995

client Breco Mechanical

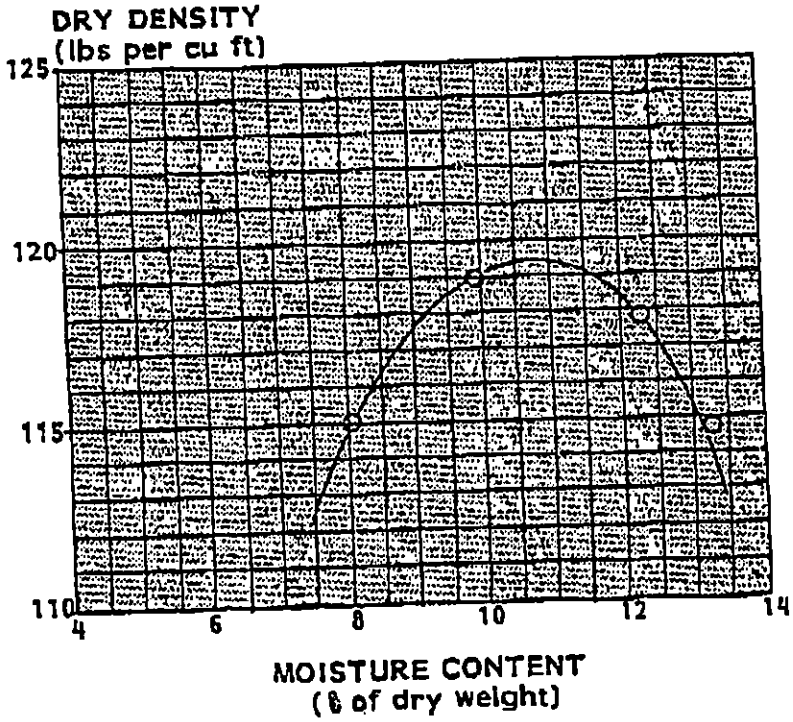
project Pelham Landfill

subject Moisture-Density Curve Analysis and Gradation Analysis

Compaction Method ASTM D698

Maximum Dry Density 119.4 pcf
Optimum Moisture Content 8.8 %

On March 3, 1995 a representative from this firm visited the jobsite and selected an in-place soil sample taken on the slope face. Test results are shown below. This was ConAgg material.



Sieve Size	Percent Passing by Weight 1"	3/4"	3/8"	No.4	No.10	No.3[illegible]	No.200
Actual	100	99	90	76	63	42	14.6

FAIRWAY TESTING CO., INC.

P. J. Aguanno, P. E.

Smith Street • Stony Point, N.Y. 10980 • 914-942-2088

FAIRWAY

Quality
Assurance

September 1, 1995

1" minus Durante

client Breco Mechanical Group

project Pelham Landfill

On August 31, 1995, a representative from this firm visited the jobsite and picked-up two soil samples labeled Durante. Test results are shown below.

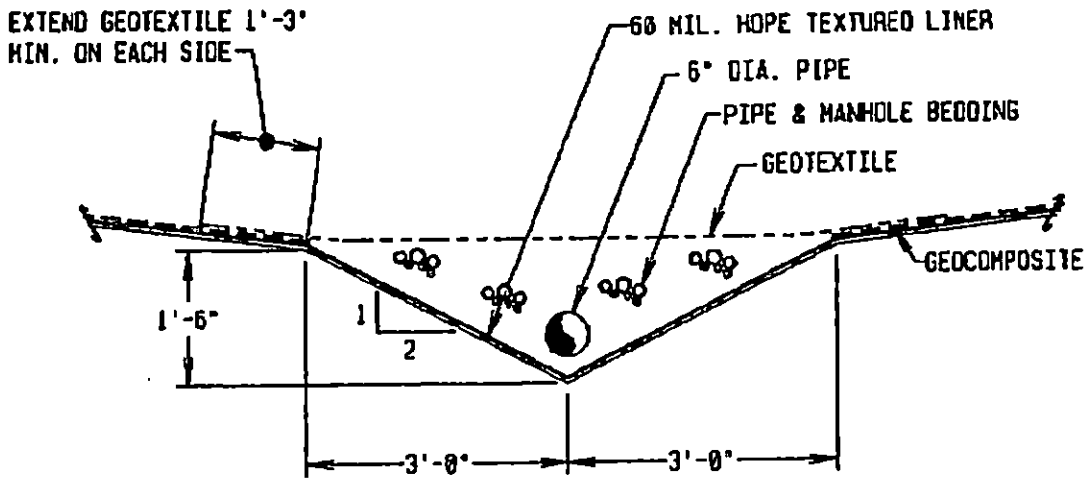
Sample	Identification
1	1" minus, 60,000 cy
2	3" minus, 60,000 cy

Sieve Size	Percent Passing by Weight 1	2
3"	100	100
1"	100	100

FAIRWAY TESTING CO., INC.

P. J. Aguanno, P.E.

Smith Street • Stony Point, N.Y. 10980 • 914-942-2088



TYPICAL INFILTRATION DRAINAGE TRENCH

(NOT TO SCALE)

Gundle®
19103 GUNDLE ROAD
HOUSTON, TEXAS 77073

TITLE: PROPOSED ALTERNATE TO BID ITEM #73

DWN: BAK	DATE: 9-21-94	SCALE: NTS	DWG: A479-D1

STRUCTURAL BACKFILL

FAIRWAY

Quality Assurance

December 27, 1994

client Briarwood Contracting Corp.

project Pelham Landfill

On this date, a representative from this firm visited Tilcon NY and picked-up two aggregate samples. Test locations and results are shown below.

PIPE and MANHOLE BEDDING - Tomkins Cove, NY

Sieve Size	Percent Passing by Weight Sample	Spec
1/2"	100	100
3/8"	79	90-100
No. 8	1	0-15
No. 30	0.3	0-30

STRUCTURAL BACKFILL - Haverstraw, NY

Sieve Size	Percent Passing by Weight Sample	Spec
3/4"	100	100
No. 4	99	70-95
No. 16	51	30-70
No. 50	28	20-50
No. 200	12.3	2-20

Soil Classification: SP, poorly graded sand

FAIRWAY TESTING CO., INC.

P. J. Aguanno, P.E.

Smith Street • Stony Point, N.Y. 10980 • 914-942-2088

- Testing

TRENCH
CLEANFILL

STAR RECYCLING INC.

50 - 04 73RD PLACE
WOODSIDE, NY 11377

QUALITY CONTROL LABORATORY

PRODUCT NAME: CLEANFILL

SIEVE ANALYSIS

Passing sieve	Percent by weight
1 "	100.0
1/2 "	97.7
3/8 "	95.5
1/4 "	90.4
# 4	87.0
#10	67.2
#40	46.3
#100	19.4
#200	14.7

Stan Fernandes
Lab. Director

Starr

(Trench Backfill)

123 Varick Avenue Brooklyn, New York 11237 Facsimile 718 628 7090 Telephone 718 386 7900

FAIRWAY

Soils
Test Report

RECEIVED APR 28 1995

April 26, 1995

client Breco Mechanical

project Pelham Landfill

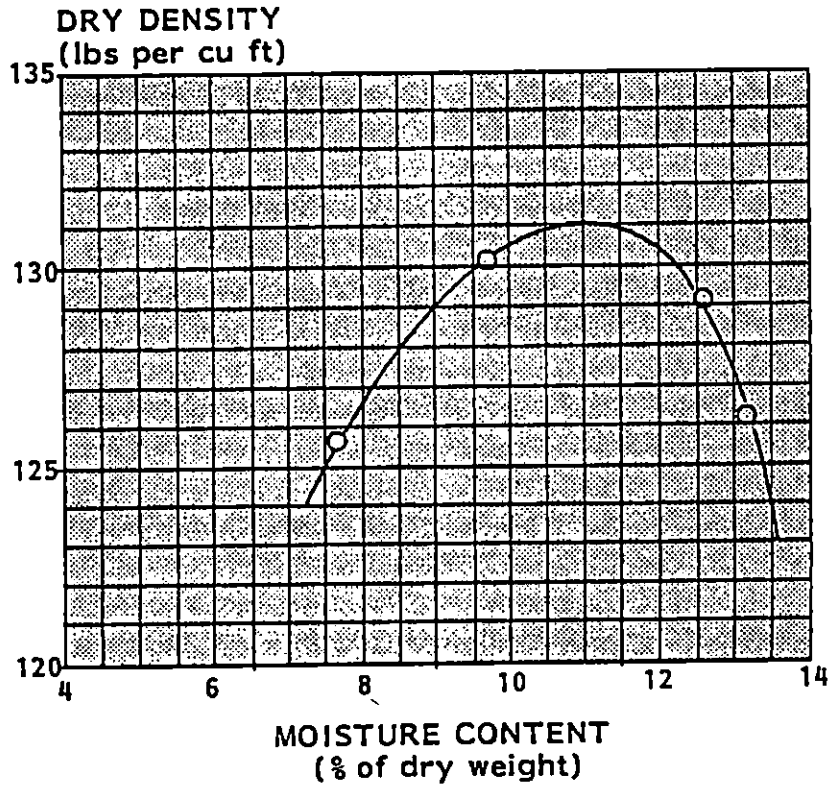
subject Moisture-Density Curve Analysis

Compaction Method ASTM D695

Maximum Dry Density 131.0 pcf
Optimum Moisture Content 11.1 %

On April 21, 1995 a representative from this firm visited the jobsite and picked-up an on-site soil sample from the trench backfilling operations. Test results are shown below.

ON-SITE SAMPLE



GRADATION ANALYSIS (D422)

Sieve Size	3"	2"	1-1/2"	1"	3/4"	3/8"	No.4	No.10	No.35	No.200
Sample	100	91	84	82	79	71	65	58	38	14.1

Percent Passing by Weight

SOIL CLASSIFICATION (ASTM D2487): GM, silty gravel with sand

FAIRWAY TESTING CO., INC.

P. J. Aguanno, P. E.

FAIRWAY

Quality Assurance

January 31, 1995

client Breco Mechanical

project Pelham Landfill

On this date, a representative from this firm visited Tilcon Quarries, Tompkins Cove, NY and picked-up an aggregate sample. Test results are shown below.

Pipe and Manhole Bedding

Sieve Size	Percent Passing by Weight Sample	Spec
1/2"	100	100
3/8"	92	90-100
No. 8	2	0-15
No. 30	1.1	0-30

FAIRWAY TESTING CO., INC.

P. J. Aquanno, P.E.

WC PROJECT-CLIENT SUBMITTAL REVIEW

NO EXCEPTIONS TAKEN ☑

FURNISH AS NOTED ☐

REVISE & RESUBMIT ☐

This review has been limited to an evaluation of whether the submittal is consistent with the Contract Documents. [illegible] responsible for verifying dimensions in the field. Review by [illegible] of Contractor of responsibility for [illegible] Contract Documents [illegible]

Date 2/3/95 By SMM

SUBMITTAL ID NUMBER 43A

WC PROJECT NO 92C4037

BRECO MECHANICAL GROUP, INC.

DATE: 1-31-95

CONTACT 876-HP 5

ITEM: –

SPEC. SECTION: 02225

PARAGRAPH: 2.1A

TEST NO.: 02225-2

DRAWING NO.: –

LOCATION: –

SUBMITTAL NO.: 876-HP-43A

APPROVED BY: B. [illegible]

Smith Street • Stony Point, N.Y. 10980 • 914-942-2088

TILCON

TILCON NEW YORK INC. P.O. Box 362 Haverstraw, NY 10927 914 638 1300

December 6, 1994

Mr. Brian Dyer
Breco Mechanical Group, Inc.
Breco Field Office
Pelham Bay Landfill
3599 Bruckner Boulevard
Bronx, NY 10464

Re: Pelham Bay Landfill Closure

Dear Sirs:

The following are the gradational analyses of the materials being submitted for use at the above referenced site, as compared with the specifications given.

Pipe & MH Bedding

Sieve Size	Tomkins Cove 3/8"	Spec. Given
1/2"	100 ✓	100
3/8"	87.8	90-100
#8	1.2 ✓	0-15
#30	0 ✓	0-3

Structural Backfill

Sieve Size	Haverstraw Screenings	
3/8"	100	
#4	99.2	(60-95)
#8	74.4	
#16	52.0 ✓	(30-72)
#30	35.9	
#50	24.2 ✓	(20-50)
#100	14.6	
#200	7.7 ✓	(2-20)

The Rip/Rap material produced at the Tilcon New York Inc. Haverstraw plant is made to conform to N.Y. State D.O.T. specifications.

The items submitted for Rip/Rap Class II is Light Stone Fill, for Rip/Rap Class IV, Medium Stone Fill and 18" top size material for Rip/Rap Class III.

Rip/Rap Class II

Light Stone Fill	% Of Total By Weight
Lighter than 100 lbs.	90-100
Larger than 6 inches	50-100
Smaller than 1/2 inch	0-10

Rip/Rap Class IV

Medium Stone Fill	% of Total By Weight
Heavier than 100 lbs.	50-100
Smaller than 4 inches	0-10

It is advised that all Rip/Rap items be visually inspected by the customer prior to shipment.

If you have any questions, please call me.

Sincerely,

Morsia Thomas

Morsia Thomas
Director, Quality Control

FAIRWAY

Quality
Assurance

September 27, 1995

TOPSOIL KARTA

client Breco Mechanical Group

project Pelham Landfill

Subject Topsoil Analysis

On September 26, 1995, a representative from this firm visited the jobsite and took a topsoil sample. Test results are shown below.

Percent Passing by Weight

Sieve Size	Sample
1"	100
3/4"	100
3/8"	96
No. 4	86
Sand { No. 10	74
No. 35 — (.5 sieve)	56
No. 270	23.2
Silt, %	21.2
Clay, %	2.0
Combined Silt and Clay, %	23.2
pH	6.9
Organic Content, %	7.7
Nitrogen, ppm	50
Potash, ppm	100
Phosphorous, ppm	200
Specific Conductance Micro MHO/cm	150

Total % Sand

74
- 23.2
50.8 %

% Sand > .5 mm

74
56
18 %

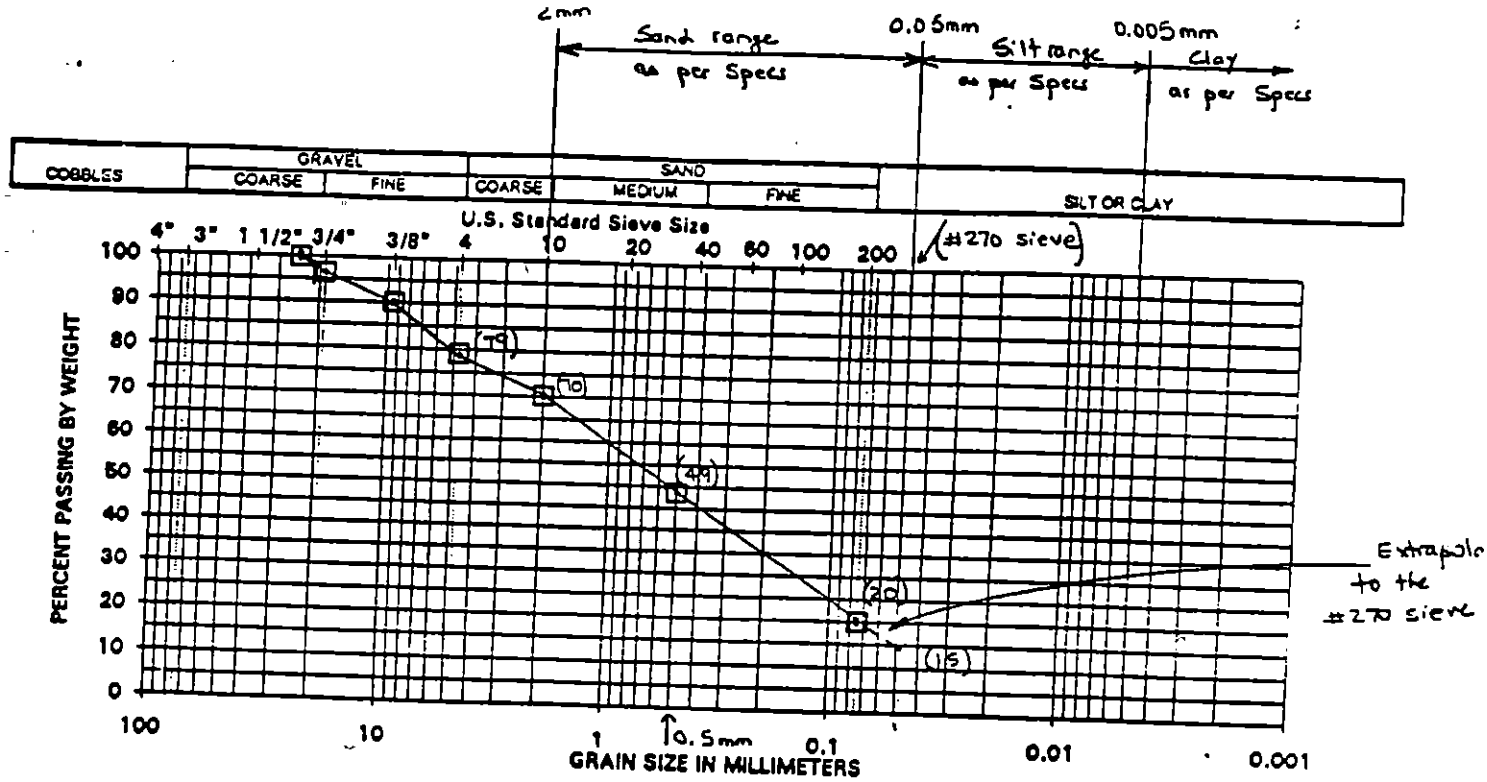
$\frac{18\%}{50.8\%} = 35\%$

Less than 1/2 the sand is greater than .5, therefore the minimum combined silt and clay content shall be 20%

FAIRWAY TESTING CO., INC.

C. J. Aguanno, P.E.

Smith Street • Stony Point, N.Y. 10980 • 914-942-2088



BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	W (%)	LL	PL
—	—	—	□		—	—	—
—	—	—	■				
					—	—	—

Spec review, Section 02920, 2.1

1A) Spec: 2" max. size
Sample: 100 % passing 1" } ⇒ OK ✓

1B) Spec: Organic content ≥ 3.75 %
Sample: Organic content = 13.9 % } meets specs, OK ✓

2.1C)

Gradation	Range	If "% larger than 0.5mm" is < 50% of sand content (1)	If "% larger than 0.5mm" is > 50% of sand content (2)	Sample	Status
Sand	2mm - 0.05mm	40 - 80%	40 - 75 %	55 %	OK
Silt	0.05mm - 0.005 mm	10 - 30%		12%	OK
Clay	0.005mm and smaller	10 - 30%	15 - 30%	8%	
Silt + Clay		≥ 20%	≥ 25%	20 %	OK

Extrapolating gradation curve to the #270 sieve, % passing #270 sieve = 15%
⇒ Sand content of sample = 70 - 15 = 55 %
⇒ 50% of sand content = 55/2 = 22.5 %
⇒ % larger than 0.5mm = 70 - 49 = 21 %
} ⇒ "% larger than 0.5mm" is < 50% sand content
⇒ column (1) applies
⇒ gradat of sample is OK ✓

D) Spec: pH = 6.0 - 7.0
Sample: pH = 7.0 } meets specs, OK ✓

Al 600 A14.00 1 wx

328-4176

FAIRWAY

Quality Assurance

February 8, 1996

TOPSOIL - ALFREDO NURSERY

client Breco Mechanical Group

project Pelham Landfill

subject Topsoil Analysis

On February 7, 1996, a representative form this firm visited the Labriolla composting yard and picked up two soil samples. Test results are shown below.

Sample	Location
~~A~~	~~On-site soil, (South pit face)~~
* B	Blended topsoil, (on-site soil with mulch)

Percent Passing by Weight

Sieve Size	A	B
1"	100	100
3/4"	94	92
3/8"	91	81
No. 4	84	78
No. 10	77	75
Sand { No. 35 — .5 Sieve	63	64
No. 270	26.7	28.4
Silt, %	24.6	25.9
Clay, %	2.1	2.5
Combined Silt & Clay	26.7	28.4
pH	7.1	6.6
Organic Content, %	2.0	7.5
Nitrogen, ppm	50	150
Potash, ppm	200	150
Phosphorus, ppm	150	125
Specific Conductance Micro MHO/cm	350	400

Total % Sand

75
- 28.4
46.6 %

% Sand > .5 mm

75
64
11 %

$\frac{11\%}{46.6\%} = 23.6\%$

less than ½ the sand is greater than .5, therefore the minimum combined silt and clay content will be 20%

FAIRWAY TESTING CO., INC.

R. S. Aguanno, P.E.

Smith Street • Stony Point, N.Y. 10980 • 914-942-2088

(914) 692-6060
FAX (914) 692-2003

TRUFFA SEED COMPANY

Manufacturers of *"VALLEY FARMS"* Brand
Grass Seed & Wild Bird Food

SEED ONLY - FERTILIZER

FAX TRANSMITTAL

Date 3/29/96

Time

# of Pages
(Including This One)

To: Walt - GPA

From: Tom T.

SUBJECT: Please verify this mixture with final substitution *
thanks

PELHAM BAY LANDFILL REMEDIATION SEED

Grass Seed Type	Application
Asclepias Syriaca (Milkweed)	3.0
* Cassia Fasciculate (Partridge Pea)	0.5
Euthamia graminifolia (Lance-leaf Goldenrod)	0.25
Solidago rugosa (Rough-stemmed Goldenrod)	0.25
Aster Pilosus (White Heath Aster)	0.25
Solidago Canadensis (Canadian Goldenrod)	0.25
Andropogon gerardii (Big Bluestem)	5.0
Schizachyrium scoparius (Little Bluestem)	4.5
Sorghastrom nutans (Indiangrass)	3.5
Panicum virgatum (Switchgrass)	1.5
Rudbeckia hirta (Black-eyed Suman)	0.25
	19.25 LBS/acre

31 INDUSTRIAL DRIVE, MIDDLETOWN, N.Y. 10940

ROCKLAND

Covers up to 15,000 Sq. Ft.

SOLUBLE HYDRO-STARTER

18-20-10

20% Organic Powder Blue

GUARANTEED ANALYSIS
Total Nitrogen (N) 18%
2.8% W.I.N.
3.7% Ammoniacal Nitrogen
11.5% Urea
Available Phosphoric Acid (P_2O_5) 20%
Soluble Potash (K_2O) 10%

Rockland Soluble Hydro-Starter, containing the Premium Nitrogen source, Powder Blue Nitroform® is a suspension type formula which will not leach or volatilize. Hydro-Starter is formulated to give the grass seedling a balanced feeding of required nutrients for maximum results. Hydro-Starter's powder-like consistency contains quick and slow release Nitrogen that will not damage seed in the slurry mix. Equipment wear and tear is significantly reduced. Hydro-Starter may also be used for improved rooting of sod, either before of after planting.

APPLICATION RATES AND YIELDS:

	Coverage	N/1000 sq. ft.	Phosphorus/1000 sq. ft.
40 Lb. Bag	10,000 sq. ft.	.72 lbs.	.8 lbs.
	12,500 sq. ft.	.58 lbs.	.64 lbs.
	15,000 sq. ft.	.48 lbs.	.53 lbs

Pre-Plant Sod Rates: Mix 40 lbs. in 180 to 200 gallon tank with Mechanical agitation and apply to 10,000 Sq. Ft.

B918240 B918240048

Net Weight 40 Lbs.

® Nitroform is a Registered Trademark of Nor-Am Agricultural Products.

SEED AND FERTILIZER - MULCH STABILIZER

TERRA-MULCH

TACKING AGENT III

TERRA-MULCH TACKING AGENT III IS A COMBINATION OF ORGANIC POLYMERS DESIGNED TO STABILIZE SOIL BY SUSPENDING WATER WITHIN THE FIBER MULCH MATRIX, REDUCING EROSION, WHILE INCREASING WATER ABSORPTION INTO THE SEED BED. THIS UNIQUE PRODUCT PROVIDES FOR A BETTER ENVIRONMENT FOR SEED TO GERMINATE IN WHILE INCREASING THE SURFACE TENSION OF ALL TYPES OF HYDRO-SEEDING MULCH MATERIALS - WOOD FIBER, PAPER FIBER AND COMBINATIONS OF WOOD AND PAPER. TACKING AGENT III IS A HIGH VISCOSITY POLYMER TACKIFIER THAT EXCEEDS MINIMUM REQUIREMENTS FOR NON-ASPHALTIC EMULSIONS. A STANDARD APPLICATION OF TACKING AGENT III TREATS AN EQUIVALENT OF 100 LBS OF GRASS SEED WITH AN ACRYLIC CO-POLYMER GEL SEED TREATMENT IMPROVING STRESS TOLERANCE OF YOUNG SEEDLINGS.

PHYSICAL PROPERTIES

NET WEIGHT	8-25-50 LB / BAGS
pH RANGE	7.0 +- .2
VISCOSITY (SAYBOLT)^	102 CPS +- 2
VISCOSITY (SAYBOLT)*	197 CPS +- 2
SURFACE TENSION*	73.9 DYNES / CM
SPECIFIC GRAVITY	.7281

^ VALUE BASED ON 30 LBS PER 1000 GALLONS OF WATER
* VALUE BASED ON 60 LBS PER 1000 GALLONS OF WATER

VISCOSITY AND SURFACE TENSION TESTING BASED ON SIMULATED FIELD APPLICATION AFTER 5 MINUTES OF MECHANICAL AGITATION.

APPLICATION RATES

MULCH BINDING

6 / 1 TO 4 / 1 SLOPE	20 LBS PER ACRE
4 / 1 TO 2 / 1 SLOPE	30 LBS PER ACRE
2 / 1 TO 1 / 1 SLOPE	40 LBS PER ACRE
>THAN 1 / 1 SLOPE	60 LBS PER ACRE

STRAW & HAY MULCH BINDING

30 LBS TACK III & 150 LBS CELLULOSE FIBER AND 1000 GALLONS OF WATER PER ACRE OR 50 LBS OF TACK III PER 1000 GALLONS OF WATER PER ACRE.

TERRA-MULCH TACKING AGENT III CONTAINS THE KNOWN FLOCCULANT POLYACRYLAMIDE (PAM). IN 1994 TACKING AGENT III WAS EVALUATED BY A MAJOR TURF UNIVERSITY TO DETERMINE ITS VALUE AS A SOIL STABILIZER. TACK III WAS APPLIED ALONE AT A RATE 60 LBS PER ACRE ON A 45% SLOPE. THE TEST PLOTS WERE SUBJECTED TO SIMULATED RAINFALL OF 12 INCHES PER HOUR FOR 30 MINUTES, THE SIMULATION TOOK PLACE WITHIN 2 HOURS OF SEEDING. TACKING AGENT III REDUCED EROSION VERSUS THE CONTROL BY 68.6% AND REDUCED WATER RUNOFF BY 21.7%. TACKING AGENT III CONTAINS A MARKER DYE FOR EASY METERING OF THE SPRAYED AREA WHEN TACKING HAY AND STRAW MULCHES. TACKING AGENT III BECOMES SLIPPERY WHEN WET. CLEAN UP ALL SPILLS THOROUGHLY. ASK YOUR DEALER ABOUT OUR *TERRA-MULCH SATISFACTION GUARANTEE.*

MANUFACTURED BY

SPITTLE ENTERPRISES, INC
PO BOX 1918
HUNTERSVILLE, NC 28078

DISTRIBUTED BY

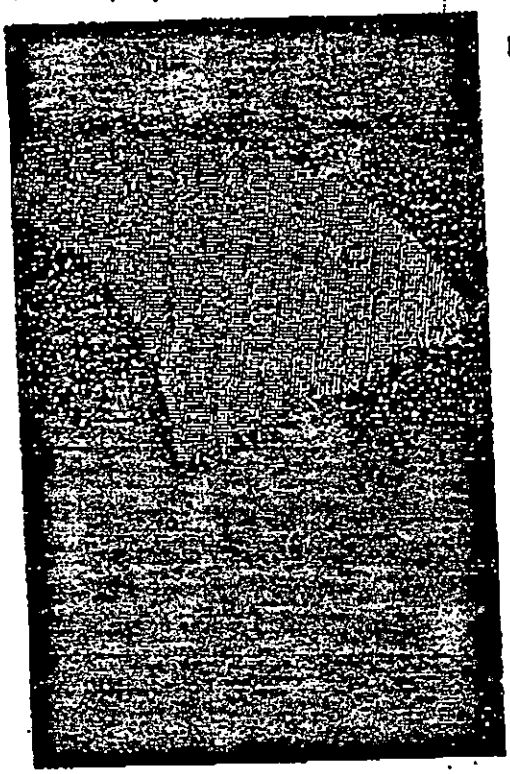
REFIBER WEST
WOOD RECYCLING INC
3 WHEELING AVENUE
WOBURN, MA 01801
800-982-8732

MULCH FOR HYDRO SEEDING

RE FIBER™ Wood

100% Recycled Wood Fiber

RE-FIBER Wood is a wood fiber mulch designed for hydraulic seeding and erosion protection that's manufactured using wood that is 100% recycled. It is engineered for discriminating landscape professionals and is created in harmony with today's environmental concerns.



▶ **RE-FIBER Wood** is university-tested.

In field and laboratory tests, Re-Fiber Wood allowed significantly less soil runoff and produced greater plant size and bulk than its competitors. Its custom-designed fiber length assures rapid and efficient absorption of water for a homogeneous mixture in hydraulic mulching equipment. Hydroseeders can count on easy handling and a uniform application.

▶ **RE-FIBER Wood** is 100% biodegradable.

It is specially formulated to protect the seed and soil from wind and heavy rainfall and gradually decompose as the lush carpet of lawn is established. The mulch contains no germination or growth-inhibiting materials.

▶ **RE-FIBER Wood** SPECIFICATIONS

Moisture Content (total weight basis)	12%±3%
pH (average)	5.4
Organic Content (minimum)	99%
Inorganic (ash) Content (maximum)	1%
Water Holding Capacity (minimum)	1 gal./lb.
Bag Net Weight	50 lb.-22.6 kg

RE-FIBER Wood is packaged in 50 pound color-coded bags for easy measurement and convenience. The durable bags are constructed from recyclable plastic and are suitable for outside storage.

RE-FIBER Wood
manufactured by
Wood Recycling, Inc.

Distributed by

For further information, call Wood Recycling, Inc • (800) 982-8732
3 WHEELING AVENUE • WOBURN, MA 01801 • (617) 937-0855 • FAX (617) 932-0945

SERIES 4
Versare Primers

PRODUCT PROFILE

GENERIC DESCRIPTION Modified Alkyd

COMMON USAGE Rust inhibitive primer for shop and field coating of structural and miscellaneous steel, tanks and machinery. Used under alkyd and water base acrylic topcoats.

COLORS 55 Red, 56 Gray, 57 White

PERFORMANCE CRITERIA Extensive test data available. Contact your Tnemec representative for specific test results.

COATING SYSTEMS

TOPCOATS Series 2H, 6, 7, 23, 43-38, 82, 113, 114. **Note:** Some systems are not for use on surfaces that are continually wet or sweat frequently. Reference the applicable topcoat data sheet for additional information.

SURFACE PREPARATION

STEEL SSPC-SP2 Hand Tool or SSPC-SP3 Power Tool Cleaning
SSPC-SP6 Commercial Blast Cleaning when extended field exposure is expected.

ALL SURFACES Must be clean, dry and free of oil, grease and other contaminants.

TECHNICAL DATA

VOLUME SOLIDS* 54.0 ± 2.0%

RECOMMENDED DFT 2.0 to 3.5 mils (50 to 90 microns) per coat.

CURING TIME

Temperature	*To Handle*	*To Recoat*
75°F (24°C)	4 hours	12 hours

Curing time varies with air & substrate temperature, air movement, humidity and film thickness.

VOLATILE ORGANIC COMPOUNDS

Unthinned	*Thinned 10%*
2.88 - 3.05 lbs/gallon (345 - 366 grams/litre)	3.20 - 3.36 lbs/gallon (384 - 403 grams/litre)

THEORETICAL COVERAGE* 866 mil sq ft/gal (21.3 m²/L at 25 microns). See APPLICATION for coverage rates.

NUMBER OF COMPONENTS One

PACKAGING 55 gallon (208.2L) drums, 5 gallon (18.9L) pails and 1 gallon (3.79L) cans.

NET WEIGHT PER GALLON* 12.14 ± 0.25 lbs (5.51 ± .11 kg)

STORAGE TEMPERATURE Minimum 20°F (-7°C) Maximum 110°F (43°C)

SHELF LIFE 24 months at recommended storage temperature.

FLASH POINT - SETA 100°F (38°C)

HEALTH & SAFETY Paint products contain chemical ingredients which are considered hazardous. Read container label warning and Material Safety Data Sheet for important health and safety information prior to the use of this product. **Keep out of the reach of children.**

Centrifugal Blower-
Color Selection,

APPLICATION

COVERAGE RATES*

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m^2/Gal)
Suggested	2.5 (65)	4.5 (115)	346 (32.2)
Minimum	2.0 (50)	3.5 (90)	433 (40.2)
Maximum	3.5 (90)	6.5 (165)	247 (23.0)

Allow for overspray and surface irregularities. Film thickness is based upon closest 0.5 mil (5 microns). Application of coating below minimum or above maximum recommended dry film thicknesses may adversely affect coating performance.

MIXING Stir thoroughly, making sure no pigment remains on the bottom of the can.

THINNING Use No. 1 Thinner or mineral spirits. For air spray, thin up to 10% or ¾ pint (380 mL) per gallon. For airless spray, brush or roller, thin up to 5% or ¼ pint (190 mL) per gallon.

SURFACE TEMPERATURE Minimum 40°F (4°C) Maximum 120°F (49°C)
The surface should be dry and at least 5°F (3°C) above the dew point.

APPLICATION EQUIPMENT

Air Spray

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss MBC or JGA	E	765 or 78	5/16" or 3/8" (7.9 mm or 9.5 mm)	3/8" or 1/2" (9.5 mm or 12.7 mm)	60-80 psi (4.2-5.5 bar)	10-20 psi (0.7-1.4 bar)

Low temperatures or longer hoses require higher pot pressure.

Airless Spray

Tip Orifice	Atomizing Pressure	Mat'l Hose ID	Manifold Filter
0.015"-0.019" (380-485 microns)	1800-3000 psi (124-207 bar)	1/4" or 3/8" (6.4 mm or 9.5 mm)	60 mesh (250 microns)

Use appropriate tip/atomizing pressure for equipment, applicator technique and weather conditions.

Roller: Use high quality synthetic nap covers. Use 1/4" to 1/2" (6.4 mm to 12.7 mm) nap depending on surface roughness.

Brush: Use high quality natural or synthetic bristle brushes.

CLEANUP Flush and clean all equipment immediately after use with the recommended thinner or mineral spirits.

* Values may vary with color.

Tnemec Company, Inc.
P.O. Box 411749, Kansas City, MO 64141

FOR INDUSTRIAL USE ONLY

Printed in USA

SERIES 23 Enduratone

TNEMEC

PRODUCT PROFILE

GENERIC DESCRIPTION Alkyd

COMMON USAGE Semi-gloss industrial enamel. Good flow, hiding and protection for most surfaces in mild to moderately severe exposures. Not for use on surfaces that are continually wet or sweat frequently.

COLORS Refer to Tnemec ColorBook.

FINISH Semi-gloss

SPECIAL QUALIFICATIONS Certain colors meet USDA requirements for use in federally inspected meat and poultry plants.

PERFORMANCE CRITERIA Extensive test data available. Contact your Tnemec representative for specific test results.

COATING SYSTEMS

PRIMERS

Steel: Series 4, 10, 37H, 50-330, 59
Galvanized Steel and Non-Ferrous Metal: Series 27. **Note:** Apply an intermediate coat of Series 27 or scarify the surface of Series 27 that has been exterior exposed for 3 weeks or longer prior to topcoating with 23. Brush blasting with fine abrasive is the preferred method of scarification.
Interior Drywall: 51-792
Wood: 36-603

SURFACE PREPARATION

ALL SURFACES Must be clean, dry and free of oil, grease and other contaminants. Remove rust and paint not tightly bonded. Spot prime.

TECHNICAL DATA

VOLUME SOLIDS* 55.5 ± 2.0%

RECOMMENDED DFT 1.5 to 3.0 mils (40 to 75 microns) per coat. **Note:** Number of coats required will vary depending on color, substrate (surface) and other variables. Contact your Tnemec representative for specific recommendations.

CURING TIME

Temperature	*To Touch*	*To Handle*	*To Recoat*
75°F (24°C)	5-7 hours	9-13 hours	12-18 hours

Curing time varies with air & substrate temperature, air movement, humidity and film thickness.
Water Tank Exteriors: Five days or more curing time required before filling with water.

VOLATILE ORGANIC COMPOUNDS

Unthinned	*Thinned 10%*
2.88 - 3.04 lbs/gallon (345 - 364 grams/litre)	3.20 - 3.35 lbs/gallon (384 - 401 grams/litre)

THEORETICAL COVERAGE* 890 mil sq ft/gal (21.8 m²/L at 25 microns). See APPLICATION for coverage rates.

NUMBER OF COMPONENTS One

PACKAGING 55 gallon (208.2L) drums, 5 gallon (18.9L) pails and 1 gallon (3.79L) cans.

NET WEIGHT PER GALLON* 11.70 ± 0.25 lbs (5.31 ± .11 kg)

STORAGE TEMPERATURE Minimum 20°F (-7°C) Maximum 110°F (43°C)

SHELF LIFE 24 months at recommended storage temperature.

FLASH POINT - SETA 100°F (38°C)

HEALTH & SAFETY Paint products contain chemical ingredients which are considered hazardous. Read container label warning and Material Safety Data Sheet for important health and safety information prior to the use of this product. **Keep out of the reach of children.**

COLOR - PA-39 Polar Morn

APPLICATION

COVERAGE RATES*

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m^2/Gal)
Suggested	2.0 (50)	3.5 (90)	445 (41.3)
Minimum	1.5 (40)	2.5 (65)	593 (55.1)
Maximum	3.0 (75)	5.5 (140)	297 (27.6)

Allow for overspray and surface irregularities. Film thickness is based upon closest 0.5 mil (5 microns). Application of coating below minimum or above maximum recommended dry film thicknesses may adversely affect coating performance.

MIXING Stir thoroughly, making sure no pigment remains on the bottom of the can.

THINNING Use No. 1 Thinner or mineral spirits. For air spray, thin up to 10% or ¾ pint (380 mL) per gallon. For airless spray, brush or roller, thin up to 5% or ¼ pint (190 mL) per gallon.

SURFACE TEMPERATURE Minimum 40°F (4°C) Maximum 120°F (49°C)
The surface should be dry and at least 5°F (3°C) above the dew point.

APPLICATION EQUIPMENT

Air Spray

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss MBC or JGA	E	765 or 78	5/16" or 3/8" (7.9 mm or 9.5 mm)	3/8" or 1/2" (9.5 mm or 12.7 mm)	60-80 psi (4.2-5.5 bar)	10-20 psi (0.7-1.4 bar)

Low temperatures or longer hoses require higher pot pressure.

Airless Spray

Tip Orifice	Atomizing Pressure	Mat'l Hose ID	Manifold Filter
0.013"-0.017" (330-430 microns)	1800-3000 psi (124-207 bar)	1/4" or 3/8" (6.4 mm or 9.5 mm)	60 mesh (250 microns)

Use appropriate tip/atomizing pressure for equipment, applicator technique and weather conditions.

Roller: Use high quality synthetic nap covers. Use 1/4" to 1/2" (6.4 mm to 12.7 mm) nap, depending on surface roughness.

Brush: Use high quality natural or synthetic bristle brushes.

CLEANUP Flush and clean all equipment immediately after use with the recommended thinner or mineral spirits.

* Values may vary with color.

Tnemec Company, Inc.
P.O. Box 411749, Kansas City, MO 64141

11200 - 2.1 B

The Fleet Companies

G. A. Fleet Associates, Inc.

P. O. Box 616
Harrison, NY 10528
G. A. Fleet Assoc.
(914) 835 - 4000
Fax (914) 835 - 1331
Fleet Pump & Service
(914) 835 - 3801
Fax (914) 835 - 2946

Important:
This drawing is not to scale-use dimensions shown. Do not fix foundation bolts rigidly until equipment is in place, since castings vary slightly in dimensions.

FLYGT Submersible Pump and Accessories

Sold To:
Barbella Environment Tech, Inc.
P. O. Box 273
Salem Industrial Park, Bldg #8
Whitehouse, NJ 08888
Contact: Thomas Jackson

Ship To:
BET c/o Pelham Bay Landfill
Pelham Bridge Road
Hunt's Point Area
Bronx, NY

Engineer: _____ **Date:** 3/15/94 **Customer Order No.** 1547

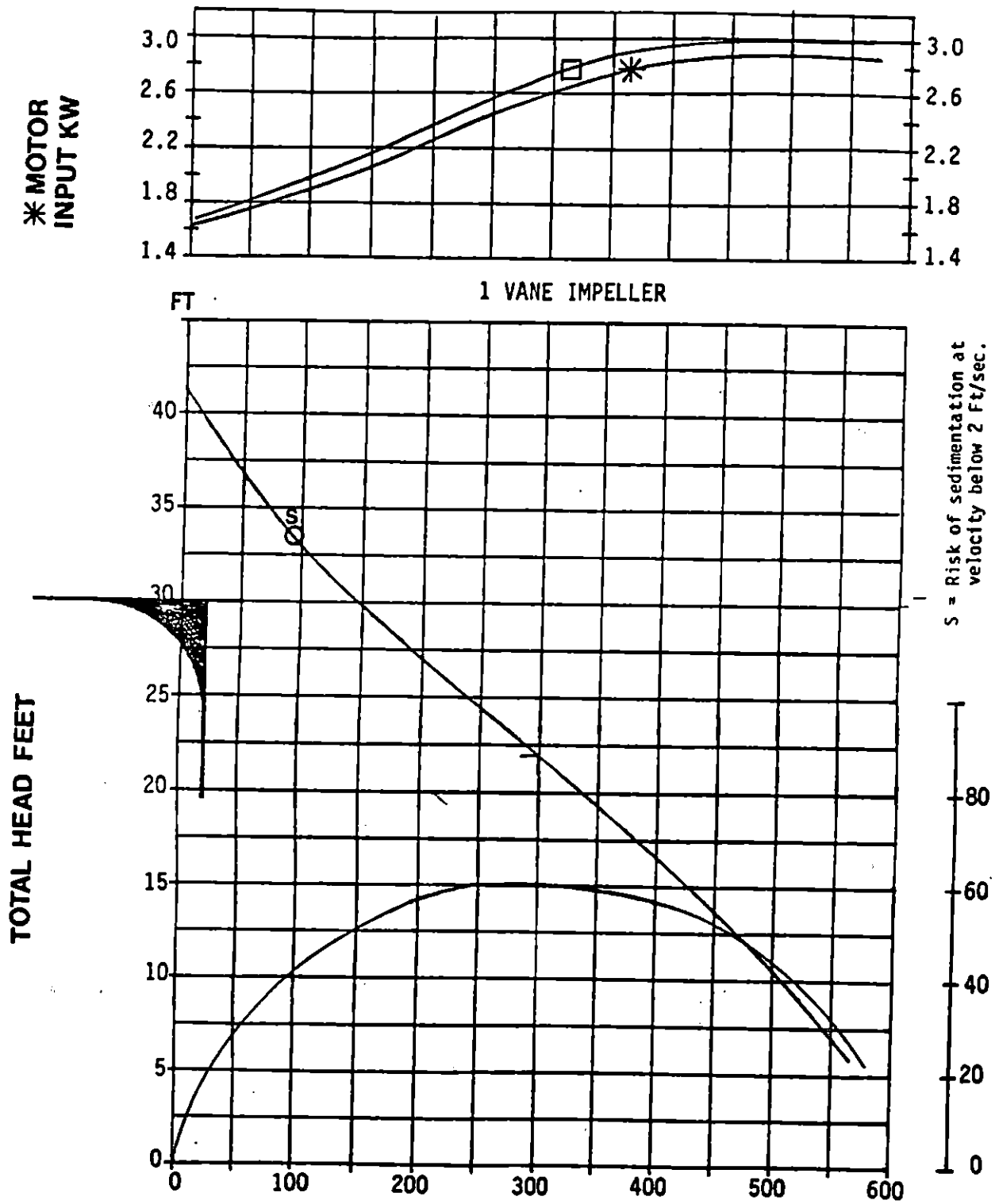
Equipment Serial No: _____ **Distr. Order No.** E18811

Marks: Pelham Landfill, Bronx, NY **Sheet:** 1 **Of:** 2 **By:** _____

QTY	DESCRIPTION
6	**Unit or Frame:** Flygt Model 3" CP-3085X with FLS Leak Detection **Impeller:** 434 **Installation:** **GPM** 20 USGPM **TDH** 30' TDH
6	**Motor:** Flygt Submersible **HP** 3 **RPM** 1800 **Volts** 460 **Phase** 3 **Cycle** 60 **Description:** TENV - Air Filled - Class F Insulation - FM Listed - Nema B Type - 1.15 S. F. **Control Voltage:** 24 Volt
	Control & Accessories
6	40 ft. SUBCAP, 14 AWG/7 19 MM Submersible Power Cables with Kellems Cable Grips
6	3" Cast Iron Discharge Elbows with Integral Lower Guide Bar Brackets and Sparkproof Discharge Adapters
6	Upper Guide Bar Brackets
6	20' Galvanized Lifting Chain
6	Certified Performance Tests. Curves to be Supplied for Engineer's Approval Prior to Shipment
3	Aluminum Access Covers (ϕ5' M. H.) w/ Pump Access Hatch (30" x 48")
3	Firetrol Model FTA620-HGO3B-X2275*001 Duplex Control Panel with options as follows: 3 by 3 HP, 440-480/3/60 Power Output NEMA 3R Exterior Enclosure NEMA 7 XP Interior Enclosure Two (2) Motor Starters HOA Selector Switches Pump Run Pilot 120V Space Heater and Thermostat Automatic Alternator with P1 Auto P2 Selector Switch Audible and Visible High Water Alarm Motor Start Counter Convenience Outlet 120V Industrial Relays for Start, Stop, and Alarm (HWA) Mini-CAS Relays B & W Electrode Probes

DWG: No. D-10

3.0 HP - 4 Pole Motor 3ϕ: 200, 230/460, 575V	CP/CS 3085 Wastewater Impeller 434	SECTION 3085	PAGE 8/434
		SUPERSEDES	ISSUED 4/86



NOTE: THE C3085 IS AVAILABLE IN CP AND CS TYPES ONLY. FOR CT TYPE USE MODEL 3085/82.

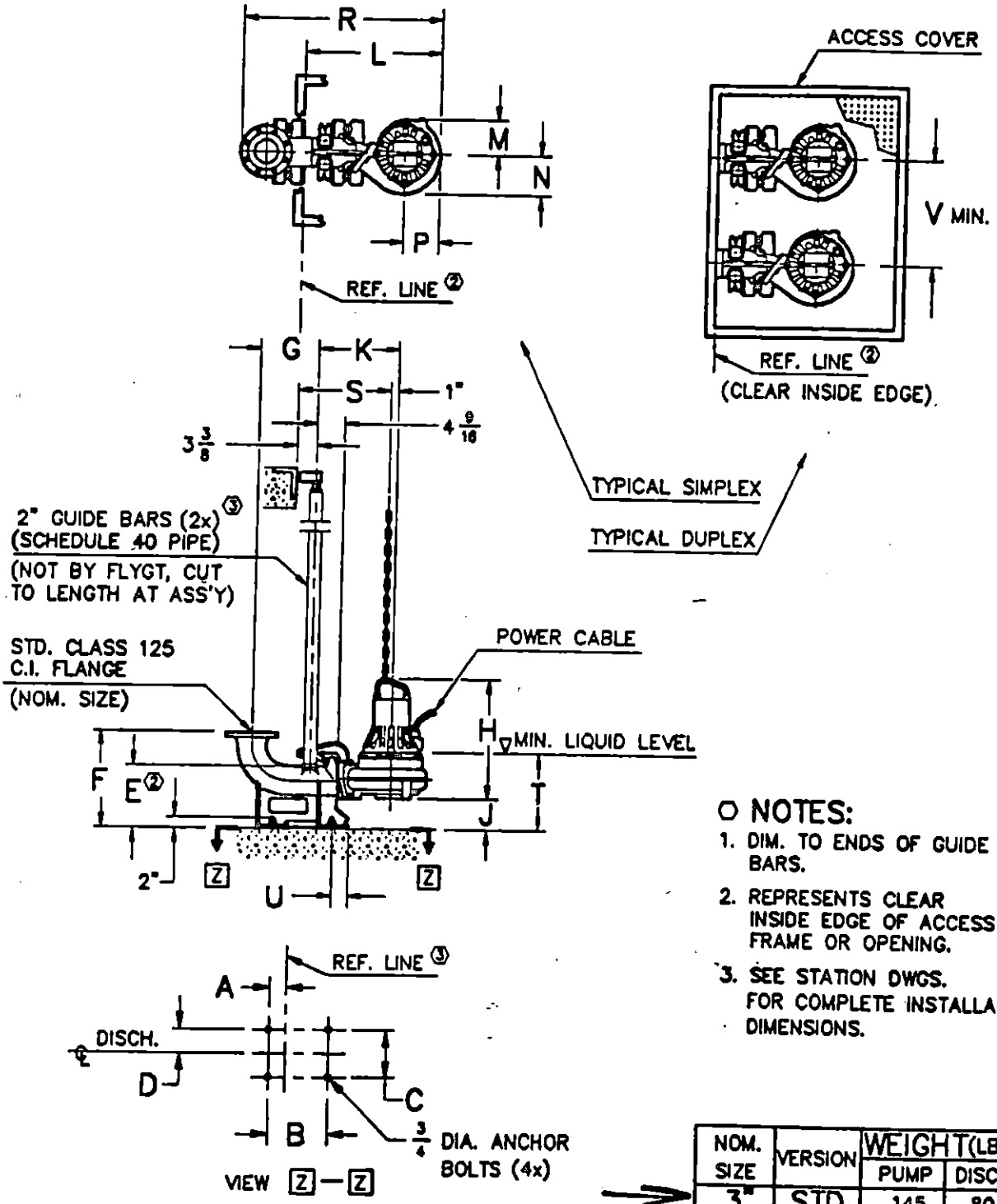
PERFORMANCE CURVES ARE BASED ON TESTS WITH CLEAR WATER AT AMBIENT TEMPERATURE.

FLYGT
FLYGT CORPORATION
A SUBSIDIARY OF ITT
129 GLOVER AVE., NORWALK, CT. 06856

CP-3085

Outline Dimensions

SECTION	PAGE
4	1
SUPERSEDES	ISSUED
6/90	12/91



NOTES:

1. DIM. TO ENDS OF GUIDE BARS.
2. REPRESENTS CLEAR INSIDE EDGE OF ACCESS FRAME OR OPENING.
3. SEE STATION DWGS. FOR COMPLETE INSTALLATION DIMENSIONS.

NOM. SIZE	VERSION	WEIGHT (LBS) PUMP	WEIGHT (LBS) DISCH
3"	STD	145	80
~~4"~~	~~STD~~	~~145~~	~~80~~

ALL DIMENSIONS IN INCHES

DIMENSIONAL CHART

NOM. SIZE	VERSION	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V
3"	STD	2 3/16	9 7/8	7 3/4	3 7/8	10 1/4	15 3/4	9 3/8	20	4 5/8	13 3/4	23 1/4	5 3/4	6 3/4	6 3/8	33 1/4	15 3/4	12 1/4	2 3/4	17 3/4
~~4"~~	~~STD~~	~~2 3/4~~	~~9 7/8~~	~~7 3/4~~	~~3 7/8~~	~~10 1/4~~	~~15 3/4~~	~~9 3/8~~	~~20~~	~~5~~	~~13 3/4~~	~~23 1/4~~	~~5 3/4~~	~~6 3/4~~	~~6 3/8~~	~~33 1/4~~	~~15 3/4~~	~~12 1/4~~	~~2 3/4~~	~~17 3/4~~

FLYGT CP3085 ~~AND 3102~~
SUBMERSIBLE PUMPS
MATERIALS OF CONSTRUCTION

CASING	-	Cast Iron, Class 30
IMPELLER	-	Cast Iron, Class 30*
SHAFT	-	Stainless Steel, AISI 420
MECHANICAL SEAL	-	Double Type
<u>UPPER</u>	-	Carbon Rotating/Carbon Ceramic Stationary
<u>LOWER</u>	-	Tungsten Carbide Rotating/Tungsten Carbide Stationary
FASTENERS	-	Stainless Steel, AISI 304
"O" RINGS	-	Nitrile Rubber

*INDICATES: Bronze <u>not</u> available

(b:flymtcon.mw)

C/D-3085

Electrical Data

SECTION	MODEL
6	3085
SUPERSEDES	ISSUED
6/90	12/91

MOTOR DATA

RATED OUTPUT POWER HP (KW)	Ø	VOLTS NOM.	FULL LOAD AMPS	LOCKED ROTOR AMPS	LOCKED ROTOR KVA	LOCKED ROTOR CODE LETTER KVA/HP	RATED INPUT POWER KW	POLES/RPM
1.6 (1.2)	1	230	7.1	23.0	5.3	B	1.6	4/1700
2.0 (1.6)	3	200 230 460 575	7.4 6.4 3.2 2.6	33.8 29.4 14.7 11.8	11.7	G	2.2	4/1700
2.4 (1.9)	1	230	10.0	46.0	10.6	D	2.3	4/1700
*2.9 (2.2)	1	230	12.0	47.0	11.0	C	2.8	2/3450
3.0 (2.4)	3	~~200~~ ~~230~~ 460 ~~575~~	~~10.0~~ ~~9.0~~ 4.5 ~~3.0~~	~~55.2~~ ~~48.0~~ 24.0 ~~19.2~~	19.1	H	3.0	4/1700
*4.0 (3.0)	3	200 230 460 575	11.0 10.0 5.0 4.0	69.9 60.8 30.4 24.2	24.2	G	3.6	2/3450

Pump Motor HP	EFFICIENCY			POWER FACTOR		
	100% LOAD	75% LOAD	50% LOAD	100% LOAD	75% LOAD	50% LOAD
1.6	75.0	76.8	74.1	0.98	0.99	0.97
2.0	73.5	74.5	72.5	0.82	0.75	0.64
2.4	80.0	81.7	79.0	0.98	0.99	0.97
~~*2.9~~	~~80.5~~	~~82.2~~	~~79.5~~	~~0.99~~	~~0.99~~	~~0.98~~
3.0	77.5	78.5	76.5	0.82	0.75	0.64
~~*4.0~~	~~81.5~~	~~82.5~~	~~81.5~~	~~0.92~~	~~0.89~~	~~0.89~~

CABLE DATA

HP	VOLTS	MAX. LENGTH FT.	CABLE SIZE	NOMINAL DIA.	CONDUCTORS (IN ONE CABLE)
1.6 (1Ø)	230	320	#14/7	19.0mm (0.75")	(3) #14AWG (PWR) (2) #14AWG (CTRL) (1) #14AWG (GND) (1) #14AWG (GC)
2.0 (3Ø)	200 230 460 575	265 350 1400 2180			
2.4 (1Ø)	230	225			
~~*2.9 (1Ø)~~	~~230~~	~~190~~			
3.0 (3Ø)	~~200~~ ~~230~~ 460 ~~575~~	~~195~~ ~~250~~ 1000 ~~4560~~			
*4.0 (3Ø)	200 230 460 575	180 225 900 1400			

* FOR VORTEX IMPELLER PUMPS

FLOJET

MASTER SPEC LIST FOR CP-PUMP CABLES

SUBMERSIBLE PUMPS - FLYGT CP-3085

CABLE SPEC'S:

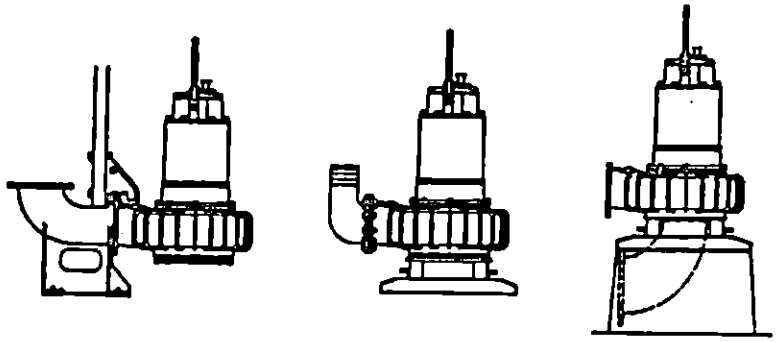
JACKET:	Dupont Hypalon (Chlorosulfinated)
INSULATION:	Dupont Nordel (Ethylene)
CABLE DIAMETER:	0.75" dia.
CONDUCTOR SIZES:	3-# 14 (Power Leads), 2-# 14 (Thermal Switches), 1-# 14 (Ground Lead), 1-# 14 Ground Check)
COLOR CODES FOR LEADS:	Red, White & Black - (POWER LEADS) Green - (GROUND LEAD) Yellow/Green - (GROUND LEAD) Blue & Orange - (THERMAL SWITCHES)

D:b
(speccppc)

EXPLOSIONPROOF PUMPS

Model	Horsepower
3085 (X)	~~1.8~~ - 3
~~3102 (X)~~	~~5.0~~ - ~~6~~
~~3127 (X)~~	~~9.4~~ - ~~10~~
~~3152 (X)~~	~~14.0~~ - ~~25~~
~~3170 (X)~~	~~25.0~~ - ~~30~~
~~3201 (X)~~	~~29.0~~ - ~~47~~
~~3230 (X)~~	~~120.0~~ - ~~214~~
~~3300 (X)~~	~~32.0~~ - ~~120~~
~~3305 (X)~~	~~100.0~~ & ~~140~~
~~3311 (X)~~	~~104.0~~ - ~~928~~
~~3355 (X)~~	~~74.0~~ - ~~148~~
~~3500 (X)~~	~~100.0~~ - ~~280~~
~~3530 (X)~~	~~100.0~~ - ~~300~~
~~3531 (X)~~	~~100.0~~ - ~~600~~
~~3601 (X)~~	~~100.0~~ - ~~800~~
~~3602 (X)~~	~~100.0~~ - ~~900~~

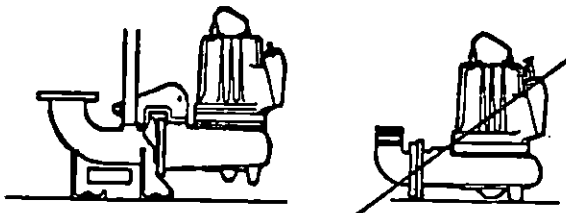
These units are special versions, model number suffix (X), of ITT Flygt's standard wastewater pumps constructed to meet explosionproof requirements and are Factory Mutual Systems approved for use in hazardous locations defined as Class 1, Division 1, Groups C and D (gasses and vapors) Class 2, Div.1, Groups E & G (dusts), Class 3, Div. 1, (fibers and flyings).
To achieve this approval, pumps are assembled from selected castings that are redesigned with longer flame paths and closer tolerences. Cable entries are specially designed as well.



FIBROUS WASTE CUTTER PUMPS

Model	Horsepower
F-3085	2.3 - 3
F-3102	4.0 - 5
F-3127	7.6 - 7.6
F-3152	16.0 - 20

These units, FP and FS prefix to model number, are constructed of cast iron and have non-clogging type impellers with cutter attachment for pumping wastewater containing stringy or fibrous materials or agricultural waste.

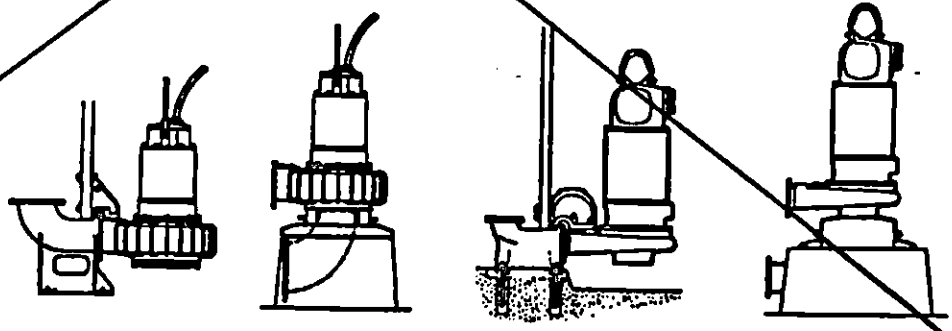


RAW WATER PUMPS

Model	Horsepower
3230	120 - 214
3300	32 - 120

These submersible pumps are for use in clean or raw water applications with capacities exceeding 2,500 GPM and total dynamic heads up to 320 feet. Motor output ranges from 32 to 214 HP. Hydraulic efficiencies of between 71% and 77% are obtained at the best efficiency points.

Impellers are of multi-vane design.

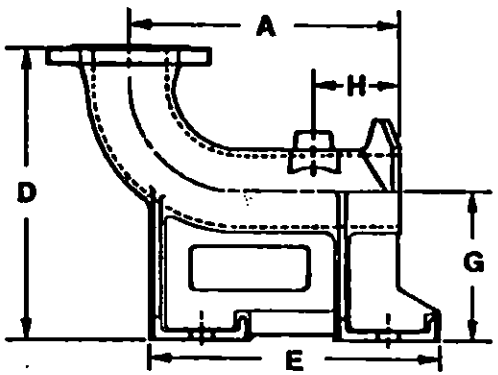


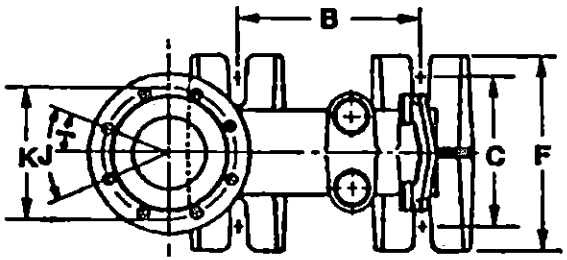
RP 3300 RT 3300 RP 3230 RT 3230

Standard Discharge Connection
Dimensions

Pump Model	Discharge Conn.	Discharge Inlet	Conn. Outlet	A	B	C	D	E	F	G	H	I	J	K
~~2 1/2" - 3087~~	~~490 17 06~~	~~2 1/2"~~	~~2 1/2"~~	~~11 5/8~~	~~7 7/8~~	~~5 3/4~~	~~9 7/8~~	~~11 1/2~~	~~7 7/8~~	~~6 1/2~~	~~4 9/16~~	~~45°~~	~~90° X 4~~	~~5 1/8~~
3" - ~~3080~~, 3085, ~~3085/82~~,	444 68 05	3"	3"	14	9 7/8	7 3/4	15 3/4	15 3/8	10 5/8	7 7/8	"	"	"	8
~~4" - 3080, 3085, 3085/82,~~ 3102, 3127, 3140, 3152	~~540 13 05~~	~~4"~~	~~4"~~	~~14 5/8~~	"	"	"	"	"	"	"	~~22.5°~~	~~45° X 8~~	~~7 1/2~~
4" - 3170	540 13 05	4"	4"	"	"	"	"	"	"	"	"	"	"	"
6" - 3102, 3127, 3140, 3152, 3201, 3170	444 70 06	5 1/2"	6"	15 9/16	11	9 1/2	17 3/4	"	12 3/16	9 7/8	"	"	"	9 1/2
8" - 3127, 3152, 3170, 3201, 3300	444 71 06	6"	8"	16 3/4	"	"	"	15	"	10 1/8	"	"	"	11 3/4
8" - 3230	388 24 06	8"	8"	21 5/8	19 11/16	16 3/4	"	23 5/8	19 3/4	8 7/8	6 7/8	"	"	"
10" - 3140, 3201	444 73 05	8"	10"	18 3/4	"	9 1/2	"	24	12 3/16	"	4 9/16	15°	30° X 12	14 1/4
10" - 3152, 3170	481 76 05	10"	10"	18 11/16	"	7 7/8	"	"	"	"	"	"	"	"
12" - 3152, 3170,3300	481 75 05	10"	12"	21 5/8	"	20 3/4	31 1/2	25 5/8	24 7/16	19 11/16	"	"	"	17
12" - 3201	481 77 05	12"	12"	"	"	20 13/16	"	25 9/16	"	"	"	"	"	"
12" - 3305, 3311	373 92 05	12"	12"	24 5/8	25 9/16	24 1/2	23 5/8	29 1/2	27 9/16	10 13/16	6 7/8	"	"	"
14" - 3201, 3300	320 15 05	12"	14"	22 5/8	19 11/16	21	33 1/2	25 5/8	24 7/16	19 11/16	4 9/16	"	"	18 3/4
14" - 3311	442 16 05	12"	14"	25 9/16	25 9/16	24 1/2	23 5/8	29 1/2	27 9/16	11 13/16	6 7/8	"	"	"
14" - 3355	388 27 05	14"	14"	"	"	"	"	"	"	"	"	"	"	"
20" - 3500, 3530, 3531	387 90 05	20"	20"	30 1/2	31 1/2	28 1/2	33	35 7/16	31 1/2	15 3/8	8 7/8	9°	18° X 20	25
24" - 3601, 3602	388 65 05	24"	24"	33	35 7/16	32 5/8	37 3/8	39 3/8	35 7/16	17 3/4	"	"	"	29 1/2

ALL DIMENSIONS ARE IN INCHES





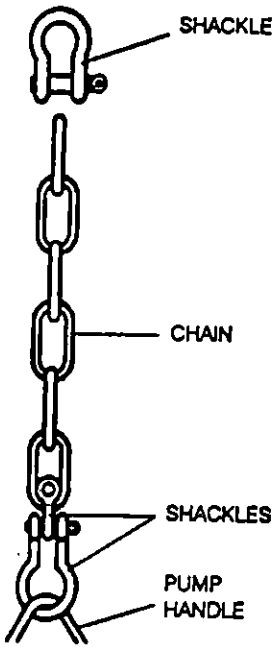
Note:
Discharge connection shown is typical for all sizes. Note the actual discharge connection may vary from that shown.

Lifting Chain & Cable

CHAIN

Chain is hot dipped galvanized carbon steel and may be ordered in any length. Fittings consist of two end shackles and are available in kits.

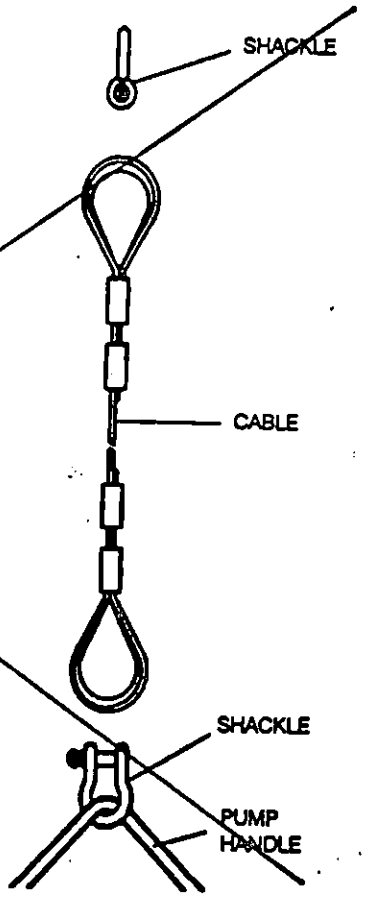
PUMP MODELS:	CHAIN SIZE:
3067, 3080, 3085, 3085/82, 3102, 3127.	5/0 Straight Coil
3140, 3152	5/16" Proof Coil
3170, 3201	3/8" Proof Coil
3230, 3300, 3305, 3355	7/16" Hi-Test
3311	1/2" Hi-Test
3351,3500,3530,3531,3601, 3602	Contact ITT Flygt Engineering



CABLE

Cable is stainless steel and may be ordered in the lengths shown below. For other lengths, contact ITT Flygt Application Engineering. Fittings consist of two end shackles and are available in kits.

PUMP MODELS:	CABLE SIZE:
3067 Thru 3152	1/4" – (316 stainless steel)
3170, 3201, 3230, 3300, 3305, 3355	3/8" – (304 stainless steel)
3311, 3351,3500, 3530, 3531, 3601, 3602	Contact ITT Flygt Engineering



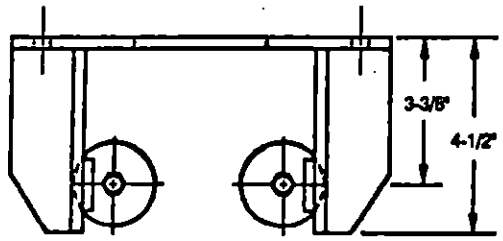
LENGTHS:

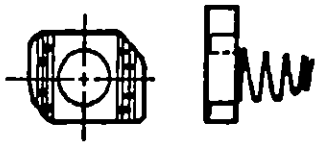
For Models 3067 Thru 3152 – 316 stainless steel cable is available in 20 to 55 foot lengths (in 5 foot increments).

All other models – 304 stainless steel cable is available in 20, 25, and 30 foot lengths.

Upper Guide Bar Brackets

UPPER GUIDE BAR BRACKET



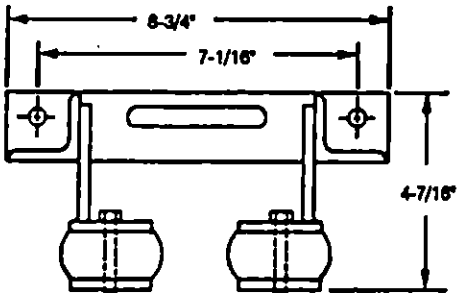


LATERAL NUT WITH SPRING

PLAIN WASHER

LOCK WASHER

HEX. HEAD BOLT



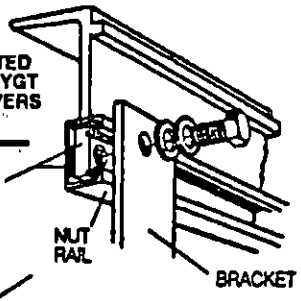
KIT NO. 14 58 93 15
(Galvanized Steel)

Standard for the following "CP" pumps:

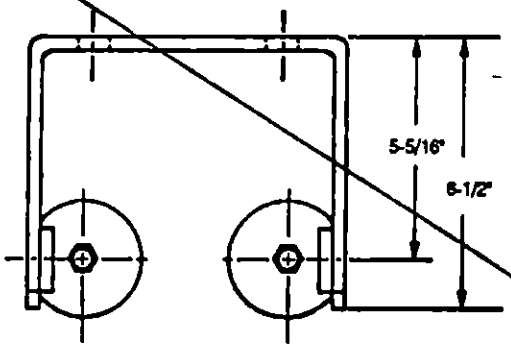
3067
~~3080~~
3085
~~3102~~
3126
3127
3140
3152

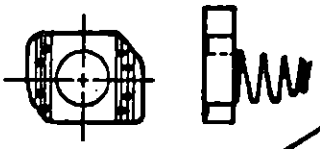
Also available in 304 stainless steel - KIT NO. 14 58 93 06

Note: use with 2" nominal guide bars



UPPER GUIDE BAR BRACKET



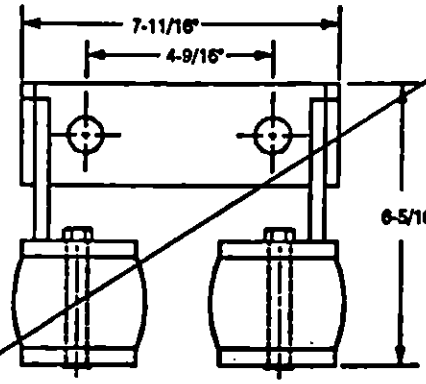


LATERAL NUT WITH SPRING

PLAIN WASHER

LOCK WASHER

HEX. HEAD BOLT



KIT NO. 14 58 93 25
(Galvanized Steel)

Standard for the following "CP" pumps:

3170
3201
3230
3300
3305
3311
3351
3355
3500
3530
3531
3601
3602

Also available in 304 stainless steel - KIT NO. 14 58 93 08

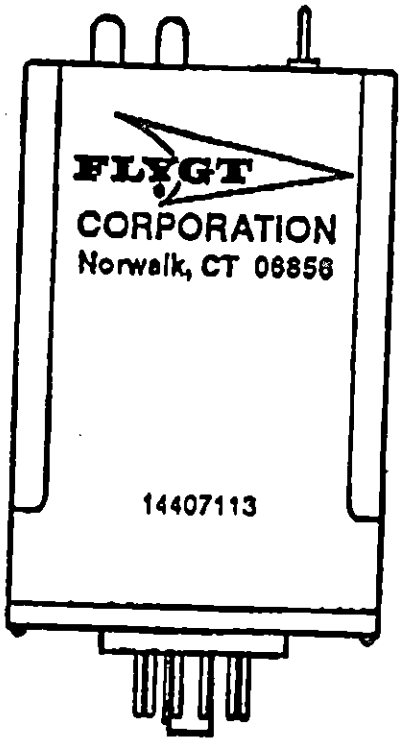
Note: use with 3" nominal guide bars

MINICAS II

(MINI CONTROL AND STATUS)

14-40 71 13

TECHNICAL MANUAL



ITT FLYGT CORPORATION

P. O. Box 5857, Norwalk, Connecticut 06856

FLYGT

PRODUCT DESCRIPTION

ITT Flygt MiniCAS II is a supervision relay for temperature and leakage sensors. It is designed for the ITT Flygt pump range 3085 - 3300 and for the ITT Flygt mixer program.

There are three types of sensors that can be connected to the MiniCAS II: Stator thermal switches, CLS water-in-oil sensor and the FLS sensor for leakage detection in the stator housing. The sensors can be used in every combination that is desired.

On the front there are two indication lamps, one for supply and temperature, one for leakage and a two position "Manual Reset" and "Auto Reset" toggle switch. Only two wires are needed for the communication between the pump and the MiniCAS II. The MiniCAS II is designed to be plugged into a standard 11 - pin socket.

Technical data

Operation principle:	Current sensing
Environment:	0 - 50°C (123°F), maximum 90% relative humidity
Supply voltage:	24 VAC (50 - 60 Hz) + 10 to - 15%
Relay contact rating:	16 A @ 277 VAC
Voltage to sensor:	12 VDC ± 10%
Values of operation:	2.5 mA <I <5 mA = OK condition I <2.5 mA = High Temperature (or interrupt) I >5.2 mA = Leakage (or short circuit) (I = current measured by MiniCAS II)

Communication

Leakage: Form "C" Relay (normally closed contact for interlocking)
Automatic reset (normally open contact for alarm)

Red LED for indication - follows the relay

Red indication lamp on = leakage indicated
Red indication lamp off = no leakage indicated

Temperature: Form "C" Relay (normally closed contact for interlocking, normally open contact for alarm) Manual reset (by interrupting the supply 1 sec. or switching the toggle switch).

Autoreset Option: The control and status unit (ITT Flygt Part Number 14-40 71 13) MiniCAS II provides both a manual and auto reset option for the over temperature function. The auto or manual reset can be selected by a toggle switch located on top of the unit.

Green LED for indication - follows the relay

Green indication lamp on = supply voltage on and no over temperature

Green indication lamp off = over-temperature or no supply voltage

Physical size

Width: 1.75"

Height: 2.36"

Depth: 3.575" with toggle switch

Part numbers

MiniCAS II	14-40 71 13
Socket, 11-pin	14-40 70 79

MODE OF OPERATION

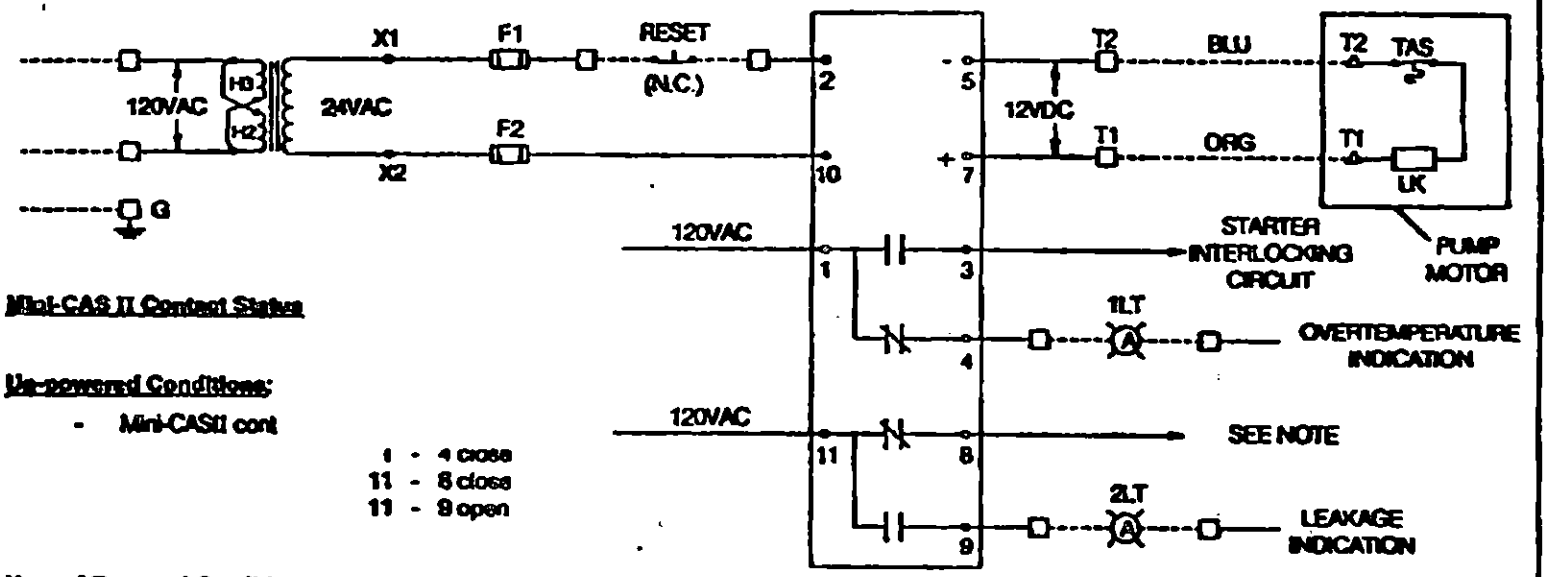
In the manual mode of operation, if an over temperature condition occurs, the unit will turn the pump off and lock it out. The only way power can be restored to the pump is by a manual restart, and only after the temperature has cooled to a point of safe operation.

In the auto reset mode, if an over temperature condition occurs, the pump will be shutdown. The pump will be automatically restarted once the temperature has cooled to a point of safe operation.

NOTE: When selecting the "Automatic Reset" mode, the control panel should include a latching type circuit for over temperature alarm display. This circuit will retain the information that an over temperature situation has occured and the operator should check the possible cause for motor over temperature.

The leakage function operates in the same manner in both auto and manual modes. Specifically, once leakage is detected, there is a 5 second delay after which the pump will be shutdown or an alarm activated. Once the leakage clears, power will be restored to the pump whether in manual or auto reset mode.

MINI CAS II WIRING DIAGRAM



Mini-CAS II Contact States

Un-powered Conditions:

- Mini-CASII cont

1 - 4 close
11 - 8 close
11 - 9 open

Normal Powered Conditions:

- No leakage, no over-temperature, power on;
- Green light is on, red light is off.
- Mini-CAS II contact status: 1 - 3 and 11 - 8 close
  1 - 4 and 11 - 9 open

Over-temperature Condition:

- Green and red lights are off;
- Mini-CAS II contact status: 1 - 3 and 11 - 9 open
  1 - 4 and 11 - 8 close

Leakage Condition:

- Green and red lights on Mini-CAS should be on;
- Mini-CAS II contacts status: 1 - 3 and 11 - 9 close
  1 - 4 and 11 - 8 open

Mini-CAS II Rating

Supply Voltage - 24VAC

Contact Ratings - 16 AMPS @ 277VAC, PF = .6

Mini-CAS II Part Number- 14-40 71 13

11 Pin Socket Part Number 14-40 70 97

NOTE: IF PUMP SHUTDOWN IS DESIRED FOR A LEAKAGE SITUATION, CONNECT MINI-CAS II CONTACTS 1 - 3 AND 11 - 8 IN SERIES.

LEGEND: TAS = STATOR THERMAL SWITCH
LK = LEAKAGE SENSOR(S)

TEST PROCEDURE

1. FOR MINI-CAS II WITH FLS

Test Condition:

- Power supply 24VAC
- 2 (two) multimeters

Test Schematic (See Attached):

Note: For a shop test, the FLS can be simulated by a toggle switch and two resistors (375 ohms and 1500 ohms connected per attached schematic).

The thermal switch can be simulated by a toggle switch.

Unpowered Conditions:

Mini-CAS II contact status: 1 - 3 open
1 - 4 close
11 - 8 close
11 - 9 open

Normal Powered Conditions:

No leakage, no over temperature, 24 VAC supply.

- Leakage switch is open; FLS resistance is 1,500 ohms;
- The green light on Mini-CAS II is on, the red light is off;
- A1 should read 110 mA (AC). A2 should read between 2.5 and 5mA DC - typical 4.0 mA DC.
- Mini-CAS II contact status: 1 - 3 and 11 - 8 close
  1 - 4 and 11 - 9 open

Leakage Condition - 24 VAC Supply

- Thermal switch is closed;
- Leakage switch is closed; combined resistance of FLS is 300 ohms.
- The green and red lights on Mini-CAS II should be on.
- Ammeter readings: A1 150 mA (AC)
  A2 - over 5.2 mA (DC) - Typical 6.5 mA (DC)
- Mini-CAS II contacts status: 1 - 3 and 11 - 9 close
  1 - 4 and 11 - 8 open

Over-temperature Condition - 24VAC Supply

- Thermal switch is open;
- The green and red lights are off;
- No reading on A2 (open circuit);
- A1 should read 60 mA
- Mini-CAS II contacts status: 1 - 3 and 11 - 9 open
  1 - 4 and 11 - 8 open

2. MINI-CAS II WITH CLS-30

Mini-CAS II should work the same way with a CLS-30 leakage sensor.

Typical readings for A2 with CLS-30:

- Normal conditions 2.9 mA DC
- Leakage conditions 5.75 mA DC

3. MINI-CAS II WITH FLS IN PARALLEL WITH CLS-30

Typical readings for A2:

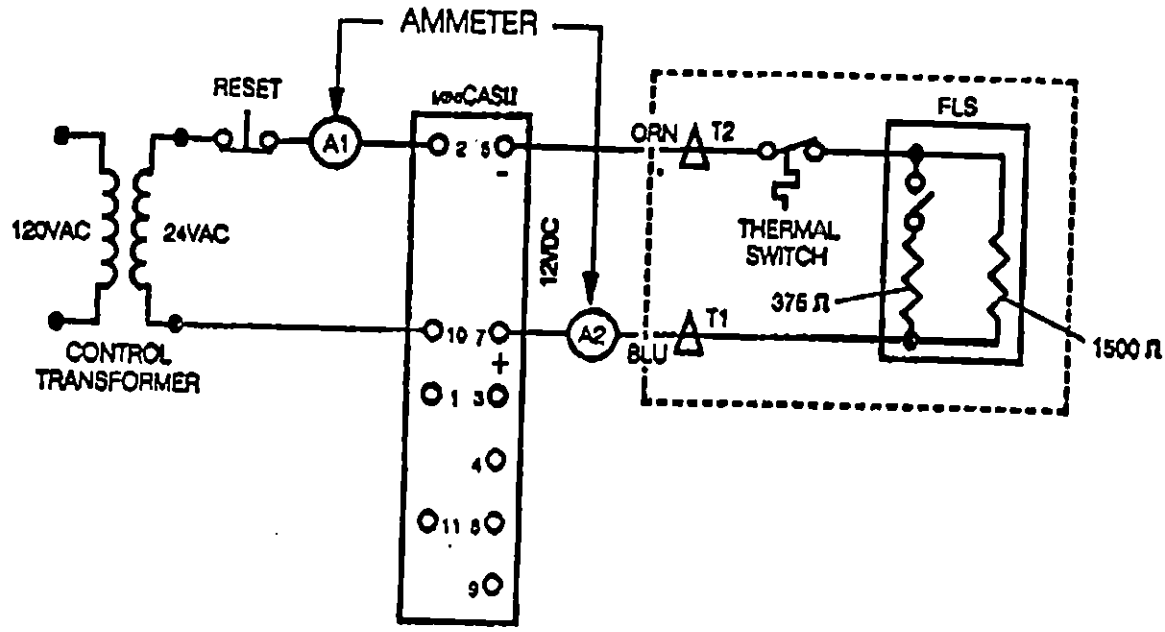
- Normal conditions: 4.80 mA
- Leakage conditions: 6.10 - 6.45 mA

REMARKS:

1. Voltages over maximum allowed by manufacturer (26 AVC) will affect the unit's lifetime but does not lead to an immediate failure. The situation is worse if a permanent leak persists and the fault is not cleared.
2. A ground fault in DC circuits, of (+) leads, will cause unit failure. The worst possible situation is a simultaneous occurrence of a high voltage supply and a ground fault in (+) circuit.
3. Whenever a Mini-CAS II fails, check the supply voltage and check for a ground fault. DO NOT REPLACE A DEFECTIVE MINI-CAS II UNTIL A POSSIBLE GROUND FAULT WAS CHECKED AND CLEARED.

ATTACHMENTS: Mini-CAS II Wiring Diagram
Mini-CAS II Test Wiring Diagram

MINICASII TEST WIRING DIAGRAM AND MINICASII TROUBLESHOOTING CHART



TROUBLESHOOTING CHART FOR FLYGT MINI - CAS II SUPERVISION RELAY

FLYGT Mini-CASII STATUS	NO POWER APPLIED	NORMAL OPERATION	STATOR OVER-TEMPERATURE	MOISTURE LEAKAGE CONDITION
Contacts #1, #3	Open	Closed	Open	Closed
Contacts #1, #4	Closed	Open	Closed	Open
Contacts #11, #8	Closed	Closed	Closed	Open
Contacts #11, #9	Open	Open	Open	Closed
A1 Ammeter Reading - A.C.	0	110 mA A.C.	60 mA A.C.	150 mA A.C.
A2 Ammeter Reading - D.C.	0	4 mA D.C.	0 mA	>8 mA D.C.
Green Indicator Light - (over-temp.)	Off	On	Off	On
Red Indicator Light - (Leakage)	Off	Off	Off	On

11200 - 2.1B

The Fleet Companies

G. A. Fleet Associates, Inc.

P. O. Box 616
Harrison, NY 10528
G. A. Fleet Assoc.
(914) 835 - 4000
Fax (914) 835 - 1331
Fleet Pump & Service
(914) 835 - 3801
Fax (914) 835 - 2946

Important:
This drawing is not to scale-use dimensions shown. Do not fix foundation bolts rigidly until equipment is in place, since castings vary slightly in dimensions.

TAG = SPARE PUMP

Sold To:
Barbella Environment Tech, Inc.
P. O. Box 273
Salem Industrial Park, Bldg #8
Whitehouse, NJ 08888
Contact: Thomas Jackson

Ship To:
BET c/o Pelham Bay Landfill
Pelham Bridge Road
Hunt's Point Area
Bronx, NY

Engineer: _____ **Date:** 3/15/94 **Customer Order No.** 1547

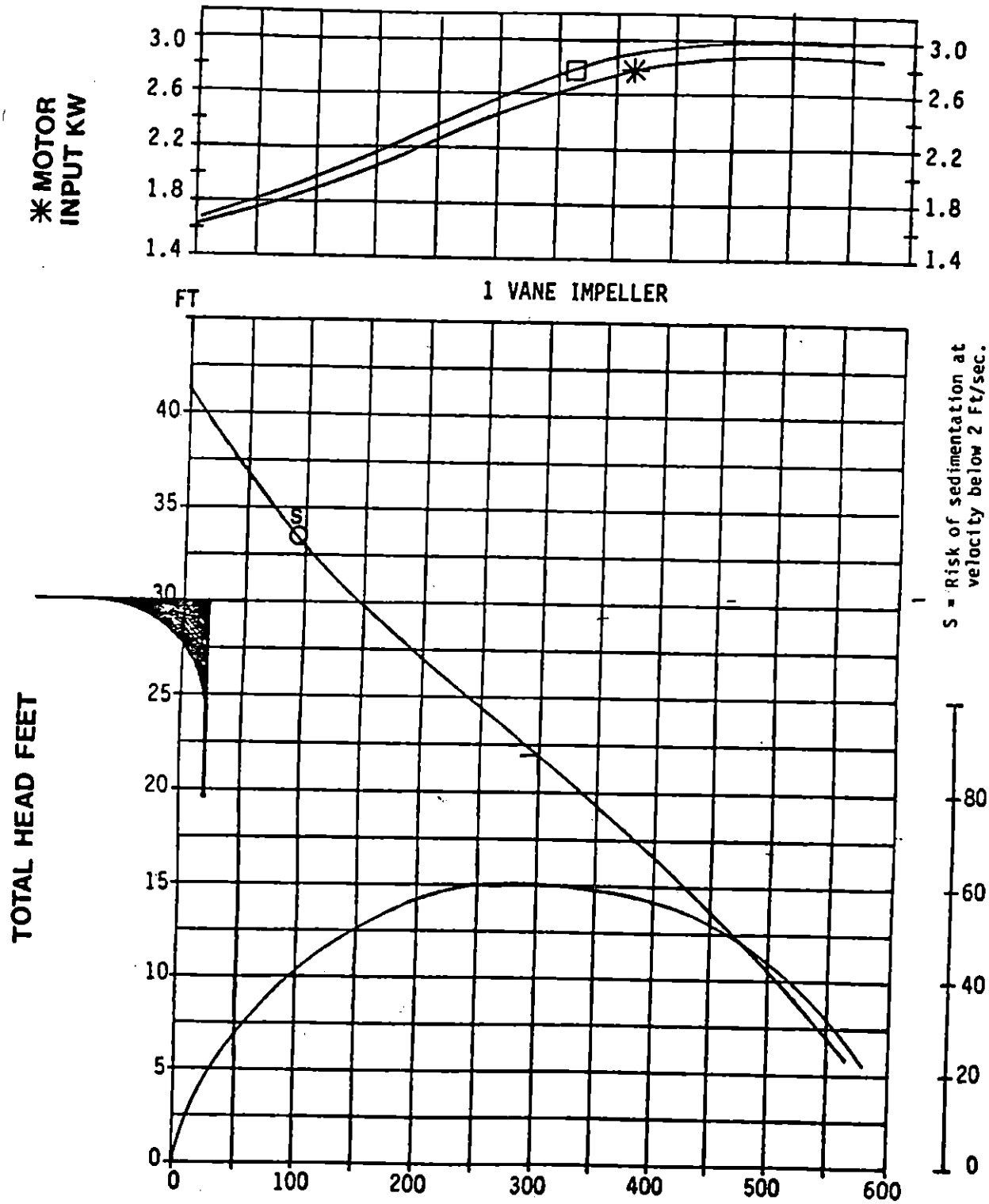
Equipment Serial No: _____ **Distr. Order No.** E18811

Marks: Pelham Landfill, Bronx, NY - Spares **Sheet:** 3 **Of:** 2 **By:** _____

QTY	DESCRIPTION
3	**Unit or Frame:** Flygt Model 3" CP-3085X with FLS Leak Detection **Impeller:** 434 **Installation:** **GPM** 20 USGPM **TDH** 30' TDH
3	**Motor:** Flygt Submersible **HP** 3 **RPM** 1800 **Volts** 460 **Phase** 3 **Cycle** 60 **Description:** TENV - Air Filled - Class F Insulation - FM Listed - Nema B Type - 1.15 S. F. **Control Voltage:** 24 Volt
3	**Control & Accessories** 40 ft. SUBCAP, 14 AWG/7 19 MM Submersible Power Cables

DWG. No. D-11

3.0 HP - 4 Pole Motor 3ϕ: 200, 230/460, 575V	CP/CS 3085 Wastewater Impeller 434	SECTION 3085	PAGE 8/434
		SUPERSEDES	ISSUED 4/86



NOTE: THE C3085 IS AVAILABLE IN CP AND CS TYPES ONLY. FOR CT TYPE USE MODEL 3085/82.

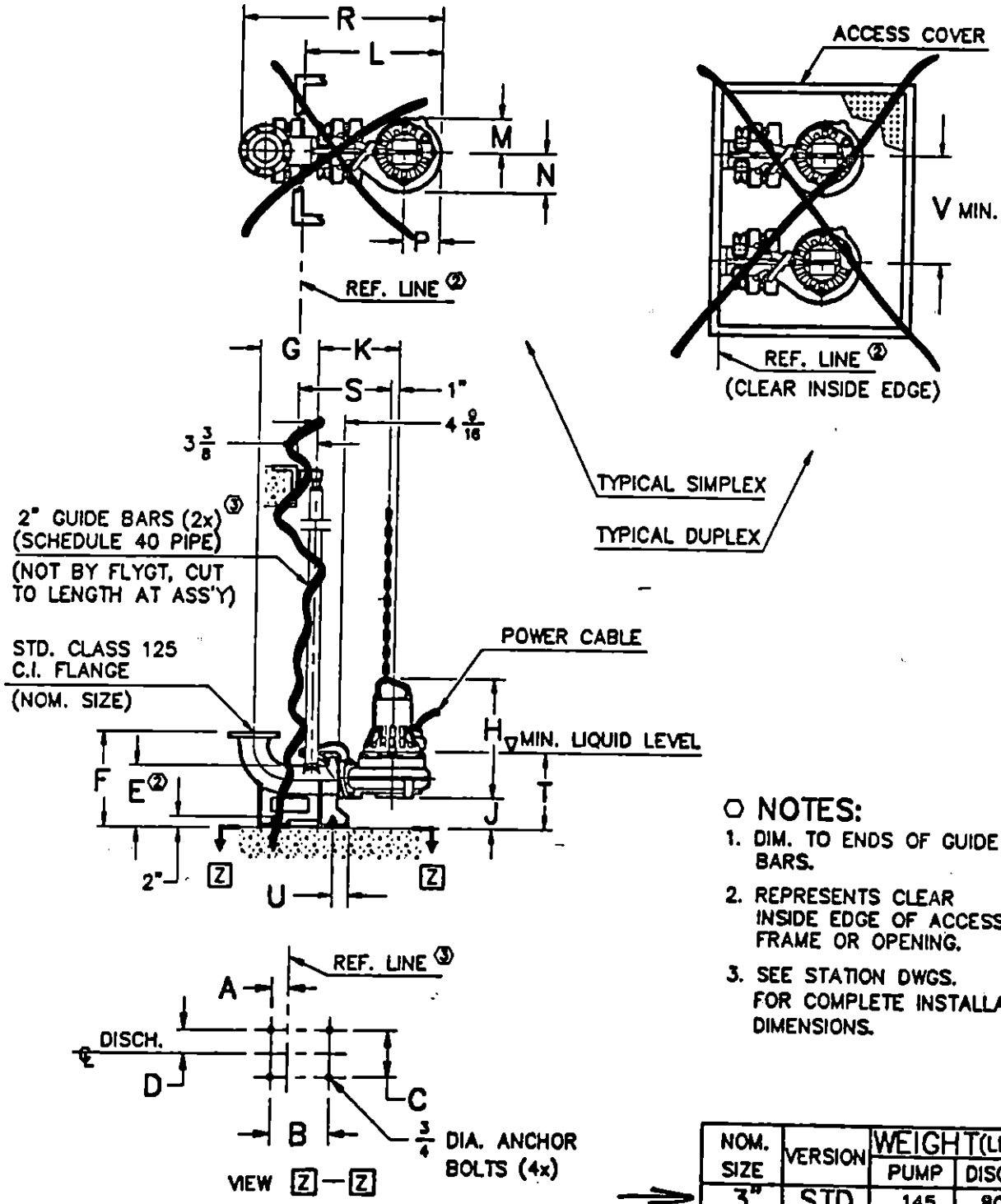
PERFORMANCE CURVES ARE BASED ON TESTS WITH CLEAR WATER AT AMBIENT TEMPERATURE.

FLYGT
FLYGT CORPORATION
A SUBSIDIARY OF ITT
129 GLOVER AVE., NORWALK, CT. 06856

CP-3085

SECTION	PAGE
4	1
SUPERSEDES	ISSUED
6/90	12/91

Outline Dimensions



NOTES:

1. DIM. TO ENDS OF GUIDE BARS.
2. REPRESENTS CLEAR INSIDE EDGE OF ACCESS FRAME OR OPENING.
3. SEE STATION DWGS. FOR COMPLETE INSTALLATION DIMENSIONS.

NOM. SIZE	VERSION	WEIGHT (LBS) PUMP	WEIGHT (LBS) DISCH
3"	STD	145	80
~~4"~~	~~STD~~	~~145~~	~~80~~

ALL DIMENSIONS IN INCHES

NOM. SIZE	VERSION	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V
3"	STD	2 3/16	9 7/8	7 3/4	3 7/8	10 1/4	15 3/4	9 3/8	20	4 5/8	13 3/4	23 1/4	5 3/4	6 3/4	6 3/8	33 1/4	15 3/4	12 1/4	2 3/4	17 3/4
~~4"~~	~~STD~~	~~2 1/4~~	~~9 7/8~~	~~7 3/4~~	~~3 7/8~~	~~10 1/4~~	~~15 3/4~~	~~9 3/8~~	~~20~~	~~6~~	~~13 3/4~~	~~23 1/4~~	~~5 3/4~~	~~6 3/4~~	~~6 3/8~~	~~33 1/4~~	~~15 3/4~~	~~12 1/4~~	~~2 3/4~~	~~17 3/4~~

FLYGT

FLYGT CP3085 ~~AND 3102~~
SUBMERSIBLE PUMPS
MATERIALS OF CONSTRUCTION

CASING	-	Cast Iron, Class 30
IMPELLER	-	Cast Iron, Class 30*
SHAFT	-	Stainless Steel, AISI 420
MECHANICAL SEAL	-	Double Type
UPPER	-	Carbon Rotating/Carbon Ceramic Stationary
LOWER	-	Tungsten Carbide Rotating/Tungsten Carbide Stationary
FASTENERS	-	Stainless Steel, AISI 304
"O" RINGS	-	Nitrile Rubber

*INDICATES: Bronze not available

(b:flymtcon.mw)

C/D-3085

Electrical Data

SECTION	MODEL
6	3085
SUPERSEDES	ISSUED
6/90	12/91

MOTOR DATA

RATED OUTPUT POWER HP (KW)	Ø	VOLTS NOM.	FULL LOAD AMPS	LOCKED ROTOR AMPS	LOCKED ROTOR KVA	LOCKED ROTOR CODE LETTER KVA/HP	RATED INPUT POWER KW	POLES/RPM
1.6 (1.2)	1	230	7.1	23.0	5.3	B	1.6	4/1700
2.0 (1.6)	3	200 230 460 575	7.4 6.4 3.2 2.6	33.8 29.4 14.7 11.8	11.7	G	2.2	4/1700
2.4 (1.8)	1	230	10.0	48.0	10.6	D	2.3	4/1700
*2.9 (2.2)	1	230	12.0	47.0	11.0	C	2.8	2/3450
3.0 (2.4)	3	~~200~~ ~~230~~ 460 ~~575~~	10.0 9.0 4.5 3.6	55.2 48.0 24.0 19.2	19.1	H	3.0	4/1700
*4.0 (3.0)	3	200 230 460 575	11.0 10.0 5.0 4.0	69.9 60.8 30.4 24.2	24.2	G	3.6	2/3450

Pump Motor HP	EFFICIENCY			POWER FACTOR		
	100% LOAD	75% LOAD	50% LOAD	100% LOAD	75% LOAD	50% LOAD
1.6	75.0	76.6	74.1	0.98	0.99	0.97
2.0	73.5	74.5	72.5	0.82	0.75	0.64
2.4	80.0	81.7	79.0	0.98	0.99	0.97
~~*2.0~~	~~80.5~~	~~82.2~~	~~79.5~~	~~0.99~~	~~0.99~~	~~0.98~~
3.0	77.5	78.5	76.5	0.82	0.75	0.64
~~*4.0~~	~~81.5~~	~~82.5~~	~~81.5~~	~~0.92~~	~~0.89~~	~~0.83~~

CABLE DATA

HP	VOLTS	MAX. LENGTH FT.	CABLE SIZE	NOMINAL DIA.	CONDUCTORS (IN ONE CABLE)
1.6 (1Ø)	230	320	#14/7	19.0mm (0.75")	(3) #14AWG (PWR) (2) #14AWG (CTRL) (1) #14AWG (GND) (1) #14AWG (GC)
2.0 (3Ø)	200 230 460 575	265 350 1400 2180			
2.4 (1Ø)	230	225			
*2.9 (1Ø)	230	190			
3.0 (3Ø)	~~200~~ ~~230~~ 460 ~~575~~	~~195~~ ~~260~~ 1000 ~~1500~~			
*4.0 (3Ø)	200 230 460 575	~~180~~ 225 900 1400			

* FOR VORTEX IMPELLER PUMPS

MASTER SPEC LIST FOR CP-PUMP CABLES

SUBMERSIBLE PUMPS - FLYGT CP-3085

CABLE SPEC'S:

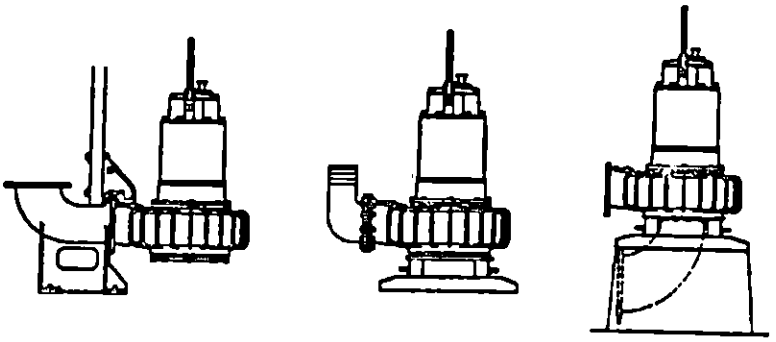
JACKET:	Dupont Hypalon (Chlorosulfinated)
INSULATION:	Dupont Nordel (Ethylene)
CABLE DIAMETER:	0.75" dia.
CONDUCTOR SIZES:	3-# 14 (Power Leads), 2-# 14 (Thermal Switches), 1-# 14 (Ground Lead), 1-# 14 Ground Check)
COLOR CODES FOR LEADS:	**Red, White & Black** - (POWER LEADS) **Green** - (GROUND LEAD) **Yellow/Green** - (GROUND LEAD) **Blue & Orange** - (THERMAL SWITCHES)

D:b
(speccppc)

EXPLOSIONPROOF PUMPS

These units are special versions, model number suffix (X), of ITT Flygt's standard wastewater pumps constructed to meet explosionproof requirements and are Factory Mutual Systems approved for use in hazardous locations defined as Class 1, Division 1, Groups C and D (gasses and vapors) Class 2, Div.1, Groups E & G (dusts), Class 3, Div. 1, (fibers and flyings).
To achieve this approval, pumps are assembled from selected castings that are redesigned with longer flame paths and closer tolerences. Cable entries are specially designed as well.

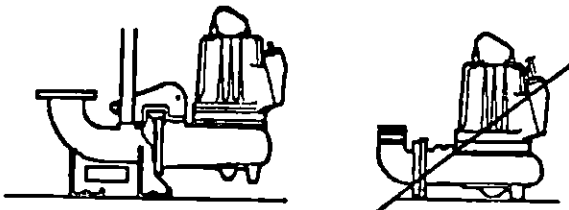
Model	Horsepower
3085 (X)	1.6 - 3
3102 (X)	5.0 - 5
3127 (X)	6.4 - 10
3152 (X)	14.0 - 25
3170 (X)	25.0 - 30
3201 (X)	29.0 - 47
3230 (X)	120.0 - 214
3300 (X)	32.0 - 120
3305 (X)	100.0 - 148
3311 (X)	184.0 - 328
3655 (X)	74.0 - 148
3500 (X)	100.0 - 280
3530 (X)	100.0 - 800
3531 (X)	100.0 - 800
3601 (X)	100.0 - 800
3602 (X)	100.0 - 800



FIBROUS WASTE CUTTER PUMPS

These units, FP and FS prefix to model number, are constructed of cast iron and have non-clogging type impellers with cutter attachment for pumping wastewater containing stringy or fibrous materials or agricultural waste.

Model	Horsepower
F-3085	2.3 - 3
F-3102	4.0 - 5
F-3127	7.6 - 7.6
F-3152	16.0 - 20

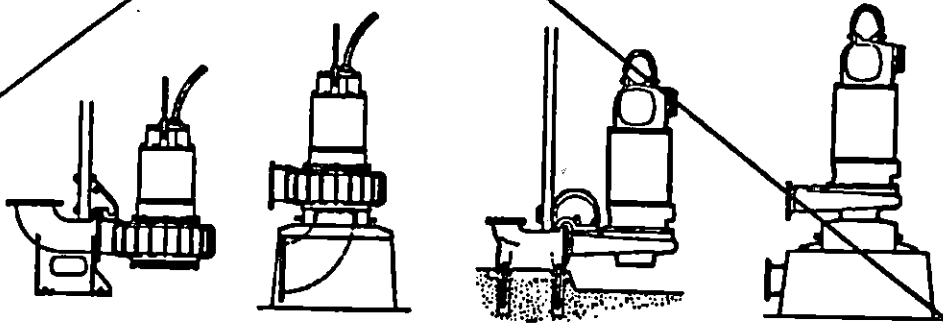


RAW WATER PUMPS

These submersible pumps are for use in clean or raw water applications with capacities exceeding 2,500 GPM and total dynamic heads up to 320 feet. Motor output ranges from 32 to 214 HP. Hydraulic efficiencies of between 71% and 77% are obtained at the best efficiency points.

Model	Horsepower
3230	120 - 214
3300	32 - 120

Impellers are of multi-vane design.

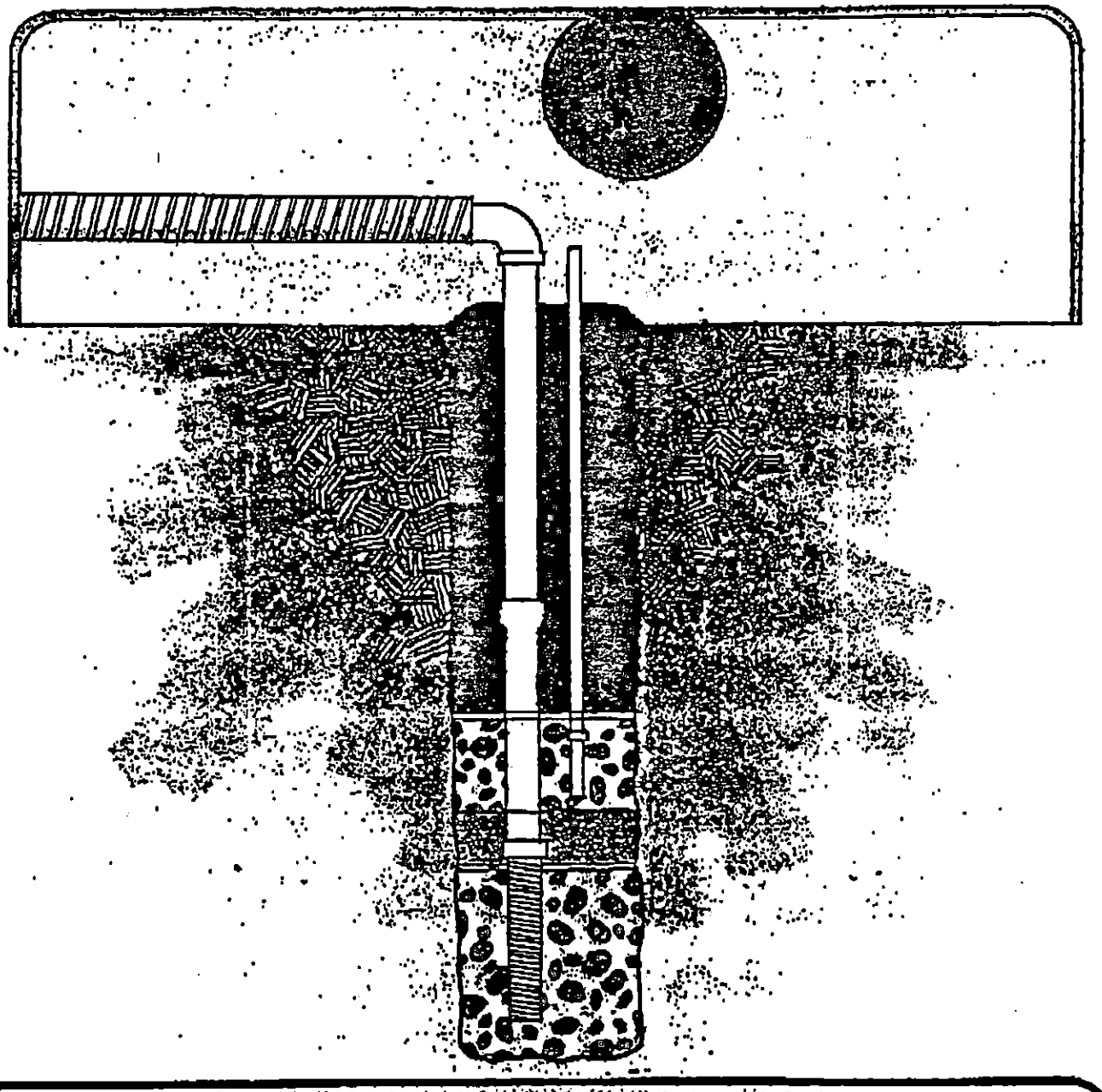


RP 3300 RT 3300 RP 3230 RT 3230

Flexible Hose - Gas Extraction Well

Kanaflex®

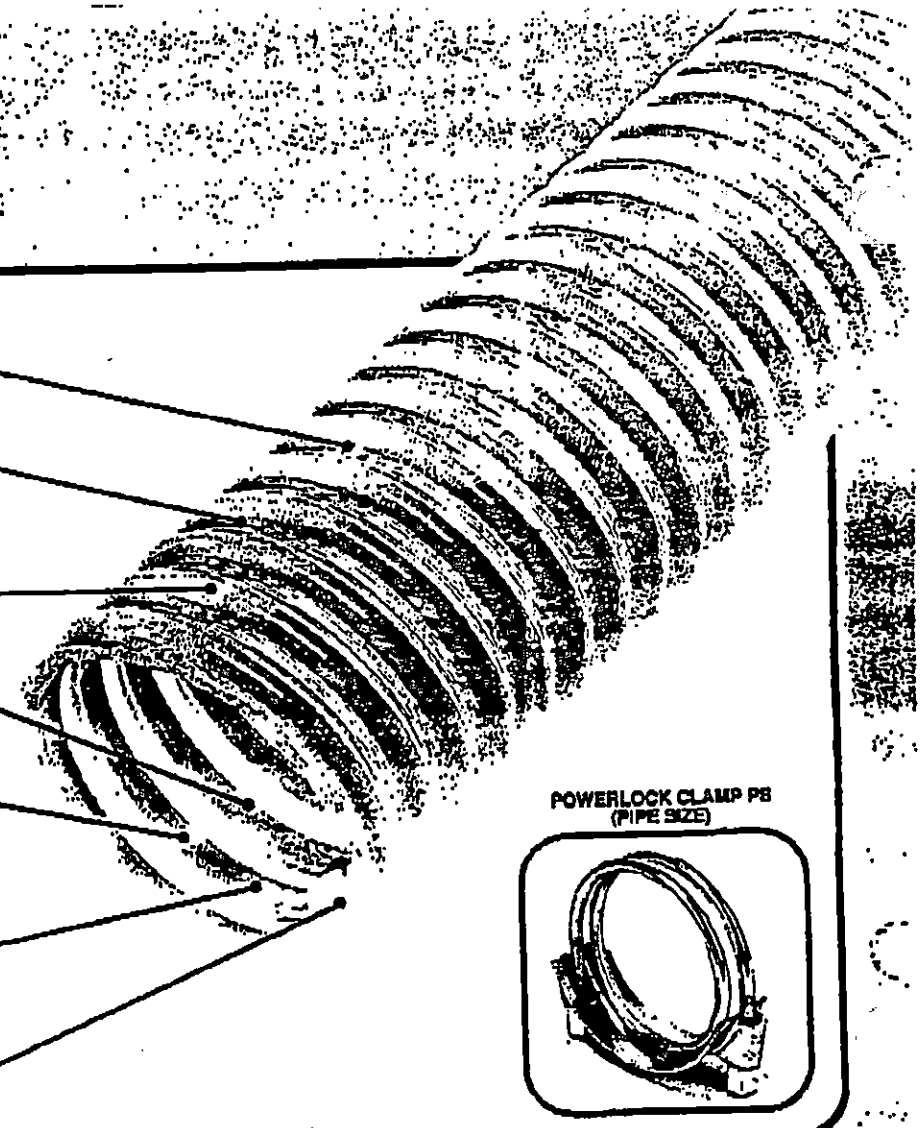
101-PS



Kanaflex 101-PS PVC suction hose is specially designed for *use in methane recovery at landfill sites.* It performs well as a flexible pipeline from wellhead to main header and as a connection between rigid pipes of the same size. It is also ideal for quick emergency repairs of broken rigid lines.

Note: Not available in HDPE

Kanaflex®
101-PS



Corrugated exterior for superior flexibility.

Weatherproof . . . highly resistant to ozone, salt water and ultraviolet light.

Pliable . . . fits over pipe ends for flexible installations where ground or structure is subject to possible movement.

Smooth bore for unrestricted flow.

Functional . . . can be "welded" to rigid PVC pipe using conventional PVC cements.

Secure . . . provides a superior hold to rigid pipe when used with Kanaflex pipe-size "Power Lock" clamps. (see illustration)

Available in lengths of 100 ft. for rapid installation and lower labor costs.

POWERLOCK CLAMP PS (PIPE SIZE)

SPECIFICATIONS

SIZE	OUTSIDE DIAMETER Inches	PITCH Inches	MIN. BENDING RADIUS 72°F, Inches	WORKING PRESSURE 72°F, P.S.I.	BURSTING PRESSURE 72°F, P.S.I.	VACUUM RATING 72°F, In. / Hg.	WEIGHT Lbs. / Ft.
2.375"	2.76	0.41	2.6	35	115	29.8	0.68
3.5"	4.00	0.63	3.5	30	100	29.8	1.20
4.5"	5.79	0.67	6.5	30	100	28.0	1.70

Kanaflex® CORPORATION
800 Woodlands Parkway
Vernon Hills, IL 60061

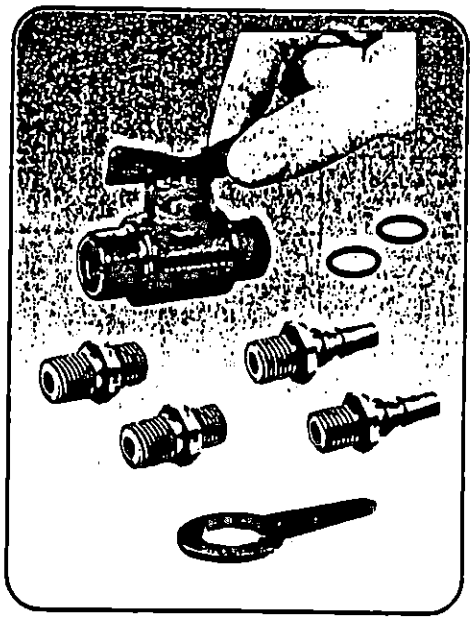
DISTRIBUTED BY:

Universal StopCocks®

Test Point - Gas Wellheads

The Hayward Universal StopCock affords simplicity and flexibility in small quarter turn valves. For on/off, restricted flow, or sampling applications, the Hayward StopCock is easily adaptable to any piping connection. 1/4" NPT female pipe thread, 1/4" NPT male pipe thread, and hose barb end connectors, for 1/4" through 7/16" I.D. tubing are furnished with the valve. These allow the valve to be fitted with up to six different end connection combinations. Simply attach the end connections you need, they are all supplied with each valve. The end connector's piston O-ring seal enables their connection to the valve without the use of adhesives, pipe sealant, or Teflon tape. A hex wrench is included to securely attach the end connectors to the valve. For added convenience, there are graduation marks on the valve body at 0°, 45°, and 90° to assist in making flow adjustments.

Universal StopCocks are available in PVC, with EPDM seats and seals, and are manufactured from NSF approved materials.

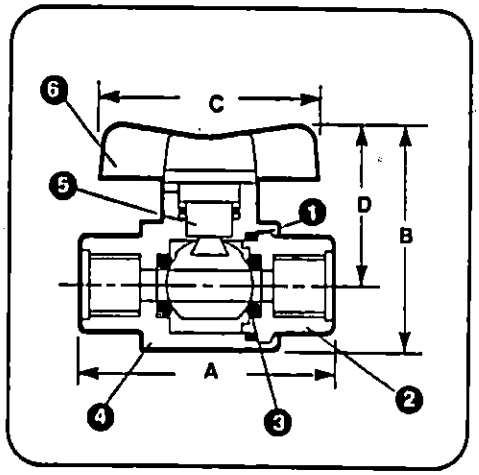


Features

- All PVC construction - will not corrode
- EPDM seats and seals
- Six end connections with single valve
- End Connection combinations: FPT x FPT, FPT x MPT, FPT x Hose, MPT x MPT, MPT x Hose, Hose x Hose
- Includes hex wrench to securely attach end connectors to the valve
- Ideal for sampling
- Ideal for laboratories, monitoring systems, original process equipment
- Flow rates down to drops per minute

Engineering Specifications

All Universal StopCocks shall be PVC (Polyvinyl Chloride) with EPDM seats and seals. StopCocks to be furnished with all necessary end connectors to make the following connections: FPT x FPT, FPT x MPT, FPT x Hose, MPT x MPT, MPT x Hose, and Hose x Hose. End connectors shall attach to valve body with a piston O-ring seal. Valve body to have graduation marks at 0°, 45°, and 90° to assist in flow adjustment. As manufactured by Hayward Industrial Products, Inc.



Universal StopCock Parts List

1 EPDM O-Ring
2 End Connector
3 EPDM Seat
4 Body
5 Stem
6 Handle

Dimensions

	A	B	C	D	Weight in lbs.
FPT x FPT	2.13	1.88	1.75	1.31	.2
FPT x MPT	2.82	1.88	1.75	1.31	.2
FPT x Hose	3.13	1.88	1.75	1.31	.2
MPT x MPT	3.50	1.88	1.75	1.31	.2
MPT x Hose	3.82	1.88	1.75	1.31	.2
Hose x Hose	4.13	1.88	1.75	1.31	.2

Dimensions are in inches. For reference only.

Selection Chart

Size	Material	End Connection	Seals	Pressure Rating
1/4"	PVC	FPT x FPT FPT x MPT FPT x Hose MPT x MPT MPT x Hose Hose x Hose	EPDM	150 psi @ 70° F non shock

Propane and nitrogen Cylinders

WORTHINGTON PROPANE CYLINDERS

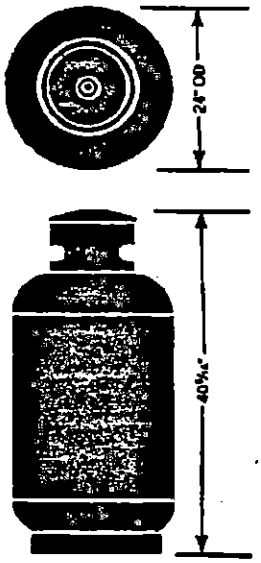
WORTHINGTON PROPANE CYLINDERS: EXCEPTIONAL QUALITY, SERVICE AND SELECTION FOR ALL APPLICATIONS.

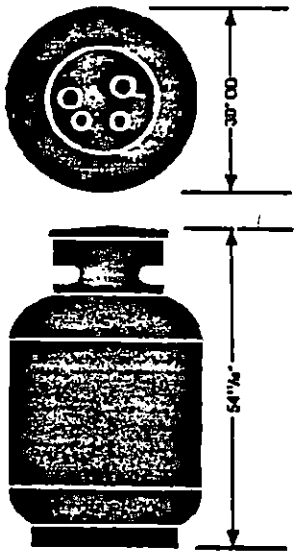
Outstanding service and unmatched quality make Worthington cylinders the most saleable on the market...in 15 size configurations for virtually all your propane applications.

And all Worthington LP-Gas cylinders *sold* in the USA are *made* in the USA. Worthington operates five plants and five warehouses in the United States, plus two Canadian plants for products sold in Canada. This helps assure quick, on-time delivery and competitive pricing in all market areas.

SPECIFICATIONS.

- 15 sizes (in pounds): 4¼, 6, 10, 11, 20, 25, 30, 40, 60, 100, 200 and 420 lb. Also aluminum forklift cylinders in 20, 33½ and 43½ lb.
- Up to 30-inch diameter.
- Rust/corrosion-resistant finish: polyurethane paint on sizes 4¼ lb. through 100 lb. Larger sizes are powder coated.
- Cylinders are manufactured in accordance with DOT 4BA or DOT 4BW specifications.
- Optional liquid level gauges.





* 100 LB.

LP-Gas Capacity (approx. gal.) (LP)	23.0
Water Capacity (lbs.)	240
Tare Weight (lbs.)	77
Cyl. Volume (cu. in.)	6596
Collar Height (in.)	7.5
Footring Diameter o/s (in.)	14

DOT-4BW-240

200 LB.

LP-Gas Capacity (approx. gal.) (LP)	45.6
Water Capacity (lbs.)	476.2
Tare Weight (lbs.)	173
Cyl. Volume (cu. in.)	13211
Collar Height (in.)	6
Footring Diameter o/s (in.)	19

DOT-4BW-240

420 LB.

LP-Gas Capacity (approx. gal.) (LP)	95.8
Water Capacity (lbs.)	1000
Tare Weight (lbs.)	315
Cyl. Volume (cu. in.)	27686
Collar Height (in.)	6
Footring Diameter o/s (in.)	23

DOT-4BW-240

WORTHINGTON CYLINDER CORPORATION
SUBSIDIARY OF WORTHINGTON INDUSTRIES INC

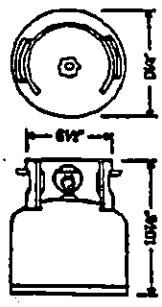
P.O. Box 391
1085 Dearborn Drive
Columbus, Ohio 43085
614/438-3013
FAX 614/438-3083

Top Valves are 10% bleeder valves

TANKS by WORTHINGTON

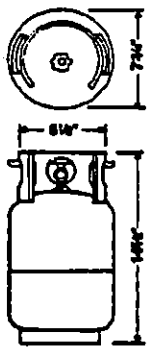
CAMPING, RECREATIONAL VEHICLES, GAS GRILLS, COOKING, HEATING AND COMMERCIAL-INDUSTRIAL USES...WORTHINGTON MAKES A SIZE TO FIT THE NEED!

QUALITY STEEL CONSTRUCTION AND A RUST-RESISTANT FINISH, COUPLED WITH ON-TIME DELIVERIES, MAKES WORTHINGTON CYLINDER THE RIGHT CHOICE— THE ONLY CHOICE!



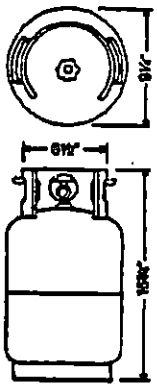
4¼ LB.

LP-Gas Capacity (approx. gallons) (LP) ...1
Water Capacity (lbs.)..10.2
Tare Weight (lbs.)....10.5
Cyl. Volume (cu. in.)..282
Collar Height (in.).....4
Footring Dia. o/s (in.)..8¼
DOT-4BA-240



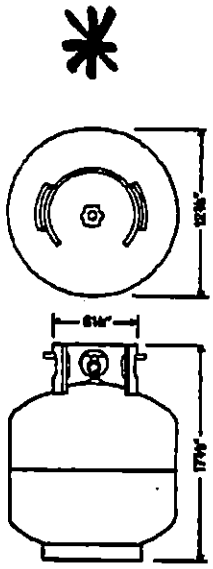
6 LB.

LP-Gas Capacity (approx. gallons) (LP)..1.5
Water Capacity (lbs.)..15.5
Tare Weight (lbs.).....9.2
Cyl. Volume (cu. in.)..430
Collar Height (in.).....4
Footring Dia. o/s (in.)..8¼
DOT-4BA-260



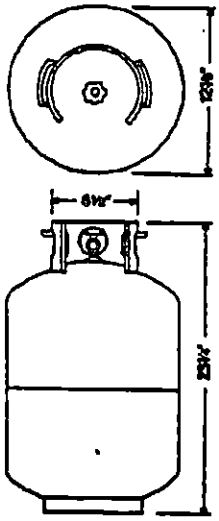
11 LB.

LP-Gas Capacity (approx. gallons) (LP) .2.5
Water Capacity (lbs.) .28.2
Tare Weight (lbs.) 13.2
Cyl. Volume (cu. in.)..728
Collar Height (in.).....4
Footring Dia. o/s (in.) 7¾
DOT-4BA-240



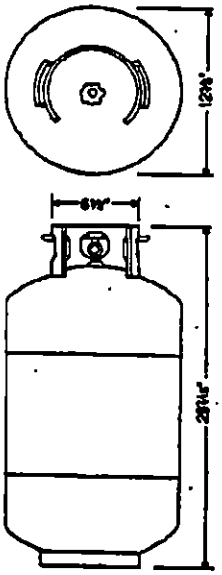
20 LB.

LP-Gas Capacity (approx. gallons) (LP)...5
Water Capacity (lbs.) .47.7
Tare Weight (lbs.)....18.0
Cyl. Volume (cu. in.) .1323
Collar Height (in.).....4"
Footring Dia. o/s (in.) 7¾
DOT-4BA-240



30 LB.

LP-Gas Capacity (approx. gallons) (LP)...7
Water Capacity (lbs.)..71.5
Tare Weight (lbs.)....25.5
Cyl. Volume (cu. in.) .1983
Collar Height (in.).....4"
Footring Dia. o/s (in.) 7¾
DOT-4BA-240



40 LB.

LP-Gas Capacity (approx. gallons) (LP) .9.4
Water Capacity (lbs.) .95.3
Tare Weight (lbs.)....29.2
Cyl. Volume (cu. in.) .2644
Collar Height (in.).....4"
Footring Dia. o/s (in.) 7¾
DOT-4BW-240

• COLUMBUS, OH.
• MIDLAND, GA.
• CLAREMORE, OK.

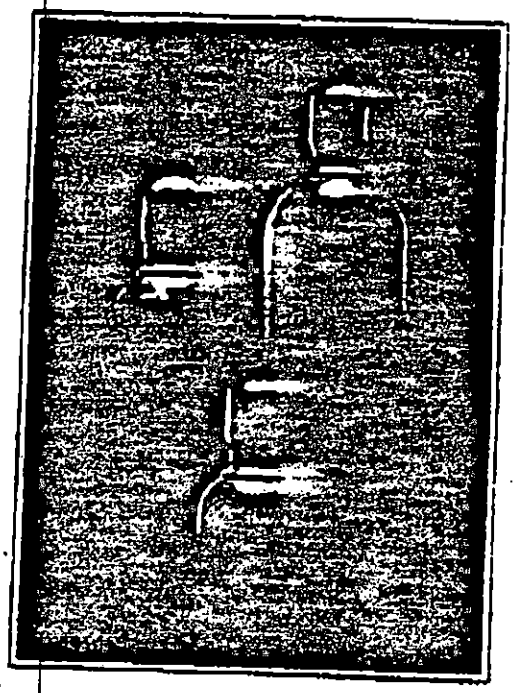
WORTHINGTON CYLINDERS
SUBSIDIARY OF WORTHINGTON INDUSTRIES, INC.

P.O. BOX 391
1085 DEARBORN DR.
COLUMBUS, OHIO 43085-4799
(614) 438-3013
TX 6874632 WORTHCYL
FAX (614) 438-3083

Top valves are 10% bleeder valves

Worthington Cylinder Corporation

High Pressure Gas Cylinder Specifications



- For Oxygen, Argon, Helium, Air, Nitrogen, mixtures and other compressed gas.
- All cylinders are complete with zinc plated neckring and cap.
- Cylinders are manufactured to allow 10% overfill in compliance with DOT regulations and are marked (+).

220 CF Nitrogen *

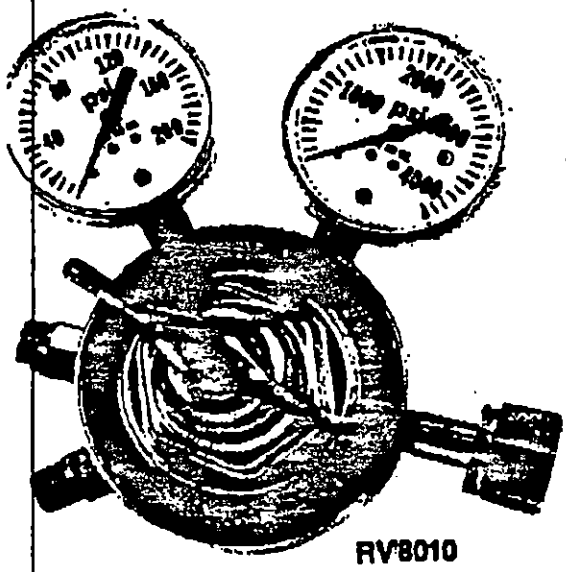
Cylinder Model	D.O.T. Spec. & Rating	Approx. Cap Oxygen	O.D.	Length	Nom. Wall	Weight	Water Capacity
		Cu.ft.@70F	Inches	Inches	Inches	Lbs.	Cu.in.
			MM	MM	MM	KG	Liters
B	3AA-2015	17/19	4.20	16.75	0.095	7.50	185
			106.00	425.00	2.41	3.40	3.03
E	3AA-2015	28/31	4.20	25.75	0.095	10.50	270
			106.00	629	2.41	4.62	4.42
20	3AA-2015	20/22	5.25	14.00	0.115	11.00	220
			133.00	355	2.92	5.00	3.60
40	3AA-2015	40/44	7.00	17.50	0.175	25.00	480
			178.00	444	4.45	11.34	7.87
55	3AA-2015	55/61	7.00	22.50	0.175	31.00	660
			178.00	571	4.45	14.06	10.82
80	3AA-2015	80/88	7.00	31.00	0.175	44.00	960
			178.00	787	4.45	20.00	15.74
110	3AA-2015	110/122	7.00	42.00	0.175	60.00	1320
			178.00	1066	4.45	27.30	21.65
125	3AA-2265	125/138	7.00	42.00	0.175	60.00	1320
			178.00	1066	4.45	27.30	21.65
150	3AA-2015	150/165	7.40	46.60	0.174	65.00	1666
			188.00	1183	4.40	29.50	27.30
20lb CO2	3AA-1800	20lbCO2	7.75	23.30	0.143	31.00	816
			197.00	589	3.60	14.10	13.40
220	3AA-2015	228/251	9.10	51.00	0.240	113.00	2650
			232.25	1282.7	6.10	51.40	43.40
254	3AA-2265	256/281	9.10	51.00	0.244	114.00	2650
			222.25	1282.7	6.20	51.80	43.40
300	3AA-2400	307/337	9.25	55.00	0.283	135.00	2995
			222.25	1397.0	7.20	61.30	49.10

WORTHINGTON CYLINDER CORPORATION
P. O. Box 128 • 101 Industrial Park • Citronelle, Alabama 36522 • (205) 866-2400 • 1-800-323-6224 • Fax: (205) 866-7759
P. O. Box 391 • 1085 Dearborn Drive • Columbus, Ohio 43085 • (614) 438-3013 • Fax: (614) 438-3083

RV-80 SERIES

Gas Cylinder Regulator Valves

SINGLE STAGE REGULATORS



RV8010

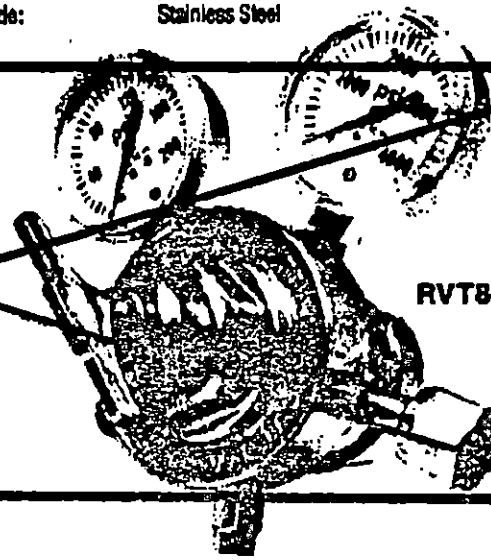
The popular RV-80 regulators are a heavy duty dependable full-flow design for medium to heavy duty use for a wide variety of applications. Ease of seat service is provided by a removable back plug.

Gauges:	2-1/2" with 1 piece polycarbonate lens
Body and Bonnet:	Forged Brass
Diaphragm:	Stainless steel
Filter:	Sintered metal cone
Adjusting screw:	Forged T-handle with precision stainless steel ball
Safety relief valve:	Reseating, non-adjustable+,++
Seal:	Stem-type safety check, closes with inlet pressure impact
Nozzle:	Stainless Steel

RVT-80 SERIES

TWO STAGE REGULATORS

The RVT-80 heavy duty regulators are designed for precision service use in a variety of medium to heavy duty applications. They give dependable, accurate steady working pressure and flow.



RVT8010

Specifications:

GAS SERVICE	SINGLE STAGE PART NO.	TWO STAGE PART NO.	CGA INLET	OUTLET CONNECTION	DELIVERY/CONTENTS 2-1/2" GAUGES	DEL. PSIG
Oxygen	RV8010 RV8010-3	RVT8010 RVT8010-3	540 540	"B" RH "B" RH	200/4000 400/4000	5-125 10-250
Acetylene	RV8011 RV8011-1 RV8011-CND	RVT8011 RVT8011-1 RVT8011-CND	510 300 CLA	"B" LH "B" LH "B" LH	30/400 30/400 30/400	2-15 2-15 2-15
Fuel Gases*	RV8012	RVT8012	510	"B" LH	60/400	2-40
Carbon Dioxide	RV8013	RVT8013	320	5/8"-18 RH (F)	200/2000	5-125
Argon	RV8014	RVT8014	580	5/8"-18 RH (F)	200/4000	5-125
Nitrogen	RV8015 RV8015A-1	RVT8015 RVT8015A-1	580 580	5/8"-18 RH (F) 1/4" Flare	200/4000 400/4000	5-125 10-300
Helium	RV8016	RVT8016	580	5/8"-18 RH (F)	200/4000	5-125
Hydrogen	RV8017	RVT8017	350	"B" LH	200/4000	5-125

*Propane, Butane, Mapp®, Apache, HPG, etc.
+Not designed to protect downstream equipment. ++Where applicable.

Regulators Ⓢ Listed

RV 8015 - Nitrogen

GOSS

PRO-FLAME

Heavy-Duty Torches and Burners

This equipment can be used for weed burning, drying, heating, melting, and other applications requiring large volumes of heat. Each uses vapor propane fuel and has a durable handle with rear on/off control valve. They are used by roofers, contractors, and farmers as well as road, railway, and industrial maintenance crews.

BP-100-XB (Vapor LP) Tar Kettle Burner

A 4 in. diameter heavy gauge steel burner which fits most tar buggies. Complete with bent tube and rear on/off control valve.

BTUs	approx. 216,000
Gas Usage	approx. 10 lb. per hr
Height	27 in
Length	9 in
Width	6½ in
Weight	5½ lbs.
Diameter	4 in.

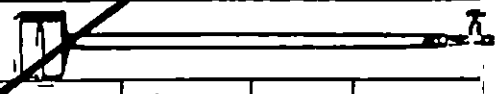
Blue-Jet Vapor Torches

Torches with Cast Iron Burners

AP-14

AP-15

AP-16 Torch emits vertical flame to heat objects from below



Torch No.	Length	Weight	Approx. BTUs at 40 PSI	Approx. Gas Usage at 40 PSI	Tip	Tip Diameter or Size
AP-14	27 in.	3½ lb.	250,000	11 lb./hr	BP-10	2¾ in.
AP-15	25 in.	4 lb	200,000	9 lb./hr	BP-11	2 in.
AP-16	21 in.	4½ lb	200,000	9 lb./hr	BP-12	2 in. x 3 in

Torches with Steel Tubing Burners

AP-10A

AP-6 Has two grips for easy handling.

AP-25

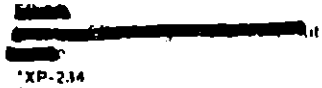
Torch No.	Length	Weight	Approx. BTUs at 40 PSI	Approx. Gas Usage at 40 PSI	Tip	Tip Diameter
AP-6/AP-10A	38½ in.	3¼ lb	225,000	10 lb./hr.	BP-8	[illegible]
AP-25	22 in	1¾ lb.	225,000	10 lb./hr.	BP-6TE	2¾ in

Regulators

High Pressure Vapor Regulators

All brass regulators used with LP torches and furnaces. Adjustable pressure from 5 to 60 PSI. U.L. listed with P.O.L. inlet spud and nut. ¼ in. NPT openings, and 9/16 —18 LH hose outlet.

EP-70G
Has 0 to 60 PSI outlet pressure gauge



*XP-234

Low Pressure Regulators

This regulator has 11 in. water column outlet pressure and is for applications requiring low gas pressure. U.L. listed with 1/4 in. NPT inlet and 3/8 in. NPT outlet. Do not use with any Goss LP torch or furnace equipment.

EP-60— Body only, no fittings
EP-60—1 P.O.L. inlet, ¾ in. flare outlet.
EP-60—2 P.O.L. inlet, ¾ in. flare outlet
EP-60—3 P.O.L. inlet, LH hose outlet
EP-60—4 T-Block inlet, ¾ in. flare outlet
EP-60—5 P.O.L. inlet less outlet

Hose

Liquid or Vapor LP Gas Hose with Spring Guard Fittings

U.L. listed with standard 9/16 —18 LH hose fittings. Working pressure: 350 PSI. Outside diameter — 5/8 in. Inside diameter: 1/4 in.

Vapor LP Gas Hose

U.L. listed with standard 9/16 —18 LH hose fittings. Working pressure: 350 PSI. Outside diameter — 9/16 in. Inside diameter: 1/4 in.

Hose No.	Length	Hose No.	Length
HPE-10	10 ft.	HEF-6	[illegible]
HPE-15	15 ft	HEF-10	[illegible]
HPE-20	20 ft	HEF-12	12 ft
HPE-30	30 ft.	HEF-20	20 ft

NOTE: Recommended that a regulator be used for safety, economy, and better operation in all applications of propane equipment.

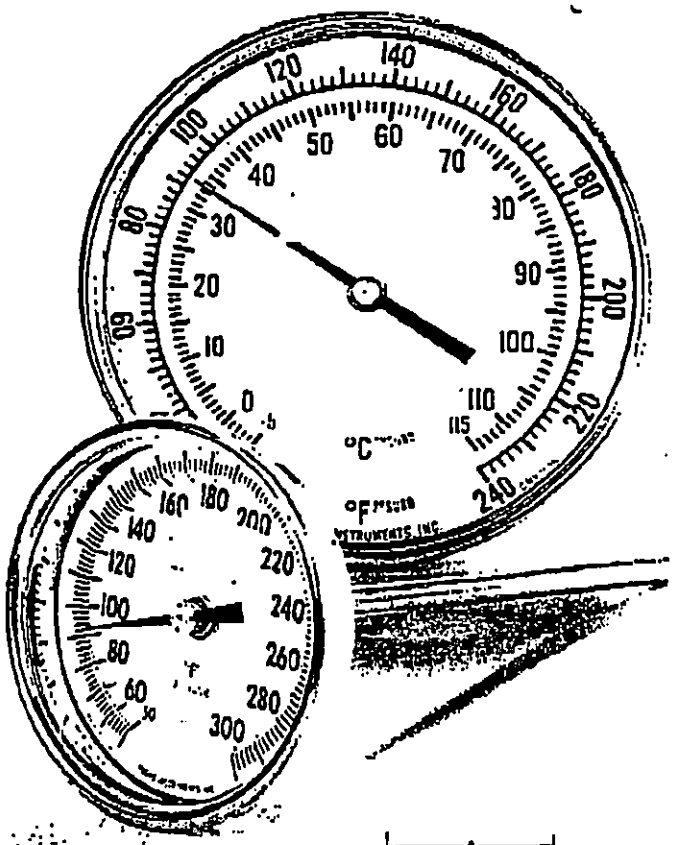
*EP-70G Regulator with dust cap and heavy duty inlet nut

90° BACK ANGLE FORM

DIAL SIZES: 3" to 5"

Model 30 & 50 Bi-Metal Thermometers

3946K

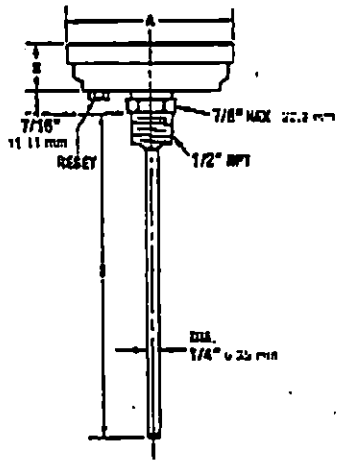


Dial Size	A	B	S (stem length)
3" 76.2 mm	3 1/4" 82.55 mm	15/16" 23.81 mm	as specified
5" 127 mm	5 1/4" 133.35 mm	15/16" 23.81 mm	as specified

ALL DIMENSIONS ± 1/16" (1.59 mm)

Catalog Numbers

Stem Length Inches	Stem Length Millimeters	MODEL 30 Dial Size 3" 76.2 mm	MODEL 50 Dial Size 5" 127 mm
2 1/2	63.5	30025	50025
4	101.6	30040	50040
6	152.4	30060	50060
9	228.6	30090	50090
12	304.8	30120	50120
15	381.0	30150	50150
18	457.2	30180	50180
24	609.6	30240	50240



Standard Ranges — Dual Scale (*Other Ranges Available*)

Fahrenheit (outer scale) Range	Fig. Interval	Div.	Celsius (inner scale) Range	Fig. Interval	Div.
-100 to 150°	20°	2°	-70 to 70°	10°	1°
- 40 to 120°	20°	2°	-40 to 50°	10°	1°
25 to 125°	10°	1°	-5 to 50°	5°	1°
0 to 140°	10°	1°	-20 to 60°	5°	1°
0 to 200°	20°	2°	-15 to 90°	10°	1°
0 to 250°	20°	2°	-20 to 120°	10°	1°
20 to 240°	20°	2°	-5 to 115°	10°	1°
50 to 300°	20°	2°	[illegible]	10°	1°
50 to 400°	50°	5°	[illegible]	20°	2°
50 to 500°	50°	5°	[illegible]	20	2°
150 to 750°	100°	10°	[illegible]	[illegible]	[illegible]
*200 to 1000°	100°	10°	[illegible]	[illegible]	[illegible]

*Not recommended for continuous use over 800°F or 425°C.

How to Order

The catalog number shown indicates only the dial size, angle form and stem length. For complete, descriptive part number please use the tables listed on page 13.

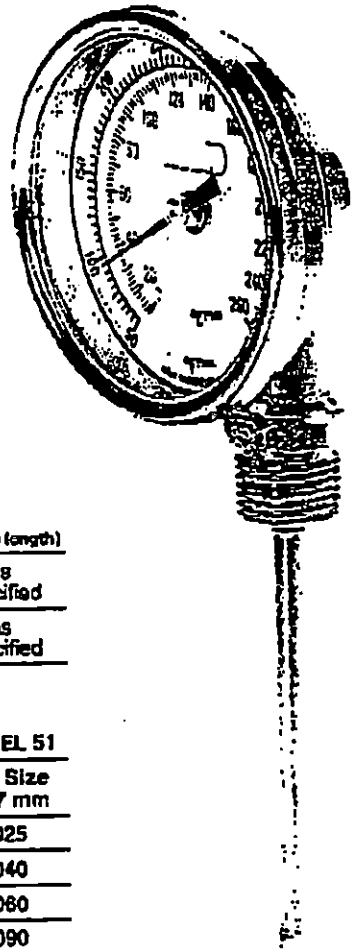
See General Specifications on page 2 for construction features and for available accessories and options.

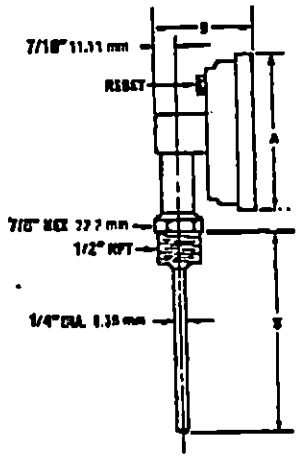
STRAIGHT FORM 90° RIGHT/LEFT ANGLE FORM

DIAL SIZES: 3" - 5"

Model 31 & 51 Bi-Metal Thermometers

3956K

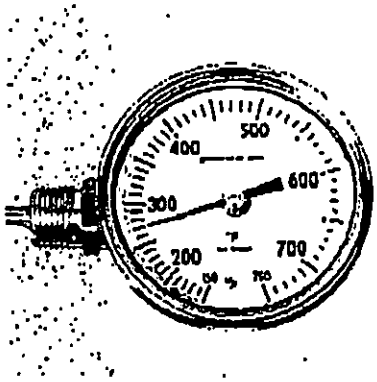




Dial Size	A	B	S (stem length)
3" 76.2 mm	3 1/4" 82.55 mm	1 7/8" 47.62 mm	as specified
5" 127 mm	5 1/4" 133.35 mm	1 7/8" 47.62 mm	as specified

ALL DIMENSIONS ± 1/16" (1.58 mm)

Catalog Numbers		MODEL 31	MODEL 51
Stem Length Inches	Millimeters	Dial Size 3" 76.2 mm	Dial Size 5" 127 mm
2 1/2	63.5	31025	51025
4	101.6	31040	51040
6	152.4	31060	51060
9	228.6	31090	51090
12	304.6	31120	51120
15	381.0	31150	51150
18	457.2	31180	51180
24	609.6	31240	51240



Standard Ranges — Dual Scale (*Other Ranges Available*)

Fahrenheit (outer scale) Range	Fig. Interval	Div.	Celsius (inner scale) Range	Fig. Interval	Div.
-100 to 150°	20°	2°	-70 to 70°	10°	1°
- 40 to 120°	20°	2°	-40 to 50°	10°	1°
**25 to 125°	10°	1°	- 5 to 50°	5°	1 2°
0 to 140°	10°	1°	-20 to 60°	5°	1 2°
0 to 200°	20°	2°	-15 to 90°	10°	1°
0 to 250°	20°	2°	-20 to 120°	10°	1°
20 to 240°	20°	2°	- 5 to 115°	10°	1°
50 to 300°	20°	2°	10 to 150°	10°	1°
50 to 400°	50°	5°	10 to 200°	20°	2°
50 to 500°	50°	5°	10 to 250°	20°	2°
150 to 750°	100°	10°	65 to 400°	50°	5°
*200 to 1000°	100°	10°	*100 to 500°	50°	5°

*Not recommended for continuous use over 800°F or 425°C.
**Not available with 2 1/2" (63.5 mm) stem.
For complete list of available ranges, including Celsius only and Fahrenheit only, please see page 13.

Side Angle Connection

~~Add suffix letter to catalog number. LS for left side angle. (Shown Above) RS for right side angle.~~

How to Order

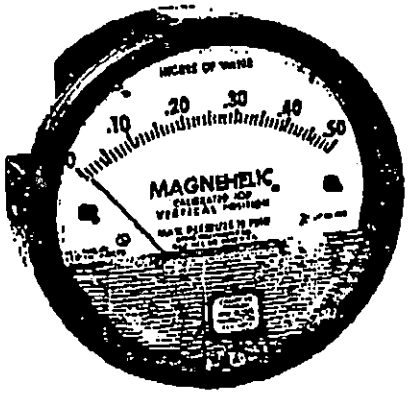
The catalog number shown indicates only the dial size, angle form and stem length. For complete, descriptive part number please use the tables listed on page 13.

See General Specifications on page 2 for construction features and for available accessories and options.

Note Temperature Range 50-300° F, Not 0-300° as specified

Pressure and Vacuum Gages

Indicate low air or gas pressures—positive, negative or differential. Accurate within 2%. 81 Ranges.



Patent Nos. 4,090,383
8,012,678

To be provided:

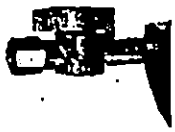
(1) Vacuum guage 0-10" Hg (inlet)
(3) Vacuum guages 0-5" Hg (spare)
(2) Pressure guages 0-100" H_2O (spare)

Select the Dwyer Magnehelic® gage for high accuracy — guaranteed within 2% of full scale — and for the wide choice of 81 ranges available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® movement, it quickly indicates low air or non-corrosive gas pressures — either positive, negative (vacuum) ~~or differential.~~ The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

Widely used to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.

Flush...Surface...or Pipe Mounted

Mounting. A single case size is used for most ranges of Magnehelic gages. They can be flush or surface mounted with standard hardware supplied. With the optional A-610 Pipe Mounting Kit they may be conveniently installed on horizontal or vertical 1¼" – 2" pipe. Although calibrated for vertical position, many ranges above 1 inch may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic gages ideal for both stationary and portable applications. A 4 9/16" hole is required for flush panel mounting. Complete mounting and connection fittings plus instructions are furnished with each instrument.



Vent valves

In applications where pressure is continuous and the Magnehelic gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.

HIGH AND MEDIUM PRESSURE MODELS

Installation is similar to standard gages except that a 4 9/16" hole is needed for flush mounting. The medium pressure construction is rated for internal pressures up to 35 psig and the high pressure up to 80 psig. Available in all ranges. Because of larger case, will not fit in portable case. Weight 1 lb., 10 oz. (Installation of the A-321 safety relief valve on standard Magnehelic gages often provides adequate protection against infrequent overpressure; see Bulletin S-101).

PHYSICAL DATA

Ambient temperature range: 20° to 140° F.*
Rated total pressure: −20" Hg. to 15 psig.†
Overpressure: Relief plug opens at approximately 25 psig.
Connections: ⅛" NPT female high and low pressure taps, duplicated – one pair side and one pair back.
Housing: Die cast aluminum. Case and aluminum parts tridite-dipped to withstand 168 hour salt spray test. Exterior finish is baked dark gray hammertoid.
Accuracy: Plus or minus 2% of full scale (3% on −0 and 4% on −00 ranges), throughout range at 70°F.
Standard accessories: Two ⅛" NPT plugs for duplicate pressure taps, two ⅛" pipe thread to rubber tubing adapters, and three flush mounting adapters with screws. (Mounting ring and snap ring retainer substituted for 3 adapters in MP & HP gage accessories.)
Weight: 1 lb. 2 oz.

*Low temperature models available as special option.
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left.

OPTIONS AND ACCESSORIES

Transparent overlays
Furnished in red and green to highlight and emphasize critical pressures.

Adjustable signal flag
Integral with plastic gage cover; has external reset screw. Available for most ranges except those with medium or high pressure construction. Can be ordered with gage or separately.

LED Setpoint Indicator
Bright red LED on right of scale shows when setpoint is reached. Field adjustable from gage face, unit operates on 12 – 24 VDC. Requires MP or HP style cover and bezel.

Portable units
Combine carrying case with any Magnehelic gage of standard range (not high pressure). Includes 9 ft. of 3/16" I.D. rubber tubing, stand-hang bracket, and terminal tube with holder.

Air filter gage accessory package
Adapts any standard Magnehelic for use as an air filter gage. Includes aluminum surface-mounting bracket with screws, two 5 ft. lengths of ¼" aluminum tubing, two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves.

Quality design and construction features

Bezel provides flange for flush mounting in panel.

Clear plastic face is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision litho-printed scale is accurate and easy to read.

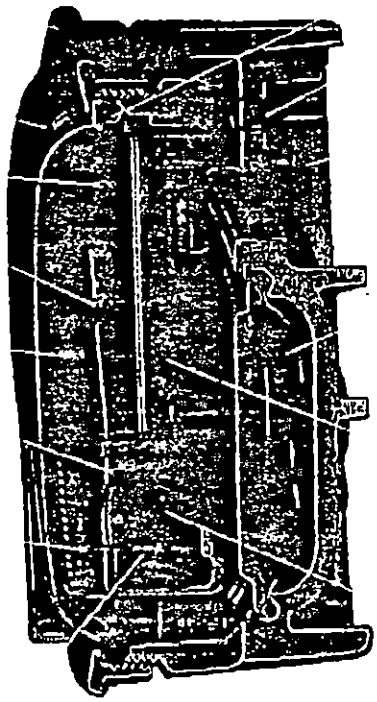
Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on helix shaft.

Pointer stops of molded rubber prevent pointer over-travel without damage.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Sapphire bearings are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

Zero adjustment screw is conveniently located in plastic cover, accessible without removing cover. "O" ring seal provides pressure tightness.



"O" ring seal for cover assures pressure integrity of case.

Blowout plug of silicone rubber protects against overpressure on 15 PSIG rated models. Opens at approximately 25 PSIG.

Die cast aluminum case is precision made. Iridite-dipped to withstand 168 hour salt spray test. Exterior finished in baked dark gray hammeroid. One case size used for all standard pressure ranges, and for both surface and flush mounting.

Silicone rubber diaphragm with integrally molded "O" ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

Calibrated range spring is a flat leaf of Swedish spring steel in temperature compensated design. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

Alnico magnet mounted at one end of range spring rotates helix without mechanical linkages.

Helix is precision milled from an alloy of high magnetic permeability, deburred and annealed in a hydrogen atmosphere for best magnetic qualities. Mounted in jeweled bearings, it turns freely to align with magnetic field of magnet to transmit pressure indication to pointer.

SERIES 2000 MAGNEHELIC® — MODELS AND RANGES

The models below will fulfill most requirements. Page 5 also shows examples of special models built for OEM customers. For special scales furnished in ounces per square inch, inches of mercury, metric units, etc., contact the factory.

Model Number	Range, Inches of Water	Minor Div.
2000-00†	0- .25	.005
2000-0†	0- .50	.01
2001	0-1.0	.02
2002	0-2.0	.05
2003	0-3.0	.10
2004	0-4.0	.10
2005	0-5.0	.10
2006	0-6.0	.20
2008	0-8.0	.20
2010	0-10	.20
2015	0-15	.50
2020	0-20	.50
2025	0-25	.50
2030	0-30	1.0
2040	0-40	1.0
2050	0-50	1.0
2060	0-60	2.0
2080	0-80	2.0
2100	0-100	2.0
2150	0-150	5.0

Model Number	Range, Zero Center Inches of Water	Minor Div.
2300-0†	.25-0-.25	.01
2301	.5-0-.5	.02
2302	1-0-1	.05
2304	2-0-2	.10
2310	5-0-5	.20
2320	10-0-10	.50
2330	15-0-15	1.0

Model Number	Range, PSI	Minor Div.
2201	0-1	.02
2202	0-2	.05
2203	0-3	.10
2204	0-4	.10
2205	0-5	.10
2210*	0-10	.20
2215*	0-15	.50
2220*	0-20	.50
2230**	0-30	1.0

*MP option standard
**HP option standard

Dual Scale Air Velocity Units

Model Number	Range, Inches of Water	Range, Air Velocity F.P.M.
2000-00AV†	0- .25	300- 2000
2000-0AV†	0- .50	500- 2800
2001AV	0-1.0	500- 4000
2002AV	0-2.0	1000- 5800
2010AV	0-10	2000-12500

For use with pilot tube.

Model Number	Range, MM of Water	Minor Div.
2000-6MM†	0-6	.20
2000-10MM†	0-10	.20
2000-25MM	0-25	.50
2000-50MM	0-50	1.0
2000-80MM	0-80	2.0
2000-100MM	0-100	2.0
Zero Center Range		
2300-20MM†	10-0-10	.50

Model Number	Range, CM of Water	Minor Div.
2000-15CM	0-15	.50
2000-20CM	0-20	.50
2000-25CM	0-25	.50
2000-50CM	0-50	1.0
2000-80CM	0-80	2.0
2000-100CM	0-100	2.0
2000-150CM	0-150	5.0
2000-200CM	0-200	5.0
2000-250CM	0-250	5.0
2000-300CM	0-300	10.0
Zero Center Ranges		
2300-4CM	2-0-2	.10
2300-10CM	5-0-5	.20
2300-30CM	15-0-15	1.0

†These ranges calibrated for vertical scale position.

Model Number	Range, Pascals	Minor Div.
2000-60 Pa†	0-60	2.0
2000-125 Pa†	0-125	5.0
2000-250 Pa	0-250	5.0
2000-500 Pa	0-500	10.0
2000-750 Pa	0-750	25.0
Zero Center Ranges		
2300-250 Pa	125-0-125	5.0
2300-500 Pa	250-0-250	10.0

Model Number	Range, Kilopascals	Minor Div.
2000-1 kPa	0-1	.02
2000-1.5 kPa	0-1.5	.05
2000-2 kPa	0-2	.05
2000-3 kPa	0-3	.10
2000-4 kPa	0-4	.10
2000-5 kPa	0-5	.10
2000-8 kPa	0-8	.20
2000-10 kPa	0-10	.20
2000-15 kPa	0-15	.50
2000-20 kPa	0-20	.50
2000-25 kPa	0-25	.50
2000-30 kPa	0-30	1.0
Zero Center Ranges		
2300-1 kPa	.5-0-.5	.02
2300-3 kPa	1.5-0-1.5	[illegible]

Suggested Specifications

A differential pressure gage for measuring (state purpose) shall be installed. Gage shall be the diaphragm-actuated dial type 4¾" O.D., with white dial, black figures and graduations and pointer zero adjustment. Gage shall be Dwyer Instruments, Inc., Magnehelic®, Catalog No. _____ reading to _____" water column, in _____" divisions.

Special Purpose Ranges

Scale No. 2401 Square Root Specify Range

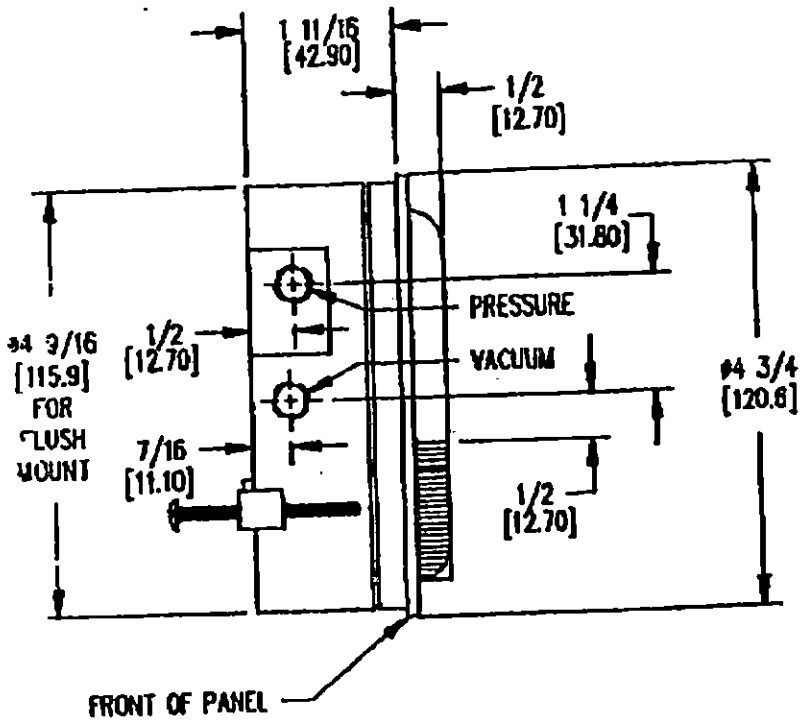
Scale No. 2402 Blank Scale Specify Range

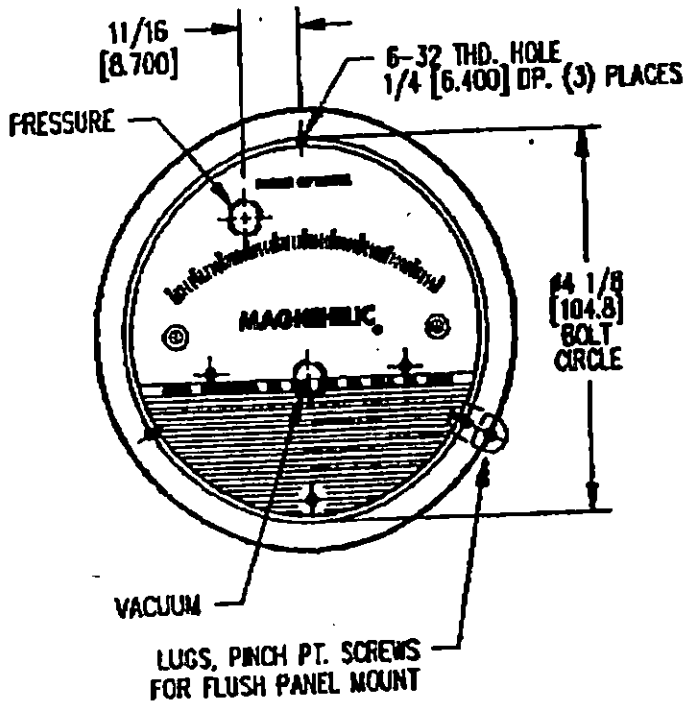
Model 2000-00N, Range – .05 to + .20" W.C. For room pressure monitoring.

Dwyer Instruments, Inc. P.O. Box 373/Michigan City, Indiana 46361/Phone 219 879-8000/Fax 219 872-9057 • U.K. Phone (01494)-461707 • Australia Phone (02) 708-4799

Hg	Div.
0-5"	.10
[illegible]"	.20

12-700060-00





WEIGHT: 1 lb. 2 oz. [.5100 kg.]
FINISH: BAKED GREY ENAMEL
CONNECTIONS: 1/8 NPT HIGH & LOW PRESSURE TAPS, DUPLICATED, ONE PAIR SIDE AND ONE PAIR BACK.
ACCURACY: PLUS OR MINUS 2% OF FULL SCALE, AT 70°F. [21.11°C]
PRESSURE RATING: SUSTAINED OR HIGHLY REPETITIVE PRESSURE, 15 psi. [103.4 kPa]
AMBIENT TEMPERATURE RANGE: 30°F. TO 140°F. [-1.110°C TO 60°C]

NOTE:
METRIC CONVERSION IN BRACKETS [ ].

NOTE:
CERTIFIED FOR RANGE_____

STANDARD TOLERANCES UNLESS NOTED:
ALL FRACTIONAL DIMENSIONS ± 1/64
ALL DECIMAL DIMENSIONS ± .005
ALL ANGLES ± 1°

SCALE: 2:1

		DATE 10-06-94	NAME OUTLINE DIMENSIONS 2000 MAGNEHELIC GAGE
		DWN BY CAT	
		CHKD EJB	
REDRAWN PER ECR #2633	CAT 10-06-94	APPD EJ	ACADR12
CHANGES	BY/DATE		

MATERIAL
FINISH

DWYER INSTRUMENTS, INC.
MICHIGAN CITY, INDIANA 46360 U.S.A.

FR. NO. 12-700060-0

Gas Flow meter

SUBMITTALS ON KURZ THERMAL MASS FLOWMETERS

PROJECT: Pelham Bay Landfill

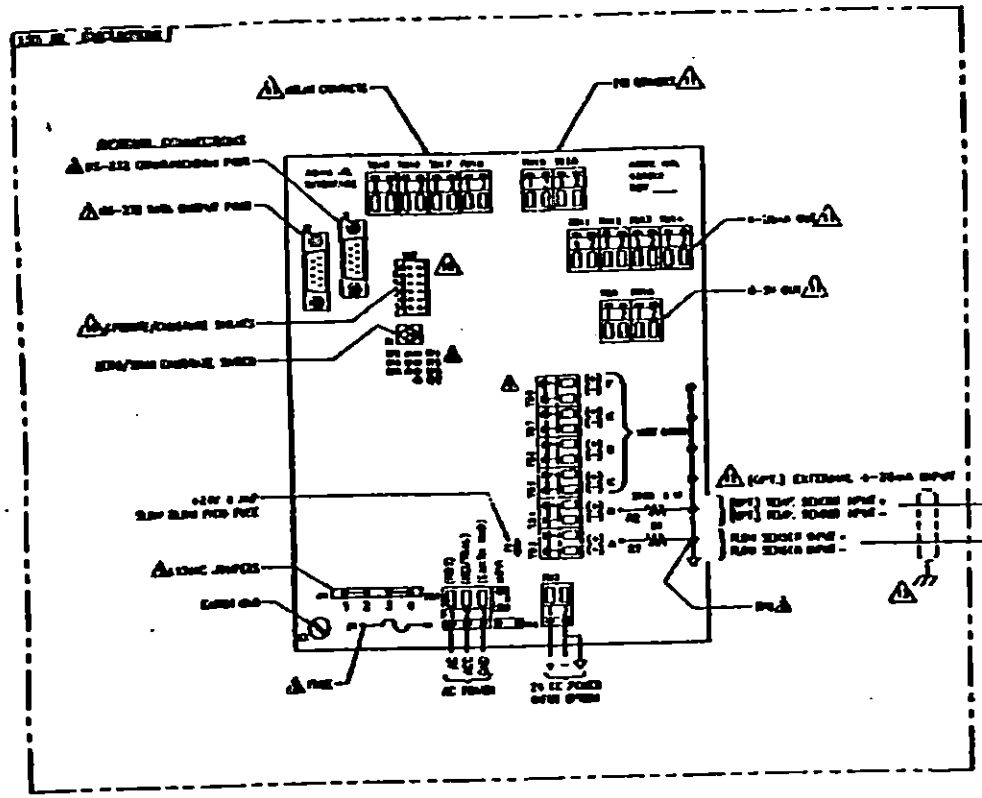
CUSTOMER: Breco Mechanical

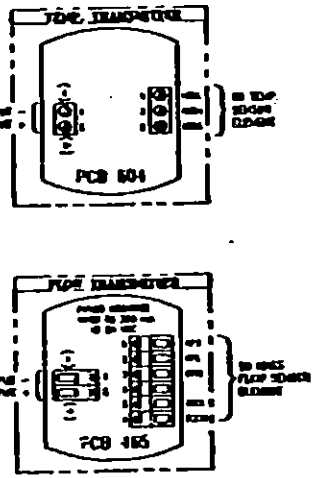
PURCHASE ORDER NUMBER: 1305

Equipment Purchased:
One (1) P/N: 752651-03-24-18-01-88-34-01 Model 450 Probe
One (1) P/N: 750101-04-01-88-04-01-88-88-01 Model 155Jr Electronics
One (1) Model 8AD8-WD Pipe Mounting Adaptor

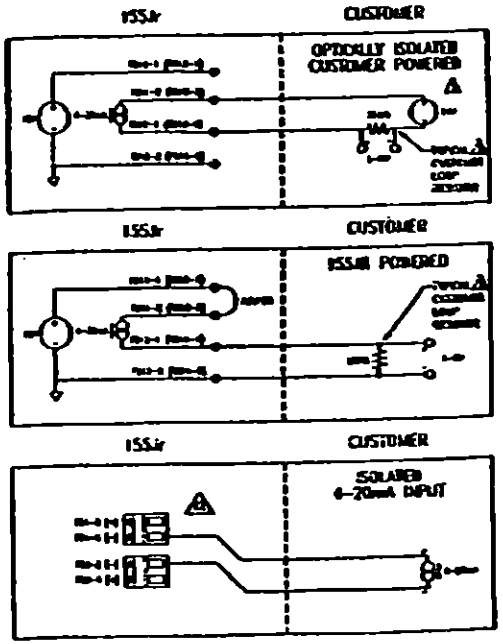
Submitted by: Industrial Representatives, Inc.
P.O. Box 421
Clifton, NJ 07015
(201) 471-2614

Date: February 22, 1995





SAMPLE DIAGRAMS, 4–20mA CONNECTIONS



NOTES:

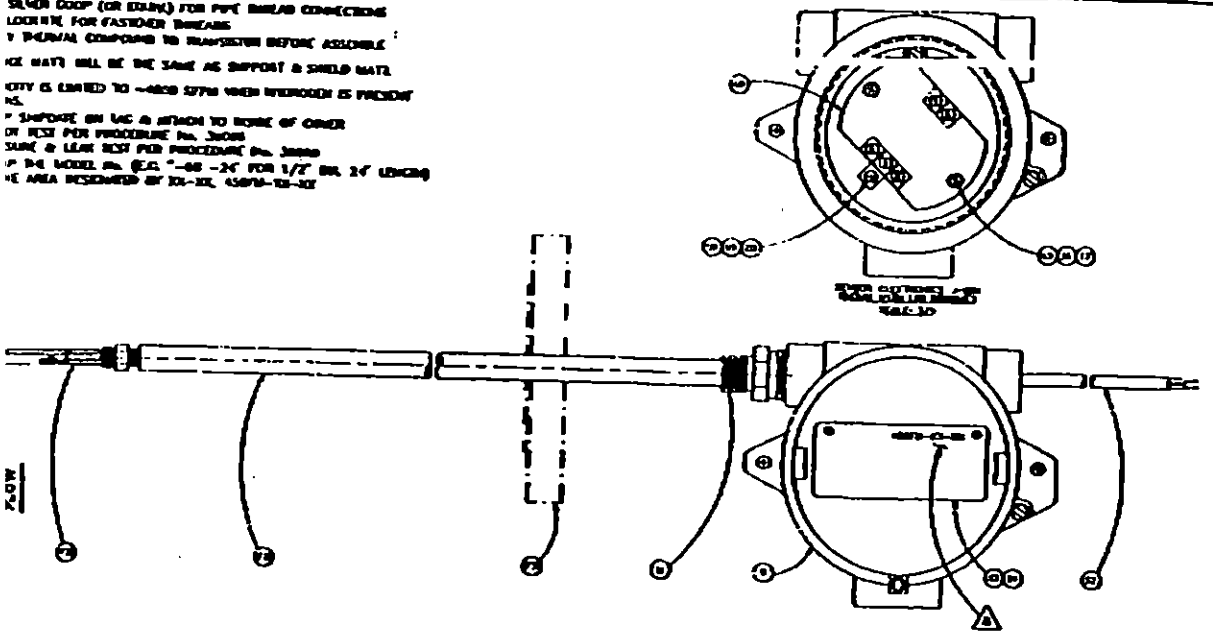
1. THIS WIRING DIAGRAM IS USED IN CONNECTION WITH PARTS DRAWINGS 750401, 750102-01, 750102-02, 750104 & 750105.
2. REF. DESIGNATORS AND P/N NUMBERS ARE FOR REF. ONLY, AND MAY NOT APPEAR ON COMPONENTS.

KURZ INSTRUMENTS, INC.

WIRING DIAGRAM, HOOK-UP, 155 JR.

D | 340155-29 | B

UNLESS OTHERWISE SPECIFIED
SILVER SOLDER (OR EQUAL) FOR PIPE THREAD CONNECTIONS
LOCTITE FOR FASTENER THREADS
THERMAL COMPOUND TO TRANSISTOR BEFORE ASSEMBLE
SHIELD MATL WILL BE THE SAME AS SUPPORT & SHIELD MATL
VELOCITY IS LIMITED TO ~4000 SFPM WHEN HYDROGEN IS PRESENT
NOTES.
SUPPORT ON GAS & ATTACH TO HOME OF OWNER
LEAK TEST PER PROCEDURE No. 30000
SURE & LEAK TEST PER PROCEDURE No. 30000
P 34 MODEL No. (E.G. "-48 -24" FOR 1/2" DIA. 24" LENGTH)
HE AREA DESIGNATED BY X1-X2, 450PM-X1-X2



FEATURE 1			
ENSOR MATERIAL	752859/752852		QTY.
316SS	130029-00		1
ST. C276	130029-05		1
NEL	130029-00		1
ANNIN	130029-00		1
ND SHOCK-CHROME	130029-00		1
316SS			
ARNIN INTRINSIC	130029-00		1
316SS			
ECIAL	130029-00		1

FEATURE 2							
PPORT & SHIELD		752859		752852			
MATL	LENGTH	SUPPORT	SHIELD	SUPPORT	SHIELD	QTY.
316SS	3"	150041-00	150047	150040-00	150048	1
	6"	150041-02	150047	150040-00	150048	1
	12"	150041-04	150047	150040-00	150048	1
	24"	150041-06	150047	150040-00	150048	1
	36"	150041-08	150047	150040-01	150048	1
	48"	-	-	150040-02	150048	1
	60"	-	-	150040-03	150048	1
316SS	SPECIAL	150041-00	150047	150040-00	150048	1
ST. C276	3'-60"					
ST. C276	SPECIAL					
NEL	3'-60"					
NEL	SPECIAL					
TANIUM	3'-60"					
TANIUM	SPECIAL					
ECIAL	3'-60"					
ECIAL	SPECIAL					

FEATURE 3			
GAS VELOCITY CALIBRATION FULL SCALE RANGE			
OPTION	ENGLISH	OPTION	METRIC
02	300 SFPM	52	1.5 SMPS
04	600	54	3
06	1000	56	5
08	2000	58	10
10	3000	60	15
12	4000	62	20
14	6000	64	30
16	8000	66	40
18	12000 SFPM	68	60 SMPS
90	SPECIAL RANGE/UNITS		

FEATURE 4			
OPTION	RFI PROTECTION CIRCUIT	PART No.	QTY.
00	NONE	-	-
01	TRANSMITTER ATTACHED		

FEATURE 5				
OPTION	SUPPORT WITH WELDED FLANGE	752854	752852	QTY.
00	NO FLANGE	-	-	-
01	3/4" ASA R.F., 150#	150046-00	150047-00	1
02	3/4" ASA R.F., 300#	150046-02	150047-02	1
11	3/4" ASA R.F., 150#	150046-03	150047-03	1
12	3/4" ASA R.F., 300#	150046-04	150047-04	1
21	1" ASA R.F., 150#	150046-05	150047-05	1
22	1" ASA R.F., 300#	150046-06	150047-06	1
31	1-1/2" ASA R.F., 150#	150046-07	150047-07	1
32	1-1/2" ASA R.F., 300#	150046-08	150047-08	1
90	SPECIAL	150046-00	150047-00	1

FEATURE 6			
OPTION	SPECIALTY GAS CALIBRATION	PROCEDURE RANGE	
00	AIR	0-100	PSIG
04	AIR	0-150	
08	AMMONIA (NH_3)	0-150	
08	ARGON (Ar)	0-150	
10	BUTANE (C_4H_{10})	0-15	
14	CARBON DIOXIDE (CO_2)	0-150	
18	DRY CHLORINE (Cl_2)	0-150	
20	ETHANE (C_2H_6)	0-150	
22	ETHYLENE (C_2H_4)	0-150	
28	HELIUM (He)	0-150	
30	HYDROGEN (H_2)	0-150	
32	METHANE (CH_4)	0-150	
34	NATURAL GAS	0-150	
40	NITROGEN (N_2)	0-150	
44	OXYGEN (O_2)	0-150	
46	PROPANE (C_3H_8)	0-150	PSIG
90	SPECIAL	SPECIFY	

QTY.	PART NO.	DESCRIPTION	ITEM
1	190008	WASHER, #4, MED. BEEH.	20
1	190216	SCR, #4-40, S/HEAD, CAPTIVE	19
1	190095	WASHER, #4, SHOULDER, NYLON	18
2	190108	WASHER, #4 INT. LOCK.	17
2	190008	STAND-OFF, #8-32, 3/8" LG. M/F	16
2	190047	SCR, #8-32, 1/2" LG. PHL. PAN	15
2	190204	SCR, #2-56, 3/16 LG. PAN. SS.	14
1	190087	LABEL, 450PM	13
1	300038-10	CABLE, 2 COND., SHIELDED, PVC, 16 GA, 10FT.	12
1	420130	PCB, ASSY, 4530	11
1	110160	J-BOX, BELLARM INC.	10
			9
			8
1	SEE CHART	FEATURE 6: SPECIAL GAS CALIBRATION	7
1		FEATURE 5: SUPPORT WITH FLANGE	6
1		FEATURE 4: RFI PROTECTION CIRCUIT	5
1		FEATURE 3: CALIBRATION RANGE	4
1		FEATURE 2: SUPPORT & SHIELD	3
1	SEE CHART	FEATURE 1: SENSOR MATL	2
QTY.	PART NO.	DESCRIPTION	ITEM

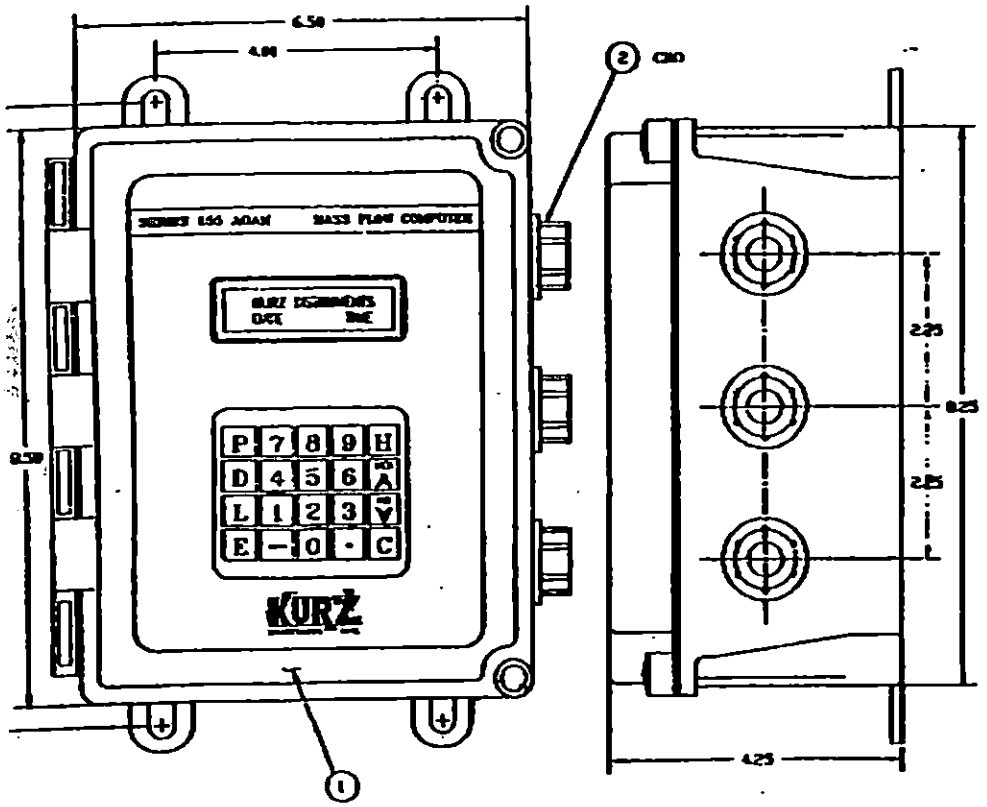
PARTS LIST

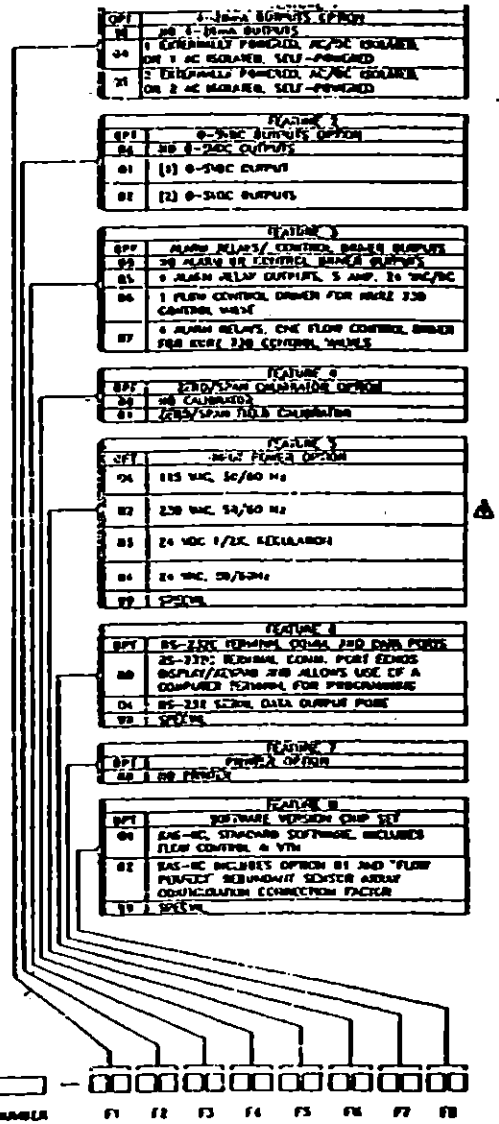
PHONE NUMBER F1 F2 F3 F4 F5 F6

KURZ INSTRUMENTS, INC.

SERIES 450 PROBE ASSY.
-F1-00/N-T1-X1-1D

D





NOTES:

1. [illegible]

5	[illegible]	[illegible]	
4	[illegible]	[illegible]	
3	[illegible]	[illegible]	
2	[illegible]	[illegible]	
1	[illegible]	[illegible]	
DESCRIPTIVE NUMBER		DESCRIPTION	
PARTS LIST			

KURZ INSTRUMENTS, INC.

ASSY., ADAM JR.,
[illegible], FIBERGLASS ENCLOSURE

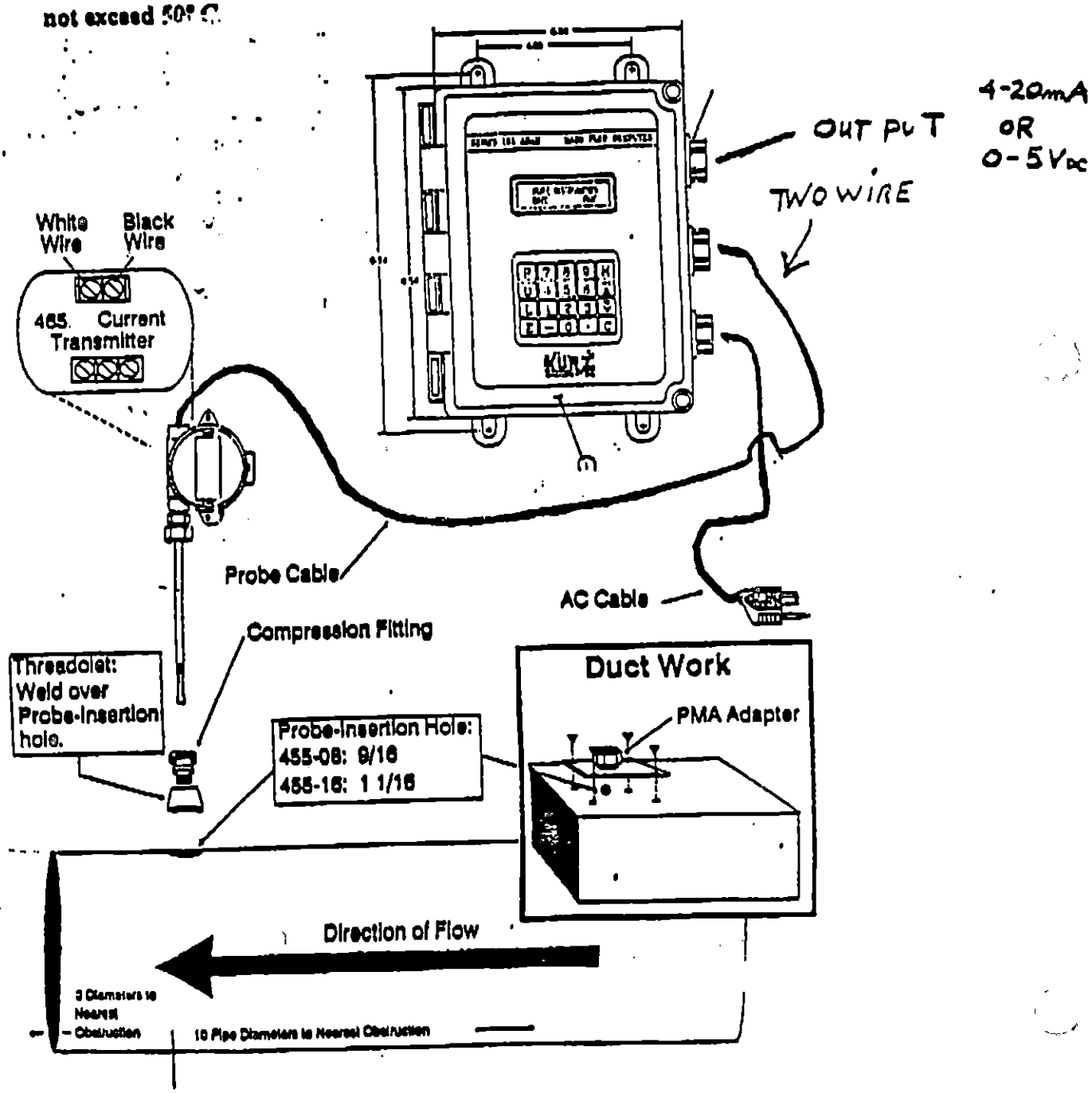
D 750101

DEC 13 '94 05:28PM KURZINSTRUMENTS

Quick Set-Up Guide

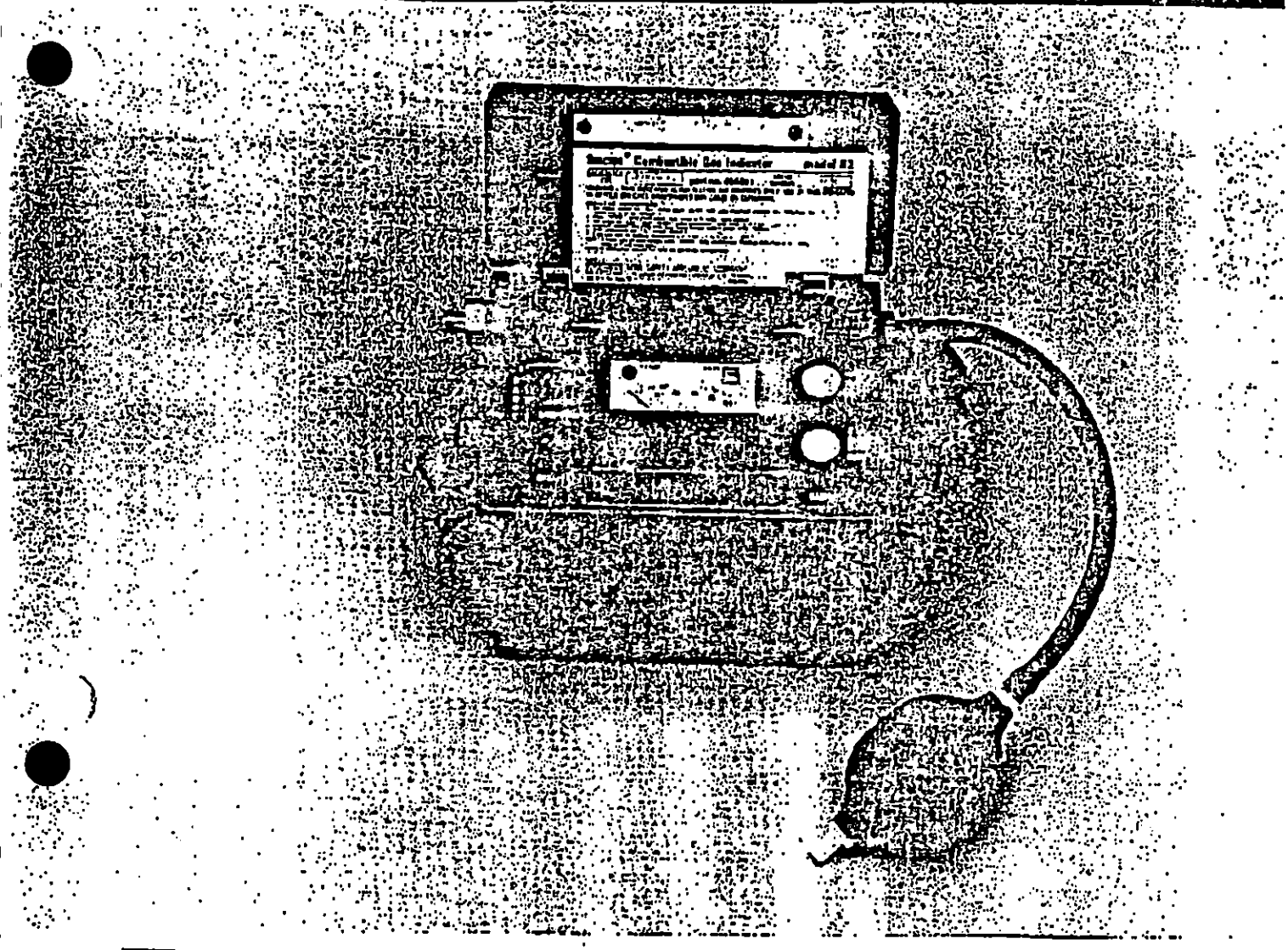
The quick set-up chart below summarizes much of the information presented in [redacted] manual. It does not, however, contain all the information you may need for safe and satisfactory installation of your 455. Kurz Instruments recommends that you read the manual before attempting installation.

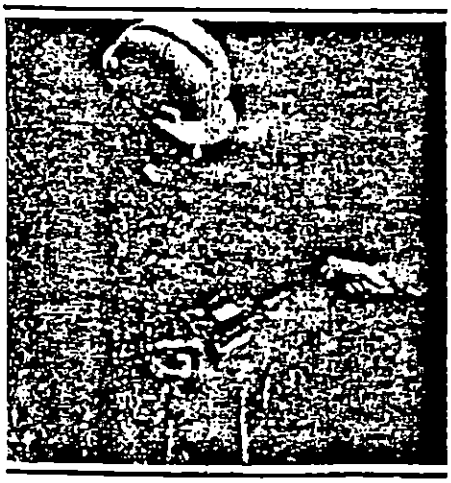
Important Note: Do NOT install the junction box close to a hot duct or stack. The ambient temperature around the junction box should not exceed 50° C.



GASCOPE® COMBUSTIBLE GAS INDICATORS

08-01-04





Sampling Equipment

FEATURES

- Effective measurement of combustible gases and vapors
- Excellent for pinpointing leaks
- 3 Models to meet differing detection needs
- Impact-resistant, waterproof case
- Equipped with neck and waist straps for hands-free operation

DESCRIPTION

Gascope Combustible Gas Indicators are portable instruments for use in detecting, measuring and pinpointing leaks of combustible gases and vapors. Housed in a high-impact-resistant and waterproof case, Gascope units measure 6 1/2" high by 7 1/4" long by 4" wide. Each unit is easily carried with integral neck and waist straps, leaving hands free for climbing, operating the instrument, or carrying additional equipment.

Meter movement is of core magnet type to prevent errors caused by stray magnetic fields such as those encountered in manholes or electric utility vaults.

MSA

The gas flow is cast as an integral part of the case, eliminating internal tubing and connections, and the possibility of leaks that could dilute samples. Flow systems incorporate a cylindrical filter chamber; the standard cotton filter prevents dirt from entering the system. A special charcoal filter can be used when necessary to distinguish between natural gas and petroleum vapors. A special line trap assembly is available to prevent water from being drawn into the indicator.

Powered by 8 zinc carbon batteries, Gascope Indicators can operate continuously for over 8 hours.

A panel indicator signals the unit's operational readiness, as well as the strength of the batteries.* Separate adjustment knobs for each measuring circuit are clutch-type to help prevent accidental changing of zero settings. A hinged case lid, with operating instructions affixed to the inside, protects the unit when not in service. When in use, the lid lies flat against the back of the case. The instrument is automatically turned off when the lid is closed.

Three Gascope Combustible Gas Indicator Models

The Model 60 is designed for use by gas utility companies in routine testing for methane-in-air concentrations in manholes, sewers, curb boxes and other street openings. The unit reads 0 to 5% by volume methane-in-air, and 0-100% by volume methane-in-air.

The Model 62S, also suitable for use by gas utility companies, is designed for reading 0-100% LEL methane-in-air and 0-100% by volume methane-in-air.

The Model 62 is designed for general industrial use. The unit provides quick detection of most combustible gases and, therefore, has a number of applications, such as testing tank and vessel interiors; locating pipeline and process system leaks; and checking confined areas in steel mills, paint factories, sewage disposal plants, chemical manufacturing facilities and other industrial applications. The unit is factory-calibrated on pentane-in-air to simulate the qualities of petroleum vapors. The Model 62 reads 0-100% LEL pentane-in-air and 0-100% by volume pentane-in-air.

*U.S. Patent No. 4,127,924 dated Nov 28, 1978 covers battery voltage regulating and condition indicating circuit for measuring instruments.

APPROVALS & STANDARDS

Gascope Combustible Gas Indicators have been tested to Factory Mutual Approval standard for Combustible Gas Detector, Class Nos. 6310-6330 (7/1/78). Suitable for use in Class I, Division 1, Groups C and D hazardous locations as defined by the National Electrical Code.

OPERATION

The Gascope Combustible Gas Indicator is prepared for operation by turning the switch to the ON position, and setting the selector switch for high or low scale. A sample is drawn in by squeezing the aspirator bulb. The instrument uses two different types of filaments: a catalytic combustion filament for the low range, and a thermal-conductivity filament for the high range.

Concentrations on the low ranges are measured by the hot-wire, Wheatstone bridge method. The filament is one arm of the bridge. When a gas sample is passed across this filament, combustibles are burned, raising the temperature of the filament. As a result, resistance is increased and the bridge becomes unbalanced.

The imbalance is proportional to the concentration of the combustibles, and is indicated on the low range of the meter.

For measuring in or above the explosive range, a thermal-conductivity filament is used. Combustibles in the sample cool this filament, causing the Wheatstone bridge to go out of balance. The imbalance, proportional to the gas concentration, is measured by the meter and read as percent-by-volume. The filament is field replaceable.

LIMITATIONS

Silanes, silicones, silicates and other compounds containing silicon in the tested atmosphere may seriously impair the response of this instrument. Some of these materials rapidly poison the catalytic combustion filament so that it will not function properly. When there is even a suspicion that such materials are in the atmosphere being tested, the instrument must be checked frequently (at least once every five uses). Calibration kits are available to conduct this test. Leaded gasoline vapors can also poison the catalytic combustion filament. To prevent this, an inhibitor filter (Part No. 47740) should be used to nullify their effect.

ORDERING INFORMATION

Gascope Combustible Gas Indicator: Complete with carrying straps and batteries, less sampling line

Part No.	Description
465475	Utility Model 60
465681	Model 62
468410	Utility Model 62S *

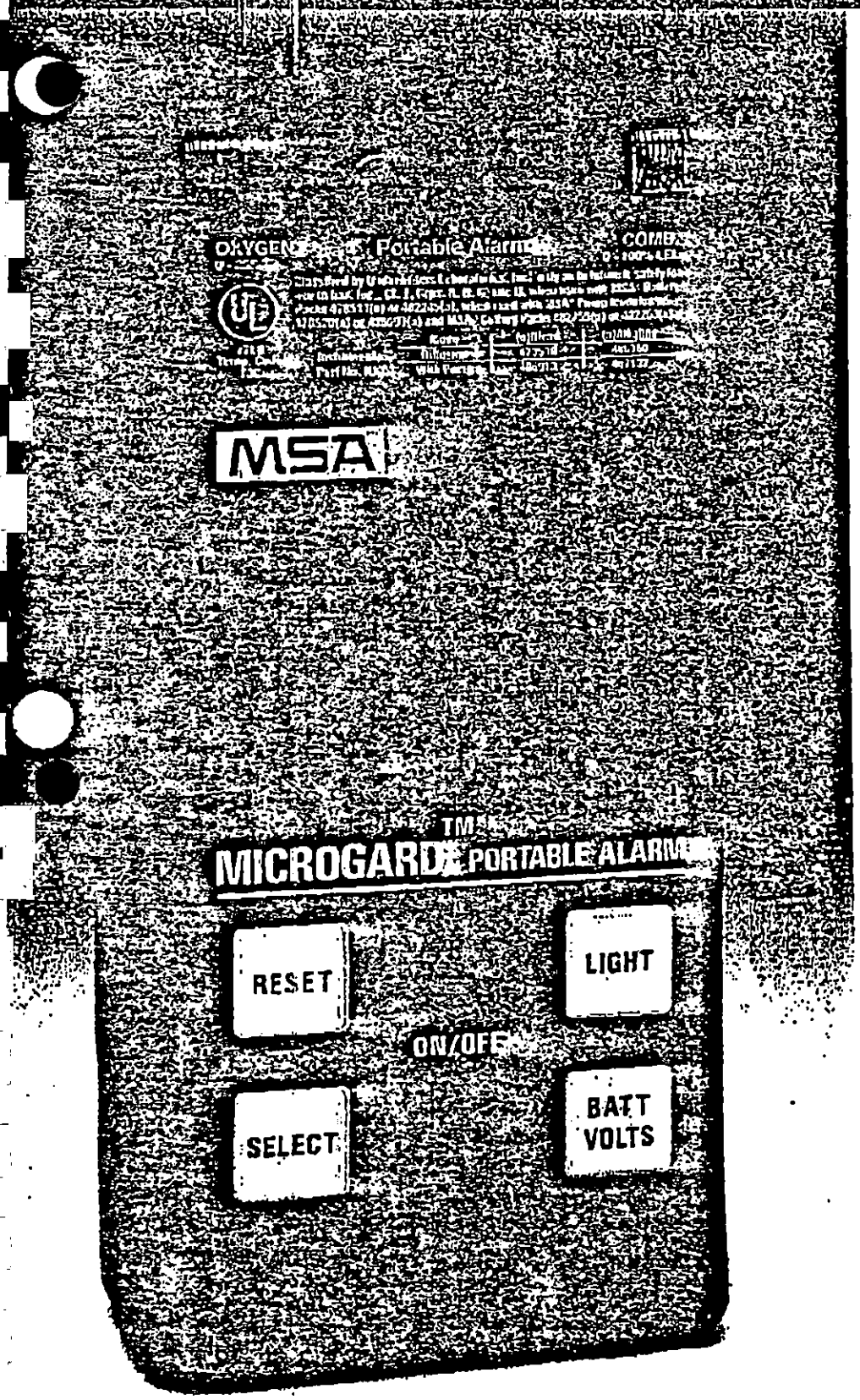
ACCESSORIES

Sampling Lines: For testing out-of-the-way areas. Available in various lengths on multiples of 5 feet. These nonabsorbent, synthetic rubber sampling lines have couplings for connecting to the instrument and a probe tube or rod, or to another length of sampling line.

Sampling Lines

Part No.	Description
11354	5-foot
11955	10-foot
11912	15-foot
11913	25-foot
11957	35-foot
11958	50-foot

MICROGARD PORTABLE ALARMS



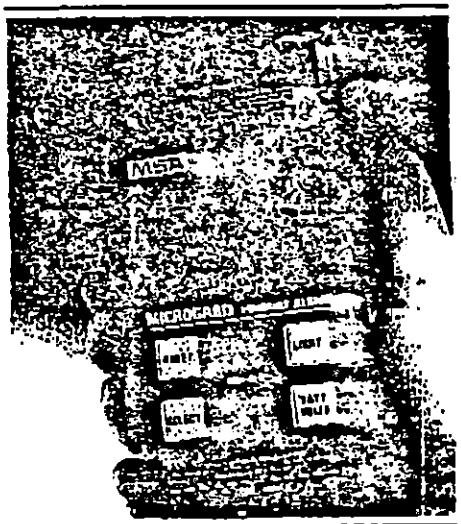
FEATURES

- State-of-the-Art Surface Mount Device (SMD) Electronics
- Seven Audible/Visual Alarms
- Rugged Housing
- Easy to Use Membrane Keypad Controls
- Rechargeable or Primary (Alkaline) Battery
- Optional Pump Module and
- Optional Aspirator Bulb Sampling Adapter
- RFI and Static-Resistant Case.

DESCRIPTION

MicroGard Portable Alarms are new generation pocket-sized instruments for simultaneously monitoring combustible gas and oxygen concentrations in work-place atmospheres and confined spaces, such as manholes, storage tanks, tank cars and shipyards. The MicroGard features state-of-the-art, compact SMD circuitry coupled with proven MSA combustible gas and oxygen sensors for reliable protection. In the diffusion mode, the instrument is ideal for hand-held, pocket, or belt-pouch use.

The MicroGard is very compact, and fits comfortably in most shirt pockets. Other modes of use include optional shoulder strap, wrist strap,



and belt pouch. The rugged case is made of flame-resistant Noryl® Plastic.

An ON/OFF switch, located on the front of the instrument behind a weather-resistant rubber boot, activates the unit. All other front-panel controls are contained within a sealed, membrane-switch keypad, and include SELECT, RESET, LIGHT, and BATT VOLTS.

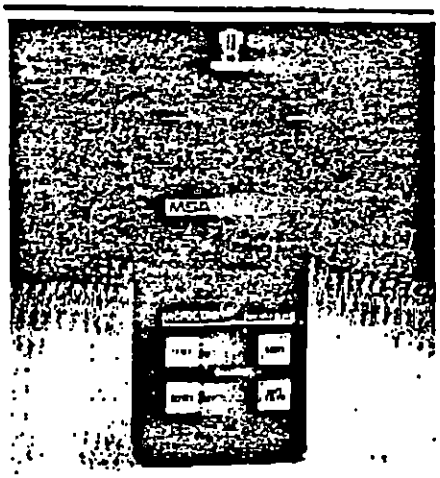
MicroGard combustible gas circuitry features either one of two combustible gas calibrations and readouts, depending upon model: 0-100% LEL (Lower Explosive Limit) with a general-purpose Pentane calibration, and 0-5% Methane-by-volume calibration; the latter model is primarily suited for gas utility and mining applications.

If the level of combustible gas concentrations in air exceeds the factory-set limit of 25% LEL (1.0% CH_4 on Methane-calibrated model), a blinking red LED and buzzer will activate, signifying an alarm condition. If the combustible gas indication reaches approximately 100% LEL (5% CH_4 on Methane model), the alarms latch and the display blanks to signify a possible over-range condition due to gas concentrations in the UEL range. An additional combustible alarm sounds if the sensor indicates a moderate below-zero signal, signifying one type of sensor failure.

MicroGard oxygen circuitry monitors the atmosphere for both oxygen-deficient and oxygen-enriched conditions. If oxygen concentrations, as measured by the partial pressure of oxygen, rise above the factory setpoints of 23% or below 19.5%, the Oxygen Alarm LED and buzzer will sound. Both the combustible gas and oxygen alarm circuits are latching, requiring activation of the RESET button to silence alarms. However, as a protective feature, all combustible gas and oxygen alarms cannot be reset until conditions have returned to levels within alarm setpoints.

MicroGard combustible gas and oxygen sensors are easily replaceable too, due to their plug-in design. The circuitry is designed for RFI resistance.

Battery condition of the MicroGard is monitored at all times, and low battery condition is communicated via

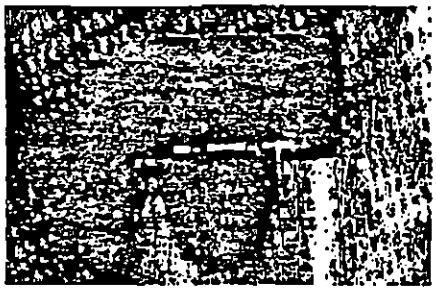


MicroGard Alarm with Sampling and Calibration Adapter (P/N 478530).

MicroGard Alarm with integral pump module.

two-stage alarm. In the first stage, "BATT" appears in the display, to warn of impending battery shutdown. When battery condition falls below levels to properly operate the instrument, audible and visual alarms activate and the display blanks.

For high-noise applications, an earphone is provided with the instrument. An optional external alarm module can also be used. This alarm module is powered by its own battery and can be clipped to a user's shoulder. Remote sampling with the MicroGard can be achieved via either Pump Module or Aspirator Bulb Adapter. The Pump Module is fully-integrating, providing a uniquely-compact device; the MicroGard battery pack is removed, and the remaining instrument body is inserted into the Pump Module. The Pump Module's battery pack (rechargeable Nicad or alkaline) will power both the pump and instrument for full-shift (8-hour) operation. MSA Probe Tubes and standard Sampling Lines, in



Pocket clip and protective screen covering sensors.

lengths from 5 to 50 feet, connect directly to the Pump Module.

Manual Aspirator Bulb remote sampling is accomplished via simple, slip-on adapter. MSA Probe Tubes and Sampling Lines attach to the flow-through aspirator bulb.

Caution: The combustible gas portion of the MicroGard Alarm has been designed to detect combustible gases and vapors in air. It is not capable of measuring the percentage of vapors in steam or inert atmospheres because of a lack of oxygen which is necessary to support combustion in the filament chamber. Neither will the instrument indicate the presence of explosive or combustible mists or sprays formed, as for example, by lubrication oils, or explosive dusts formed by grain or coal. The MicroGard is designed for use in air and is not to be used for the measurement of combustibles in atmospheres containing more than 25% or less than 10% oxygen by volume.

Limitations: Silanes, silicones, and other compounds containing silicon in the tested atmosphere may seriously impair response of this instrument. Some of these materials rapidly "poison" the detector filament so that it will not function properly. When there is even a suspicion that such materials are in the atmosphere being tested, the instrument must be checked frequently (at least after each five tests). A calibration kit is available to conduct this test. Leaded gasoline vapors can also poison the detector filament of this instrument. Oxygen-deficient (less than 10%) atmospheres may not indicate the true concentrations of combustible gas.

APPROVALS & STANDARDS

All MicroGard Portable Alarms are Classified by Underwriters' Laboratories, Inc. as to intrinsic safety only for use in hazardous locations, Class I Groups A, B, C, and D. They will perform within basic performance specifications when exposed to an RF field at the limits of acceptable human exposure as defined in ANSI C95.1.

All MicroGard Alarms (except LEL-only versions) are CSA Approved Class I, Groups A, B, C, and D. The single-unit 120-volt charger, Part Number 633548, is listed with Underwriters' Laboratories and CSA.

SPECIFICATIONS

Performance Characteristics:

(at 25° C ambient temperature after a 15-minute warm-up period)

Accuracy:

Oxygen: ± 0.3% oxygen at constant temperature and atmospheric pressure. ± 0.5% oxygen with temperature changes from calibration temperature over the range 0° to 40°C.

Combustible Gas: ±3% LEL for 0 to 50 % LEL and ±5% LEL for 50 to 100% LEL for Pentane-calibrated models. ±0.2% CH_4 for 0 to 2.5% CH_4 and ±0.3% CH_4 for 2.5 to 5.0% CH_4 for methane-calibrated models.

Ranges:

Oxygen: 1 to 25%

Combustible Gas: 0 to 100% LEL in air for Pentane models; 0 to 5.0% CH_4 in air for Methane models

Response Time (Aspirator Mode):

Oxygen: 90% of final reading in 10 seconds at 32° to 104°F (0° to 40° C) 90% of final reading in 3 minutes at 0°F (-18° C)

Combustible Gas: 90% of final reading in 8 seconds

Oxygen Sensor Life:

One year warranty when used at atmospheric pressure containing 20.8% oxygen or less without the presence of poisoning agents.

Operating Temperature Range:

Oxygen: 32° to 104°F (0° to 40° C) normal; Low limit is 0°F (-18°C) when calibrated at temperature of use. High limit is 122° F (50° C) when calibrated at temperature of use; however, service life may be reduced with prolonged exposure to this temperature.

Combustible Gas: 32° to 122°F (0° to 50°C); Low limit 0°F (-18°C) if calibrated at temperature of use.

Operating Characteristics:

Power Supply:

Nicad: Sealed, rechargable 2.4 volt, 2.0 ampere-hour nickel-cadmium battery pack.

Operating Time: 8 to 10 hours nominal continuous usage at normal ambient temperature, with fully charged Nicad battery pack. 8 hours at 32°F (0°C), with fully charged Nicad battery pack, depending upon battery condition.

Alkaline: 3-volt alkaline battery pack with two-user replaceable "C" Cells (Duracell MN 1400 only)

Operating Time: Up to 24 hours continuous usage at normal operating temperature, with alkaline batteries. 8+ hours nominal continuous usage at 32°F (0°C) with fresh alkaline batteries.

Readout:

Liquid Crystal Display (LCD) with 0.5" high digits

Physical Characteristics:

Case Construction:

Flame, RFI and Static-Resistant Noryl Plastic filled with stainless steel fibers.

Dimensions:

5-3/4" high x 2-3/4" wide x 1-1/8" deep (Instrument only)

8-1/4" high x 2-3/4" wide x 2-1/2" deep (Instrument in Pump Module)

Weight:

14.3 ounces (0.41 kg) (Instrument only)

27.9 ounces (0.79 kg) (Instrument in Pump Module)

Supplied Accessories:

Wrist Strap

Earphone

ORDERING INFORMATION

MicroGard Model Identification				
Portable Alarm Mode of Operation/ Supplied Battery Pack	Gas Calibration			
	0-25% Oxygen 0-100% LEL	0-25% Oxygen 0-5.0% CH_4	0-5.0% CH_4	0-100% LEL
Diffusion/ Rechargeable Nicad Battery Pack (478510)	Part No. 478500	Part No. 482250	Part No. 482260	Part No. 492501
Diffusion/Alkaline Battery Pack (482245)	485360	485359	485361	492502
Pump Module (478520)/ Rechargeable Nicad Battery Pack (482255)	* 486913	487135	487470	492504
Pump Module (485693)/Alkaline Battery Pack (482259)	487137	487138	487471	492505

Charging Accessories:

Part No.	Description
633548	Charger, 120-volt, Single-Unit
478490	Charger, 12-volt, Single-Unit, for auto use
478540	Charger, 120/240 volt, Five-Unit

Sampling Accessories:

Part No.	Description
478530	Sampling and Calibration Adapter (requires P/N 485800 for aspirator bulb sampling)
485800	Aspirator Assembly for use with P/N 478530
478520	Pump Module, Rechargeable Nicad Batteries, less charger
485693	Pump Module, Replaceable Alkaline "C" Batteries
74814	Line Trap
11354	Sampling Line, synthetic rubber, with couplings, 5 ft
11955	Sampling Line, synthetic rubber, with couplings, 10 ft
11912	Sampling Line, synthetic rubber, with couplings, 15 ft
11913	Sampling Line, synthetic rubber, with couplings, 25 ft 15%
11958	Sampling Line, synthetic rubber, with couplings, 50 ft
11961	Probe tube, hollow brass, 3 ft
73743	Probe tube, hollow plastic, 3 ft
11960	Probe tube, solid brass, 4 ft
486934	Probe tube, hollow plastic, 18 inches long

Replacement Parts:

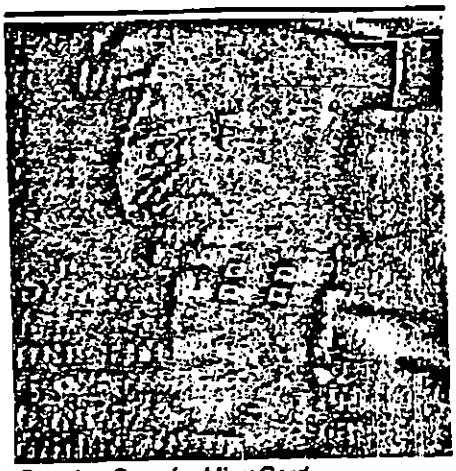
Part No.	Description
474407	Wrist Strap
633722	Earphone
482249	Dust Plug for Earphone Jack
482248	Pocket Clip
478538	Instruction Manual
478510	Battery Pack, Nicad Rechargeable, for Instrument
482245	Battery Pack, Alkaline, for Instrument
482255	Battery Pack, Nicad Rechargeable, for Pump Module
482259	Battery Pack, Alkaline for Pump Module
633546	Battery, Alkaline, "C", Duracell MN1400
473840	Pushbutton boot, rubber
629250	Alarm Buzzer
480566	Oxygen Sensor
478537	Combustible Sensor

Calibration Accessories:

Part No.	Description
For diffusion MicroGard use:	
476610	Calibration Check Kit, Model R, with 0.25 lpm Flow Control Regulator, complete, (less calibration gas), including:
	459949 Flow Control, 0.25 lpm
	449482 Adapter Hose
For MicroGard use with Pump Module:	
476609	Calibration Check Kit, Model R, with 1.5 lpm Flow Control Regulator, complete, (less calibration gas), including:
	459948 Flow Control, 1.5 lpm
	449401 Adapter Hose
Select appropriate Gas:	
476304	Calibration Check Gas, 0.75% Pentane and 15% Oxygen, for Pentane-calibrated MicroGard
459942	Calibration Check Gas, 2.5% Methane-in-Air, for Methane-Calibrated MicroGard

Miscellaneous Accessories:

Part No.	Description
474555	Shoulder Strap
478533	Carrying Case for Instrument
478529	Carrying Case for Pump Module
485659	Travel Case for MicroGard and Access.
485695	Remote Alarm Module



Carrying Case for MicroGard

Repairs

MSA's strategically located Regional Repair and Service Centers are staffed with specialists who have the knowledge and the equipment to provide testing, calibration, and repair of MSA MicroGard Portable Alarms, with genuine MSA replacement parts. Product modification or repair by anyone other than certified MSA personnel may void warranties and approvals. For the location of your nearest MSA Service Center, call toll-free at 1-800-MSA-2222.

Note: This Data Sheet contains only a general description of the MSA MicroGard Portable Alarms for Combustible Gas and Oxygen. While uses and performance capabilities are described, under no circumstances should this product be used except by qualified, trained personnel, and not until the instructions, labels or other literature accompanying the product have been carefully read and understood and the precautions therein set forth followed. Only they contain the complete and detailed information concerning this product.

MSA Offices and representatives in principal cities worldwide.
In U.S. call nearest stocking location toll free at 1-800-MSA-2222.
For MSA International, call (412) 967-3249 or Fax (412) 967-3451.

Corporate Headquarters: P.O. Box 426, Pittsburgh, PA 15230 USA.

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ESCORT SAMPLING PUMP

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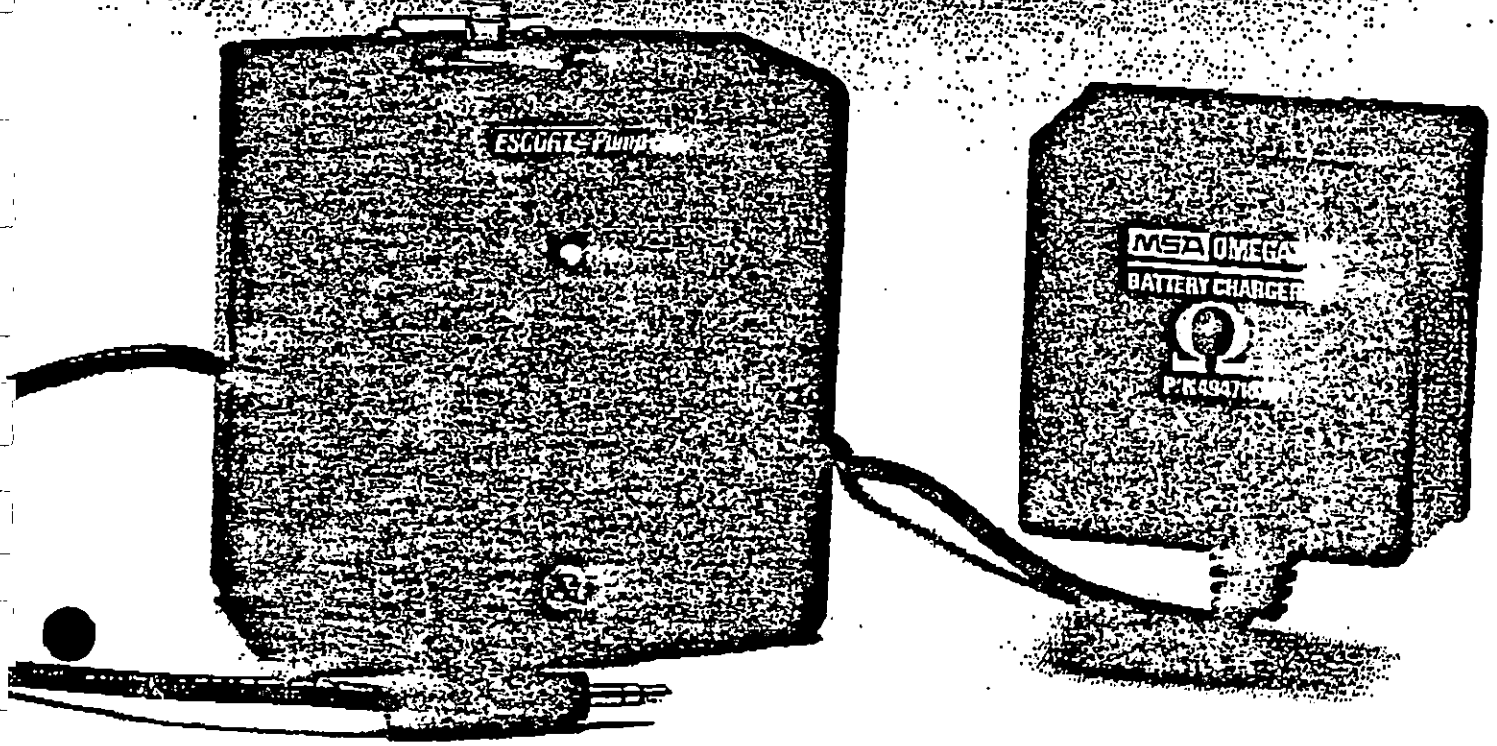


FEATURES

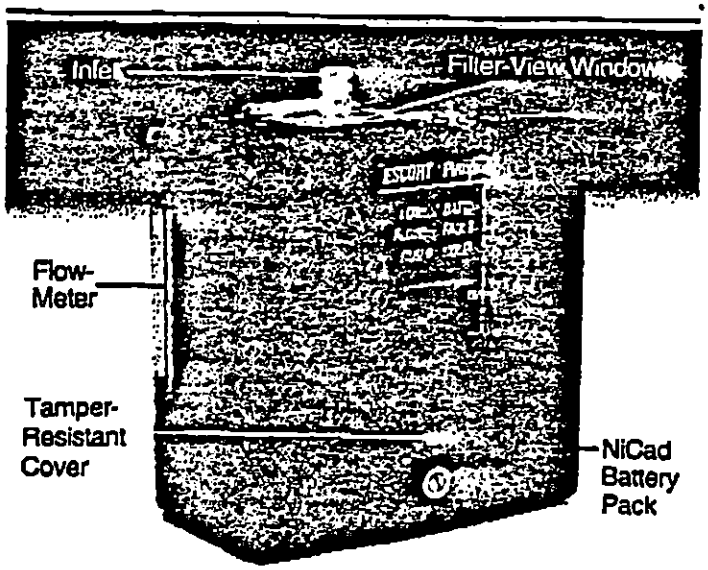
- Resistant to water spray while running
- Inlet filter traps moisture and particulate matter
- Stainless steel impregnated ABS plastic case provides RFI/EMI protection
- Weighs only 19 ounces
- Exceptionally quiet operation
- Elapsed time readout
- Flow-Fault Indicator shows if sample inlet is blocked
- Low-Battery Indicator
- State-of-the-art electronic flow control
- Designed to meet IP66 standard for water and dust tightness

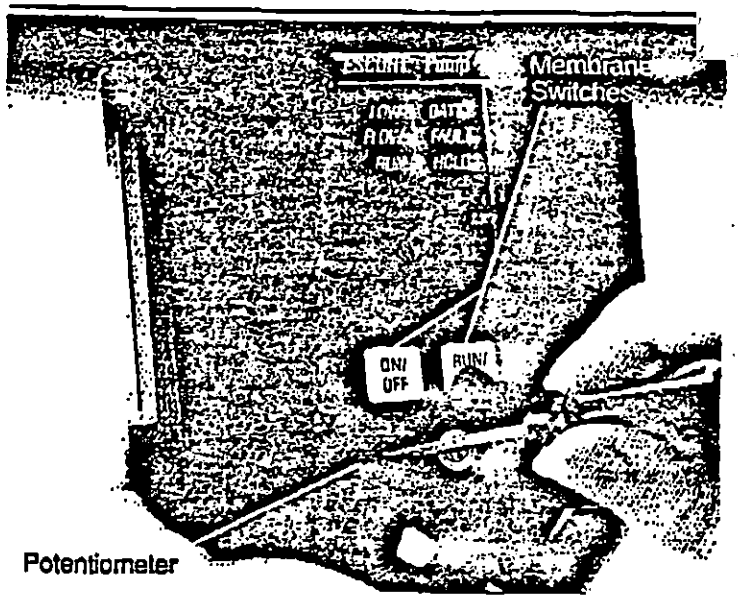
DESCRIPTION

The Escort Sampling Pump can be used with a variety of personal and area sampling devices to collect such airborne contaminants as asbestos fibers, toxic gases, vapors, particulates, fumes and mists. It can also be used to sample silica dust, coal dust and organic vapors.

Escort Pumps provide regulated flow for many types of sample collection media, including filter discs, charcoal tubes and other sorbent tubes, impingers and reagent filter discs.

Exceptionally compact, lightweight and quiet in operation, the Escort Pump promotes rapid user acceptance. Engineered for exposure to the elements, the unit can be exposed to water spray while operating.





State-of-the-art electronics provide constant flow (volume) control, with ±5% regulation of flow rate and automatic compensation for changes in battery voltage, temperature, altitude and sample load.

The circuit board is assembled with surface-mount devices (SMD) which provide an extremely compact module.

The internal diaphragm pump provides vacuums comparable to heavier, bulkier pumps. Normal flow range of the Escort Pump is 0.5 to 3 liters per minute (lpm), covering most industrial hygiene applications. Flow rates down to 1 milliliter per minute (mlpm) are attainable when the Gemini™ Twin-Port Sampler is used (See page 3).

The stainless steel-filled plastic case provides protection against electromagnetic or radio-frequency interference (EMI and RFI, respectively). The unit is assembled with rust-proof stainless steel screws. A belt clip allows the unit to be worn at the waist.

The Escort Pump has three controls — an ON/OFF key, a RUN/HOLD key, and a flow-rate potentiometer, all of which are located behind a tamper-resistant cover held in place with a set screw. This cover helps prevent unauthorized access to control functions.

The multi-turn potentiometer provides precise adjustment of flow rate, which can be viewed on the integral flow meter. The flow meter is graduated in 0.2 lpm divisions and is easier to read because it has a higher resolution than flow meters on many other pumps.

To help avoid accidental shut-off of the pump, the ON/OFF key has a time-delay switch that requires the user to hold it down for two full seconds before the unit turns on or off. When the Escort Pump is on, an amber light-emitting diode (LED) illuminates.

The RUN/HOLD key works like a "pause" button, allowing the user to temporarily stop sampling without resetting the elapsed time reading. The amber LED flashes when the unit is in the hold mode. Pressing the key again restarts the pump as well as the elapsed time indicator.

For protection against moisture, the ON/OFF and RUN/HOLD keys are membrane keys, protected by a sealed plastic overlay.

Three gaskets seal the case, making the unit resistant to water spray and dust while running. This feature is especially important to asbestos abatement workers who pass through decontamination showers while wearing the unit. The gaskets are located between: the main body of the pump and front face; battery pack connection and main body; and the inlet filter and tubing connector.

A special Teflon* filter prevents water and dust from being drawn into the pump mechanism, thus increasing service life. A transparent view window over the filter on the inlet lets the user see anything that has accumulated on the filter. The inlet filter is field replaceable.

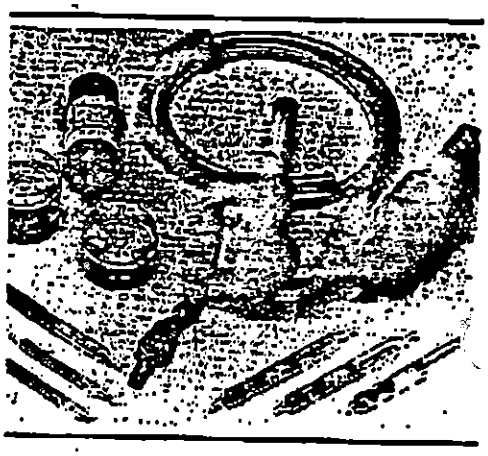
The four-digit elapsed time readout is a liquid crystal display (LCD) that shows cumulative minutes of operation for easy calculation of time-weighted averages (TWAs). It retains the last reading when the pump is off, in the hold mode, or in the event of flow blockage or low-battery shut-down.

The Escort Pump includes separate red LEDs to indicate flow blockage and low battery.

The state-of-the-art mechanical design of the Escort Pump is highly efficient, allowing the use of a compact rechargeable NiCad battery pack. Its compact size helps keep the overall weight of the pump low.

Battery life varies, depending on the selected flow rate and the pneumatic load imposed by the chosen sampling device, but in most cases the Escort Pump will operate for a full eight-hour shift before charging is necessary (see Figure 1).

The port for the charging jack is located on the battery pack, rather than the pump module, so that the battery can be charged either while on the unit, or when removed.



Sample collection media.

*Trademark of the Du Pont Company

OPERATION

The Escort Pump is designed for simple operation. Set-up is easily accomplished by:

1) Attaching a sample collection device, such as a filter cassette, to the pump's inlet fitting;
2) Loosening and rotating the front cover;
3) Pressing and holding the ON/OFF membrane key for two seconds;
4) Setting the flow rate to the desired level by adjusting the potentiometer with the supplied screwdriver; and
5) Closing and tightening the front cover.

During pump operation, an electronic signal output proportional to the motor speed is generated.

This signal is then compared via an error amplifier with a set-point voltage established by the flow control. If the motor speed signal is not equal to the set-point voltage, the error amplifier adjusts the motor drive circuit to make the flow rate equal to the set-point value. Sample flow is then closely controlled at this rate until a flow adjustment is made by the user.

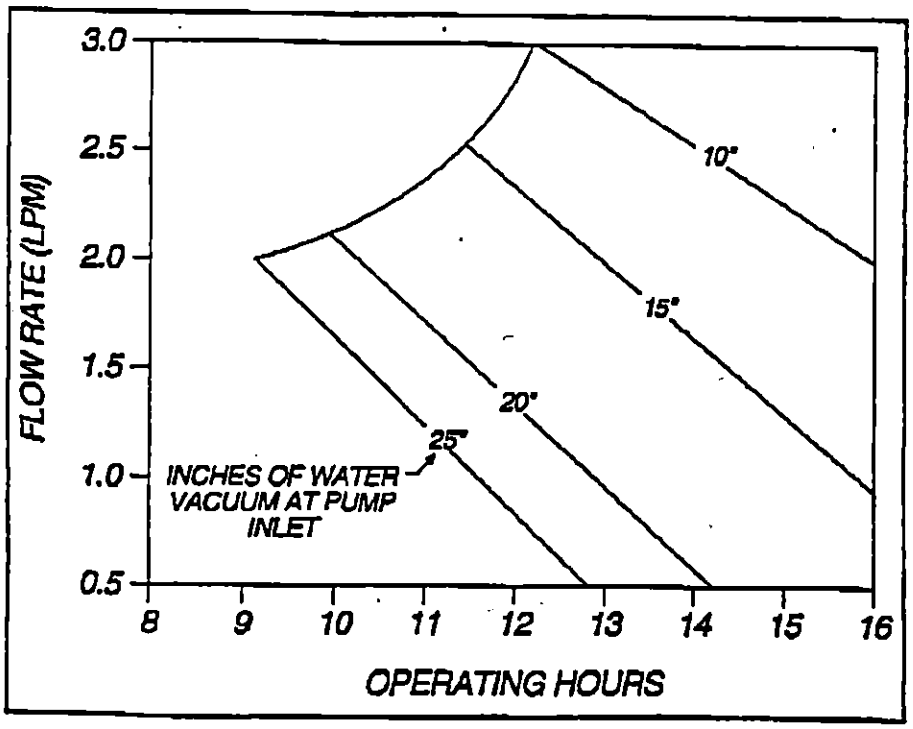
When the flow control potentiometer is turned to increase or decrease the sampling flow rate, the error amplifier output causes the motor drive circuit to increase or decrease pump speed. When the flow signal reaches the set-point level, the pump is held at a constant speed, and hence, sample flow is maintained at a new fixed rate.

If ambient pressure, temperature or sample-loading changes occur, the speed is automatically adjusted to compensate for a decrease or increase in flow rate.

The LCD display automatically sets itself to zero when the pump is first turned on. The timer accumulates and displays total elapsed running time in minutes. When the pump is turned off, the elapsed running time remains on the display so that it can be recorded by the user. Only when the pump is turned on again will the timer reset to zero.

In the event that a flow blockage occurs, the Flow-Fault Indicator circuitry illuminates a red LED to alert the user. Within one minute, the pump automatically shuts off, but the cumulative elapsed time remains on the display.

If the battery drops below 4.1 volts, a low-battery condition results. When this condition occurs, a separate red LED illuminates and the pump immediately shuts off. The reading on the timer is retained for user reference. Further battery drain is limited to just a few milliamperes, which helps prevent damage to the battery pack through deep discharge.



Typical flow and load regime for Escort Pump.

SPECIFICATIONS

Electrical Characteristics:

Power Supply: 4.8-volt battery pack of four nickel cadmium cells

Battery Pack Capacity: 1.7-1.8 ampere hour

Battery Pack Recharge Time: 14-16 hours (overnight) with Omega™ Charger

Typical Battery Pack Life: 300 or more charging cycles

Operating:

Flow Control: Volumetric flow rate held within ±5% of set-point over entire operating range, with automatic compensation for battery voltage, altitude, temperature and sample load changes of 10 inches of water.

Flow Rate: Flow rate adjustable between 0.5 and 3 lpm; lower flow rates attainable (to 1 mlpm) with optional Gemini Twin-Port Sampling accessory

Flow Indication: Integral Flow meter graduated in 0.2 lpm divisions

Operating Range: 30 inches of water load up to 2 lpm; 20 inches up to 2.5 lpm and 10 inches up to 3 lpm

Flow Blockage Detection: Flow-Fault LED comes on immediately when block is detected. Pump shuts down within one minute if block is not cleared.

Elapsed Time Readout: To 9999 minutes with a resolution of 1 minute. Holds last reading after either flow or battery shut-down and when pump is off or in hold mode.

Operating Time: Varies with flow rate and sampling device loading. Minimum eight-hour operation at 2.5 lpm with 15-inch water load.

Operating Temperature Limits: 32-113°F (0-45°C); While charging, 50-86°F (10-30°C)

Altitude Compensation: Below sea-level to at least 10,000 feet (3,035 meters) above sea level.

Physical:

Weight: 19 oz (550 gm), with battery pack

Dimensions: 2" deep x 4" high x 3-7/8" wide (5.1 cm x 10.3 cm x 9.8 cm), with battery pack

Serial Number Identification: Located inside housing

ORDERING INFORMATION

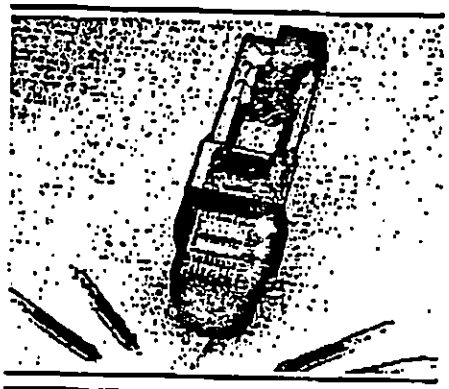
Part No.	Description
803371	Escort Pump Kit, includes: pump, tubing, screwdriver (for potentiometer adjustment), and instruction manual
* 802876	Escort Pump Kit, same as above, but includes single-unit 110v Omega Charger.
802877	Escort Pump/Gemini Sampler Kit, includes: Part Nos. 802876 and 497697
802626	5-Pump Escort Kit, includes: five Escort Pumps, tubing, instruction manuals and 5-unit battery charger (Part No. 801759)

Chargers (all 50/60 Hz)

* 494716	110v Single-unit Omega Charger
495965	220v Single-unit Omega Charger
801759	Five-unit Omega Charger, 110/220v adaptable

Replacement Parts

497702	Battery pack with O-Ring
802897	One Replacement Inlet Filter
800503	Replacement Instruction Manual
802922	Escort Pump Overhaul Kit (contains common components needed for routine maintenance.)



ACCESSORIES

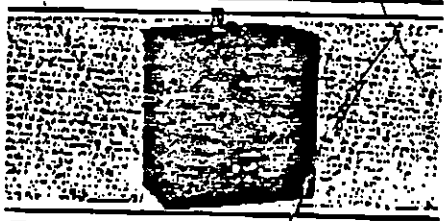
Gemini® Twin-Port Sampler

For low-flow control when sorbent tubes are used, the Gemini Twin-Port Sampler is a valved mechanism that allows flow adjustment down to 1 mlpm (0.001 lpm).

As an added benefit, the Gemini accessory permits simultaneous sampling from two sorbent tubes, with independently controlled flow rates of each.

Dual sampling means two like sorbent tubes can be attached for simultaneous sampling at different flow rates, or two different tubes can be used to sample two types of substances at once.

497697	Gemini Twin-Port Sampling Kit, includes: Gemini Sampler, tube protectors, Y-connector, clips, and carrying case.

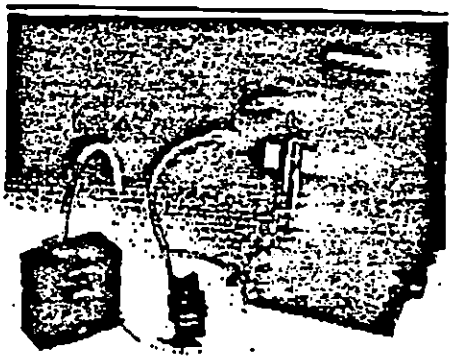


Tamper-Evident Labels

Special tamper-evident labels are available from MSA to indicate if an unauthorized worker attempts to access the control functions. These adhesive backed labels are applied over the front cover set screw after the unit is set up. These labels will not remain intact if removed.

802698	Sheet of 10 Tamper-Evident Labels

Flow Indicators



Part No.	Description
635477	OptiFlow™ Digital Flow Indicator, Model 660, 5 mlpm to 5 lpm
635478	OptiFlow Digital Flow Indicator, Model 735, 0.1 lpm to 16.5 lpm
635479	PC Link Data Package and computer interface box (compatible with IBM-type machines having DOS 2.0 or higher and a male DB25 RS-232 port)

APPROVALS & STANDARDS

Escort Sampling Pumps are U.L. Listed as intrinsically safe for use in hazardous locations - Class I, Groups A, B, C, D; Class II, Groups E, F and G; and Class III, Division I locations.

SERVICE

MSA's strategically located Regional Service Centers are staffed with specialists who have the knowledge and the equipment to provide testing, calibration and repair of Escort Pumps, with genuine MSA replacement parts. Product modification or repair by anyone other than certified MSA personnel may void warranties and approvals.

Call MSA toll-free at 1-800-MSA-2222 for the location of your nearest Service Center.

MSA Offices and representatives in principal cities worldwide.
In U.S. call nearest stocking location toll free at 1-800-MSA-2222.
For MSA International, call (412) 967-3249 or Fax (412) 967-3451.

Corporate Headquarters: P.O. Box 426, Pittsburgh, PA 15230 USA.

Data Sheet 05-00-01

Printed in U.S.A. 4407(L)

AIR/GAS SAMPLING BAGS

THE PRACTICAL METHOD FOR DATA COLLECTING

Our 5-layer (U.S. Pat.) Sampling Bags provide a simple, economical method of collecting and transferring air/gas samples to a centrally located laboratory or test instrument for analysis.

- **Extremely simple to use and maintain**
- **Does not require highly trained technicians to operate**
- **Will pinpoint IF and WHERE a gas or pollution problem is present without investing in expensive equipment**
- **Ideal for hard to reach locations**

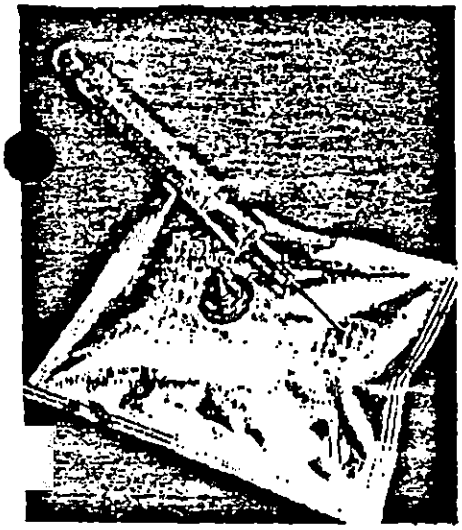


FIG. 1

In contrast to other single-layer plastic materials generally in use, the silvery Calibrated Instruments Gas Sampling Bags are made by a special process (U.S. Patent) of 5 different layers of materials bonded together to form a single flexible material 5.5 mil thick.

FIG. 2

These bags have many applications, since the 5 layers will not permeate any gases in or out, will not chemically interact with gases, and will not absorb or adsorb to any degree. The bags can also be used to collect vapors and for use with odor test panels.

FEATURES:

- A syringe for entry and withdrawal can be used with the silicone rubber septum attached to the outside of the bag. The septum is not in contact with gas on the inside until the syringe needle penetrates. (Fig. 1)
- A special ON/OFF valve combination hose bib easily connects to standard tubing and can be opened and shut as required.
- The Snout Entry Bag comes sealed. Easily snipped open to connect to special bubble tubing, and can be resealed many times.

The bags can withstand pressures to approx. .46 atm - 6 to 7 lbs. and temperatures up to 150°F. Exposing to higher temperatures for short periods is acceptable. If high-temperature stack gases are to be collected, tubing long enough to allow the gases to cool to 190°F before they enter the bag should be used.

PULSE PUMP Model #3 (Fig. 3)

The sampling bags may be used in conjunction with a battery operated pump that can be worn by the individual doing the sampling (Fig. 2) or can be mounted at the test site. The pump has infinitely adjustable flow rates from approximately 1 to 85 liters per hour (.0166 liters per minute to 1.5 liters per minute). Inlet and outlet ports for filling of gas sampling bags as well as for use with charcoal tubes and mini impingers.

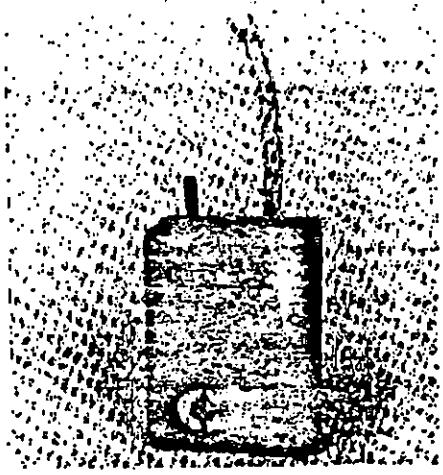


FIG. 3

CALIBRATED INSTRUMENTS, INC.
200 SAW MILL RIVER ROAD HAWTHORNE, NEW YORK 10532
TEL: (914) 741-5700 TELEX: CALIB AKLY 131 423 FAX: (914) 741-5711

APPLICATIONS FOR Cali5Bond™ GAS SAMPLING BAGS

Cali-5-Bond™ Gas Sampling Bags have been a valuable means for establishing standards in industrial hygiene for many years. One of the most popular uses of the Cali-5-Bond™ bags is to determine if indeed there is a problem, the severity of the situation, and possibly where it occurs. This is far simpler and, of course, more economical than using expensive, dedicated and sophisticated gas analytical instruments at the site.

To cite examples:

- When a new process is introduced in manufacturing, to assure a safe workplace.
- To check the Time Weighted Average quality of ventilated air in a coal mine.
- To trace and evaluate a plume of stack gas in the open.
- To quickly ascertain the safety for breathing in a confined space (manhole, etc.).
- To determine the extent of a gas leak or spill, etc.

These are direct methods not subject to the many possible errors with other sampling techniques which require intermediate steps. Gas Sampling technology offers another advantage. It is not necessary to keep track of the precise volume collected or the elapsed time required to obtain the sample. When this method is used correctly, the collected sample is truly representative of the environment when and where collected, either as a grab sample or a Time Weighted Average over a selected period of time.

Further, employing sophisticated, expensive gas analyzers to establish concentration levels usually means being restricted to one fixed monitoring point. In contrast, totally portable gas sampling bags permit absolute freedom of movement and measurement over a wide area of selected points..

Any gas sampling bag technique is dependent upon the quality of the sampling bag used. Sample bag construction and materials must insure the physical integrity of any sample taken. In order for a collected sample to be truly representative of the environment when it was collected and to store the sample without change for a reasonable length of time, it is essential that bags have these properties:

- Bag material should be chemically inert
- Bags must not absorb or adsorb collected gas samples
- Bags must be impermeable (in or out)
- Bags should not become brittle (especially around valve) or otherwise deteriorate with time.
- Bags should be mechanically strong to resist rough and repeated handling in the field
- Bag material should be opaque rather than transparent to protect collected gases from changes due to ultraviolet or other light exposure

Our Cali-5-Bond™ Gas Sampling Bags fulfill all of these requirements. Gas sampling bags are useful for still many more applications. The precision gas standards prepared according to I.S.O. procedures are easily accomplished. Cali-5-Bond™ Gas Sampling Bags may be purchased with the new Luer-Fit Valve™ and/or a self-sealing silicon septum to permit easy syringe injection or withdrawal.

Gas analyzers may be calibrated in remote field locations by taking these same calibration gases in Cali-5-Bond™ Gas Sampling Bags to the instrument site.

We can manufacture bags in any size and type to your exact specifications.

CALIBRATED INSTRUMENTS, INC.
200 SAW MILL RIVER ROAD HAWTHORNE, NEW YORK 10532
TEL: (914) 741-5700 TELEX: CALIB ARLY 131 423 FAX: (914) 741-5711

AIR/GAS SAMPLE COLLECTION SYSTEM COMPONENTS AND ACCESSORIES

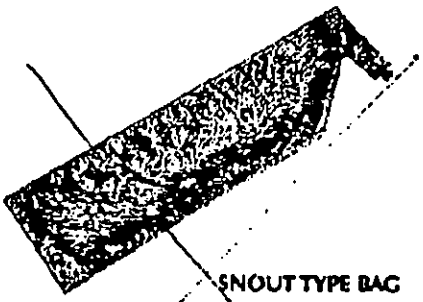
Cali-5-Bond™ GAS SAMPLING BAGS

Truly non-permeable Cali-5-Bond™ Gas Sampling Bags are made by a special bonding process (U.S. Patent) of layering 5 different materials into a single inert flexible sheet 5.5 mil thick. This material ensures the integrity of collected sample until field or lab analysis is completed.

An outer layer of polyester provides added strength and surface durability to these *flexible metal containers*. Totally opaque, a middle layer of aluminum foil prevents UV degradation of collected samples. Cali-5-Bond™ Bags may also be used for sampling liquids for gas-liquid combinations.

PILLOW-SHAPE BAG

Cali-5-Bond™ Bags are available in Pillow or Snout shape. Standard sizes up to 170 liters are supplied with the new Luer-Fit Valve™ or the ON/OFF (twist-type) with hose bib tubing connection.

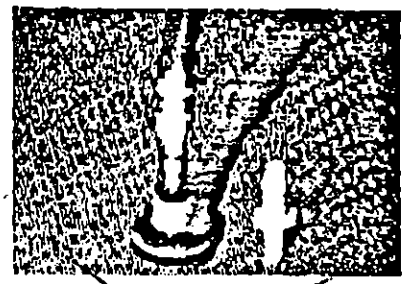


SNOUT TYPE BAG

Snout entry bags come sealed. Easily snipped open to receive a special bubble tubing, the snout can be used as a purging port prior to reusing the bag. Snout ports are resealable.

LUER-FIT VALVE™

- Secure, self-closing valve
- Cannot be opened or left opened accidentally. NO LOST SAMPLES!
- Fits any standard Luer taper syringe barrel
- Eliminates dangerous needles
- Lasts indefinitely
- Use with Hann-Pump™ and with Quik-Mate™ Connector

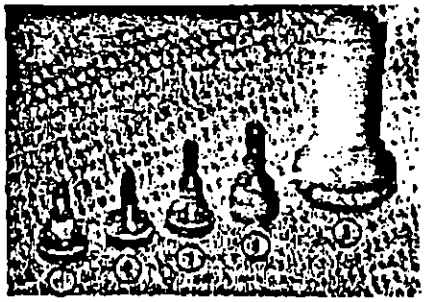


QUIK-MATE™ CONNECTOR

Flow-through adaptor for instant (push-pull) connection of tubing to Luer-Fit Valve™.

HANN-PUMP™

- Provides the simplest, most economical grab sampling available. Foolproof.
- Mates directly with new Luer-Fit Valve™. Just squeeze the pump.
- Dual purpose: fill or empty bags. Move gas samples in and out of bags by reversing ends of the Hann-Pump™
- Discard after use. Eliminates costly and time-consuming decontamination.



OPTIONAL VALVES

1. Luer-Fit Valve™
2. Twist-type, 1.0" high, with hose bib connection
3. Twist-type, 1.5" high, with hose bib connection
4. ¼" I.D. straight through connection with threaded cap closure. Also use as additional purging port.
5. Large cross-section entry nozzle (¾" I.D.) for human breathing, physiological testing, etc.

PULSE PUMP™ MODEL III

Air Sampling Pump. Operates on 2 standard batteries (1.5 v/9v) which provide up to 42-46 hours of continuous operation. Adjustable flow rates from 1-85 liters per hour. Measures approximately 5" x 3" x 2". Weighs 13 oz.

SYRINGES

Syringes for withdrawal or injection through silicone rubber septum or Luer-Fit Valve™. Sizes 10cc and 50cc.

SYRINGE CHECK VALVE

Provides needleless syringe entry into open-ended tubing.

CALIBRATED INSTRUMENTS, INC.
200 SAW MILL RIVER ROAD HAWTHORNE, NEW YORK 10532
TEL: (914) 741-5700 TELEX: CALIB ARLY 131 423 FAX: (914) 741-5711

Air & Gas Sample Collection Products

Calibrated Instruments, Inc.
200 Saw Mill River Road
Hawthorne, New York 10532
Tel: (914) 741-5700
Fax: (914) 741-5711

Cali-5-Bond™ Gas Sampling Bags (GSB)

5-Layer Material • Non-Permeable • Inert • Totally Opaque • Extra Strength • 5.5 Mil Thick

Item Number	Standard Shape	Size (in) (approx)	Capacity (approx)	Cost per Unit (US$) 1-50	51+	150+
GSB - P / 3X5	pillow	3 x 5	0.1 (liters)	$ 16.35	$ 15.75	$ 15.25
GSB - P / 4x6	pillow	4 x 6	0.5	17.25	16.40	15.70
* GSB - P/1	pillow	6 x 6 (a)	1.0	18.15	17.50	16.90
GSB - PCC / 1	pillow (cc)	6 x 9.5 (b)	1.0	18.15	17.50	16.90
GSB - S / 1.2	snout	6 x 11	1.2	19.50	18.50	17.95
GSB - PCC / 2	pillow (cc)	8 x 12	2	24.70	23.95	23.50
GSB - S / 2	snout	8 x 15	2	24.70	23.95	23.50
GSB - PCC / 5	pillow (cc)	8 x 23	5	27.00	26.20	25.80
GSB - S / 5	snout	8 x 27	5	27.00	26.20	25.80
GSB - P / 10	pillow (cc)	16 x 14	10	30.40	29.60	28.90
GSB - S / 10	snout	16 x 16	10	30.40	29.60	28.90
GSB - P / 15	pillow	16 x 19	15	33.00	32.00	–
GSB - PCC / 22	pillow (cc)	16 x 25	22	35.00	33.95	–
GSB - S / 22	snout	16 x 25	22	35.00	33.95	–
GSB - PCC / 44	pillow (cc)	24 x 24	44	41.50	40.25	–
GSB - S / 44	snout	24 x 24	44	41.50	40.25	–
GSB - P / 60	pillow	31 x 23	60	61.70	59.85	–
GSB - P / 90	pillow	31 x 31	90	82.50	79.00	–
GSB - P / 170	pillow	31 x 49	170	142.25	117.75	–
GSB - P / 200	pillow	31 x 55	200	180.00	166.00	–

5 - Layers: Polyester, Polyvinylidene Chloride, Aluminum Foil, Polyamide, High Density Polyethylene
(a)(b) 1-liter bags vary in shape; shipped as available from stock
(cc) corner cut
Price includes Twist-type (1.0") Valve / or / Straight-Thru Connection & Septum
Custom Bag Sizes & Shapes Available

Gas Conditioning & Handling (GCH)

Item Number	Description	
GCH - DM/D	DM™ Series: Portable Gas Sample Dryer with dessicant	$ 40.00
GCH - DM/R	Dessicant Refill; Packet for DM™ Gas Sample Dryer	3.00

Valves (V)(STOP)

		First Unit	Additional
V - NPB-1/TT	NPB / on-off / twist-type / 1.0" / hose barb	N / C	$ 3.85
V - NPB-2/OO	NPB / on-off / twist-type / 1.38" / hose barb / "OO"	$ 1.50	5.35
V - SS-2/OO	SS / on-off / twist-type / 1.38" / hose barb / "OO"	By Quotation	
V - L/F-1	DEL / Luer-Fit with Quik-Mate	1.50	5.35
V - NPB-S/1.38	NPB / tire / 1.38" / threaded cap (1/4" OD)	N / C	3.85
V - CHR-S/1.12	CHR / tire / 1.12" / threaded cap (1/4" OD)	N / C	3.85
STOPBASE - F	Stopcock Base; bag adapter (DEL)	N / C	3.85
STOPCK - ROT/L1200	Stopcock; rotating Luer; polycarbonate	N / C	2.25
STOPCK - L/S1100	Stopcock; Luer slip; polycarbonate	N / C	2.25
STOPCK - SEP	Stopcock Septum; twist; polycarbonate; latex	–	.75
STOPCK - DE/1500	Stopcock Plug	–	.15

Straight Thru Connections (STC)

STC - NPB-S-1.38	NPB / tire / 1.38" / threaded cap (1/4" OD)	N / C	$ 3.85
STC - CHR-S-1.12	CHR / tire / 1.12" / threaded cap (1/4" OD)	N / C	3.85
STC - NPB-F-SR	NPB / 1.38" / swage ring	N / C	3.85
STC - SS-F-SR	SS / 1.38" / swage ring	By Quotation	
STC - POLY-.75ID	3/4" ID / 2.5" / polypropylene	$ 17.50	17.50

Legend

AL	=	Aluminum
CHR	=	Chrome
DEL	=	Delrin
N/C	=	No Charge
NPB	=	Nickel Plated Brass
P	=	Pillow
PCC	=	Pillow / Corner Cut
PS	=	Polysulfone
PVC	=	Polyvinylidene Chloride
S	=	Snout
SS	=	Stainless Steel
STC	=	Straight Thru Connection

Notes:

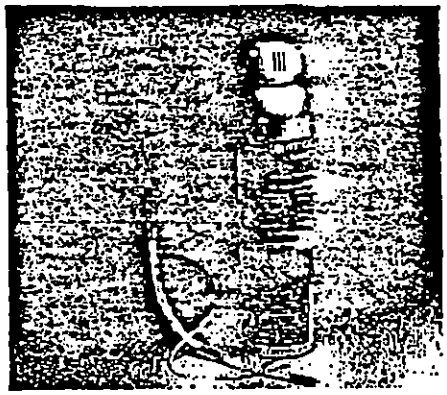
Prices subject to change.
Effective date: 05.10.94

Calibration Check Kits

quick, convenient method of checking instruments

New

Squirt™ Gas Bump Tester



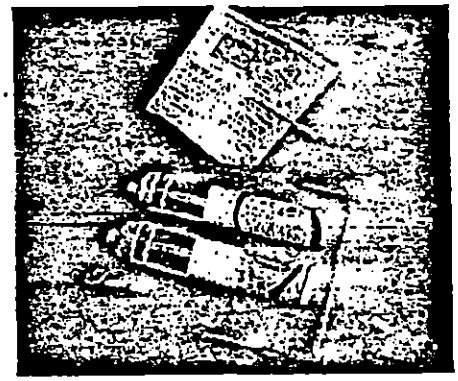
Provides a lightweight, convenient and inexpensive way to check the sensor response of MSA instruments. The bump tests supplement regular calibration at a service center or maintenance department. It uses a disposable cylinder with 11 liters of gas, works without a regulator and gives you a reading as fast as 15 seconds. Its ease of use promotes tests in the field, on the shop floor or in the truck. The kit comes with three balloons and all the necessary tubing and fittings to attach to the instrument, packed in a vinyl carrying bag.

Description	*Part No.*
Squirt Gas Bump Test Kit, less cylinder, but with required fittings and adapters	813411

Instrument	*Squirt Gas Cylinder*	*Combustible*		*Oxygen*	*Carbon Monoxide*	*Hydrogen Sulfide*	*Balance*
		Methane	*Pentane Simulant*				
Explosimeter	815307	2.5%	See cylinder	—	—	—	Air
Gasport	814350	2.5%	—	15% O_2	60 ppm CO	—	Nitrogen
Passport	814497	1.3%	52% LEL	15% O_2	60 ppm CO	—	Nitrogen
MiniCO*	814978	—	—	—	60 ppm CO	—	Air
Microgard*	815308	1.3%	52% LEL	15% O_2	—	—	Nitrogen

* Requires calibration adapter

Model R Calibration Check Kits



Model R Check Kits consist of a regulating valve which includes a gauge to measure container pressure; an adapter hose with sampling line connection; an adapter hose without a sampling line connection; sensor adapters (where applicable); instructions; and a case fitted with room for two cylinders of calibration check gas.

The cylinders of calibration check gas for use with Model R Kits are small light-weight steel containers approximately 10¾ inches high and 2⅝ inches in diameter and, depending upon the individual pressure requirements, contain 16 to 20 liters of a specified gas mixture of a known (± 5% tolerance) concentration. See page 137 for calibration check gas.

Description	*Part No.*
Calibration Check Kit, Model R, with 1.5 lpm regulator—complete	476609
Regulator (1.5 lpm)	459948
Adapter hose (with sampling line connection)	449401
Adapter hose (without sampling line connection)	449482
Calibration Check Kit, Model R, with 0.25 lpm regulator—complete	476610
Regulator (0.25 lpm)	459949
Adapter hose (with sampling line connection)	449401
Adapter hose (without sampling line connection)	449482
Sensor Adapter for Spotter® Methane Detector	457364
Sensor Adapter for all MSA continuous combustible gas detectors	456673
Sensor adapter for Explosilarm® Combustible Gas Alarm, Model 100	458302
Calibration plug for MSA continuous electrochemical sensors	473150
Zero cap for MSA continuous combustible gas detectors	69217
Zero cap for MSA continuous electrochemical sensors	631570

For more complete information, see Data Sheet 08-00-28.

Model RP Calibration Check Kits

Model RP Check Kits consist of a regulating valve which includes a gauge to measure container pressure; an adapter hose; sensor adapter (where applicable); instructions; and a case fitted with room for two large cylinders of calibration check gas.

The cylinders of calibration check gas for use with Model RP Kits are lightweight steel containers approximately 14¼ inches high and 3¼ inches in diameter and, depending upon the individual pressure requirements, contain 60 to 100 liters of a specified gas mixture of a known (± 5% tolerance) concentration. See page 137 for calibration check gas.

Description	*Part No.*
Calibration Check Kit, Model RP, with 1.5 lpm regulator—complete	477150
Regulator (1.5 lpm)	467896
Adapter hose (with sampling line connection)	449401
Adapter hose (without sampling line connection)	449482
Calibration Check Kit, Model RP, with 0.25 lpm regulator—complete	477149
Regulator (0.25 lpm)	467895
Tubing, 30" (without sampling connection line)	24194
Calibration plug for MSA continuous electrochemical sensors	473150
Zero plug for MSA continuous electrochemical sensors	631570
Zero plug for MSA portable electrochemical sensors	628474
Calibration plug for MSA portable electrochemical sensors	465898

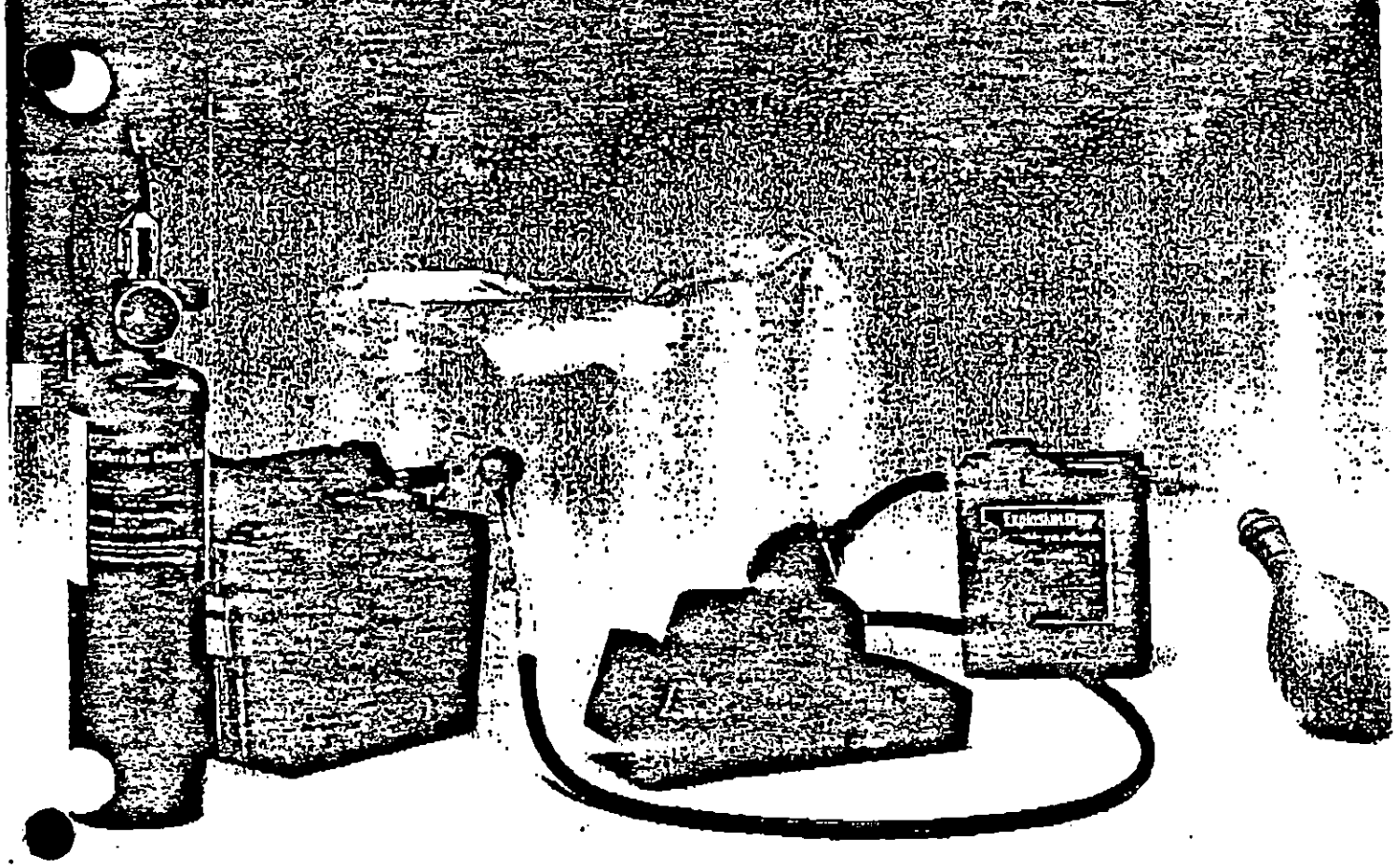
Calibration Check Gas

Cylinders for Model R Calibration Check Kits

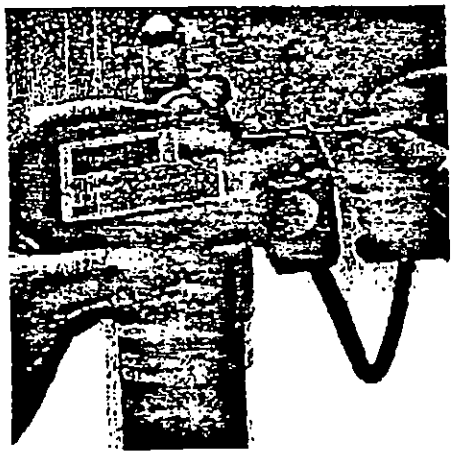
Concentration	*Background*	*Part No.*
1.25% Methane	Air	461047
2.0% Methane	Air	459945
* 2.5% Methane	Air	459942
0.75% Pentane	Air	466193
1000 ppm Pentane	Air	476303
0.75% Pentane/15.0% Oxygen	Nitrogen	476304
0.6% Propane	Air	459943
8% Butane	85% N_2/15% CO_2	460345
0.8% Hydrogen	Air	459946
5.0% Oxygen	Nitrogen	476302
20.8% Oxygen	Nitrogen	468248
0.75% Pentane/15.0% Oxygen	Nitrogen	476304
20 ppm Carbon Monoxide	Air	477888
60 ppm Carbon Monoxide	Air	461768
150 ppm Carbon Monoxide	Air	459944
300 ppm Carbon Monoxide	Air	461769

CALIBRATION CHECK KITS FOR USE WITH MSA PORTABLE INSTRUMENTS

08-00-28



Among the convenient MSA Calibration Check Kit options are: the Model R Calibration Check Kit shown used with a Gascope Model 300; an Ampoule-Type Check Kit, used with a Passport Personal Alarm; and an Aerosol-Type Check Kit used with an Explosimeter Indicator.



FEATURES

- Quick and easy to use to verify the accuracy and response time of MSA portable electronic instruments
- All kits provide convenience in performing calibration checks in accordance with NIOSH, OSHA, NFPA and ISA standards
- Wide selection of kits and calibration gases to meet varying user needs
- Three basic types of kits available: Model R and RP; Aerosol-Type and Ampoule-Type

DESCRIPTION

MSA Calibration Check Kits, when use with the appropriate calibration check gas, offer a quick, convenient and economical method of checking the response of MSA gas detection instruments.

The Model R and RP Check Kits use cylinder containing a specific concentration of compressed calibration chec gas. These kits are used for combustib gas detectors and certain multi-gas detectors.

Aerosol-type check kits use a convenient three-liter pressurized can for added portability. These are used for combustible gas.

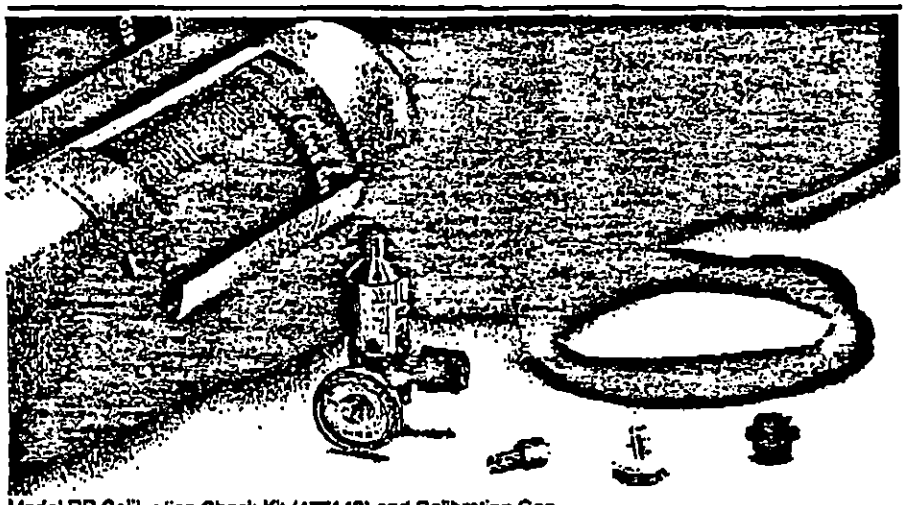
Ampoule-type check kits are used fc specific toxic gases and eliminate the need for gas cylinders, regulators or constant temperature devices.

Model R & RP Calibration Check Kits

With the Model R and RP Calibration Check Kits, a cylinder pressurized with a specific calibration gas is used to introduce a known concentration of gas into the gas detection instrument.

The primary difference between the two kit models is the size of the cylinders used (Model RP cylinders contain more calibration gas), the delivered gas flow rate, and the selection of cylinders available.

Both kit models include: a regulating valve, which controls the flow and includes a gauge to measure pressure of the calibration gas cylinder; appropriate calibration tubing to connect the calibration gas cylinder to the instrument; sensor adapters, as needed; instructions; and a rugged high-density polyethylene carrying case with room for two cylinders of calibration check gas.



Model RP Calibration Check Kit (477149) and Calibration Gas.

MSA offers two types of Model R and Model RP check kits, depending on the type of instrument being calibrated.

Depending on the kit, the regulator supplies calibration gas at either 0.25 liters per minute (lpm) or 1.5 lpm. The 0.25 lpm regulators are for diffusion-

ORDERING INFORMATION

Important: Calibration Check Kits are designed for use with specific instruments. Please see the Selection Guide on pages 6 - 8 for applicability of kits.

Part No.

476610 Model R Calibration Check Kit, *less calibration gas*. Includes:
- 459949 0.25 lpm Regulator
- 449401 30-inch Calibration Tube with Fitting
- 449482 30-inch Calibration Tube
- 457364 Sensor Adapter for Spotter Methane Detector
- 458302 Sensor Adapter for Explosilarm, Model 100
- 636246 Tubing Adapter for Passport and Gascope Models 300 & 300L
- 465898 Sensor Adapter for MiniCO Indicators
- 628474 Zero Plug for MiniCO Indicators

* **476609 Model R Calibration Check Kit, *less calibration gas*. Includes:**
- 459948 1.5 lpm Regulator
- 449401 30-inch Calibration Tube with Fitting
- 449482 30-inch Calibration Tube

Cylinders for Model R Calibration Check Kits

Part No.	Concentration	Background
Methane		
461047	1.25% Methane (25% LEL)	Air
459945	2.0% Methane (40% LEL)	Air
* 459942	2.5% Methane (50% LEL)	Air
Hydrogen		
459946	0.8% Hydrogen (20% LEL)	Air
Pentane		
466193	0.75% Pentane (50% LEL)	Air
476303	1,000 ppm Pentane (6.7% LEL)	Air
476304	0.75% Pentane (50% LEL) & 15% Oxygen	N_2
Butane		
460345	8% Butane	85% N_2 15% CO_2
Propane		
459943	0.6% Propane (29% LEL)	Air
Carbon Monoxide		
477885	20 ppm Carbon Monoxide	Air
461768	60 ppm Carbon Monoxide	Air
459944	150 ppm Carbon Monoxide Air	Air
461769	300 ppm Carbon Monoxide Air	Air
Oxygen		
476302	5% Oxygen	N_2
468248	20.8% Oxygen	N_2

Note: N_2 is nitrogen; CO_2 is carbon dioxide.

type instruments, Passport and certain Gascope models, whereas the 1.5 lpm devices are for sample-draw instruments.

Calibration check gas cylinders must be purchased separately.

The cylinders of calibration check gas for use with Model R Kits are small lightweight steel containers approximately 10-5/8 inches high and 2-5/8 inches in diameter and, depending upon the individual pressure requirements, contain 20 liters of a specified gas mixture of a known (±5% tolerance) concentration. Note: The butane cylinder, Part No. 460345, contains 10 liters.

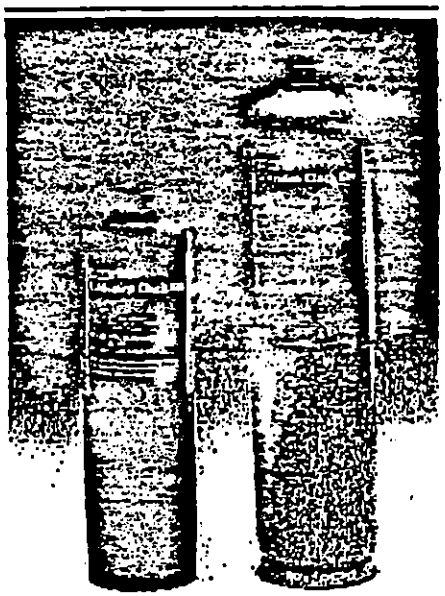
The cylinders of calibration check gas for use with Model RP Kits are lightweight steel containers (or aluminum in the case of hydrogen sulfide) approximately 14-1/4 inches high and 3-1/2 inches in diameter and, depending upon the type of cylinder, contain 100 liters of a specified gas mixture of a known (±5% tolerance) concentration. Note: Hydrogen sulfide cylinders contain 58 liters.

OPERATION

To prepare a Model R or RP Check Kit for use, the regulator assembly is connected to the cylinder. Then the adapter hose is connected between the outlet of the regulator assembly and the inlet of the instrument, using the appropriate sensor adapter where required.

Detailed instructions for calibration and instrument checks are provided in the instruction manual of the specific instrument.

When not in use, the regulating valve and adapter hose can be easily detached from the expendable cylinder for convenient storage.



Model R and Model RP Cylinders

Part No.

477149 Model RP Calibration Check Kit, *less calibration gas.* Includes:

- 467895 0.25 lpm Regulator
- 485030 30-inch Calibration Tube
- 636246 Adapter for Passport and Gascope, Models 300 &300L
- 465898 Sensor Adapter for MiniCO Indicators
- 628474 Zero Plug for MiniCO Indicators

477150 Model RP Calibration Check Kit, *less calibration gas.* Includes:

- 467896 1.5 lpm Regulator
- 449401 30-inch Calibration Tube with Fitting
- 485030 30-inch Calibration Tube

Cylinders for Model RP Calibration Check Kits

Part No.	Concentration	Background
Methane		
491041	2.5% Methane (50% LEL)	Air
Pentane Simulant		
478192	1.45% Methane & 15% Oxygen	N_2
Pentane Simulant and Carbon Monoxide		
478191	1.45% Methane, 15% Oxygen & 60 ppm Carbon Monoxide	N_2
Carbon Monoxide		
473180	300 ppm Carbon Monoxide	Air
Carbon Dioxide		
479266	2,000 ppm Carbon Dioxide	Air
479265	2.5% Carbon Dioxide	Air
Hydrogen Sulfide		
467898	10 ppm H_2S	N_2
467897	40 ppm H_2S	N_2
Oxygen		
479857	20.8% Oxygen	N_2

Note: N_2 is nitrogen.

SELECTION GUIDE

The following tables show the applicability of the various Calibration Check Kits and Calibration Gas to specific instruments or types of instruments.

Combustible Gas Instruments				
Instrument	**Calibration Kit Required**		**Calibration Gas Cylinder**	
Gascope® Indicators Models 300, 300L	Model R	476610	Methane 40% LEL	459945
			Methane 50% LEL	459942
	Model RP	477149	Methane 50% LEL	491041
Gascope Indicators Models 60, 62, 62S	Model R	476609	Methane 40% LEL	459945
			Methane 50% LEL	459942
Explosimeter® Indicators (all) Models 2, 2A, 2B, 2C, 3, 4, 5	Model RP	477150	Methane 50% LEL	491041
	Aerosol	454380	Methane 40% LEL	96329
			Methane 50% LEL	463464
Explosilarm® Portable Alarms Model 102 (0-10%/0-100% LEL) Model 100 (0-100% LEL)	Model R	476610	Pentane 6.7% LEL	476303
			Pentane 50% LEL	466193
Spotter® Methane Detector	Model R	476610	Methane 40% LEL	459945
			Methane 50% LEL	459942
Spotter Model QII	Model R	476610	Pentane 50% LEL	466193
Methane Monitoring System Models V, VI, VII	Model R	476610	Methane 25% LEL	461047
			Methane 40% LEL	459945
			Methane 50% LEL	459942

Toxic Gas Instruments				
Instrument	**Calibration Kit Required**		**Calibration Gas Cylinder or Ampoule**	
MiniCO® Carbon Monoxide Indicator Models IV, V	Model R	476610	CO 20 ppm	477888
			CO 60 ppm	461768
			CO 150 ppm	459944
			CO 300 ppm	461769
MiniCO 2000 Indicator	Model R	476610	CO 20 ppm	477888
			CO 60 ppm	461768
			CO 150 ppm	459944
			CO 300 ppm	461769
	Model RP	477149	CO 60 ppm	478191*
			CO 300 ppm	473180
Mini H_2S® Indicator Mini H_2S 2000 Indicator	Model RP	477149	H_2S 10 ppm	467898
			H_2S 40 ppm	467897
Chlorine Indicator, Model 90	Ampoule	471735	Cl_2 5 ppm	471673

* *Contains a pentane simulant.*

2-in-1 Combination Instruments

Instrument	Calibration Kit Required		Calibration Gas Cylinder	
Combustible Gas & Oxygen Alarms Models 250, 260, 261	Model R	476609	Pentane 50% LEL Oxygen 15%	476304
	Model RP	477150	Pentane 50% LEL Oxygen 15%	478192
MiniGard® II Combustible Gas and Oxygen Indicator	Model R *plus* Sampling Adapter	476610 488973† or 474806	Pentane 50% LEL Oxygen 15%	476304
	Model RP *plus* Sampling Adapter	477149 488973† or 474806	Pentane 60% LEL Oxygen 15%	478192*
MicroGard® Indicator *with Pump Module*	Model R	476609	Pentane 50% LEL Oxygen 15% Methane 50% LEL	476304 459942
	Model RP	477150	Pentane 60% LEL Oxygen 15%	478192*
MicroGard Indicator *diffusion mode*	Model R *plus* Sampling Adapter	476610 478530	Pentane 50% LEL Oxygen 15% Methane 50% LEL	476304 459942
	Model RP *plus* Sampling Adapter	477149 478530	Pentane 60% LEL Oxygen 15%	478192*

3-in-1 Combination Instruments

Instrument	Calibration Kit Required		Calibration Gas Cylinder	
Model 360 for Combustible Gas, Oxygen and Carbon Monoxide	Model R	476609	Pentane 50% LEL Oxygen 15% CO 20 ppm CO 60 ppm CO 150 ppm CO 300 ppm	476304 477888 461768 459944 461769
	Model RP	477150	Pentane 50% LEL Oxygen 15% CO 60 ppm	478191*
Model 361 for Combustible Gas, Oxygen and Hydrogen Sulfide	Model RP	477150	Pentane 50% LEL Oxygen 15% H_2S 10 ppm	478192* 467898
MiniGard III for Combustible Gas, Oxygen and Carbon Monoxide; *with Pump Module*	Model RP	477150	Pentane 60% LEL Oxygen 15% CO 60 ppm	478191*
MiniGard III for Combustible Gas, Oxygen and Hydrogen Sulfide *with Pump Module*	Model RP	477150	Pentane 60% LEL Oxygen 15% H_2S 10 ppm	478192* 467898
MiniGard III for Combustible Gas Oxygen and Carbon Monoxide *diffusion mode*	Model RP *plus* Sampling Adapter	477149 488973	Pentane 60% LEL Oxygen 15% CO 60 ppm	478191*
MiniGard III for Combustible Gas Oxygen and Hydrogen Sulfide *diffusion mode*	Model RP *plus* Sampling Adapter	477149 488973	Pentane 60% LEL Oxygen 15% H_2S 10 ppm	478192* 467898

†*Compatible with MiniGard III Indicators.*

**Contains a pentane simulant.*

Passport® Instruments				
Instrument	Calibration Kit Required		Calibration Gas Cylinder or Ampoule	
Combustible Gas, Oxygen and Carbon Monoxide	Model RP *plus* Calibration Cap *or* Pump Module	477149 497367 497430	Pentane 60% LEL Oxygen 15% CO 60 ppm	478191*
Combustible Gas and Oxygen	Model RP *plus* Calibration Cap *or* Pump Module	477149 497367 497430	Pentane 60% LEL Oxygen 15%	478192*
Hydrogen Sulfide	Model RP *plus* Calibration Cap *or* Pump Module	477149 497367 497430	H_2S 10 ppm	467898
	Ampoule Ampoule	481660 471735	H_2S 10 ppm	471674
Hydrogen Cyanide	Ampoule Ampoule	481660 471735	HCN 10 ppm	471675
Chlorine	Ampoule	471735	Chlorine 5 ppm	471673
Sulfur Dioxide	Ampoule	471735	SO_2 10 ppm	485461
Nitrogen Dioxide	Ampoule	471735	NO_2 5 ppm	485462
Nitric Oxide	Ampoule	471735	NO 50 ppm	493663

** Contains a pentane simulant.*

CALIBRATION FREQUENCY

Instructions specific to the calibration of various instruments are supplied with the instrument being calibrated. MSA recommends that response checks be conducted before each day's use of an instrument — more frequently if sensor contamination is suspected. A response check is a simple check in which no adjustments are made to the instrument unless the check shows that the instrument is not operating within specified limits. Then, full calibration by authorized personnel may be warranted.

Daily calibration checks are also specified in the Occupational Safety & Health Administration (OSHA) Technical Manual, the National Institute for Occupational Safety & Health (NIOSH) Resource Manual for Protection in Confined Spaces, the National Fire Protection Association (NFPA) Standard 306 for the Control of Gas Hazards on Vessels, and the Instrument Society of America (ISA) Recommended Practices for Hydrogen Sulfide Instruments, among others.

SERVICE

MSA's strategically located Regional Service Centers are staffed with specialists who have the knowledge and equipment to provide testing calibration and repair of MSA instruments with genuine MSA replacement parts. Product modification or repair by anyone other than certified MSA personnel may void warranties and approvals.

Call MSA toll-free at 1-800-MSA-2222 for the location of your nearest Service Center.

Note: This Data Sheet contains only a general description of Calibration Check Kits and accessories. While uses and performance capabilities are described, under no circumstances should these products be used until the instructions, labels or other literature accompanying the products have been read and understood and the precautions therein set forth followed. Only they contain the complete and detailed information concerning these products.

MSA Offices and representatives in principal cities worldwide.
In U.S. call nearest stocking location toll free at 1-800-MSA-2222.
For MSA International, call (412) 967-3249 or Fax (412) 967-3451.

Corporate Headquarters: P.O. Box 426, Pittsburgh, PA 15230 USA.

Data Sheet 08-00-28

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PAINT SPECS FOR FLARE ASSEMBLY

FAX TRANSMITTAL FORM

JOHN ZINK COMPANY

A Division of Koch Engineering Company, Inc.
P.O. Box 21220
Tulsa, OK 74121-1220

DELIVER TO:	Mark San Angelo	DATE: July 21, 1995	
COMPANY:	Breco		
FAX NUMBER:	914-963-3989		
TOTAL PAGES:	7		
SENDER'S NAME:	Theresa Partee	MSG. NO.:	
YOUR REFERENCE:	1304	OUR REFERENCE:	BF-AO12224
FAX COPIES TO:			
OFFICE COPIES TO:			

IF MISSENT, PLEASE TELEPHONE 918 234-2946. THIS MESSAGE IS BEING SENT FROM FAX 918 234-19.

In reference to paint for the flare stack, I have attached specifications on Sherwin Williams paint.

Zinc Clad I - 9.01: John Zink standard primer paint.

Kem Hi-Temp 900-SA - 7.06: John Zink prefers to use this as the top coat. Can pick different colors, but note temperatures to right of color. If stack temperature exceeds this temperature then there may be discoloration. Expected stack temperature for this unit is minimum of 300 deg. F to a maximum of 500 deg. F.

Kem Hi Temp Aluminum - 7.11: This paint is aluminum in color and is good for temperatures up to 1000 deg. F. No discoloration with this paint.

If you have any questions, please contact me at 918-234-2946.

Regards.

SHERWIN WILLIAMS

Industrial Maintenance Coatings

PRODUCT DATA **9.01**

(MC-56, A24)

ZINC CLAD™ I

A ONE-PACKAGE INORGANIC ZINC-RICH COATING

B69A56

PRODUCT DESCRIPTION

ZINC CLAD™ I is a solvent-based inorganic ethyl silicate one-package zinc-rich coating.

USES

- As a 1-coat maintenance coating or as a permanent primer for severe environment service
- Bridges
- Drilling Rigs
- Economical replacement for galvanizing with similar performance levels
- Low temperatures or very high temperature and/or high humidity conditions
- Refineries
- Shop or field application
- Water intake and discharge lines (non-potable)
- Where organic solvent or fuel resistance is required
- Where tough abrasion resistance and hardness of a primer are necessary
- Not recommended for severe acid or alkali exposure

USE UNTOPCOATED:

- Light and moderate corrosive atmospheric exposure
- Fresh and demineralized water immersion service (non-potable)

PERFORMANCE INFORMATION:

- Fast dry
- Provides cathodic/sacrificial protection by the same mechanism as galvanizing. Also protects steel by forming an inorganic moisture and solvent barrier
- 10-15 years performance in normal atmospheric exposure
- Coating self-heals to resume protection if damaged
- Functions better than galvanizing because of self-healing characteristics

PHYSICAL PROPERTIES:

- Abrasion resistance ..... 1.9 g. (ASTM D4060 CS-17 wheel, 1,000 cycles, 1 kg Taber Abraser)
- Dry Heat Resistance (ASTM D2485) ..... 750°F
- Elcometer Adhesion (ASTM D4541) ..... 320 psi
- Moisture Condensation Resistance ..... No failure (ASTM D4585, 100°F, 1000 hours)
- Pencil Hardness (ASTM D3363) 7H
- Salt Fog Resistance ..... No failure (ASTM B117, 1000 hours)
- Thermal Shock ..... Excellent (ASTM D2246, 250 cycles)
- Wet Heat Resistance ..... 115°F

RESISTANCE GUIDE (per ASTM D3912, untopcoated)

- Immersion Resistance @ 77°F
  Fresh and demineralized water
- Resistance to Fumes, Splash and Spillage
  Organic solvents/fuels ..... Severe (except chlorinated solvents)
  Animal fats and oils ..... Severe
- Consult your Sherwin-Williams representative for specific application and performance recommendations.

Zinc Rich 9.01; MC56 A24; 1/94 2000607

CHARACTERISTICS

- **Color/Finish:** Gray-Green/Flat
- **Curing Mechanism:** Solvent evaporation and polymerization due to moisture absorption.
- **Drying Schedule:** (temperature & humidity dependent) @ 77°F, 50% RH @ 5 mils wet:

Rain resistant:	20-30 minutes
To Touch:	30 minutes
Tack Free:	1 hour
To Recoat:	16 hours
To Cure:	Atmospheric 7 days
(place in service)	Immersion 30 days

- **Flash Point:** 72°F (Pensky Martens Closed Cup)
- **Packaging:** 3 gallon containers
- **Recommended Spreading Rate:** wet mils: 5.0-7.0; dry mils: 3.0-4.0; approx. sq.ft./gal.: 220-295
- **Spreading Rate Coverage:** 892 sq.ft./gal. @ 1 mil dry (theoretical, no loss)
- **Shelf Life:** 6 months unopened @ 90°F maximum
- **Shipping Classification:** X003
- **Shipping Wt:** 61.0 lbs.
- **VOC:** 550 g/l; 4.58 lbs/gal
- **Volume Solids:** 55 ± 2% (ASTM D2697)
- **Weight Solids:** 76 ± 2%
- **Weight/Gallon:** 19.0 lbs.
- **Zinc Dust Pigment Content in Dry Film:** 86%
- **Zinc Dust Pigment/gal.:** 12.43 lbs.
- **Zinc Dust Pigment/sq.ft. @ 3 mils dry:** 0.67 oz.

Analysis (mixed):

Pigment by weight		70.4%
Zinc Dust (ASTM D520, Type I)	65.4%	
Silicates	4.1%	
Yellow Iron Oxide	0.9%	
Additives	0.3%	
Vehicle by weight		29.6%
Hydrolyzed Ethyl Silicate	3.4%	
Acrylic Polymer	1.6%	
Aromatic Hydrocarbons	18.4%	
Alcohols	5.5%	
Additives	0.7%	
Total	100%	100%

SURFACE PREPARATION

Zinc rich coatings require direct contact of the zinc pigment in the coating and the metal substrate for optimum performance. Surface must be dry, free from oil, dirt, dust, mill scale, or other contaminants to ensure good adhesion.

Application within 8 hours of preparing surface is mandatory.

Steel: (Atmospheric)
Remove grease and oil by Solvent Cleaning per SSPC-SP1.

To achieve maximum cathodic protection of Zinc Clad I, substrate should be Near White Blast clea per SSPC-SP10. Minimum surface preparatio be Commercial Blast Cleaning per SSPC-SP6

NOTE: If blast cleaning with steel media is used, an appropriate amount of steel grit blast media should be incorporated into the work mix to render a dense, angular 1.5-2.0 mil surface profile. Do not apply Zinc Clad I over steel shot blast prepared steel.

Steel: (Immersion Service)
Remove grease and oil by solvent cleaning per SSPC-SP1. Then prepare surface to white metal blast per SSPC-SP5.

Pickling:
Acceptable (last step - flush with hot water for complete neutralization).

Galvanized Steel:
Wire brush small areas and wipe clean. Large areas must be Brush Blasted per SSPC-SP7.

Weathered Zinc-Rich Primer:
Remove zinc salts by either high pressure water washing and scrubbing with stiff brushes or sweep blast followed by water flush. Allow to dry.

Repair or Touch-Up:
Needle gun or spot blast to near white metal. Clean surrounding weathered zinc primer as above.

NOTE: Oil Base, Alkyd, Epoxy Ester, Silicone Alkyd Topcoats are not recommended. Polyurethane topcoats require a tie coat of catalyzed epo Consult the Sherwin-Williams data sheet for Clad II Epoxy, Heavy Duty Epoxy, Bild & Finish Epoxy or Recoatable Epoxy for specific system recommendations.

C.01 PRODUCT DATA

(MC-56, A24)

primer

ZINC CLAD™ I

A ONE-PACKAGE INORGANIC ZINC-RICH COATING

B69A56

SHERWIN WILLIAMS

Industrial Maintenance Coatings

RECOMMENDED SYSTEMS

- **Zinc Primer/Finish** (Immersion or Atmospheric)
  1 ct. Zinc Clad I, B69A56 @ 3 mils DFT
  Total DFT mils: 3

- **Acrylic Latex Topcoat** (Atmospheric)
  1 ct. Zinc Clad I, B69A56 @ 3 mils DFT
  1 ct. DTM Acrylic Gloss Coating B66 Series @ 3 mils DFT
  Total DFT mils: 6

- **Acrylic Latex Topcoat** (Atmospheric)
  1 ct. Zinc Clad I, B69A56 @ 3 mils DFT
  2 cts. Metalatex Semi-Gloss Coating @ 1.5 mils DFT/ct.
  Total DFT mils: 6

- **Coal Tar Epoxy Topcoat** (Atmospheric)
  1 ct. Zinc Clad I, B69A56 @ 3 mils DFT
  [illegible] Hi-Mil Sher-Tar Epoxy B69B40/B50V40 @ [illegible]0 mils DFT
  [illegible] DFT mils: 19-23

- **Epoxy Topcoat** (Atmospheric)
  1 ct. Zinc Clad I, B69A56 @ 3 mils DFT
  1 or 2 cts. Heavy Duty Epoxy B67 Series/B60V3 @ 6 mils DFT/ct.
  Total DFT mils: 9-15

- **Epoxy Topcoat** (Atmospheric)
  1 ct. Zinc Clad I, B69A56 @ 3 mils DFT
  2 cts. Tile Clad II Epoxy B62 Series/B60V70 @ 4 mils DFT/ct.
  Total DFT mils: 11

- **Urethane Topcoat** (Atmospheric)
  1 ct. Zinc Clad I, B69A56 @ 3 mils DFT
  1 ct. Tile Clad II B62 Series/B60V70 @ 4 mils DFT (Heavy Duty Epoxy also acceptable.)
  NOTE: Topcoat within 30 days:
  1 ct. Hi-Bild Polyurethane* B65 Series/B60V2 @ 2-3 mils DFT
  Total DFT mils: 9-10
  * (Hi-Solids Polyurethane B65W300 Series also acceptable.)

APPLICATION

Apply a full wet coat using 50% overlap. Take extra precaution to avoid "dry spraying." Double coat edges, welds, bends, etc. During application, film thickness is best checked by monitoring material consumption, allowing a 25% loss factor. After drying, check for dry film thickness using film gauge.

- **Curing:** This coating cures by absorbing moisture. In low humidities or indoors, frequent repeated mist coats of water will accelerate cure. It is preferable to leave coated objects exposed to the weather elements for two weeks or more to achieve maximum cure.

- **Topcoating:** Note minimum cure times at normal conditions before topcoating. Longer drying periods are required if primer cannot be water mist sprayed when humidity is low.

Occasionally topcoats will pinhole or delaminate from zinc-rich coatings. This is usually due to poor ambient conditions or faulty application of topcoats. This can be minimized by:

- Providing thorough ventilation and suitable application and substrate temperature.
- Avoid dry spray of topcoat.
- Applying a wet full coat, but at minimum film build, usually not greater than 5 mils wet.
- If pinholing develops, apply a mist coat, reduced up to 50%. Allow 10 minutes flash off and follow with a full coat.

Recoating itself: Recoat preferably when the first coat is in dry-to-tack state. Reduce second or touch-up coat up to 15% with R7K58. If first coat has weathered and exhibits salt formation, salts should be removed as above.

Application Conditions:
Temperature: 40°-100°F (air, surface, material) (at least 5°F above dew point)
Relative Humidity: 20-95%

- **Methods:** Conventional and Airless Spray (Brush - small areas)

Airless Spray: (continuous agitation during application mandatory)
Unit: 30 CFM, 1800-2000 psi pressure, 30:1 (without siphon). Set ball checks to maximum travel for viscous material. Use teflon packings. Tip: .017" to .021" Filter: None. Fluid Hose: 3/8" ID. For continuous operation in larger areas, use Spee-Flow Airless Commander Zinc Pump or equivalent airless spray equipment.
Brush: For touch-up and repair only. Keep material well-agitated at all times.
Conventional Spray: (Continuous agitation during application mandatory) Moisture trap required in air line. Binks 18 gun, 66 fluid oz. nozzle, 63PB air nozzle, 1/2" ID fluid hose (50' max. length), ID air hose (50' max. length) 30-40 psi atomization pressure, 10-20 psi fluid pressure or equivalent equipment.
Keep pressure pot at level of applicator to avoid blocking of fluid line due to weight of material. Blow back coating in fluid line at intermittent shutdowns; but continue agitation at pressure pot.

- **Mixing Instructions:** Thoroughly mix material to a uniform consistency. Pour mixture through 40-60 mesh screen. Continued agitation of mixture during application is required, otherwise zinc dust will quickly settle out. Keep original container tightly closed to prevent contact with atmospheric moisture. Do not reclaim thickened material with solvent.

- **Reducer:** Below 80°F: Xylene R2K4
  Above 80°F: R7K58

- **Reduction:** Up to 10% by volume as necessary to be compatible with the existing application and environmental conditions. Cut back atomization pressure as much as possible. Avoid dry spray.

- **Clean-Up:** Use Xylene, following supplier's safety cautions.

SHERWIN-WILLIAMS USE
SMIS
3's —— 6401-97018

PRECAUTIONS

Contents are FLAMMABLE. Keep away from heat, sparks and open flame. During use and until all vapors are gone keep area ventilated; do not smoke; extinguish all flames, pilot lights and heaters; turn off stoves, electric tools and appliances and any other source of ignition. Contamination with water, acids or alkalis will produce pressure in a closed container.

CONTAINS XYLENE AND LEAD.

VAPOR AND SPRAY MIST HARMFUL. Use only with adequate ventilation. To avoid overexposure, open windows and doors or use other means to ensure fresh air entry during application and drying. If you experience eye watering, headaches or dizziness, increase fresh air or wear a vapor/particulate respirator (TC23C or equivalent) or leave the area. THE RESPIRATORY PROTECTION MUST BE WORN DURING SPRAY APPLICATION and sanding, wire brushing or other types of abrading, and while burning, brazing or welding the dried film of lead-containing coatings.
Avoid contact with eyes and skin. If ingested, seek medical attention immediately. Wash hands after using. Keep container closed when not in use. Do not transfer contents to other containers for storage.

NOTICE: Reports have associated repeated and prolonged overexposure to solvents with permanent brain and nervous system damage. Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal.

DO NOT TAKE INTERNALLY.
KEEP OUT OF THE REACH OF CHILDREN.

CONTAINS LEAD: Do not apply on toys and other children's articles, furniture or any interior surface of a dwelling or facility which may be occupied or used by children. Do not apply on any exterior surface of dwelling units, such as window sills, porches, or railings to which children may commonly be exposed.

SHERWIN WILLIAMS

Industrial Maintenance Coatings

PRODUCT DATA 7.06

KEM HI-TEMP COATINGS NO. 900-SA SERIES

LOW TEMPERATURE CURING
HIGH PERFORMANCE HEAT RESISTANT COATING
*Maximum Service Temperature - No. 2 Silver 900°F (482°C)
*All Other Colors Up To 700°F (371°C), [See *Note Section]

PRODUCT DESCRIPTION:

Kem Hi-Temp No. 900-SA is a low temperature curing, heat resistant coating, curable at temperatures as low as 300F (149C) in sixteen hours or at 400F (204C) in one hour. No. 900-SA is formulated from a specially modified silicone acrylic resin and pure high temperature pigments. Only the finest ingredients available are used to produce this unique coating. The cured film will withstand continuous operating temperatures up to 900F (482C), see "Heat Resistance of Standard Colors" section below for specific temperature capabilities of each color. Kem Hi-Temp No. 900-SA contains no saponifiable resins and is, therefore, suitable for application over zinc rich primers; also suitable for use on stainless steel surfaces where stress corrosion cracking is a major concern. No. 900-SA is formulated with special ingredients to minimize contamination from chlorides, other halides, sulfides, nitrates and metals which are known to induce external stress corrosion cracking of stainless steel. It contains no free metallic zinc and therefore, will not contribute to embrittlement of stainless steel welds.

RECOMMENDED USES:

A protective and decorative coating for use on mufflers, furnaces, boilers, stacks, pipes, and other metal surfaces that will have service temperatures up to 900F (482C). Can be applied direct to any metal surface that has been sandblasted to a white metal finish, or can be applied over organic or inorganic zinc rich primers. Use wherever a low temperature curing, silicone-acrylic, heat resistant coating is desired. Not recommended for use on the inside of ovens, stacks, etc.

PERFORMANCE INFORMATION:

No. 900-SA dries by solvent evaporation and by polymerization, however, the coating must be heat-cured for sixteen hours at 300F (149C) or one hour at 400F (204C) to obtain maximum film properties, resistance to chemicals and heat. Thoroughly cured, the coating shows remarkable ability to withstand prolonged exposure to temperatures up to 900F (482C) see "Heat Resistance of Standard Colors" section below for specific temperature capabilities of each color. No. 900-SA is suitable for application over "Zinc Clad Inorganic Primers". The coating possesses excellent adhesion to zinc rich primers. When applied over Zinc Clad No. 1, the primer has a tendency to bleed into the No. 900-SA coating, causing the colors to appear slightly lighter. The heat resistance of No. 900-SA is affected by zinc rich primers, due to the lower temperature limits of zinc primers, see "Heat Resistance of Standard Colors" section below.

CHARACTERISTICS:

Finish ..... (*) Gloss
Resin Type ..... Modified silicone acrylic
Type of Cure ..... Solvent evaporation/ polymerization
Drying Time @ 77F (25C) & 50% R.H.
To touch ..... 1 hour
To recoat ..... 1 1/2 hours
Full cure ..... Heat cure required, see below
Curing Temperature & Time
Minimum curing temperature 300F (149C)
Minimum curing time ..... 16 hours at 300F (149C) or 1 hour at 400F (204C)
Application Temperature ..... 50F (10C) to 150F (66C)
Spreading Rate Per Coat: For Temperatures
Up to 500°F (260°C) .....400 sq.ft/gal. (9.8m²/L) 4.0 mils wet, 1.5 mils dry
Above 500°F (260°C) .....600 sq.ft/gal. (14.7 m²/L) 2.7 mils wet, 1.0 mils dry
Coverage @ 1 Mil Dry..... 600 sq.ft/gal.
Solids by Weight ..... 50% ± 2%
Solids by Volume ..... 38% ± 2%
Weight per Gallon ..... Varies with color
Flash Point of Liquid Coating ..... 45F (7.2C) (closed cup)
Reducer/Cleaner..... Xylol (Xylene)
Shelf Life..... 18 months (unopened)
Packaging ..... 1, 5, and 55 gal. containers
Shipping Weight ..... 4 gals. - 48 lbs.
5 gals. - 58 lbs.
55 gals. - 650 lbs.
Application ..... Brush, conventional and airless spray

(*) Gloss diminishes at higher temperatures.

*** Heat Resistance of Standard Colors No. 900-SA Direct to Metal**

*No. 1 Black..... Up to 700F (371C)
*No. 2 Silver..... Up to 900F (482C)
*No. 3 Lagoon ..... Up to 400F (204C)
*No. 4 Topaz ..... Up to 450F (232C)
*No. 5 Horizon ..... Up to 400F (204C)
*No. 6 Newport ..... Up to 500F (260C)
*No. 7 Mauve ..... Up to 450F (232C)
*No. 8 Walnut..... Up to 550F (288C)
*No. 9 Fawn ..... Up to 400F (204C)
*No. 10 Russet..... Up to 550F (288C)
*No. 11 Quarry..... Up to 400F (204C)
*No. 12 Camouflage.... Up to 500F (260C)
*No. 13 Dusty..... Up to 400F (204C)
*No. 14 Golden ..... Up to 500F (260C)
*No. 15 Charcoal ..... Up to 600F (315C)
*No. 16 Steel ..... Up to 500F (260C)
*No. 17 Pewter..... Up to 500F (260C)
*No. 18 White..... Up to 450F (232C)
*No. 19 Safety Blue .... Up to 500F (2
*No. 20 Safety Orange Up to 500F (2
*No. 21 Safety Green ... Up to 500F (2
*No. 22 Safety Yellow... Up to 500F (260C)
*No. 23 Safety Red ..... Up to 500F (260C)

† Heat Resistance of Standard Colors No. 900-SA Over Zinc Clad No. 1 Primer

No. 1 Black..... Up to 700F (371C)
No. 2 Silver..... Up to 700F (371C)
*No. 3 Lagoon ..... Up to 500F (260C)
*No. 4 Topaz ..... Up to 500F (260C)
*No. 5 Horizon ..... Up to 500F (260C)
*No. 6 Newport ..... Up to 500F (260C)
*No. 7 Mauve ..... Up to 500F (260C)
*No. 8 Walnut..... Up to 500F (260C)
*No. 9 Fawn ..... Up to 500F (260C)
*No. 10 Russet..... Up to 500F (260C)
*No. 11 Quarry..... Up to 500F (260C)
*No. 12 Camouflage.... Up to 500F (260C)
*No. 13 Dusty..... Up to 500F (260C)
*No. 14 Golden ..... Up to 500F (260C)
*No. 15 Charcoal ..... Up to 500F (260C)
*No. 16 Steel ..... Up to 500F (260C)
*No. 17 Pewter..... Up to 500F (260C)
*No. 18 White..... Up to 450F (232C)
*No. 19 Safety Blue .... Up to 500F (260C)
No. 20 Safety Orange Not recommended
*No. 21 Safety Green ... Up to 500F (260C)
*No. 22 Safety Yellow... Up to 500F (260C)
No. 23 Safety Red .... Not recommended

† Heat Resistance of Standard Color No. 900-SA Over Zinc Clad B59V1/B59DZ Primer

*Colors No. 1 through No. 18 & 21-22 .. Up to 500F (260C)
Except No. 18 ..... Up to 450F (232C)

.06c PRODUCT DATA

SHERWIN WILLIAMS

Industrial Maintenance Coatings

KEM HI-TEMP COATING NO. 900-SA SERIES

LOW TEMPERATURE CURING
HIGH PERFORMANCE HEAT RESISTANT COATING
*Maximum Service Temperature - No. 2 Silver 900°F (482°C)
*All Other Colors Up To 700°F (371°C), [See *Note Section]

† Heat Resistance of Standard Colors No. 900-SA Over Zinc Clad No. 7 Primer

No. 1 Black.....Up to 500F (260C)
No. 2 Silver.....Up to 500F (260C)
*Colors, No. 9
through 19 & 21-22 . . Up to 450F (232C)

*NOTE: When applied direct to metal, all standard colors will withstand dry service temperatures up to 700°F (371°C), [No. 2 Silver up to 900°F (482°C)]. However, during the initial heating cycle, there will be a significant darkening of the asterisk (*) colors, as the temperatures range from 450F (232C) to 650F (343C). As the temperature increases above 650F (343C), the color will lighten to [illegible] closely resemble the original color, and [illegible] not appreciably change on cooling and reheating. Should the surface temperature not exceed 650F (343C), the color will remain considerably off color.

† When applied over Zinc Clad Primers, the maximum service temperature is no greater than the Zinc Clad Primer used.

SURFACE PREPARATION:

METAL: All metal surfaces must be sandblasted to a white metal finish, a low profile blast is preferred, as it will give best results. Coat immediately after blasting with desired Zinc Clad Primer or apply No. 900-SA direct to the blasted surface. All surfaces must be clean, dry and free of all contaminants or coating will not form a proper bond. When applied over Zinc Clad Primers, make sure primer is fully cured and dry.

APPLICATION:

Mix thoroughly by boxing or slowly stirring, avoid incorporating air into the paint. Can be applied by brush or spray. Spray application is preferred, as a more uniform film is generally obtained. Thin only as necessary with Xylol (Xylene). No other reducer should be used.

Do not apply heavier films than specified, as the coating may blister.

[illegible]
[illegible]ished sandblasted metal, apply two coats [illegible] 900-SA at the specified coverage rates, [Ref: Characteristics Section (Spreading Rate Per Coat)]. Allow at least 1 1/2 hours drying time at ambient [77F (25C)] temperature. Longer drying time will be required at lower temperatures. Two coats are recommended for best results.

Primed metal. Be sure primer is fully cured. Allow adequate time at recommended temperature and humidity level for complete curing of Zinc Clad Inorganic Zinc Rich Primers. Primer surface must be clean and free of all contaminants. Apply only one coat of 900-SA

NOTE: Colors No. 20 and 23 are not recommended for use on galvanized steel or over zinc rich primers.

SPRAY APPLICATION: No. 900-SA should be reduced approximately 10% by volume, with Xylol (Xylene) thinner before application. Apply at the specified coverage rates, [Ref: Characteristics Section (Spreading Rate Per Coat)]. A couple of passes may be required to obtain the desired film thickness. Allow to dry a minimum of 1 1/2 hours or until dry before proceeding.

BRUSH APPLICATION: Apply full bodied coats at the specified coverage rates, [Ref: Characteristics Section (Spreading Rate Per Coat)]. Allow to air-dry a minimum of 1 1/2 hours or until dry before proceeding.

Note: When surface, and/or air temperature is high and/or when painting under breezy conditions, some solvent reduction may be necessary to increase wet edge time and improve flow.

CURING: Kem Hi-Temp No. 900-SA must be heat-cured to obtain maximum properties. After final coat has been applied, allow one hour before heating, then cure by gradually increasing the temperature to 300F (149C), hold for sixteen hours or 400F (204C) for one hour. For temperatures between 300F (149C) and 400F (204C), adjust time proportionately.

After curing, for best performance, it is essential that the temperature be taken up slowly, over a period of hours, to the normal operating temperature.

APPLICATION EQUIPMENT:

Conventional Spray

Air Supply ..... 12 CFM, 50 psi at nozzle, fluid 15-20 psi
Gun ..... Graco 217-800 to 217-816
Type ..... External mix
Reduction ..... Up to 10%

Airless Spray

Pump ..... Mauler 11 (minimum)
Fluid pressure ..... 2500 psi
Strainer ..... 100 Mesh
Fluid hose ..... 1/4" diameter
Gun G-10N
Tip ..... .015 - .020
Reduction ..... Up to 10%

PRECAUTIONS:

WARNING! FLAMMABLE LIQUID & VAPOR: CONTAINS XYLENE & PETROLEUM DISTILLATES. VAPOR HARMFUL. MAY AFFECT THE BRAIN OR NERVOUS SYSTEM CAUSING DIZZINESS, HEADACHE OR NAUSEA. CAUSES EYE, SKIN, NOSE AND THROAT IRRITATION. NOTICE: Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage. Intentional misuse by deliberately concentrating and inhaling the contents may be harmful or fatal. Keep away from heat, sparks and flame. VAPORS MAY CAUSE FLASH FIRE. Do not smoke. Extinguish all flames and pilot lights, and turn off stoves, heaters, electric motors and other sources of ignition during use and until all vapors are gone. Prevent build-up of vapors by opening all windows and doors to achieve cross-ventilation.

USE ONLY WITH ADEQUATE VENTILATION. Do not breathe vapors or spray mist. Ensure fresh air entry during application and drying. If you experience eye watering, headache or dizziness or if air monitoring demonstrates vapor/mist levels are above applicable limits, wear an appropriate, properly fitted respirator (NIOSH/MSHA approved) during and after application. Follow respirator manufacturer's directions for respirator use. Close container after each use. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

FIRST AID: If you experience difficulty in breathing, leave the area to obtain fresh air. If continued difficulty is experienced, get medical assistance immediately. In case of eye contact, flush immediately with plenty of water for at least 15 minutes and get medical attention; for skin, wash thoroughly with soap and water. If swallowed, get medical attention immediately. If spilled, contain spilled material and remove with inert absorbent. Dispose of contaminated absorbent, container and unused contents in accordance with local, state and federal regulations.

KEEP OUT OF THE REACH OF CHILDREN.

Information provided herein is based on tests believed to be reliable. In as much as we have no control over the use or application to which others may put this material, we make no guarantee or warranty. This product is sold on the condition that each user of the material make their own evaluation to determine the material's suitability for their own particular use.

SHERWIN WILLIAMS

Industrial Maintenance Coatings

PRODUCT DATA 7.11

KEM HI-TEMP ALUMINUM

100-A-518

PRODUCT DESCRIPTION

KEM HI-TEMPALUMINUM is a silicone leafing aluminum coating for use where operating temperatures range up to 1000°F. It is self-priming and has excellent exterior durability. An optional catalyst may be used to assure full cure at normal ambient temperatures if the coating cannot be brought up to a minimum temperature of 450°F for 30 minutes.

USES:

- High temperature steel:
  - ductwork
  - stacks
  - mufflers

RESISTANCE GUIDE:

- Temperature resistance.....1000°F

CHARACTERISTICS

- **Color:** Aluminum
- **Drying Schedule @ 75°F, 50% RH**
  - To touch: 2 hours
  - To recoat: 18-24 hours
  - Full cure: 3 days
- **Flash Point:** 81°F
- **Number of Components:** One (optional catalyst)
- **Packaging:** 1 gal.
- **Pot life:** 3-5 hours @ 70°F (if catalyzed with 700-C-418)
- **Recommended Spreading Rate:** wet mils: 3.0-3.5; dry mils: 1.0-1.2; approx. sq.ft./gal.: 569-700
- **Spreading Rate Coverage:** 569 sq.ft./gal. @ 1 mil DFT (theoretical, no loss)
- **Volume Solids:** 35%
- **Weight/gal.:** 8.7 lbs/gal.
- **VOC:** 532 g/l, 4.4 lbs./gal.
- **Shelf Life:** 12 months unopened @ 75°F

SURFACE PREPARATION

Remove all grease, oil, dirt or other contaminants by Solvent Cleaning per SSPC-SP1 prior to further surface preparation.

Steel:

Preferred:	SSPC-SP5 White Metal Blast Cleaning
Minimum:	SSPC-SP10 Near-White Metal Blast Cleaning

Profile height: 0.0 - 1.0 mils.

Remove all weld spatter and round all sharp edges by grinding. Blast clean all surfaces [illegible] a sharp, angular abrasive for optimum s[illegible] profile. Coat blast-cleaned surfaces within 8[illegible] of blast-cleaning or before flash rusting occurs.

7.11

PRODUCT DATA

SHERWIN WILLIAMS

Industrial Maintenance Coatings

KEM HI-TEMP ALUMINUM

100-A-518

RECOMMENDED SYSTEMS

- **Steel: up to 1000°F**

  2 cts. Kem Hi-Temp Aluminum @ 1 mil DFT/ct.

  Total mils DFT: 2

- **Steel: up to 800°F**

  1 ct. Kem Hi-Temp Primer 411-A-002 @ 1 mil DFT

  1 ct. Kem Hi-Temp Alumium @ 1 mil DFT

  Total mils DFT: 2.0

APPLICATION

- **Mixing Instructions:**
  Stir container thoroughly with power agitation. If using 700-C-418, Catalyst, add 5 fluid oz. per gallon and mix thoroughly.
  NOTE: If catalyst is used, it must be used in both coats.

- **Methods:**
  Brush or spray.

- **Equipment:**
  Conventional Spray

	Graco	Binks
Gun	900	18
Tip and needle	055	63C/63A
Air cap	942	63PE
Atomizing pressure	50-60 psi	50-60 psi
Fluid pressure	10-12 psi	10-12 psi

Airless Spray

Pump ratio	30:1
Tip orifice	.015
Fan width at 12"	12 inches
Fluid pressure	1800 psi
Filter screen	60 mesh
Hose	1/4"

- **Thinning:**
  Up to 10% with Xylol, R2K4.

- **Induction Time:** 15 minutes @ 77°F (if catalyzed)

- **Temperature:**
  Do not apply at temperatures below 50°F. Surface temperature must be at least 5°F above the dew point.

- **Clean Up:**
  Xylol, R2K4.

PRECAUTIONS

Contents are FLAMMABLE. Vapors may cause flash fires. Keep away from heat, sparks and open flame. During use and until all vapors are gone: keep area ventilated; do not smoke; extinguish all flames, pilot lights and heaters. Turn off stoves, electric tools, appliances, and any other sources of ignition.

CONTAINS ALIPHATIC HYDROCARBONS, AROMATIC HYDROCARBONS, METALLIC PIGMENT.

VAPOR HARMFUL. Use only with adequate ventilation. To avoid overexposure, open windows and doors or use other means to ensure fresh air entry during application and drying. If you experience eye watering, headaches or dizziness, increase fresh air or wear respiratory protection (NIOSH/MSHA TC23C or equivalent) or leave the area.

Avoid contact with eyes and skin. Wash hands after using. Keep container closed when not in use. Do not transfer contents to other containers for storage.

Avoid contamination with water. Water can cause evolution of gas which may result in dangerously increased pressure in closed container.

FIRST AID: In case of eye contact, flush thoroughly with large amounts of water for 15 minutes and get medical attention. For skin contact, wash thoroughly with soap and water. In case of respiratory difficulty, provide fresh air and call physician. If swallowed, get medical attention immediately.

DELAYED EFFECTS FROM LONG TERM OVER-EXPOSURE: Contains solvents which can cause permanent brain and nervous system damage. Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal.

DO NOT TAKE INTERNALLY

KEEP OUT OF THE REACH OF CHILDREN

FOR PROFESSIONAL USE ONLY

NOT FOR RESIDENTIAL USE

SEE MATERIAL SAFETY DATA SHEET

The information, rating and opinions stated here pertain to the material currently offered, and represent the results of tests believed to be reliable. Published technical data and instructions are subject to change. Consult with your Sherwin-Williams representative for coating recommendations.

MANUFACTURER'S PRODUCT SPECIFICATION

Schedule 40 & 80 PVC Industrial Pipe

ESLON THERMOPLASTICS

Gas Extraction Wells- PVC Pipe, Fittings, & Valves

DIMENSIONS – PIPE AND DUCT

Scope:
This specification sheet covers the manufacturer's requirements for PVC Schedule 40 and Schedule 80 IPS pressure pipe. This pipe meets or exceeds the industry standards set forth by the American Society for Testing and Materials and the National Sanitation Foundation.

PVC Materials:
Rigid PVC (polyvinyl chloride) used in the extrusion of Schedule 40 and 80 pipe is of Type I, Grade 1 compound as stated in ASTM D-1784. Raw material used in extrusion shall contain the specified amounts of color pigment, stabilizers, and other additives approved by the National Sanitation Foundation.

Dimensions:
Physical dimensions and tolerances of PVC Schedule 40 and 80 pipe meet the requirements of ASTM standard specification D-1785.

Marking:
PVC Schedule 40 and 80 pipe is marked as prescribed in ASTM D-1785 to indicate the manufacturer's name or trademark, material designation code, the nominal pipe size, the Schedule size with the pressure rating in PSI for water at 73°F, the ASTM designation number D-1785, and the NSF seal for potable water.

Sample Specification:
All PVC Schedule 40 and 80 pipe shall conform to ASTM D-1785. Schedule 40 fittings shall conform to ASTM D-2466, Schedule 80 socket fittings to ASTM D-2467 and ASTM D-2464 for threaded Schedule 80 fittings. Both pipe and fittings shall be the product of one manufacturer, as manufactured by Eslon Thermoplastics, Charlotte, North Carolina, 1-800-438-7681, or approved equal.

ASTM MEMBER

NAPD NATIONAL ASSOCIATION OF PLASTICS DISTRIBUTORS

NSF

MANUFACTURER'S PRODUCT SPECIFICATION

Schedule 80 PVC Fittings

ESLON THERMOPLASTICS

Scope:
This specification sheet covers the manufacturer's requirements for PVC Schedule 80 pipe fittings. These fittings meet or exceed the standards set by the American Society for Testing and Materials and the National Sanitation Foundation.

PVC Materials:
Rigid PVC (polyvinyl chloride) used in the manufacture of Schedule 80 fittings is of Type I, Grade 1 compound as stated in ASTM D-1784. Raw material used in molding shall contain the specified amounts of color pigment, stabilizers, and other additives approved by the National Sanitation Foundation.

Dimensions:
Physical dimensions and tolerances of PVC Schedule 80 IPS fittings meet the requirements of ASTM standard specification D-2467 for socket-type fittings and ASTM D-2464 for threaded fittings. Threaded fittings have Taper Pipe Threads in accordance with ANSI/ASME B1.20.1.

Marking:
PVC Schedule 80 fittings are marked as prescribed in ASTM D-2464 and D-2467 to indicate the manufacturer's name or trademark, material designation, the NSF mark, size of fitting, and ASTM designation D-2464 (threaded) or D-2467 (socket).

Sample Specification:
All Schedule 80 socket fittings shall conform to ASTM D-2467 and ASTM D-2464 for threaded fittings. Both pipe and fittings shall be the product of one manufacturer, as manufactured by Eslon Thermoplastics, Charlotte, North Carolina, 1-800-438-7681, or approved equal.

ASTM MEMBER

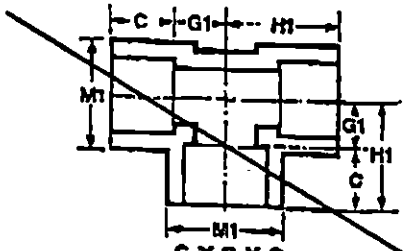
MEMBER NATIONAL ASSOCIATION OF PLASTICS DISTRIBUTORS NAPD

NSF

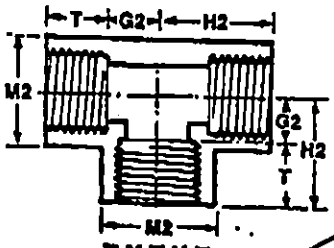
SCHEDULE 80 PVC FITTINGS

ESLON THERMOPLASTICS

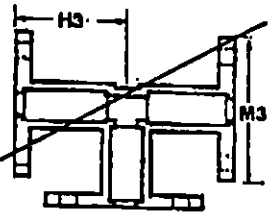
Tees



S X S X S
FIG. 801



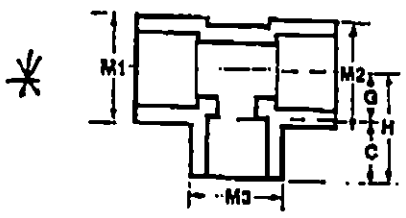
T X T X T
FIG. 802



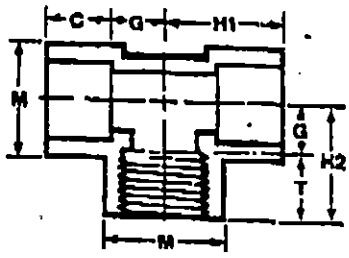
FLG X FLG X FLG
FIG. 822

Nom. Pipe Size	Max. O.D. Dim. M1	SOCKET – FIG. 801 Part No.	C	H1	G1	Approx. Wt.(lb)	Max. O.D. Dim. M2	THREADED – FIG. 802 Part No.	T	H2	G2	Approx. Wt.(lb)	Max. O.D. Dim. M3	FLANGED – FIG. 822 Part No.	H3	Approx. Wt.(lb)
½	1 13/64	8301	57/64	1 27/64	17/32	.116	1 9/16	8317	¾	1 13/64	29/64	.143	—	—	—	—
¾	1 7/16	8302	1 1/64	1 19/32	37/64	.182	1 1/2	8318	27/32	1 13/16	17/32	.194	—	—	—	—
1	1 13/16	8303	1 9/64	1 27/32	45/64	.265	1 27/32	8319	1	1 9/16	9/16	.288	4½	8830	3 3/16	1.500
1¼	2 1/16	8304	1 17/64	2 5/32	37/64	.393	2 7/32	8320	1 1/8	1 65/64	35/64	.558	4 5/8	8831	3 1/16	2.284
1½	2 3/16	8305	1 25/64	2 13/32	11/16	.522	2 23/64	8321	63/64	2 5/64	13/32	.732	5	8832	4 1/16	2.440
2	2 13/16	8306	1 ½	2 25/32	19/32	.865	3 1/32	8322	1 31/64	2 7/8	1 21/64	.930	6	8833	4 3/16	3.790
2½	3 29/64	8307	1 29/32	3 11/32	19/16	1.500	3 9/16	8323	1 29/64	2 31/32	1 33/64	1.380	7	8834	5 1/16	5.730
3	4 7/32	8308	1 7/8	3 3/4	1 13/16	2.325	4 5/16	8324	1 7/16	3 5/16	1 7/8	2.296	7½	8835	5 3/16	7.830
4	5 1/4	8309	2 1/4	4 5/8	2 1/8	3.690	5 7/16	8325	1 19/32	3 7/8	2 9/32	3.690	9	8836	6 7/16	15.610
6	7 19/32	8310	3	6 9/16	3 9/16	8.875	—	—	—	—	—	—	11	8837	8 1/16	28.543
8	9 7/8	8311	4	8½	4½	19.140	—	—	—	—	—	—	—	8838	10 13/64	55.207

Reducing Tees



S X S X S
FIG. 403



S X S X T
FIG. 402

Nom. Pipe Size	Max. O.D. Dim. M1	M2	M3	SXSXS – FIG. 403 Part No.	C	H	G	Approx. Wt.
¾ × ¾ × ½	1 3/16	1 3/8	1 3/16	8330	7/8	1 1/2	19/32	0.150
1 × 1 × ¾	1 3/4	1 3/4	1 3/8	8332	1 1/16	1 3/4	1 1/16	0.245
1½ × 1½ × 1	2 3/8	2 3/8	1 3/4	8335	1 5/32	2 5/32	1	0.455
2 × 2 × 1	2 7/8	2 7/8	1 3/4	8338	1 5/32	2 1/2	1 11/32	0.585
2 × 2 × 1½	2 7/8	2 7/8	2 3/8	8339	1 13/32	2 1/2	1 1/4	0.715
3 × 3 × 2	4 1/8	4	2 3/4	8340	1 13/32	3 5/32	1 25/32	1.710
4 × 4 × 3	5 1/16	5 1/16	4	8342	1 17/32	4 3/16	2 5/16	3.095
6 × 6 × 4	6 29/32	7 9/16	5 1/2	8345	2 1/4	5 13/16	3 3/4	7.830
8 × 8 × 6	9 3/4	9 3/4	7 19/32	8346	3 1/8	7 7/32	4 17/32	16.280

Nom. Pipe Size	Max. O.D. Dim. M	THREADED – FIG. 402 Part No.	T	C	H1	H2	G	Wt.
½	1 9/32	8360	3/4	7/8	1 3/8	1 3/4	1/2	0.140
¾	1 1/2	8361	1 1/8	1 1/8	1 5/8	1 3/4	9/16	0.195
1	1 25/32	8362	1 5/32	1 5/8	1 27/32	1 27/32	21/32	0.300

NOTES:
Physical dimensions and tolerances meet the requirements of ASTM Standards D-2467 for socket type fittings and D-2464 for threaded fittings.
PVC material meets ASTM Standard D-1784.
All dimensions are in inches unless otherwise specified.
Dimensions are subject to change without notice. Contact factory for certification.

NSF-pw

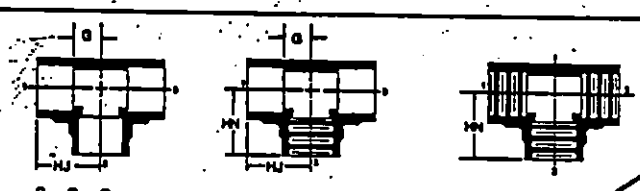
R&G SLOANE
A Susquehanna Company

PLASTIC PIPING SYSTEMS
1 HOLLYWOOD COURT
SOUTH PLAINFIELD, N.J. 07080
PHONE: 908-753-2500
FAX: 908-753-1291

HI-STRENGTH SCHEDULE 80™ PRESSURE FITTINGS DIMENSIONAL DATA

PVC & CPVC TYPE I FITTINGS FOR IPS SCHEDULE 80 PIPE

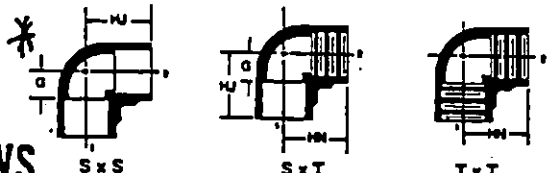
TEES



S x S x S FIG. 801 | S x S x T FIG. 802 | T x T x T FIG. 805

SIZE	SIZE CODE	HJ SLIP	HN THREAD	G —	WEIGHTS* FIG. 801	FIG. 802	FIG. 805
¼ †	002	61/64	55/64	21/64	.05	N.A.	.05
⅜ †	003	5/64	1	13/32	.09	N.A.	.07
½	005	25/64	1 9/32	17/32	.13	.14	.14
¾	007	37/64	1 3/8	19/32	.19	.18	.18
1	010	1 27/32	1 11/16	25/32	.29	.29	.31
1¼	012	2 9/32	1 15/16	29/32	.42	.48	.45
1½	015	2 13/32	2 1/16	1 1/32	.62	.60	.56
2	020	2 25/32	2 11/32	1 9/32	.82	.82	.72
2½ †	025	3 9/32	3 7/64	1 17/32	1.73	1.68	1.77
3	030	3 29/32	3 31/64	1 55/64	2.56	2.46	2.04
4 x 4 x 2	420	3 17/32	N.A.	1 1/4	4.10	4.02	3.74
6 x 6 x 4	532	5 11/32	N.A.	2 11/32	14.94	N.A.	N.A.
8	080	8 9/16	N.A.	4 9/16	20.13	N.A.	
8 x 8 x 6	585	7 7/8	N.A.	3 7/8	15.51		

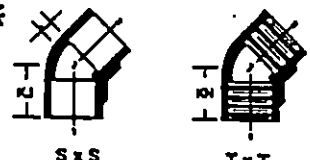
90° ELBOWS



S x S FIG. 806 | S x T FIG. 807 | T x T FIG. 808

SIZE	SIZE CODE	HJ SLIP	HN THREAD	G —	WEIGHTS* FIG. 806	FIG. 807	FIG. 808
¼ †	002	61/64	55/64	21/64	.04	N.A.	.04
⅜ †	003	1 9/64	1	13/32	.06	N.A.	.05
½	005	1 25/64	1 9/32	17/32	.10	.09	.10
¾	007	1 37/64	1 3/8	19/32	.14	.14	.13
1	010	1 27/32	1 11/16	25/32	.23	.21	.34
1¼	012	2 9/32	1 15/16	29/32	.37	.33	.34
1½	015	2 13/32	2 1/16	1 1/32	.44	.44	.40
2	020	2 25/32	2 11/32	1 9/32	.70	.70	.72
2½ †	025	3 9/32	3 7/64	1 17/32	1.25	1.29	1.30
3	030	3 29/32	3 31/64	1 55/64	1.87	1.79	1.93
4	040	4 15/32	4 9/64	2 25/64	3.24	3.37	2.70
6	060	6 9/16	N.A.	3 9/16	11.00	N.A.	N.A.
8	080	8 9/16	N.A.	4 9/16		N.A.	N.A.

45° ELLS



S x S FIG. 817 | T x T FIG. 819

SIZE	SIZE CODE	KJ SLIP	KN THREAD	J —	WEIGHTS* FIG. 817	FIG. 819
¼ †	002	61/64	49/64	11/64	.04	.03
⅜ †	003	61/64	13/16	13/64	.06	.04
½	005	1 9/64	1 1/64	9/32	.11	.10
¾	007	1 11/32	1 7/32	11/32	.15	.14
1	010	1 15/32	1 31/64	11/32	.22	[illegible]
1¼	012	1 31/32	1 37/64	13/32	.35	
1½	015	1 55/64	1 1/2	31/64	.40	
2	020	2 9/32	1 23/32	21/32	.69	.57
2½ †	025	2 15/32	2 15/64	47/64	1.08	1.27
3	030	2 31/32	2 27/64	25/32	1.40	1.43
4	040	3 9/32	2 49/64	1 1/32	2.56	2.28
6	060	4 13/16	N.A.	1 13/16	9.35	N.A.
8	080	6 1/16	N.A.	2 1/16		N.A.

SCHEDULE 80 PVC AND CPVC FITTINGS

SIZES AND DIMENSIONS

COUPLINGS

S x S FIG. 829 — T x T FIG. 830

SIZE	SIZE CODE	L SLIP	L THREAD	N	WEIGHTS* FIG. 829	WEIGHTS* FIG. 830
¼	002	1 23/64	1 9/32	3/32	.03	.03
⅜	003	1 5/8	1 21/64	1/8	.04	.04
½	005	1 27/64	1 41/64	1/8	.07	.07
¾	007	2 9/64	1 23/32	5/64	.10	.09
	010	2 25/64	2 5/32	5/64	.16	.16
1	012	2 31/32	2 9/16	5/32	.24	.21
1½	015	2 29/32	2 7/32	5/32	.30	.26
	020	3 5/32	2 15/32	5/32	.43	.36
2½	025	3 3/4	3 25/64	1/4	.81	.89
	030	4	3 33/64	1/4	1.23	1.20
	040	4 3/4	3 29/32	1/4	2.12	1.82
	060	6 9/16	N.A.	5/16	6.97	N.A.
	080	8 9/16	N.A.	5/16		N.A.

REDUCER COUPLINGS

S x S FIG. 829 — T x T FIG. 830

SIZE	SIZE CODE	L SLIP	L THREAD	N	WEIGHTS* FIG. 829	WEIGHTS* FIG. 830
½ x ¼	052	1 5/8	1 7/16	3/32	.06	.05
½ x ⅜	073	1 3/4	1 15/32	3/32	.06	.06
¾ x ½	101	2	1 25/32	3/32	.10	.09
1 x ½	130	2 1/8	1 27/32	3/32	.16	.14
1 x ¾	131	2 1/4	1 7/8	3/32	.15	.14
1¼ x ¾	167	2 3/8	1 27/32	3/32	.21	.19
1¼ x 1	168	2 1/2	2 3/32	3/32	.23	.22
1½ x 1	211	2 5/8	2 1/8	3/32	.28	.25
1½ x 1¼	212	2 3/4	2 3/32	3/32	.31	.27
2 x 1½	251	3	2 7/16	3/32	.44	.38
2½ x 2	292	3 7/16	2 3/4	3/16	.75	.71
3 x 2	338	3 7/16	2 7/8	3/16	1.01	.95
4 x 3	422	4 3/8	3 5/8	1/4	1.65	1.64
6 x 4	532	10 1/4	N.A.	3 1/2	6.90	N.A.
8 x 6	585	9 1/8	N.A.	2 1/16	7.04	N.A.

REDUCER BUSHINGS

STYLE 2 SP x S FIG. 837 — STYLE 2 SP x T FIG. 838 — STYLE 2 SP x T FIG. 839

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SIZE	SIZE CODE	FIG. 837 L	FIG. 837 HL	FIG. 837 WT.	FIG. 838 L	FIG. 838 WTS.*	FIG. 839 L	FIG. 839 WT.
⅜ x ¼	052	1 5/16	9/32	.01	1 5/16	.01	1 1/32	
½ x ¼	072	1 1/16	7/16	.02	1 1/16	.02	1 7/32	
½ x ⅜	073	1 1/16	5/16	.02	1 1/16	.02	1 7/32	
¾ x ¼	098						1 7/32	
¾ x ⅜	099	1 3/16	11/16				1 7/32	
¾ x ½	101	1 9/32	13/32	.04	1 9/32	.04	1 1/16	.02
1 x ¼	128	1 7/16	15/16				1 13/32	
1 x ⅜	129	1 7/16	15/16				1 13/32	
1 x ½	130	1 13/32	½	.07	1 13/32	.08	1 13/32	
1 x ¾	131	1 13/32	13/32	.06	1 13/32	.06	1¼	.04
1¼ x ½	166	1 17/32	21/32	.14	1 17/32	.14	1 7/16	
1¼ x ¾	167	1 17/32	17/32	.12	1 17/32	.13	1 7/16	
1¼ x 1	168	1 17/32	13/32	.09	1 17/32	.08	1 9/32	.07
1½ x ½	209	1 21/32	25/32	.19	1 21/32	.19	1½	
1½ x ¾	210	1 21/32	21/32	.17	1 21/32	.18	1½	
1½ x 1	211	1 21/32	17/32	.14	1 21/32	.13	1½	
1½ x 1¼	212	1 21/32	13/32	.08	1 21/32	.17	1 9/16	.06
2 x ½	247	1 25/32	29/32	.32	1 25/32	.20	1½	
2 x ¾	248	1 25/32	25/32	.30	1 25/32	.33	1½	
2 x 1	249	1 25/32	21/32	.25	1 25/32	.30	1½	
2 x 1¼	250	1 25/32	17/32	.20	1 25/32	.21	1½	
2 x 1½	251	1 25/32	13/32	.17	1 25/32	.10	1 11/32	.12
2½ x 1½	291	2 5/32	29/32	.40	2 5/32	.40	2 1/8	
2½ x 2	292	2 5/32	19/32	.27	2 5/32	.34	1 27/32	.22
	336	2 3/16	15/16				2 3/8	
	337	2 3/16	13/16				2 3/8	
3 x 2	338	2 5/32	29/32	.61	2 5/32	.62	1 29/32	.34
3 x 2½	339	2 5/32	19/32	.38	2 5/32	.46		
4 x 2	420	2 3/8	1 1/8	1.14	2 3/8	1.13	2 5/32	
4 x 3	422	2 3/8	¾	1.07	2 3/8	1.00	2 5/32	
6 x 4	532	6 7/8	4 3/8	3.50				

SCHEDULE 80 PVC AND CPVC FITTINGS

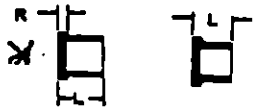
SIZES AND DIMENSIONS

CAPS

SLIP FIG. 847 THREAD FIG. 848

SIZE	SIZE CODE	W SLIP	W THREAD	HL —	WEIGHTS* FIG. 847	WEIGHTS* FIG. 848
¼ †	002	61/64	59/64	21/64	.02	.02
⅜ †	003	1 3/32	61/64	11/32	.03	.03
½	005	1 9/32	1 3/32	13/32	.05	.05
¾	007	1 29/64	1 15/64	29/64	.07	.06
1	010	1 31/32	1 29/64	17/32	.12	.11
1¼	012	1 55/64	1⅝	39/64	.16	.16
1½	015	2 1/16	1 23/32	11/16	.22	.22
2	020	2 15/64	1 55/64	51/64	.37	.30
2½ †	025	2 23/32	2 39/64	31/32	.60	.61
3	030	3 1/32	2 25/32	1 5/32	.92	.93
4	040	3 41/64	3⅛	1 25/64	1.48	1.37
6	060	4 61/64	N.A.	1 61/64	5.11	N.A.
8	080	6½	N.A.	2½		N.A.

PLUGS



SLIP FIG. 849 THREAD FIG. 850

SIZE	SIZE CODE	L SLIP	L THREAD	R —	WEIGHTS* FIG. 849	WEIGHTS* FIG. 850
¼	002	N.A.	25/32	N.A.	N.A.	.007
⅜	003	N.A.	25/32	N.A.	N.A.	.009
½	005	1 1/16	15/16	3/16	.028	.030
¾	007	1 7/16	1	7/32	.047	.041
1	010	1⅜	1¼	¼	—	.059
1¼	012	1 17/32	1 21/32	9/32	.115	.106
1½	015	1 11/16	1 11/32	5/16	.164	.131
2	020	1⅞	1 7/16	⅜	.241	.198
2½	025	N.A.	2	N.A.	N.A.	N.A.
3	030	2 7/32	2	9/32	.463	.441
4	040	2⅝	2⅛	⅜	.955	.750

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PVC-IPS SCHEDULE 80 SOCKET DIMENSIONS

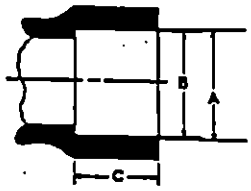

TABLE II

SIZE	PIPE O. D.	ENTRANCE (A) MAX.	ENTRANCE (A) MIN.	BOTTOM (B) MAX.	BOTTOM (B) MIN.	MAX. OUT OF ROUND	SOCKET DEPTH (C)
¼	.540	.556	.548	.540	.532	.016	.63
⅜	.675	.691	.683	.675	.667	.016	.75
½	.840	.856	.848	.844	.836	.016	.88
¾	1.050	1.066	1.058	1.054	1.046	.020	1.00
1	1.315	1.335	1.325	1.320	1.310	.020	1.13
1¼	1.660	1.680	1.670	1.665	1.655	.024	1.25
1½	1.900	1.924	1.912	1.906	1.894	.024	1.38
2	2.375	2.399	2.387	2.381	2.369	.024	1.50
2½	2.875	2.903	2.889	2.882	2.868	.030	1.75
3	3.500	3.532	3.516	3.508	3.492	.030	1.88
4	4.500	4.536	4.518	4.509	4.491	.030	2.25
6	6.625	6.668	6.646	6.636	6.614	.060	4.50 **
8	8.625	8.685	8.655	8.640	8.610	.090	4.50

TO SPECIFY OR PLACE AN ORDER
USE THE FIGURE NUMBER AND SIZE CODE
EXAMPLE: 801-020 — 2" TEE SXSXS

† Hub Style Fittings

* Note: All weights are for PVC 1 Grey and are listed in pounds each. For CPVC weights multiply by 1.09. Complies with ASTM Standard D-2467.

** 6" FLANGE IS 3.50 DEPTH

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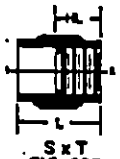
NSF

PPFA

SCHEDULE 80 PVC AND CPVC FITTINGS

SIZES AND DIMENSIONS

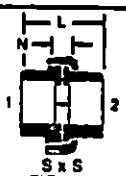
MALE ADAPTERS



S x T
FIG. 835

SIZE	SIZE CODE	L	HL	WEIGHTS*
¼ †	002	1 9/16	11/16	.03
⅜ †	003	1 7/16	11/16	.04
½	005	1¾	13/16	.07
¾	007	1 59/64	55/64	.10
1	010	2 13/64	1 9/64	.16
1¼	012	2 27/64	1 9/64	.22
1½	015	2 9/16	1 7/64	.28
2	020	2 23/32	1 9/64	.41
2½ †	025	3½	1¾	.88
3	030	3¾	1 49/64	1.20
4	040	4 15/64	1 55/64	1.92

UNIONS

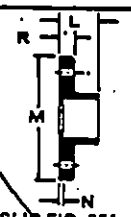


S x S
FIG. 897

T x T
FIG. 898

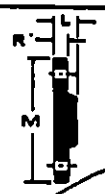
SIZE	SIZE CODE	L SLIP	N SLIP	L THREAD	WEIGHTS* FIG. 897	WEIGHTS* FIG. 898
¼	002	1 23/64	29/64	1 39/64	.08	.08
⅜	003	1 27/64	23/64	1 37/64	.12	.10
½	005	2 13/32	21/32	2 19/32	.22	.23
¾	007	2 9/16	9/16	2 9/16	.30	.30
1	010	2 31/32	23/32	2 31/32	.42	.44
1¼	012	3 1/8	9/8	3 1/8	.64	.60
1½	015	3 7/16	19/32	19/32	.75	.69
2	020	3 43/64	43/64	2 31/64	1.04	.97
3	030	4 29/32	29/32	4 9/32	2.89	2.92

FLANGES



SLIP FIG. 851

THREAD FIG. 852



BLIND FIG. 853

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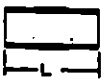
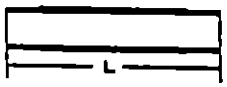
SIZE	SIZE CODE	NO. OF HOLES	DIAM. OF BOLTS	DIAM. OF BOLT CIRCLE	M	R	FIG. 851 L	FIG. 851 N	FIG. 851 WTS.*	FIG. 852 L	FIG. 852 WTS.*	FIG. 853 L	FIG. 853 WTS.*
½	005	4	½	2.38	3.50	.41	1 7/32	⅛	.21	29/32	.20	½	.19
¾	007	4	½	2.75	3.88	.47	1 3/32	⅛	.28	31/32	.28	9/16	.28
1	010	4	½	3.13	4.25	.53	1 5/32	⅛	.39	1⅛	.39	21/32	.39
1¼	012	4	½	3.50	4⅝	.60	1 7/16	⅛	.50	1 3/16	.50	¾	.52
1½	015	4	½	3.88	5	.66	1 9/16	⅛	.64	1 5/32	.62	13/16	.67
2	020	4	⅝	4.75	6	.71	1 11/16	⅛	.98	1¼	.95	15/16	1.08
2½	025	4	⅝	5.50	7	.77	1 31/32	3/32	1.50	1 23/32	1.50	1	1.60
3	030	4	¾	6.00	7½	.89	2 3/32	3/32	1.88	1 27/32	1.87	1⅛	2.13
4	040	8	⅞	7.50	9	1.09	2 15/32	3/32	3.04	1 15/16	2.91	1 11/32	3.65
6	060	8	¾	9.50	11	1¼	3 27/32	3/16	4.35	—	—		
8	080	8	¾	11.75	13½	1 3/16	4 27/32	3/16	7.55	—	—		

NIPPLES

CLOSE



SHORT



LONG

MT X MT
FIG. 861

NIPPLE DIAMETER	CLOSE NIPPLES Size Code	CLOSE NIPPLES Length	SHORT NIPPLES Size Code	SHORT NIPPLES Length	LONG NIPPLES Size Code	Length	Size Code	Length	Size Code	Length	Size Code	Length	Size Code	Length	Size Code	Length
¼	037	⅞	038	1½	039	2	041	3	042	4	043	5	044	6	046	8
⅜	055	1	056	1½	057	2	058	3	059	4	061	5	062	6	064	8
½	077	1⅛	078	1½	079	2	081	3	082	4	083	5	084	6	086	8
¾	104	1⅜	105	2			106	3	107	4	108	5	109	6	112	8
	133	1½	134	2			135	3	136	4	137	5	138	6	141	8
1¼	170	1⅝	171	2½			172	3	173	4	174	5	175	6	177	8
1½	213	1¾	214	2½			215	3	216	4	217	5	218	6	220	8
2	251	2	252	2½			253	3	254	4	255	5	256	6	258	8
2½	292	2½	293	3					295	4	296	5	297	6	299	8
3	338	2⅝	239	3					341	4	342	5	343	6	345	8
4	[illegible]	[illegible]	[illegible]	4												

2-1/2"-6" Safe Block™ True Union Ball Valves

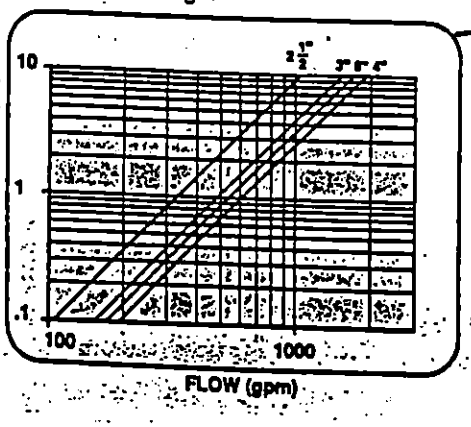
Hayward 2-1/2" through 6" Safe Block True Union Ball Valves are rated to 225 psi. They provide quick quarter turn shut off and eliminate the need for unions.

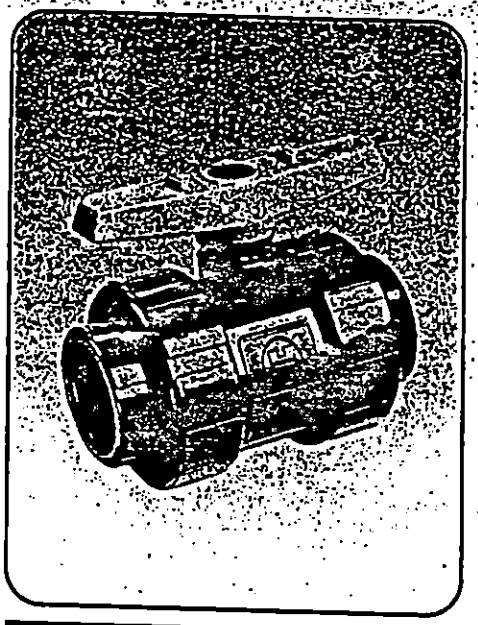
Hayward True Union Valves are safe blocked in all sizes and materials. Large size Hayward safe blocked valves feature O-ring backed, reversible teflon seats. This provides a low running and seating torque which extends the cycle life of the valve. Furthermore, should the seats ever become scratched or scored, simply unscrew the seal retainer and reverse the teflon seats for twice the service life. The valve has a highly visible OSHA orange handle that also serves as a special tool used to adjust the seal retainer when compensating for seat wear.

Hayward Safe Block Ball Valves are often used in applications where the fluids being conveyed are highly corrosive and run the full range of the PH scale. Hayward large sized ball valves afford twice the protection against fugitive emissions. A double O-ring stem seal provides a double barrier, preventing chemical seepage through the valve stem.

For added safety, the safe block seal retainer features a left hand thread. The union nut can be disassembled without risk to the seating torque on the ball, or the seating position of the seal retainer. Hayward large size ball valves can be actuated while in service. A unique actuation adaptor kit permits perfect alignment and proper support of Hayward pneumatic and electric actuators.

Hayward 2-1/2" through 4" safe block ball valves are a full port design, while the 6" is venturied from a 4" valve. They are made from NSF approved material and are available in PVC, CPVC, and Polypropylene with Viton or EPDM O-rings.



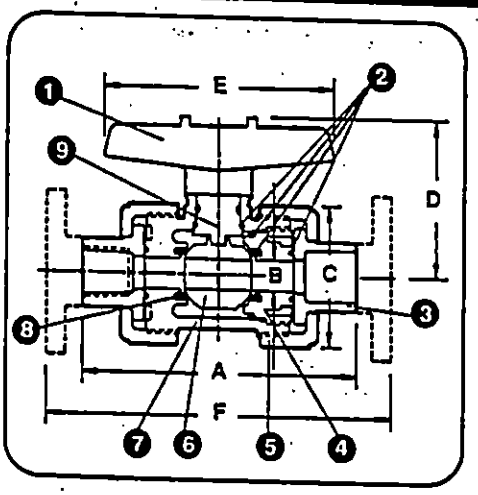


Features

- 225 psi rated
- Safe Block design
- Internals can be inspected and serviced
- Threaded seal retainer to adjust for seat wear
- Reversible Teflon seats doubles the life of the valve
- Full Port design for greater Cv values
- O-ring backed Teflon seats for low running and seating torque
- Double O-ring stem seals for added sealing against chemical and abrasive attack
- OSHA orange handle designed as adjustable tool
- Simple maintenance performed with no special tools

Options

- 2" Square Operating Nuts
- Valve Safe Lock Outs
- Electric & Pneumatic Actuators



2-1/2"-6" Safe Block True Union Ball Valves Parts List

1 Handle
2 O-Ring Seals
3 End Connector
4 Seal Retainer
5 Union Nut
6 Ball
7 Body
8 Teflon Seat
9 Stem

Dimensions

Size	A	B	C	D	E	F	Weight in lbs. Soc/Thd	Weight in lbs. Flanged
2-1/2"	10.56	3.00	6.40	5.50	10.50	14.38	11.00	15.00
3"	10.56	3.00	6.40	5.50	10.50	14.44	10.50	14.50
4"	12.94	3.81	8.56	6.50	10.50	17.13	17.60	24.80
6"		3.81	8.56	6.50	10.50	19.19	—	30.75

Dimensions are in inches. For reference only.

Selection Chart

Size	Material	End Connection	Seals	Pressure Rating
2½"-4"	PVC	Socket, Threaded	Viton	225 psi @ 70° F non shock
3"-4"	CPVC	or Flanged	EPDM	
6"	PVC	Flanged	Viton or EPDM	
3"-4"	PPL	Threaded or Flanged	Viton	

Engineering Specifications

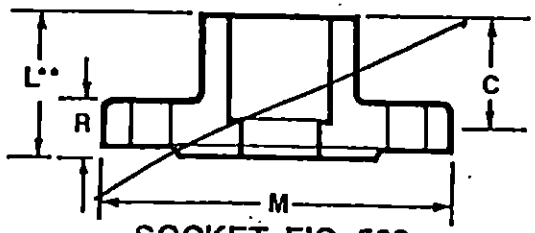
All True Union Ball Valves 2-1/2" through 6" shall be PVC (Polyvinyl Chloride), CPVC (Chlorinated Polyvinyl Chloride) or Polypropylene with (Socket, Threaded, or Flanged) end connections. Seals shall be (Viton or EPDM) with Teflon seats. Valves 2-1/2" through 4" valve shall be a full port design, 6" shall be venturied from a 4" valve. The valves shall have reversible, O-ring backed Teflon seats, be safe blocked, adjustable for seat wear, and serviceable by removal of the seal retainer. The stems shall have double O-ring seals for added safety. For future automation, the valves shall be adaptable for field mountable actuation. As manufactured by Hayward Industrial Products, Inc.

Socket Flanges-150 Lb.

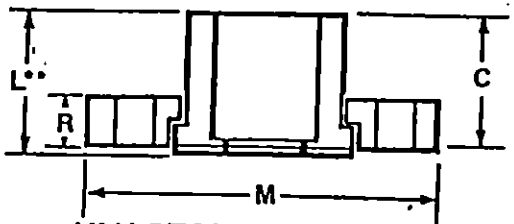
Nom. Pipe Size	Max. O.D. Dim. M	Part No.	Dimensions			No. Bolt Holes	Bolt Hole Dia.	Bolt Circle Dia.	Approx. Wt. (lb)
ONE PIECE FLANGES*			FIG. 509						
			L**	C†	R				
½	3½	5081	1 1/16	29/32	15/32	4	⅝	2⅜	.198
¾	3⅞	5082	1 3/16	1	½	4	⅝	2¾	.280
1	4½	5083	1 5/16	15/32	9/16	4	⅝	3⅛	.378
1¼	4⅝	5084	1½	1¼	⅝	4	⅝	3½	.494
1½	5	5085	1½	1⅜	23/32	4	⅝	3⅞	.628
2	6	5086	1 11/16	1½	¾	4	¾	4¾	.972
VAN STONE STYLE FLANGES*			FIG. 509-VS						
			L**	C†	R				
3	7½	5087	2	1⅞	29/32	4	¾	6	1.64
4	9	5088	2½	2¼	1 3/32	8	¾	7½	2.72
6	11	5089	3 5/32	3	1¼	8	⅞	9½	4.14
8	13½	5090	4 9/16	4¼	1½	8	⅞	11¾	8.153
10	15 31/32	5471	6⅜	5 25/32	1⅝	12	1	14¼	12.865
12	19 1/16	5472	7 9/16	7 2/16	1 21/32	12	1	17	19.450
VAN STONE STYLE SPIGOT FLANGES			FIG. 509-VS-SPG						
			I	L**	C†	R			
3	7½	5467	3 5/64	3 5/32	1⅞	29/32	4	¾	6	1.870
4	9	5468	3 9/16	3 21/32	2¼	1 3/32	8	¾	7½	2.945
6	11	5469	4 13/32	4½	3	1¼	8	⅞	9½	4.710
8	13½	5470	5 45/64	5 51/64	4	1½	8	⅞	11¾	8.740

*One piece style flanges in 3, 4, 6, 8, 10, and 12 inch sizes have been discontinued.
**Includes seal ring height (length overall).
† C dimension is socket depth or spigot length.

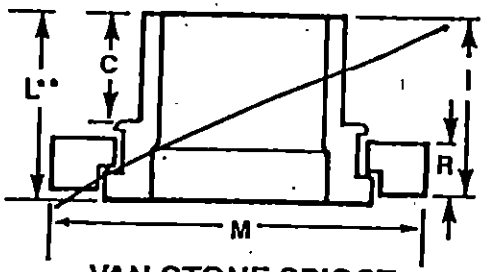
NSF-pw SE



SOCKET FIG. 509



VAN STONE FIG. 509-VS



VAN STONE SPIGOT FIG. 509-VS-SPG

NOTES:
Flange bolt hole patterns meet ANSI B16.5.
CPVC material meets ASTM Standard D-1784.
All dimensions are in inches unless otherwise specified.
Dimensions are subject to change without notice. Contact factory for certification.

Contents

DRISCOPIPE

Driscopipe® 6400 Polyethylene Piping Systems

Introduction

Driscopipe 6400 Polyethylene Piping Systems offer the energy industry and the environmental engineer economic, innovative and modern solutions to age-old problems. This Driscopipe system provides the contemporary engineer proven engineered answers to many traditional problems and new applications.

The plastics industry is over 100 years old, but polyethylene resins were not discovered until the 1930s. The polyethylenes used today in modern piping systems were developed in the early 1950s. One of the first applications was in oil and gas gathering piping systems. Phillips Petroleum Company was one of the pioneers in utilizing the advantages of polyethylene in this area and has over 30 years experience to offer the industry.

Phillips was also one of the first major oil and gas producing companies to diversify into the petrochemical field to upgrade by-products of their producing and refining processes. Phillips is one of the world's largest producers of polyolefin plastics, as well as many other petrochemicals. Polymerization processes developed by Phillips are used worldwide. Today, much of the world's high density polyethylene is made by the Phillips process. It is through this leadership and long established technical know-how that specialized pipe resins were developed.

Driscopipe Piping Systems are the result of a continued team effort by Phillips Petroleum and its subsidiaries – Phillips 66 Company and Phillips Driscopipe, Inc. – to research and develop complete polyethylene piping systems of exceptional quality for demanding applications. Phillips 66 Company takes raw natural gas liquid products produced by Phillips and converts them into base petrochemical feedstocks, such as ethylene. At other plants, Phillips 66 Company converts these feedstocks into numerous polyolefin plastics which are sold under the familiar Marlex® trademark. Some of these Marlex resins are tailor-made for polyethylene pipe. For example, Marlex resins are used to manufacture Driscopipe products which are extremely tough and durable. Phillips has developed special processing techniques and equipment for these resins which achieve finished products unmatched in the industry in quality, engineering properties and performance.

Driscopipe Piping Systems have been installed worldwide. Literally thousands of miles of this pipe are in service in hundreds of different industrial, municipal and general applications. Engineers have used Driscopipe to solve a wide range of problems related to cost, corrosion and serviceability which elude traditional materials.

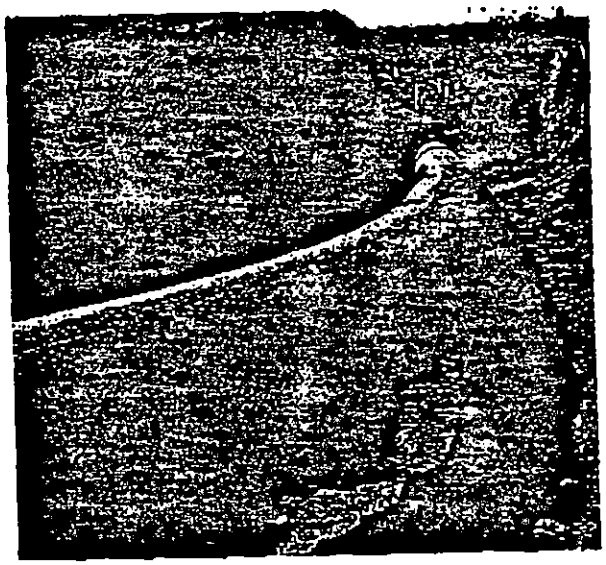
Phillips Petroleum and its subsidiaries, Phillips 66 Company and Phillips Driscopipe, Inc., form a totally integrated effort from the natural resource raw materials at the well head to the finished piping product. This total organization has been developing, testing and providing polyethylene compounds, piping components and systems since the 1950s.

Lightweight – Flexible

The inherent light weight and flexibility of Driscopipe 6400 provide many cost saving benefits related to handling, storage, hauling, unloading, stringing, joining and installation. Because of its light weight, Driscopipe 6400 can be moved, handled and placed in the ditch with smaller and less expensive construction equipment. Usually, manpower requirements are also reduced.

Driscopipe 6400 weighs less than water. It has a specific gravity of .955-.957 and will float. The combination of light weight and flexibility provides opportunity to heat fusion join the pipe in a convenient work area and pull it into position where terrain or other obstacles present installation problems. The pipe can be joined above ground and rolled or lowered into the trench, 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 6400 allows it to be curved over, under and around obstacles, and to make elevation and directional changes, thus eliminating the need for some fittings and reducing installation costs. The pipe can be cold bent as it is installed to a nominal radius of 20-40 times the pipe diameter.



Chemical Resistance

Driscopipe 6400, for all practical purposes, is chemically inert. There are only a few chemicals which will affect it. Naturally occurring chemicals in the soil will not attack Driscopipe or cause it to degrade in any way. It is not an electrical conductor; it does not rot, rust or corrode by electrolytic action or require cathodic protection. It neither supports the growth of, nor is affected by, algae, bacteria or fungi, and is resistant to marine biological attack. Dry, gaseous hydrocarbons have no adverse effect on expected service life. Liquid hydrocarbons will permeate the wall and reduce hydrostatic strength, but will not degrade the material. Upon evaporation of the hydrocarbon, the pipe will regain its original physical properties. When in continuous contact with hydrocarbons, the pipe's hydrostatic strength or allowable operating pressure must be derated. The method of derating for environmental conditions is covered further in the section entitled, "Temperature and Environmental Service Factors". Driscopipe 6400 will tolerate most downhole corrosion inhibitors, hot soils and sour gas.

Data on specific chemicals and downhole inhibitors is outlined in the following table.

Some reagents are marked with an asterisk (*). Although Driscopipe 6400 is chemically resistant to these agents, under certain conditions they may cause stress cracking.

When handling reagents listed under the "Marginal", "Unsatisfactory", "Not Known" or asterisk categories, consult a Driscopipe Sales Representative for assistance in designing piping systems.

CHEMICAL RESISTANCE OF DRISCOPIPE 6400

S – Satisfactory	This product has no effect on Driscopipe high density polyethylene.
M – Marginal	A loss of physical properties occurs. Systems design and conditions of use will be the determining factors.
U – Unsatisfactory	A significant loss of strength, softening or embrittlement occurs. Driscopipe is unsuitable for prolonged contact.
N – Not Known	

All concentrations are 100% unless noted otherwise.

On reagents marked marginal, chemical attack will be recognized by a loss of physical properties of the pipe which may require a change in design factors.

Reagent	70°F (21°C)	140°F (60°C)
Acetic Acid* 1-10%	S	S
Acetic Acid* 10-100%	S	M
Acetone	M	U
Acrylic Emulsions*	S	S
Aluminum Chloride	S	S
Aluminum Fluoride	S	S
Aluminum Sulfate	S	S
Alums (all types)	S	S
Ammonia 100% Dry Gas	S	S
Ammonium Carbonate	S	S
Ammonium Chloride	S	S
Ammonium Fluoride, 20%	S	S
Ammonium Hydroxide, 0.88 Sp. Gr.	S	S
Ammonium Metaphosphate, SAT	S	S
Ammonium Nitrate	S	S
Ammonium Persulfate	S	S
Ammonium Sulfate	S	S
Ammonium Sulfide	S	S
Ammonium Thiocyanate	S	S
Amyl Acetate 100%	M	U
Amyl Alcohol* 100%	S	S
Amyl Chloride 100%	M	U
Aniline 100%	S	N
Antimony Chloride	S	S
Aqua Regia	U	U
Barium Carbonate	S	S
Barium Chloride	S	S
Barium Hydroxide	S	S
Barium Sulfate	S	S
Barium Sulfide	S	S
Benzene 100%	M	U
Benzene Sulfonic Acid	S	S
Bismuth Carbonate, SAT	S	S
Boric Acid	S	S
Bromic Acid, 10%	S	S
Bromine, Liquid, 100%	M	U
Butanediol*	S	S
Butyl Acetate, 100%	M	U
Butyl Alcohol*	S	S
Calcium Bisulfide	S	S
Calcium Carbonate	S	S
Calcium Chlorate	S	S
Calcium Chloride	S	S
Calcium Hydroxide	S	S
Calcium Hypochlorite Bleach Solution	S	S
Calcium Nitrate, 50%	S	S
Calcium Sulfate	S	S
Carbon Dioxide 100% Dry	S	S
Carbon Dioxide 100% Wet	S	S
Carbon Disulfide	N	U
Carbon Monoxide	S	S
Carbon Tetrachloride	M	U
Carbonic Acid	S	S
Chlorine Dry Gas 100%	S	M
Chlorine Moist Gas	M	U
Chlorine Liquid	M	U
Chlorobenzene	M	U
Chlorosulfonic Acid, 100%	U	U
Chrome Alum, SAT	S	S
Chromic Acid up to 50%	S	S
Cleaning Acid*	S	M
Copper Chloride	S	S
Copper Cyanide	S	S
Copper Fluoride, 2%	S	S
Copper Nitrate	S	S
Copper Sulfate	S	S
Crude Oil	S	M
Cuprous Chloride, SAT	S	S
Cyclohexanol*	S	S
Cyclohexanone	M	U
Detergents*	S	M
Diethylene Glycol*	S	S
Diglycolic Acid*	S	S
Dimethylamine	M	U
Disodium Phosphate	S	S
Dowell Carbon 326	S	S
Dowell Carbon 325	S	S

CHEMICAL RESISTANCE OF DRISCOPIPE 6400

Reagent	70°F (21°C)	140°F (60°C)
Dowtil M 133	S	S
Ethyl Acetate, 100%	M	U
Ethyl Alcohol* 100%	S	S
Ethyl Butyrate	M	U
Ethyl Chloride	M	U
Ethyl Ether	U	U
Ethylene Chloride	U	U
Ethylene Glycol*	S	S
Ferric Chloride	S	S
Ferric Nitrate	S	S
Ferrous Chloride	S	S
Ferrous Sulfate	S	S
Fluorine	S	U
Fluoroboric Acid	S	S
Fluosilicic Acid	S	S
Formaldehyde* 40%	S	N
Formic Acid	S	S
Fuel Oil	S	U
Furfural, 100%	M	U
Gallic Acid*	S	S
Gasoline	M	U
Glycerine (Glycerol)	S	S
Glycol*	S	S
Glycolic Acid* 30%	S	S
Hexanol, Tert.*	S	S
Hydrobromic Acid 50%	S	S
Hydrocyanic Acid	S	S
Hydrochloric Acid	S	S
Hydrofluoric Acid 0-75%	S	S
Hydrogen	S	S
Hydrogen Bromide 10%	S	S
Hydrogen Chloride Gas Dry	S	S
Hydrogen Peroxide 30%	S	S
Hydrogen Peroxide 90%	S	M
Hydrogen Phosphide 100%	S	S
Hydroquinone	S	S
Hydrogen Sulfide	S	S
Hypochlorus Acid	S	S
Lead Acetate	S	S
Lube Oil	S	M
Magnesium Carbonate, SAT	S	S
Magnesium Chloride, SAT	S	S
Magnesium Hydroxide, SAT	S	S
Magnesium Nitrate, SAT	S	S
Magnesium Sulfate, SAT	S	S
Mercuric Chloride, SAT	S	S
Mercuric Cyanide, SAT	S	S
Mercurous Nitrate, SAT	S	S
Mercury	S	S
Methyl Alcohol*	S	S
Methyl Chloride	M	U

Reagent	70°F (21°C)	140°F (60°C)
Methyl Chloride, 100%	U	U
Methyl Ethyl Ketone, 100%	U	U
Methylsulfuric Acid*	S	S
Nickel Chloride, SAT	S	S
Nickel Nitrate Conc.	S	S
Nickel Sulfate, SAT	S	S
Nicotinic Acid	S	S
Nitric Acid 0-30%	S	S
Nitric Acid 30-70%	S	M
Nitric Acid 95-98%	U	U
Nitrobenzene 100%	U	U
Oleic Acid Conc.	U	U
Oxalic Acid*	S	S
Perchloric Acid 10%	S	S
Petroleum Ether	U	U
Phenol 90%	U	U
Phosphoric Acid	S	S
Pickling/Plating Solutions	S	S*
Potassium Bicarbonate	S	S
Potassium Borate 1%	S	S
Potassium Bromate 10%	S	S
Potassium Bromide	S	S
Potassium Carbonate	S	S
Potassium Chlorate	S	S
Potassium Chloride	S	S
Potassium Chromate 40%	S	S
Potassium Cyanide, SAT	S	S
Potassium Dichromate 40%	S	S
Potassium Ferri/ Ferro Cyanide	S	S
Potassium Fluoride	S	S
Potassium Hydroxide 20%	S	S
Potassium Nitrate, SAT	S	S
Potassium Perborate, SAT	S	S
Potassium Perchlorate 10%	S	S
Potassium Permanganate 2%	S	S
Potassium Sulfate Conc.	S	S
Potassium Sulfide Conc.	S	S
Potassium Sulfite Conc.	S	S
Potassium Persulfate	S	S
Propargyl Alcohol*	S	S
Propyl Alcohol*	S	S
Propylene Dichloride 100%	U	U
Propylene Glycol*	S	S
Sea Water	S	S
Selenic Acid	S	S
Silicic Acid	S	S
Silver Nitrate Sol.	S	S
Sodium Acetate, SAT	S	S
Sodium Benzoate 35%	S	S
Sodium Bicarbonate, SAT	S	S

Reagent	70°F (21°C)	140°F (60°C)
Sodium Bisulfate, SAT	S	S
Sodium Bisulfite, SAT	S	S
Sodium Borate	S	S
Sodium Bromide Dilute Sol.	S	S
Sodium Bromide Oil Solution	S	S
Sodium Carbonate Conc.	S	S
Sodium Chlorate, SAT	S	S
Sodium Chloride, SAT	S	S
Sodium Cyanide	S	S
Sodium Dichromate, SAT	S	S
Sodium Ferricyanide	S	S
Sodium Ferrocyanide	S	S
Sodium Fluoride, SAT	S	S
Sodium Hydroxide Conc.	S	S
Sodium Hypochlorite	S	S
Sodium Nitrate	S	S
Sodium Sulfate	S	S
Sodium Sulfide, SAT	S	S
Sodium Sulfite, SAT	S	S
Stannous Chloride	S	S
Stannic Chloride	S	S
Stearic Acid*	S	S
Sulfuric Acid 0-50%	S	S
Sulfuric Acid 70%	S	M
Sulfuric Acid 80%	S	U
Sulfuric Acid 90-98%	M	U
Sulfuric Acid, Fuming	U	U
Sulfurous Acid	S	S
Tannic Acid 10%	S	S
Tartaric Acid, SAT	N	N
Tetralin	U	U
Tetrahydrofurane	N	N
Toluene	M	U
Transformer Oil	S	M
Tretolite K-147	S	S
Tretolite K-141	S	S
Tretolite PD-33	S	S
Tretolite R-25	S	S
Tretolite F-84	S	S
Tretolite XT39	S	S
Trichloroacetic Acid 10%	S	S
Trichloroethylene	U	U
Trisodium Phosphate, SAT	S	S
Turpentine	U	U
Urea	S	S
Wetting Agents	S	S
Xylene	M	U
Zinc Chloride, SAT	S	S
Zinc Sulfate, SAT	S	S

*To compensate for hydrocarbon saturation effects on long term hydrostatic strength refer to Working Pressure Table, p.10.

*Potassium Dichromate/Sulfuric Acid Solution

*Sulfuric/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	Hours To Failure*
Dowell Carbon 328	Corrosion Inhibitor	Water	>1000
Dowell Carbon 325	Corrosion Inhibitor	Hexane	>1000
Tretolite K-147	Corrosion Inhibitor	Hexane	>1000
Tretolite K-141	Corrosion Inhibitor	Water	>1000
Dowell M 133	Bactericide and Corrosion Inhibitor	Water	>1000
Aliquot 400	Bactericide and Corrosion Inhibitor	Water	>1000
Tretolite PD-33	Paraffin Dispersant	Water	>1000
PPC-8	Corrosion Inhibitor	Water	>1000
Tretolite R-25	Demulsifier	Hexane	>1000
Tretolite F-94	Demulsifier	Hexane	>1000
Tretolite XT-39	Paraffin Remover	Water	>1000

*Test 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.

Driscopipe 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 trenches.

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 innovative piping design.

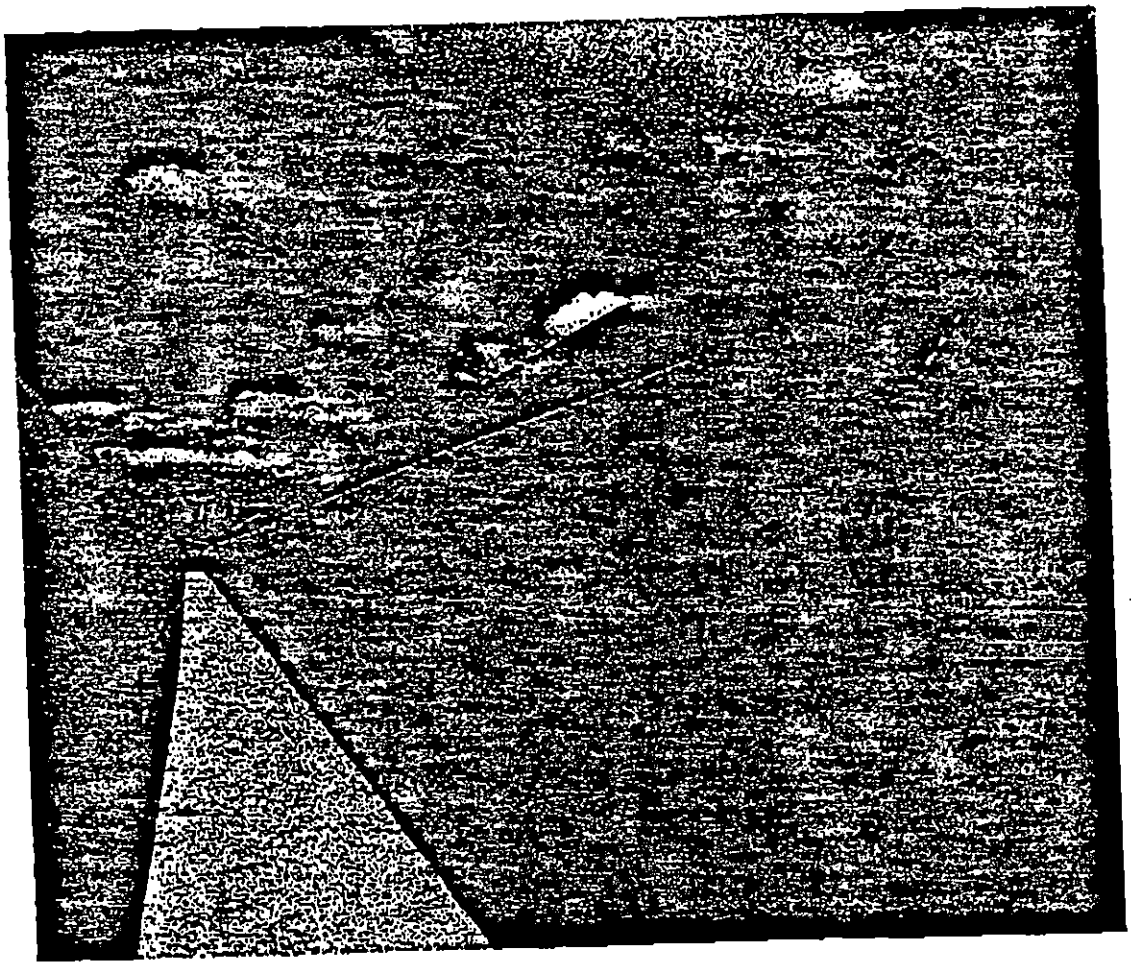
Factors

Driscopipe polyethylene pipe has a very smooth inside surface. It maintains excellent flow properties throughout 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 diameter 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 pigging 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.



DRISCOPIPE

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.

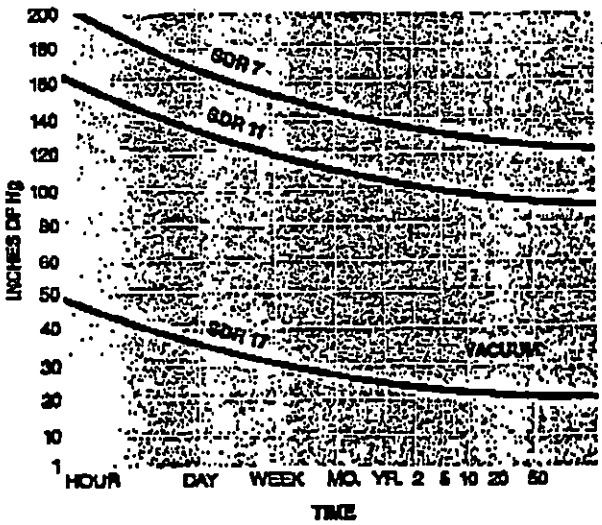
Typical cases of vacuum or suction pipelines are gravity flow, downhill siphon lines, pipelines which are cleaned by vacuum and gas gathering lines operating under vacuum. When subjected to a vacuum, a sufficiently heavy wall pipe must be selected to resist the collapsing forces. Basically, the pipe's 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°F (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 failure 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 properly applying Chart 1, the possibility of collapse is minimized.

Chart 1

Vacuum Plus External Load Resistance

Inches of Mercury at 73.4°F



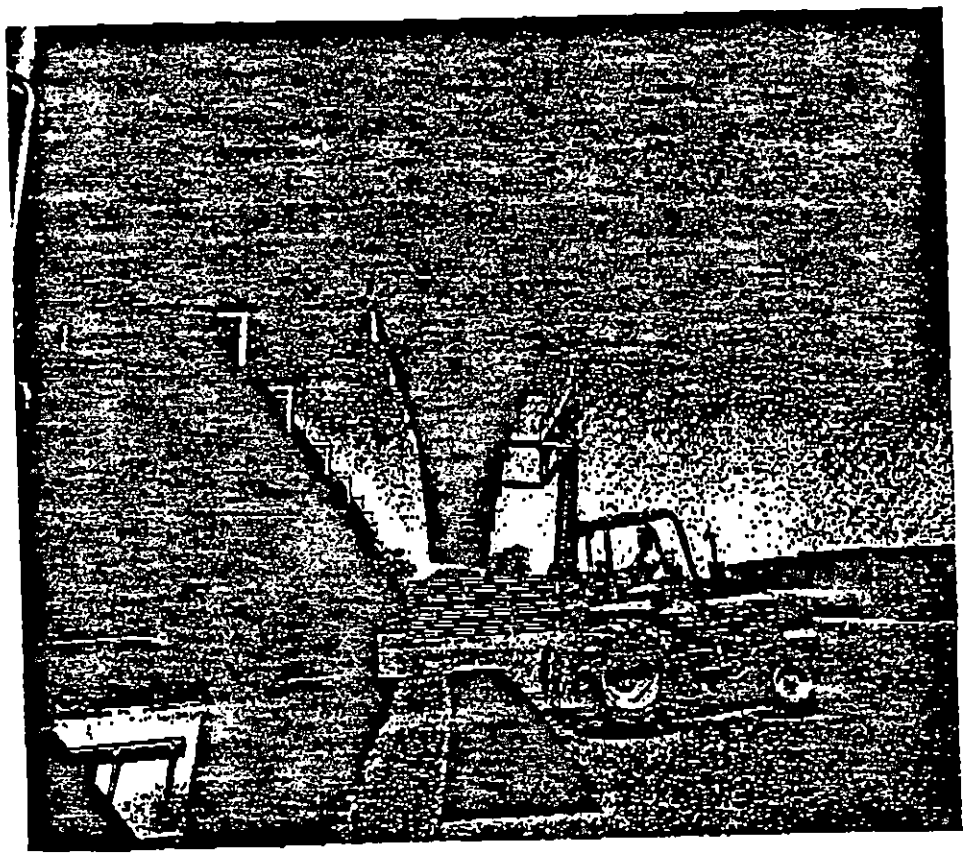
F[illegible]ny cases, as a general rule of thumb, DR 15.5 o[illegible]r DR pipe can be used safely at 70°F or lower temperatures to carry full vacuum. For vacuum pipeline fittings, lower DR (thicker wall) is selected for fabricating fittings. For example, a buried vacuum pipeline using DR 17 pipe would use fittings made from 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).

A buried pipeline operating under a negative pressure (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.



DRISCOPIPE

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.

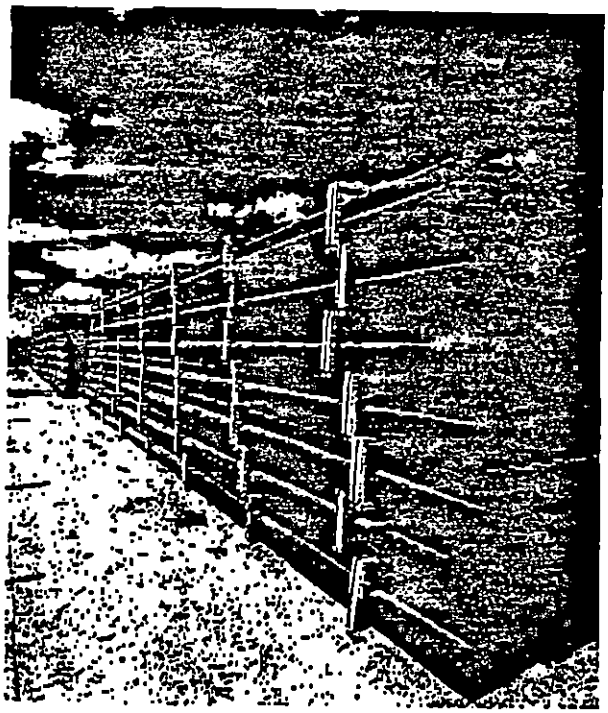
Applications

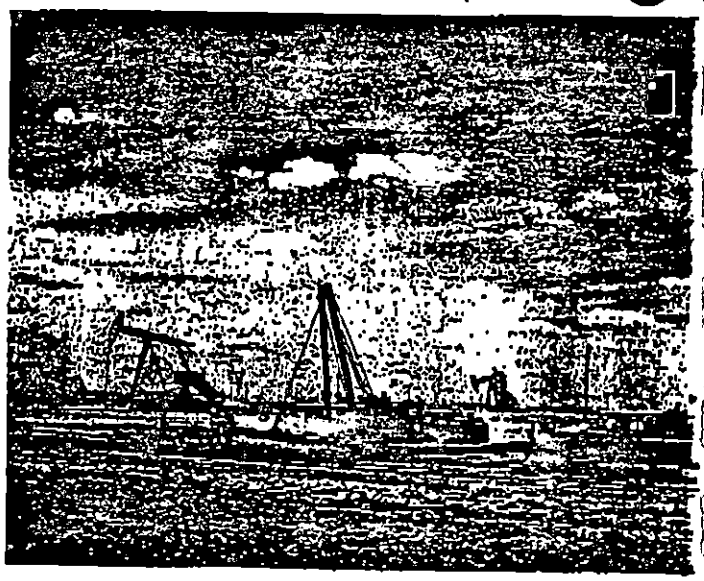
Driscopipe 6400 is extruded from a Type III, Class C, Category 5, Grade P34 compound as described in ASTM D 1248. It is classified as cell 345434C according to ASTM D 3350 and has the material designation of PE 3408. The pipe is manufactured to meet the requirements of ASTM D 2513 which is necessary 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.





ngs

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 = $\frac{\text{Outside Diameter (inches)}}{\text{Minimum Wall Thickness (inches)}}$

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 thermoplastic 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 192.123, is 0.32 with a maximum allowable operating pressure of 100 psig. Higher pressure systems may be granted by a waiver from DOT.

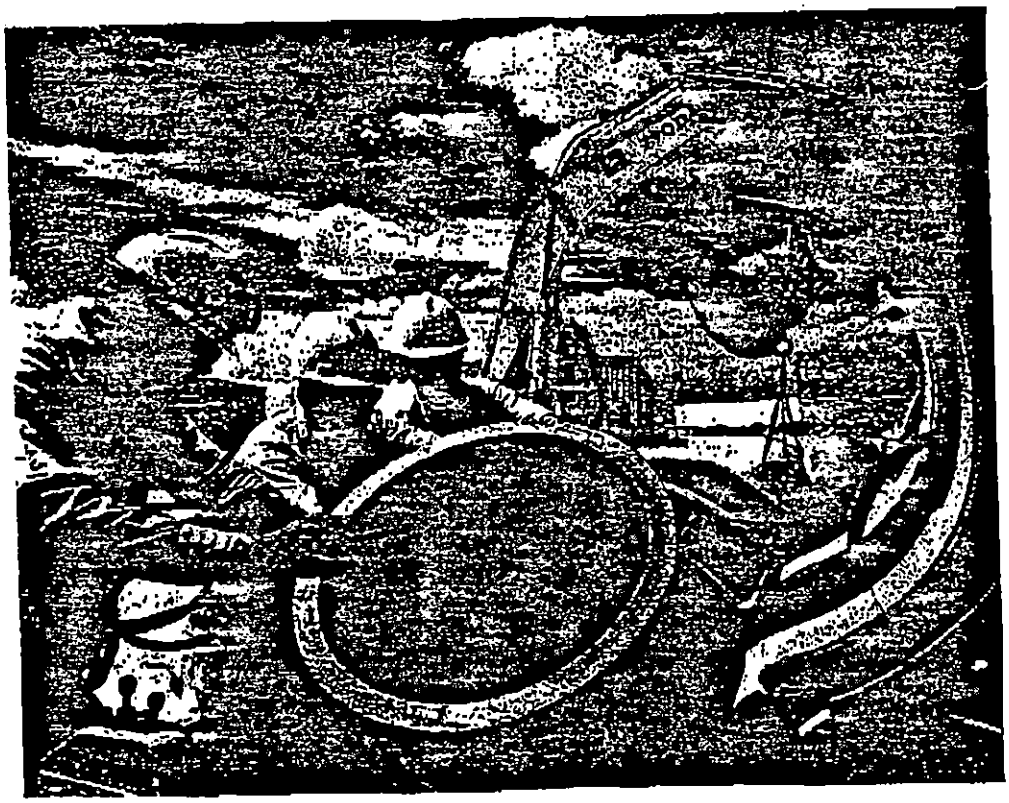
Environmental Service Factors

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.	SDR 7	SDR 9	SDR 11	SDR 17
73.4°F	1.00	265 psig	200 psig	160 psig	100 psig
100°F	0.79	210 psig	158 psig	126 psig	79 psig
120°F	0.62	165 psig	125 psig	100 psig	63 psig
140°F	0.50	133 psig	100 psig	80 psig	50 psig



DRISCOPIPE

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°F 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.

Butt heat fusion joining is the recommended method for joining Driscopipe 6400. Phillips has utilized butt heat fusion for over 30 years of Driscopipe's polyethylene piping experience in the oil fields. Butt 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

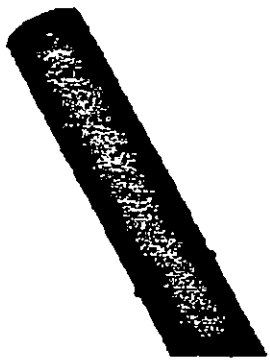


Figure 2
Tensile Pull Test

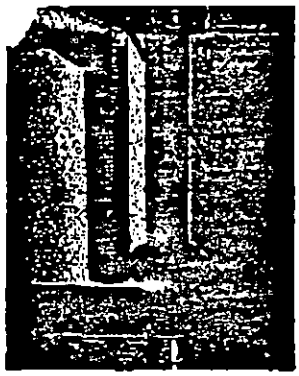
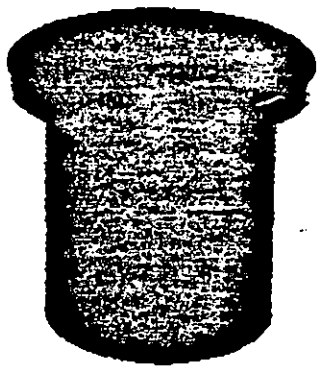


Figure 3
Molded Flange Adapter



ged 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 fittings 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

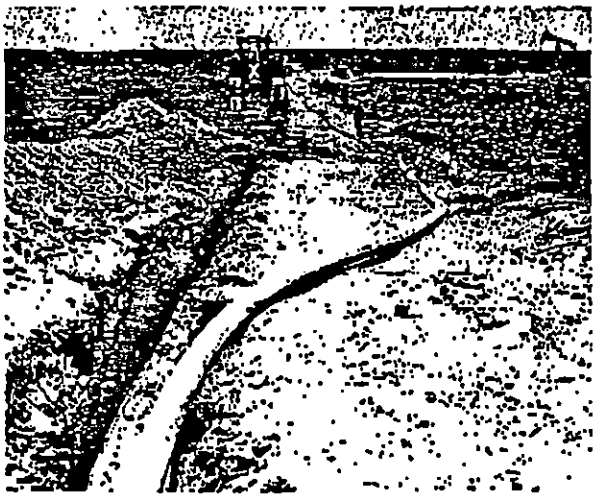
The width of the trench is usually determined by the diameter of the pipe. The pipe should have some slack and the trench should be wide enough to provide for good compaction of soil around the pipe. Detector tapes are available from other sources for pipeline detection.

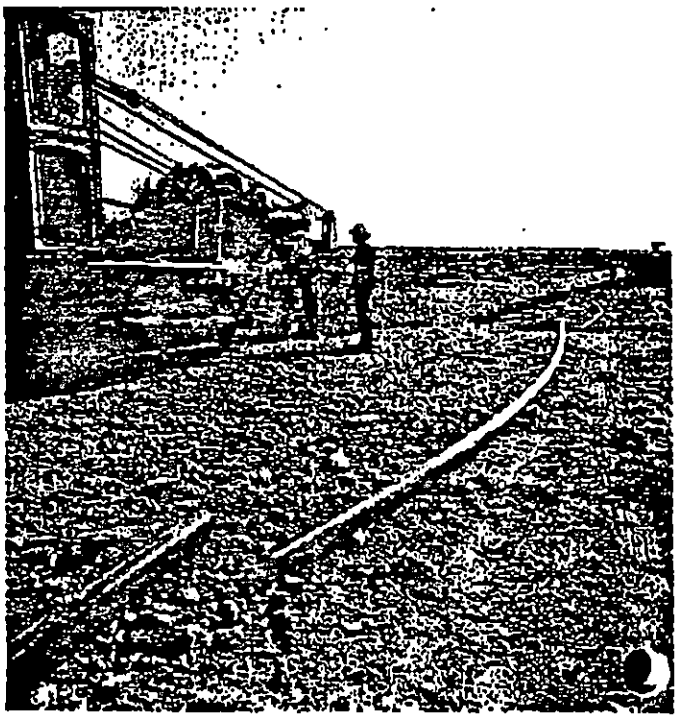
The depth of the trench should be sufficient to provide a minimum of 30 inches of cover. In cultivated areas this should be increased to 36 inches.

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.





here 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

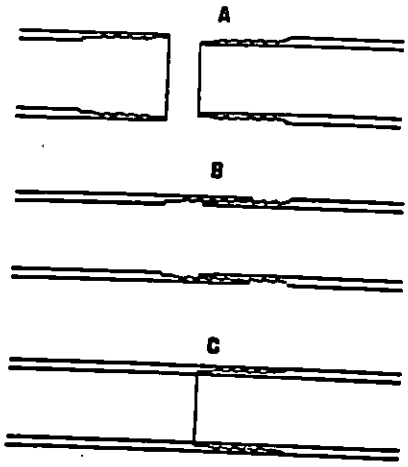
Polyethylene pipe will develop very high static electricity charges under certain conditions. One of these conditions occurs during the squeeze-off procedure. Special precautions must be taken to accommodate this phenomenon.

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.

HDPE COLLECTION PIPE
JOINT DETAILS
(LEACHATE COLLECTION)

02223
2.8B



BarbVark™
Quick Connect Pipe Joints
Patent Pending

Interlocking Barbs give the BarbVark™ Pipe Joint a fast, simple and strong connection in a fraction of the time it takes to fusion weld.

FITTINGS

Tees, elbows, caps etc. are available with BarbVark™ Quick Connect Pipe Joints. Call for dimensions.

A. Align joints. **B.** Push together.
C. Joint assembles in seconds.

Available on all our polyethylene pipe, slotted or blank.

REUSABLE QUICK CONNECT/DISCONNECT JOINT

Reusable BarbVark™ Quick Connect Joint available for installations that require moving from time to time. Using our assembly tool, simply snap the joint together, and when desired snap apart again.

Assembly Comparison

BarbVark™ Quick Connect Pipe Joints **VERSUS** **Fusion Welding**

In many collection and screen applications the installation of polyethylene pipe by fusion welding is too slow and expensive. Often work crews sit and wait for the painfully slow pipe fusion welding process and eat up thousands of dollars of unproductive time. Fortunately there is an alternative: BarbVark™ Quick Connect Pipe Joints. These snap together joints cut the assembly time of polyethylene pipe into a small fraction of the time used in fusion welding.

Using an example of a 4" SDR 15.5 Polyethylene Slotted Pipe Installation on a geomembrane liner we can accurately estimate the time savings provided by using BarbVark™ Pipe Joints. After laying the 20 foot lengths end to end on the liner let's compare the time to assemble a 3,000' length between fusion welding and BarbVark™ Pipe Joints.

BarbVark™ Quick Connect Pipe Joints
Patent Pending
Requirements: 1 one person crew, $_____.00 a day
(no training or special abilities needed)
: Assembly tool rental, $75.00 day

Assembly time per joint: 2 minutes = 600' hour
3,000' ÷ 600' hour = 5 hours

Fusion Welding
Requirements: 2 person crew, $_____.00 a day
(one worker should be a certified fusion welder)
: fusion welder rental, $75.00 day

Assembly time
per joint: 10 minutes = 120' hour
3,000' ÷ 120' hour = 25 hours or 3+ days

CONCLUSION

Labor:	Fusion welding:	50 man hours*
	BarbVark™:	5 man hours
Tool Rental:	Fusion welding:	$300.00
	BarbVark™:	$ 75.00
Assembly Time:	Fusion welding:	25 hours
	BarbVark™:	5 hours

D-6-A

Use these assembly times to estimate the costs of down time for other crews waiting for completion of pipe installation.

*Expenses can be much greater if a certified welder is brought in to perform fusion welding.

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DRISCOPIPE

6400 Series Data Sheet

HDPE GAS PIPE AND FITTINGS

Typical Material Physical Properties ⊕

Property	Test Method	Unit	Nominal Value
Density	ASTM D 1505	gms/cc	0.955
Melt Index	ASTM D 1238 (2.16 kg/190°)	gms/10 min.	0.11 ♦
Environmental Stress Cracking Resistance Condition A, B & C, F 0 Compressed Ring, F 50	ASTM D 1693 ASTM F 1248	hrs. hrs.	> 5000** > 1000
Tensile Strength, Yield Type IV Specimen	ASTM D 638 (2"/min.)	psi	3200
Elongation at Break Type IV Specimen	ASTM D 638 (2"/min.)	%	> 750
Vicat Softening Temperature	ASTM D 1525	°F	257
Brittleness Temperature	ASTM D 746	°F	<-180
Flexural Modulus	ASTM D 790	psi	135,000
Modulus of Elasticity	ASTM D 638	psi	130,000
Hardness	ASTM D 2240	Shore D	65
Coefficient of Linear Thermal Expansion Molded Specimen Extruded Pipe	ASTM D 696	in./in./°F	8.3×10^{-5} 1.2×10^{-4}
Thermal Conductivity	Dynatech-Colora Thermoconductor	BTU, in./ft.²/hrs./°F	2.7
Long Term Strength 73° F 140° F	ASTM D 2837	psi psi	1600 800
Material Cell Classification	ASTM D 3350		345434C
Material Designation	PPI Recommendation		PE 3408

- Driscopipe® 6400 meets or exceeds the requirements of ASTM D-2513 and API 15 LE specifications.

⊕ This list of typical physical properties is intended for basic characterization of the material and does not represent specific determinations or specifications. The physical properties values reported herein were determined on compression molded specimens prepared in accordance with Procedure C of ASTM D 1928 and may differ from specimens taken from pipe.

** Tests discontinued because of no failures and no indication of stress crack initiation.

♦ Average Melt Index value with a standard deviation of 0.01.

Distributed by:

LEE SUPPLY CO. INC.

P.O. Box 35 Charleroi, PA 15022

Phone: 412-483-3543 FAX: 412-483-6577

PPI

To secure product information or leave a message for a sales engineer or technical service representative:
Phone: 1-800-527-0662
1-214-783-2666
Fax: 1-214-783-2689

PHILLIPS DRISCOPIPE, INC.

Printed in Texas, USA 6-91

Industrial/
Municipal
1000 Series

Oil & Gas

6400 Series

Fittings

Molded & Fabricated

Dimensions & Sizes

Effective: 9-14-92

DRISCOPIPE

A subsidiary of Phillips Petroleum Co.

Distributed by:

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

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DRISCOPIPE

A subsidiary of Phillips Petroleum Company

P.O. Box 83-3866
Richardson, Texas 75083-3866

1-800-527-0662 or 1-214-783-2666

DRISCOPIPE

90° Ells

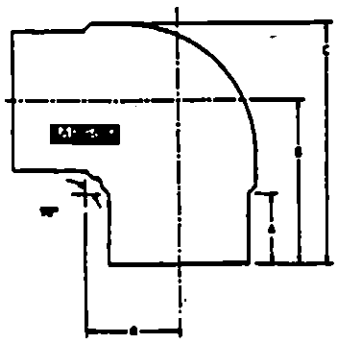
Nominal Size		Type **	psi †	Dimensions, inches A	B	C	R	WT. LBS.
2"	SDR 9.3 11	Molded	190 160	2.9	4.5	5.7	2.0	1
	SDR 7 11	fab'd	200 120	3.0	10.2	11.4	8.7	1 1
3"	SDR 9.3 11 17	Molded	190 160 100	3.0	5.1	6.9	2.5	2
	SDR 7 11 17	fab'd	200 120 75	3.0	10.8	12.5	9.8	4 3 2
4"	SDR 9.3 11 17 26	Molded	190 160 100 64	3.0	5.8	8.0	3.0	3
	SDR 7 11	fab'd	200 120	5.0	16.8	19.1	14.2	8 6
5"	SDR 11	fab'd	120	5.0	17.9	20.7	16.0	8
6"	SDR 9.3 11 17 26	Molded	190 160 100 64	3.0	7.4	10.8	4.4	9
	SDR 7 11 17	fab'd	200 120 75	6.0	21.4	24.7	18.3	19 15 9
8"	SDR 11	Molded	160	6.0	12.0	16.5	6.0	25
	SDR 7 11 17 26	fab'd	200 120 75 48	6.0	22.4	26.7	19.4	45 30 21 15
10"	SDR 11	Molded	160	6.0	13.3	18.6	7.3	41
	SDR 7 11 17 26	fab'd	200 120 75 48	6.0	23.5	28.8	20.4	49 35 22 15
12"	SDR 11	Molded	160	7.5	15.8	22.3	8.3	70
	SDR 7 11 17 26	fab'd	200 120 75 48	8.0	30.5	36.8	26.5	95 88 52 45

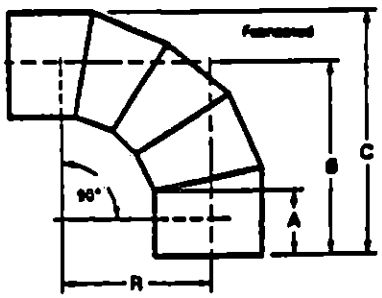
Nominal Size		Type **	psi †	Dimensions, inches A	B	C	R	WT. LBS
14"	SDR 7 11 17 26	fab'd	200 120 75 48	8.0	31.0	38.0	27.1	165 100 52 35
16"	SDR 7 11 17 26	fab'd	200 120 75 48	10.0	38.1	46.1	33.1	175 152 140 110
18"	SDR 11 17 26	fab'd	120 75 48	10.0	39.1	48.1	34.1	234 170 130
20"	SDR 11 17 26	fab'd	120 75 48	11.0	43.2	53.2	37.7	220 190 166
21.5	SDR 11 17 26	fab'd	120 75 48	11.0	44.0	54.7	38.4	426 305 250
22"	SDR 11 17 26	fab'd	120 75 48	11.0	44.2	55.2	38.7	430 315 255
24"	SDR 11 17 26	fab'd	120 75 48	11.0	45.2	57.2	39.7	467 340 212
26"	SDR 11	fab'd	120	10.0	43.1	56.1	38.1	528
28"	SDR 11 17 26	fab'd	120 75 48	10.0	44.1	58.1	39.0	500 400 310
30"	SDR 17 26	fab'd	75 48	10.0	45.9	60.9	41.1	300 205
800mm (31.496)	SDR 17 26	fab'd	75 48	10.0	45.9	61.6	40.9	425 350
32"	SDR 17 26	fab'd	75 48	10.0	46.1	62.1	41.1	430 355
36"	SDR 17 26	fab'd	75 48	10.0	48.1	66.1	43.1	750 670
42"	SDR 17 26	fab'd	75 48	10.0	51.1	72.1	44.1	800 715
48"	SDR 26	fab'd	48	10.0	54.1	78.1	49.1	1111

Non-listed sizes, contact your Driscopipe representative.

** Fabbed Ells are not fully pressure rated, see "Technical Considerations".

† PSI @ 73.4 degrees F. (▒) = duplication

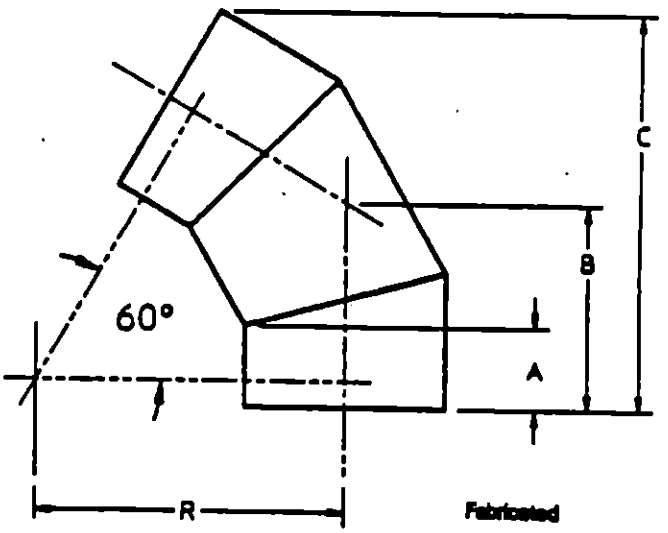




60° Ells

Nominal Size		Type **	psi †	Dimensions, inches A	B	C	R	Wt. lbs.
2"	SDR 7	fab'd	200	3.0	6.0	10.1	8.7	1
	11		120					.5
3"	SDR 7	fab'd	200	3.0	6.5	11.3	9.8	2
	11		120					1
	17		75					1
4"	SDR 7	fab'd	200	5.0	10.0	16.9	14.2	4
	11		120					3
	17		75					2
5"	SDR 11	fab'd	120	5.0	10.7	18.5	16.0	6
6"	SDR 7	fab'd	200	6.0	12.6	21.7	18.3	12
	11		120					10
	17		75					6
	26		48					4
8"	SDR 7	fab'd	200	6.0	13.2	23.5	19.4	24
	11		120					17
	17		75					12
	26		48					9
10"	SDR 7	fab'd	200	6.0	13.8	25.3	20.4	35
	11		120					28
	17		75					17
	26		48					10
12"	SDR 7	fab'd	200	8.0	17.9	32.4	26.5	65
	11		120					51
	17		75					36
	26		48					25
14"	SDR 7	fab'd	200	8.0	18.3	33.5	27.1	95
	11		120					63
	17		75					45
	26		48					35
16"	SDR 11	fab'd	120	10.0	22.4	40.5	33.1	100
	17		75					72
	26		48					55
18"	SDR 11	fab'd	120	10.0	23.0	42.2	34.1	130
	17		75					94
	26		48					80
20"	SDR 11	fab'd	120	11.0	23.1	43.4	30.5	150
	17		75					100
	26		48					74
21.5	SDR 11	fab'd	120	11.0	23.6	44.7	31.3	194
	17		75					140
	26		48					120

Nominal Size		Type **	psi †	Dimensions, inches A	B	C	R	WT. LBS
22"	SDR 11	fab'd	120	11.0	23.7	45.1	31.5	194
	17		75					140
	26		48					115
24"	SDR 11	fab'd	120	11.0	24.3	46.8	32.5	247
	17		75					178
	26		48					150
26"	SDR 11	fab'd	120	10.0	25.3	49.2	38.1	336
28"	SDR 11	fab'd	120	10.0	25.3	49.2	38.1	255
	17		75					200
	26		48					160
30"	SDR 17	fab'd	75	10.0	26.8	53.1	41.1	270
	26		48					220
800mm (31.496)	SDR 17	fab'd	75	10.0	26.9	53.9	40.9	197
	26		48					165
32"	SDR 17	fab'd	75	10.0	27.0	54.4	41.1	205
	26		48					170
36"	SDR 17	fab'd	75	10.0	28.1	57.8	43.1	400
	26		48					300
42"	SDR 17	fab'd	75	10.0	30.3	63.0	46.1	460
	26		48					400
48"	SDR 26	fab'd	48	10.0	29.8	68.2	49.1	548



** FAB'D Ells are not fully pressure rated, see "TECHNICAL CONSIDERATIONS"

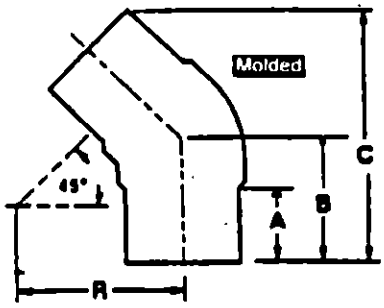
† PSI @ 73.4 degrees F. (▒) = duplication

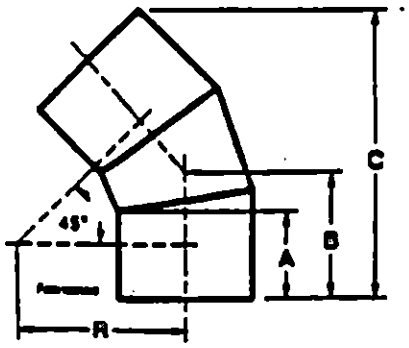
Non-listed sizes, contact your Driscopipe representative.

45° Ells

Nominal Size		Type **	psi †	Dimensions, inches A	B	C	R	WT. LBS
2"	SDR 7	fab'd	200	3.0	5.1	9.6	8.7	1
	SDR 11		120					.5
3"	SDR 9.3	Molded	190	3.0	5.0	9.8	3.6	2
	SDR 11		160					
	SDR 7	fab'd	200	3.0	5.4	10.4	9.8	2
	SDR 11		120					1
4"	SDR 9.3	Molded	190	3.0	5.0	10.1	3.8	3
	SDR 11		160					
	SDR 17		100	3.0	5.0	10.1	3.8	
	SDR 26		64					
	SDR 7	fab'd	200	5.0	8.5	16.1	14.2	4
	SDR 11		120					3
5"	SDR 11	fab'd	120	5.0	8.9	17.1	16.0	5
6"	SDR 9.3	Molded	190	3.0	7.0	12.0	9.6	9
	SDR 11		160					
	SDR 17		100	3.0	7.0	12.0	9.6	
	SDR 26		64					
	SDR 7	fab'd	200	6.0	10.6	20.5	18.3	10
	SDR 11		120					8
8"	SDR 11	Molded	160	6.0	10.0	17.3	9.6	16
	SDR 7	fab'd	200	6.0	11.0	21.9	19.4	25
	SDR 11		120					20
	SDR 17		75					9
	SDR 26		48					6
10"	SDR 11	Molded	160	6.0	13.3	22.8	17.5	40
	SDR 7	fab'd	200	6.0	11.5	23.4	20.4	30
	SDR 11		120					29
	SDR 17		75					20
	SDR 26		48					15
12"	SDR 11	Molded	160	7.5	15.8	27.0	20.0	70
	SDR 7	fab'd	200	8.0	15.0	30.0	26.5	57
	SDR 11		120					49
	SDR 17		75					35
	SDR 26		48					28
14"	SDR 7	fab'd	200	8.0	15.3	30.9	27.1	95
	SDR 11		120					65
	SDR 17		75					45
	SDR 26		48					35
16"	SDR 7	fab'd	200	10.0	18.7	37.6	33.1	125
	SDR 11		120					99
	SDR 17		75					70
	SDR 26		48					50
18"	SDR 11	fab'd	120	10.0	19.1	39.0	34.1	139
	SDR 17		75					95
	SDR 26		48					85

Nominal Size		Type **	psi †	Dimensions, inches A	B	C	R	WT. LBS
20"	SDR 11	fab'd	120	11.0	21.1	43.1	37.7	190
	SDR 17		75					110
	SDR 26		48					75
21.5	SDR 11	fab'd	120	11.0	21.4	44.1	38.4	196
	SDR 17		75					138
	SDR 26		48					97
22"	SDR 11	fab'd	120	11.0	21.5	44.5	38.7	198
	SDR 17		75					140
	SDR 26		48					100
24"	SDR 11	fab'd	120	11.0	221.9	45.9	39.7	255
	SDR 17		75					180
	SDR 26		48					116
26"	SDR 11	fab'd	120	10.0	20.8	44.7	38.1	280
28"	SDR 11	fab'd	120	10.0	21.2	46.1	39.0	250
	SDR 17		75					200
	SDR 26		48					150
30"	SDR 17	fab'd	75	10.0	21.8	47.9	41.1	250
	SDR 26		48					180
800mm (31.496)	SDR 17	fab'd	75	10.0	21.9	48.6	40.9	245
	SDR 26		48					200
32"	SDR 17	fab'd	75	10.0	22.1	48.9	41.1	250
	SDR 26		48					200
36"	SDR 17	fab'd	75	10.0	22.9	51.8	43.1	400
	SDR 26		48					275
42"	SDR 17	fab'd	75	10.0	24.1	56.0	46.1	410
	SDR 26		48					350
48"	SDR 26	fab'd	48	10.0	25.4	60.2	49.1	647





** FAB'D Ells are not fully pressure rated, see "TECHNICAL CONSIDERATIONS".

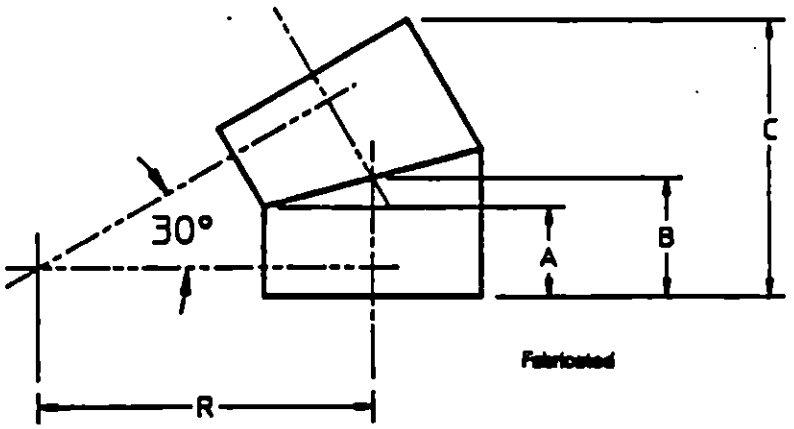
† PSI @ 73.4 degrees F. (▒) = duplication

Non-listed sizes, contact your Driscopipe Representative

30° Ells

Nominal Size		Type **	psi †	Dimensions, inches A	B	C	R	WT. LBS
2"	SDR 7	fab'd	200	3.0	3.3	6.8	8.7	.5
	11		120	[illegible]	[illegible]	[illegible]	[illegible]	.5
3"	SDR 7	fab'd	200	3.0	3.5	7.4	9.8	1
	11		120	[illegible]	[illegible]	[illegible]	[illegible]	1
	17		75	[illegible]	[illegible]	[illegible]	[illegible]	.5
4"	SDR 7	fab'd	200	5.0	5.6	11.6	14.2	3
	11		120	[illegible]	[illegible]	[illegible]	[illegible]	2
	17		75	[illegible]	[illegible]	[illegible]	[illegible]	2
5"	SDR 11	fab'd	120	5.0	5.8	12.1	16.0	3
6"	SDR 7	fab'd	200	6.0	6.9	14.5	18.3	8
	11		120	[illegible]	[illegible]	[illegible]	[illegible]	6
	17		75	[illegible]	[illegible]	[illegible]	[illegible]	4
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	3
8"	SDR 7	fab'd	200	6.0	6.9	14.5	18.3	15
	11		120	[illegible]	[illegible]	[illegible]	[illegible]	10
	17		75	[illegible]	[illegible]	[illegible]	[illegible]	6
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	4
10"	SDR 7	fab'd	200	6.0	7.4	16.6	20.4	20
	11		120	[illegible]	[illegible]	[illegible]	[illegible]	16
	17		75	[illegible]	[illegible]	[illegible]	[illegible]	11
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	7
12"	SDR 7	fab'd	200	8.0	9.7	21.3	26.5	38
	11		120	[illegible]	[illegible]	[illegible]	[illegible]	29
	17		75	[illegible]	[illegible]	[illegible]	[illegible]	20
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	14
14"	SDR 7	fab'd	200	8.0	9.9	22.0	27.1	46
	11		120	[illegible]	[illegible]	[illegible]	[illegible]	36
	17		75	[illegible]	[illegible]	[illegible]	[illegible]	24
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	18
16"	SDR 11	fab'd	120	10.0	12.1	26.7	33.1	58
	17		75	[illegible]	[illegible]	[illegible]	[illegible]	40
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	28
18"	SDR 11	fab'd	120	10.0	12.4	27.7	34.1	75
	17		75	[illegible]	[illegible]	[illegible]	[illegible]	53
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	40
20"	SDR 11	fab'd	120	11.0	13.7	30.5	30.5	85
	17		75	[illegible]	[illegible]	[illegible]	[illegible]	58
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	42
21.5	SDR 11	fab'd	120	11.0	13.9	31.3	36.1	111
	17		75	[illegible]	[illegible]	[illegible]	[illegible]	80
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	63

Nominal Size		Type **	psi †	Dimensions, inches A	B	C	R	WT. LBS
22"	SDR 11	fab'd	120	11.0	14.0	31.5	36.1	111
	17		75	[illegible]	[illegible]	[illegible]	[illegible]	80
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	65
24"	SDR 11	fab'd	120	11.0	14.2	32.5	37.5	141
	17		75	[illegible]	[illegible]	[illegible]	[illegible]	100
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	64
26"	SDR 11	fab'd	120	10.0	13.5	31.7	38.1	168
28"	SDR 11	fab'd	120	10.0	13.8	32.7	39.0	160
	17		75	[illegible]	[illegible]	[illegible]	[illegible]	120
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	90
30"	SDR 17	fab'd	75	10.0	14.0	33.7	41.1	125
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	100
800mm (31.496)	SDR 17	fab'd	75	10.0	14.2	34.4	40.9	133
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	108
32"	SDR 17	fab'd	75	10.0	14.2	34.4	40.9	135
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	110
36"	SDR 17	fab'd	75	10.0	14.8	36.7	43.1	200
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	150
42"	SDR 17	fab'd	75	10.0	15.6	39.7	46.1	250
	26		48	[illegible]	[illegible]	[illegible]	[illegible]	200
48"	SDR 26	fab'd	48	10.0	16.4	42.7	43.1	304

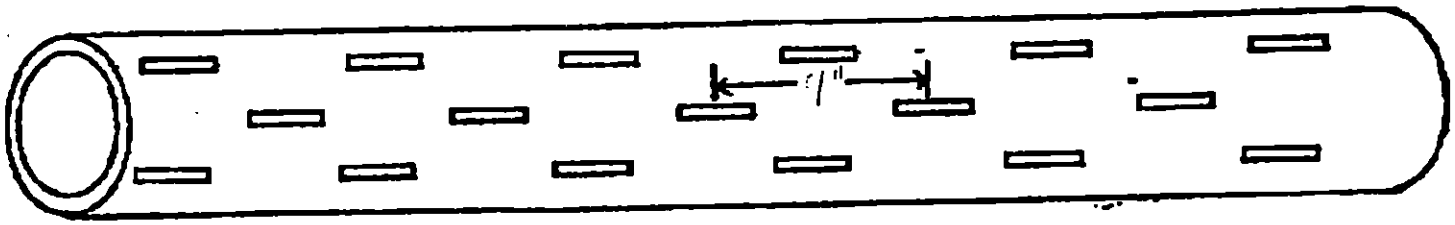


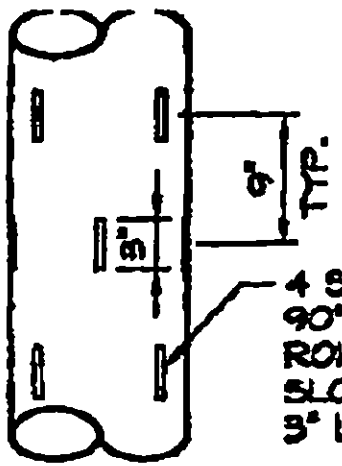
** FAB'D Ells are not fully pressure rated, see "TECHNICAL CONSIDERATIONS".
† PSI @ 73.4 degrees F. ([illegible]) = duplication

Non-listed items, contact your Driscopipe representative.

PVC Slotted Pipe - Gas Extraction Well

PLASTIC PIPING SYSTEMS - BR #10
1 Hollywood Court
South Plainfield, N.J. 07080
Phone: 908-753-2500
Fax: 908-753-1291





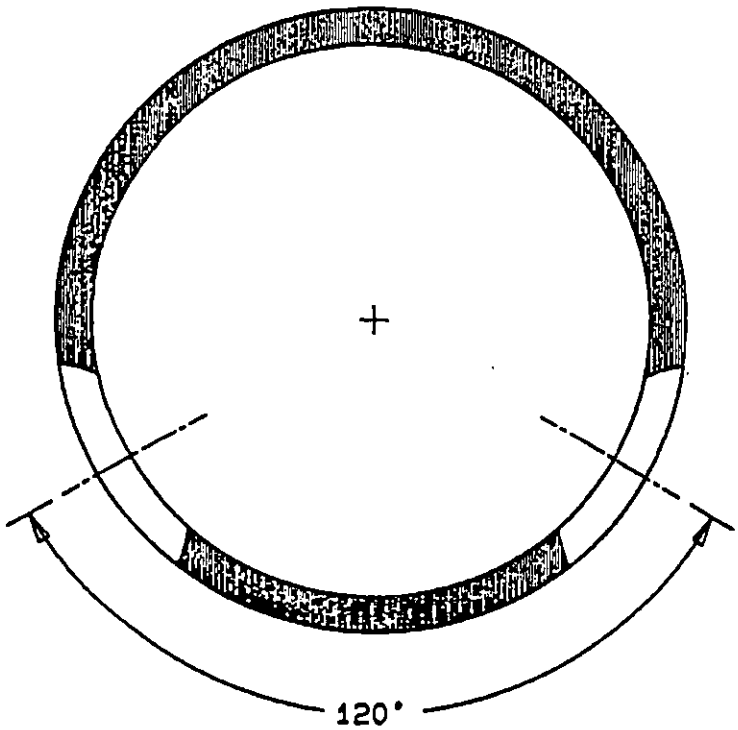
4 SLOTS PER ROW 90° APART. ADJACENT ROWS STAGGERED 45°. SLOTS TO BE 1/8" WIDE, 3" LONG @ 9" O.C.

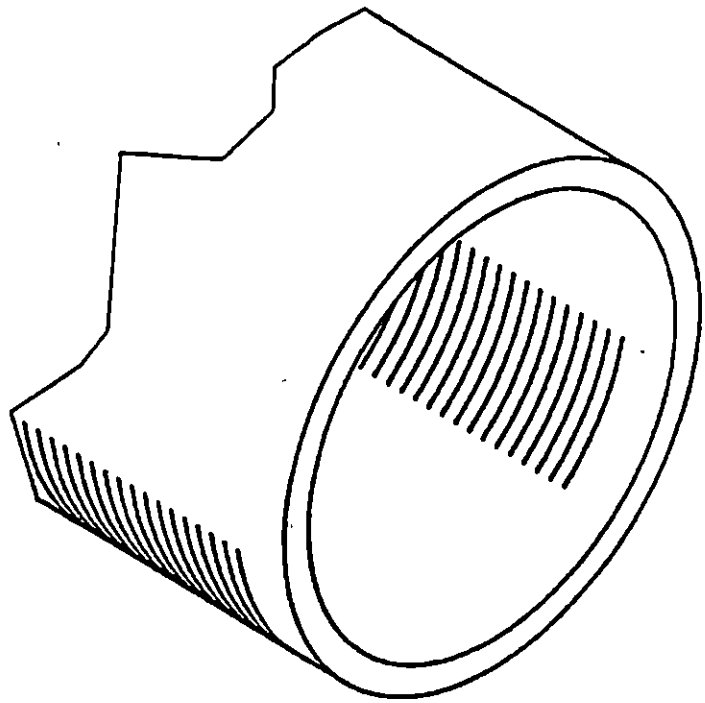
PIPE DIA. 4" SCH. 80
O.D. 4.500 I.D. 3.786
MIN. WALL .337 LENGTH 10'/20'
END P x P SLOT WIDTH .125 LENGTH 3"
SPACING 9" o.c. CENTERS # ROWS 8
PATTERN 8 rows of slots.
CONFIGURATION 45° apart, staggered.

BEDROCK ENTERPRISES, INC.
P.O. BOX 747
FORKED RIVER, NEW JERSEY 08731
(609) 693-9434
FAX# 609-971-8708

Date 11-17-94	Drawing #	Quote #	Drawn by MS
Scale N/A			Approved by
Customer PPS - NJ			Revised
Pelham Bay, Bronx NY			Revised
			Revised

HDPE COLLECTION PIPE
(LEACHATE COLLECTION)





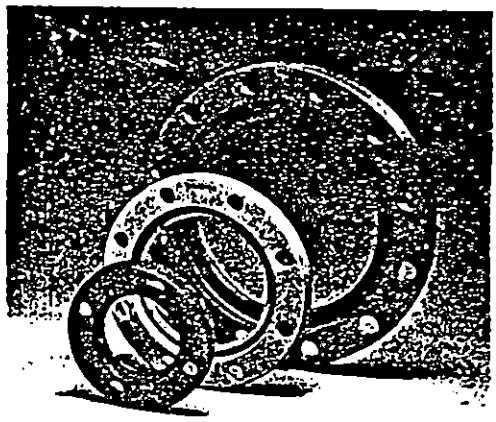
8" SDR 17 HDPR
.032 SLOT WIDTH
.250 SLOT SPACING
2 ROWS ON 120° CENTERS
4"DIA SLOTTING BLADE
6.5 sq in OPEN AREA
PER LINEAL FOOT

Plastic Pipelines Division
M.L. Sheldon Plastics Corp.
350 Lexington Avenue
New York, NY 10016

AARDVARK
CORPORATION

HYD06:

Slip-On Metal Flanges



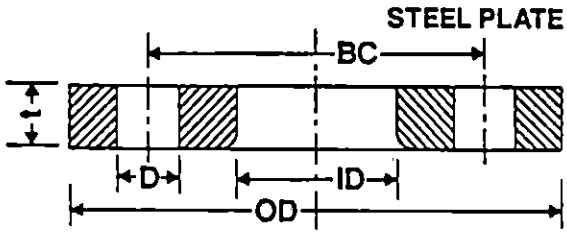
k flanges are made from ductile Flanges from other materials can also be supplied for specific applications. The metal flanges are drilled to ANSI B16.5 bolt circles. Flanges can be supplied with corrosion resistant coatings.

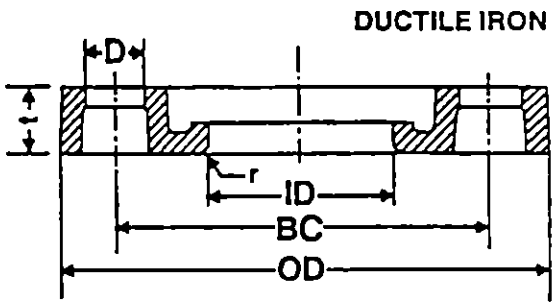
Ductile Iron

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	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	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	8	8	12	12	12	16	16	20	20	20	28	28	32	36	36	44	44	52
Diam. of Bolt Holes 'D'	¾	¾	⅞	⅞	1	1	1⅛	1⅛	1¼	1¼	1⅜	1⅜	1⅜	1⅜	1⅝	1⅝	1⅝	1⅝	1⅜	1⅜
Pressure Rating (PSI)	275	275	275	275	275	275	250	250	250	200	200	200	150	120	120	100	100	80	60	60

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





Steel Plate

TABLE 9 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	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	9.00	11.37	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 Thickness "t"	Group 1	¾	¾	¾	¾	1⅛	1⅛	1⅛	1⅛	1¼	1¼	1¼	1½	1½	1¼	1¼	1½	1½	1¾	2	2½
	Group 2								1¼	1½	1½	1½	1¾	2	1½	1¾	1¾	1¾	2	2½	3
	Group 3															2	2	2	2¼		
Number of Bolts 'n'		4	8	8	8	12	12	12	16	16	20	20	20	28	28	32	36	36	44	44	52
Diam. of Bolt Holes 'D'		¾	¾	⅞	⅞	1	1	1⅛	1⅛	1¼	1¼	1⅜	1⅜	1⅜	1⅜	1⅝	1⅝	1⅝	1⅛	1⅜	1⅜
Pressure Rating PSI	Group 1	200	200	200	200	200	200	160	100	100	100	100	100	80	80	45	45	45	45	45	45
	Group 2								160	160	160	125	125	125	100	60	60	60	60	60	60
	Group 3															80	80	80	80		

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

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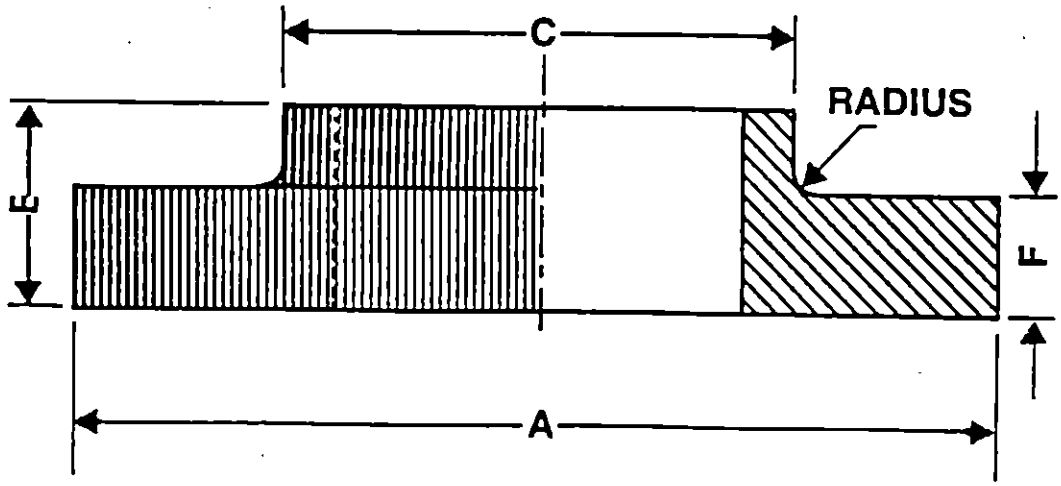
Polyethylene Stub-Ends

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	NOMINAL PIPE SIZE																			
	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	13.13	15.64	17.27	19.32	21.18	23.45	25.35	27.70	31.64	34.45	39.27	43.08	45.00	51.38	58.30	66.79
'C' Diameter	3.50	4.50	6.63	8.63	10.75	12.75	14.00	16.00	18.00	20.00	22.00	24.00	28.00	31.59	36.00	39.47	42.00	47.38	55.12	62.99
'E' Overall Thickness	1.73	1.73	2.01	2.24	2.71	3.15	3.94	3.94	3.53	4.72	5.11	5.11	5.51	5.51	5.51	5.51	5.51	6.30	6.89	[illegible]
'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



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Joining **Sclairpipe** to other materials

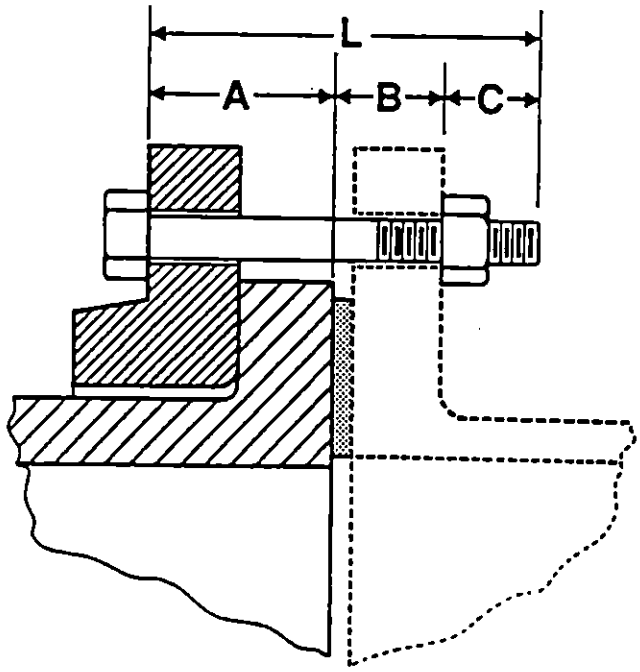
Because of the many variations of flange styles and dimensions, it would be beyond the scope of this brochure to detail all connections. The line drawing and table below show dimension "A" - the combined thickness of a SCLAIRPIPE stub end and of a standard flange. The designer should supply dimension "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	28	32	36	40	42	48	55	63
Number of Bolts	4	8	8	8	12	12	12	16	16	20	20	20	28	28	32	36	36	44	44	52
Diam. of Bolts	⅝	⅝	¾	¾	⅞	⅞	1	1	1⅛	1⅛	1¼	1¼	1¼	1¼	1½	1½	1½	1[1]	1¼	1¼
A Ductile Iron	1.94	1.94	2.06	2.37	2.69	3.12	3.74	3.80	4.31	4.44	4.50	4.50	5.13	5.15	5.22	5.41	5.41	5.87	6.83	6.83
A 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	4.25	4.75	4.52	4.60	5.04	5.04	5.75	6.33	6.83
A Steel Plate, GRP.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.61	4.25	4.26	4.25	4.50	5.25	4.77	5.10	5.29	5.29	6.00	6.83	7.33
A Steel Plate, GRP.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5.35	5.54	5.54	6.25	[illegible]	[illegible]

NOTES: (1) Bolt for 48" Ductile Iron Flange is 1½".



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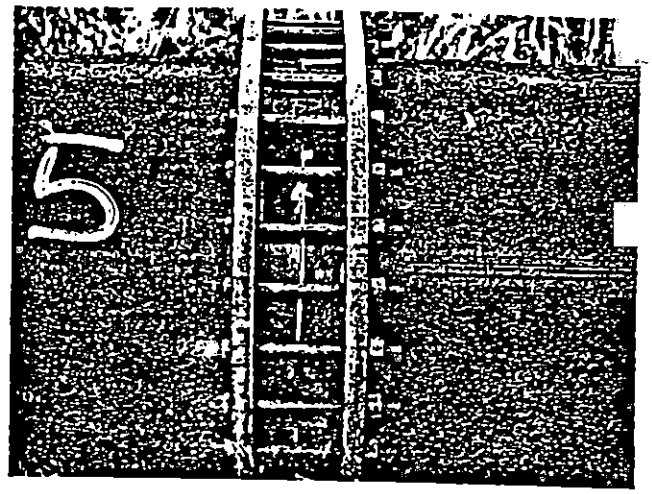
Sclairpipe to Sclairpipe Flanged Connection

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.



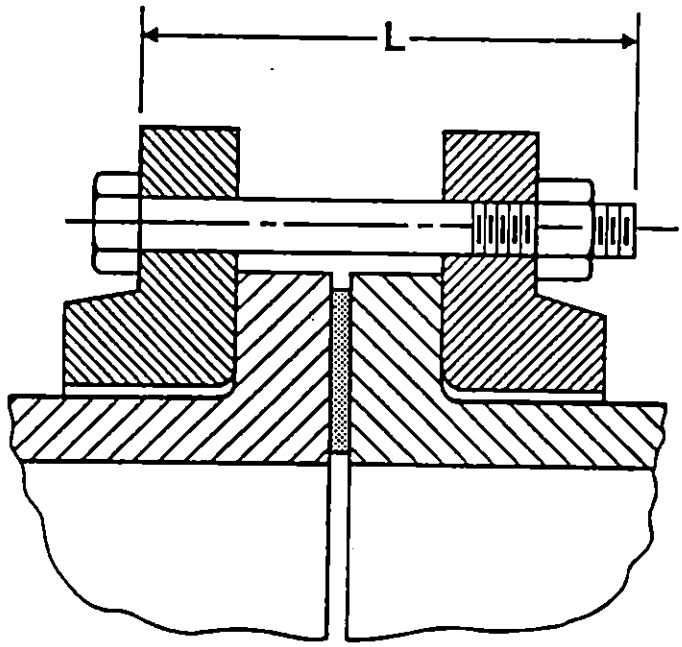
Bolt Lengths

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	48	55	63
Number of Bolts	4	8	8	8	12	12	12	16	16	20	20	20	28	28	32	36	36	44	44	52
Diam. of Bolts	⅝	⅝	¾	¾	⅞	⅞	1	1	1⅛	1⅛	1¼	1¼	1¼	1¼	1½	1½	1½	1[(1)]	1¼	1¼
L Ductile Iron	5.00	5.00	5.50	6.50	7.50	8.00	9.50	10.00	11.00	11.00	12.00	12.00	13.00	13.00	13.00	14.00	14.00	15.00	16.00	16.00
L Steel Plate, GRP.1	5.00	5.00	5.00	5.50	7.50	8.00	9.00	9.00	10.00	10.00	11.00	11.00	12.00	12.00	12.00	13.00	13.00	14.00	15.00	16.00
L Steel Plate, GRP.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9.50	11.00	11.00	11.00	12.00	13.00	12.00	13.00	14.00	14.00	14.00	16.00	17.00
L Steel Plate, GRP.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14.00	14.00	14.00	15.00	[illegible]	[illegible]

NOTES: (1) Bolt Diameter for 48" Ductile Iron Flange is 1½".

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



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CHEMICAL RESISTANCE OF DRISCOPIPE 6400

Reagent	70°F (21°C)	140°F (60°C)
Dowell M 133	S	S
Ethyl Acetate, 100%	M	U
Ethyl Alcohol* 100%	S	S
Ethyl Butyrate	M	U
Ethyl Chloride	M	U
Ethyl Ether	U	U
Ethylene Chloride	U	U
Ethylene Glycol*	S	S
Ferric Chloride	S	S
Ferric Nitrate	S	S
Ferrous Chloride	S	S
Ferrous Sulfate	S	S
Fluorine	S	U
Fluoroboric Acid	S	S
Fluosilicic Acid	S	S
Formaldehyde* 40%	S	N
Formic Acid	S	S
Fuel Oil	S	U
Furfural, 100%	M	U
Gallic Acid*	S	S
Gasoline	M	U
Glycerine (Glycerol)	S	S
Glycol*	S	S
Glycolic Acid* 30%	S	S
Hexanol, Tert.*	S	S
Hydrobromic Acid 50%	S	S
Hydrocyanic Acid	S	S
Hydrochloric Acid	S	S
Hydrofluoric Acid 0-75%	S	S
Hydrogen	S	S
Hydrogen Bromide 10%	S	S
Hydrogen Chloride Gas Dry	S	S
Hydrogen Peroxide 30%	S	S
Hydrogen Peroxide 90%	S	M
Hydrogen Phosphide 100%	S	S
Hydroquinone	S	S
Hydrogen Sulfide	S	S
Hypochlorous Acid	S	S
Lead Acetate	S	S
Lube Oil	S	M
Magnesium Carbonate, SAT	S	S
Magnesium Chloride, SAT	S	S
Magnesium Hydroxide, SAT	S	S
Magnesium Nitrate, SAT	S	S
Magnesium Sulfate, SAT	S	S
Mercuric Chloride, SAT	S	S
Mercuric Cyanide, SAT	S	S
Mercurous Nitrate, SAT	S	S
Mercury	S	S
Methyl Alcohol*	S	S
Methyl Chloride	M	U

Reagent	70°F (21°C)	140°F (60°C)
Methyl Chloride, 100%	U	U
Methyl Ethyl Ketone, 100%	U	U
Methylsulfuric Acid*	S	S
Nickel Chloride, SAT	S	S
Nickel Nitrate Conc.	S	S
Nickel Sulfate, SAT	S	S
Nicotinic Acid	S	S
Nitric Acid 0-30%	S	S
Nitric Acid 30-70%	S	M
Nitric Acid 95-98%	U	U
Nitrobenzene 100%	U	U
Oleic Acid Conc.	U	U
Oxalic Acid*	S	S
Perchloric Acid 10%	S	S
Petroleum Ether	U	U
Phenol 90%	U	U
Phosphoric Acid	S	S
Pickling/Plating Solutions	S	S*
Potassium Bicarbonate	S	S
Potassium Borate 1%	S	S
Potassium Bromate 10%	S	S
Potassium Bromide	S	S
Potassium Carbonate	S	S
Potassium Chlorate	S	S
Potassium Chloride	S	S
Potassium Chromate 40%	S	S
Potassium Cyanide, SAT	S	S
Potassium Dichromate 40%	S	S
Potassium Ferri/ Ferro Cyanide	S	S
Potassium Fluoride	S	S
Potassium Hydroxide 20%	S	S
Potassium Nitrate, SAT	S	S
Potassium Perborate, SAT	S	S
Potassium Perchlorate 10%	S	S
Potassium Permanganate 2%	S	S
Potassium Sulfate Conc.	S	S
Potassium Sulfide Conc.	S	S
Potassium Sulfite Conc.	S	S
Potassium Persulfate	S	S
Propargyl Alcohol*	S	S
Propyl Alcohol*	S	S
Propylene Dichloride 100%	U	U
Propylene Glycol*	S	S
Sea Water	S	S
Selenic Acid	S	S
Silicic Acid	S	S
Silver Nitrate Sol.	S	S
Sodium Acetate, SAT	S	S
Sodium Benzoate 35%	S	S
Sodium Bicarbonate, SAT	S	S

Reagent	70°F (21°C)	140°F (60°C)
Sodium Bisulfate, SAT	S	S
Sodium Bisulfite, SAT	S	S
Sodium Borate	S	S
Sodium Bromide Dilute Sol.	S	S
Sodium Bromide Oil Solution	S	S
Sodium Carbonate Conc.	S	S
Sodium Chlorate, SAT	S	S
Sodium Chloride, SAT	S	S
Sodium Cyanide	S	S
Sodium Dichromate, SAT	S	S
Sodium Ferricyanide	S	S
Sodium Ferrocyanide	S	S
Sodium Fluoride, SAT	S	S
Sodium Hydroxide Conc.	S	S
Sodium Hypochlorite	S	S
Sodium Nitrate	S	S
Sodium Sulfate	S	S
Sodium Sulfide, SAT	S	S
Sodium Sulfite, SAT	S	S
Stannous Chloride	S	S
Stannic Chloride	S	S
Stearic Acid*	S	S
Sulfuric Acid 0-50%	S	S
Sulfuric Acid 70%	S	M
Sulfuric Acid 80%	S	U
Sulfuric Acid 90-98%	M	U
Sulfuric Acid, Fuming	U	U
Sulfurous Acid	S	S
Tannic Acid 10%	S	S
Tartaric Acid, SAT	N	N
Tetralin	U	U
Tetrahydrofurane	N	N
Toluene	M	U
Transformer Oil	S	M
Tretolite K-147	S	S
Tretolite K-141	S	S
Tretolite PD-33	S	S
Tretolite R-25	S	S
Tretolite F-64	S	S
Tretolite XF39	S	S
Trichloroacetic Acid 10%	S	S
Trichloroethylene	U	U
Trisodium Phosphate, SAT	S	S
Turpentine	U	U
Urea	S	S
Wetting Agents	S	S
Xylene	M	U
Zinc Chloride, SAT	S	S
Zinc Sulfate, SAT	S	S

*To compensate for hydrocarbon saturation effects on long term hydrostatic strength refer to Working Pressure Table, p.10.

*Potassium Dichromate/Sulfuric Acid Solution

*Sulfuric/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	Hours To Failure*
Dowell Carbon 328	Corrosion Inhibitor	Water	>1000
Dowell Carbon 325	Corrosion Inhibitor	Hexane	>1000
Tretolite K-147	Corrosion Inhibitor	Hexane	>1000
Tretolite K-141	Corrosion Inhibitor	Water	>1000
Dowell M 133	Bactericide and Corrosion Inhibitor	Water	>1000
Aliquot 400	Bactericide and Corrosion Inhibitor	Water	>1000
Tretolite PD-33	Paraffin Dispersant	Water	>1000
PPC-8	Corrosion Inhibitor	Water	>1000
Tretolite R-25	Demulsifier	Hexane	>1000
Tretolite F-94	Demulsifier	Hexane	>1000
Tretolite XT-39	Paraffin Remover	Water	>1000

*Test 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.

Driscopipe 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 trenches.

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 innovative piping design.

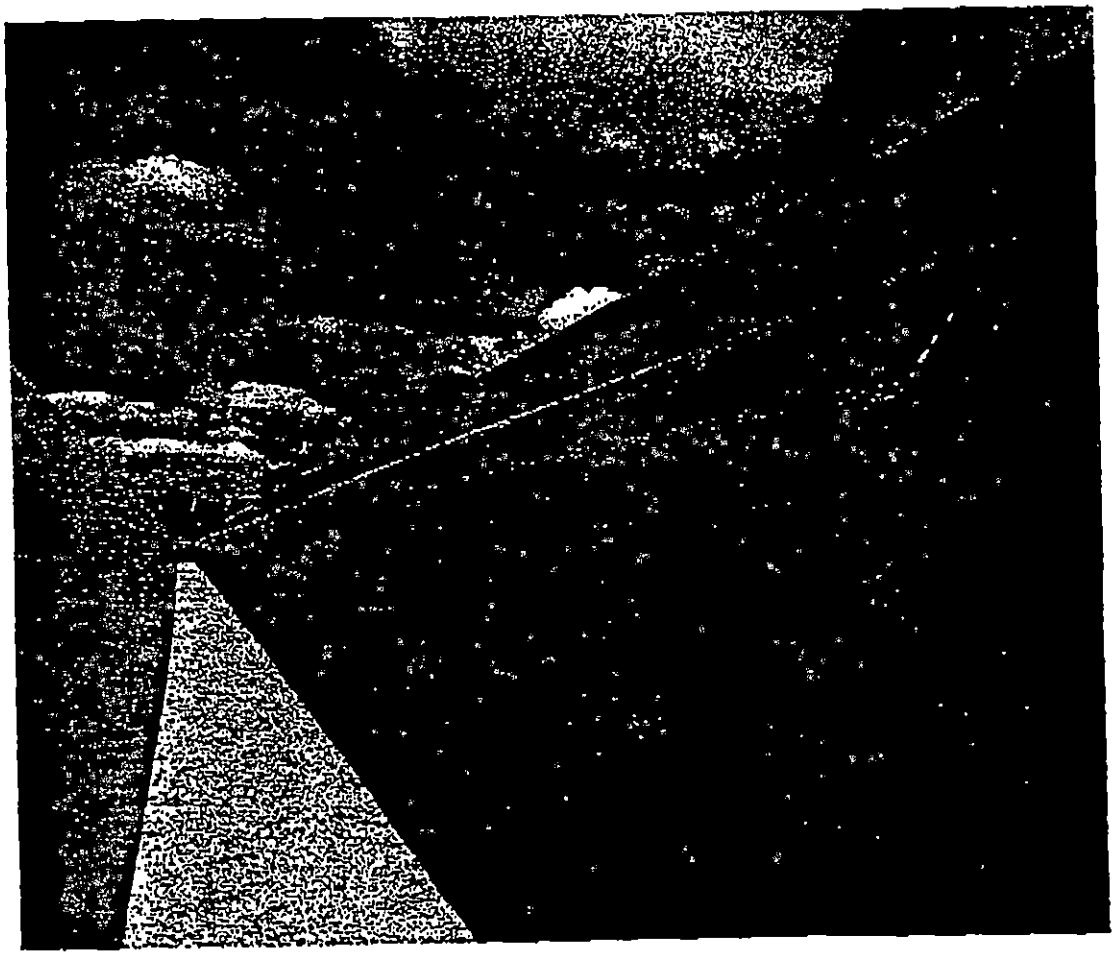
w Factors

:opipe polyethylene pipe has a very smooth inside surface. It maintains excellent flow properties throughout 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 diameter 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 pigging 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.

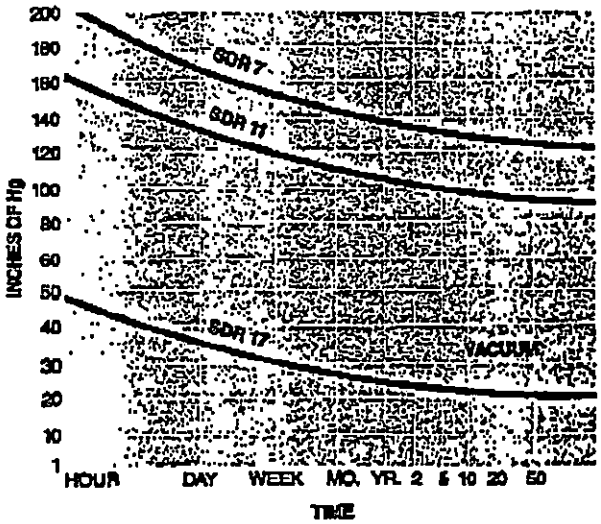
Typical cases of vacuum or suction pipelines are gravity flow, downhill siphon lines, pipelines which are cleaned by vacuum and gas gathering lines operating under vacuum. When subjected to a vacuum, a sufficiently heavy wall pipe must be selected to resist the collapsing forces. Basically, the pipe's 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°F (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 failure 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 properly applying Chart 1, the possibility of collapse is minimized.

Chart 1

Vacuum Plus External Load Resistance

Inches of Mercury at 73.4°F



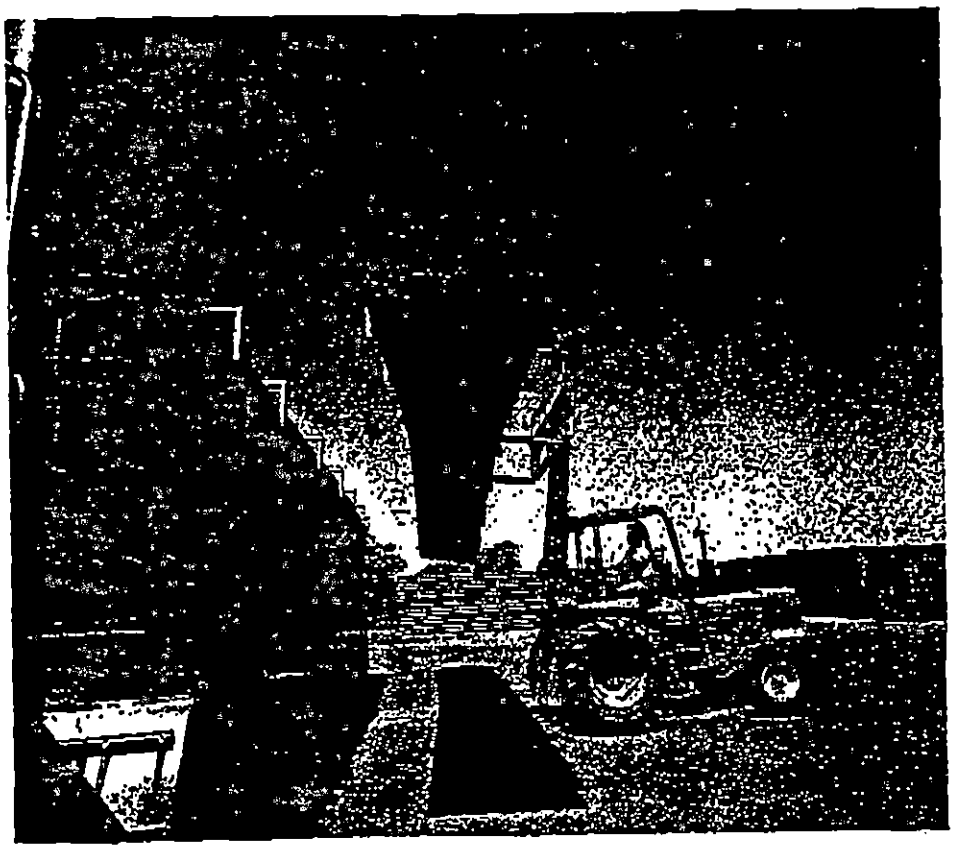
-----any cases, as a general rule of thumb, DR 15.5 er DR pipe can be used safely at 70°F or lower ıratures to carry full vacuum. For vacuum pipeline fittings, lower DR (thicker wall) is selected for ·oricating fittings. For example, a buried vacuum ɔeline using DR 17 pipe would use fittings made ·rom 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).

ɔ buried pipeline operating under a negative ·essure (vacuum) not only has the static and live ,oads 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.

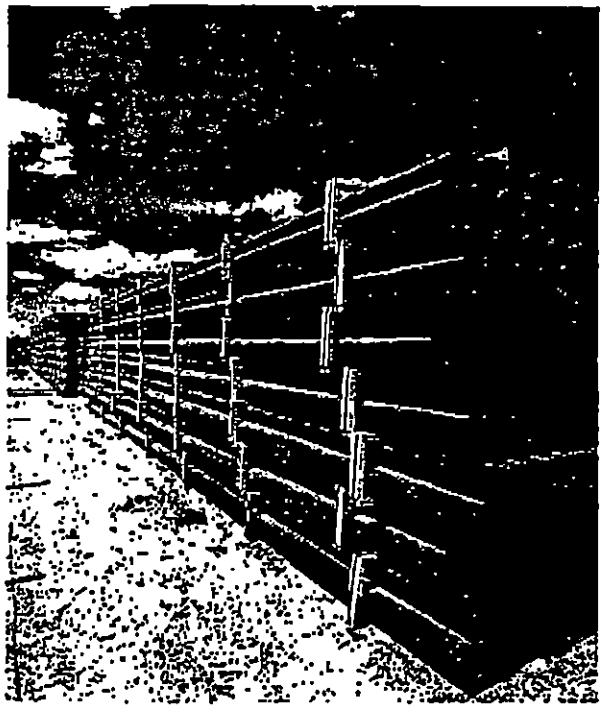
Applications

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 = $\frac{\text{Outside Diameter (inches)}}{\text{Minimum Wall Thickness (inches)}}$

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 thermoplastic 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 192.123, is 0.32 with a maximum allowable operating pressure of 100 psig. Higher pressure systems may be granted by a waiver from DOT.

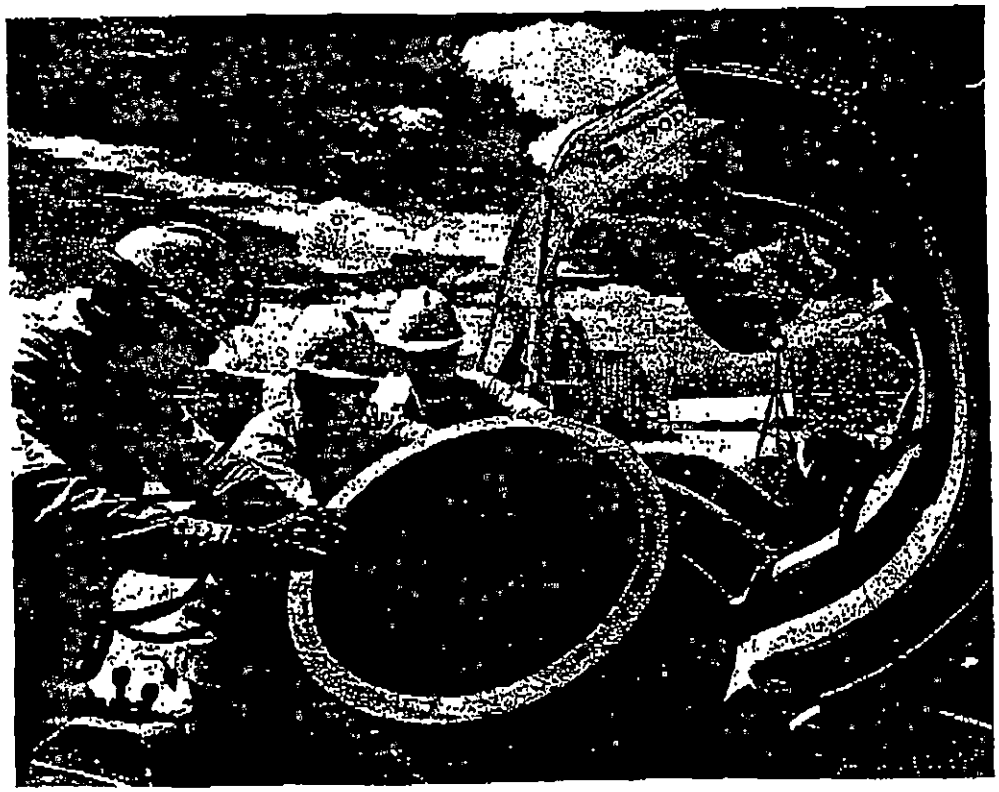
Environmental Service Factors

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.	SDR 7	SDR 9	SDR 11	SDR 17
73.4°F	1.00	265 psig	200 psig	160 psig	100 psig
100°F	0.79	210 psig	158 psig	126 psig	79 psig
120°F	0.62	165 psig	125 psig	100 psig	63 psig
140°F	0.50	133 psig	100 psig	80 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°F 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.

Butt heat fusion joining is the recommended method for joining Driscopipe 6400. Phillips has utilized butt heat fusion for over 30 years of Driscopipe's polyethylene piping experience in the oil fields. Butt 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

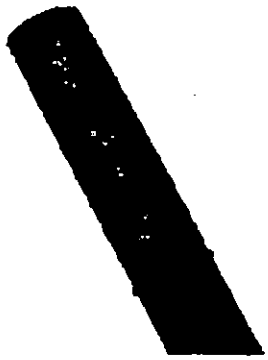


Figure 2
Tensile Pull Test

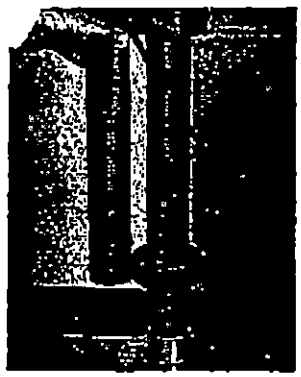
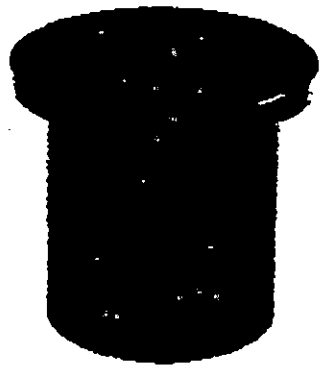


Figure 3
Molded Flange Adapter



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 fittings 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

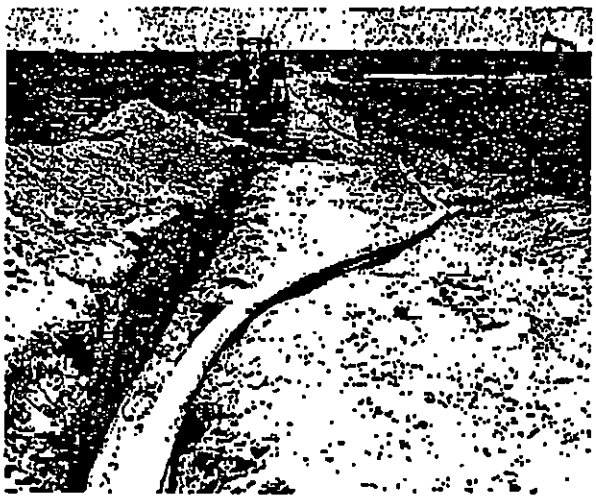
The width of the trench is usually determined by the diameter of the pipe. The pipe should have some slack and the trench should be wide enough to provide for good compaction of soil around the pipe. Detector tapes are available from other sources for pipeline detection.

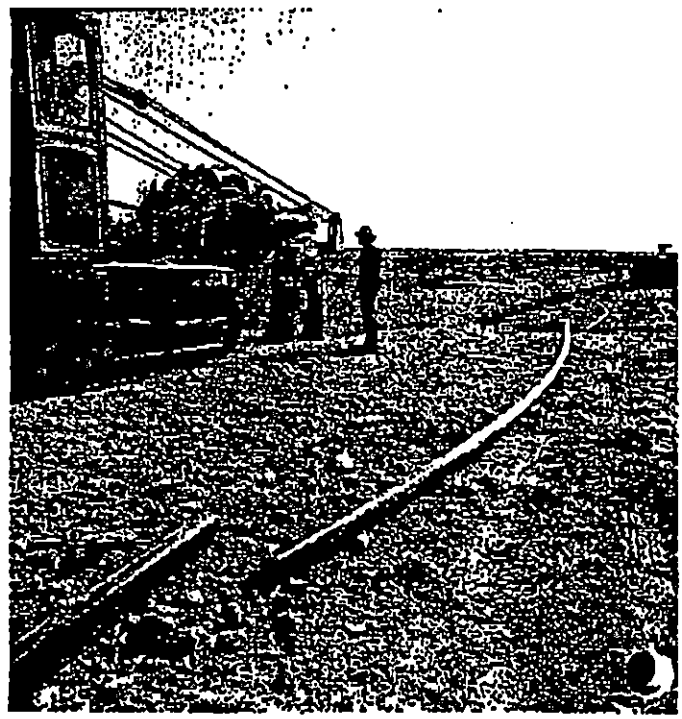
The depth of the trench should be sufficient to provide a minimum of 30 inches of cover. In cultivated areas this should be increased to 36 inches.

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.

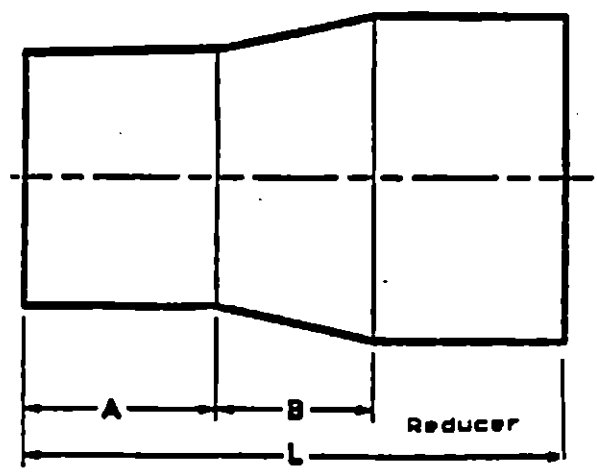
DRISCOPIPE

Reducers

Nominal Size			Type	psi †	Dimensions, inches A	B	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	fab'd	100	4.0	1.9	10.0	2
6x4	SDR	9.3 11	Molded	190 160	3.0	2.3	7.5	3
	SDR	7 11 17	fab'd	267 160 100	3.3	4.0	11.0	7 4 3
6x5	SDR	11	fab'd	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
10x8	SDR	7 11 17 26	fab'd	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	fab'd	267 160 100 64	5.6	3.8	15.0	28 22 16 14
14x12	SDR	7 11 17 26	fab'd	267 160 100 64	7.0	2.4	16.4	45 30 22 20
16x14	SDR	11 17 26	fab'd	160 100 64	7.0	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	fab'd	160 100 64	6.0	3.5	17.8	60 45 36
21.5 x 20	SDR	11 17 26	fab'd	160 100 64	7.0	3.8	17.8	91 65 50
22x20	SDR	11 17 26	fab'd	160 100 64	7.0	3.8	17.8	91 65 50

Nominal Size			Type	psi †	Dimensions, inches A	B	L	WT. LBS
24x21.5	SDR	11 17 26	fab'd	160 100 64	9.0	3.8	21.8	124 89 56
24x22	SDR	11 17 26	fab'd	160 100 64	9.0	3.8	21.8	124 89 56
26x24	SDR	11 15.5 32.5	fab'd	160 110 51	9.0	4.0	22.0	150 95 65
28x24	SDR	11 17 26	fab'd	160 100 64	9.0	6.0	24.0	174 100 75
800mm x28 (31.496)	SDR	17 26	fab'd	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 26	fab'd	100 64	9.0	12.0	30.0	250 150
32x30	SDR	17 26	fab'd	100 64	9.0	12.0	28.0	255 155
36x800mm (31.496)	SDR	17 26	fab'd	100 64	9.0	12.0	30.0	290 200
36x32	SDR	17 26	fab'd	100 64	9.0	12.0	30.0	290 200

Non-listed sizes, contact your Driscopipe representative



† PSI @ 73.4 degrees F. (▒) = duplication

Not Shown: 16x10 Eccentric Reducer Fab'd
16x8 " " "
16x10 Concentric " "

Tees

DRISCOPIPE

Nominal Size		Type **	psi †	Dimensions, inches A	B	C	E	WT LBS.
2"	SDR 9.3	Molded	190	4.8	4.8	9.5	3.0	1
	SDR 11		160					
	SDR 7	fab'd	200	8.0	15.0	16.0	6.8	4
	SDR 11		120					3
3"	SDR 9.3	Molded	190	4.8	4.8	9.5	2.3	2
	SDR 11		160					
	SDR 17		100					
	SDR 7	fab'd	200	8.0	15.0	16.0	6.3	5
	SDR 11		120					4
4"	SDR 9.3	Molded	190	5.3	5.3	10.5	3.0	3
	SDR 11		160					3
	SDR 17		100					3
	SDR 26		64					3
	SDR 7	fab'd	200	8.0	15.0	16.0	5.8	8
	SDR 11		120					6
5"	SDR 11	fab'd	120	8.5	14.0	17.0	5.7	11
6"	SDR 9.3	Molded	190	7.5	7.5	15.0	3.0	10
	SDR 11		160					10
	SDR 17		100					9
	SDR 26		64					9
	SDR 7	fab'd	200	8.5	14.0	17.0	5.2	21
	SDR 11		120					15
8"	SDR 11	Molded	160	12.0	12.0	24.0	6.0	30
	SDR 7	fab'd	200	14.0	19.5	28.0	9.7	50
	SDR 11		120					30
	SDR 17		75					27
	SDR 26		48					27
10"	SDR 11	Molded	160	13.3	13.3	26.5	6.0	51
	SDR 7	fab'd	200	14.0	19.5	28.0	8.6	70
	SDR 11		120					47
	SDR 17		75					34
	SDR 26		48					34
12"	SDR 11	Molded	160	15.5	15.5	31.0	7.5	90
	SDR 7	fab'd	200	15.0	19.5	30.0	8.6	110
	SDR 11		120					71
	SDR 17		75					52
	SDR 26		48					51

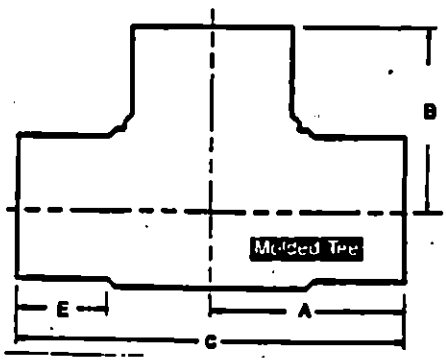
Nominal Size		Type **	psi †	Dimensions, inches A	B	C	E	WT. LBS
14"	SDR 7	fab'd	200	16.0	19.5	32.0	9.0	140
	SDR 11		120					90
	SDR 17		75					66
	SDR 26		48					56
16"	SDR 11	fab'd	120	16.0	19.5	32.0	8.0	118
	SDR 17		75					86
	SDR 26		48					76
18"	SDR 11	fab'd	120	19.0	19.0	38.0	10.0	143
	SDR 17		75					96
	SDR 26		48					64
20"	SDR 11	fab'd	120	23.8	25.0	47.5	13.9	267
	SDR 17		75					179
	SDR 26		48					120
21.5	SDR 11	fab'd	120	19.0	25.0	38.0	8.2	284
	SDR 17		75					252
	SDR 26		48					120
22"	SDR 11	fab'd	120	19.0	25.0	38.0	8.0	290
	SDR 17		75					266
	SDR 26		48					150
24"	SDR 11	fab'd	120	23.8	25.0	47.5	11.8	400
	SDR 17		75					292
	SDR 26		48					185
26"	SDR 11	fab'd	120	24.0	25.0	148.0	13.0	466

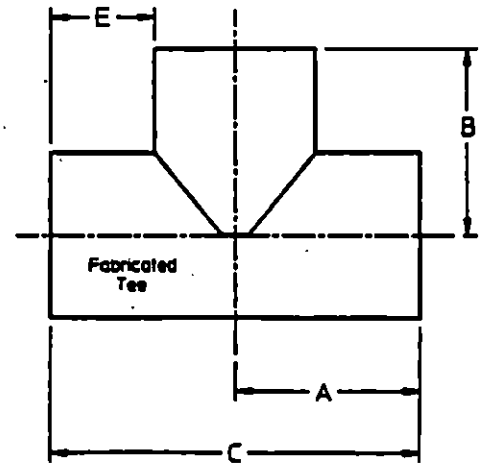
flanged									
	28"	SDR 11	fab'd	120	74.0	26.0	148.0	55.0	1175
		SDR 17		75					665
	800mm (31.496)	SDR 17	fab'd	75	74.0	27.0	148.0	53.0	1380
		SDR 26		48					760
	32"	SDR 17	fab'd	75	74.0	27.0	148.0	53.0	1400
		SDR 26		48					770
	36"	SDR 17	fab'd	75	79.0	31.0	158.0	56.0	1550
		SDR 26		48					980

** FAB'D tees are not fully pressure rated, see "TECHNICAL CONSIDERATIONS".

† PSI @ 73.4 degrees F. (▒) = duplication

Non-listed sizes, contact your Driscopipe representative.





45° Wyes

DRISCOPIPE

Nominal Size		psi †	Type	Dimensions, inches A	B	C	E	F	WT. LBS
2"	SDR 11	120	TrueLat	18.5	na	25.0	14.6	17.5	2
3"	SDR 11	120	TrueLat	17.3	na	25.0	14.4	18.8	4
	SDR 7	200	Phillips	11.0	8.0	18.0	11.8	25.5	7
	SDR 11	120							5
4"	SDR 11	120	TrueLat	19.5	na	26.5	14.1	19.5	8
	SDR 7	200	Phillips	14.0	7.7	22.0	12.3	30.1	12
	SDR 11	120							8
	SDR 17	75							5
	26	48							5
6"	SDR 11	120	TrueLat	27.6	na	35.5	19.9	27.9	25
	SDR 7	200	Phillips	16.0	7.9	24.8	12.8	28.8	31
	SDR 11	120							21
	SDR 17	75							14
	26	48							9
8"	SDR 11	120	TrueLat	30.4	na	40.2	20.0	30.4	47
	SDR 7	200	Phillips	18.0	15.2	31.0	15.8	41.7	54
	SDR 11	120							36
	SDR 17	75							24
	26	48							16
10"	SDR 11	120	TrueLat	32.8	na	43.2	20.0	32.8	77
	SDR 7	200	Phillips	21.0	17.1	35.0	15.3	44.7	89
	SDR 11	120							60
	SDR 17	75							40
	26	48							27
12"	SDR 11	120	TrueLat	35.4	na	46.0	20.0	35.4	118
	SDR 7	200	Phillips	22.0	20.2	36.8	17.5	52.3	171
	SDR 11	120							116
	SDR 17	75							77
	26	48							52
14"	SDR 11	120	TrueLat	38.9	na	49.8	22.0	38.9	155
	SDR 7	200	Phillips	23.0	19.4	41.0	24.5	57.8	248
	SDR 11	120							167
	SDR 17	75							112
	26	48							75

Nominal Size		psi †	Type	Dimensions, inches A	B	C	E	F	WT. LBS
16"	SDR 11	120	Phillips	24.0	19.4	43.0	24.3	58.5	228
	SDR 17	75							153
	26	48							102
18"	SDR 11	120	Phillips	25.0	31.1	46.0	23.8	76.9	308
	SDR 17	75							207
	26	48							138
20"	SDR 11	120	Phillips	26.0	35.1	47.0	23.5	83.2	405
	SDR 17	75							271
	26	48							181
21.5	SDR 11	120	Phillips	27.0	35.4	49.0	23.3	83.8	496
	SDR 17	75							332
	26	48							222
22"	SDR 11	120	Phillips	27.0	35.5	49.0	23.3	84.0	519
	SDR 17	75							348
	26	48							232
24"	SDR 11	120	Phillips	28.0	35.1	51.0	22.8	83.0	645
	SDR 17	75							428
	26	48							289

Flanged										
	26"	SDR 11	120	Phillips	74.0	33.8	148.0	22.8	81.3	1250
	28"	SDR 11	120	Phillips	74.0	50.2	148.0		96.2	878
		SDR 17	75							588
		26	48							393
	800 mm	SDR 17	75	Phillips	74.0	39.7	148.0			744
		SDR 26	48							497
	32"	SDR 17	75	Phillips	74.0	40.0	148.0			768
		26	48							513
	36"	SDR 17	75	Phillips	79.0	42.0	158.0			971
		26	48							649

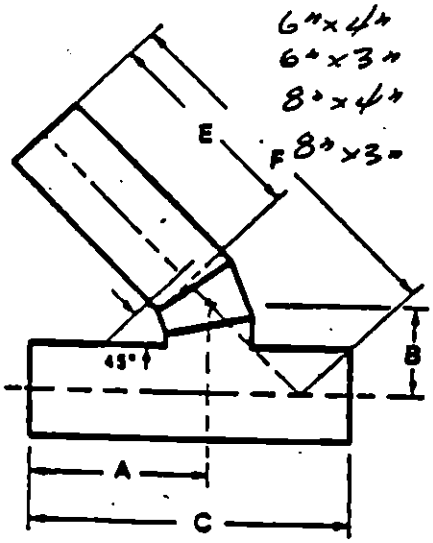
Flanged wyes 26" & up include a slip-on b/u ring

Wyes are de-rated, see TECHNICAL CONSIDERATIONS.

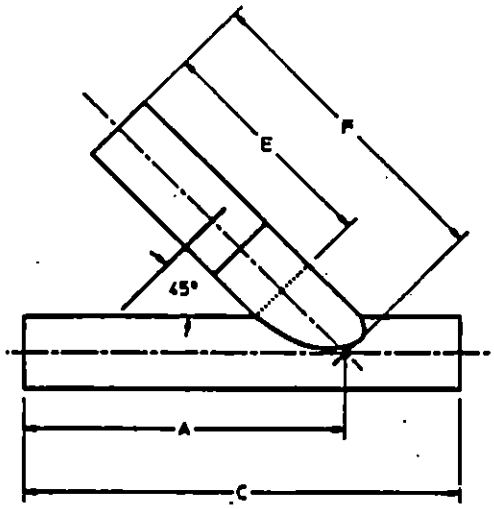
† PSI @ 73.4 degrees F. (▒) = duplication

Reducing wyes may be available on special quotes.

4"x3"
6"x4"
6"x3"
8"x4"
8"x3"



Phillips Wye



TrueLateral Wyes

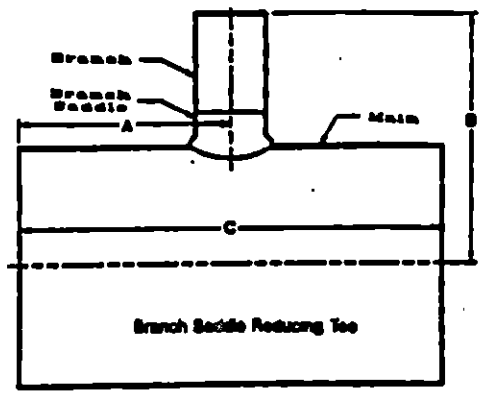
Branch Saddle Reducing Tees

	NOMINAL SIZE		psi †	Dimensions, inches A	B	C	WT. LBS
2" outlet	3x2	SDR 11	160	12	12	24	3
	4x2	SDR 11	160	12	12	24	4
	6x2	SDR 11	160	13	13	26	6
	8x2	SDR 11 17	160 100	14 (duplication)	14 (duplication)	28 (duplication)	14 10
	10x2	SDR 11 17	160 100	14 (duplication)	14 (duplication)	28 (duplication)	16 13
	12x2	SDR 11 17	160 100	14 (duplication)	14 (duplication)	28 (duplication)	27 20
3" outlet	4x3	SDR 11	160	12	12	24	4
	6x3	SDR 11	160	13	13	26	6
	8x3	SDR 11 17	160 100	14 (duplication)	14 (duplication)	28 (duplication)	14 11
	10x3	SDR 11 17	160 100	14 (duplication)	14 (duplication)	28 (duplication)	18 15
	12x3	SDR 11 17	160 100	14 (duplication)	14 (duplication)	28 (duplication)	30 22
4" outlet	6x4	SDR 11	160	13	13	26	8
	8x4	SDR 11 17	160 100	14 (duplication)	14 (duplication)	28 (duplication)	18 13
	10x4	SDR 11 17	160 100	14 (duplication)	14 (duplication)	28 (duplication)	20 18
	12x4	SDR 11 17	160 100	14 (duplication)	14 (duplication)	28 (duplication)	32 25
	18x4	SDR 11 17 26	160 100 64	19 (duplication)	19 (duplication)	38 (duplication)	65 50 35

	NOMINAL SIZE		psi †	Dimensions, in. A	B	C	WT. LBS
6" outlet	8x6	SDR 11 17	160 100	14 (duplication)	14 (duplication)	28 (duplication)	30 25
	10x6	SDR 11 17	160 100	14 (duplication)	14 (duplication)	28 (duplication)	32 30
	12x6	SDR 11 17	160 100	14 (duplication)	14 (duplication)	28 (duplication)	45 38
	14x6	SDR 11 17	160 100	15 (duplication)	15 (duplication)	30 (duplication)	45 40
	16x6	SDR 11 17 26	160 100 68	16 (duplication)	16 (duplication)	32 (duplication)	59 48 37
	18x6	SDR 11 17 26	160 100 68	19 (duplication)	19 (duplication)	38 (duplication)	66 61 45
	20x6	SDR 11 17 26	160 100 68	19 (duplication)	19 (duplication)	38 (duplication)	91 72 52
	21.5 x 6	SDR 11 17 26	160 100 68	19 (duplication)	19 (duplication)	38 (duplication)	102 80 56
	24x6	SDR 11 17 26	160 100 68	25 (duplication)	25 (duplication)	50 (duplication)	153 118 80
	36x6	SDR 17 26	100 68	25 (duplication)	30 (duplication)	50 (duplication)	503 323

† PSI @ 73.4° F. (duplication) = duplication

Non-listed sizes, contact your Driscopipe representative.



Flange Connectors

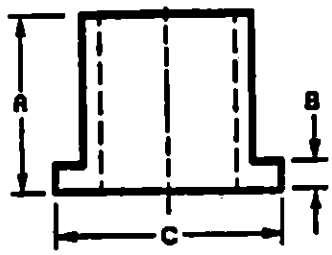
Nominal Size		TYPE **	PSI †	Dimensions, inches A	B	C	WT. LBS
1"	9.3	mfla	190	4.0	0.2	2.4	.5
	SDR 11	mfla	160				
1-1/4	9.3	mfla	190	4.0	0.3 / 0.2	2.8	.5
	SDR 11	mfla	160				
1-1/2	9.3	mfla	190	4.0	0.3 / 0.2	3.1	.5
	SDR 11	mfla	160				
2"	SDR 7	mfla	267	6.0	0.4	4.0	1
	11	mfla	160				1
	SDR 11	STUB	160	1.8	0.8	4.0	.5
3"	7	mfla	267	6.0	0.6	5.0	2
	SDR 11	mfla	160				2
	17	mfla	100				2
4"	7	mfla	267	6.0	0.8	6.6	3
	SDR 11		160				3
	17		100				3
6"	7	mfla	267	8.0	1.2	8.5	8
	SDR 11		160		0.8		7
	17		100		0.8		7
	26		64		0.8		7
8"	7	mfla	267	9.0	1.6	10.6	11
	SDR 11		160		1.0		10
	17		100		0.8		10
	26		64	9.0	0.8	10.6	10
	SDR 11	STUB	160	2.0	0.8	10.6	5
10"	7	mfla	267	9.0	1.9	12.8	19
	SDR 11		160		1.3		18
	17		100		0.9		17
	26		64		0.8		17

Stub End Connectors

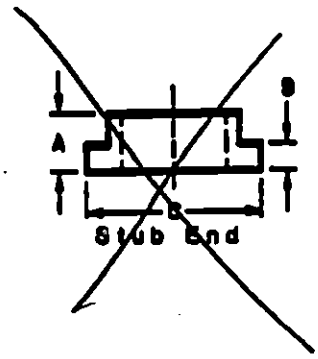
28"	SDR 17	SsSe	100	4.0	2.1	32.3	35
30"	SDR 26	SsSe	64	4.0	1.8	34.5	40
800mm	SDR 17	SsSe	100	4.0	2.3	36.7	45
32"	SDR 17	SsSe	100	4.0	2.5	36.7	45
36"	SDR 17	SsSe	100	4.0	2.1	40.8	60
1000mm	SDR325	SsSe	51	4.0	1.5	47.4	68
42"	SDR 32.5	SsSe	51	4.0	1.6	47.4	73
48"	SDR 32.5	MmSe	51	4.0	2.0	53.9	90

Nominal Size		Type **	psi †	Dimensions, inchs A	B	C	WT. LBS
12"	SDR 7	mfla	267	10.8	2.3	15.0	25
	11		160		1.5		24
	17		100		1.0		23
	26		64		0.8		22
14"	SDR 7	mfla	267	11.0	2.6	17.5	55
	11		160		1.7		40
	17		100		1.1		40
16"	SDR 7	mfla	267	12.0	3.0	20.0	80
	11		160		1.9		60
	17		100		1.2		45
	26		64		0.8		43
18"	SDR 7	mfla	267	12.0	3.3	21.1	95
	11		160		2.1		68
	17		100		1.4		55
	26		64		1.0		50
20"	SDR 11	mfla	160	12.0	2.3	23.5	66
	17		100		1.5		64
	26		64		1.0		62
21.5	SDR 11	mfla	160	12.0	2.4	25.6	68
	17		100		1.6		66
	26		64		1.0		64
22"	SDR 11	mfla	160	12.0	2.5	25.6	67
	17		100		1.6		65
	26		64		1.1		63
24"	SDR 9	mfla	200	14.0	3.5	27.9	190
	17		100		1.8		140
	32.5		51		1.0		95

Type **
mfla = molded flange adapter.
STUB = molded stub end (being discontinued).
SsSe = sheet stock stub end
MmSe = molded machined stub end



Molded Flange Adapter



Stub End

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

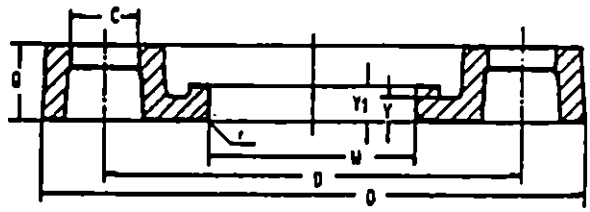
Stainless Steel #316 Convoluted Back-up Rings

(dimensions are in inches)

Nominal Pipe Size (inches)	O Nominal Outside Dia.of Ring	Q Minimum Thickness of ring	W Minimum Diameter of Bore	Y / Y_1 Nominal Length thru Hub	n Num.of bolt holes	C Min.Dia. of bolt holes	D Dia.of bolt 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
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

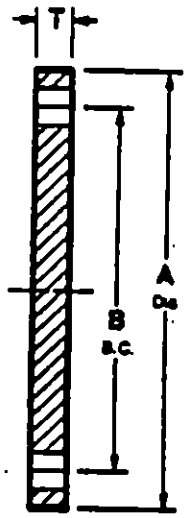
Physical Properties ASTM A351CF8M
Tensile Strength 70,000 psi
Yield Strength 30,000 psi
Elongation in 2" 30%

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



Blind Steel Flange Plates

Nominal Size	Dimensions, inches A	B	T	# of Holes	Hole dia.	Wt. lbs
1	4.25	3.25	0.75	4	0.63	2
1-1/4	4.63	3.50	.	4	0.63	3
1-1/2	5.00	3.88	.	4	0.63	3
2	6.00	4.75	.	4	0.75	5
3	7.50	6.00	.	4	0.75	8
4	9.00	7.50	.	8	0.75	11
5	10.00	8.50	.	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	.	12	1.00	50
14	21.00	18.75	.	12	1.13	61
16	23.50	21.25	.	16	1.13	70
18	25.00	22.75	.	16	1.25	80
20	27.50	25.00	.	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	.	28	1.50	375
36	46.00	42.75	.	32	1.63	500
42	53.00	49.50	.	36	1.63	600
48	59.00	56.00	.	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 - AWWA C207 and 125# cast iron flanges-ANSI B16.1. Special dimensioned flanges and non-ductile iron flanges quoted upon request.

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 tees 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 firtingss, 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 wye 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 ease 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® & 6400® series pipe.
- Driscopipe Fabricated fittings are manufactured from Driscopipe 1000® & 6400® piping systems. Fabricated ells, wyes and tees are made by butt fusing together mitre cut segments of pipe to obtain the desired shape.
- Fabricated elbows: 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 polyethylene.
- Driscopipe special fittings are custom designed for your specific application through your Driscopipe representative.

DRISCOPIPE

1000 PE3408

Butt Fusion Procedure for Pipe and Fittings

1. 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
4. 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.

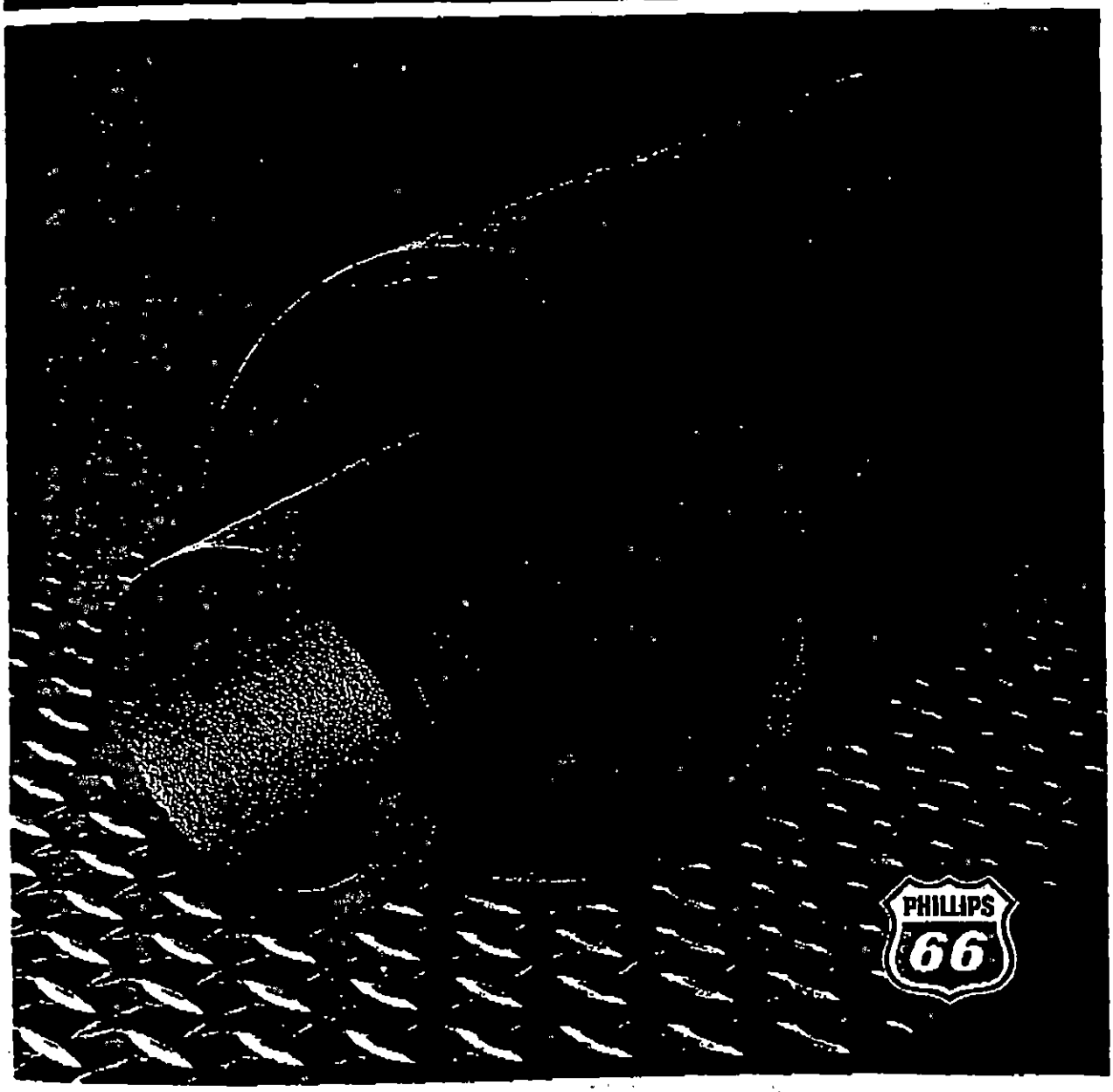
Heater plates should be double checked with a tempilstik or pyrometer for correct **surface** temperature (375°F – 400°F).

Avoid polyester type materials which melt and stick to heater plates

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 (SDR's) and chemical compatibility. The outer polyethylene casing can withstand external corrosion while providing the needed secondary containment of hazardous fluids should the carrier pipe leak. Both leak detection and reporting systems can be installed within Driscopipe 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 Marlex® 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

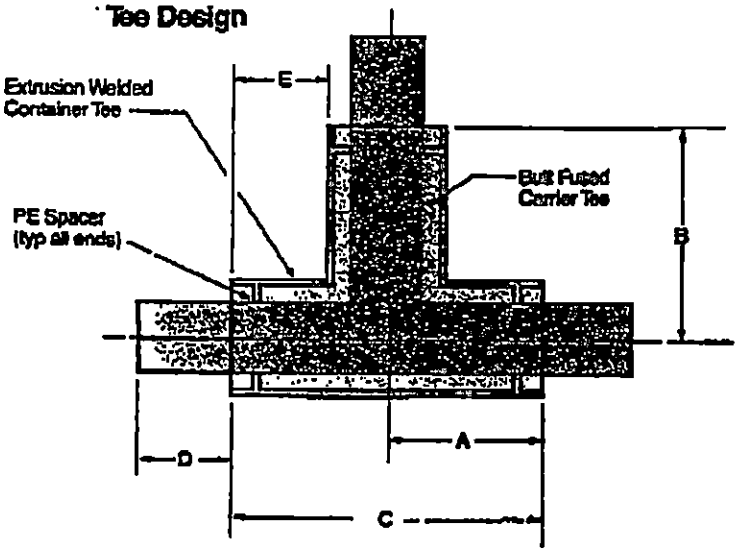
Driscopipe dual containment piping is a high density, very high molecular weight polyethylene pipe with a PPI listing as a PE 3408 materials. Using ASTM D3350, the carrier pipe may be described by the material cell class #355434C or #345434C. The containment pipe is usually designated as a #345434C material.

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 8500 were developed for these demanding environments.

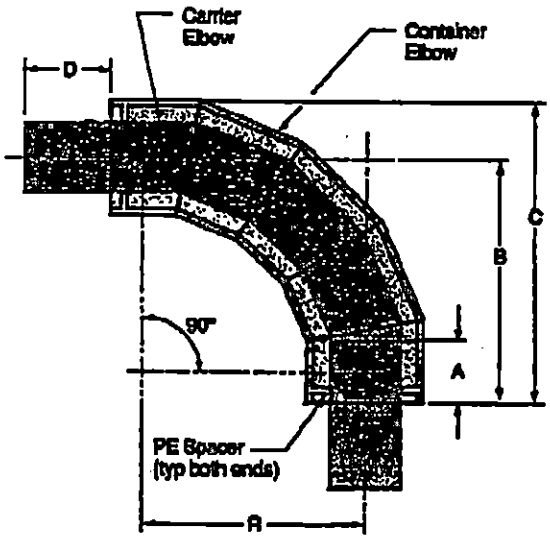
Polyethylene pipe is:

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

Tee Design



90° Ell Design



Driscopipe high density polyethylene piping offers innovative new solutions to old material handling problems. These piping systems give the engineer proven solutions to many traditional problems and applications.

Piping Components

Driscopipe 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.

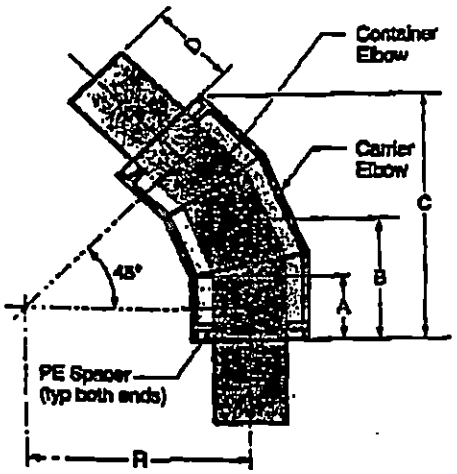
Carrier Pipes: Pipe sizes from 2" to 12" in water rated working pressures of gravity flow to 267 psi are available. When operating at elevated temperatures or when transporting hydrocarbon based fluids, contact your distributor. These conditions will each reduce the standard pressure rating of the carrier pipe.

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 containment piping may be completely field fabricated from component pieces. However, prefabrication 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

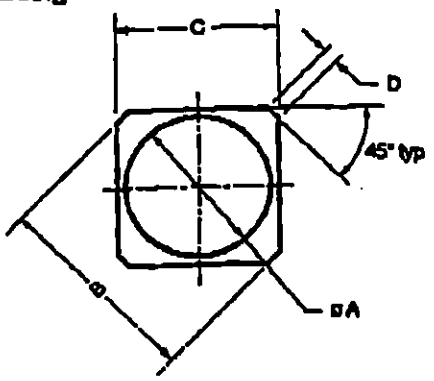
- Piping can be engineered for draining or pressure applications.
- The PE pipe is joined by heat-fusion, a proven welding technique that provides leak-free joints.
- The carrier pipe must be rated to carry the flowstream pressure. The containment piping may be equally rated or of thinner wall depending 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 shop-fabricated 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



DRISCOPIPE

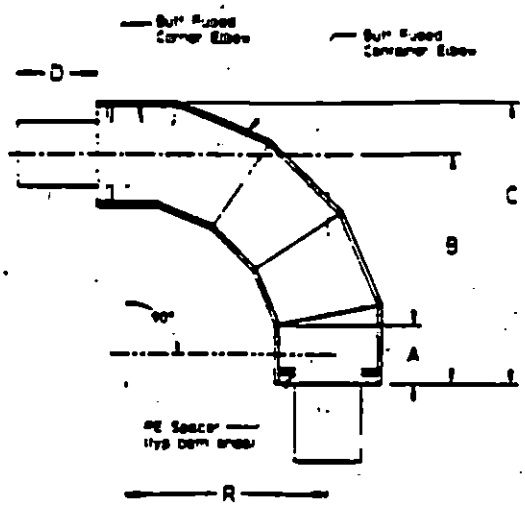
Dimensions & Pressure Ratings
1000 Series Pipe

Size	SDR	PSI @73.4	Weight lbs. per ft	Dimensions - inches Nominal O D	Approx. I D	Min. Wall	Packaging
1"	11	160	.19	1.315	1.075	.120	500 ft.coil
1-1/4	11	160	.30	1.660	1.358	.151	500 ft.coil
1-1/2	11	160	.40	1.900	1.554	.173	500 ft.coil
2"	7	267	.92	2.375	1.697	.339	88 jts.per bundle
	9	200	.74		1.847	.264	
	11	160	.62		1.943	.216	16 bundles per truck
	13.5	128	.52		2.023	.176	
	15.5	110	.46		2.069	.153	
	17	100	.42		2.095	.140	
3"	7	267	2.00	3.500	2.500	.500	46 jts.per bundle
	9	200	1.62		2.722	.389	
	11	160	1.35		2.864	.318	14 bundles per truck
	13.5	128	1.12		2.982	.259	
	15.5	110	.99		3.040	.226	
	17	100	.91		3.088	.206	
	19	89	.82		3.132	.184	
	21	80	.74		3.166	.167	
	26	64	.61		3.230	.135	
	32.5	51	.49		3.284	.108	
4"	7	267	3.31	4.500	3.214	.643	29 jts.per bundle
	9	200	2.67		3.500	.500	
	11	160	2.23		3.682	.409	14 bundles per truck
	13.5	128	1.85		3.834	.333	
	15.5	110	1.63		3.920	.290	
	17	100	1.50		3.970	.265	
	19	89	1.35		4.026	.237	
	21	80	1.23		4.072	.214	
	26	64	1.00		4.154	.173	
	32.5	51	.81		4.224	.138	
5-3/8"	21	80	1.75	5.375	4.863	.256	15 jts.per bundle
	26	64	1.43		4.961	.207	14 bundles per truck
	32.5	51	1.15		5.045	.165	
5"	7	267	5.05	5.563	3.973	.795	
	9	200	4.08		4.327	.618	
	11	160	3.42		4.551	.506	
	13.5	128	2.84		4.739	.412	
	15.5	110	2.50		4.845	.359	
	17	100	2.29		4.909	.327	
	19	89	2.07		4.977	.293	
	21	80	1.88		5.033	.265	
	26	64	1.53		5.139	.214	
	32.5	51	1.23		5.221	.171	
6"	7	267	7.16	6.625	4.733	.946	13 jts.per bundle
	9	200	5.78		5.153	.736	14 bundles per truck
	11	160	4.84		5.421	.602	
	13.5	128	4.03		5.643	.491	
	15.5	110	3.54		5.771	.427	
	17	100	3.25		5.845	.390	
	19	89	2.93		5.927	.349	
	21	80	2.66		5.995	.315	
	26	64	2.17		6.115	.255	
	32.5	51	1.75		6.217	.204	
7"	7	267	8.29	7.125	5.089	1.018	11 jts.per bundle
	9	200	6.69		5.541	.792	12 bundles per truck
	11	160	5.61		5.829	.648	
	13.5	128	4.66		6.069	.528	
	15.5	110	4.10		6.205	.460	
	17	100	3.76		6.287	.419	
	19	89	3.39		6.375	.375	
	21	80	3.08		6.445	.340	
	26	64	2.51		6.577	.274	
	32.5	51	2.02		6.685	.220	

Size	SDR	PSI @73.4	Weight lbs.	Dimensions - inches Nominal O D	Approx. I D	Min. Wall	Packaging
8"	7	267	12.14	8.625	6.161	1.232	9 jts.per bundle
	9	200	9.80		6.709	.958	
	11	160	8.21		7.057	.784	10 bundles per truck
	13.5	128	6.82		7.347	.639	
	15.5	110	6.00		7.513	.556	
	17	100	5.50		7.611	.507	3600 ft. per truck
	19	89	4.96		7.717	.454	
	21	80	4.52		7.803	.411	
	26	64	3.68		7.961	.332	
	32.5	51	2.97		8.095	.265	
10"	7	267	18.86	10.750	7.678	1.536	per truck
	9	200	15.23		8.362	1.194	
	11	160	12.75		8.796	.977	80 jts.per loose load
	13.5	128	10.59		9.158	.796	
	15.5	110	9.33		9.362	.694	
	17	100	8.55		9.486	.632	56 jts.per strip load
	19	89	7.71		9.618	.566	
	21	80	7.01		9.726	.512	
	26	64	5.71		9.924	.413	
	32.5	51	4.62		10.088	.331	
12"	7	267	26.53	12.750	9.108	1.821	per truck
	9	200	21.44		9.916	1.417	
	11	160	17.94		10.432	1.159	52 jts.per loose load
	13.5	128	14.89		10.862	.944	
	15.5	110	13.12		11.104	.823	
	17	100	12.03		11.250	.750	42 jts.per strip load
	19	89	10.84		11.408	.671	
	21	80	9.86		11.536	.607	
	26	64	8.04		11.770	.490	
	32.5	51	6.48		11.966	.392	
13"	7	267	29.24	13.386	9.562	1.912	per truck
	9	200	23.62		10.412	1.487	
	11	160	19.78		10.952	1.217	48 jts.per loose load
	13.5	128	16.43		11.402	.992	
	15.5	110	14.46		11.658	.864	
	17	100	13.26		11.812	.787	42 jts.per strip load
	19	89	11.96		11.976	.705	
	21	80	10.86		12.112	.637	
	26	64	8.87		12.356	.515	
	32.5	51	7.15		12.562	.412	
14"	7	267	31.99	14.000	10.000	2.000	per truck
	9	200	25.84		10.888	1.556	
	11	160	21.64		11.454	1.273	48 jts.per loose load
	13.5	128	17.97		11.926	1.037	
	15.5	110	15.81		12.194	.903	
	17	100	14.32		12.352	.824	30 jts.per strip load
	19	89	13.07		12.526	.737	
	21	80	11.90		12.666	.667	
	26	64	9.69		12.924	.538	
	32.5	51	7.83		13.138	.431	
16"	9	200	33.73	16.000	12.444	1.778	per truck
	11	160	28.27		13.090	1.455	
	13.5	128	23.46		13.630	1.185	33 jts.per loose load
	15.5	110	20.65		13.936	1.032	
	17	100	18.95		14.118	.941	30 jts.per strip load
	19	89	17.07		14.316	.842	
	21	80	15.53		14.476	.762	
	26	64	12.66		14.770	.615	
	32.5	51	10.21		15.016	.492	

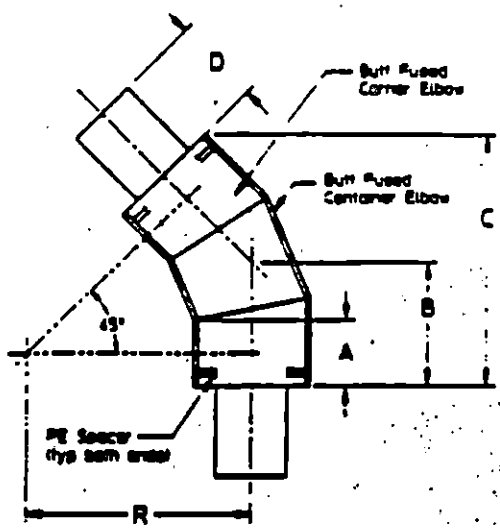
Dual Wall 90 Degree Ells

Carrier Pipe	x	Container Pipe	psi	Dimensions, (inches) A	B	C	D	R	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	6" SDR 26	120/75	6.0	21.4	24.7	6.0	18.4	13/11
4" 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	x	10" SDR 26	120/75	6.0	23.5	28.8	8.0	20.5	48/40
8" SDR 11/17	x	12" SDR 26	120/75	6.0	30.5	36.9	8.0	26.5	93/77
12" SDR 11/17	x	16" SDR 26	120/75	6.0	30.5	36.9	8.0	26.5	186/148



Dual Wall 45 Degree Ells

Carrier Pipe	x	Container Pipe	psi	Dimensions, (inches) A	B	C	D	R	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	6" SDR 26	120/75	6.0	21.4	24.7	6.0	18.4	13/11
4" 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	x	10" SDR 26	120/75	6.0	23.5	28.8	8.0	20.5	48/40
8" SDR 11/17	x	12" SDR 26	120/75	6.0	30.5	36.9	8.0	26.5	93/77
12" SDR 11/17	x	16" SDR 26	120/75	6.0	30.5	36.9	8.0	26.5	121/96



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

Distributed by:

DRISCOPIPE

Dual Wall Fittings

1000 series

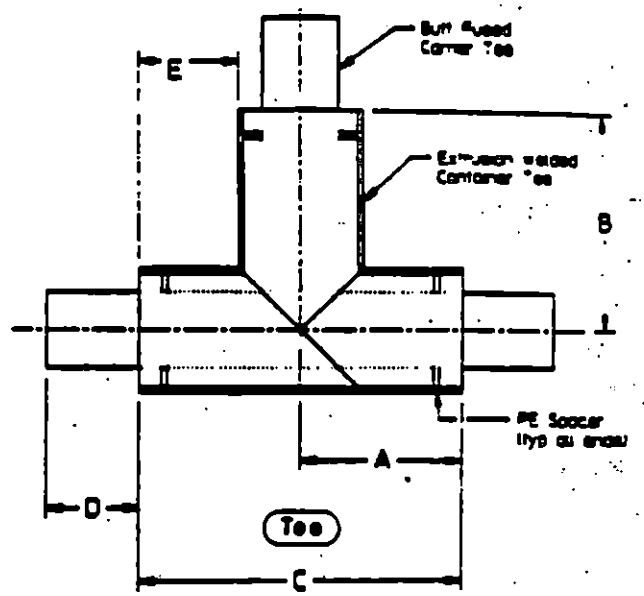
Dimensions

Effective: 4-1-93

Dual Wall Tees

Carrier Pipe	x	Container Pipe	psi	Dimensions, (inches) A	B	C	D	E	Lbs.
2" SDR 11	x	4" SDR 26	120	6.0	21.4	24.7	6.0	18.4	7
3" SDR 11/17	x	6" SDR 26	120/75	8.5	8.5	17.0	6.0	5.2	9/8
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

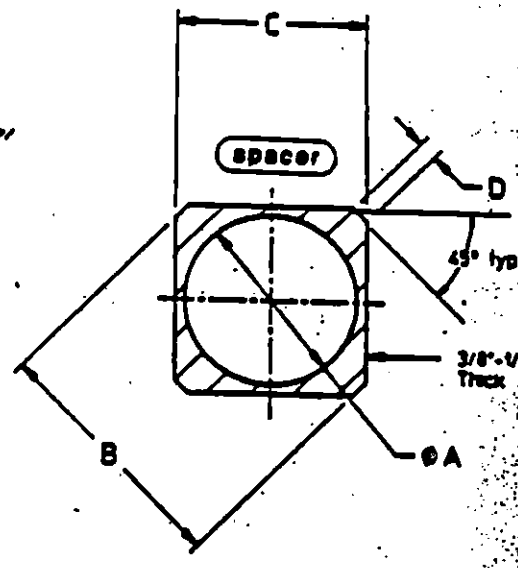
Container pipe (outside pipe) is SDR 26.
Carrier Pipe (inside pipe) is psi @ 73.4° F.



Dual Wall Spacers

Not Shown = 2" x 4"

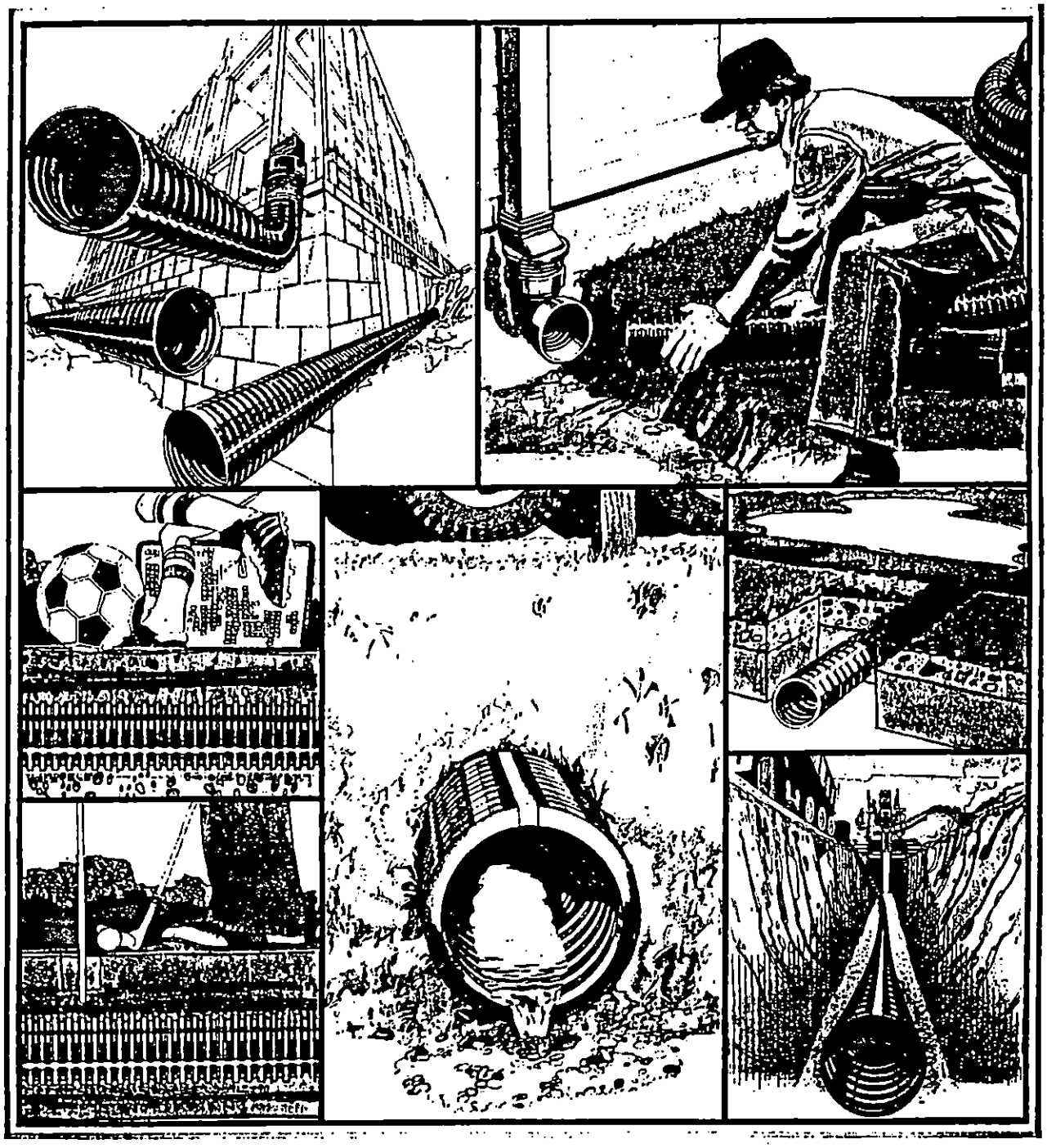
Nominal Size	Dimensions, inches A	B	C	D	Lbs
3 x 6" SDR 26	3.6	6.2	4.6	0.4	1
4 x 8" SDR 26	4.6	8.0	5.9	0.4	1
6 x 10" SDR 26	6.8	10.1	7.5	0.5	1
8 x 12" SDR 26	8.8	11.8	9.5	1.6	1
3 x 6" SDR 11	3.6	5.5	4.6	1.1	1
4 x 8" SDR 11	4.6	7.1	5.9	1.3	1
6 x 10" SDR 11	6.8	8.9	7.5	1.7	1
8 x 12" SDR 11	8.8	10.5	9.5	2.9	1



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

02610/ADV
BuyLine 0805

ADS corrugated polyethylene tubing



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

ADS®
ADVANCED DRAINAGE SYSTEMS, INC.

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.

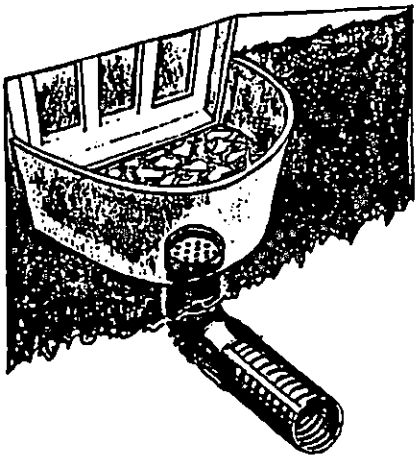
Basement window well drainage prevents rainwater from seeping down the foundation wall and entering the basement. This is accomplished by running a length of non-perforated tubing from the drain in the bottom of the well to the disposal area.

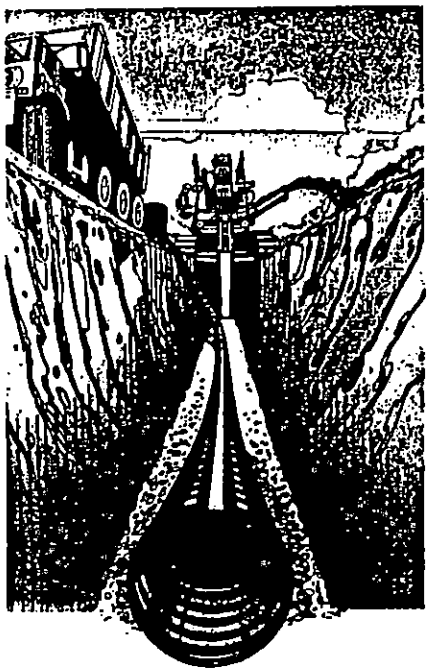
Driveway and sidewalk underdrainage is used to prevent frost damage or pavement deterioration due to unstable bases. Installation of perforated drainage tubing in a bed of gravel allows the water to drain out of the base course and be channeled away from the pavement.

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 fittings and connections and less labor to install.





for a variety of applications.

Culverts

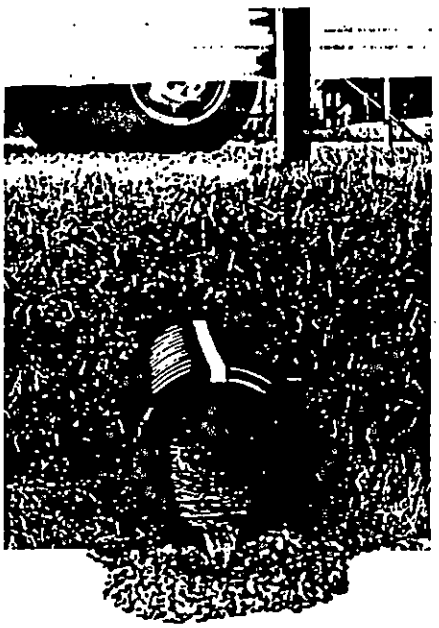
Culverts are easily drained with ADS culvert pipe; it is lighter and easier to handle and install than clay, concrete or corrugated metal, resulting in reduced labor costs. ADS culvert pipe has excellent load bearing strength, meeting the toughest requirements. It is approved by most state departments 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.

Airport 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.

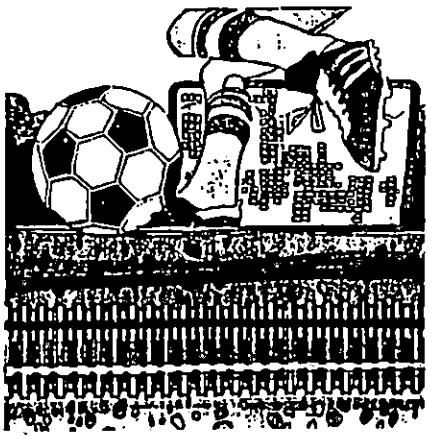
Athletic/Recreational

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

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

Look for the ADS green stripe.

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

ADS®

ADVANCED DRAINAGE SYSTEMS, INC.

Easy-to-use heavy-duty ADS fittings

Split Coupling

3"–311 6"– 811
4"–411 10"–1011
5"–511 12"–1211
6"–611 15"–1511

Snap Coupling

3"–312 6"–612
4"–412 8"–812
5"–512 10"–1012

Internal Coupler

4"–415
5"–515
6"–615
8"–815

Internal Reducing Coupler

5"–4"–425
6"–5"–526

Reducing Coupler

4"x3"–314 8"x6"–816
5"x4"–514 10"x 8"–1018
6"x4"–614 12"x10"–1210
8"x5"–516 15"x12"–1512

Snap Tee

3"–321 5"–525
4"–421 6"–626

Saddle Tee

4"–443 6"–646
5"–545 8"–843

Blind Tee

3"–341 5"–541
4"–441 6"–641

Downspout Adapter

3" — 364 (3¼ × 2½)
4" — 464 (3¼ × 2½)
4" — 465 (3 × 4¼)

45° "Y"

3"–322 5"–522
4"–422 6"–622

Spin-on Couplings

18"–1811
24"–2411

Split End Cap

3"–331 8"– 831
4"–431 10"–1031
5"–531 12"–1231
6"–631 15"–1531

Snap Adapter

3"–362 6"–662
4"–462 8"–862
5"–562

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 15"/15" to 12"
15" to 10"

Perforated Tubing

3"–301–300' Coils
4"–401–250' Coils
5"–501–165' Coils
6"–601–100' Coils
8"–801– 20' Lengths
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

3"–351–300' 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

Drain Guard®	Sock
3"–372	373–300' Coils
4"–472	473–250' Coils
5"–572	573–165' Coils
6"–672	673–100' Coils
8"–872	873–20' Lengths
10"–1072	1073–20' Lengths
12"–1272	12"–1273–20' Lengths
	15"–1573–20' Lengths

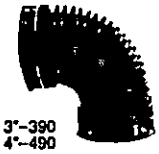
Heavy Duty Tubing

Perf.	Non-Perf.
8"–801	851–20' Lengths
10"–1001	1051–20' Lengths
12"–1201	1251–20' Lengths
15"–1501	1551–20' Lengths
18"–1801	1851–20' Lengths
24"–2401	2451–20' Lengths

45° ELL

4"–445

90° ELL



3"–390
4"–490

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.

ADS distributor locations and distribution network

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 Charlotte, NC	1-800-733-6133	**MIDWEST** Iowa City, IA	1-800-733-3889
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	1-800-733-8876

Insist on the ADS green stripe.

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

Corporate Office
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Columbus, Ohio 43221
(614) 457-3051

ADS®
ADVANCED DRAINAGE SYSTEMS, INC.

STEEL CASING FOR HDPE GAS PIPE UNDER ROAD

SEAMLESS BLACK STEEL PIPE

Nominal Size	O.D. Inches	Wall Inches	Weight Per Foot	I.P.S. Schedule No.	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
6"	6.625	.280	18.97	40 Std	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
		.864	53.16	XXS	6,542.32	7,206.77
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
10"	10.750	.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
		1.125	115.64	160	14,928.80	16,405.03
12"	12.750	.375	49.56	Std.	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
		1.312	160.27	160	19,501.94	21,494.47
14"	14.000	.375	54.57	30 Std	5,681.52	6,316.51
		.500	72.09	XS	7,677.16	8,523.62
		.750	106.13	80	13,538.54	14,886.01
		1.406	189.11	160	24,129.23	26,530.80
16"	16.000	.375	62.58	30 Std	6,637.99	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
		1.594	245.25	160		33,681.87
18"	18.000	.375	70.59	Std	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

CAPPCO TUBULAR PRODUCTS U.S.A.
A Division of Georgia Tubular Products, Inc.

Tom Connor
Northeast Representative

January 30, 1995

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

RE: 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,

Tom Connor

Thomas P. Connor
Northeast Representative

TPC/jo

1787 SENTRY PARKWAY WEST • BLUE BELL, PA 19422 • PHONE: (215) 540-2253 • FAX: (215) 540-2249

BRECO MECHANICAL GROUP, INC.
201 Saw Mill River Road
YONKERS, NEW YORK 10701

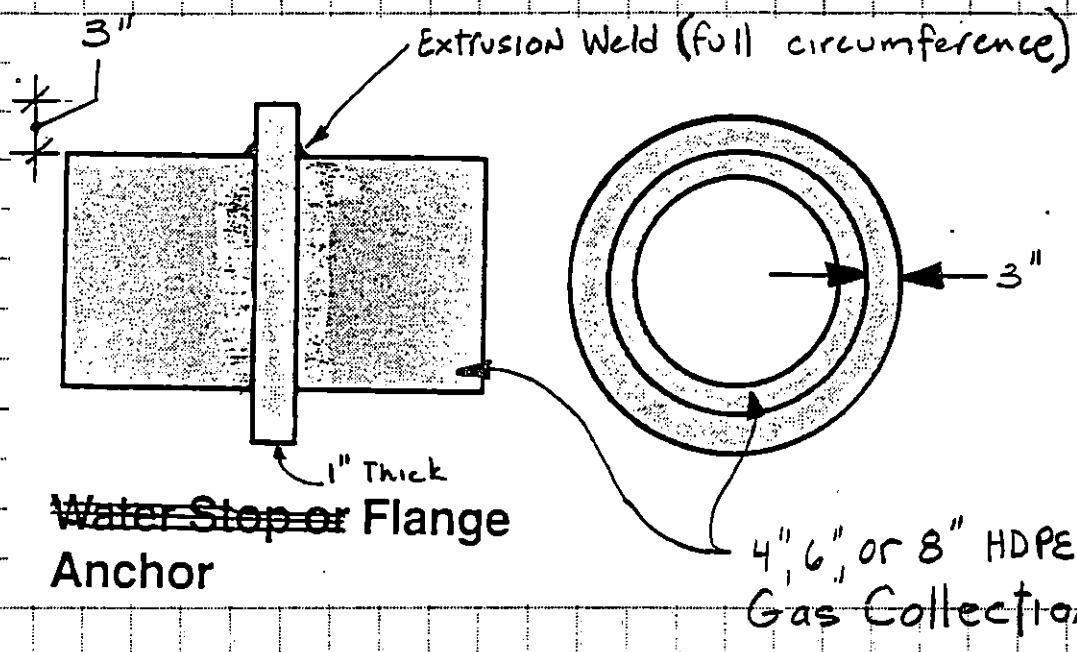
JOB

SHEET NO. 1 OF 1

CALCULATED BY DATE

CHECKED BY DATE

SCALE No Scale



HDPE PIPE ANCHORS

30" SMOOTH HDPE SED. BASIN CONN. PIPING

DRISCOPIPE

Dimensions & Pressure Ratings
1000 Series Pipe

Size	SDR	PSI @73.4	Weight lbs.	Dimensions - inches Nominal O D	Approx. I D	Min. Wall	Packaging per truckload
18"	9	200	42.71	18.000	14.000	2.000	27 jts.per loose load
	11	160	35.76		14.728	1.636	
	13.5	128	29.69		15.334	1.333	
	15.5	110	26.14		15.678	1.161	
	17	100	23.99		15.882	1.059	20 jts.per strip load
	19	89	21.60		16.106	0.947	
	21	80	19.65		16.286	0.857	
	26	64	16.03		16.616	0.692	
	32.5	51	12.94		16.892	0.554	
20"	11	160	44.15	20.000	16.364	1.818	20 jts.per loose load
	13.5	128	36.66		17.038	1.481	
	15.5	110	32.27		17.420	1.290	
	17	100	29.60		17.648	1.176	16 jts.per strip load
	19	89	26.68		17.894	1.053	
	21	80	24.26		18.096	0.952	
	26	64	19.79		18.462	0.769	
	32.5	51	15.96		18.770	0.615	
21.5	11	160	51.04	21.500	17.590	1.955	18 jts.per loose load
	13.5	128	42.38		18.314	1.593	
	15.5	110	37.30		18.726	1.387	
	17	100	34.23		18.970	1.265	16 jts.per strip load
	19	89	30.84		19.236	1.132	
	1	80	28.05		19.452	1.024	
	6	64	22.88		19.846	0.827	
	32.5	51	18.46		20.176	0.662	
22"	11	160	53.43	22.000	18.000	2.000	
	13.5	128	44.38		18.740	1.630	
	15.5	110	39.04		19.162	1.419	
	17	100	35.83		19.412	1.294	
	19	89	32.28		19.684	1.158	
	21	80	29.37		19.904	1.048	
	26	64	23.95		20.308	0.846	16 jts.per loose load
	32.5	51	19.32		20.646	0.677	
24"	11	160	63.59	24.000	19.636	2.182	12 jts.per strip load
	13.5	128	52.81		20.444	1.778	
	15.5	110	46.47		20.904	1.548	
	17	100	42.65		21.176	1.412	
	19	89	38.41		21.474	1.263	
	21	80	34.95		21.714	1.143	
	26	64	28.50		22.154	0.923	
	32.5	51	22.98		22.524	0.738	
26"	13.5	128	61.97	26.000	22.148	1.926	12 jts.per loose load
	15.5	110	54.55		22.646	1.677	
	17	100	50.03		22.942	1.529	
	19	89	45.07		23.264	1.368	9 jts.per strip load
	21	80	41.01		23.524	1.238	
	26	64	33.45		24.000	1.000	
	32.5	51	26.98		24.400	0.800	
28"	13.5	128	71.86	28.000	23.852	2.074	10 jts.per loose load
	15.5	110	63.26		24.388	1.806	
	17	100	58.04		24.706	1.647	
	19	89	52.29		25.052	1.474	9 jts.per strip load
	21	80	47.55		25.334	1.333	
	26	64	38.80		25.846	1.077	
	32.5	51	31.31		26.276	0.862	
30"	13.5	128	82.50	30.000	25.556	2.222	9 jts.per loose load
	15.5	110	72.62		26.130	1.935	
	17	100	66.64		26.470	1.765	
	19	89	60.02		26.842	1.579	9 jts.per strip load
	21	80	54.61		27.142	1.429	
	26	64	44.54		27.692	1.154	
	32.5	51	35.92		28.154	0.923	
800 mm	15.5	110	80.04	31.496	27.432	2.032	
	17	100	73.45		27.790	1.853	
	19	89	66.17		28.180	1.658	
	21	80	60.19		28.496	1.500	
	26	64	49.07		29.074	1.211	9 jts.per loose load
	32.5	51	39.59		29.558	0.969	
32"	15.5	110	82.64	32.000	27.870	2.065	6 jts.per strip load
	17	100	75.79		28.236	1.882	
	19	89	68.28		28.632	1.684	
	21	80	62.13		28.952	1.524	
	26	64	50.68		29.538	1.231	
	32.5	51	40.89		30.030	0.985	
34"	17	100	85.58	34.000	30.000	2.000	
	19	89	77.07		30.422	1.789	
	21	80	70.13		30.762	1.619	
	26	64	57.22		31.384	1.308	6 jts.per loose load
	32.5	51	46.14		31.908	1.046	
36"	17	100	95.96	36.000	31.764	2.118	4 jts.per strip load
	19	89	86.44		32.210	1.895	
	21	80	78.61		32.572	1.714	
	26	64	64.15		33.230	1.385	
	32.5	51	51.74		33.784	1.108	
1000 mm	19	89	103.36	39.370	35.226	2.072	
	21	80	94.04		35.620	1.875	
	26	64	76.69		36.342	1.514	4 jts.per loose load
	32.5	51	61.85		36.948	1.211	
42"	26	64	87.27	42.000	38.770	1.615	4 jts.per strip load
	32.5	51	70.39		39.416	1.292	
1200 mm	26	64	110.45	47.244	43.610	1.817	
	32.5	51	89.11		44.336	1.454	
54"	26	64	144.30	54.000	49.846	2.077	1 joint per trk.
	32.5	51	116.42		50.676	1.662	

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

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

SDR (Standard Dimension Ratio) = $\frac{OD}{\text{min. wall}}$

Pressure rating = $\frac{2\,s}{SDR-1}$ @ 73.4 deg. F

s = hydrostatic design stress (800 psi)

2-91

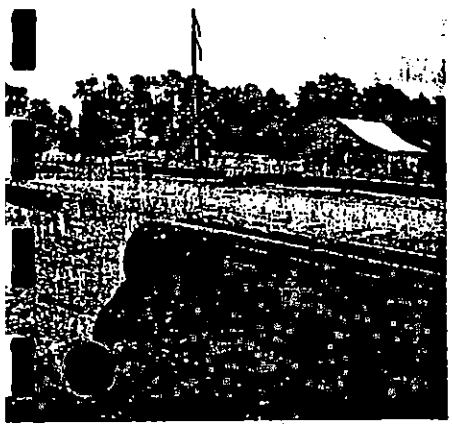
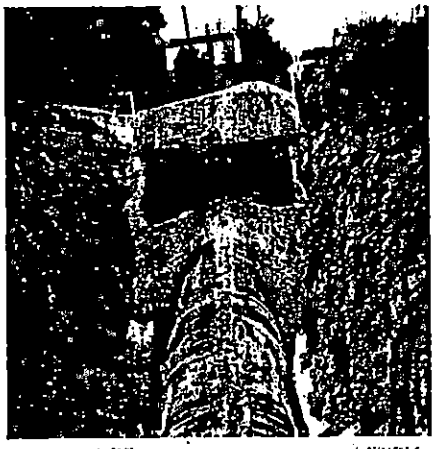
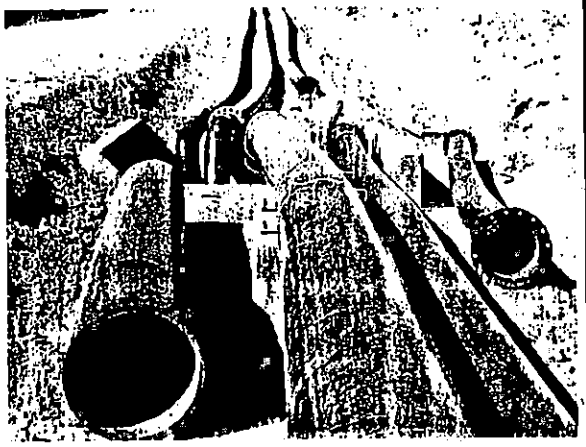
DRISCOPIPE®

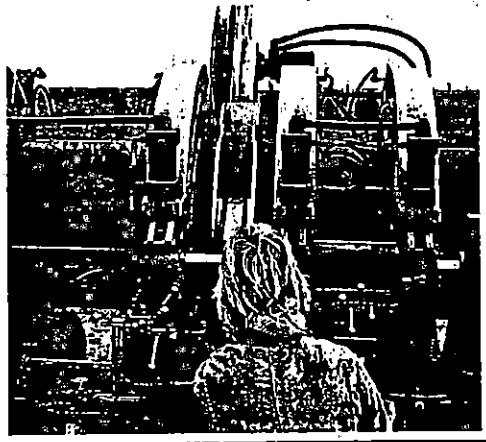
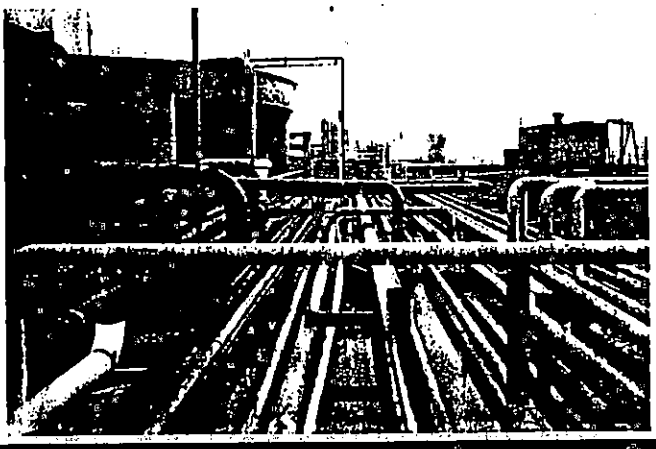
Engineering Characteristics

PHILLIPS 66

Contents

Photographs shown are typical Driscopipe installations.

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.)	1635
438,000 hrs. (50 yrs.)	1604
500,000 hrs. (57 yrs.)	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.

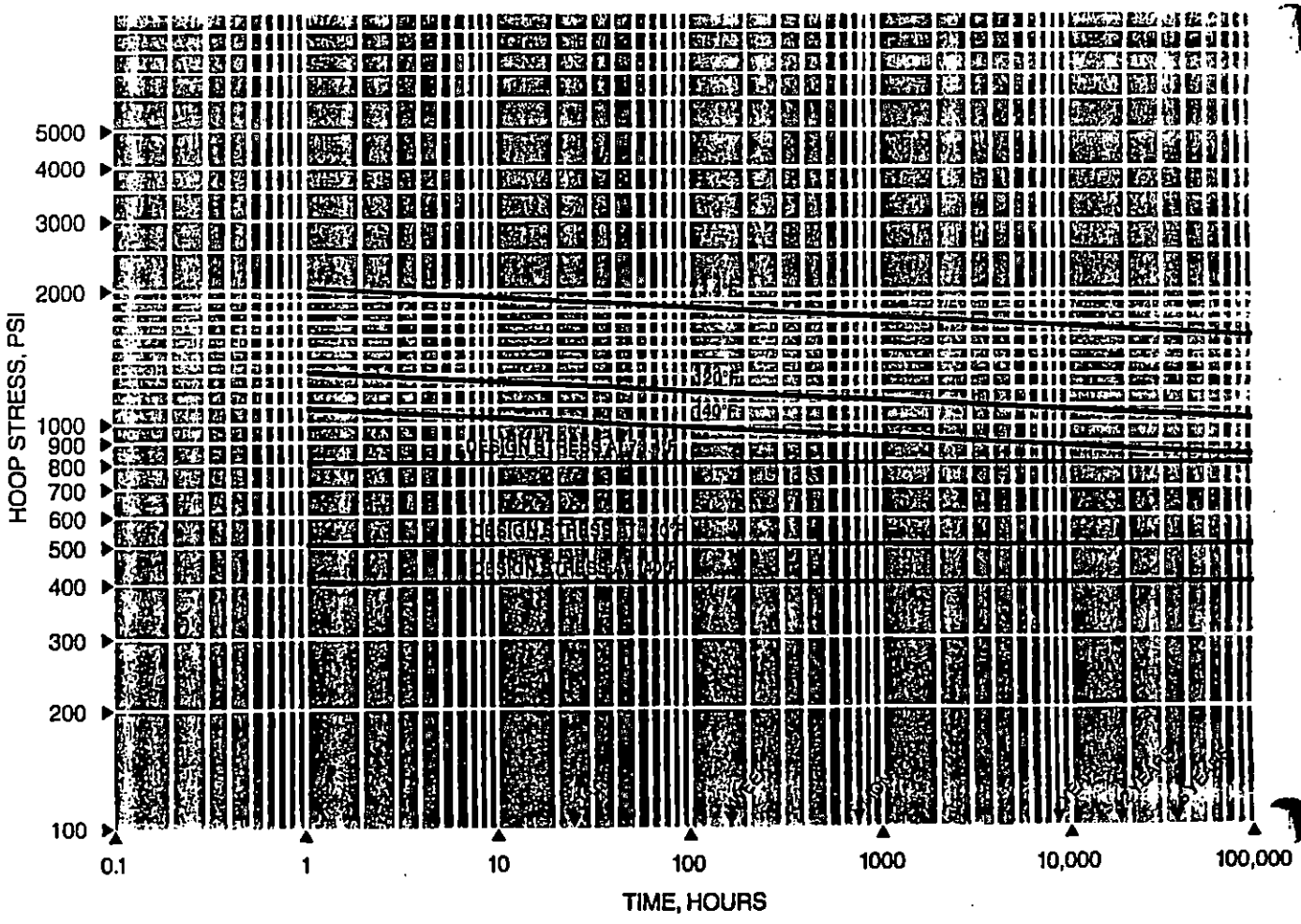
The long term hydrostatic tests are conducted by using ASTM standard test procedures which may be applied to all types of plastic pipe (ASTM D 1598 Test for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure). Stress-life tests are conducted by using numerous pipe samples which are filled 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 of 73.4°F and one or more higher 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.

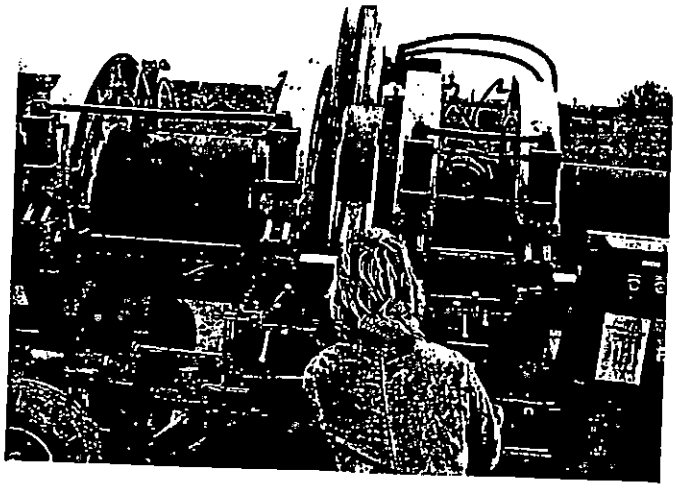
The design pressures for Driscopipe are determined by the following equation, adopted internationally by the industry for this purpose:

$$P = \frac{2S}{SDR - 1} \times F \quad \text{or} \quad P = 2S\frac{t}{D - t} \times F$$

Where:
- D = Specified Outside Diameter, Inches
- P = Design Pressure, psi
- S = Long Term Hydrostatic Strength, psi, at the design temperature
- t = Minimum Wall Thickness, Inches
- F = Service Design Factor
- SDR = 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.

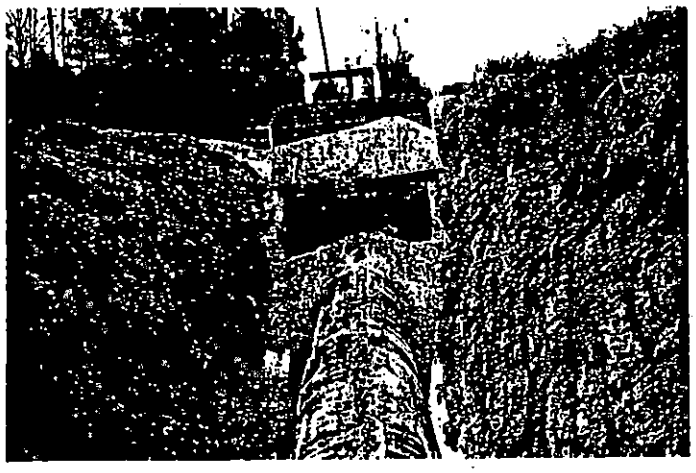
Lightweight – Flexible

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 fittings 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.

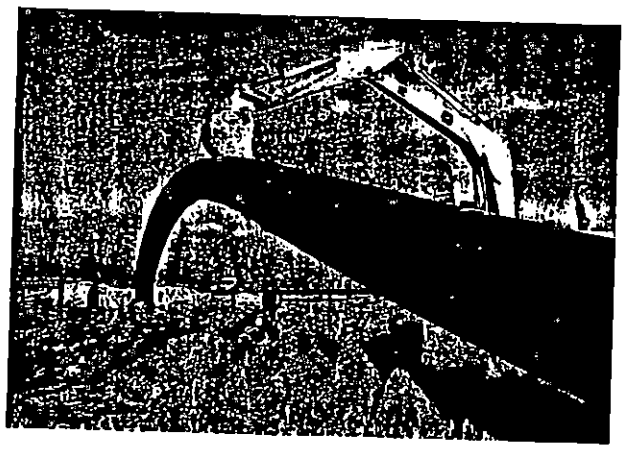
Even though "toughness" has become generally recognized by the industry as a highly desirable characteristic ... there is no standard test which can be used to directly compare the "toughness" among polyethylenes ... as well as among the different plastic materials which are considered suitable for piping.

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. °C
1	A	48	50	50°
2	B	24	50	50°
3	C	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 test 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 fuming 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 = Outside Diameter, Inches
- P = Design Pressure, psi
- S = Long Term Hydrostatic Strength, psi, at the design temperature
- t = Minimum Wall Thickness, Inches
- F = Service Design Factor
- SDR = Standard Dimension Ratio of D/t

CHEMICAL RESISTANCE OF DRISCOPIPE

S – Satisfactory
U – Unsatisfactory
M – Marginal
N – Not known

All concentrations are 100% unless noted otherwise.

On reagents marked marginal, chemical attack will be recognized by a loss of physical properties of the pipe which may require a change in design factors.

Reagent	70°F (21°C)	140°F (60°C)
Acetic Acid 1-10%	S	S
Acetic Acid 10-60%	S	M
Acetic Acid 80-100%	S	M
Acetone	M	U
Acrylic Emulsions	S	S
Aluminum Chloride-Dilute	S	S
Aluminum Chloride Conc.	S	S
Aluminum Fluoride Conc.	S	S
Aluminum Sulfate Conc.	S	S
Alums (All Types) Conc.	S	S
Ammonia 100% Dry Gas	S	S
Ammonium Carbonate	S	S
Ammonium Chloride Sat'd	S	S
Ammonium Fluoride 20%	S	S
Ammonium Hydroxide 0.88 S.G.	S	S
Ammonium Metaphosphate Sat'd	S	S
Ammonium Nitrate Sat'd	S	S
Ammonium Persulfate Sat'd	S	S
Ammonium Sulfate Sat'd	S	S
Ammonium Sulfide Sat'd	S	S
Ammonium Thiocyanate Sat'd	S	S
Amyl Acetate	M	U
Amyl Alcohol 100%	S	S
Amyl Chloride 100%	N	U
Aniline 100%	S	N
Antimony Chloride	S	S
Aqua Regia	U	U
Barium Carbonate Sat'd	S	S
Barium Chloride	S	S
Barium Hydroxide	S	S
Barium Sulfate Sat'd	S	S
Barium Sulfide Sat'd	S	S
Beer	S	S
Benzene	M	U
Benzene Sulfonic Acid	S	S
Bismuth Carbonate Sat'd	S	S
Bleach Lye 10%	S	S
Black Liquor	S	S
Borax Cold Sat'd	S	S
Boric Acid Dilute	S	S

Reagent	70°F (21°C)	140°F (60°C)
Boric Acid Conc.	S	S
Bromic Acid 10%	S	S
Bromine Liquid 100%	M	U
Butanediol 10%	S	S
Butanediol 60%	S	S
Butanediol 100%	S	S
Butyl Alcohol 100%	S	S
Calcium Bisulfide	S	S
Calcium Carbonate Sat'd	S	S
Calcium Chlorate Sat'd	S	S
Calcium Chloride Sat'd	S	S
Calcium Hydroxide	S	S
Calcium Hypochlorite BL'GH Sol.	S	S
Calcium Nitrate 50%	S	S
Calcium Sulfate	S	S
Camphor Oil	N	U
Carbon Dioxide 100% Dry	S	S
Carbon Dioxide 100% Wet	S	S
Carbon Dioxide Cold Sat'd	S	S
Carbon Disulfide	N	U
Carbon Monoxide	S	S
Carbon Tetrachloride	M	U
Carbonic Acid	S	S
Castor Oil Conc.	S	S
Chlorine Dry Gas 100%	S	M
Chlorine Moist Gas	M	U
Chlorine Liquid	M	U
Chlorobenzene	M	U
Chloroform	M	U
Chlorosulfonic Acid 100%	M	U
Chrome Alum Sat'd	S	S
Chromic Acid 20%	S	S
Chromic Acid Up to 50%	S	S
Chromic Acid and Sulfuric Acid	S	M
Cider	S	S
Citric Acid Sat'd	S	S
Coconut Oil Alcohols	S	S
Cola Concentrates	S	S
Copper Chloride Sat'd	S	S
Copper Cyanide Sat'd	S	S
Copper Fluoride 2%	S	S
Copper Nitrate Sat'd	S	S
Copper Sulfate Dilute	S	S
Copper Sulfate Sat'd	S	S
Cottonseed Oil	S	S
Crude Oil*	S	M
Cuprous Chloride Sat'd	S	S
Cychohexanol	S	S
Cyclohexanone	M	U
Detergents Synthetic	S	S
Developers, Photographic	S	S
Dextrin Sat'd	S	S
Dextrose Sat'd	S	S
Dibutylphthalate	S	M
Disodium Phosphate	S	S

Reagent	70°F (21°C)	140°F (60°C)
Diazo Salts	S	S
Diethylene Glycol	S	S
Diglycolic Acid	S	S
Dimethylamine	M	U
Emulsions, Photographic	S	S
Ethyl Acetate 100%	M	U
Ethyl Alcohol 100%	S	S
Ethyl Alcohol 35%	S	S
Ethyl Butyrate	M	U
Ethyl Chloride	M	U
Ethyl Ether	U	U
Ethylene Chloride	U	U
Ethylene Chlorohydrin	U	U
Ethylene Dichloride	M	U
Ethylene Glycol	S	S
Ferric Chloride Sat'd	S	S
Ferric Nitrate Sat'd	S	S
Ferrous Chloride Sat'd	S	S
Ferrous Sulfate	S	S
Fish Solubles	S	S
Fluoboric Acid	S	S
Fluorine	S	U
Fluosilicic Acid 32%	S	S
Fluosilicic Acid Conc.	S	S
Formaldehyde 40%	S	N
Formic Acid 0-20%	S	S
Formic Acid 20-50%	S	S
Formic Acid 100%	S	S
Fructose Sat'd	S	S
Fruit Pulp	S	S
Fuel Oil	S	U
Furfural 100%	M	U
Furfuryl Alcohol	M	U
Gallic Acid Sat'd	S	S
Gas Liquids*	S	M
Gasoline*	M	U
Gin	S	U
Glucose	S	S
Glycerine	S	S
Glycol	S	S
Glycolic Acid 30%	S	S
Grape Sugar Sat'd Aq.	S	S
Hexanol, Tert.	S	S
Hydrobromic Acid 50%	S	S
Hydrocyanic Acid Sat'd	S	S
Hydrochloric Acid 10%	S	S
Hydrochloric Acid 30%	S	S
Hydrochloric Acid 35%	S	S
Hydrochloric Acid Conc.	S	S
Hydrofluoric Acid 40%	S	S
Hydrofluoric Acid 60%	S	S
Hydrofluoric Acid 75%	S	S
Hydrogen 100%	S	S
Hydrogen Bromide 10%	S	S
Hydrogen Chloride Gas Dry	S	S

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

continued on page 10

continued from page 9

CHEMICAL RESISTANCE OF DRISCOPIPE

Reagent	70°F (21°C)	140°F (60°C)
Hydrogen Peroxide 30%	S	S
Hydrogen Peroxide 90%	S	M
Hydrogen Phosphide 100%	S	S
Hydroquinone	S	S
Hydrogen Sulfide	S	S
Hypochlorus Acid Conc.	S	S
Inks	S	S
Iodine (Alc. Sol.) Conc.	S	U
Lactic Acid 10%	S	S
Lactic Acid 90%	S	S
Latex	S	S
Lead Acetate Sat'd	S	S
Lube Oil*	S	M
Magnesium Carbonate Sat'd	S	S
Magnesium Chloride Sat'd	S	S
Magnesium Hydroxide Sat'd	S	S
Magnesium Nitrate Sat'd	S	S
Magnesium Sulfate Sat'd	S	S
Mercuric Chloride Sat'd	S	S
Mercuric Cyanide Sat'd	S	S
Mercurous Nitrate Sat'd	S	S
Mercury	S	S
Methyl Alcohol 100%	S	S
Methyl Bromide	M	U
Methyl Chloride	M	U
Methyl Ethyl Ketone 100%	M	U
Methylsulfuric Acid	S	S
Methylene Chloride 100%	M	U
Milk	S	S
Mineral Oils	S	U
Molasses Comm.	S	S
Nickel Chloride Sat'd	S	S
Nickel Nitrate Conc.	S	S
Nickel Sulfate Sat'd	S	S
Nicotine Dilute	S	S
Nicotinic Acid	S	S
Nitric Acid 0-30%	S	S
Nitric Acid 30-50%	S	M
Nitric Acid 70%	S	M
Nitric Acid 95-98%	U	U
Nitrobenzene 100%	U	U
Octyl Cresol	S	U
Oils and Fats*	S	M
Oleic Acid Conc.	S	U
Oleum Conc.	U	U
Orange Extract	S	S
Oxalic Acid Dilute	S	S
Oxalic Acid Sat'd	S	S
Ozone 100%	S	U
Perchloric Acid 10%	S	S
Petroleum Ether	U	U
Phenol 90%	U	U
Phosphoric Acid Up to 30%	S	S
Phosphoric Acid Over 30%	S	S
Phosphoric Acid 90%	S	S

Reagent	70°F (21°C)	140°F (60°C)
Phosphorous (Yellow) 100%	S	N
Phosphorus Pentoxide 100%	S	N
Photographic Solutions	S	S
Pickling Baths		
Sulfuric Acid	S	S
Hydrochloric Acid	S	S
Sulfuric-Nitric	S	U
Plating Solutions		
Brass	S	S
Cadmium	S	S
Chromium	N	N
Copper	S	S
Gold	S	S
Indium	S	S
Lead	S	S
Nickel	S	S
Rhodium	S	S
Silver	S	S
Tin	S	S
Zinc	S	S
Potassium Bicarbonate Sat'd	S	S
Potassium Borate 1%	S	S
Potassium Bromate 10%	S	S
Potassium Bromide Sat'd	S	S
Potassium Carbonate	S	S
Potassium Chlorate Sat'd	S	S
Potassium Chloride Sat'd	S	S
Potassium Chromate 40%	S	S
Potassium Cyanide Sat'd	S	S
Potassium Dichromate 40%	S	S
Potassium Ferri/ Ferro Cyanide Sat'd	S	S
Potassium Fluoride	S	S
Potassium Hydroxide 20%	S	S
Potassium Hydroxide Conc.	S	S
Potassium Nitrate Sat'd	S	S
Potassium Perborate Sat'd	S	S
Potassium Perchlorate 10%	S	S
Potassium Sulfate Conc.	S	S
Potassium Sulfide Conc.	S	S
Potassium Sulfite Conc.	S	S
Potassium Persulfate Sat'd	S	S
Propargyl Alcohol	S	S
Propyl Alcohol	S	S
Propylene Dichloride 100%	U	U
Propylene Glycol	S	S
Rayon Coagulating Bath	S	S
Sea Water	S	S
Selenic Acid	S	S
Shortening	S	S
Silicic Acid	S	S
Silver Nitrate Sol.	S	S
Soap Solution Any Conc'n	S	S
Sodium Acetate Sat'd	S	S
Sodium Benzoate 35%	S	S

Reagent	70°F (21°C)	140°F (60°C)
Sodium Bicarbonate Sat'd	S	S
Sodium Bisulfate Sat'd	S	S
Sodium Bisulfite Sat'd	S	S
Sodium Borate	S	S
Sodium Bromide Dilute Sol.	S	S
Sodium Carbonate Con.	S	S
Sodium Carbonate	S	S
Sodium Chlorate Sat'd.	S	S
Sodium Chloride Sat'd	S	S
Sodium Cyanide	S	S
Sodium Dichromate Sat'd	S	S
Sodium Ferricyanide	S	S
Sodium Ferrocyanide Sat'd	S	S
Sodium Fluoride Sat'd	S	S
Sodium Hydroxide Conc.	S	S
Sodium Hypochlorite	S	S
Sodium Nitrate	S	S
Sodium Sulfate	S	S
Sodium Sulfide 25%	S	S
Sodium Sulfide Sat'd Sol.	S	S
Sodium Sulfite Sat'd	S	S
Stannous Chloride Sat'd	S	S
Stannic Chloride Sat'd	S	S
Starch Solution Sat'd	S	S
Stearic Acid 100%	S	S
Sulfuric Acid 0-50%	S	S
Sulfuric Acid 70%	S	M
Sulfuric Acid 80%	S	U
Sulfuric Acid 96%	M	U
Sulfuric Acid 98%	M	U
Sulfuric Acid, Fuming	U	U
Sulfurous Acid	S	S
Tallow*	S	M
Tannic Acid 10%	S	S
Tanning Extracts Comm.	S	S
Tartaric Acid Sat'd	N	N
Tetrahydrofurane	N	U
Titanium Tetrachloride Sat'd	N	U
Toluene	M	U
Transformer Oil	S	M
Trisodium Phosphate Sat'd	S	S
Trichloroethylene	U	U
Urea Up to 30%	S	S
Urine	S	S
Vinegar Comm.	S	S
Vanilla Extract	S	S
Wetting Agents	S	S
Whiskey	S	N
Wines	S	S
Xylene	M	U
Yeast	S	S
Zinc Chloride Sat'd	S	S
Zinc Sulfate Sat'd	S	S

For additional chemical resistance listings, consult the P.P.I. technical report #TR 19/10-84, Table I and the ISO technical report #ISO/Data 8-1979, Tables I, II, III.

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 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.

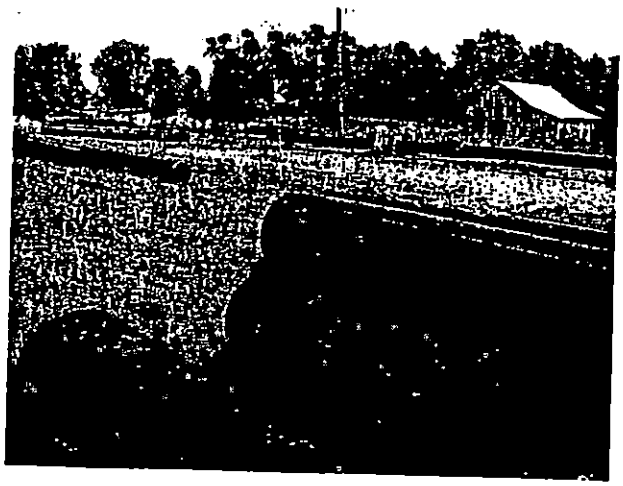
Knowledge of the long term strength of Driscopipe at the various temperatures allows selective design of a system. Accurate interpolations can be made for other temperatures between those which are known when data at three or more temperature levels is available.

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
−40°	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.

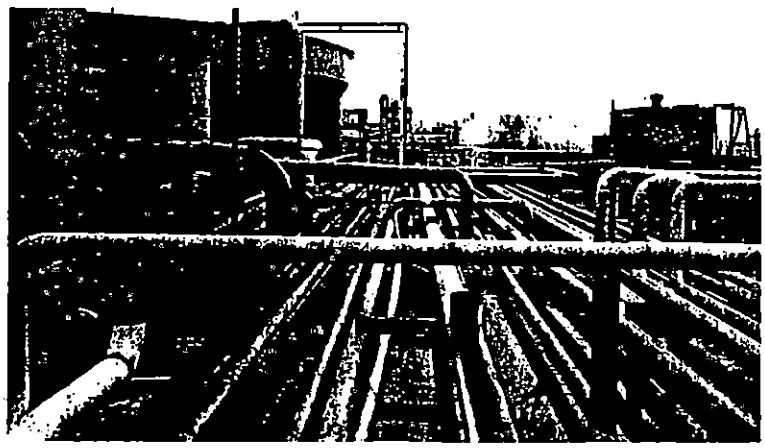
Temperature °F	Modulus of Elasticity, psi
–20°	300,000
0°	260,000
32°	200,000
75°	130,000
100°	105,000
140°	60,000

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 $.75 \times 10^{-4}$ for Driscopipe 8600 to $.83 \times 10^{-4}$ 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 1.2×10^{-4} in/in/°F.

The circumferential coefficient of expansion and contraction for Driscopipe is approximately $.6 \times 10^{-4}$ 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.



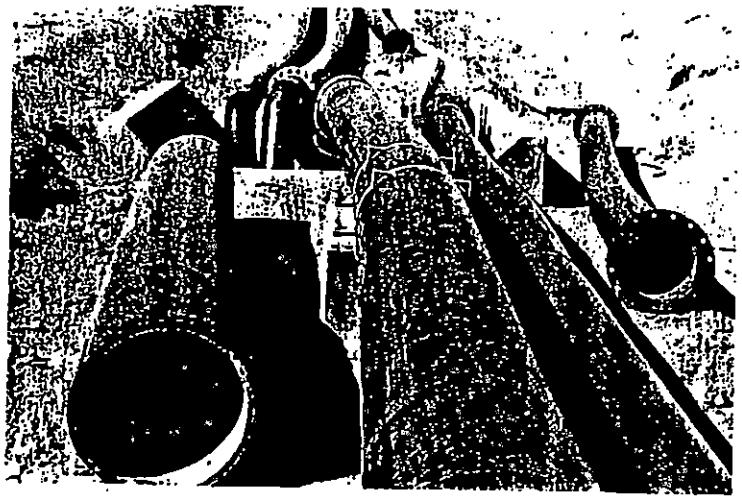
Tests have been conducted wherein the temperature of more than 100 feet of unrestrained pipe was changed 130°F in a period of a few minutes. The total force created by contraction was measured and proved to be about (½) one-half the theoretical calculated value. Thermoplastic materials are unique in 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 Driscopipe 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.

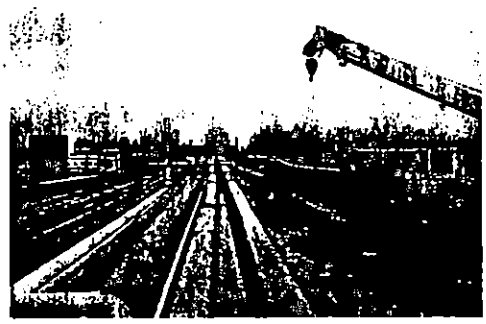
Driscopipe is also protected against degradation caused by ultraviolet rays when exposed to direct sunlight. The material contains 2½% of finely divided carbon black which also accounts for the black color of Driscopipe. Carbon black is the most effective single additive capable of enhancing the weathering 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.

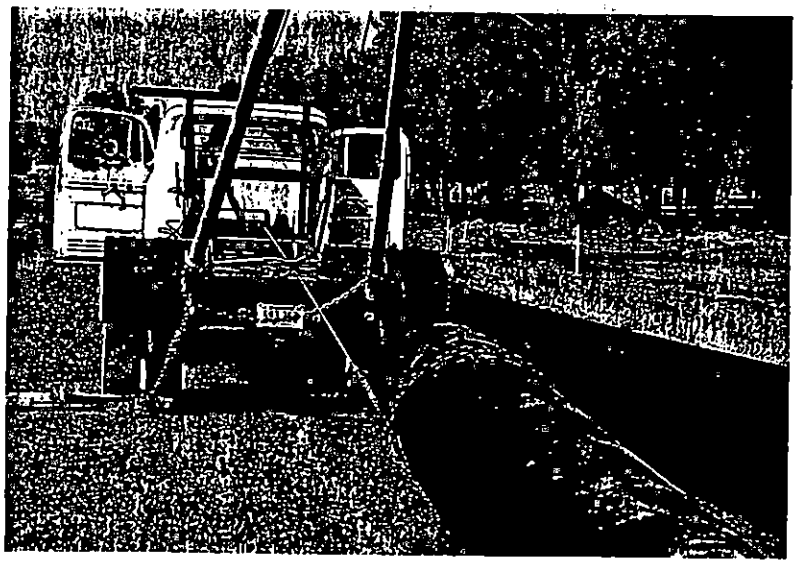
These permeation rates are considered very low. They result in negligible loss of product and create no hazard. For example, polyethylene piping systems are the predominant material used to construct new gas distribution systems and to renew old deteriorated systems. The permeation rate will vary in 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 ¼ 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 ft/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 joint 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 McElroy 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.

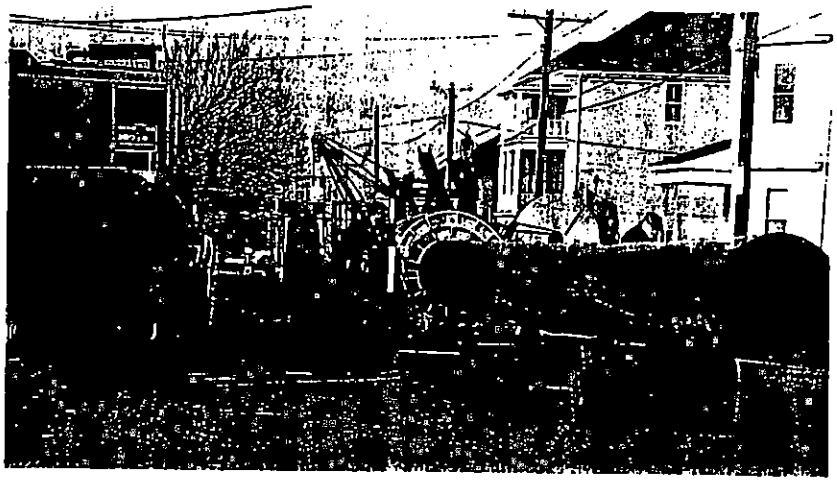
The heat fusion joining system has been so successful that it is the "standard" joining system for polyethylene. There are many reasons ... here are some.

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 melted 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.

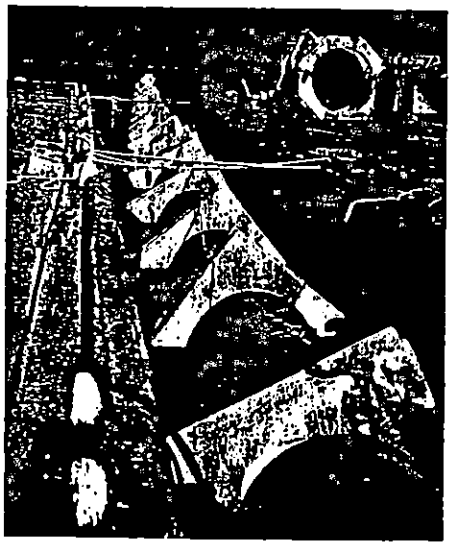


One heat fusion operator, with equipment, typically does the whole operation himself, sometimes using a second person as a helper. Pipe tolerances, ovality and curvature are no problem and "melt" is easily controlled by the visual procedure.

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 de-rating 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!

D-9

15000-
2.1

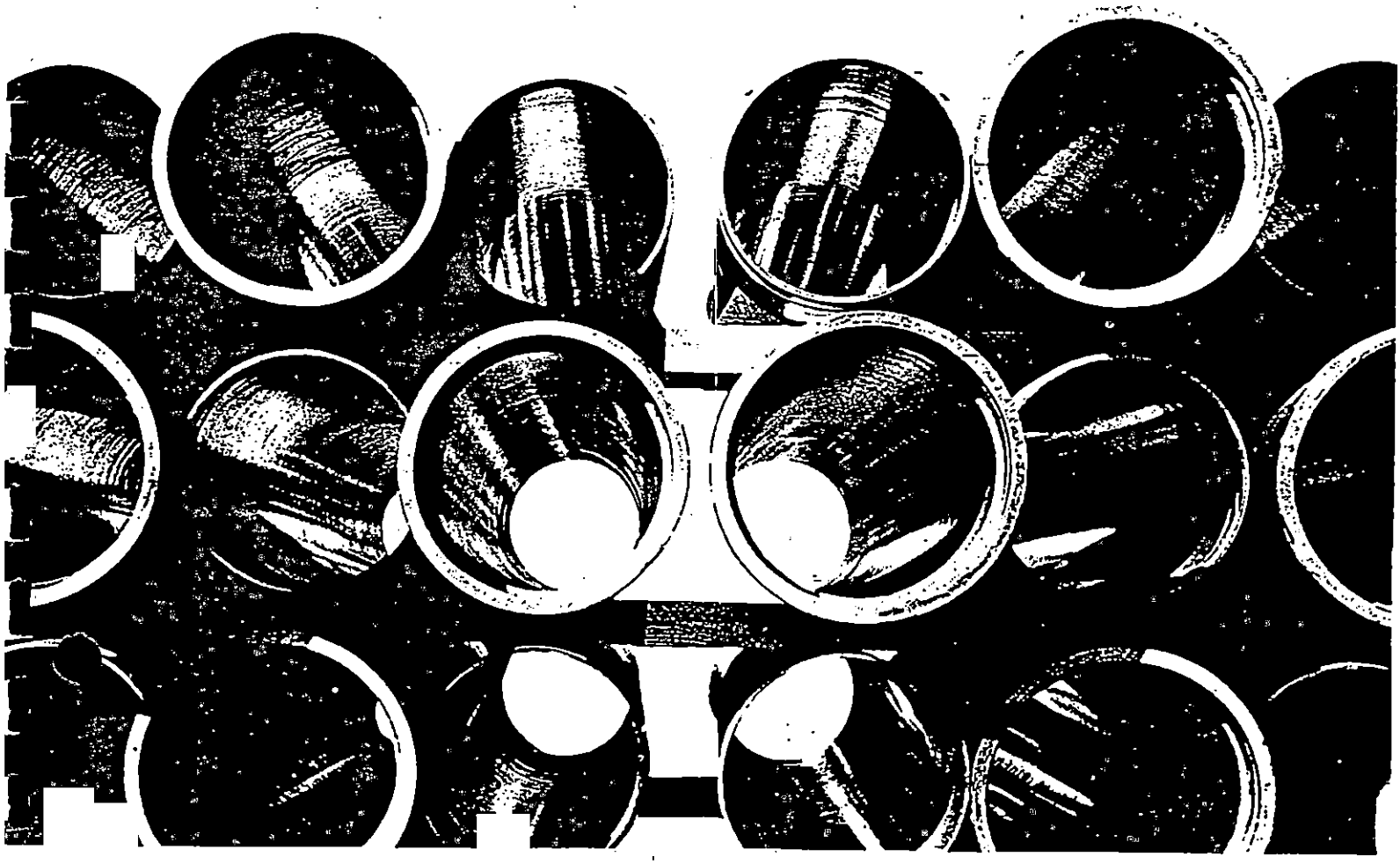
DUCTILE IRON PIPING

ATLANTIC STATES CAST IRON PIPE COMPANY
183 Sitgreaves Street
Phillipsburg, N.J. 08865
Ph. 908-454-1161
FAX 908-454-1026

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

McWANE CAST IRON PIPE COMPANY
P.O. Box 607
Birmingham, AL 35201
Ph. 205-322-3521
FAX 205-324-7250

PACIFIC STATES CAST IRON PIPE COMPANY
P.O. Box 1219
Provo, Utah 84603
Ph. 801-373-6910
FAX 801-377-0338



NOMINAL THICKNESS FOR STANDARD PRESSURE CLASSES OF DUCTILE-IRON PIPE

Size in.	Outside Diameter in.	Pressure Class*				
		150	200	250	300	350
		Nominal Thickness — in.				
[illegible]	3.96	[illegible]	—	[illegible]	—	.025**
[illegible]	4.80	[illegible]	—	[illegible]	—	.025**
[illegible]	6.90	[illegible]	—	[illegible]	—	.025**
[illegible]	9.05	[illegible]	—	[illegible]	—	.025**
10	11.10	[illegible]	—	[illegible]	—	.026
12	13.20	[illegible]	—	[illegible]	—	.028
[illegible]	15.30	[illegible]	—	.028	0.30	.031
[illegible]	17.40	[illegible]	—	.030	0.32	.034
[illegible]	19.50	[illegible]	—	.031	0.34	.036
20	21.60	[illegible]	—	.033	0.36	.038
24	25.80	[illegible]	0.33	.037	0.40	.043
30	32.00	.034	0.38	.042	0.45	.049
[illegible]	38.30	.038	0.42	.047	0.51	.056

* 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:

SIZE (Inches)	CASTING TOLERANCES (Inches)
3 - 8	– 0.05
10 - 12	– 0.06
14 - 36	– 0.07

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

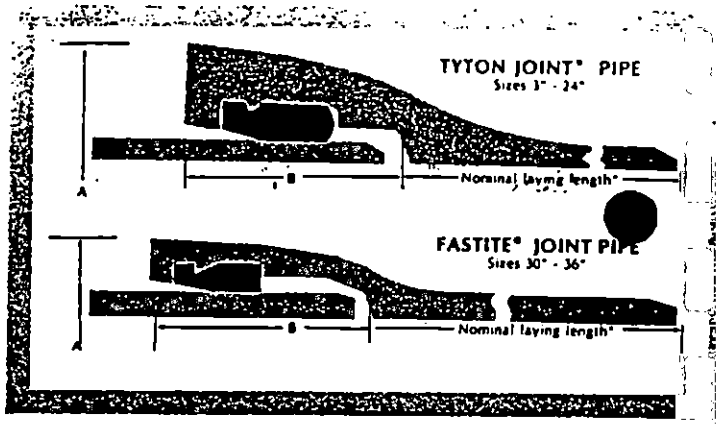
Size Inches	Pressure Class	Thickness	Outside Diameter*	18-Foot Laying Length Weight Per Length†	18-Foot Laying Length Avg. Weight Per Foot††
		Inches		Pounds	
[illegible]	350	.025	3.96	185	9.2
4	350	.025	4.80	225	11.3
6	350	.025	6.90	300	16.6
8	350	.025	9.05	395	22.0
10	350	.026	11.10	510	28.4
12	350	.028	13.20	655	36.4
[illegible]	250	.028	15.30	770	42.9
	300	.030	15.30	825	45.8
	350	.031	15.30	850	47.2
[illegible]	250	.030	17.40	940	52.3
	300	.032	17.40	1000	55.5
	350	.034	17.40	1060	58.8
18	250	.031	19.50	1090	60.5
	300	.034	19.50	1185	65.9
	350	.036	19.50	1250	65.9
20	250	.033	21.60	1290	71.6
	300	.036	21.60	1395	77.6
	350	.038	21.60	1470	81.6
24	200	.033	25.80	1550	86.1
	250	.037	25.80	1725	95.8
	300	.040	25.80	1855	103.0
	350	.043	25.80	1985	110.2
30	150	.034	32.00	2000	111.2
	200	.038	32.00	2220	123.2
	250	.042	32.00	2435	135.2
	300	.045	32.00	2595	144.2
	350	.049	32.00	2810	156.1
36	150	.038	38.30	2675	148.7
	200	.042	38.30	2935	163.1
	250	.047	38.30	3260	181.1
	300	.051	38.30	3520	195.5
	350	.056	38.30	3840	213.4

*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.

**Available in 20' lengths.

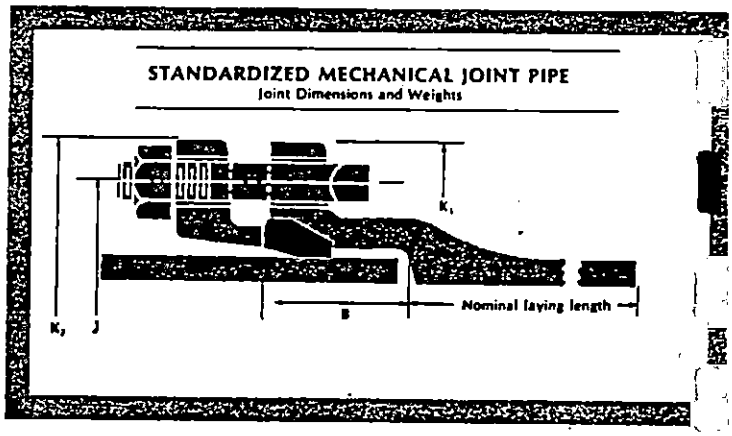
†Including bell; calculated weight of pipe rounded off to nearest 5 lbs.

††Including bell; average weight, per foot, based on calculated weight of pipe before rounding.



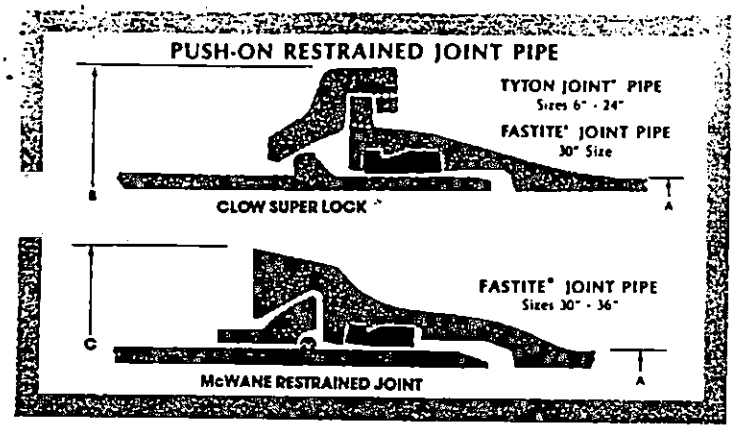
Size Inches	*Pipe Thickness Inches From	*Pipe Thickness Inches To	Outside Diameter Inches	Dimensions in Inches A	Dimensions in Inches B
3	.25	.40	3.96	5.80	3.00
4	.25	.41	4.80	6.86	3.1
6	.25	.43	6.90	8.75	3.3
8	.25	.45	9.05	11.05	3.69
10	.26	.47	11.10	13.15	3.7
12	.28	.49	13.20	15.30	3.7
14	.28	.51	15.30	17.85	5.00
16	.30	.52	17.40	20.00	5.00
18	.31	.53	19.50	22.10	5.0
20	.33	.54	21.60	24.25	5.0
24	.33	.56	25.80	28.50	5.00
30	.34	.63	32.00	34.95	6.5
36	.38	.73	38.30	41.37	6.5

* 3" - 4" Nominal 20' laying length. - 6" Nominal 18' or 20'
8" - 36" Nominal 18' laying length.
Dimensions subject to manufacturing tolerances.



Size Inches	Pipe Thickness Inches From	Pipe Thickness Inches To	Outside Diameter Inches	Dimensions in Inches B	I	K	K'	Bolt No.	Bolt Size Inches	Bolt Length Inches	Bell Weight Pounds	Gland Wt. Pounds
3	.25	.40	3.96	3.50	6.19	6.62	7.69	[illegible]	⅝	[illegible]	11	[illegible]
4	.26	.41	4.80	3.50	7.50	8.06	9.12	[illegible]	¾	[illegible]	16	[illegible]
6	.25	.43	6.90	3.50	9.50	11.06	11.12	[illegible]	¾	[illegible]	18	[illegible]
8	.27	.45	9.05	3.50	11.75	13.31	13.37	[illegible]	¾	[illegible]	24	[illegible]
10	.29	.47	11.10	3.50	14.00	15.62	15.62	[illegible]	¾	[illegible]	31	[illegible]
12	.31	.49	13.20	3.50	16.25	17.88	17.88	[illegible]	¾	[illegible]	37	[illegible]
14	.33	.51	15.30	3.50	18.75	20.25	20.25	[illegible]	¾	[illegible]	61	[illegible]
16	.34	.52	17.40	3.50	21.00	22.50	22.50	[illegible]	¾	[illegible]	[illegible]	[illegible]
18	.35	.53	19.50	3.50	23.25	24.75	24.75	[illegible]	¾	[illegible]	[illegible]	[illegible]
20	.36	.54	21.60	3.50	25.50	27.00	27.00	[illegible]	¾	[illegible]	98	[illegible]
24	.38	.56	25.80	3.50	30.00	31.50	31.50	[illegible]	¾	[illegible]	123	[illegible]

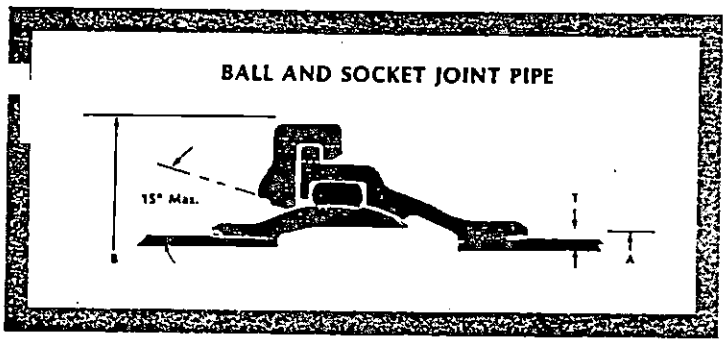
* 3" - 4" Nominal 20' laying length. -6" nominal 18' or 20'
8" - 24" Nominal 18' laying length.
Dimensions subject to manufacturing tolerances.



Nom. Pipe Size Inches	Pressure Rating* psi	Joint Deflection In Degrees	Joint Deflection Inches in 18 feet	A Pipe O.D. Inches	B Retainer O.D. Inches	C Bell O.D. Inches
6	350	4	15	6.90	11.75	[illegible]
8	350	4	15	9.05	14.38	[illegible]
10	350	4	15	11.10	16.75	[illegible]
12	350	4	15	13.20	19.13	[illegible]
14	350	3	11	15.30	21.75	[illegible]
16	350	3	11	17.40	24.00	[illegible]
18	350	3	11	19.50	26.38	[illegible]
20	350	3	11	21.60	28.63	[illegible]
[illegible]	350	3	11	25.80	33.75	[illegible]
[illegible]	250	2	7	32.00	40.13	38.75
[illegible]	250	2	7	38.90	—	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.



Size	Thickness Class (A21.51)	Thickness T	A Pipe O.D.	B Retainer O.D.	Full Length Weight - Lb.** As Shipped	Full Length Weight - Lb.** Under Water Full of Air	Full Length Weight - Lb.** Under Water Full of Water	Safe End Pull (Lb.)
[illegible]	55	.40	6.90	13 1/8	545	240	465	50,000
[illegible]	55	.42	9.05	16 1/8	770	240	655	70,000
[illegible]	55	.44	11.10	19 1/8	1005	220	860	95,000
[illegible]	55	.46	13.20	22 1/8	1270	155	1080	120,000
[illegible]	56	.51	15.30	24 1/8	1655	160	1410	145,000
[illegible]	56	.52	17.40	27 1/8	1990	45	1685	165,000
[illegible]	56	.53	19.50	30	2375	70	2015	195,000
[illegible]	58*	.59			2560	110	2170	
[illegible]	56	.54	21.60	32 1/4	2810	200	2375	210,000
[illegible]	59*	.63			3110	100	2635	
[illegible]	56	.56	25.80	38 1/4	3700	620	3110	260,000
[illegible]	62*	.74			4415	955	3715	
[illegible]	58	.71	32.00	46 1/4	5855	900	4920	335,000
[illegible]	61*	.83			6435	180	5360	
[illegible]	57	.78	38.30	54 1/2	8145	1800	6880	400,000
[illegible]	59*	.88			8725	725	7330	

* [illegible] is 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

Size in.	Pressure† Class psi	Nominal Thickness in.	Laying Condition: Type 1 Trench	Type 2 Trench	Type 3 Trench	Type 4 Trench	Type 5 Trench
			Maximum Depth of Cover‡ — ft				
3	350	0.25	78	88	99	100§	100§
4	350	0.25	53	61	69	85	100§
6	350	0.25	26	31	37	47	65
8	350	0.25	16	20	25	34	50
10	350	0.26	11**	15	19	28	45
12	350	0.28	10**	15	19	28	44
14	250	0.28	††	11**	15	23	36
	300	0.30	††	13	17	26	42
	350	0.31	††	14	19	27	44
16	250	0.30	††	11**	15	24	34
	300	0.32	††	13	17	26	39
	350	0.34	††	15	20	28	44
18	250	0.31	††	10**	14	22	31
	300	0.34	††	13	17	26	36
	350	0.36	††	15	19	28	41
20	250	0.33	††	10	14	22	30
	300	0.36	††	13	17	26	35
	350	0.38	††	15	19	28	38
24	200	0.33	††	8**	12	17	25
	250	0.37	††	11	15	20	29
	300	0.40	††	13	17	24	32
	350	0.43	††	15	19	28	37
30	150	0.34	††	—	9	14	22
	200	0.38	††	8**	12	16	24
	250	0.42	††	11	15	19	27
	300	0.45	††	12	16	21	29
	350	0.49	††	15	19	25	33
36	150	0.38	††	—	9	14	21
	200	0.42	††	8**	12	15	23
	250	0.47	††	10	14	18	25
	300	0.51	††	12	16	20	28
	350	0.56	††	15	19	24	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.

R

Type 5 Trench — ft
100§
100§
65
50
45
44
36 42 44
34 39 44
31 36 41
30 35 38
25 29 32 37
22 24 27 29 33
21 23 25 28 32

ed for each
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ANSI/AWWA
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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.

JOINT 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 ¼-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.

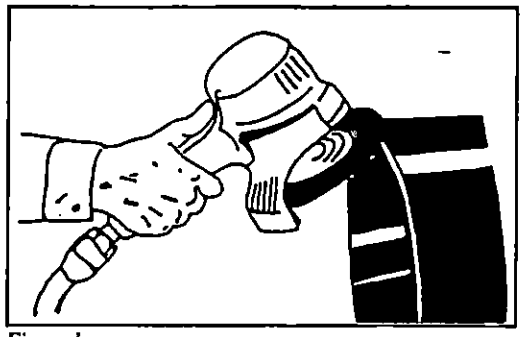


Figure 1

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.	Max Pipe Circumference In.
3	3.90	4.02	12¼	12⅝
4	4.74	4.86	14 29/32	15 9/32
6	6.84	6.96	21½	21⅞
8	8.99	9.11	28¼	28⅝
10	11.04	11.16	34 11/16	35 1/16
12	13.14	13.26	41 9/32	41 21/32
14	15.22	15.35	47 13/16	48 1/32
16	17.32	17.45	54 13/32	54 13/16
18	19.42	19.55	61	61 13/32
20	21.52	21.65	67 19/32	68
24	25.72	25.85	80 13/16	81 7/32
30	31.94	32.08	100 11/32	100 25/32
36	38.24	38.38	120⅛	120 9/16

Above table based on ANSI/AWWA C151/A21.51 guidelines for push-on joints

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 Applicabl

Thickness Design of Ductile Iron
Ductile Iron Pipe for Water and

Ductile Iron Pipe for Gravity Flo
Ductile Iron Fittings for Water a
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 Encase
Joints — Pipe and Fittings
Push-On and Mechanical R
Flanged .....
Grooved and Shouldered .
Pipe Threads .....
Installation .....

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

Notes:

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

* For nominal pipe siz conditions other than T

† Flat bottom is define

** Loose soil or select n foreign materials, and fr

§ American Association o Suite 225, Washington.

Mechanical Joint Pipe

Maximum Allowable Joint Defl

Size of Pipe	Y-Maximum Joint Deflection in Degrees
3	8°-18'
4	8°-18'
6	7°- 7'
8	5°-21'
10	5°-21'
12	5°-21'
14	3°-35'
16	3°-35'
18	3°- 0'
20	3°- 0'
24	2°-23'

*20 - Ft. Length

Push-on Joint Pipe

Maximum Deflection Full Leng

Size of Pipe	Maximum Joint Deflection in Degrees
3	5°
4	5°
6	5°
8	5°
10	5°
12	5°
14	5°
16	5°
18	5°
20	5°
24	5°
30	5°
36	5°

*20 - Ft. Length

Standards Applicable to Ductile Iron Pipe and Fittings

ckness Design of Ductile Iron Pipe	ANSI/AWWA C150/A21.50
ctile Iron Pipe for Water and Other Liquids	ANSI/AWWA C151/A21.51 FEDERAL WWP421D, Grade C
uctile Iron Pipe for Gravity Flow Service	ANSI/ASTM A746
uctile Iron Fittings for Water and Other Liquids	
30" through 36"	ANSI/AWWA C110/A21.10
ctile Iron Compact Fittings	
3" through 24"	ANSI/AWWA C153/A21.53
anged Fittings	ANSI/AWWA C110/A21.10 ANSI B16-1
uctile Iron Pipe with Threaded Flanges	ANSI/AWWA C115/21.15
atings and Linings:	
Asphaltic	ANSI/AWWA C151/A21.51 ANSI/AWWA C110/A21.10 ANSI/AWWA C153/A21.53
Cement Lining	ANSI/AWWA C104/A21.4
Various Epoxy Linings and Coatings	MANUFACTURER'S STANDARD
Exterior Polyethylene Encasement	ANSI/AWWA C105/A21.5
ts — Pipe and Fittings	
Push-On and Mechanical Rubber-Gasket Joints	ANSI/AWWA C111/A21.11 FEDERAL WWP421D
Flanged	ANSI/AWWA C115/A21.15 ANSI B16.1
Grooved and Shouldered	ANSI/AWWA C606
Threads	ANSI B2.1
allation	ANSI/AWWA C600

LAYING CONDITIONS

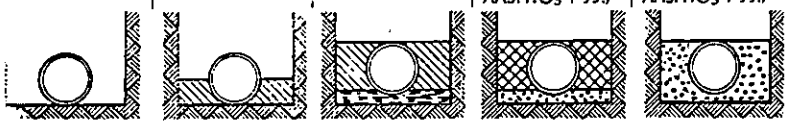
Type 1† — ...l-bottom ...nch.* Loose ...backfill.

Type 2 — Flat-bottom trench.* Backfill lightly consolidated to centerline of pipe.

Type 3 — Pipe bedded in 4-in. minimum loose soil.** Backfill lightly consolidated to top of pipe.

Type 4 — 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.)

Type 5 — Pipe bedded in compacted granular material to centerline of pipe. Compacted granular or select** material to top of pipe. (Approximately 90% Standard Proctor, AASHTO§ 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 ANSI/AWWA C600.

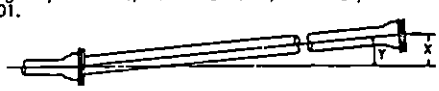
* For nominal pipe sizes 14 in. and larger, consideration should be given to the use of laying conditions other than Type 1.

† Flat bottom is defined as undisturbed 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

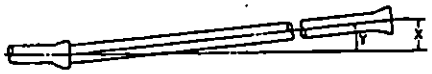


Maximum Allowable Joint Deflection

Size of Pipe	Y-Maximum Joint Deflection in Degrees	X Deflection in Inches 18 ft. Length	Approximate Radius in Feet of Curve Produced by Succession of Joints 18 ft. Length
3	8°-18'	35"	140"
4	8°-18'	35"	140"
6	7°- 7'	30"	160"
8	5°-21'	20"	195
10	5°-21'	20"	195
12	5°-21'	20"	195
14	3°-35'	13.5"	285
16	3°-35'	13.5"	285
18	3°- 0'	11"	340
20	3°- 0'	11"	340
24	2°-23'	9"	450

- Ft. Length

sh-on Joint Pipe



ximum Deflection Full Length Pipe

Size of Pipe	Maximum Joint Deflection in Degrees	Deflection in Inches 18 foot length	Deflection in Inches 20 foot length	Approximate Radius in Feet of Curve Produced by Succession of Joints 3" same as 4" 18 ft. length	Approximate Radius in Feet of Curve Produced by Succession of Joints 3" same as 4" 20 ft. length
3	5°	19"	21	206	230
4	5°	19"	21	206	230
6	5°	19"	21	206	230
8	5°	19"		206	
10	5°	19"		206	
12	5°	19"		206	
14	5°	19"		206	
16	5°	19"		206	
18	5°	19"		206	
20	5°	19"		206	
24	5°	19"		206	
30	5°	19"		206	
36	5°	19"		206	

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 metho design outlined in ANSI/AWWA C150/A21.50

Size In.	Thickness Class	Thickness In.	OD* In.	Wt. of Barrel Per Ft. Lb.	Push-on Joint Wt. of Bell Lb.	Push-on Joint Wt. Per Lgth.† Lb.	Push-on Joint Avg. Wt. Per Ft. ‡ Lb.	Mechan Wt. of Bell† Lb.	Mechan Wt. Lgth.† Lb.	Mechan Wt. Ft. ‡ Lb.
3	51	.25	3.96	8.9	9	185	9.4	11	190	9
3	52	.28	3.96	9.9	9	205	10.4	11	210	10
3	53	.31	3.96	10.9	9	225	11.4	11	230	11.4
3	54	.34	3.96	11.8	9	245	12.2	11	245	12.4
3	55	.37	3.96	12.8	9	265	13.2	11	265	13
3	56	.40	3.96	13.7	9	285	14.2	11	285	14
4	51	.26	4.80	11.3	11	235	11.8	16	240	12
4	52	.29	4.80	12.6	11	265	13.2	16	270	13
4	53	.32	4.80	13.8	11	285	14.4	16	290	14.6
4	54	.35	4.80	15.0	11	310	15.6	16	315	15.8
4	55	.38	4.80	16.1	11	335	16.6	16	340	16
4	56	.41	4.80	17.3	11	355	17.8	16	360	18
6	50	.25	6.90	16.0	15	305	16.8	18	305	17
6	51	.28	6.90	17.8	15	335	18.6	18	340	18
6	52	.31	6.90	19.6	15	370	20.4	18	370	20.6
6	53	.34	6.90	21.4	15	400	22.2	18	405	22.4
6	54	.37	6.90	23.2	15	435	24.0	18	435	24
6	55	.40	6.90	25.0	15	465	25.8	18	470	26
6	56	.43	6.90	26.7	15	495	27.5	18	500	27
8	50	.27	9.05	22.8	22	430	24.0	24	435	24
8	51	.30	9.05	25.2	22	475	26.4	24	480	26.5
8	52	.33	9.05	27.7	22	520	28.9	24	525	29.0
8	53	.36	9.05	30.1	22	565	31.3	24	565	31.4
8	54	.39	9.05	32.5	22	605	33.7	24	610	33
8	55	.42	9.05	34.8	22	650	36.0	24	650	36
8	56	.45	9.05	37.2	22	690	38.4	24	695	38
10	50	.29	11.10	30.1	29	570	31.7	31	575	31.6
10	51	.32	11.10	33.2	29	625	34.8	31	630	34.9
10	52	.35	11.10	36.2	29	680	37.8	31	685	37.9
10	53	.38	11.10	39.2	29	735	40.8	31	735	40.9
10	54	.41	11.10	42.3	29	785	43.7	31	790	43
10	55	.44	11.10	45.1	29	840	46.7	31	845	46
10	56	.47	11.10	48.0	29	895	49.6	31	895	49
12	50	.31	13.20	38.4	35	725	40.3	37	730	40.5
12	51	.34	13.20	42.0	35	790	43.9	37	795	44.1
12	52	.37	13.20	45.6	35	855	47.5	37	860	47.7
12	53	.40	13.20	49.2	35	920	51.1	37	925	51
12	54	.43	13.20	52.8	35	985	54.7	37	985	54
12	55	.46	13.20	56.3	35	1050	58.2	37	1050	58
12	56	.49	13.20	59.9	35	1115	61.8	37	1115	62.0
14	50	.33	15.30	47.5	60	915	50.8	61	915	50.9
14	51	.36	15.30	51.7	60	990	55.0	61	990	55.1
14	52	.39	15.30	55.9	60	1065	59.2	61	106	9
14	53	.42	15.30	60.1	60	1140	63.4	61	114	3.5
14	54	.45	15.30	64.2	60	1215	67.5	61	121	7.5
14	55	.48	15.30	68.4	60	1290	71.7	61	129	1
14	56	.51	15.30	72.5	60	1365	75.8	61	1365	75.9
16	50	.34	17.40	55.8	68	1070	59.6	74	1080	59.9
16	51	.37	17.40	60.6	68	1160	64.4	74	1165	64.7
16	52	.40	17.40	65.4	68	1245	69.2	74	1250	69.5
16	53	.43	17.40	70.1	68	1330	73.9	74	1335	74.2
16	54	.46	17.40	74.9	68	1415	78.7	74	1420	79.0
16	55	.49	17.40	79.7	68	1505	83.5	74	1510	83.8
16	56	.52	17.40	84.4	68	1585	88.2	74	1595	88.5
18	50	.35	19.50	64.4	78	1235	68.7	85	1245	69
18	51	.35	19.50	69.3	78	1335	74.1	85	1340	74
18	52	.41	19.50	75.2	78	1430	79.5	85	1440	79.9
18	53	.44	19.50	80.6	78	1530	84.9	85	1535	85
18	54	.47	19.50	86.0	78	1625	90.3	85	1635	90.7
18	55	.50	19.50	91.3	78	1720	95.6	85	1730	96.0
18	56	.53	19.50	96.7	78	1820	101.0	85	1825	101
20	50	.36	21.60	73.5	87	1410	78.3	98	1420	78.9
20	51	.39	21.60	79.5	87	1520	84.3	98	1530	84.9
20	52	.42	21.60	85.5	87	1625	90.3	98	1635	90.9
20	53	.45	21.60	91.5	87	1735	96.3	98	1745	96.9
20	54	.48	21.60	97.5	87	1840	102.3	98	1855	102.9
20	55	.51	21.60	103.4	87	1950	108.2	98	1960	108.8
20	56	.54	21.60	109.3	87	2055	114.1	98	2065	114.7
24	50	.38	25.80	92.9	105	1775	98.7	123	1795	99.7
24	51	.41	25.80	100.1	105	1905	105.9	123	1925	106.9
24	52	.44	25.80	107.3	105	2035	113.1	123	2055	114.1
24	53	.47	25.80	114.4	105	2165	120.2	123	2180	121.2
24	54	.50	25.80	121.6	105	2295	127.4	123	2310	128.4
24	55	.53	25.80	128.8	105	2425	134.6	123	2440	135.6
24	56	.56	25.80	135.9	105	2550	141.7	123	2570	142.7
30	50	.39	32.00	118.5	170	2305	127.9		...	
30	51	.43	32.00	130.5	170	2520	139.9		...	
30	52	.47	32.00	142.5	170	2735	151.9		...	
30	53	.51	32.00	154.4	170	2950	163.8		...	
30	54	.55	32.00	166.3	170	3165	175.7		...	
30	55	.59	32.00	178.2	170	3180	187.6		...	
30	56	.63	32.00	190.0	170	3590	199.4		...	
36	50	.43	38.30	156.5	239	3055	169.8		...	
36	51	.48	38.30	174.5	239	3380	187.8		...	
36	52	.53	38.30	192.4	239	3700	205.7		...	
36	53	.58	38.30	210.3	239	4025	223.6		...	
36	54	.63	38.30	228.1	239	4345	241.4		...	
36	55	.68	38.30	245.9	239	4665	259.2		...	
36	56	.73	38.30	263.7	239	4985	277.0		...	

† Including Bell; calculated weight of pipe rounded off to nearest 5 lbs.

‡ Including Bell; average weight per foot, based on calculated weight of p... ...orm rounding.

Weights and dimensions are nominal per above standards.

* Tolerances of OD 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.

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

8" - 36" Nominal 18' laying length.

Ed. 6-

Atlantic States
A DIVISION OF McWANE INC.

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

GENERAL CERTIFICATION

SOLD TO:
Barbella Environmental Technology, Inc.
P.O. Box 273
Salem Industrial Park - Bldg. #8
Whitehouse, N.J. 08888

SHIP TO:
Pelham Bay Landfill
Bronx, N.Y.

DATE: May 3, 1994
S.O.:
CUSTOMER'S P.O.#
DATE OF SHIPMENT:
B/L #
CARRIER:

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:

MATERIAL	NOM.L/L	CLASS
1,070' - 6" Tyton Joint Pipe	18'	56
415' - 4" Ditto	20'	54
Plus Various MJ Fittings		DI

STANDARDS:

DUCTILE IRON PIPE
X ANSI/AWWA C151/A21.51
___ Fed. WW-P-421D, Grade C

FITTINGS
X ANSI/AWWA C110/A21.10
___ ANSI/AWWA C153 (DI CL. 350 Compact)

JOINTS
X Push-On: ANSI/AWWA C111/A21.11
X MJ: ANSI/AWWA C111/A21.11
___ Flange: ANSI/AWWA C115/A21.15 (NO ACCESSORIES)

LINING (Per ANSI/AWWA C104 A21.4)
X Asphaltic coated inside & outside
___ Standard Cement Lining
X Double Cement Lining
___ Other

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

Notary Public of New Jersey

ATLANTIC STATES
CAST IRON PIPE COMPANY

By: Wilma Mains
Wilma Mains
Title: Sales Assistant

Form #115 (4/88)

EWELL W. FINLEY & PARTNERS, INC.	JOB NUMBER 1655
	SUBMITTAL NO. 15000-1.5

- [x] A. APPROVED
- [ ] B. APPROVED AS CORRECTED
- [ ] C. REVISE AND RESUBMIT
- [ ] D. NOT APPROVED
- [ ] E. NO ACTION REQUIRED
- [ ] OTHER: _____

DATE RECEIVED:	REVIEWED BY:	DATE RETURNED:
5.10.94	CJP	5.25.94

CORRECTIONS OR COMMENTS MADE ON THE SUBMITTALS DURING THIS REVIEW DO NOT RELIEVE CONTRACTOR FROM COMPLIANCE WITH REQUIREMENTS OF THE DRAWINGS AND SPECIFICATIONS. THIS SUBMITTAL REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT OF THE PROJECT AND GENERAL COMPLIANCE WITH THE INFORMATION GIVEN IN THE CONTRACT DOCUMENTS. THE CONTRACTOR IS RESPONSIBLE FOR CONFIRMING AND CORRELATING ALL QUANATITIES AND DIMENSIONS, SELECTING FABRICATION PROCESSES AND TECHNIQUES OF CONSTRUCTION, COORDINATING HIS WORK WITH THAT OF ALL OTHER TRADES, AND PERFORMING HIS WORK IN A SAFE AND SATISFACTORY MANNER.

(609) 461-3000

FAX (609) 461-3955

RHAWN
FLANGE & MACHINE CO., INC.

PENNSYLVANIA AVENUE AND RANCOCAS LANE
P.O. BOX 127
DELANCO, NEW JERSEY 08075-0127

15000 - 2.1

Barbella Enviromental Technology, Inc.
24 Tannery Road
Somerville, NJ 08876

July 8,1994

Re: Pelham 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* W/RETAINER 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.Krout

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

JAY D. RHAWN
NOTARY PUBLIC OF NEW JERSEY
Commission Expires April 1, 1996

D-20

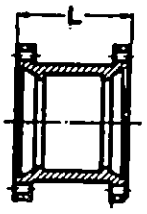
RHAWN FLG. & MACH. INC.

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

SLEEVES

15000-2.2



MJ Sleeve.
→ Fig. 344. Short.
~~Fig. 345. Long.~~

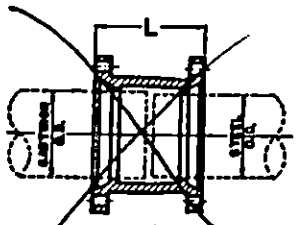
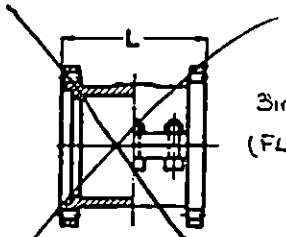


Fig. 346.
MJ Transition Sleeve.



MJ Split Sleeve
Fig. 347. Short.
Fig. 348. Long.

3in MJ PIPE SLEEVE #344
(FLEX PIPE CONN).

Table No. 234

Size	Pressure Rating psi	MJ Sleeve 344 Short L	MJ Sleeve 344 Short Wt.	MJ Sleeve 345 Long L	MJ Sleeve 345 Long Wt.	MJ Transition Sleeve 346 L	MJ Transition Sleeve 346 Wt.	MJ Split Sleeve 347 Short L	MJ Split Sleeve 347 Short Wt.	MJ Split Sleeve 348 Long L	MJ Split Sleeve 348 Long 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	11	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	11	655	18	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, gaskets 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".

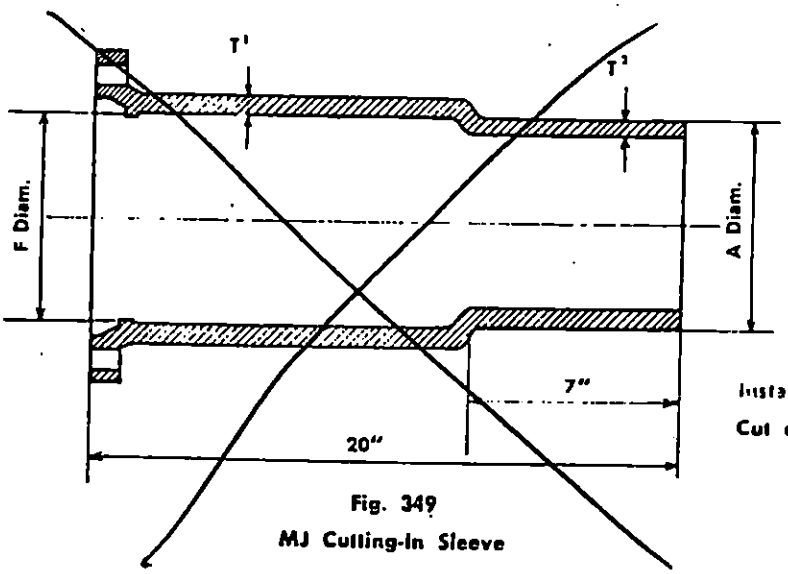


Fig. 349
MJ Cutting-In Sleeve

Size	A	F	T¹	T²	Weight
3"	3.96	4.06	.47	.48	40
4"	4.80	4.90	.55	.45	60
6"	6.90	7.00	.60	.48	75
8"	9.05	9.15	.66	.51	105
10"	11.10	11.20	.72	.57	125
12"	13.20	13.30	.79	.62	155

Installation Note.
Cut out—4" Plus Overall Length of Fitting Used with the Sleeve.

ANSI SPECIFICATION A 21.11 (AWWA C. 111)

NOTE: Weight does not include accessories weight.

D-21

(609) 461-3000

FAX (609) 461-3955

RHAWN
FLANGE & MACHINE CO., INC.

PENNSYLVANIA AVENUE AND RANCOCAS LANE
P.O. BOX 127
DELANCO, NEW JERSEY 08075-0127

15000-
2.3

FLANGE BOLTS AND GASKETS

Barbella Enviromental Technology, Inc.
24 Tannery Road
Somerville, NJ 08876

July 13,1994

Re: Pelham 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 hex head bolt with heavy hex head 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.Krout

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

JAY D. RHAWN
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires April 1, 1998

D-19

NEWBURGH INDUSTRIAL CO

WHOLESALE DISTRIBUTOR OF PIPE • VALVES • FITTINGS AND PIPING SPECIALTIES

STAINLESS STEEL PIPE

Ham

THE FAX AND ONLY THE FAX!!!!!!!!!

TO Mark San Angelo

LOCATION Bresco Mech

FROM Dean A. Cuccos

DATE 9/11/95

OF PAGES INCLUDING COVER SHEET 4

MESSAGE: S.S. Pipe Submittals

Spec 15065
Para 2.1
pg 15065-2
Dwg GS.2

QUALITY PRODUCTS • DEPENDABLE SERVICE • COMPETITIVE PRICES

555 RTE. 52 EAST • WALDEN, NEW YORK 12586
TEL: 914-778-8187 • FAX 914-778-5881

STANDARD STAINLESS STEEL TUBING

GENERAL CHARACTERISTICS

STAINLESS STEEL TYPES	CHEMICAL COMPOSITION PRINCIPAL ELEMENTS %				MECHANICAL PROPERTIES ANNEALED CONDITION - NOMINAL				TYPICAL CHARACTERISTICS
	CR	NI	C	OTHER ELEMENTS	TENSILE PSI	YIELD PSI	ELONG. % IN 2"	HARDNESS ROCKWELL	
304	18.00-20.00	8.00-11.00	0.08 max	—	85,000 105,000	35,000 75,000	55 20	B80 Ann B85 ½Hd	General purpose "300" series grade for tubing applications.
304L	18.00-20.00	8.00-13.00	0.035 max	—	80,000	30,000	55	B75	Low carbon type 304 where greater resistance to carbide percipitation is desired.
304H	18.00-20.00	8.00-11.00	0.04-0.10	—	85,000	35,000	55	B80	Carbon modified for improved high temperature strength.
310	24.00-26.00	19.00-22.00	0.15 max	—	95,000	45,000	45	B85	High resistance to scaling and oxidation up to 2000°F.
316	16.00-18.00	11.00-14.00	0.08 max	Mo 2.00-3.00	85,000	35,000	50	B80	Better corrosion resistance than type 304 in reducing media. Good hi-temp strength.
316L	16.00-18.00	10.00-15.00	0.035 max	Mo 2.00-3.00	75,000	30,000	50	B75	Low carbon type 316 where greater resistance to carbide percipitation is desired.
316H	16.00-18.00	11.00-14.00	0.04-0.10	Mo 2.00-3.00	85,000	35,000	50	B80	Carbon modified for improved temperature strength.
317	18.00-20.00	11.00-14.00	0.08 max	Mo 3.00-4.00	90,000	40,000	45	B85	Similar to type 316 but with better corrosion resistance and creep strength.
321	17.00-20.00	9.00-13.00	0.08 max	Ti 5XC-0.60	90,000	35,000	55	B80	Titanium stabilized against carbide precipitation. Similar properties to type 304.
347	17.00-20.00	9.00-13.00	0.08 max	Cb + Ta 10XC-1.00	95,000	40,000	50	B85	Columbian and tantalum stabilized against carbide precipitation.

PHYSICAL PROPERTIES (Annealed)

TYPE	DENSITY LBS/CU. IN.	SPECIFIC ELECT. RESIST OHMS CM/CM³	SPECIFIC HEAT BTU/LB. DEG. F	THERMAL CONDUCT BTU/HR.SQ.FT./DEG. F (212°)	MEAN COEFFICIENT OF EXPANSION °F		TENSION PSI MODULUS OF ELASTICITY	MAGNETIC PREMEABILITY
					32-212	32-1200		
304 304L	0.29	72	0.12	9.4	8.6×10^{-6}	10.4×10^{-6}	28.0×10^{6}	1.003
310	0.29	78	0.12	9.2	8.8×10^{-6}	9.7×10^{-6}	29.0×10^{6}	1.003
316 316L	0.29	74	0.12	9.4	8.9×10^{-6}	10.3×10^{-6}	28.0×10^{6}	1.003
317	0.29	74	0.12	9.4	8.9×10^{-6}	10.3×10^{-6}	28.0×10^{6}	1.003
321	0.29	72	0.12	9.3	9.3×10^{-6}	10.7×10^{-6}	28.0×10^{6}	1.003
347	0.29	73	0.12	9.3	9.3×10^{-6}	10.6×10^{-6}	28.0×10^{6}	1.003
21-6-9	0.29	—	0.12	8.6	9.3×10^{-6}	—	28.5×10^{6}	1.002

PIPE SCHEDULES

Pipe Size	O.D. In Inch.	5s	5	10s	10	20	30	40s STD.	40	60	80s & E.H.	80	100	120	140	160
⅛	.405		.035 .1383	.049 .1863	.049 .1863			.068 .2447	.068 .2447		.095 .3145	.095 .3145				
¼	.540		.049 .2570	.065 .3297	.065 .3297			.088 .4248	.088 .4248		.119 .5351	.119 .5351				
⅜	.675		.049 .3276	.065 .4235	.065 .4235			.091 .5676	.091 .5676		.126 .7388	.126 .7388				
½	.840	.065 .5383	.065 .6383	.083 .6710	.083 .6710			.109 .8510	.109 .8510		.147 1.088	.147 1.088				.188 1.304
¾	1.050	.065 .6836	.065 .6836	.083 .8572	.083 .8572			.113 1.131	.113 1.131		.154 1.474	.154 1.474				.219 1.937
1	1.315	.065 .8678	.065 .8678	.109 1.404	.109 1.404			.133 1.679	.133 1.679		.179 2.172	.179 2.172				.250 2.844
1¼	1.660	.065 1.107	.065 1.107	.109 1.806	.109 1.806			.140 2.273	.140 2.273		.191 2.997	.191 2.997				.250 3.765
1½	1.900	.065 1.274	.065 1.274	.109 2.085	.109 2.085			.145 2.718	.145 2.718		.200 3.631	.200 3.631				.281 4.859
2	2.375	.065 1.604	.065 1.604	.109 2.638	.109 2.638			.154 3.653	.154 3.653		.218 5.022	.218 5.022				.344 7.444
2½	2.875	.083 2.475	.083 2.475	.120 3.531	.120 3.531			.203 5.793	.203 5.793		.276 7.661	.276 7.661				.375 10.01
3	3.500	.083 3.029	.083 3.029	.120 4.332	.120 4.332			.216 7.576	.216 7.576		.300 10.25	.300 10.25				
3½	4.000	.083 3.472	.083 3.472	.120 4.973	.120 4.973			.226 9.109	.226 9.109		.318 12.51	.318 12.51				
4	4.500	.083 3.915	.083 3.915	.120 5.613	.120 5.613			.237 10.79	.237 10.79	.281 12.66	.337 14.98	.337 14.98		.438 19.01		.531 22.51
4½	5.000							.247 12.53			.355 17.61					
5	5.563	.109 6.349	.109 6.349	.134 7.770	.134 7.770			.258 14.62	.258 14.62		.375 20.78	.375 20.78		.500 27.04		.625 32.96
6	6.625	.109 7.585	.109 7.585	.134 9.290	.134 9.289			.280 18.97	.280 18.97		.432 28.57	.432 28.57		.562 36.39		.719 45.30
7	7.625							.301 23.57			.500 38.05					
8	8.625	.109 9.914	.109 9.914	.148 13.40	.148 13.40	.250 22.36	.277 24.70	.322 28.55	.322 28.55	.406 35.64	.500 43.39	.500 43.39	.594 50.87	.719 60.93	.812 67.76	.906 74.69
9	9.625							.342 33.90			.500 48.72					
10	10.750	.134 15.19	.134 15.19	.165 18.65	.165 18.70	.250 28.04	.307 34.24	.365 40.48	.365 40.48	.500 54.74	.500 54.74	.594 64.33	.719 76.93	.844 89.20	1.000 104.1	1.125 115.7
11	11.750							.375 45.55			.500 60.07					
12	12.750	.156 21.07	.165 22.18	.180 24.18	.180 24.20	.250 33.38	.330 43.77	.375 49.56	.406 53.53	.562 73.16	.500 65.42	.688 88.51	.844 107.2	1.000 125.5	1.125 139.7	1.312 160.3
14	14.000	.156 23.07		.188 27.73	.250 36.71	.312 45.68	.375 54.57	.375 54.57	.438 63.37	.594 84.91	.500 72.09	.750 106.1	.938 130.7	1.094 150.7	1.250 170.2	1.406 189.1
16	16.000	.165 27.90		.188 31.76	.250 42.05	.312 52.36	.375 62.58	.375 62.58	.500 82.77	.656 107.6	.500 82.77	.844 136.6	1.031 164.8	1.219 192.9	1.438 223.5	1.594 245.1
18	18.000	.165 31.43		.188 35.76	.250 47.39	.312 59.03	.438 82.06	.375 70.59	.562 104.8	.750 138.2	.500 93.45	.938 170.8	1.156 208.0	1.375 244.1	1.562 274.2	1.781 308.6
20	20.000	.188 39.78		.218 46.05	.250 52.73	.375 78.60	.500 104.1	.375 78.60	.594 122.9	.812 166.4	.500 104.1	1.031 208.9	1.281 258.1	1.500 295.4	1.750 341.1	1.[illegible] 3[illegible]
24	24.000	.218 55.37		.250 63.41	.250 63.41	.375 94.62	.562 140.8	.375 94.62	.688 171.2	.969 238.1	.500 125.5	1.219 296.4	1.531 367.4	1.812 429.4	2.062 483.1	2.[illegible] 541.9

UPPER FIGURES
Wall Thickness
in Inches

DIMENSIONS AND WEIGHTS OF SEAMLESS AND WELDED STEEL PIPE

LOWER FIGURE
Weight Per Fo
in Pounds

ALLOWABLE WORKING PRESSURES FOR A-312 WELDED PIPE

TYPE 316L
Schedules 10S

TEMPERATURE °F.			-328 TO 300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500
MAX. STRESS			14200	13200	12250	11450	11100	10950	10700	10300	10300	10000	9800	9500	9250	8700	7450	5450	4000	2850	2100	1600	1150	850
NOM. PIPE SIZE	SCH. NO.	NOM. WALL	ALLOWABLE WORKING PRESSURES PSIG																					
½	5S	.065	2023	1889	1753	1639	1603	1567	1531	1503	1474	1431	1403	1360	1324	1263	1114	816	598	441	314	239	172	127
	10S	.083	2637	2452	2276	2127	2080	2034	1987	1950	1913	1857	1820	1769	1718	1646	1465	1072	786	580	413	314	226	167
¾	5S	.065	1608	1494	1387	1296	1268	1239	1211	1189	1166	1132	1109	1075	1047	996	873	638	468	345	246	187	134	99
	10S	.083	2079	1932	1793	1676	1640	1603	1566	1537	1508	1464	1435	1391	1354	1292	1141	824	612	451	321	245	176	130
1	5S	.065	1272	1182	1097	1025	1003	981	958	940	922	896	878	851	828	788	685	501	368	271	193	147	105	78
	10S	.109	2185	2032	1886	1763	1724	1686	1647	1615	1586	1539	1509	1462	1424	1360	1202	879	645	476	339	258	185	137
1¼	5S	.065	1000	930	863	806	789	771	753	739	725	704	690	669	651	617	536	392	287	212	151	115	82	61
	10S	.109	1710	1589	1475	1379	1348	1318	1288	1264	1240	1204	1180	1144	1114	1060	930	681	499	368	262	199	143	106
1½	5S	.065	870	809	751	702	686	671	656	644	631	613	601	582	567	536	465	340	249	184	131	99	71	53
	10S	.109	1485	1380	1281	1197	1171	1145	1119	1098	1077	1045	1026	993	967	919	804	588	431	318	226	172	124	91
2	5S	.065	693	644	598	559	546	534	522	512	502	488	478	463	451	426	369	270	198	146	104	79	56	42
	10S	.109	1178	1095	1016	950	929	908	887	871	854	829	813	788	767	727	633	463	340	251	178	136	97	72
2½	5S	.083	732	680	631	590	577	564	551	541	531	515	505	489	476	450	390	285	209	154	109	83	60	44
	10S	.120	1068	993	921	861	842	823	805	790	774	752	737	714	695	659	573	419	307	227	161	123	88	65
3	5S	.083	599	557	516	483	472	462	451	443	434	422	413	400	390	368	318	232	170	126	89	68	49	36
	10S	.120	872	811	753	703	688	673	657	645	633	614	602	584	568	538	466	341	250	184	131	100	72	53
3½	5S	.083	523	486	451	421	412	403	394	386	379	368	361	350	340	321	277	203	149	109	78	59	42	31
	10S	.120	761	707	656	614	600	587	573	563	552	536	525	509	496	469	406	297	218	160	114	87	62	46
4	5S	.083	464	431	400	374	366	358	349	343	336	326	320	310	302	285	246	179	132	97	69	52	37	26
	10S	.120	675	627	582	544	532	520	508	499	489	475	466	451	439	415	359	262	192	142	101	77	55	41
5	5S	.109	493	458	425	398	389	380	371	365	358	347	340	330	321	303	261	191	140	103	73	56	40	29
	10S	.134	608	565	525	490	480	469	458	450	441	428	420	407	395	374	323	236	173	128	91	69	49	36
6	5S	.109	413	384	356	333	326	318	311	305	300	291	285	276	269	254	218	160	117	86	61	47	33	24
	10S	.134	509	473	439	411	402	393	384	376	369	359	351	341	332	313	270	197	145	107	76	58	41	30
8	5S	.109	316	294	273	255	249	244	238	234	229	223	218	211	206	194	167	122	89	66	47	35	25	19
	10S	.148	431	401	372	348	340	332	325	319	313	303	297	288	281	265	228	167	122	90	64	49	35	26
10	5S	.134	312	290	269	251	246	240	235	231	226	220	215	209	203	191	165	120	88	65	46	35	25	18
	10S	.165	385	358	332	310	304	297	290	285	279	271	266	257	251	236	203	149	109	80	57	43	31	23
12	5S	.156	306	285	264	247	241	236	231	226	222	215	211	205	199	188	161	118	86	64	45	34	24	18
	10S	.180	354	329	305	285	279	273	266	262	257	249	244	237	230	217	187	137	100	74	52	40	28	21
14	5S	.156	270	253	240	225	220	215	210	206	202	196	192	186	181	171	147	107	79	58	41	31	22	16
	10S	.188	336	313	290	271	266	259	253	249	244	237	232	225	219	206	178	130	95	70	50	38	27	20
16	5S	.165	258	239	222	208	203	199	194	190	187	181	178	172	168	158	136	99	73	53	38	29	21	15
	10S	.188	294	273	253	237	232	227	221	217	213	207	203	196	191	180	155	113	83	61	43	33	23	17
18	5S	.165	229	213	197	184	180	176	172	169	166	161	158	153	149	140	120	88	64	47	34	25	18	13
	10S	.188	261	243	225	210	206	201	197	193	189	184	180	174	170	160	137	100	74	54	38	29	21	15
20	5S	.188	235	218	202	189	185	181	177	173	170	165	162	157	153	144	123	90	66	49	34	26	19	14
	10S	.218	272	253	236	220	215	210	205	201	197	192	188	182	177	167	144	105	77	57	40	30	22	16
24	5S	.218	227	211	195	183	179	175	171	167	164	159	156	151	147	139	119	87	64	47	33	25	18	13
	10S	.250	260	242	224	210	205	201	196	192	189	183	179	174	169	160	137	100	73	54	38	29	21	15

The Allowable Stress Values used are as shown in Appendix "A" of ANSI B31.3—1979 for welded pipe in ASTM A-312 having a weld joint factor of .85.

Allowable Working Pressures shown for each size reflect the minus 12½% manufacturer's wall tolerance.

See Page 88 for calculation details.
All dimensions are in inches.

(continued on next page

Gaskets for Stainless Steel Pipe

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 sealability 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 asbestos gasketing ■ Offers virtually the lowest amount of leakage over any competitive non-metallic gasketing
Creep 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 fibrous type of nonmetallic, asbestos-free gasketing

Typical Physical Properties

ASTM Test Method	Physical Properties	BLUE-GARD STYLES 3000	3200/3400	3300	3700	CP-9900	CP-3920
F37	**Sealability** 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	0.1	0.3	0.3
	Nitrogen: Gasket load, 3000 psi (20.7 N/mm²) Internal pressure, 30 psi (2 bar)	0.6	0.4	1.0	0.7	0.1	0.1
F38	**Creep Relaxation** Percent:	20.3	18.4	18.2	24.5	30.0	30.0
F36	**Recovery** Percent:	60	50	50	40	40	40
F36	**Compressibility** Percent:	7-17	7-17	7-17	7-17	15-30	15-30
F146	**Fluid Resistance after Five Hour Immersions** **ASTM #1 Oil @ +300°F (+150°C),** Thickness Increase Range, %:	0-5	0-10	0-5	20 min.	0-5	0-15
	Weight Increase, Maximum:	8	20	15	—	25	45
	ASTM IRM #903 @ +300°F (+150°C), Thickness Increase Range, %:	0-15	15-30	15-30	60 min.	0-15	0-40
	Tensile Loss, Maximum:	35	70	50	—	40	65
	ASTM Fuel A @ +70-85°F (+21-29°C), Thickness Increase Range, %:	0-5	0-15	0-10	10 min.	0-10	0-15
	Weight Increase, Maximum:	8	25	20	—	20	30
	ASTM Fuel B @ +70-85°F (+21-29°C), Thickness Increase Range, %:	0-10	5-20	5-20	20 min.	0-15	0-25
	Weight Increase, Maximum:	16	30	20	—	30	45
F152	**Tensile Strength** Across Grain psi (N/mm²):	2500 (17)	2800 (18)	2800 (19)	2500 (17)	2000 (14)	1500 (10)
	Density (1/16" thk. 1.5mm) lbs./ft.³: (grams/cm³):	100 (1.60)	100 (1.60)	100 (1.60)	100 (1.60)	65 (1.04)	65 (1.04)
DIN 3535 Part 4	**Gas Permeability** cc/min. **Nitrogen:** Internal pressure: 580 psi (40 bar) Gasket load: 4640 psi (32 N/mm²)	.05	.03	.08	.04	.001	.001

This is a general guide and should not be the sole means of selecting or rejecting this material. ASTM test results in accordance with ASTM F-104; properties based on 0.8mm (1/32") sheet thickness (except as noted).

BLUE-GARD gasketing in command

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

Style 3000

Color:	Blue
Binder:	Nitrile (NBR)
Service:	Water, aliphatic hydrocarbons, oils, gasoline, mild acids and alkalies*
Temperature:	max. +700°F (+370°C)†; min. -40°F (-40°C) Continuous oper. temp. +400°F (+205°C)
Pressure, max.:	1000 psi (70 bar)
P x T, max.:	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:	SBR
Service:	Water, saturated steam, mild acids and alkalies, inert gases*
Temperature:	max. +700°F (+370°C)†; 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)†; 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 use against oils, fuels and refrigerants.

Style 3700

Color:	Light Grey
Binder:	EPDM
Service:	Water, saturated steam, acids and caustics of moderate concentrations*
Temperature:	max. +700°F (+370°C)†; 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)

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

WARNING:

[illegible]

CP-3900/CP-3920

highly compressible gasketing

Styles CP-3900/CP-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 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 torque retention in a large number of mediums.

Specifications

Style CP-3900

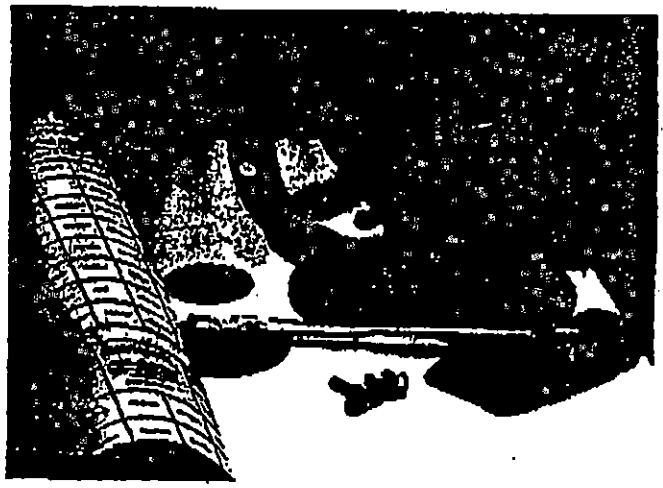
Color:	Black
Binder:	Nitrile (NBR)
Service:	Water, aliphatic hydrocarbons, oils, gasoline, mild acids and alkalies*
Temperature:	max. +700°F (+370°C)†; min. -40°F (-40°C) Continuous oper. temp. +400°F (+205°C)
Pressure, max.:	1000 psi (70 bar)
P x T, max.:	350,000 (12,000)** (1/32" and 1/16" thick) 250,000 (7,290)** (1/8" thick)

Style CP-3920

Color:	Off White
Binder:	SBR
Service:	Water, saturated steam, mild acids and alkalies, inert gases*
Temperature:	max. +700°F (+370°C)†; min. -40°F (-40°C) Continuous oper. temp. +400°F (+205°C)
Pressure, max.:	1000 psi (70 bar)
P x T, max.:	350,000 (12,000)** (1/32" and 1/16" thick) 250,000 (7,290)** (1/8" thick)

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

†When approaching maximum temperature consult the Garlock Engineering Department
*Consult General Chemical Resistance of Compressed Gasketing Products catalog
**P x T max. = psi x °F (bar x °C)

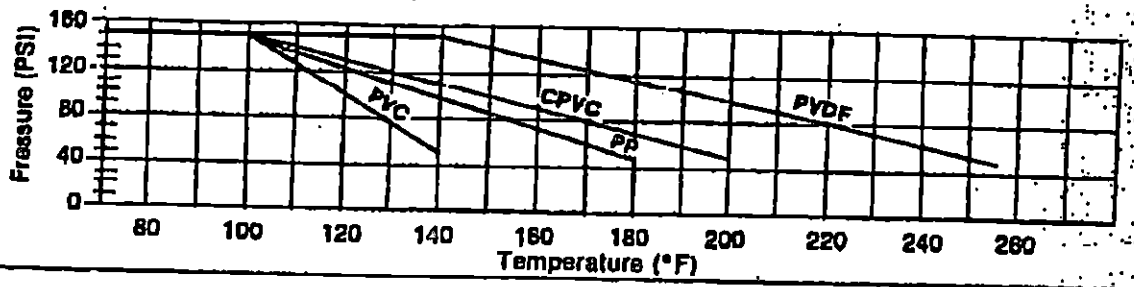


PRESSURE (PSI) - TEMPERATURE (°F) GUIDELINES

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.



PVC BUTTERFLY VALVES

Globe Valves

BODY	TEMP. (°F)	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
PVC	32 — 70	150	150	150	150	150	150
	100	105	105	105	105	105	105
	120	105	105	105	105	105	105
PP	-5 — 70	105	105	105	105	105	90
	140	90	90	90	90	90	70
	180	65	65	65	65	65	40

Sight Glasses

SIZE \ TEMP. (°F)	PVC			CPVC & PP			PVDF			
	32 — 70	120	140	32 — 100	140	175	-4 — 100	140	195	215
1/2" - 1"	150	100	50	150	100	55	150	150	100	85
1 1/2" - 2"	85	85	50	85	85	55	85	85	85	85
2 1/2" - 4"	60	60	50	60	60	55	60	60	60	60

Butterfly Valves

BODY	DISC	TEMP. (°F)	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"
PVC	PP	32 — 70	150	150	150	150	150	150	150	150	100	100	85	70	60	50
		120	100	100	100	100	100	100	100	100	60	60	60	30	30	30
		140	70	70	70	45	45	45	40	30	30	30	30	20	20	20
PVDF	PVDF	-40 — 250	150	150	150	150	150	150	100	80	60	40	40	40	40	40

Horizontal Swing Check Valve

SIZE \ TEMP. (°F)	PVC				PP				PVDF				
	EPDM			TEFLON	EPDM			TEFLON	EPDM				TEFLON
	32 — 70	110	120	32 — 120	-5 — 110	140	180	-5 — 110	-5 — 140	180	195	210	-5 — 210
3/4"	150	150	100	40	150	100	90	40	150	120	100	85	85
1"	150	150	100	40	150	100	90	40	150	120	100	85	85
1 1/2"	150	150	100	40	150	100	80	40	150	120	100	70	85
2"	150	150	100	40	150	100	80	40	150	120	90	55	85
2 1/2"	150	100	100	40	100	85	70	35	150	100	80	50	85
3"	150	100	100	40	100	70	60	30	150	100	80	40	70
4"	100	70	70	30	70	65	40	30	100	85	60	35	70
5"	100	70	70	30	70	50	35	30	100	85	60	30	60
6"	100	70	60	25	70	40	30	20	100	70	50	30	40
8"	70	40	40	20	40	35	25	15	70	50	40	30	40

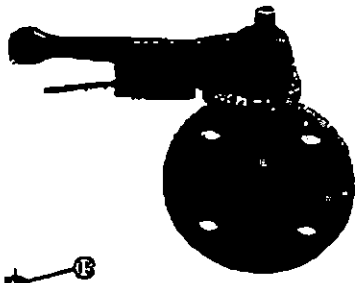
Diaphragm Valves

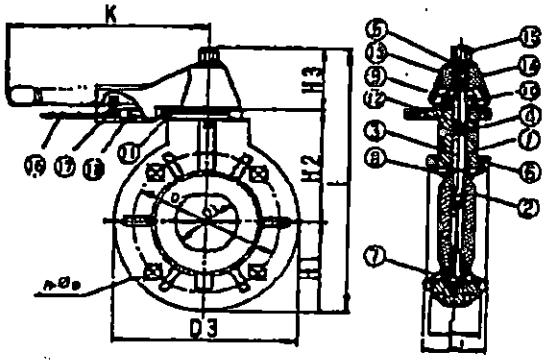
VALVE SIZE	EPDM DIAPHRAGM						TEFLON DIAPHRAGM					
	PVC		CPVC		PVDF		PVC		CPVC		PVDF	
	70°F	140°F	70°F	200°F	70°F	260°F	70°F	140°F	70°F	200°F	70°F	280°F
1/2"	150	120	150	100	150	90	150	100	150	100	150	90
3/4"	150	120	150	100	150	90	150	100	150	100	150	90
1"	150	120	150	100	150	90	150	100	150	100	150	90
1 1/2"	150	120	150	100	150	90	150	100	150	100	150	90
2"	150	120	150	100	150	90	150	100	150	100	120	75
2 1/2"	150	120	150	100	150	90	150	100	150	100	120	75
3"	150	120	150	90	150	90	90	75	90	75	90	60
4"	150	120	150	90	150	90	90	75	90	75	90	60
5"	100	90	100	60	100	60	60	50	60	50	60	50
6"	100	90	100	60	100	60	60	50	60	50	60	50
8"	60	50	60	45	60	45	45	35	45	35	60	45
10"	60	50	60	45	60	45	45	35	45	35	60	45

NOTE: TEFLON IS A REGISTERED TRADEMARK OF E.I. DU PONT.

THERMOPLASTIC BUTTERFLY VALVES

LEVER HANDLE TY





Materials of Construction

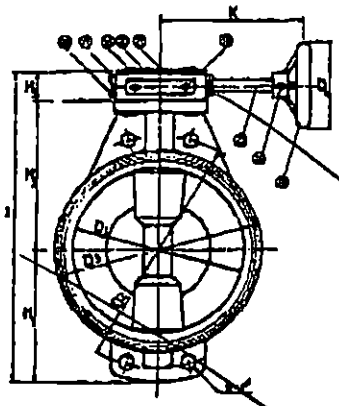
ITEM	PARTS	Pcs	MATERIALS	ITEM	PARTS	Pcs	MATERIALS
1	BODY	1	UPVC/PP/PPG/PVDF	11	RETAINER CAP	1	STEEL PP
2	DISC	1	UPVC/PP/PPG/PVDF	12	POSITIONER	1	[illegible]
3	STEM	1	[illegible]	13	SCREW	2	[illegible]
4	STEM O-RING	2	EPDM/VITON	14	HANDLE	1	[illegible]
5	[illegible]	1	[illegible]	15	INSERTED METAL OF HANDLE	1	WHITE METAL
6	SEAT	1	EPDM/VITON	16	PIN	1	PVC COATED SPRING [illegible]
7	DISC O-RING (1)	1	EPDM/VITON	17	HANDLE LEVER	1	[illegible]
8	DISC O-RING (2)	1	EPDM/VITON	18	SPRING	1	[illegible]
9	STEM BEARING	1	[illegible]	19	SET PIN	1	[illegible]

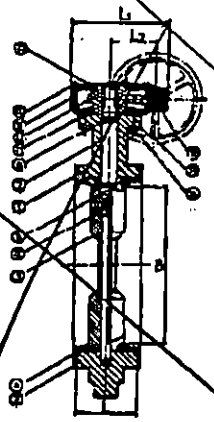
ANSI Dimensions

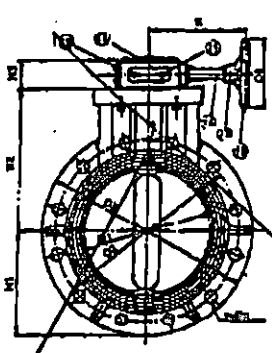
Unit: in

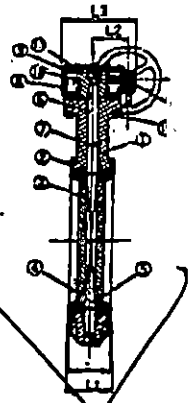
Nom. Size DN-inch	D1	D2	D3	Ød	n	L	L1	H1	H2	H3	I	K	PVC	PP	[illegible]
50-2	2.24	4.75	6.54	0.75	4	1.38	1.65	3.27	4.01	2.46	9.96	8.06	150	105	150
65-2½	2.75	5.50	7.24	0.75	4	1.64	1.81	3.47	4.33	2.46	10.63	8.66	150	105	150
80-3	3.15	6.00	7.87	0.75	4	1.66	1.81	3.94	4.84	2.46	11.20	8.66	150	105	150
100-4	4.01	7.50	9.06	0.75	8	1.85	2.20	4.53	5.43	2.68	12.64	8.66	150	105	150
125-5	5.14	8.50	10.00	0.875	8	2.24	2.40	5.00	6.30	2.76	15.00	10.20	150	105	150
150-6	6.02	9.50	11.42	0.875	8	2.44	2.80	5.71	6.96	3.78	16.45	12.20	150	105	150
200-8	8.00	11.75	13.23	0.875	8	2.99	3.45	6.61	8.18	3.00	18.45	16.30	150	105	150

GEAR OPERATOR TYPE









ANSI Dimensions

Unit:

wt. lbs	NOM. SIZE DN-INCH	D1	D2	n	ød	D3	L	L1	H1	H2	H3	K	L2	L3	D4	[illegible]
	200-8	7.99	11.75	8	1.00	13.30	2.99	3.50	6.65	8.19	2.83	7.09	2.00	5.28	8.60	
14.5	250-10	10.00	14.25	12	1.00	15.75	3.78	4.37	7.87	11.14	2.83	7.09	2.00	5.28	5.30	
22.5	300-12	12.28	17.00	12	1.00	18.29	4.57	5.16	9.65	11.73	2.83	7.09	2.00	5.28	8.60	19
40.0	350-14	13.78	19.75	16	1.25	24.41	6.54	7.28	12.20	14.41	3.43	9.61	3.07	7.87	13.00	[illegible]

Materials of Construction

ITEM	PARTS	Pcs	MATERIALS	ITEM	PARTS	Pcs	MATERIALS
1	BODY	1	UPVC/PP/PPG/PVDF	11	INDICATOR PLATE	1	PVC
2	SEAT	1	EPDM/VITON	12	GEAR	1	DUCTILE IRON
3	DISC	1	UPVC/PP/PPG/PVDF	13	OIL SEAL	1	EPDM
4	DISC O-RING (A)	2	EPDM/VITON	14	BEARING	1	BRONZE
5	DISC O-RING (B)	2	EPDM/VITON	15	ADJUSTABLE BOLT	2	SS41
6	STEM	1	[illegible]	16	BEARING	1	SS41
7	STEM O-RING	1	EPDM/VITON	17	SET PIN	1	COATED STEEL
8	GEAR BOX	1	CAST IRON	18	HAND WHEEL	1	CAST IRON
9	GEAR BOX CAP	1	CAST IRON	19	TIGHTENING BOLT	1	[illegible]
10	SIDE CAP	1	CAST IRON				

Materials of Construction

NO.	PARTS	MATERIALS	NO.	PARTS	MATERIALS
1	BODY	PVC, PP, PPG, PVDF	14	[illegible] FOR GEAR BOX	[illegible]
2	SEAT	EPDM, CSM, VITON	15	WASHER	SS-410 [illegible]
3	DISC	PVC, PP, PPG, PVDF	16	BEARING	BRONZE
4	DISC SEAL	EPDM, VITON	17	FRONT SIDE CAP	CAST IRON
5	[illegible] SEAL	EPDM, VITON	18	TIGHTENING BOLT FOR FRONT SIDE CAP	[illegible]
6	INSERTED METAL OF DISC	DUCTILE IRON-SUS-304	19	TIGHTENING BOLT FOR BOX CAP	SS-410
7	STEM	SUS-410, SUS-316	20	INDICATOR PLATE	ALUMINUM
8	STEM SEAL	EPDM, VITON	21	TIGHTENING BOLT & WASHER FOR INDICATOR PLATE	SS-410
9	GEAR BOX	CAST IRON	22	ADJUSTABLE BOLT	[illegible]
10	BOX-CAP	CAST IRON	23	BEARING	[illegible]
11	GEAR	DUCTILE IRON	24	SET PIN	STEEL
12	MACHINE KEY	SS-41	25	HAND WHEEL	CAST IRON
13	OIL SEAL	EPDM, NBR			

[illegible] Dimensions

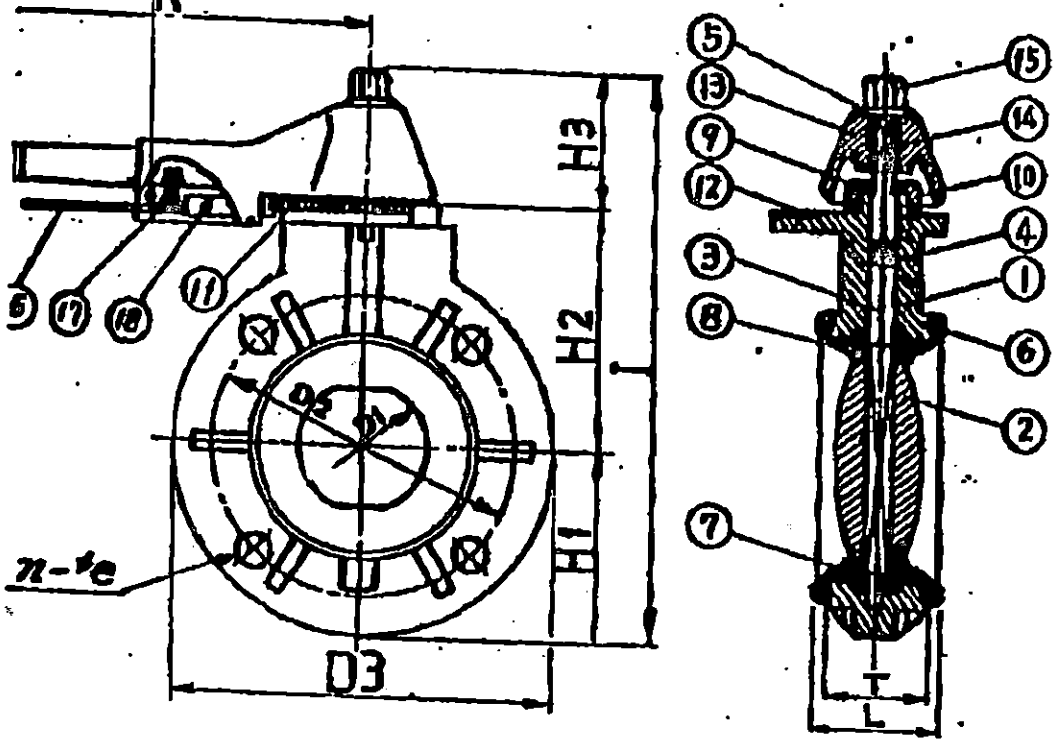
Unit: inch

[illegible]	D1	D	D4	n	n	D2	D3	K	L	D5	H2	H3	I	L1	L2	L3	TEST PRESS (N/m²)	WT. (lbs.)
																	60.0V	
[illegible]	14.1	13.8	16.7	1.1	4	10.2	8.1	8.1	4.8	10.4	11.6	2.6	24.7	7.7	6.9	7.1	100	38
[illegible]	16.7	13.4	21.3	1.1	4	10.3	8.1	8.1	5.2	11.6	15.4	2.4	28.7	7.7	6.9	7.1	[illegible]	47

OPTIONAL FEATURES

- Stem Extensions

BUTTERFLY VALVE (Lever handle type)



MATERIALS OF CONSTRUCTION

Item	Parts	Pcs	Materials
1	Body	1	UPVC, PP, PPS, DUPF
2	Disc	1	UPVC, PP, PPS, PVDF
3	Stem	1	SUS410, SUS316
4	Stem O'ring	2	EPDM, VITON
5	Washer	1	SUS304
6	Seat	1	EPDM, VITON
7	Disc O'ring (1)	2	EPDM, VITON
8	Disc O'ring (2)	2	EPDM, VITON
9	Stem Retainer	1	SUS304
10	Retainer Cap	1	UPVC, PP
11	Positioner	1	SUS304
12	Screw	3	SUS304
13	Handle	1	ABS
14	Inserted Metal of Handle	1	FC0208
15	Nut	1	PVC COATED BRASS, SUS
16	Handle lever	1	SUS304
17	Spring	1	SUS304
18	Set Pin	1	BSBM

ANSI DIMENSIONS

unit: inch

Nom. Size Dn-inch	D1	L	D2	φe	n	D3	T	H1	H2	H3	I	K
50 - 2	2.24	1.61	4.75	0.75	4	6.50	1.26	3.27	4.01	2.68	9.96	8.66
65 - 2½	2.83	1.69	5.50	0.75	4	7.32	1.46	3.66	4.33	2.68	10.67	8.66
80 - 3	3.15	1.81	6.00	0.75	4	7.87	1.46	3.94	4.64	2.68	11.26	8.66
100 - 4	4.01	2.16	7.50	0.75	8	9.05	1.81	4.53	5.43	2.68	12.64	8.66
125 - 5	5.20	2.60	8.50	0.875	8	10.16	2.24	5.08	6.37	3.78	15.23	12.40
150 - 6	6.02	2.80	9.50	0.875	8	11.38	2.40	5.71	6.96	3.78	16.45	12.20
200 - 8	8.00	3.58	11.75	0.875	8	13.30	2.99	6.61	8.18	3.66	18.45	16.30

CERTIFIED

CORRECT FOR GENERAL DIMENSIONS

Date _____ Per: _____

THERMOPLASTIC VALVES INC.

ARRANGEMENT DRAWING
BUTTERFLY VALVE
SIZE: 2" - 8"

DWN BY	DATE	DWG NO.
CKP	11-4-93	TPV-13250

BACK UP RINGS

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
→ 4"	115psi
→ 6"	135psi
→ 8"	125psi
10"	135psi
12"	115psi
14"	105psi
16"	95psi
18"	85psi
20"	75psi
22"	75psi
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 FREE: 1-800-486-0752

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

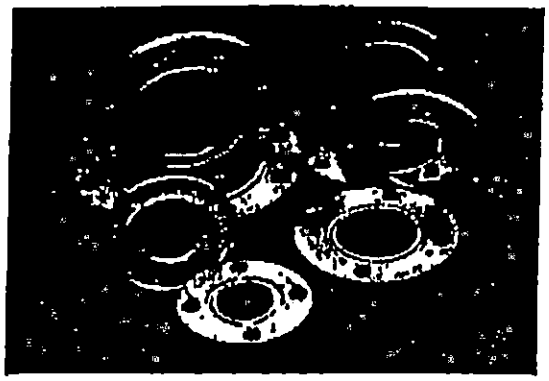
IMPROVED PIPING (IPP) PRODUCTS, INC.

DELTAFLEX® BUPP-SS

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

ABOUT IMPROVED PIPING PRODUCTS, INC.

We 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[1] is the most unique and cost effective light weight stainless steel flange connection system in the world... and its *available only from IPP*[2].

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-welding. Ideal for low to medium pressure applications, DELTAFLEX BUPP-SS can be considered for virtually any service requiring stainless steel flanges.

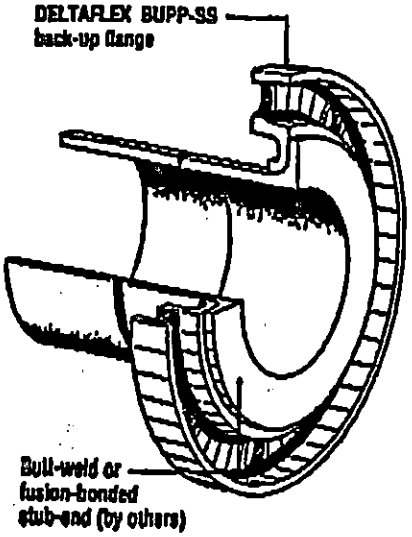
[1] Light weight / convoluted flange
[2] Patent applied for
[3] For full class 150 pressure/temperature service see our literature on DELTAFLEX LJ-SS

FEATURES AND BENEFITS

- Cast stainless steel flange conforms to A351 material specs
- Designed for use with butt-welded, thermoplastic, or steel stub-ends
- DELTAFLEX is 60% of the weight of a comparable carbon steel flange
- Rated for 110 psi operating pressure: 150# drilling[3]
- Flange is reusable... it is not welded to the pipe
- Flexible structure is superior where vibration and thermal stresses exist
- Interchangeable 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 bolt 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 bolt holes are aligned — install the bolts, nuts, and washers — *one man can do it efficiently.*



IPP — A Strong Customer Connection

DELTAFLEX BUPP-SS STAINLESS STEEL BACK-UP FLANGE DIMENSIONS

Pipe Size	D	Q	W	Y	T	n	C	B	R	Weight (lbs.)	Operating Pressure
1"	4.25	.40	1.38	.3	.20	4	.62	3.12	.08	.98	110 psi
1½"	6.00	.40	1.97	.3	.20	4	.62	3.87	.08	1.26	110 psi
2"	6.00	.40	2.48	.4	.20	4	.75	4.75	.13	1.78	110 psi
3"	7.50	.40	3.60	.4	.20	4	.75	6.00	.13	2.50	110 psi
4"	9.00	.50	4.50	.4	.20	8	.75	7.50	.13	3.66	110 psi
6"	11.00	.50	6.75	.5	.25	8	.87	9.50	.13	6.08	110 psi
8"	13.50	.70	8.75	.5	.25	8	.87	11.75	.13	8.61	110 psi
10"	16.00	.90	10.92	.5	.25	12	1.00	14.25	.13	12.41	110 psi
12"	19.00	1.03	12.92	.5	.30	12	1.00	17.00	.25	20.86	110 psi
14"	21.00	1.13	14.18	.5	.30	12	1.12	18.75	.25	25.71	110 psi
16"	23.50	1.25	16.19	.5	.30	16	1.12	21.25	.25	31.71	110 psi
18"	25.00	1.34	18.20	.5	.30	16	1.25	22.75	.25	33.89	110 psi
20"	27.50	1.47	20.25	.5	.30	20	1.25	25.00	.25	40.77	110 psi
22"	29.50	1.54	22.25	.7	.35	20	1.37	27.25	.25	52.00	110 psi
24"	32.00	1.60	24.25	.5	.40	20	1.27	29.50	.25	59.14	110 psi

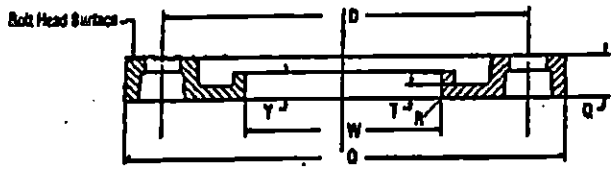
MATERIAL PROPERTIES

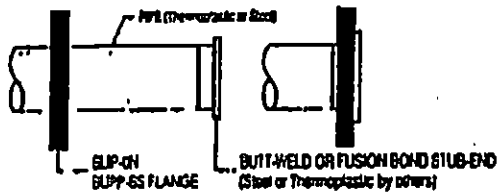
ASTM A351 CF8M

Tensile Strength	70,000 psi
Yield Strength	30,000 psi
Elongation in 2"	30%
Carbon	.08%
Manganese	1.50%
Silicon	1.50%
Sulphur	.04%
Phosphorous	.04%
Chromium	18.0 – 21.0%
Nickel	9.0 – 12.0%
Molybdenum	2.0 – 3.0%

PRESSURE-TEMPERATURE RATING FOR BUPP-SS FLANGES

Temperature °F	Operating Pressure
-20 to 100	110
200	98
300	86
400	76
500	68
600	55
650	50
700	44





SAMPLE SPECIFICATION

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.

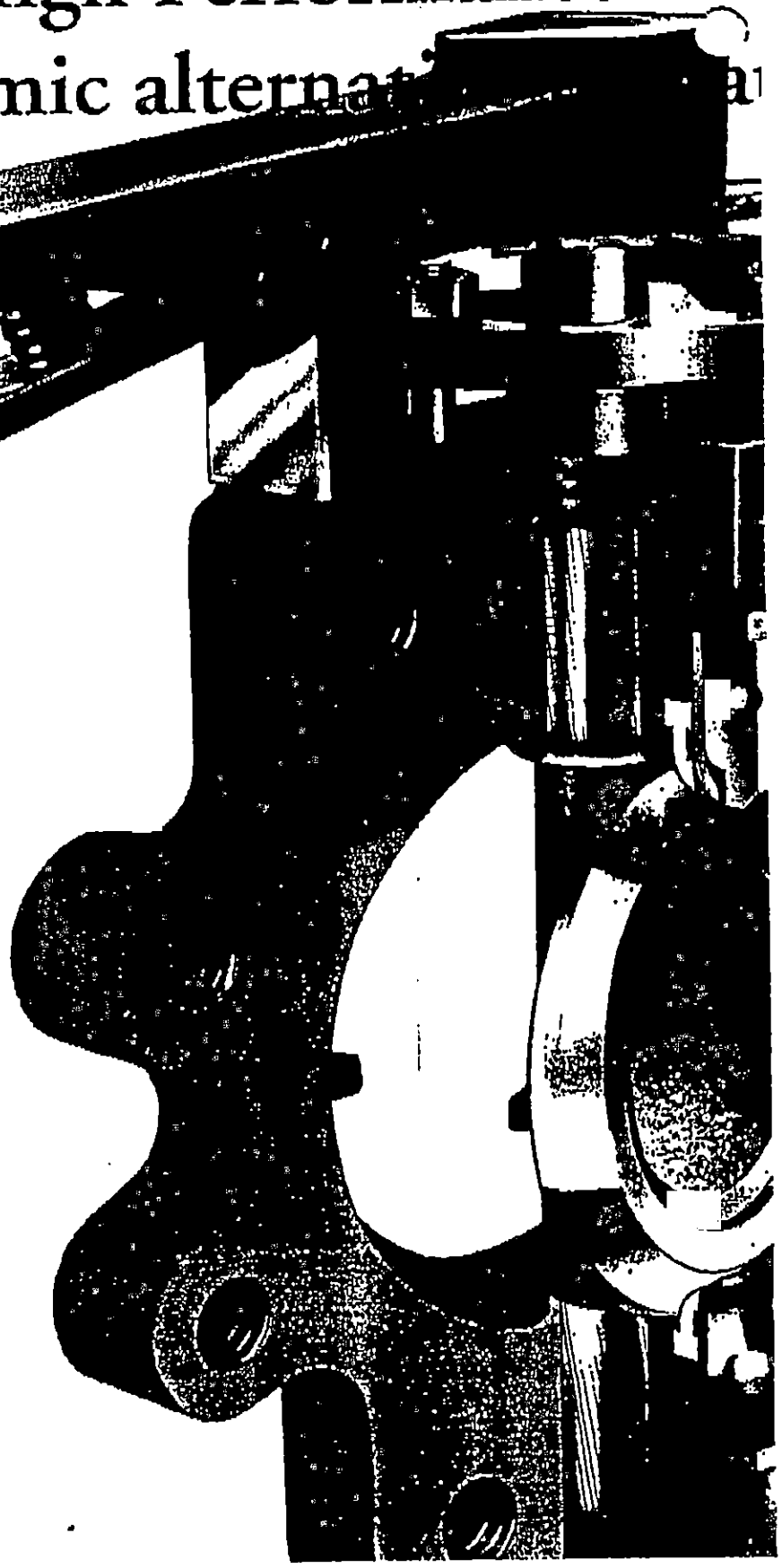
IMPROVED PIPING (IPP) PRODUCTS, INC.

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

DELTAFLEX BUPP-SS ©1994 3M 94-2

Hi Seal, the High Performance Bu

- the economic alterna



Winn Hi-Seal high performance butterfly valves are designed to offer efficient, bi-directional sealing 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.

BUTTERFLY VALVE FOR GAS VENTILATION

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

The Range:-

Body Types

Wafer	Clamped between flanges with spanning bolts or studs
~~Wafer Lugged~~	~~Tapped or clearance holes available~~
~~Double flanged~~	~~Suitable for ANSI and DIN Standards~~

Design Types

Soft Seated	for general purpose applications.
~~Firesafe~~	~~for process industry use where superior safety is required.~~
~~Metal Seated~~	~~for high temperature and/or abrasive services.~~

Size Range

Pressure class	ANSI 150 DIN PN 10/16	~~ANSI 300~~ ~~DIN PN 25/40~~
Sizes inch ~~mm~~	~~2 - 48~~ 6" ~~50 - 1200~~ 10"	~~2 - 24~~ ~~50 - 600~~

Body Materials

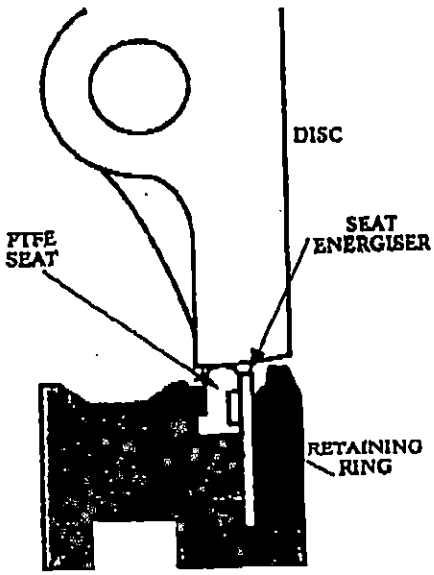
Standard	Carbon Steel (ASTM A 216 WCC) ~~Stainless Steel (ASTM A 351 CF8M)~~ ~~Aluminium Bronze (BS 1400 AB2)~~
Alternatives	Duplex Stainless Steels 6 Mo Inconel Ferralium Hastelloy Titanium Monel Other materials on request

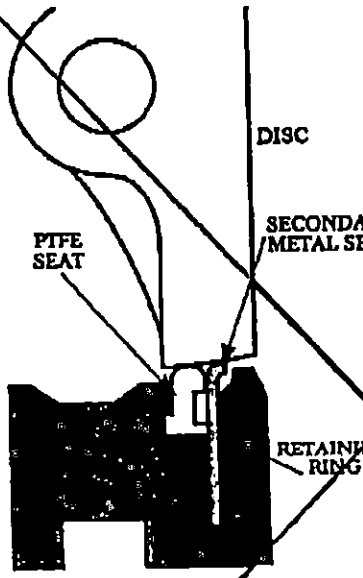
Seat Materials

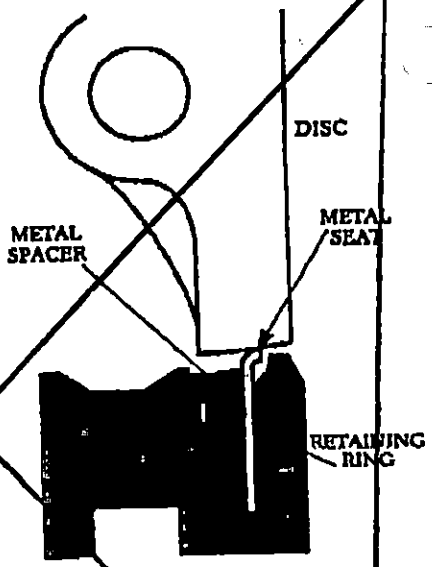
Standard (Soft Seat & Firesafe)	PTFE
Alternative Seat Materials	RTFE (Reinforced PTFE) UHMPE (Ultra high Molecular Weight Polyethelene)
Metal Seated Valves	Inconel

Disc Material 316 SS
Shaft Material 17-4 SS

Design Features







Soft Seated

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.

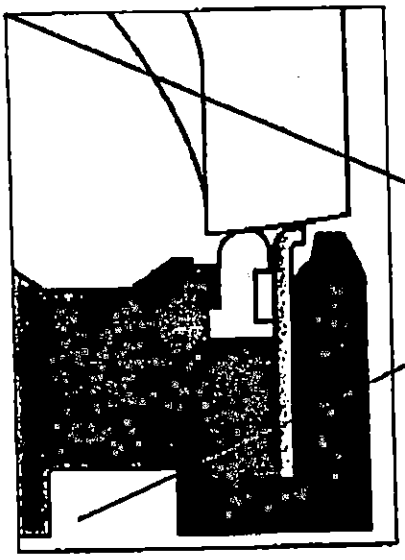
Firesafe

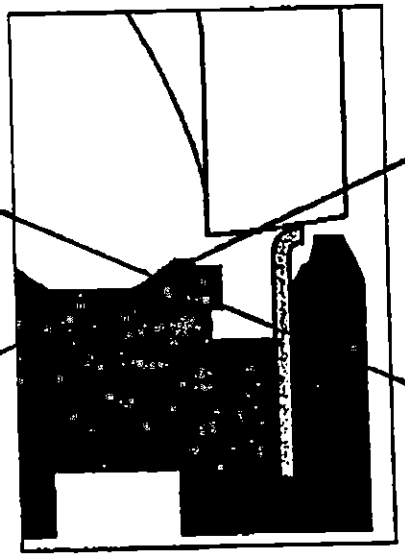
In firesafe models the energising ring is extended so as to form a secondary metal seal in the event of soft seat destruction.

Metal Seated

For high temperature or abrasive applications the soft seat is replaced by a metallic spacer and the metal seat forms the seal.

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





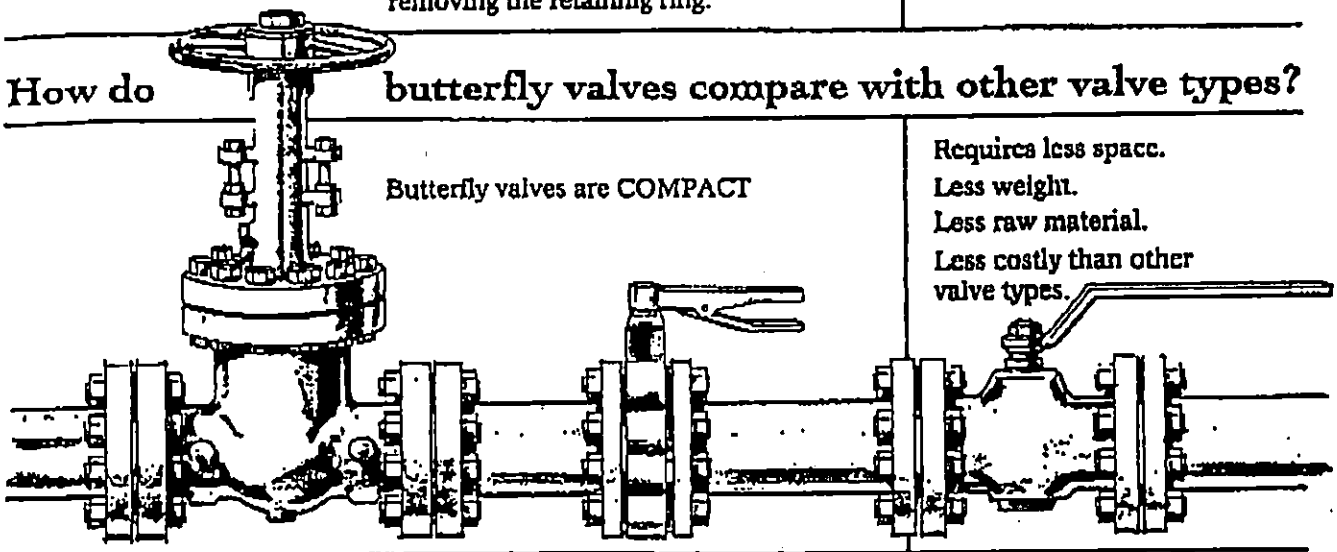
Firesafe Design

Destruction of the soft seat due to elevated 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-Directional Seal	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 principle which ensures a seal in either direction. As the valve begins to open the disc swings away from the seat eliminating wear points and extending seat life.	Low operating torque. Positive sealing in either direction. Long seat life. Lugged valves ideal for end-of-line service.
✓ One Piece Shaft	Single piece shaft design ensures rigidity and stability of the shaft/disc assembly. The input drive is a key, designed to fail mechanically should abnormal torques be applied thus protecting the internal disc/shaft assembly.	Long life operation. To maximise safety.
✓ 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.

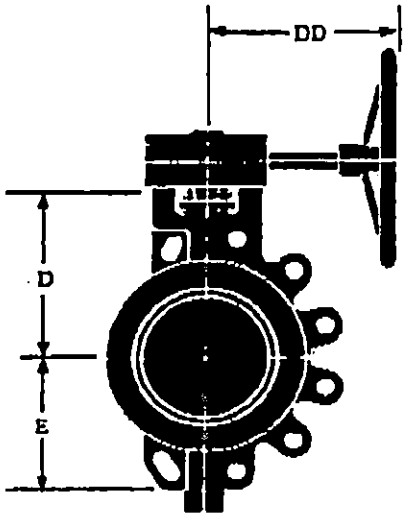
How do butterfly valves compare with other valve types?

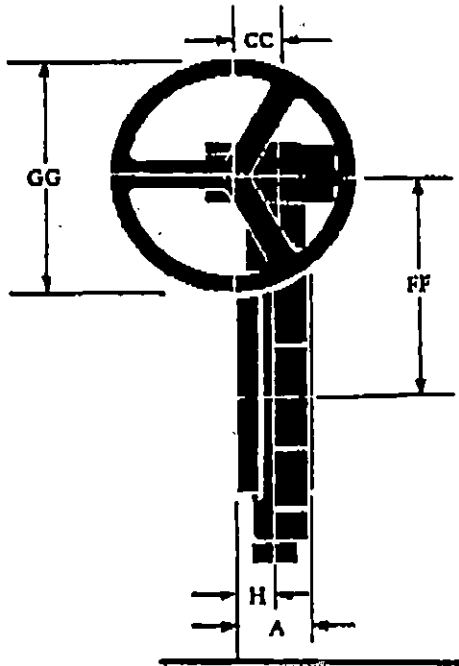


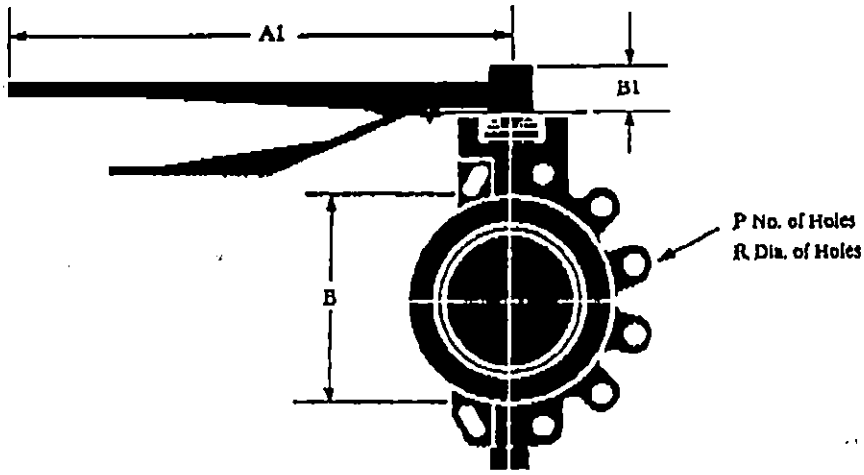
Butterfly valves are COMPACT	Require less space. Less weight. Less raw material. Less costly than other valve types.
Butterfly valves are QUARTER TURN valves	Easy operation by lever, gearbox or actuator. Superior gland integrity.
Butterfly valves have FEWER PARTS	Easier to maintain.
Butterfly valves are SUITABLE FOR CONTROL PURPOSES	Linear flow characteristics between 30° and 70° of opening.

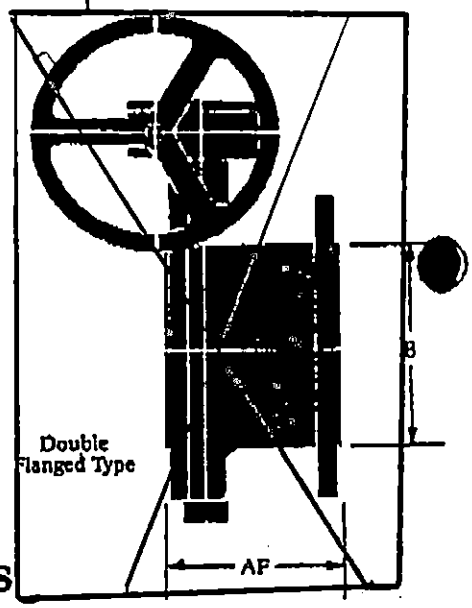
Gate valves cannot claim ANY of these advantages.

Outline Dimensions

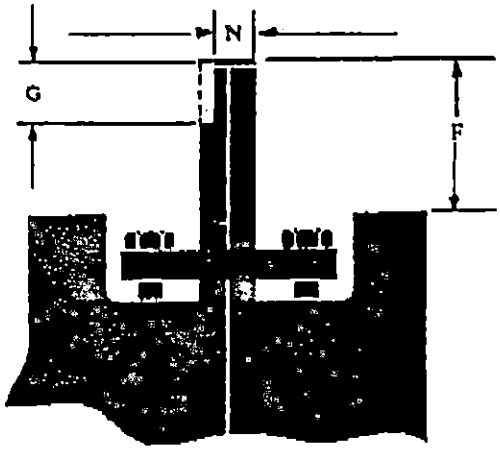




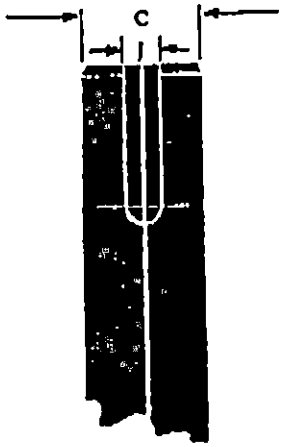




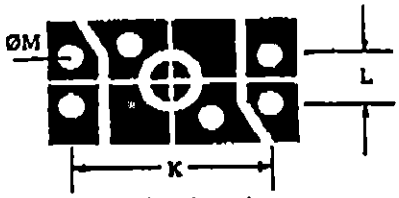
Operator Mounting Dimensions



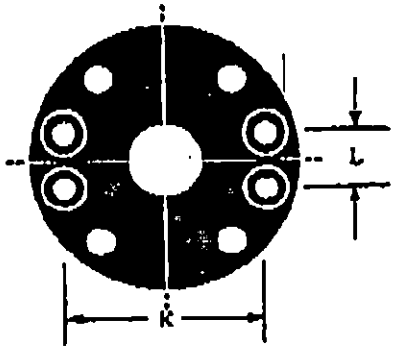
Shaft shown in Closed Position



Shaft Keyway Dimensions



Top Works Dimensions



Optional ISO Mounting Flange

ANSI Class 150

SIZE		BODY Inches mm						OPERATOR Inches mm						LUGS		SHAFT Inches mm					MOUNTING PAD Inches mm			WEIGHT (kg)		
Ins.	mm	A	B	D	H	E	AF	A1	B1	FF	DO	GG	CC	P	R	C	G	J	F	N	K	L	M	WAFER	LUG	FLANGED
2	50	1.69 43	4.02 102	4.53 115	0.98 25	2.91 74	4.25 108	9.84 250	1.65 42	5.79 147	8.66 220	4.92 125	2.36 60	4	⅜" UNC	0.50 12.7	0.55 14	0.13 3.2	1.61 41	0.43 10.8	3.25 82.5	- -	⅜" UNC	13 6	13 6	- -
3	80	1.89 48	5.43 138	5.43 138	1.08 27.5	4.92 125	4.49 114	9.84 250	1.65 42	6.69 170	8.66 220	4.92 125	2.36 60	4	⅜" UNC	0.63 16	0.55 14	0.19 4.8	1.61 41	0.51 13.0	3.25 82.5	- -	⅜" UNC	18 8	20 9	44 20
4	100	2.13 54	6.38 162	5.98 152	1.18 30	5.28 134	5.00 127	14.96 380	1.65 42	7.24 184	8.66 220	7.87 200	2.36 60	8	⅜" UNC	0.69 17.5	0.79 20	0.19 4.8	1.61 41	0.57 14.6	3.25 82.5	- -	⅜" UNC	24 11	31 14	48 22
5	125	2.24 57	7.32 186	6.97 177	1.38 35	5.94 151	5.51 140	14.96 380	1.65 42	8.23 209	9.29 236	7.87 200	2.36 60	8	½" UNC	0.69 17.5	0.79 20	0.19 4.8	1.61 41	0.57 14.6	3.25 82.5	- -	⅜" UNC	29 11	40 18	- -
6	150	2.24 57	8.50 216	7.48 190	1.38 35	6.73 171	5.51 140	19.69 500	2.05 52	9.09 231	9.29 236	9.84 250	2.64 67	8	½" UNC	0.94 23.8	1.38 35	0.25 6.4	2.05 52	0.79 20.1	4.02 102	- -	⅜" UNC	35 16	51 23	66 30
8	200	2.52 64	10.63 270	8.03 204	1.63 41.5	7.76 197	5.98 152	- -	- -	9.65 245	9.29 236	9.84 250	2.64 67	8	½" UNC	0.94 23.8	1.38 35	0.25 6.4	2.05 52	0.79 20.1	4.02 102	- -	⅜" UNC	53 24	66 30	99 45
10	250	2.80 71	12.76 324	9.76 248	1.75 44.5	9.37 238	6.50 165	- -	- -	11.38 289	12.01 305	17.72 450	2.64 67	12	⅝" UNC	1.25 31.8	1.69 43	0.31 8.0	2.05 52	1.07 27.2	5.00 127	1.00 25.4	⅜" UNC	88 40	106 48	143 65
12	300	3.19 81	15.00 381	11.54 293	1.89 48	10.71 272	7.01 178	- -	- -	13.31 338	12.01 305	29.92 760	3.39 86	12	⅝" UNC	1.38 35	1.97 50	0.37 9.5	2.20 56	1.15 29.3	5.98 152	1.63 41.3	⅜" UNC	117 53	154 70	209 95
14	350	3.62 92	17.24 438	12.72 323	2.20 56	11.85 301	7.48 190	- -	- -	14.57 370	12.01 305	29.92 760	4.37 111	12	1" UNC	1.63 41.3	2.52 64	0.44 11.1	2.76 70	1.37 34.9	7.01 178	1.63 41.3	½" UNC	191 87	224 102	275 125
16	400	4.02 102	19.29 490	14.41 366	2.44 62	13.23 336	8.50 216	- -	- -	16.54 420	16.61 422	29.92 760	5.43 138	16	1" UNC	2.00 50.8	1.57 40	0.50 12.7	3.07 78	1.71 43.5	7.76 197	1.77 45.0	½" UNC	339 154	374 170	440 200
18	450	4.49 114	21.65 550	16.30 414	2.76 70	15.00 381	8.74 222	- -	- -	18.43 468	15.91 404	17.72 450	5.43 138	16	1⅛" 8 UN	2.25 57.2	1.57 40	0.63 16	3.07 78	1.89 47.9	7.76 197	1.97 50	⅝" UNC	444 201	660 300	550 250
20	500	5.00 127	24.02 610	20.00 508	2.93 74.5	16.18 411	9.02 229	- -	- -	22.13 562	17.20 437	17.72 450	5.43 138	20	1⅛" 8 UN	2.50 63.5	2.56 65	0.63 16	3.54 90	2.15 54.5	8.27 210	1.97 50	⅝" UNC	504 229	836 380	682 310
24	600	6.06 154	28.54 725	22.05 560	3.70 94	18.23 463	10.51 267	- -	- -	24.57 624	19.69 500	17.72 450	7.13 181	20	1¼" 8 UN	2.87 73	2.77 45	0.75 19	3.94 100	2.44 62	9.49 241	2.99 76	⅝" UNC	594 270	880 400	935 425
26	650	6.50 165	29.25 743	22.24 565	3.94 100	20.51 521	11.50 292	- -	- -	25.00 635	21.46 545	23.62 600	9.33 237	20	1½" 8 UN	3.25 82.5	2.56 65	0.87 22	4.33 110	2.76 70	11.22 285	4.33 110	⅝" UNC	733 333	990 450	1342 610
28	700	9.02 229	31.26 794	23.35 593	3.94 100	21.42 544	11.50 292	- -	- -	26.10 663	21.46 545	23.62 600	9.33 237	28	1¾" 8 UN	3.25 82.5	2.56 65	0.87 22	4.33 110	2.76 70	11.22 285	4.33 110	⅝" UNC	895 407	1210 550	1804 820
30	750	9.02 229	33.74 857	24.61 625	3.94 100	22.68 576	11.50 292	- -	- -	27.36 695	21.46 545	23.62 600	9.33 237	28	1¾" 8 UN	3.25 82.5	2.56 65	0.87 22	4.33 110	2.76 70	11.22 285	4.33 110	⅝" UNC	1056 480	1426 648	2112 960
32	800	9.49 241	35.75 908	25.63 651	4.33 110	24.29 617	12.52 318	- -	- -	28.39 721	21.46 545	23.62 600	9.33 237	28	1½" 8 UN	3.50 89	2.76 70	0.87 22	4.92 125	3.00 76.2	11.22 285	4.33 110	¾" UNC	1269 577	1716 780	2400 1100
36	900	9.49 241	40.24 1022	30.67 779	5.12 130	26.93 684	12.99 330	- -	- -	33.43 849	20.71 526	23.62 600	9.33 237	32	1½" 8 UN	3.94 100	3.65 92.7	1.00 25.4	5.91 150	3.40 86.3	11.22 285	4.33 110	¾" UNC	1929 877	2605 1184	3245 1475
40	1000	9.49 241	44.25 1124	32.48 825	5.12 130	28.74 730	16.14 410	- -	- -	35.24 895	20.71 526	23.62 600	9.33 237	36	1½" 8 UN	3.94 100	3.65 92.7	1.00 25.4	5.91 150	3.40 86.3	11.22 285	4.33 110	¾" UNC	2330 1059	3146 1430	4147 1885
42	1050	11.81 300	47.01 1194	34.41 874	5.12 130	30.63 778	16.14 410	- -	- -	37.17 944	24.09 612	23.62 600	9.33 237	36	1½" 8 UN	3.94 100	3.65 92.7	1.00 25.4	5.91 150	3.40 86.3	11.22 285	4.33 110	¾" UNC	3221 1464	3705 1684	4532 2060
48	1200	13.78 350	53.50 1359	40.94 1040	6.10 155	36.26 921	18.50 470	- -	- -	44.21 1123	30.59 777	23.62 600	11.50 292	44	1½" 8 UN	4.92 125	4.17 106	1.25 31.8	4.33 110	4.21 107	11.22 285	4.33 110	⅞" UNC	4101 1864	5535 2516	6094 2770

ANSI Class 300

SIZE		BODY Inches mm					OPERATOR Inches mm						LUGS		SHAFT Inches mm					MOUNTING PAD Inches mm			WEIGHT (kg)	
Ins.	mm	A	B	D	H	E	A1	B1	FF	DO	GG	CC	P	R	C	G	J	F	N	K	L	M	WAFER	LUG
2	50	1.69 43	3.62 92	4.53 115	0.98 25	2.91 74	9.84 250	1.65 42	5.79 147	8.66 220	4.92 125	2.36 60	8	⅜" UNC	0.50 12.7	0.55 14	0.13 3.2	1.61 41	0.43 10.8	3.25 82.5	- -	⅜" UNC	13 6	13 6
3	80	1.89 48	5.00 127	5.43 138	1.08 27.5	4.92 125	9.84 250	1.65 42	6.69 170	8.66 220	4.92 125	2.36 60	8	½" UNC	0.63 16	0.55 14	0.19 4.8	1.61 41	0.51 13.0	3.25 82.5	- -	⅜" UNC	18 8	20 9
4	100	2.13 54	6.18 157	5.98 152	1.18 30	5.28 134	14.96 380	1.65 42	7.24 184	8.66 220	7.87 200	2.36 60	8	½" UNC	0.69 17.5	0.79 20	0.19 4.8	1.61 41	0.57 14.6	3.25 82.5	- -	⅜" UNC	24 11	31 14
5	125	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
6	150	2.24 57	8.50 216	7.48 190	1.38 35	6.73 171	- -	- -	9.09 231	9.29 236	9.84 250	2.64 67	12	½" UNC	0.94 23.8	1.38 35	0.25 6.4	2.05 52	0.79 20.1	4.02 102	- -	⅜" UNC	35 16	57 26
8	200	2.80 71	10.63 270	8.86 225	1.63 41.5	8.58 218	- -	- -	10.47 266	12.01 305	17.72 450	2.64 67	12	⅝" UNC	1.25 31.8	1.69 43	0.31 8.0	2.05 52	1.07 27.2	5.00 127	1.00 25.4	⅜" UNC	62 28	95 43
10	250	3.23 82.5	12.76 324	10.43 265	1.75 44.5	10.51 267	- -	- -	12.20 310	12.01 305	29.92 760	3.39 86	16	⅝" UNC	1.38 35	1.97 50	0.37 9.5	2.20 56	1.15 29.3	5.98 152	1.63 41.3	⅜" UNC	121 55	154 70
12	300	3.62 92	15.00 381	12.01 305	1.89 48	12.05 306	- -	- -	13.86 352	12.01 305	29.92 760	4.37 111	16	1¼" 8 UN	1.63 41.3	2.52 64	0.44 11.1	2.76 70	1.37 34.9	7.01 178	1.63 41.3	½" UNC	165 75	220 100
14	350	4.61 117	16.26 413	13.39 340	2.20 56	13.11 333	- -	- -	15.51 394	16.61 422	29.92 760	5.43 138	20	1⅛" UNC	2.00 50.8	1.57 40	0.50 12.7	3.07 78	1.71 43.5	7.76 197	1.77 45.0	½" UNC	251 114	330 150
16	400	5.24 133	18.30 470	14.96 380	2.36 65	14.96 380	- -	- -	17.09 434	15.91 404	17.72 450	5.43 138	20	1¼" 8 UN	2.25 57.2	1.57 40	0.63 16	3.07 78	1.89 47.9	7.76 197	1.97 50	⅝" UNC	508 231	616 280
18	450	5.87 149	20.98 533	19.09 485	2.87 73	16.22 412	- -	- -	21.22 539	17.20 437	17.72 450	5.43 138	24	1¼" 8 UN	2.50 63.5	2.56 65	0.63 16	3.54 90	2.15 54.5	8.27 210	1.97 50	⅝" UNC	623 283	770 350
20	500	6.25 159	22.99 584	20.20 513	3.05 77.5	17.28 439	- -	- -	22.72 577	19.69 500	17.72 450	7.13 181	24	1¼" 8 UN	2.87 73	2.77 45	0.75 19	3.94 100	2.44 62	9.49 241	2.99 76	⅝" UNC	834 379	990 450
24	600	7.13 181	27.24 692	23.70 602	3.70 94	20.79 528	- -	- -	26.46 672	21.46 545	23.62 600	9.33 237	24	1½" 8 UN	3.25 82.5	2.56 65	0.87 22	4.33 110	2.76 70	11.22 285	4.33 110	¾" UNC	1346 611	1540 700

Note: All weights refer to bare shaft valve only.

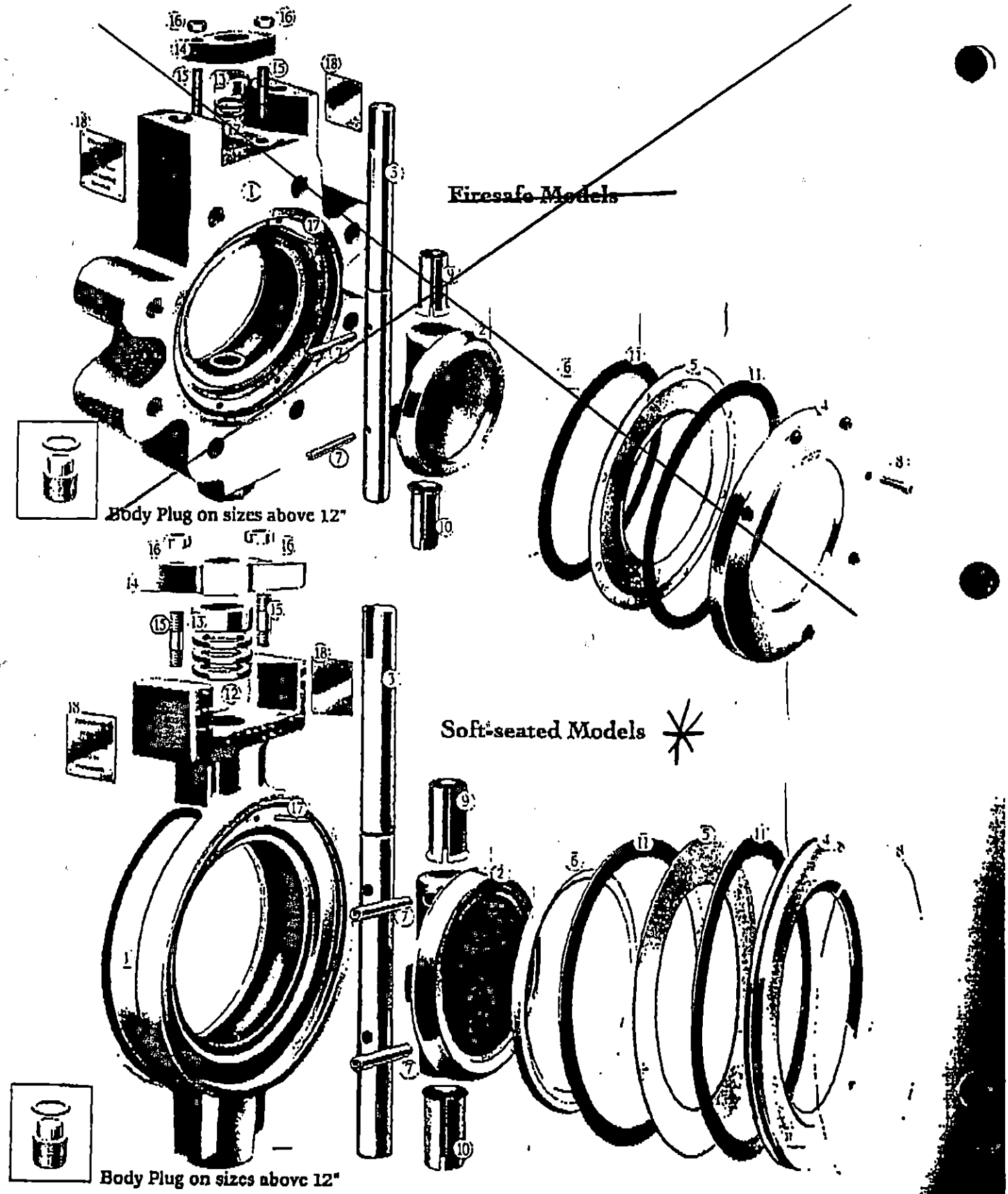
ISO Mounting Flange

Valve Size	ANSI 150 PN10/16	ANSI 300 PN25/40
2-6"	F10	F10
8"	F10	F12
10"	F12	F14
12"	F14	F16
14"	F16	

For sizes 14" class 300 (PN25/40) and above consult

Parts List

~~Firesafe or~~ Soft-seated, Wafer, ~~Lug~~ and ~~Double Flanged~~ Valves.



Materials of Construction.

Standard materials for FIRESAFE models.

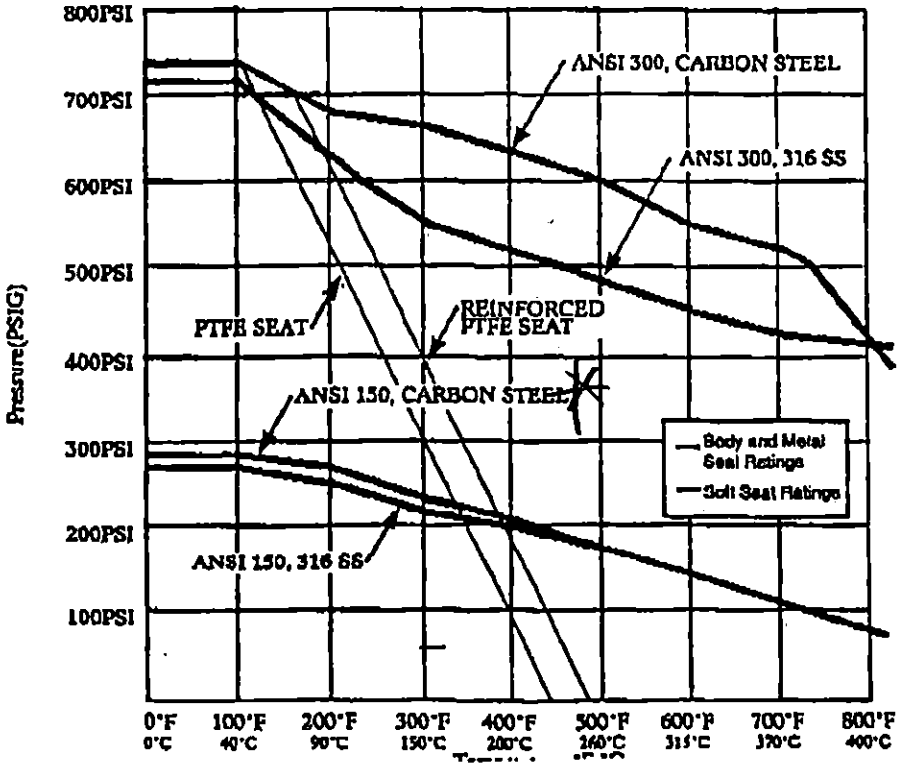
ITEM	DESCRIPTION	CARBON STEEL VALVES	STAINLESS STEEL VALVES	ALUMINIUM BRONZE VALVES
(1)	[redacted]	ASTM A216 WCC	ASTM A351 CF8M	BS 1400 AB2
(2)	DISC	ASTM A351 CF8M ENP	ASTM A351 CF8M ENP	BS 1400 AB2
(3)	[redacted]	ASTM A564 Gr 630 (17-4PH)	ASTM A564 Gr 630 (17-4PH)	K MONEL
(4)	RETAINING RING	BS 4360 43A	BS 1501 316 S31	BS 1400 AB2
(5)	[redacted]	INCONEL 625	INCONEL 625	INCONEL 625
(6)	SOFT SEAT	VIRGIN PTFE	VIRGIN PTFE	VIRGIN PTFE
(7)	[redacted]	AISI 302	AISI 302	K MONEL
(8)	RETAINING RING SCREW	HIGH TENSILE STEEL	BS 4882 Gr B8X	K MONEL
(9)	[redacted]	PTFE COMPOSITE	PTFE COMPOSITE	PTFE COMPOSITE
(10)	SHAFT BEARING -BOTTOM	PTFE COMPOSITE	PTFE COMPOSITE	PTFE COMPOSITE
(11)	[redacted]	GRAPHITE	GRAPHITE	GRAPHITE
(12)	GLAND PACKING	GRAPHITE	GRAPHITE	GRAPHITE
(13)	[redacted]	BS 970 316 S31	BS970 316 S31	BS970 316 S31
(14)	GLAND FOLLOWER FLANGE	ASTM A351 CF8M	ASTM A351 CF8M	ASTM A351 CF8M
(15)	[redacted]	BS 4882 Gr B7	BS 4882 Gr B8X	BS 4882 Gr B8X
(16)	GLAND NUT	BS 4882 Gr 2H	BS 4882 Gr 8X	BS 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.

Materials of construction are as above, except

(2)	DISC	ASTM A351 CF8M	ASTM A351 CF8M	BS 1400 AB2
(5)	SEAT ENERGISER	INCONEL 825	INCONEL 825	INCONEL 625
(8)	RETAINING RING SPRING	STAINLESS STEEL	STAINLESS STEEL	PHOSPHOR BRONZE
(12)	GLAND PACKING	VIRGIN PTFE	VIRGIN PTFE	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.

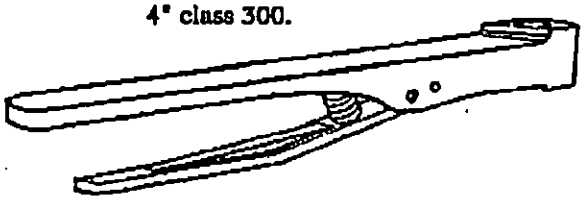
The body ratings shown are from ANSI B16.5/BS 1560 Pt 2.

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

Operation Methods

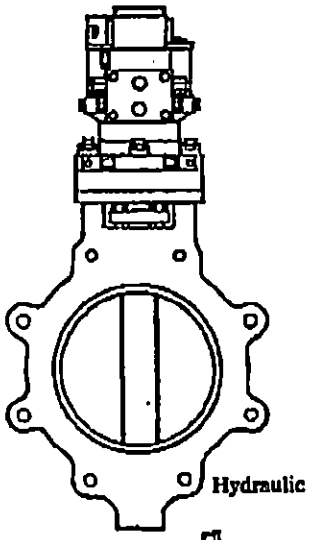
Handlever

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.

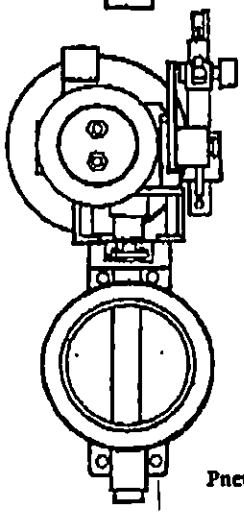


Powered Operation/Control

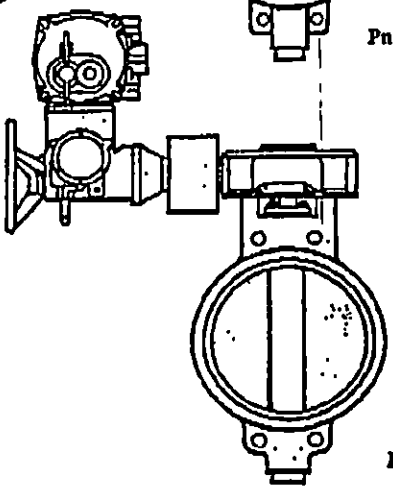
Pneumatic, electric or hydraulic actuators with ancillary equipment such as solenoid valves, limit switches, positioners etc. can be supplied.



Hydraulic



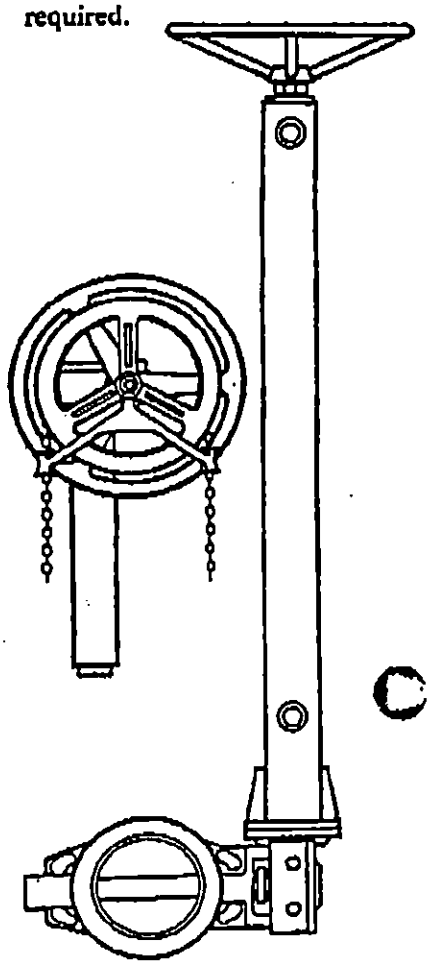
Pneumatic



Electric

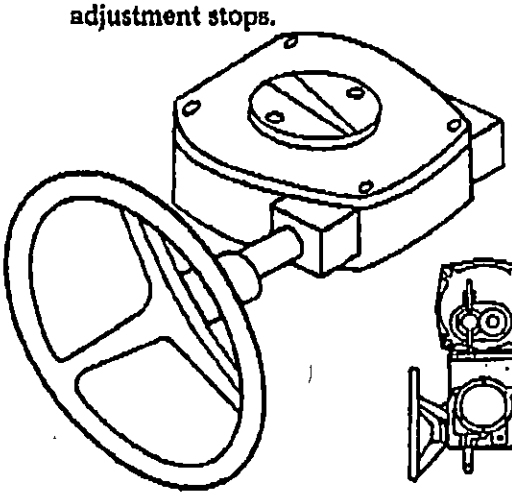
Adaptions

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



Gearbox

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



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.)

Technical Specifications

Design	API 609, BS 5155, MSS SP-68
Wall Section	ANSI B16.34
End Flange Compatability	ANSI B16.5
Face to Face	BS 5155, API 609
Pressure/Temperature Rating	ANSI B16.34
Fire Test Certification	BS 5146, BS 6755 Pt 2, API 6FA, API 607, DOT Rule 54, Exxon BP 3-14-1-2A
Pressure Testing	BS 6755 Pt 1
Factory Quality System	ISO 9001, EN 29001, BS 5750 Pt 1
ISO Top Mounting Flange (when specified)	ISO 5211

How to Order Hi-Seal Butterfly Valves

Valve Coding System describes type of valve, materials of construction, operator, and special service preparation if requested.

Example

10 - S 15 W - 1 1 2 2 - 2 [ ]

SIZE

VALVE TYPE
- ~~F - Firesafe~~
- S - Soft Seat
- ~~M - Metal Seat~~

ANSI RATING
- 15-150
- ~~30-300~~

BODY STYLE
- W - Wafer
- ~~L - Lug~~
- ~~F - Double Flange~~

BODY MATERIAL
- 1 - Carbon Steel
- ~~2 - Stainless Steel (316)~~
- ~~3 - Aluminum Bronze~~
- ~~4 - Ferralium~~
- ~~5 - 5 MO.~~
- ~~X - Other~~

DISC/SHAFT MATERIAL
- 1 - 316 S.S. Disc 17-4 S.S. Shaft
- ~~2 - Al-Bro Disc Monel Shaft~~
- ~~3 - Ferralium Disc Ferralium Shaft~~
- ~~4 - 5 M.O. Disc Ferralium Shaft~~
- ~~5 - Monel Disc Monel Shaft~~
- ~~6 - 316 S.S. Disc 316 S.S. Shaft~~
- ~~7 - Alloy 20 Disc Alloy 20 Shaft~~
- ~~X - Other~~

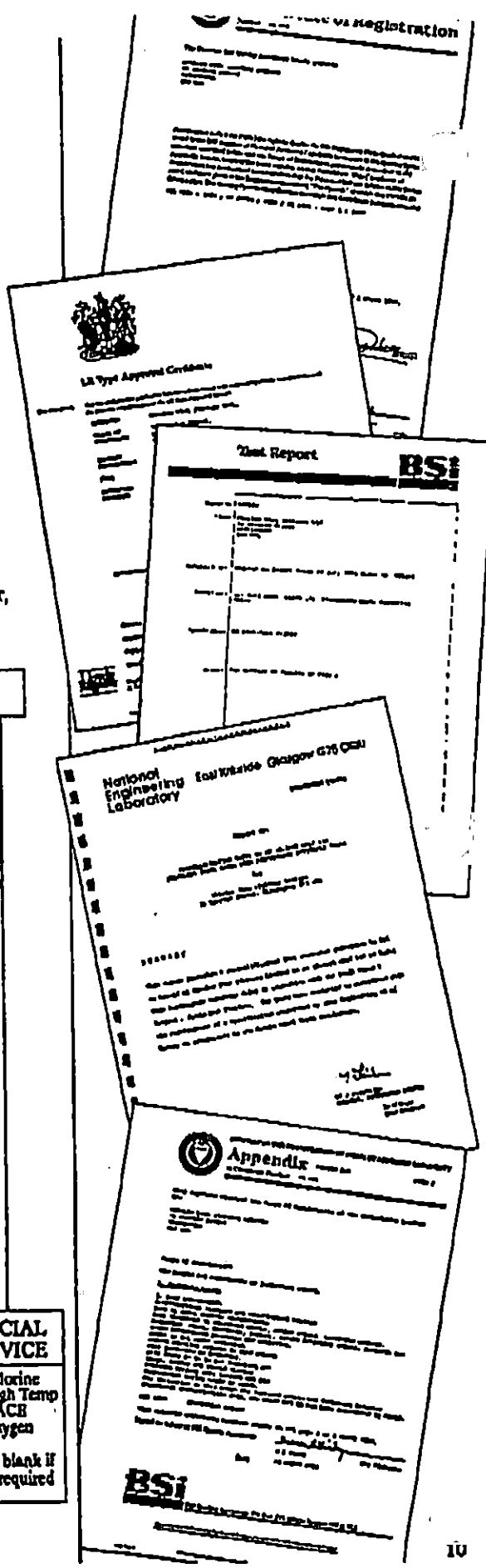
SEAT MATERIAL
- Soft Seated
- 2 - PTFE
- ~~3 - RTFE~~
- ~~4 - UHMPE~~
- ~~Firesafe~~
- ~~5 - PTFE/Inconel~~
- ~~6 - RTFE/Inconel~~
- ~~Metal Seated~~
- ~~M - Inconel~~

OPERATOR
- ~~0 - Bare Shaft~~
- ~~1 - 10 Position Lever Lock Handle~~
- 2 - Gear Operator (Weatherproof)
- ~~4 - Gear Operator (O-Ring Sealed)~~
- ~~5 - Pneumatic Actuator (Specify)~~
- ~~6 - Electric Actuator (Specify)~~
- ~~7 - Extended Shaft (Specify)~~

PACKING-MATERIAL
- Soft Seated
- 2 - PTFE
- ~~3 - Graphite~~
- ~~Firesafe~~
- ~~5 - Graphite~~
- Metal Seated
- ~~5 - Graphite~~

SPECIAL SERVICE
- C - Chlorine
- H - High Temp
- N - NACE
- O - Oxygen

Leave blank if none required

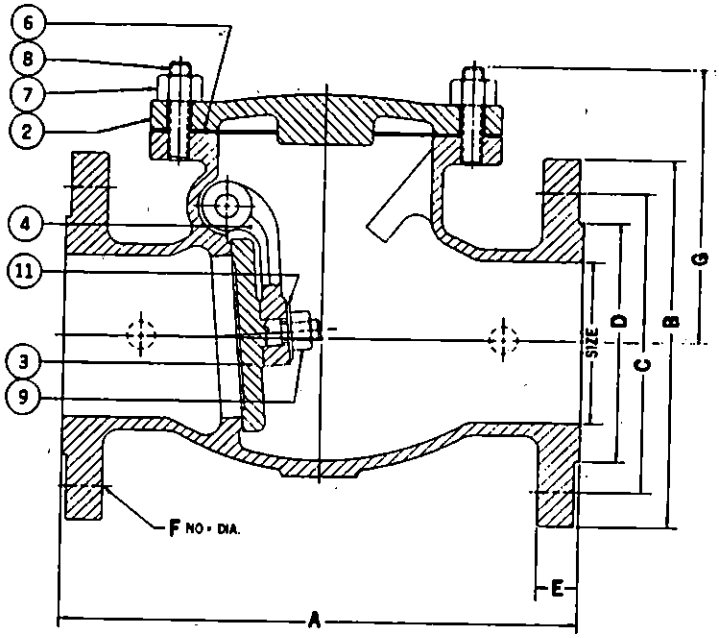


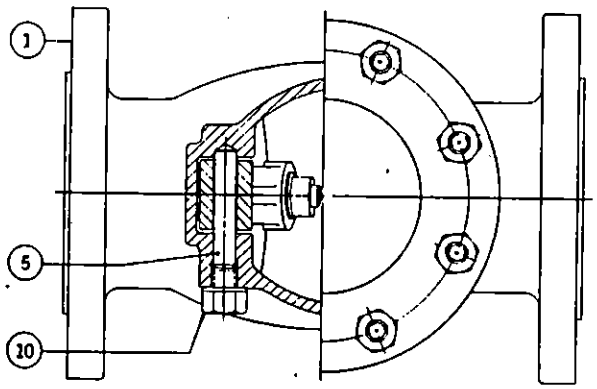
Stainless Steel **Swing Check Valves**

150 Lb

Dimensions/150 Lb/Figure No. S151F6-316

Size	A	B	C	D	E	F	G	wt/lbs
½ "	4¼	3½	2⅜	1⅜	7/16	4 × ⅝	2¾	8
¾ "	4⅝	3⅞	2¾	1 11/16	7/16	4 × ⅝	3¼	9½
1 "	5	4¼	3⅛	2	7/16	4 × ⅝	3½	10½
1½"	6½	5	3⅞	2⅞	9/16	4 × ⅝	3¾	16½
2 "	8	6	4¾	3⅝	⅝	4 × ¾	5	22
2½"	8½	7	5½	4⅛	11/16	4 × ¾	5	33
3 "	9½	7½	6	5	¾	4 × ¾	6¼	45
4 "	11¼	9	7½	6⅜	15/16	8 × ¾	6½	71
6 "	14	11	9⅛	8⅛	1	8 × ⅞	8	123
8 "	19½	13½	11¾	10⅝	1⅛	8 × ⅞	10	220
10 "	24½	16	14¼	12¾	1 5/16	12 × 1	12⅞	330
12 "	27½	19	17	15	1¼	12 × 1	14	500
14 "	31	21	18¾	16¼	1⅜	12 × 1⅛	16⅛	685
16 "	34	23½	21¼	18½	1 7/16	16 × 1⅛	18⅜	1050
18 "	38½	25	22¾	21	1 9/16	16 × 1¼	20⅜	1510
20 "	38½	27½	25	23	1 11/16	20 × 1¼	22½	2020
24 "	51	32	29½	27¼	1⅞	20 × 1⅜	24⅜	2900





Part	Material
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.

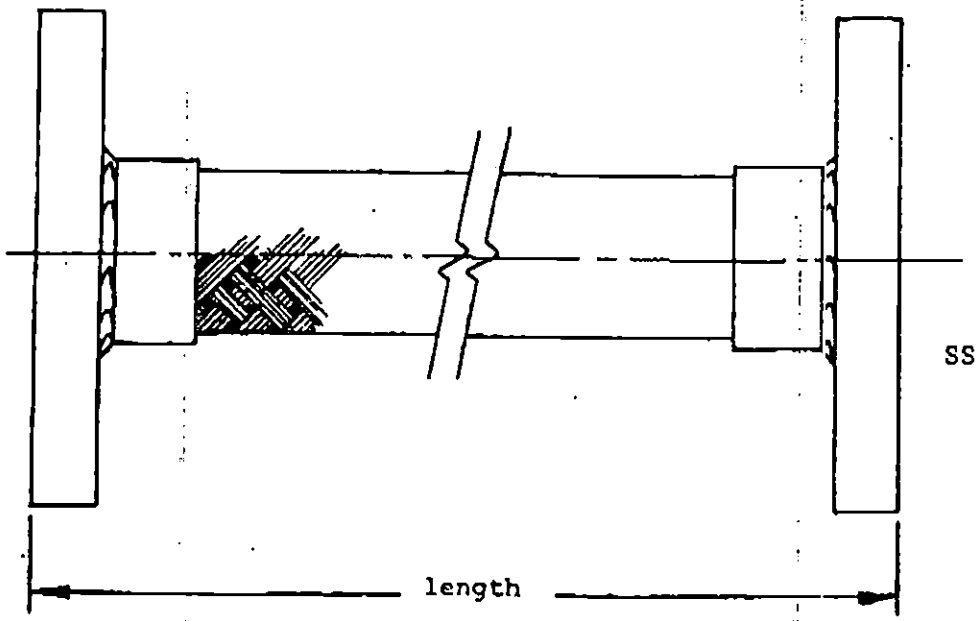
Applicable Standards

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

WILLIAM E.
WILLIAMS
VALVE CORPORATION
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-304 plate with
150# drilling

ITEM	QUANT.	MODEL NO.	SIZE ID & LENGTH	WORKING PRESSURE 70°F		
		PCS 250 FLG	2-1/2 X 9	400#		
		PCS 300 FLG	3 X 9	288#		
		PCS 400 FLG	4 X 9	285#		
		PCS 500 FLG	5 X 11	225#		
		PCS 600 FLG	[redacted]	200#		
		PCS 800 FLG	8 X 12	185#		
		PCS 1000 FLG	[redacted]	175#		
		PCS 1200 FLG	12 X 14	160#		
		PCS 1400 FLG	14 X 14	130#		
		PCS 1600 FLG	16 X 14	110#		

CUSTOMER _____

PROJECT _____

ENGINEER _____

ARCHITECT _____

PRO/P.O.No. _____

[redacted]

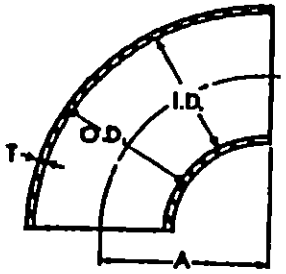
[redacted]

32-900

WELD FITTINGS

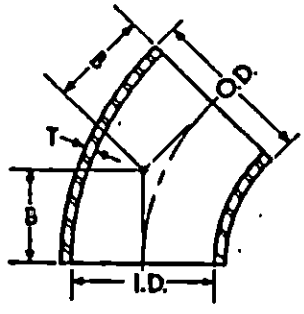
WELD FITTINGS - Are generally manufactured to ASTM A403 with dimensional tolerances in accordance with MSS SP-43 for schedules 5s and 10s and with ANSI B16.9 for schedules heavier than schedule 10s.

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



90° ELBOWS
LONG RADIUS

NOM. PIPE SIZE	OUTSIDE DIAMETER (O.D.)	CENTER TO FACE (A)	SCHEDULE 5S INSIDE DIAMETER (I.D.)	SCHEDULE 5S WALL THICKNESS (T)	SCHEDULE 10S INSIDE DIAMETER (I.D.)	SCHEDULE 10S WALL THICKNESS (T)	SCHEDULE 40S INSIDE DIAMETER (I.D.)	SCHEDULE 40S WALL THICKNESS (T)	SCHEDULE 80S INSIDE DIAMETER (I.D.)	SCHEDULE 80S WALL THICKNESS (T)	NOM. PIPE SIZE
½	.840	1½	.710	.065	.674	.083	.622	.109	.546	.147	½
¾	1.050	1⅛	.920	.065	.884	.083	.824	.113	.742	.154	¾
1	1.315	1½	1.185	.065	1.097	.109	1.049	.133	.957	.179	1
1¼	1.660	1⅞	1.530	.065	1.442	.109	1.380	.140	1.278	.191	1¼
1½	1.900	2¼	1.770	.065	1.682	.109	1.610	.145	1.500	.200	1½
2	2.375	3	2.245	.065	2.157	.109	2.067	.154	1.939	.218	2
2½	2.875	3¾	2.709	.083	2.635	.120	2.469	.203	2.323	.276	2½
3	3.500	4½	3.334	.083	3.260	.120	3.068	.216	2.900	.300	3
3½	4.000	5¼	3.834	.083	3.760	.120	3.548	.226	3.364	.318	3½
4	4.500	6	4.334	.083	4.260	.120	4.026	.237	3.826	.337	4
5	5.563	7½	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	.180	12.000	.375	11.750	.500	12

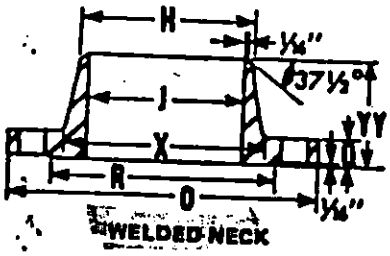


45° ELBOWS
LONG RADIUS

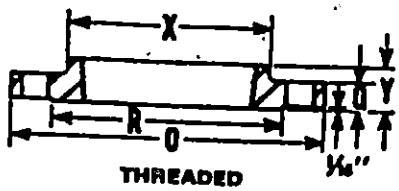
NOM. PIPE SIZE	OUTSIDE DIAMETER (O.D.)	CENTER TO FACE (B)	SCHEDULE 5S INSIDE DIAMETER (I.D.)	SCHEDULE 5S WALL THICKNESS (T)	SCHEDULE 10S INSIDE DIAMETER (I.D.)	SCHEDULE 10S WALL THICKNESS (T)	SCHEDULE 40S INSIDE DIAMETER (I.D.)	SCHEDULE 40S WALL THICKNESS (T)	SCHEDULE 80S INSIDE DIAMETER (I.D.)	SCHEDULE 80S WALL THICKNESS (T)	NOM. PIPE SIZE
½	.840	⅝	.710	.065	.674	.083	.622	.109	.546	.147	½
¾	1.050	7/16	.920	.065	.884	.083	.824	.113	.742	.154	¾
1	1.315	⅞	1.185	.065	1.097	.109	1.049	.133	.957	.179	1
1¼	1.660	1	1.530	.065	1.442	.109	1.380	.140	1.278	.191	1¼
1½	1.900	1⅛	1.770	.065	1.682	.109	1.610	.145	1.500	.200	1½
2	2.375	1⅜	2.245	.065	2.157	.109	2.067	.154	1.939	.218	2
2½	2.875	1¾	2.709	.083	2.635	.120	2.469	.203	2.323	.276	2½
3	3.500	2	3.334	.083	3.260	.120	3.068	.216	2.900	.300	3
3½	4.000	2¼	3.834	.083	3.760	.120	3.548	.226	3.364	.318	3½
4	4.500	2½	4.334	.083	4.260	.120	4.026	.237	3.826	.337	4
5	5.563	3⅛	5.345	.109	5.295	.134	5.047	.258	4.813	.375	5
6	6.625	3¾	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	10.750	6¼	10.482	.134	10.420	.165	10.020	.365	9.750	.500	10
12	12.750	7½	12.438	.156	12.390	.180	12.000	.375	11.750	.500	12

ASA B16.5

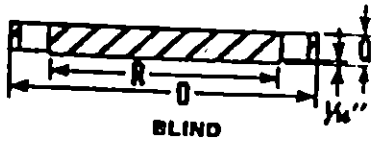
ASA 150 POUND FORGED FLANGES



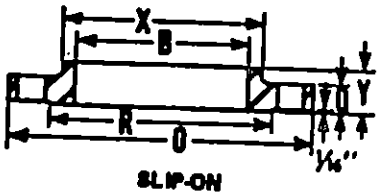
WELDED NECK



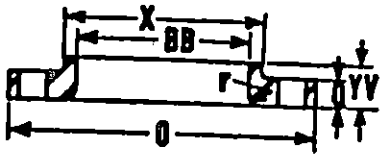
THREADED



BLIND



SLIP-ON



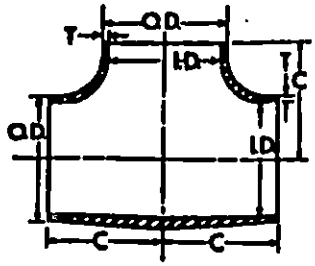
LAP JOINT

NOMINAL PIPE SIZE	COMMON DIMENSIONS						WELDING NECK			SLIP-ON INCREASED			LAP JOINT	
	O	O*	R	X	NUMBER AND DIAMETER OF BOLT HOLES*	BOLT CIRCLE	YY*	H	J*	Y*	B	r	YY	BB
½	3½	7/16	1⅜	1 3/16	4- ⅝	2⅜	1⅞	.84	.62	⅜	.88	⅛	⅜	.90
¾	3⅞	½	1 11/16	1½	4- ⅝	2¾	2 1/16	1.05	.82	⅜	1.09	⅛	⅜	1.11
1	4¼	9/16	2	1 15/16	4- ⅝	3⅛	2 9/16	1.32	1.05	11/16	1.36	⅛	11/16	1.38
1¼	4⅝	⅝	2½	2 5/16	4- ⅝	3½	2¼	1.66	1.38	13/16	1.70	3/16	13/16	1.72
1½	5	11/16	2⅞	2 9/16	4- ⅝	3⅞	2 7/16	1.90	1.61	⅞	1.95	¼	⅞	1.97
2	6	¾	3⅝	3 1/16	4- ¾	4¾	2½	2.38	2.07	1	2.44	5/16	1	2.46
2½	7	⅞	4⅛	3 9/16	4- ¾	5½	2¾	2.88	2.47	1⅛	2.94	5/16	1⅛	2.97
3	7½	15/16	5	4¼	4- ¾	6	2¾	3.50	3.07	1 3/16	3.57	⅜	1 3/16	3.60
3½	8½	15/16	5½	4 13/16	8- ¾	7	2 13/16	4.00	3.55	1¼	4.07	⅜	1¼	4.10
4	9	15/16	6 3/16	5 5/16	8- ¾	7½	3	4.50	4.03	1 5/16	4.57	7/16	1 5/16	4.60
5	10	15/16	7 5/16	6 7/16	8- ⅞	8½	3½	5.56	5.05	1 7/16	5.66	7/16	1 7/16	5.69
6	11	1	8½	7 9/16	8- ⅞	9½	3½	6.63	6.07	1 9/16	6.72	½	1 9/16	6.75
8	13½	1⅛	10⅝	9 11/16	8- ⅞	11¾	4	8.63	7.98	1¾	8.72	½	1¾	8.75
10	16	1 3/16	12¾	12	12-1	14¼	[illegible]	10.75	10.02	1 15/16	10.88	½	1 15/16	10.92
12	19	1¼	15	14⅛	12-1	17	4½	12.75	12.00	2 3/16	12.88	½	2 3/16	12.92

Flanges conform to ASA B16.5.

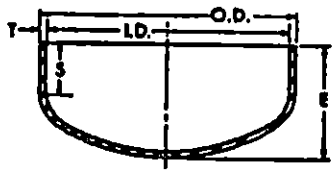
+ [illegible] raised face is included in thickness O and length through hub Y, YY

* Unless otherwise specified Welding Neck Flanges in sizes 12" and smaller are based in dimensions on listed to correspond to Schedule 40S pipe. Special bores on specification. Sizes 14" and larger—bore to be specified by purchaser.



STRAIGHT TEES

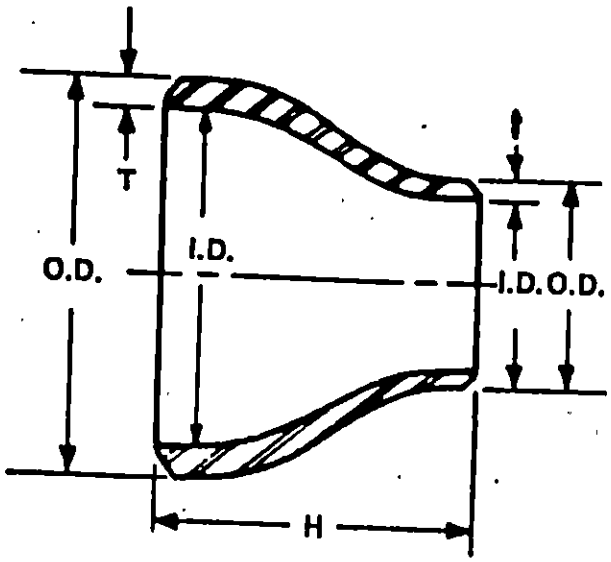
NOM. PIPE SIZE	OUTSIDE DIAMETER (O.D.)	CENTER TO END (C)	SCHEDULE 5S INSIDE DIAMETER (I.D.)	SCHEDULE 5S WALL THICKNESS (T)	SCHEDULE 10S INSIDE DIAMETER (I.D.)	SCHEDULE 10S WALL THICKNESS (T)	SCHEDULE 40S INSIDE DIAMETER (I.D.)	SCHEDULE 40S WALL THICKNESS (T)	SCHEDULE 80S INSIDE DIAMETER (I.D.)	SCHEDULE 80S WALL THICKNESS (T)	NOM. PIPE SIZE
½	.840	1	.710	.065	.674	.083	.622	.109	.546	.147	½
¾	1.050	1⅛	.920	.065	.884	.083	.824	.113	.742	.154	¾
1	1.315	1½	1.185	.065	1.097	.109	1.049	.133	.957	.179	1
1¼	1.660	1⅞	1.530	.065	1.442	.109	1.380	.140	1.278	.191	1¼
1½	1.900	2¼	1.770	.065	1.682	.109	1.610	.145	1.500	.200	1½
2	2.375	2½	2.245	.065	2.157	.109	2.067	.154	1.939	.218	2
2½	2.875	3	2.709	.083	2.635	.120	2.469	.203	2.323	.276	2½
3	3.500	3⅜	3.334	.083	3.260	.120	3.068	.216	2.900	.300	3
3½	4.000	3¾	3.834	.083	3.760	.120	3.548	.226	3.364	.318	3½
4	4.500	4⅛	4.334	.083	4.260	.120	4.026	.237	3.826	.337	4
5	5.563	4⅞	5.345	.109	5.295	.134	5.047	.258	4.813	.375	5
6	6.625	5⅝	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	10.750	8½	10.482	.134	10.420	.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

NOM. PIPE SIZE	OUTSIDE DIAMETER (O.D.)	LENGTH (E) TANGENT LENGTH (S)	SCHEDULE 5S INSIDE DIAMETER (I.D.)	SCHEDULE 5S WALL THICKNESS (T)	SCHEDULE 10S INSIDE DIAMETER (I.D.)	SCHEDULE 10S WALL THICKNESS (T)	SCHEDULE 40S INSIDE DIAMETER (I.D.)	SCHEDULE 40S WALL THICKNESS (T)	SCHEDULE 80S INSIDE DIAMETER (I.D.)	SCHEDULE 80S WALL THICKNESS (T)	NOM. PIPE SIZE
½	.840	E 1 S .74	.710	.065	.674	.083	.622	.109	.546	.147	½
¾	1.050	E 1 S .88	.920	.065	.884	.083	.824	.113	.742	.154	¾
1	1.315	E 1½ S 1.10	1.185	.065	1.097	.109	1.049	.133	.957	.179	1
1¼	1.660	E 1½ S 1.02	1.530	.065	1.442	.109	1.380	.140	1.278	.191	1¼
1½	1.900	E 1½ S .95	1.770	.065	1.682	.109	1.610	.145	1.500	.200	1½
2	2.375	E 1½ S .83	2.245	.065	2.157	.109	2.067	.154	1.939	.218	2
2½	2.875	E 1½ S .88	2.709	.083	2.635	.120	2.469	.203	2.323	.276	2½
3	3.500	E 2 S 1.02	3.334	.083	3.260	.120	3.068	.216	2.900	.300	3
3½	4.000	E 2½ S 1.40	3.834	.083	3.760	.120	3.548	.226	3.364	.318	3½
4	4.500	E 2½ 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	E 3½ S 1.70	6.407	.109	6.357	.134	6.065	.280	5.761	.432	6
8	8.625	E 4 S 1.88	8.407	.109	8.329	.148	7.981	.322	7.625	.500	8
10	10.750	E 5 S 2.13	10.482	.134	10.420	.165	10.020	.365	9.750	.500	10
12	12.750	E 6 S 2.63	12.438	.156	12.390	.180	12.000	.375	11.750	.500	12

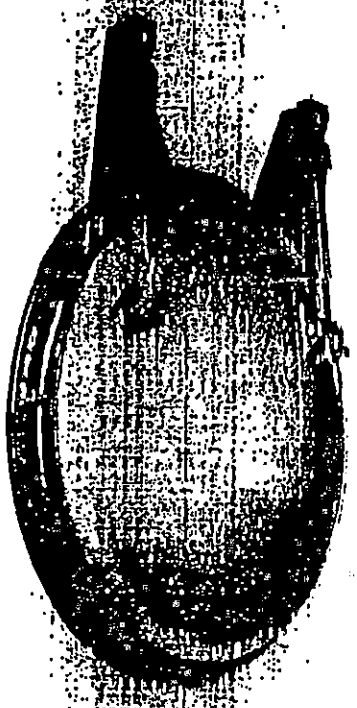
CONCENTRIC REDUCERS (CONT'D)



NOM. PIPE SIZE	OUTSIDE DIAMETER LARGE END (O.D.)	OUTSIDE DIAMETER SMALL END (O.D.)	LENGTH (H)	SCHEDULE 5S INSIDE DIAM (I.D.) LARGE END - LE SMALL END - SE	SCHEDULE 5S WALL THICKNESS LARGE END - T SMALL END - t	SCHEDULE 10S INSIDE DIAM (I.D.) LARGE END - LE SMALL END - SE	SCHEDULE 10S WALL THICKNESS LARGE END - T SMALL END - t	SCHEDULE 40S INSIDE DIAM (I.D.) LARGE END - LE SMALL END - SE	SCHEDULE 40S WALL THICKNESS LARGE END - T SMALL END - t	SCHEDULE 80S INSIDE DIAM (I.D.) LARGE END - LE SMALL END - SE	SCHEDULE 80S WALL THICKNESS LARGE END - T SMALL END - t	NOM. PIPE SIZE
6x3½	6.625	4.000	5½	LE 6.407 SE 3.834	T .109 t .083	LE 6.357 SE 3.760	T .134 t .120	LE 6.065 SE 3.548	T .280 t .226	LE 5.761 SE 3.364	T .432 t .318	6x3½
6x4	6.625	4.500	5½	LE 6.407 SE 4.334	T .109 t .083	LE 6.357 SE 4.260	T .134 t .120	LE 6.065 SE 4.026	T .280 t .237	LE 5.761 SE 3.826	T .432 t .337	6x4
6x5	6.625	5.563	5½	LE 6.407 SE 5.345	T .109 t .109	LE 6.357 SE 5.295	T .134 t .134	LE 6.065 SE 5.047	T .280 t .258	LE 5.761 SE 4.813	T .432 t .375	6x5
8x3½	8.625	4.000	6	LE 8.407 SE 3.834	T .109 t .083	LE 8.329 SE 3.760	T .148 t .120	LE 7.981 SE 3.548	T .322 t .226	LE 7.625 SE 3.364	T .500 t .318	8x3½
8x4	8.625	4.500	6	LE 8.407 SE 4.334	T .109 t .083	LE 8.329 SE 4.260	T .148 t .120	LE 7.981 SE 4.026	T .322 t .237	LE 7.625 SE 3.826	T .500 t .337	8x4
8x5	8.625	5.563	6	LE 8.407 SE 5.345	T .109 t .109	LE 8.329 SE 5.295	T .148 t .134	LE 7.981 SE 5.047	T .322 t .258	LE 7.625 SE 4.813	T .500 t .375	8x5
8x6	8.625	6.625	6	LE 8.407 SE 6.407	T .109 t .109	LE 8.329 SE 6.357	T .148 t .134	LE 7.981 SE 6.065	T .322 t .280	LE 7.625 SE 5.761	T .500 t .432	8x6
10x4	10.750	4.500	7	LE 10.482 SE 4.334	T .134 t .083	LE 10.420 SE 4.260	T .165 t .120	LE 10.020 SE 4.026	T .365 t .237	LE 9.750 SE 3.826	T .500 t .337	10x4
10x5	10.750	5.563	7	LE 10.482 SE 5.345	T .134 t .109	LE 10.420 SE 5.295	T .165 t .134	LE 10.020 SE 5.047	T .365 t .258	LE 9.750 SE 4.813	T .500 t .375	10x5
10x6	10.750	6.625	7	LE 10.482 SE 6.407	T .134 t .109	LE 10.420 SE 6.357	T .165 t .134	LE 10.020 SE 6.065	T .365 t .280	LE 9.750 SE 5.761	T .500 t .432	10x6
10x8	10.750	8.625	7	LE 10.482 SE 8.407	T .134 t .109	LE 10.420 SE 8.329	T .165 t .148	LE 10.020 SE 7.981	T .365 t .322	LE 9.750 SE 7.625	T .500 t .500	10x8
12x5	12.750	5.563	8	LE 12.438 SE 5.345	T .156 t .109	LE 12.390 SE 5.295	T .180 t .134	LE 12.000 SE 5.047	T .375 t .258	LE 11.750 SE 4.813	T .500 t .375	12x5
12x6	12.750	6.625	8	LE 12.438 SE 6.407	T .156 t .109	LE 12.390 SE 6.357	T .180 t .134	LE 12.000 SE 6.065	T .375 t .280	LE 11.750 SE 5.761	T .500 t .432	12x6
12x8	12.750	8.625	8	LE 12.438 SE 8.407	T .156 t .109	LE 12.390 SE 8.329	T .180 t .148	LE 12.000 SE 7.981	T .375 t .322	LE 11.750 SE 7.625	T .500 t .500	12x8
12x10	12.750	10.750	8	LE 12.438 SE 10.482	T .156 t .134	LE 12.390 SE 10.420	T .180 t .165	LE 12.000 SE 10.020	T .375 t .365	LE 11.750 SE 9.750	T .500 t .500	12x10

AUTOMATIC FLAP GATES
CIRCULAR OPENING

HEAVY DUTY TYPE



Circular heavy duty flap gate, flat frame type with flexible and adjustable hinge link mechanism.

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 flange.

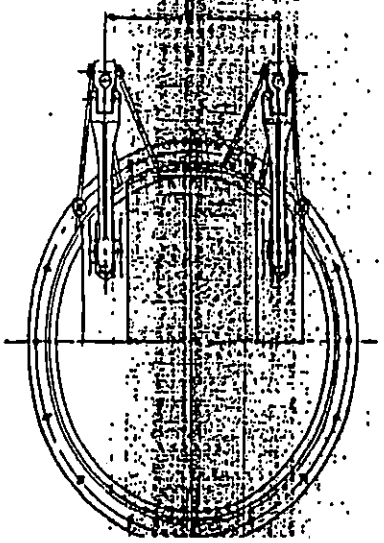
The gate has two adjustment features: at the top laterally and at the center for any misalignment. Hinge points have lubrication fittings.

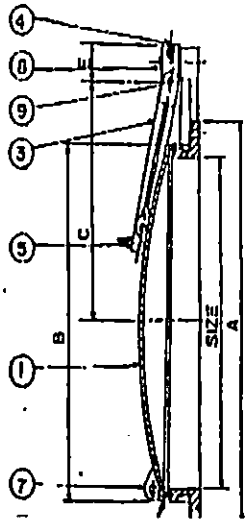
The flap opens on minimum differential head.

DIMENSIONS — INCHES

Size Diam.	A	B	C	D	E
18	25	21¼	17¼	—	5
20	27½	23¼	20	—	5
21	28½	24¼	20½	—	5
24	32	27¼	18	—	5
30	38¾	35	26½	24	6
36	46	41	27	26	6½
42	53	47	31½	30	7½
48	59½	53½	30	34	7½
54	66¼	59	40½	38	7½
60	73	65	45	42	7½
66	80	71	48	42	7½
72	86½	77	58¾	50	7⅞
78	93	81	64	55	8
84	99¾	92	69	60	8
90	106¼	98	74	65	8
96	113¾	104	79	70	8

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

24" ϕ FLAP VALVE

CRAFT

CRAFT MACHINE WORKS, INC.
2102 49th Street, Hampton, Virginia 23661
Tele: (804) 380-8615 Fax: (804) 380-9120

SUGGESTED CAST IRON TIDE GATE SPECIFICATIONS

Tide Gates shall be solid, ribbed tide gates, complete with frames, bronze, neoprene, or cast iron seat facing, double adjustable hinges, posts and links, mounted to wall thimbles, or walls, as manufactured by Craft Machine Works, Inc. of Hampton, Virginia.

Materials

Flap & Frame	- Cast Iron ASTM A126 Class B
Hinge Links	- Ductile Iron
Hinges	- Manganese Bronze
Hinge Posts & Pins	- Silicon Bronze
Adjusting Screws	- Silicon Bronze
Anchor Studs & Nuts	- Stainless Steel ASTM A276 Type 316
Wall Thimble (if required)	- Cast Iron ASTM A126 Class B
Seat Face	- Bronze, Neoprene or Cast Iron

Flap

The Tide Gate Flap shall be of Cast Iron ASTM A126 Class B with vertical and horizontal ribs capable of withstanding the design head with a safety factor of 5.

Frame

The Tide Gate Frame shall be Cast Iron ASTM A126 Class B. The flange shall be faced and drilled to match the anchor bolt layout provided. The seat facing of the frame shall be sloped from the vertical with a dovetail groove machined to accept the neoprene or bronze seat which shall be mechanically retained without the use of fasteners. Metal thickness of the frame shall not be less than 1" with flanges not less than 1-1/2" thick.

Seats

Seat facings shall be malleable extruded bronze of a composition which will resist dezincification and will increase in working ability with cold working. The seat facings shall be machined to a 63 micro-inch finish or better, or neoprene Seats made from stock of the best grade of neoprene having a tensile strength of 1,500 p.s.i., a minimum elongation of 400 percent and a durometer hardness number 60±5 on the shore "A" scale.

The installed seat facing will be made of a special shape to fill and permanently lock into the machined dovetail grooves when installed.

Seats shall be cast iron machined to a 125 micro-inch finish or better.

CRAFT

CRAFT MACHINE WORKS, INC.
2102 48th Street, Hampton, Virginia 23661
Tele: (804) 380-8615 Fax: (804) 380-9120

SUGGESTED CIRCULAR FLAP VALVES SPECIFICATIONS

Circular Flap Valves where shown in the valve schedule and contract drawings, shall be as manufactured by the Craft Machine Works, Inc., Hampton, Virginia.

Valves shall have a cast iron flanged frame, cast iron flap, with iron to iron, bronze, or neoprene seating. The hinge arms and flap shall be cast in one piece, and shall be attached to the frame by means of a bronze pivot pin.

Flap valves less than Six inch in diameter with bronze or neoprene seating shall have a cast bronze flap, otherwise the flap is of cast iron.

CRAFT

SUGGESTED CAST IRON TIDE GATE SPECIFICATIONS

HINGE LINKS

Hinge Links shall be of ductile iron, bronze bushed and provided with noncorrosive grease fittings. Adjustable hinges shall be of manganese bronze. Hinge posts, hinge pins, and adjusting studs shall be of silicon bronze.

CASTINGS

Casting shall be true to pattern, sound, smooth, and without injurious cold shunts, swells, lump scabs, scoria, sand holes and other defects and imperfections.

Plugging and filling will not be allowed where the physical strength of the casting will be impaired. All castings shall be thoroughly cleaned, inside and outside, of sand and dirt. Sandblasting, wire brushes, scrapers or other approved mechanical appliances shall be used for this purpose. Acid or other corrosive liquids shall not be used in the cleaning of castings.

WALL THIMBLES

Wall Thimbles shall be of the section ("F") and depth as indicated on the plans and listed in the gate schedule. They shall be Cast Iron, one piece construction, of adequate strength to withstand all operational and reasonable installation stresses. Wall thimbles shall be internally braced during concrete placement. A center ring or waterstop will be cast around the periphery of the thimble. The front flange will be machined and have tapped holes for the Tide Gate attaching studs. Large rectangular wall thimbles will be provided with holes in the invert to allow satisfactory concrete placement beneath the thimble.

WORKING DRAWINGS

Detailed working drawings and descriptions shall be furnished in conformity with the General Conditions of the Contract Documents.

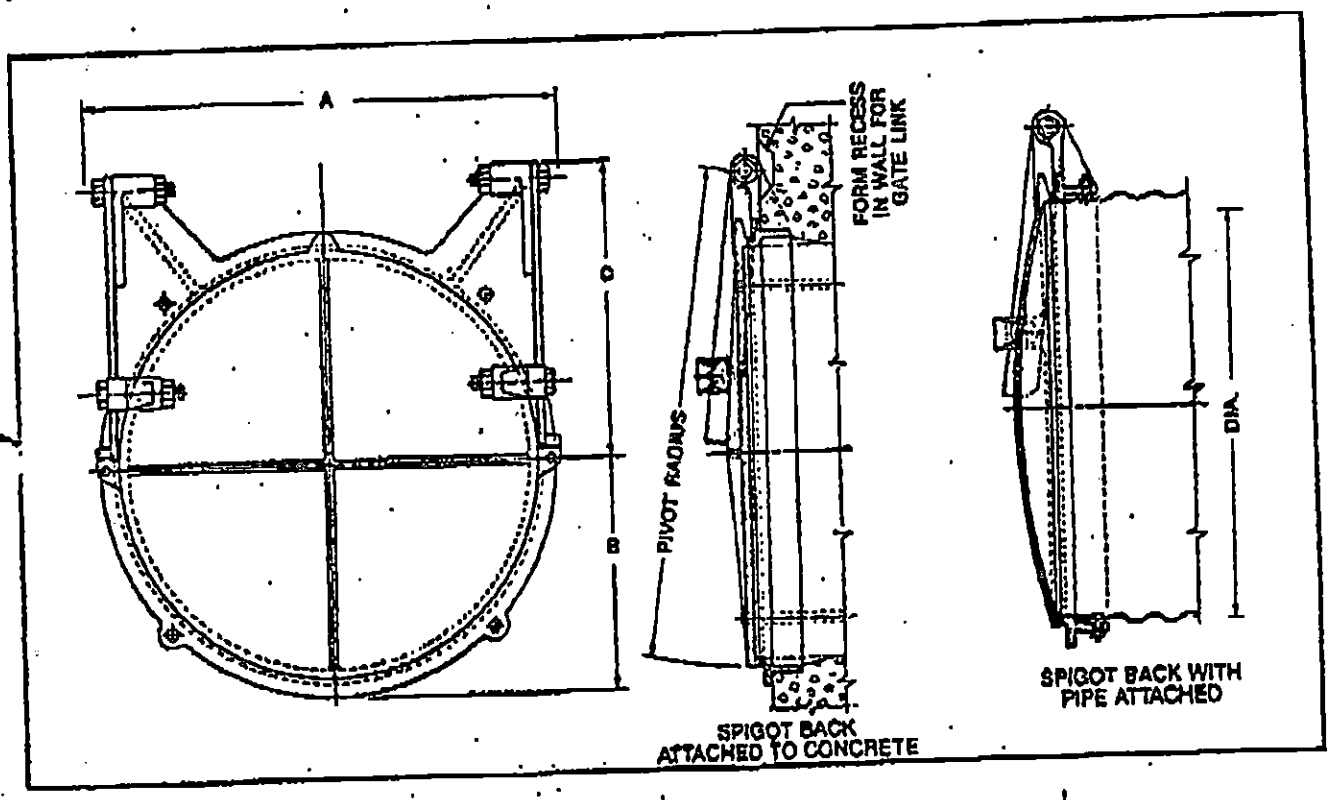
MODEL 10C FLAP GATE

- For seating heads to 10 feet
- Round opening
- Spigot back
- Cast iron seating surfaces

The Model 10C flap gate consists of the simplest possible design with double hinge action for heads to 10 feet. Pivot points are stationary. Ring and flap are of cast iron with galvanized steel hinge arms and assembly bolts and bronze bushings. Extension of the cast iron bosses of the flap over the top of the pivot arms limits the double hinge action, and prevents the bottom of the flap from folding inside the ring and wedging the gate in the open position.

The gate is made in spigot back for attaching to corrugated steel pipe. Most sizes are now available in flat back for attaching to a concrete wall. Anchor bolts are placed in the original pour of concrete. After the gate is in place on the anchors and properly aligned using the double nuts, grout is packed between the gate seat and the wall.

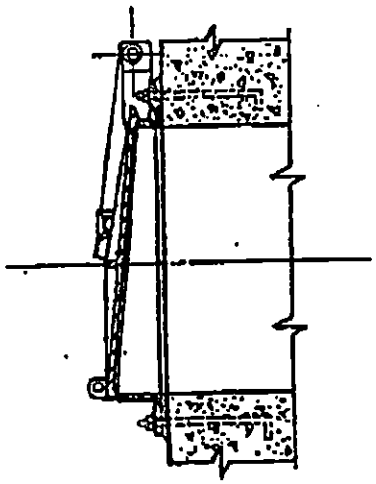
This gate opens under a minimum head differential, yet is positive closing under a few inches of water on the face of the gate. A lifting eye is cast integrally with the flap to permit manual operation.



(All Dimensions in Inches)

SIZE	A*	B	C	PIVOT RADIUS
6	8.75	3.75	4.75	7.50
8	10.75	5.00	6.50	10.25
10	12.75	6.25	8.00	12.50
12	15.25	7.25	9.25	15.00
15	18.75	9.00	11.50	18.50
18	21.75	10.50	13.75	22.25
21	24.75	12.25	16.00	26.00
24	27.75	13.75	18.00	29.75
30	34.25	17.00	21.75	36.25
36	41.50	20.50	26.25	43.75
42	47.50	23.50	31.00	51.50
48	54.00	27.00	35.50	58.75

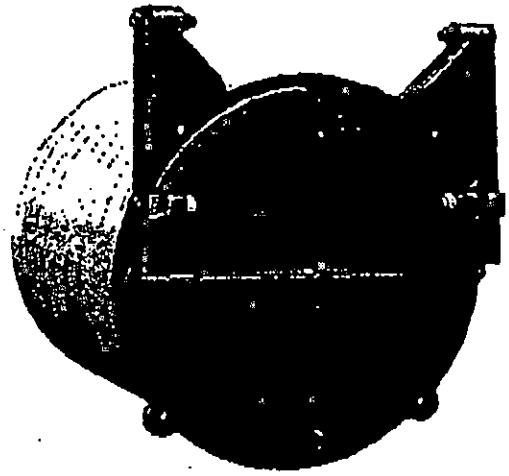
*Maximum width of gate may occur at top or on horizontal center line. "A" dimension is shown for maximum horizontal width of gate.



FLAT BACK ATTACHED TO CONCRETE

Revised 8-85

SPECIFICATIONS FOR MODEL 10C FLAP GATE



General
Flap gates shall be ~~Armco~~ FRESNO Model 10C or approved equal. Similar installations shall have operated successfully for five years or more. All component parts shall be of the type material shown in the Materials section of this specification.

Seat
The spigot back seat shall be one-piece cast iron with a raised section around the perimeter of the waterway to provide the seating face. The seat shall be shaped to provide two pivot bosses extended above the top of the waterway opening.

Cover
The cover shall be one-piece cast iron with pivot point bosses, a lifting eye and a reinforced section around the perimeter of the waterway opening. Pivot bosses shall be designed to limit the double hinge action, preventing the cover from rotating sufficiently to become wedged in the open position.

Seating Faces
The cast iron seating faces of the seat and cover shall be machined to a plane with a minimum 63 micro-inch finish.

Links
The links connecting the cover and the upper pivot bosses shall be one-piece galvanized steel and of sufficient section to safely withstand the normal forces encountered during gate operation. Each link shall be provided with a commercial grade bronze bushing at the pivot points.

Fasteners
All anchor bolts, assembly bolts and nuts shall be galvanized steel and of ample section to safely withstand forces created by operation of the gate under the heads shown in the Gate Schedule. Quantity and size of the fasteners shall be as recommended by the manufacturer. Anchor bolts shall be furnished with two nuts each to install gates attached to concrete.

Painting
Exposed machined or bearing surfaces shall be coated with a water-resistant rust preventive compound. All assembled units shall be shop painted in accordance with the manufacturer's standard practice.

Installation
Installation of the flap gates shall be done by the contractor in a workmanlike manner in accordance with the manufacturer's instructions.

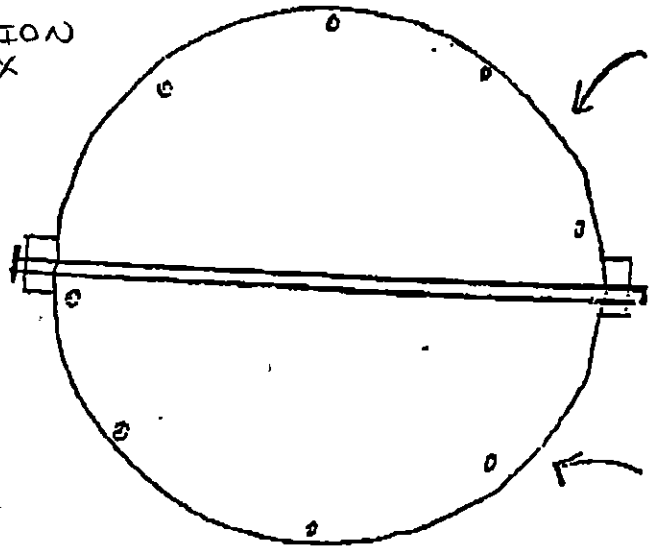
Materials
Materials shall conform to the requirements of the following ASTM Standards.

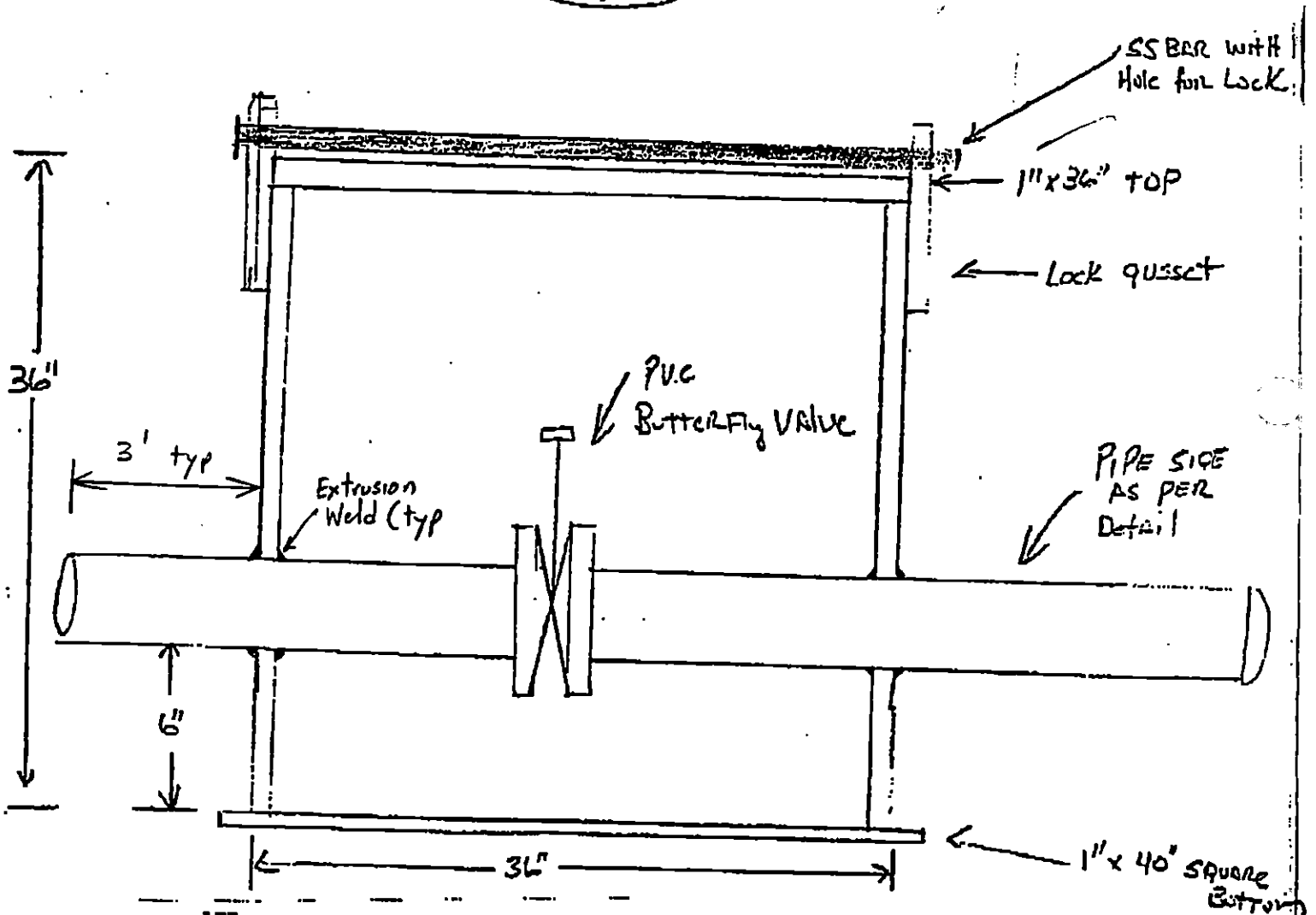
CAST IRON	A 126, Class B
GALVANIZED STEEL (Fasteners)	A 307 (Bolts) A 164 (Galvanized Coating)
GALVANIZED STEEL	A 36 or A 306 (Carbon Steel) A 123 (Galvanized Coating)

GATE SCHEDULE

QUANTITY REQUIRED	SIZE OPENING	SEATING HEAD	REMARKS

GAS EXTRACTION VALVE BOX





LEE SUPPLY CO. INC.
• DIVERSIFIED PIPING SYSTEMS
• INDUSTRIAL • MINING • ENVIRONMENTAL PRODUCTS

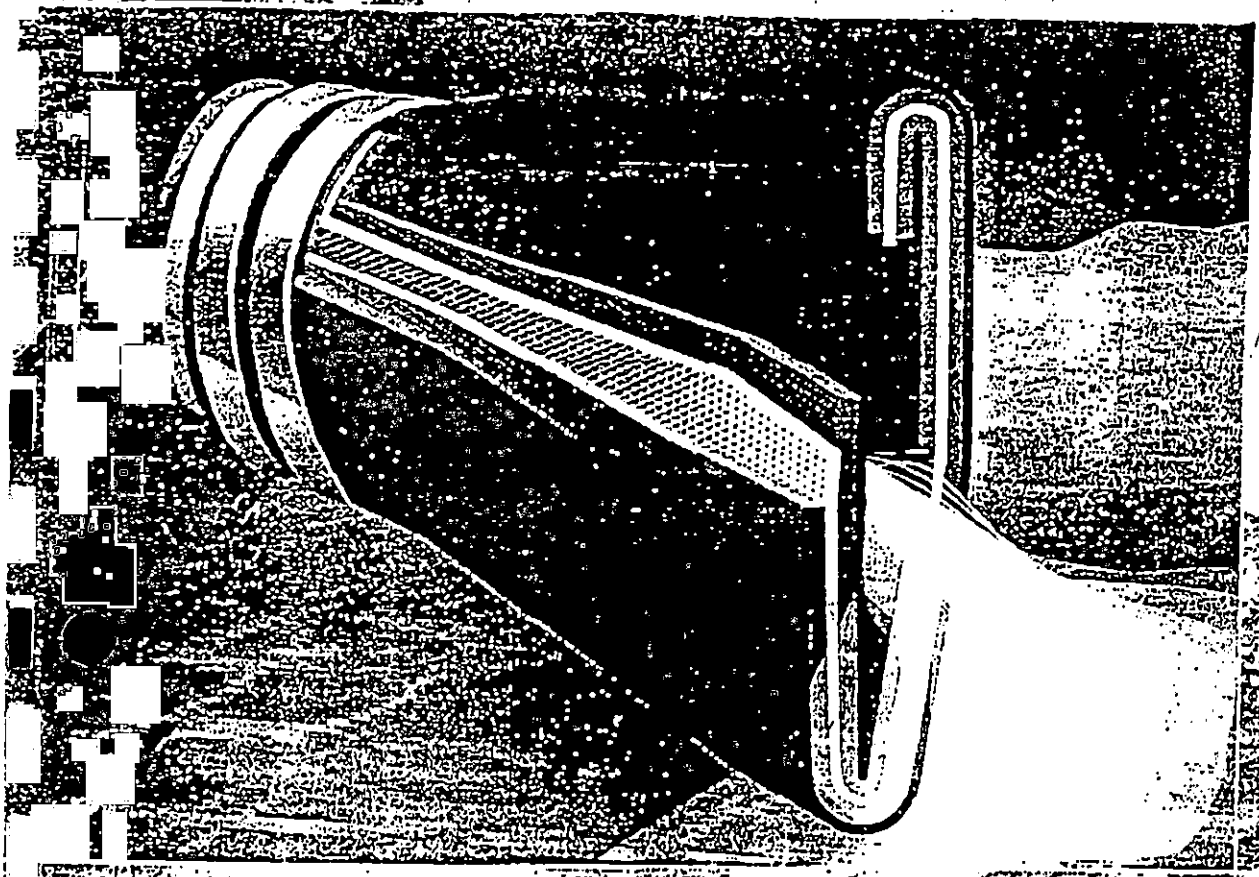
P.O. Box 35 Charleroi, PA 15022

Phone: 412-483-3543 FAX: 412-483-0577

PIPE DETAIL

VALVE BOX	PIPE Φ
1	4"
2	8"
3	8"
4	8"
5	6"
6	4"

TIDE FLEX
CHECK VALVES



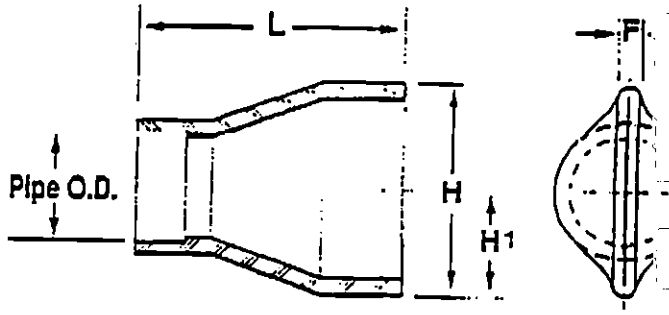
Tideflex™

ERFORMANCE

Ordering Information

Specifying information required to custom-build a Tideflex™ Valve for your exact application includes line pressure, back pressure, flow rate and velocity and O.D. of pipeline.

Red Valve manufactures Tideflex™ Valves to special O.D. dimensions and can also provide a mounting thimble.



Ordering a Tideflex™ Valve is as easy as completing this chart!

	Minimum	Maximum
Back Pressure	_____	_____
Line Pressure	_____	_____

Maximum Flow Rate _____

Maximum Flow Velocity _____

Discharge To: ☐ Atmosphere ☐ Under Water

Pipe O.D. _____ Pipe Material _____

VALVE SIZE (NOM.)	STEEL PIPE O.D.*	MAXIMUM LENGTH L	MAXIMUM HEIGHT H**	CENTERLINE TO BASE HEIGHT H1	Wi
1/2"	.840	2-1/2"	1-3/16"	19/32"	
3/4"	1.050	2-3/4"	1-15/16"	31/32"	
1"	1.315	3"	2"	1"	
1-1/4"	1.660	3"	2"	1	
1-1/2"	1.900	6-1/4"	2-13/16"	1-13/32	
2"	2-3/8"	6"	3-3/4"	1-7/8"	
2-1/2"	2-7/8"	7"	4-9/16"	2-9/32"	
3"	3-1/2"	8"	5-1/4"	2-5/8"	
4"	4-1/2"	9"	7-1/4"	3-5/8"	
5"	5-9/16"	16"	10-5/8"	5-5/16"	1-
6"	6-5/8"	13"	10-3/8"	5-3/16"	
8"	8-5/8"	16"	13-1/16"	6-17/32"	15
10"	10-3/4"	19"	15-3/8"	7-11/16"	
12"	12-3/4"	22"	17-13/16"	8-29/32"	
14"	14"	22"	21-1/2"	10-3/4"	1-
16"	16"	24"	22-1/4"	11-1/8"	1-
18"	18"	26"	26-3/4"	13-3/8"	1-
20"	20"	27"	29-3/4"	14-7/8"	1-
24"	24"	36"	37-1/4"	18-5/8"	1-
30"	30"	38"	43-3/4"	21-7/8"	
32"	29-1/4"	46"	46-1/2"	23-1/4"	
36"	36"	50"	51-3/8"	25-11/16"	2-
42"	42"	64"	61-1/2"	30-3/4"	2-
48"	48"	65"	81-1/2"	30-3/4"	2-
51"	50-3/4"	74"	64-1/2"	32-1/4"	2-
60"	60"	78"	80-3/4"	40-3/8"	2-
72"	72"	95"	103"	51-1/2"	
78"	78"	92"	111"	55-1/2"	
84"	84"	88"	111"	55-1/2"	
90"	90"	98"	119-1/2"	59-3/4"	3

*Steel, Concrete, and Ductile Iron pipe O.D.s vary. It is important to for proper sizing.

**Height may vary slightly due to customized construction.

TIDEFLEX™ PE

E.P.A. Tests Call Tideflex™ an "Excellent Solution."

The Enrivonmental Protection Agency's (E.P.A.) recent test results proved Red Valve's patented Tideflex™ Check Valve to be an excellent solution to eliminate maintenance costs and operational failures with traditional flap gate valves.

According to the report:

"Problems with malfunctioning flap gates, like frozen hinge pins, accumulation of debris, worn seats, misalignment, warpage and corroded parts and costs of maintenance crews are eliminated with the Tideflex™ Valve."

Today, thousands of patented Tideflex™ Valves and diffuser valve systems are operating maintenance-free worldwide. These valves have successfully withstood severe winter freezes, typhoons, hurricanes and flooding, minimizing damage to wetlands, beaches and residential areas, eliminating hydraulic surges to waste water treatment plants and saving municipalities millions of dollars in maintenance and treatment costs.

PROBLEM

These traditional flap gate valves were held open by telephone poles to eliminate loud clanging noises and allow for better outflow. Unfortunately, they no longer prevented backflow into the city's water treatment plant.

SOLUTION

Tideflex™ all rubber check valves were installed, and eliminated the noise as well as completely preventing the backflow problem. Simply Revolutionary!

Function

The Tideflex™ Valve is manufactured of flexible elastomer material reinforced with synthetic fabric much like an automobile tire. Neoprene construction with a special EPDM cover for ozone protection is furnished as a standard. Pure Gum Rubber, Hypalon, Butyl, Buna-N, EPDM and Viton are also available, and come with standard EPDM covers.

Forward hydraulic pressure opens the valve automatically without any additional energy source and reverse hydraulic pressure seals the valve automatically. The Tideflex™ Valve is simple to install. Two metal bands easily connect it to the O.D. of a pipeline.

By engineering the elastomer fabric matrix in varying degrees of flexibility, each Tideflex™ Valve is customized to your exact application to open with minimum specified head pressure and withstand maximum specified back pressure.

This versatile design of the Tideflex™ Valve also allows it to be used as a vacuum breaker on pipelines and pressure vessels to prevent closing.

The inherent cushioning action of the Tideflex™ Valve's elastomer design completely eliminates noise. The valve's heavy-duty construction makes it vandal-proof and reduces the likelihood of children entering a pipeline.

A number of other custom-designed check valves like Red Valve's Series 33 are available for in-line service.

TYPICAL SUBMITTAL DRAWING

CHECK VALVE SIZE	A	B	C	D	E
1/4	.687	3	.500	1.062	.500
1/2	.687	2.500	.500	.500	.500
3/4	1.437	2.750	.750	.500	.500
1	1.375	3	.750	.750	.625
1-1/4	1.375	3	.750	.750	.625
1-1/2	2.187	4	.875	.750	.625

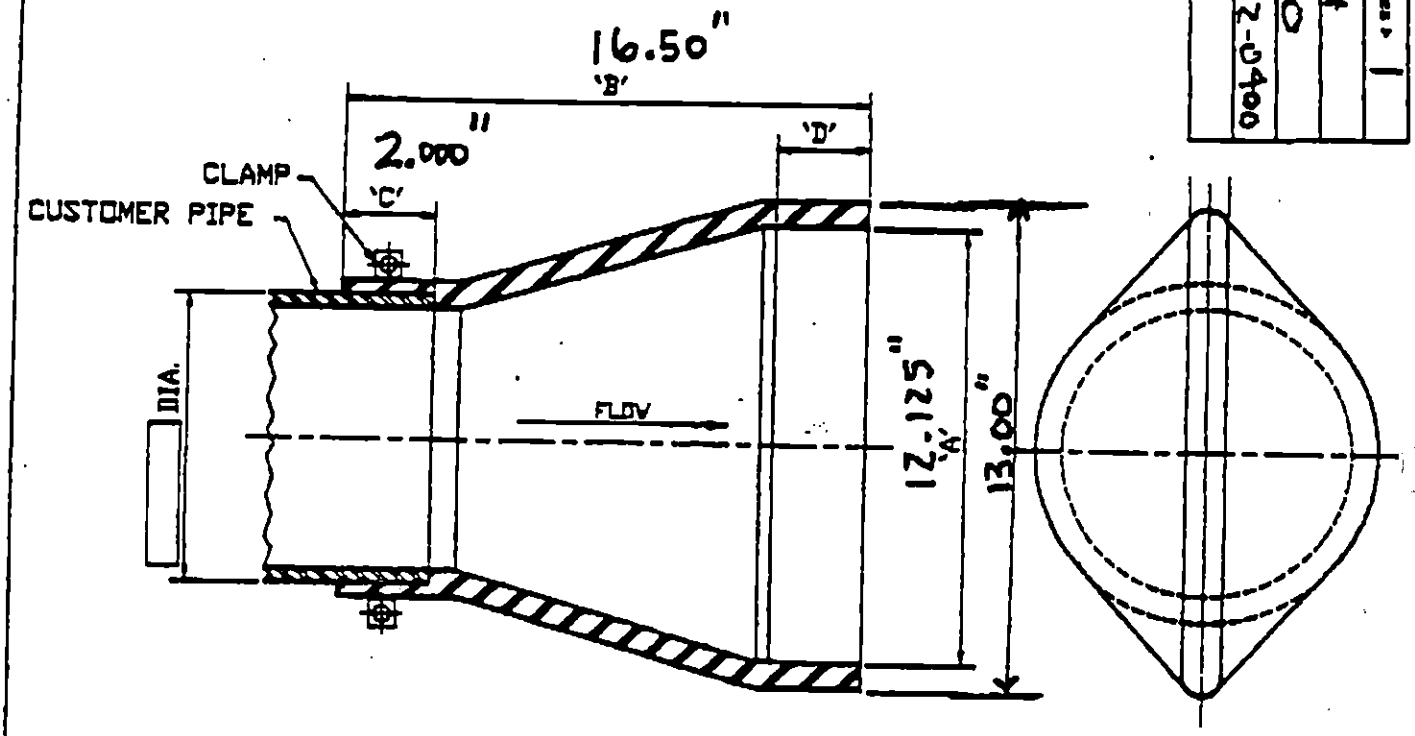
Post-it® brand fax transmittal memo 7671 | # of pages ▸ 1

To JEFF | From KEITH

Co. BARBELLA | Co. TISCO

Dept. | Phone # 201-492-0400

Fax # | Fax #



NOTES:

1. MAXIMUM BACK PRESSURE - 6 FEET
   LINE PRESSURE - GRAVITY / MIN. TO OPEN
2. MATERIAL TO BE BUNA-N
3. VALVE IS FURNISHED WITH 2 STAINLESS STEEL MOUNTING CLAMPS
4. VALVE IS TO BE MOUNTED WITH THE OUTLET IN THE VERTICAL POSITION
5. TIDEFLEX TO FIT ON A 8 5/8 DIA. ~~PIPE~~ HDPE PIPE

CUSTOMER APPROVAL

SIGNED_____ DATE_____

02223_
2.3

RED VALVE PRODUCT NO.

TF-2 TIDEFLEX CHECK VALVE

DWG. BY V. KISH CHK'D BY DATE 90-11-20	CUSTOMER ORDER NO.	RED VALVE CO. INC. 700 NORTH BELL AVENUE CARNEGIE, PA 15106	DWG. NO. RVS-	REV. 0
DATA BY:		FILENAME TF2T2RA	S.O. NO.	

15100 - 2.2

KENNEDY VALVE KENSEAL II RESILIENT WEDGE VALVES

KENNEDY VALVE

KENNEDY VALVE AWWA Resilient Wedge Gate Valves Meet or Exceed the Requirements of AWWA Standard C509 UL-262/FM-1120/1130 ULC-Underwriters' of Canada

Size Range	Water Working Pressure psi	Bubble-Tight Test psi	Hydrostatic Shell Test psi
2"-12"	200	200	400

Available in either non-rising stem or outside screw & yoke.

Available End Connections & Size Range		Figure No. (STD)	Figure No. with Post Plate
Flg. End (NRS)	2" - 12"	4561	4701 (3" - 12")
→ M.J.	2" - 12" (except 2 1/2")	4571	4071 (3" - 12")
Flg. & M.J.	3" - 12"	4572	4072
Push-on for PVC (SDR)	2" - 8"	4597	4597P (3" - 8")
Flg. End (OS & Y)	2 1/2" - 12"	4068	N/A
M.J. for Tapping	4" - 12"	4950	4950P
Push-on for D.I. & C900 PVC	4" - 12"	4901	4901P
M.J. Cutting-in	4" - 8"	4576	(Consult K.V.)
Push-on D.I. X Flg.	4" - 12"	4902	4902P
Threaded	2" - 3"	4057	4057P (3" only)

Accessories

Indicator Posts
"T" Handles
Stem Guides
→ 2" Sq. Operating Nuts
Floorstands (non-rising stem)
Handwheels
Extension Stems
Floor Boxes
Chain Wheels

D-16A

LISTED UL 888H

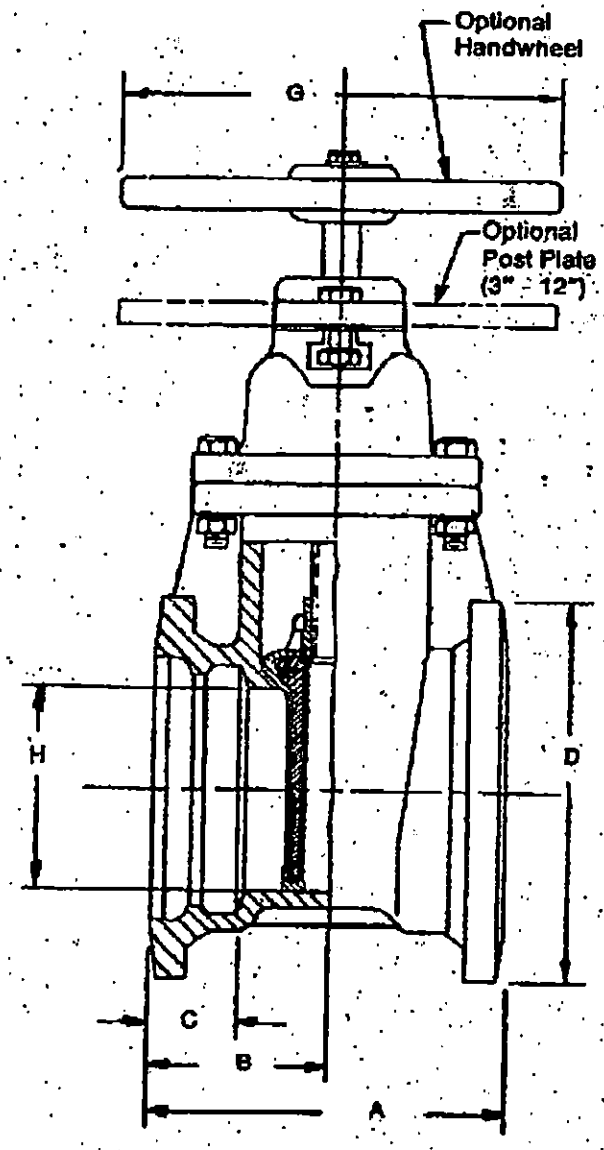
FM APPROVED

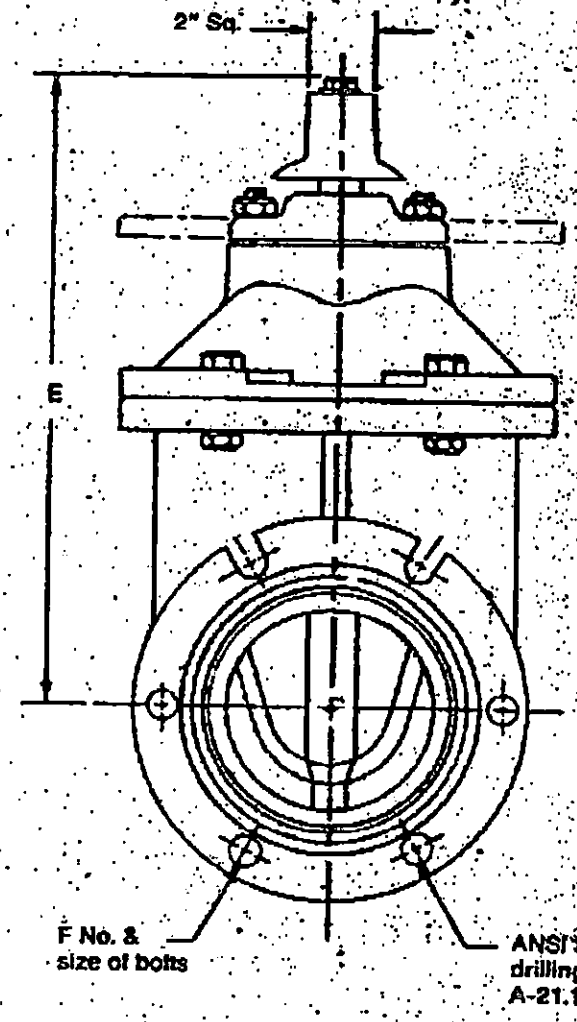
ULC

A.W.W.A Standard C509

2" - 12" KENSEAL II R/W VALVE SMJ ENDS GENERAL DIMENSION

KENNEDY VALVE





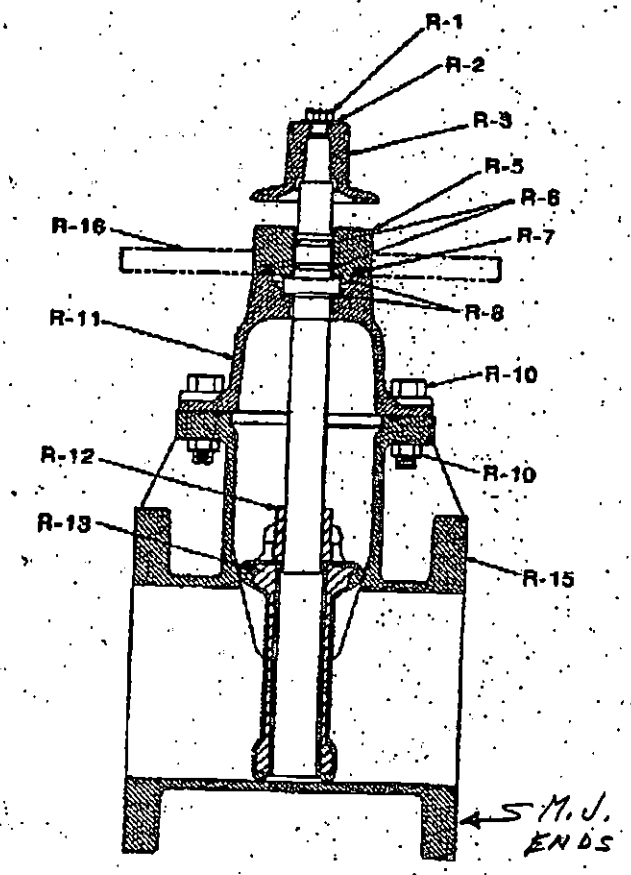
VALVE SIZE	A	B	C	D	E	F	G	H	Weight*
2	8-1/4	4-1/8	2.50	4-1/2	10-7/8	2-5/8	7-1/4	2	38
2-1/2	--------	--------	--------	--------	--------	--------	--------	--------	--------
3	8-1/2	4-1/4	2.50	7-3/4	12-3/8	4-5/8	10	3	63
4	9-1/2	4-3/4	2.50	9-1/8	14-3/4	4-3/4	10	4-1/4	85
6	10	5	2.50	11-1/8	19	6-3/4	12	6-1/4	128
8	10-1/2	5-1/4	2.50	13-3/4	22-1/2	6-3/4	14	8-14	200
10	12	6	2.50	15-3/4	26-1/2	8-3/4	18	10-1/4	309
12	13	6-1/2	2.62	18	30	8-3/4	18	12-1/4	471

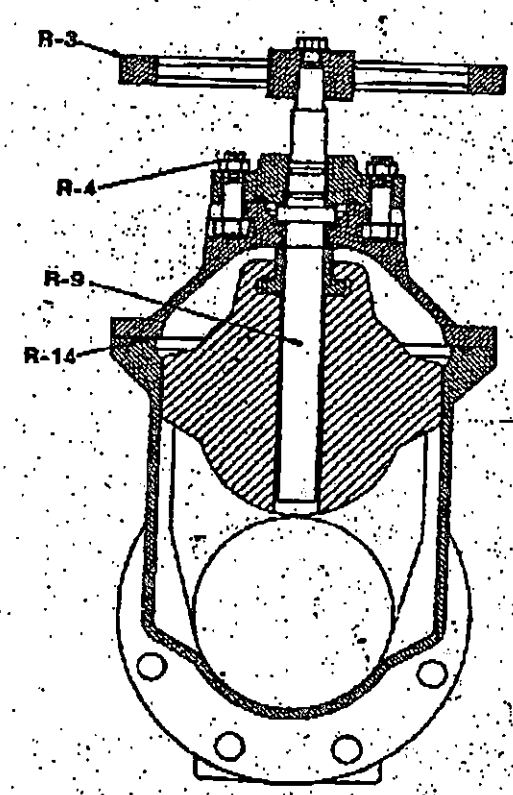
*Add 16# for Indicator Post Plate (3"-12" only)

D-16B

RESILIENT SET GATE VALVE
N.R.S. ASSEMBLY
KENSEAL II

KENNEDY VALVE





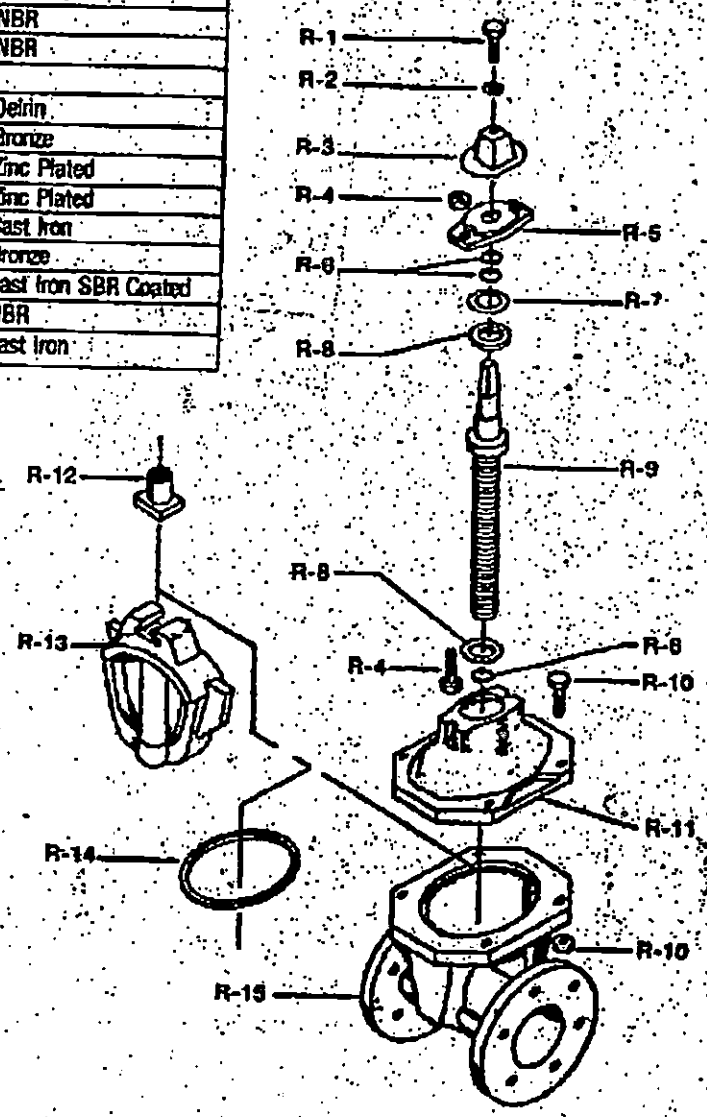
DET.	NAME OF PART		MATERIAL	ASTM SPEC.
R-1	Hex Head Bolt		Zinc Plated Steel	ASTM A307
R-2	Flat Washer		Zinc Plated Steel	ASTM A307
R-3	Operating Nut		Cast Iron	ASTM A126 Class B
	Handwheel		Cast Iron	ASTM A126 Class B
R-4	Hex. Bolt & Nut		Zinc Plated Steel	ASTM A307/A563
R-5	Stuffing Box	2" thru 8"	Cast Iron	ASTM A126 Class B
		10" and 12"	Ductile Iron	ASTM A536 Gr. 65-45-10
R-6	O-Ring (Stem)		Buna - N	----------
R-7	O-Ring (Stuffing Box)		Buna - N	----------
R-8	Thrust Washer		Delrin	----------
R-9	Stem (AWWA Grade C)		Manganeze Bronze	ASTM B584 CDA 867
R-10	Hex. Head Cover Bolts & Nuts		Zinc Plated Steel	ASTM A307/A563
R-11	Cover		Cast Iron	ASTM A126 Class B
R-12	Stem Nut (AWWA Grade A)		Bronze (Low Zinc)	ASTM B584 CDA 844
R-13	Wedge Disc		C.I. SBR Coated	ASTM A126 Class B
R-14	O-Ring (Cover)		Buna - N	----------
R-15	Body (All Types)		Cast Iron	ASTM A126 Class B
R-16	Plate		Cast Iron	ASTM A126 Class B

D-16C

RESILIENT SEAT GATE VALVE
KENSEAL II (1992)
ASSEMBLY — EXPLOSION

KENNEDY VALVE

REF.	QTY.	DESCRIPTION	MATERIALS
R-1	1	Hold Down Hex Bolt	Zinc Plated Steel
R-2	1	Hold Down Bolt Washer	Zinc Plated Steel
R-3	1	Sq. Operating Nut OR *Handwheel (Not Shown)	Cast Iron
R-4	2	Bolt & Nut (Stuffing Box)	Zinc Plated
R-5	1	Stuffing Box	Cash Iron
R-6	2	O-Ring (Stem)	NBR
R-7	1	O-Ring (Stuffing Box)	NBR
R-8	1	Thrust Washer (Sizes 2" - 2 1/2")	
	2	Thrust Washer (Sizes 3" thru 12")	Delrin
R-9	1	Stem	Bronze
R-10	4	Cover Bolts & Nuts (Sizes 2" thru 6")	Zinc Plated
	8	Cover Bolts & Nuts (Sizes 8" thru 12")	Zinc Plated
R-11	1	Cover	Cast Iron
R-12	1	Stem Nut	Bronze
R-13	1	Wedge Disc	Cast Iron SBR Coated
R-14	1	O-Ring (Cover)	NBR
R-15	1	Body	Cast Iron



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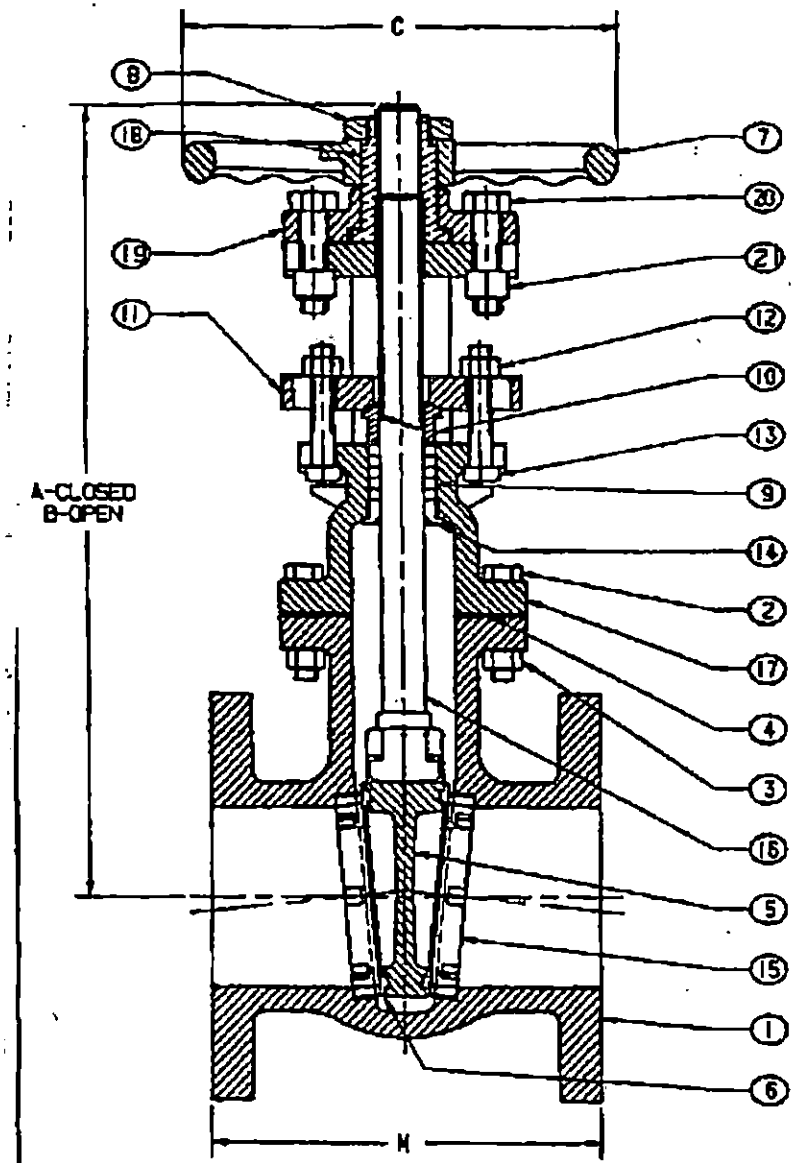

NO.	DESCRIPTION	MATERIAL	ASTM SPEC. (UNS NO.)
1	BODY	CAST IRON	A126 CL. B
2	BONNET BOLT	STEEL	A307 GR. A
3	BONNET BOLT NUT	STEEL	A563 GR. A
4	BONNET GASKET	COMPRESSED NON-ASB	
5	DISC (SIZES 2-3)	BRONZE	B584 (C84400)
5	DISC (SIZES 4-8)	CAST IRON	A126 CL. B
6	DISC RING (SIZES 4-8)	BRONZE	B584 (CE4400)
7	HANDWHEEL (SIZES 2-4)	MALL. IRON	A197
7	HANDWHEEL (SIZES 6-8)	CAST IRON	A126 CL. B
8	HANDWHEEL LOCKNUT	MALL. IRON	A197
9	PACKING	NON-ASBESTOS	
10	PACKING GLAND	IRON	
11	PACKING GLAND FLANGE (SIZES 2-3, 8)	MALL. IRON	A197
11	PACKING GLAND FLANGE (SIZES 4-6)	CAST IRON	A126 CL. B
12	PACKING GLAND FLANGE NUT	STEEL (EZP)	A563 GR. A
13	PACKING GLAND FLANGE BOLT-SQ. HD.	STEEL	A307 GR. A
14	REPACKING BUSHING	BRONZE	B62 (CB3500)
15	SEAT RING	BRONZE	B584 (CB4400)
16	STEM	BRONZE	B584 AE. 875
17	YOKE BONNET	CAST IRON	A126 CL. B
18	YOKE BUSHING	BRONZE	B62 (CB3500)
19	YOKE CAP	CAST IRON	A126 CL. B
20	YOKE CAP BOLT	STEEL	A307 GR. A
21	YOKE CAP BOLT NUT-SQ.	STEEL	A563 GR. A

SIZE	A	B	C	H
2	12.83	15.19	7.00	7.00
2 1/2	13.57	16.44	7.00	7.50
3	14.69	17.98	8.00	8.00
4	17.75	22.27	10.00	9.00
6	23.78	30.12	12.00	10.50
8	28.13	36.53	14.00	11.50
10	32.81	43.31	14.00	13.00

CONFORMS TO MSS-SP-70 TYPE I AND WW-V-58 TYPE I, CLASS I

INFORMATION ON THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE

FILE NO. A1024C

WKN	1-6-88
DR.	DATE
CHN	1-7-88
DR.	DATE
JOG	1-8-88
APP.	DATE

FIG. G-623
CLASS 125, FLANGED END
IBBM, OUTSIDE SCREW & YOKE
IRON GATE VALVE

STOCKHAM VALVES & FITTINGS

IV1176 | C

D-17

15100 - 2.3

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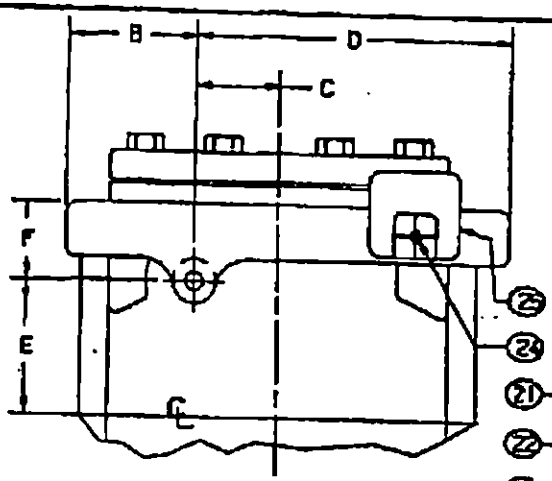
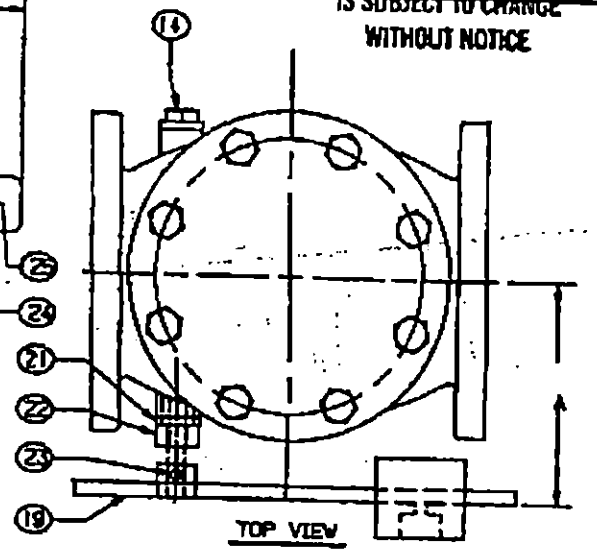
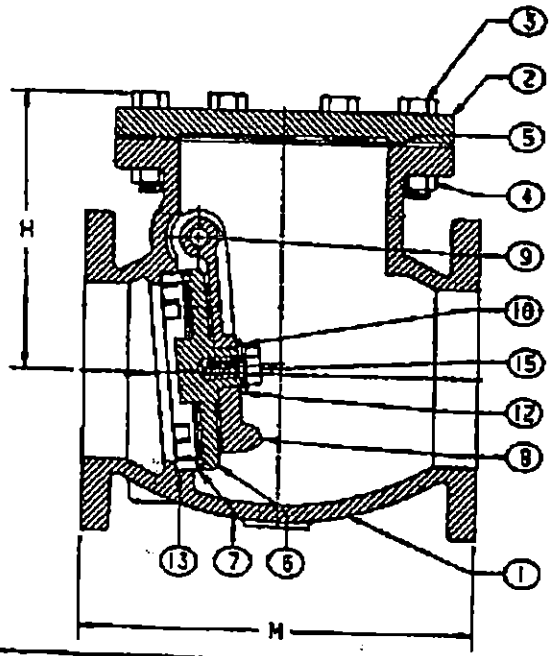


LEVER & WEIGHT ATTACHMENT



TOP VIEW



NO.	DESCRIPTION	MATERIAL	ASTM SPEC.	UNS NO.
1	BODY	CAST IRON	A126 CLASS B	
2	CAP	CAST IRON	A126 CLASS B	
3	CAP BOLT	STEEL	A307 GRADE A	
4	CAP BOLT NUT	STEEL	A563 GRADE A	
5	CAP GASKET	NON-ASB		
6	DISC (2-3)	BRONZE	B62	(C83600)
6	DISC (4-30)	CAST IRON	A126 CLASS B	
7	DISC RING (4-30)	BRONZE	B62	(C83600)
8	HINGE (2-3)	BRONZE	B62	(C83600)
8	HINGE (4-6)	MALL. IRON	A197	
8	HINGE (8-30)	DUCTILE	A395	
9	HINGE PIN (2-6)	STAINLESS STEEL	A276	(S31600)
9	HINGE PIN (8-24)	STAINLESS STEEL	A276	(S41000)
10	LOCKWASHER (2-3)	18-8 SS PASSIVATED		
10	LOCKWASHER (4-30)	STEEL-EZP		
11	NAMEPLATE (NOT SHOWN)	STAINLESS STEEL		
12	PLAIN WASHER (2-3)	18-8 SS PASSIVATED		
12	PLAIN WASHER (4-30)	STEEL-EZP		
13	SEAT RING	BRONZE	B62	(C83600)
14	SIDE PLUG	BRONZE	B62	(C83600)
15	CAPSCREW (2-3)	18-8 SS PASSIVATED		
15	CAPSCREW (4-20)	STEEL-EZP	A307 GRADE A	
16	STUD (18-30) (NOT SHOWN)	STEEL-EZP	A307 GRADE A	
17	STUD NUT (18-30) (NOT SHOWN)	STEEL-EZP	A563 GRADE A	
18	STUD PIN (18-30) (NOT SHOWN)	STAINLESS STEEL	A276	(S31600)
19	LEVER (2-14)	MALL. IRON	A197	
19	LEVER (16-30)	STEEL	A197	
21	STUFFING BOX	BRONZE	B62	(C83600)
22	PACKING NUT	BRONZE	B62	(C83600)
23	LEVER SET SCREW	STEEL	A307 GRADE A	
24	WEIGHT SET SCREW	STEEL	A307 GRADE A	
25	WEIGHT	CAST IRON	A126 CLASS B	
26	PACKING (NOT SHOWN)	TFE IMP. NON-ASB		
27	LEVER KEY (NOT SHOWN)	STEEL		
28	HINGE KEY (8-30) (NOT SHOWN)	STEEL		
29	PACKING GLAND (NOT SHOWN)	BRASS	616 (C36000)	

SIZE	H	R	SIZE	H	H
2	4.81	8.00	10	13.06	24.50
2-1/2	5.63	8.50	12	15.25	27.50
3	6.00	9.50	14	16.88	31.00
4	8.00	11.50	16	19.08	38.00
5	8.84	13.00	18	24.00	38.00
6	9.75	14.00	20	27.56	42.00
8	11.38	18.50	24	34.00	48.00
			30	38.00	60.00

SIZE	A	B	C	D	E	F
2	4.31	3.25	.94	6.00	1.81	1.75
2-1/2	4.63	3.25	1.25	8.00	2.25	1.75
3	5.63	3.50	1.41	8.50	2.59	2.06
4	6.81	4.50	1.81	8.00	3.47	2.13
5	7.31	5.00	2.44	12.00	4.13	2.56
6	7.69	5.00	2.94	12.00	4.69	2.56
8	9.50	6.00	3.78	14.00	6.00	2.88

SIZE	A	B	C	D	E	F
10	10.88	7.00	4.75	16.00	7.25	3.25
12	12.38	8.00	5.84	18.00	8.56	3.25
14	11.79	9.00	6.97	24.00	9.94	3.37
16	13.56	10.00	8.38	28.00	11.25	3.63
18	14.50	11.00	9.84	30.00	13.50	3.83
20	16.75	12.00	11.50	32.50	15.25	4.13
24	18.69	12.00	13.50	37.00	17.63	4.13
30	22.38	15.00	17.94	47.00	21.06	4.25

DNH	12-19-84
CHN	12-19-84
JDG	12-19-84

FIG. G-931 L & W
IBBM SWING CHECK VALVE
WITH LEVER & WEIGHT ATTACHMENT
CLASS 125, FLANGED END

FILE NO. A04688

STOCKHAM VALVES & FITTINGS

G-931 L & W | E

D 7B

CHARLOTTE PIPE AND FOUNDRY COMPANY

VALVE BOX LEACHATE COLLECTION

VALVE BOX BASES

FOR THREE-PIECE VALVE BOXES

15100-2.5

No. 160 Oval Base

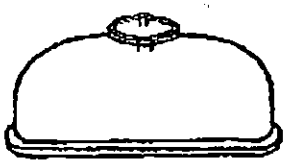
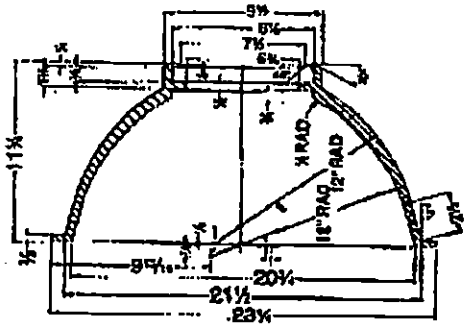


Fig. UTL 279



	Size Valve Inches	Weight	List Each
160 Oval	16 or Smaller	90	$72.00

VALVE BOX EXTENSION SECTIONS - SCREW TYPE

5¼" SHAFT

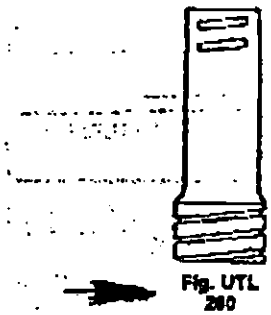
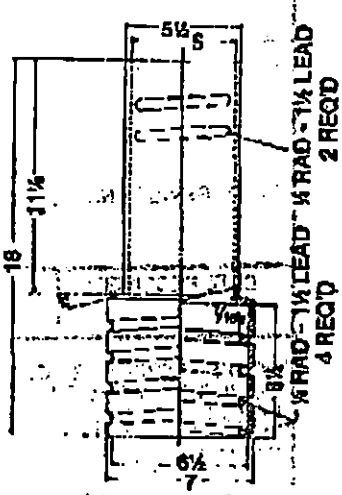


Fig. UTL 280



	Weight	List Each
Increases Length of 6¼" Screw Type Boxes 12 inches	28	$34.00

Weights are approximate and are for shipping purposes only.

D-23

CHARLOTTE PIPE AND FOUNDRY COMPANY

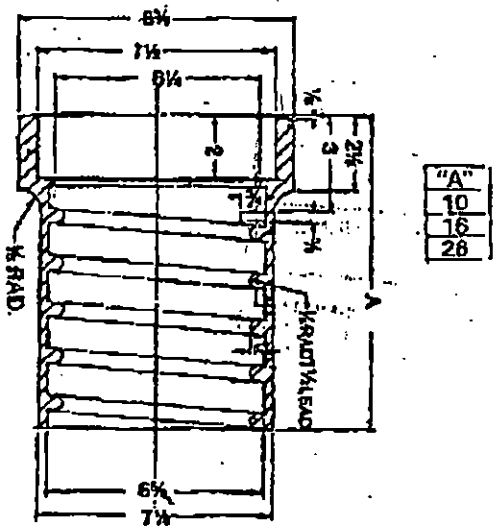
TWO PIECE VALVE BOXES

Fig. UTL 273

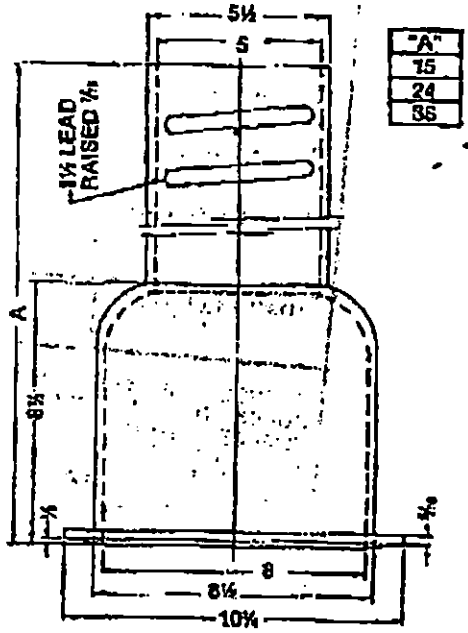
For Gas or Water Mains, Diameter of Shaft, 5¼ Inches
Screw Type for 16" and Smaller Valves

		Complete		Top and Cover			Bottom	
Screw Type	Extension, Inches	Lbs. Wt.	Each List.	Ins. Lgth.,	Lbs. Wt.	Each List.	Ins. Lgth..	Lbs. Wt.	Each List.
461-S	18-24	60	$ 73.00	10	35	$44.00	15	25	$29.00
562-S	24-36	80	89.00	16	45	50.00	24	35	39.00
564-S	36-48	92	101.00	16	47	50.00	36	45	51.00
664-S	39-60	106	118.00	28	63	67.00	36	45	51.00

Drop Cover marked "WATER" furnished unless otherwise specified.



TOP SECTION
NOTE:
- Covers on page 14



BOTTOM SECTION

Weights are approximate and are for shipping purposes only.

D-23

Instrumentation and Control @ Flare Unit

JOHN ZINK COMPANY (JZ) A DIVISION OF KOCH ENGINEERING	SPECIFICATION CONTROL PANEL BILL OF MATERIALS	SPEC.NO. 1 S.O.NO. BF -A0012224 PAGE 1 OF 2

LOCATION: NEW YORK CITY, NEW YORK		CUSTOMER: BRECO	
FACILITY: PHELHAM BAY LANDFILL			
INQ.:	JZ.PO.NO:	CUST.PO.NO.:	

ITEM	QTY	TAG NUMBER(s)	DESCRIPTION	JZ P/N
1	1	PNL 101	HOFFMAN #A-48H3612SSLP NEMA4X ENCLOSURE WITH #A-48P36 PANEL	900995
				010268
2	4	S-1,S-2,S-3,S-4	ALLEN BRADLEY #800H-HR2A SELECTOR SWITCH, 2-POS'N., NEMA 4,	001208
			1-N/O,1-N/C CONTACT	
4	1	S-5	ALLEN BRADLEY #800H-JR2KA7AXXX SELECTOR SWITCH, 3-POS'N., NEMA 4	300390
5	1	L-9	ALLEN BRADLEY #800H-PR16A AMBER PILOT LIGHT,NEMA 4, TRANSFORMER TYPE	001598
				010232
6	1	L-7	ALLEN BRADLEY #800H-PR16B BLUE PILOT LIGHT,NEMA 4, TRANSFORMER TYPE	001598
				010233
7	3	L-2,L-4,L-5	ALLEN BRADLEY #800H-PR16G GREEN PILOT LIGHT,NEMA 4, TRANSFORMER TYPE	001598
				010234
8	1	L-1	ALLEN BRADLEY #800H-PR16W WHITE PILOT LIGHT,NEMA 4, TRANSFORMER TYPE	001598
				010235
9	4	L-6,L-8,L-11,L-12	ALLEN BRADLEY #800H-PR16R RED PILOT LIGHT,NEMA 4, TRANSFORMER TYPE	001598
				010104
11	3	PB-1,PB-3,PB-4	ALLEN BRADLEY #800H-R2A BLACK PUSHBUTTON, 1-N/O, 1N/C CONTACT, NEMA 4	001608
12	1	PB-2	ALLEN BRADLEY #800T-FX6D4 RED PUSHBUTTON (MAINTAINED)	022791
13	1	FB-1	GOULD #30313R FUSE BLOCK FOR MIDGET FUSES 3 POLE, 600VAC/30AMP RATING	402378
14	3	F-1,F-2,F-3	GOULD #TMR-3 FUSE, 250V/3 AMP RATING	402474
15	2	PDB-4,PDB-5	MARATHON 1431553-POLE POWER DISTRIBUTION BLOCK, 1 PRI./6 SEC.	404962
17	2	CB-9,CB-14	SQUARE D #QOU120 CIRCUIT BREAKER, 20 AMP/120VAC (1-POLE)	010225
18	1	CB-13	SQUARE D #QOU110 CIRCUIT BREAKER, 10 AMP/120VAC (1-POLE)	010223
19	1	RCPT-1	PERFECTLINE #T11 WEATHERPROOF BOX, LEVITON #6599 GFCI RECEPT, WGF100-CV COVER	030157

NOTES: ALL ITEMS TO BE U.L. LABELED

PREPARED : G.GORDON	DATE: 04/04/1995	REV 4 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 3 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 2 DATE: 07/26/1995	APP: CL	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 1 DATE: 07/06/1995	APP: CL	Shipment Promise Date: / /

17401 02 ADOPTED FROM ISA-20 1975

JOHN ZINK COMPANY

A DIVISION OF KOCH ENGINEERING

SPECIFICATION

CONTROL PANEL BILL OF MATERIALS

SPEC.NO. 1

S.O.NO. BF -A0012226

LOCATION: NEW YORK CITY, NEW YORK

CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INQ.:

JZ.PO.NO:

CUST.PO.NO.:

ITEM	QTY	TAG NUMBER(S)	DESCRIPTION	JZ P/N
20	1	SL-1	APPLETON #LPSL-10150-G/MT 100 WATT, WHITE, HIGH PRESSURE SODIUM LIGHT WITH	030162
			INTERMATIC #K4221 PHOTOCELL	
	1	SL-2	APPLETON #LU 100HPS HIGH PRESSURE SODIUM LAMP	401504
21	1	H-1	WATLOW #020150C1-C-040-HOIT SILICONE RUBBER ENCLOSURE HEATER, 150 WATT/120VAC	030158
			(2" X 15"), WITH BUILT-IN THERMOSTAT (40° F SETTING).	
			HEATER BONDED TO ALUMINUM PLATE ON SIDE OPPOSITE FLANGE.	
22	1	W-1	TEGAM AW 2228SS WINDOW DOOR NEMA 4X	401136
23	1	GFI-1	LEVITON #6599 GFI RECEPTACLE WITH COVER AND RACO #660 OR EQUAL OUTLET BOX	401112
26	4	CR-24,CR-68,CR-73,CR-81	POTTER-BRUMFIELD #KUP14A15, 120V/60HZ RELAY, 3PDT, WITH ALLEN BRADLEY	016478
			#700HN127 BASE	901621
27	100		JOHN ZINK #JZ16KX THERMOCOUPLE EXTENSION WIRE (100 FEET)	022724
			(SHIP LOOSE FOR CUSTOMER FIELD INSTALLATION)	
28	25'		DELCO #440 HIGH VOLTAGE IGNITION LEAD (25 FEET)	002167
			(SHIP LOOSE FOR CUSTOMER FIELD INSTALLATION)	
	1	HS-201	ALLEN-BRADLEY # 801H-HR2B SELECTOR SWITCH, 2 POS'N, NEMA 4	001521
			2-N/O & 2-N/C CONTACTS	001708
				001708

NOTES: ALL ITEMS TO HAVE U.L. LABEL

PREPARED : G.GORDON	DATE: 04/04/1995	REV 1 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 2 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 3 DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 4 DATE:	APP:	Shipment Promise Date: / /

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION FLAME DETECTION SYSTEM	SPEC.NO. 2 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK		CUSTOMER: BRECO	
FACILITY: PHELHAM BAY LANDFILL			
INQ.:	JZ.PO.NO:	CUST.PO.NO.:	

			JZ P/N
FLAME SCANNER	Manufacturer	HONEYWELL	
	Model No.	#C7012E1112 SELF CHECKING FLAME SCANNER	026441
	Type	■ Ultra-Violet ☐ Infra-Red ☐ Flame Rod Other	
	Quantity	1	
	Power Requirement	120 VAC/60 HZ.	
	Lead Length		
	Mounting Connection	NEMA 4.	
	Tag Number(s)	BE-103	
FLAME RELAY	Manufacturer	HONEYWELL	
	Model No.	#R4075C1005	001615
	Type	FLAME RELAY WITH SUB-BASE AND AMPLIFIER	
	Quantity	1	
	Power Requirement	120 VAC / 60 HZ.	
	Amplifier	R7247C1001	001506
	Wiring Base	Q295A-1039	001511
	F.F.R.T.	2 TO 4 SEC	
	Tag Number(s)	BS-103	

Notes: FLAME SCANNER BE-103 SHIP LOOSE, FLAME RELAY BS-103 MOUNTED IN PNL-101
ALL ITEMS TO BE U.L. LABELED

PREPARED : G.GORDON	DATE: 04/04/1995	REV 4 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 3 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 2 DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 1 DATE:	APP:	Shipment Promise Date: / /

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION POTENTIOMETER INSTRUMENTS	SPEC.NO. 3 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK		CUSTOMER: BRECO	
FACILITY: PHELHAM BAY LANDFILL		TAG.NO. : TSH-101	
INQ.:	JZ.PO.NO:	CUST.PO.NO.:	

GENERAL	1	Service	HIGH STACK TEMP SHUT-DOWN
	2	Function	Record ☐ Indicate ■ Control ☐ Blind ☐ Transmit ☐
			Other:
	3	Type	Auto Bal. ■ Man Bal. ☐ Galv ☐ Other:
	4	Case	MFR STD ■ Nom Size Color: MFR STD ☐ Other:
	5	Mounting	Flush ■ Surface ☐ Rack ☐ Multi-case ☐ Other:
			For Multiple Case, See Spec. Sheet
	6	Enclosure Class	Gen Purpose ■ Weather Proof ☐ Explosion-Proof ☐ Class Other:
	7	Power Supply	117 V 60Hz ■ Other:
	8	Chart	Strip ☐ Circ ☐ Time Marks ☐ Range No.
			Chart Speed: Change Gears
	9	Scales	Type Range 1 2
	10	Printout	No. of Points Sec Per Point Full Travel Speed
			Print Character and Color Point Select ☐
	11	Selector Switches	No. and Form In Case ☐ External ☐
			Switch Cabinet Specs
XMTR	12	Trans Output	4-20 mA ☐ 10-50 mA ☐ 21-103 kPa (3-15 psig) ☐ Other:
			Input-Output Isolation ☐ For Receiver See Sheet
CONTROLLER	13	Control Modes	P =Prop(Gain), I =Integral(Auto Reset), D =Derivative(Rate),Sub: s =Slow, f =fast
			P ☐ PI ☐ PD ☐ PID ☐ If ☐ Df ☐ Is ☐ Ds ☐
			Other:
	14	Action	On Meas. Increase Output: Increases ☐ Decreases ☐
	15	Auto-Man Switch	None ☐ MFR STD ☐ Specify:
	16	Set Point Adj.	Manual ☐ External ☐ Remote ☐ Specify:
	17	Manual Reg.	None ☐ MFR STD ☐ Other:
	18	Output	4-20 mA ☐ 10-50 mA ☐ 21-103 kPa (3-15 psig) ☐ Other:
INPUT	19	Thermocouple Type	J(IC) ☐ K(CA) ■ T(CC) ☐ E(CHR-CON) ☐ Other:
			Ref Junction Comp ☐ Lead Resistance (Galv)
	20	Other Input	Resistance Temp Sensor ☐ Calibration
			Other:
ALARMS	21	Alarm Switches	Quantity 2 Form
	22	Function	Meas. Var. ■ Deviation ☐ Contacts to OPEN Measure
			Other:
	23		Front Adj. Back Adj.
OPTIONS	24	T/C Burnout Drive	None ☐ Upscale ■ Downscale ☐
	25	Accessories	Case Illuminator ☐
			Filter Reg. ☐ Other:
	26	MFR & Model No.	OMRON E5C2-R20K-32DEG-2192-AC-120 △1

Notes: MOUNT IN PNL-101
JZ PART NO. *-003

MOUNT: PANEL ■ SKID ☐ FIELD ☐ OTHER ☐

PREPARED : G.GORDON	DATE: 04/04/1995	REV △0 DATE:	APP:	Release for Purchase: __/__/__
CHECKED :	DATE: / /	REV △1 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV △2 DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV △3 DATE: 07/26/1995	APP: CL	Shipment Promise Date: __/__/__

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION POTENTIOMETER INSTRUMENTS	SPEC.NO. 4 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK		CUSTOMER: BRECO	
FACILITY: PHELHAM BAY LANDFILL		TAG.NO. : TR-201	
INQ.:	JZ.PO.NO:	CUST.PO.NO.:	QTY.:1

GENERAL	1	Service	TEMPERATURE RECORDER
	2	Function	Record ■ Indicate □ Control □ Blind □ Transmit □
			Other:
	3	Type	Auto Bal. □ Man Bal. □ Galv □ Other:
	4	Case	MFR STD ■ Nom Size Color: MFR STD ■ Other:
	5	Mounting	Flush □ Surface ■ Rack □ Multi-case □ Other:
			For Multiple Case, See Spec. Sheet
	6	Enclosure Class	Gen Purpose ■ Weather Proof □ Explosion-Proof □ Class Other:
	7	Power Supply	117 V 60Hz ■ Other:
	8	Chart	Strip □ Circ ■ Time Marks □ Range No.
			Chart Speed: Change Gears
	9	Scales	Type Range 1 (4-20mA) 0-4000 ACFM 2 (4-20ma) 0-2400 F
	10	Printout	No. of Points Sec Per Point Full Travel Speed
			Print Character and Color Point Select □
	11	Selector Switches	No. and Form In Case □ External □
			Switch Cabinet Specs
XMTR	12	Trans Output	4-20 mA □ 10-50 mA □ 21-103 kPa (3-15 psig) □ Other:
			Input-Output Isolation □ For Receiver See Sheet
CONTROLLER	13	Control Modes	P =Prop(Gain), I =Integral(Auto Reset), D =Derivative(Rate),Sub: s =Slow, f =fast
			P □ PI □ PD □ PID □ If □ Df □ Is □ Ds □
			Other:
	14	Action	On Meas. Increase Output: Increases □ Decreases □
	15	Auto-Man Switch	None □ MFR STD □ Specify:
	16	Set Point Adj.	Manual □ External □ Remote □ Specify:
	17	Manual Reg.	None □ MFR STD □ Other:
	18	Output	4-20 mA □ 10-50 mA □ 21-103 kPa (3-15 psig) □ Other:
INPUT	19	Thermocouple Type	J(IC) □ K(CA) □ T(CC) □ E(CHR-CON) □ Other:
			Ref Junction Comp □ Lead Resistance (Galv)
	20	Other Input	Resistance Temp Sensor □ Calibration
			Other:
ALARMS	21	Alarm Switches	Quantity NONE Form
	22	Function	Meas. Var. □ Deviation □ Contacts to Measure
			Other:
	23		Front Adj. Back Adj.
OPTIONS	24	T/C Burnout Drive	None ■ Upscale □ Downscale □
	25	Accessories	Case Illuminator □
			Filter Reg. □ Other:
	26	MFR & Model No.	HONEYWELL # DR45AT-1100-00-000-A-000S00-0

Notes: TR201 MOUNTED IN PNL 101
JZ PART NO. 404296

MOUNT: PANEL ■ SKID □ FIELD □ OTHER □

PREPARED : G.GORDON	DATE: 04/04/1995	REV △ DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV △ DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV △ DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV △ DATE:	APP:	Shipment Promise Date: / /

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION THERMOCOUPLES AND THERMOWELLS	SPEC.NO. 5 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK | CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INQ.: | JZ.PO.NO: | CUST.PO.NO.: | QTY.:4

1. Complete Assembly ■ Other:
   MFR. & Model No. TSC #494-3647-18-K

ELEMENT

   MFR. & Model No.
2. ISA Type "K" Wire Size 14 AWG
3. Sheathed: 5/16" O.D. Material 310 S.S
   Exposed □ Grounded □ Ungrounded ■
   Enclosed □ Beaded Insulators □ Spring Loaded □
4. Nipple Size Dimension "N" 6" Union ■
5. Packed Connector

HEAD

6. Screwed-Cap & Chain ■ Others :
7. Material: CAST IRON Conduit Conn. 3/4"
8. Terminal Block: Single ■ Duplex □

WELL OR TUBE

9. Material 99.5% ALUMINA
10. Construction: Tapered □ Straight ■
    Drilled □ Built-Up □ Closed End Tube ■
11. Dimension: MFR. STD. □ O.D. 11/16" I.D. 7/16"
12. Connections: Process 1.0" INT.
13. Style: Screwed □ Flanged □

Rev.	Tag No.	Well Dimes. "U"	Well Dimes. "T"	Element Length	Single Duplex	Type	Gage	Service	JZ Part No.
	TE-101	18"		MFG. STD.	SINGLE	K	14	HIGH STACK TEMP. SHUT-DOWN TSH-101	022963
	TE-201A	18"		MFG. STD.	SINGLE	K	14	TEMP. CONTROL TIC-201	022963
	TE-201B	18"		MFG. STD.	SINGLE	K	14	TEMP. CONTROL TIC-201	022963

Notes: SHIP LOOSE

MOUNT: SKID □ FIELD ■ OTHER □

PREPARED : G.GORDON	DATE: 04/04/1995	REV △ DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV △ DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV △ DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV △ DATE:	APP:	Shipment Promise Date: / /

JOHN ZINK COMPANY (JZ) A DIVISION OF KOCH ENGINEERING	SPECIFICATION PRESSURE CONTROL VALVES AND REGULATORS	SPEC.NO. 6
		S.O.NO. BF -A0012224
		PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK					CUSTOMER: BRECO					
FACILITY: PHELHAM BAY LANDFILL										
INQ.:		JZ.PO.NO:			CUST.PO.NO.:				QTY.:	1
	1	Tag. No.			PCV-608					
	2	Service			PILOT GAS					
	3	Line No./Vessel No.								
	4	Line Size/Sched. No.			1/2"					
	5	Function			REGULATOR					
	6	Type of Body								
	7	Body Size	Port Size		1/2"	1/4"				
	8	Guiding	No. Of Ports							
	9	End Conn. & Rating			1/2"					
	10	Body Material			ALUMINUM					
	11	Packing Material			BRASS					
BODY	12	Lubricator	Isolating Valve							
	13	Seal Type								
	14	Trim Form								
	15	Trim Material			NITRILE					
	16	Seat Material			NITRILE					
	17	Required Seat Tightness								
	18	Max. Allow.,Sound Level dBA								
	19	Type of Actuator								
	20	Pilot								
ACTUATOR	21	Supply to Pilot								
	22	Self Cont.	Ext. Conn.							
	23	Diaphragm Material								
	24	Diaphragm Rating								
	25	Spring Range		PSIG	5-35					
	26	Set Point		PSIG	10					
	27									
	28	Filt. Reg.	Supply Gage							
	29	Line Strainer								
ACCESSORIES	30	Housing Vent								
	31	Internal Relief								
	32									
	33									
	34	FLOW UNITS			LIQUID		STEAM		GAS	
	35	Fluid			PROPANE					
	36	Quant. Max	C		30 SCFH					
	37	Quant. Oper.	C							
	38	Valve C	Valve FL							
	39	Norm. Inlet Press.	Δ P		15 PSIG					
SERVICE	40	Max. Inlet Press.		PSIG	250					
	41	Max. Shut Off Δ P								
	42	Temp. Max.	Operating		150 °F					
	43	Oper. sp. gr.	Mol. Wt.		1.52					
	44	Oper. Visc.	% Flash							
	45	% Superheat	% Solids							
	46	Vapor Press.	Crit. Press.							
	47	Predicted Sound Level dBA								
SHIPMENT	48	Manufacturer			FISHER					
■ SKID MOUNT	49	Model No.			#64-27					
□ SHIP LOOSE	50	JZ Part No.			016414					

PREPARED : G.GORDON	DATE: 04/04/1995	REV 4 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 3 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 2 DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 1 DATE:	APP:	Shipment Promise Date: / /

JOHN ZINK COMPANY

A DIVISION OF KOCH ENGINEERING

SPECIFICATION
SOLENOID VALVES

SPEC.NO. 7

S.O.NO. BF -A0012224

LOCATION: NEW YORK CITY, NEW YORK

CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INQ.: | JZ.PO.NO: | CUST.PO.NO.: | QTY.: 1

GENERAL	1	Tag. No.		FV-609						
	2	Service		PILOT GAS						
	3	Line No./Vessel No.								
	4	Quantity		1						
VALVE BODY	5	Type								
	6	Size: Body	Port	1/2" SCRD	3/4"					
	7	Rating	Type Conn.	50 PSIG @	125 °F					
	8	Material -- Body		ALUMINUM						
	9	Material -- Seat		BUNA N						
	10	Material -- Diaphragm		BUNA N						
	11	Operation Direct/Pilot		DIRECT						
	12	Packless or Type Packed								
	13	Manual Re-Set		NO						
	14	Manual Operator								
	15									
	16									
WHEN DE-ENERGIZED	17	2-Way Valve Opens/Close			CLOSES					
	18	3-Way								
	19	Vent Port Opens/Close								
	20	Press Port Opens/Close								
	21	4-Way								
	22	Press to Cyl.1 / Cyl.2								
	23	Exh. from Cyl.1 / Cyl.2								
	24									
	25									
SOLENOID	26	Enclosure		NEMA 4,7						
	27	Voltage / HZ		120 VAC	60 HZ					
	28	Style of Coil								
	29	Single or Double Coil								
	30									
	31									
SERVICE CONDITIONS	32	Fluid		PROPANE						
	33	Qty. Maximum		30 SCFH						
	34	Oper. Diff. Min / Max		0	50					
	35	Allow. Diff. Min / Max								
	36	Temp. Norm / Max. Degree°F			125					
	37	Oper. sp. gr.		1.52						
	38	Oper. Viscosity								
	39	Required Cv								
	40	Valve Cv		4.4						
	41									
	42									
	43									
	44	Manufacturer		ASCO						
	45	Model Number		EF8215G20						
	46	John Zink Part Number		012004						

Notes:

MOUNT: SKID ☒ FIELD ☐ OTHER ☐

PREPARED : G.GORDON	DATE: 04/04/1995	REV 0 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 1 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 2 DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 3 DATE:	APP:	Shipment Promise Date: / /

17/00 74 ADOPTED FROM 161 20 1075

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION MANUAL BALL VALVE	SPEC.NO. 8 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK		CUSTOMER: BRECO	
FACILITY: PHELHAM BAY LANDFILL			
INQ.:	JZ.PO.NO:	CUST.PO.NO.:	

GENERAL	Manufacturer	WATTS
	Model No.	C7000
	Port Type	Reduced ■ Full Port □
	Process Connection	NPT ■ Socket Weld □ Flanged □ ANSI Other: SCREWED
MATERIALS		
	Body	CARBON STEEL
	Ball	CARBON STEEL
	Stem	CARBON STEEL
	Seal / Seat	TFE/TFE
	Packing	TFE
	Handle	

QTY	TAG	Nominal Size INCH	Op. Press. PSI	Op. Temp. ° F	Service	JZ Part No.
1	HV-606	1/2	10	80	PILOT PRESSURE INDICATOR (PROPANE)	012635
1	HV-610	1/2	10	80	PILOT MANUAL SHUT-OFF (PROPANE)	012635

Notes:

MOUNT: PANEL □ SKID ■ FIELD □ OTHER □

PREPARED : G.GORDON	DATE: 04/04/1995	REV△ DATE:	APP:	Release for Purchase: __/__/__
CHECKED :	DATE: / /	REV△ DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV△ DATE:	APP:	Quotation Att'd: __Yes __No
PROJ.APP.:	DATE: / /	REV△ DATE:	APP:	Shipment Promise Date: __/__/__

17401.03 ADOPTED FROM ISA-20-1975

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION PRESSURE GAGES	SPEC.NO. 9 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK | CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INQ.: | JZ.PO.NO: | CUST.PO.NO.:

1. Type: Direct Reading ■ 3-15 lb Receiver □
   Other:
2. Mounting: Surface □ Local ■ Flush □
3. Dial: Diameter 4 1/2" Color WHITE
4. Case: Cast Iron □ Aluminum □ Phenol ■
   Other:
5. Ring: Screwed □ Hinged □ Slip □ Std □
   Other:
6. Blow-out Protection: None □ Back □ Disc □
   Solid Front □ Other:
7. Lens: Glass □ Plastic □ OTHER:
8. Options: Syphon □ Material
   Snubber □
   Pressure Limit Valve □
   Movement Damping □
9. Nominal Accuracy Required
10. MFR. & Model No. U.S. GAUGE 1982
11. Press. Element: Bourdon ■ Bellows □
    Other:
12. Element Mtl: Bronze □ Steel □ 316 SS
    Other:
13. Socket Mtl: Bronze □ Steel ■ SS
    Other:
14. Connection-NPT: 1/4 in. □ 1/2 in. ■ Other:
    Bottom ■ Back □
15. Movement: Bronze □ SS ■ Nylon □
    Other:
16. Diaphragm Seal
    MFG Type
    Wetted Part Mtl. Other Mtl.
    Fill Fluid
    Process Conn. Gage Conn.
    JOHN ZINK P/N

Rev.	Quan.	Tag No.	Range PSIG	Oper.Press. PSIG	Service	JZ PART No.
	1	PI-612	0-30	.10	PILOT GAS	030373

Notes:

MOUNT: PANEL □ SKID □ FIELD ■ OTHER □

PREPARED : G.GORDON	DATE: 04/04/1995	REV △ DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV △ DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV △ DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV △ DATE:	APP:	Shipment Promise Date: / /

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION DIFFERENTIAL PRESSURE INSTRUMENTS	SPEC.NO. 10 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK		CUSTOMER: BRECO	
FACILITY: PHELHAM BAY LANDFILL		TAG.NO. : PDSL-203	
INO.:	JZ.PO.NO:	CUST.PO.NO.:	QTY.: 1

GENERAL	1	Service	DIFFERENTIAL PRESSURE
	2	Function	Record ☐ Indicate ☐ Control ■ Blind ☐ Trans ☐ Integ ☐ Other:
	3	Case	MFR STD ■ Nom Size 3.5"X5" Color: MFR STD ■ Other:
	4	Mounting	Flush ☐ Surface ■ Yoke ☐ Other:
	5	Enclosure Class	General Purpose ☐ Weather Proof ■ Explosion-Proof ■ Class 1
			For Use in Intrinsically Safe System. ☐ Other:
	6	Power Supply	117 V 60Hz ■ Other ac dc ☐ Volts
	7	Chart	12 in Circ. ☐ Other Range Time Marks
	8	Chart Drive:	24 hr Other: Elec. ☐ Spring ☐ Other:
	9	Scales	Type Range 1 2 3
XMTR	10	Transmitter Output	4-20 mA ☐ 10-50 mA ☐ 21-103 kPa (3-15 psig) ☐ Other:
			For Receiver See Spec . Sheet
CONTROLLER	11	Control Modes	P =Prop(Gain), I =Integral(Auto Reset), D =Derivative(Rate),Sub: s =Slow, f =fast
			P ☐ PI ☐ PD ☐ PID ☐ If ☐ Df ☐ Is ☐ Ds ☐
			Other:
	12	Action	On Meas. Increase Output: Increase ☐ Decrease ☐
	13	Auto-Man Switch	None ☐ MFR STD ☐ Other:
	14	Set Point Adj.	Manual ☐ External ■ Remote ☐ Other:
	15	Manual Reg.	None ☐ MFR STD ☐ Other:
	16	Output	4-20 mA ☐ 10-50 mA ☐ 21-103 kPa (3-15 psig) ☐ Other:
UNIT	17	Service	Flow ☐ Level ☐ Diff. Pressure ■ Other:
	18	Element Type	Diaphragm ■ Bellows ☐ Mercury ☐ Other:
	19	Material	Body CAST ALUMINUM Element FLUORSILICONE RUBBER
	20	Rating	Overrange Body Rating 10 psig
	21	Diff. Range	Fixed ■ Adj. Range Set At 0.5" W.C.
	22		Elevation Suppression
	23	Process Data	Fluid AIR Max. Temp. AMBIENT Max. Press. ATMOSPHERE
	24	Process Conn.	1/2 in. NPT ☐ Other: 1/8" NFT
OPTIONS	25	Alarm Switches	Quantity 1 Form SPDT Rating
	26	Function	Meas. Var. ■ Deviation ☐ Contact to on Incr. Meas.
	27	Options	Pressure Element ☐ Range Material
			Temp. Element ☐ Range Type
			Filt. Reg. ☐ Sup. Gage ☐ Output Gage ☐ Charts
			Valve Manifold
			Cond. Pots ☐ Adj. Damp ☐ Integral Sq. Rt. Ext. ☐
			Integrator
			Other:
	28	MFR & Model No.	DWYER 1950-1

Notes: PDSL-203 SHIP LOOSE

PREPARED : G.GORDON	DATE: 04/04/1995	REV 4 DATE:	APP:	JZ PART NO.: 024372
CHECKED :	DATE: / /	REV 3 DATE:	APP:	
SECT.APP.:	DATE: / /	REV 2 DATE:	APP:	
PROJ.APP.:	DATE: / /	REV 1 DATE:	APP:	

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION MISCELLANEOUS INSTRUMENTS PURGE AIR BLOWER	SPEC.NO. 11 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK		CUSTOMER: BRECO	
FACILITY: PHELHAM BAY LANDFILL		TAG.NO. : BL-202	
INQ.:	JZ.PO.NO:	CUST.PO.NO.:	QTY.: 1

TAG/ITEM	DESCRIPTION
BL-202	AMERICAN FAN COMPANY PURGE AIR BLOWER
	MODEL: #SC-800, ARRANGEMENT 4-FM
	1750 RPM @ .5BHP
	DUTY: 700 CFM @ 1.7" W.C. STATIC PRESSURE @ 100 °F
	@ .071 DENSITY
	MOTOR: 3/4 HP, 1800 RPM, TEFC, 230/460 VAC, 3 PHASE, 60 HZ,
	56-C FRAME
	ACCESORIES: OUTLET FLANGE, INLET SCREEN, 50% CUT-OFF DAMPER, DRAIN

NOTES: BL-202 SHIP LOOSE
JZ PART NO. 303553

PREPARED : G.GORDON	DATE: 04/04/1995	REV 1 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 2 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 3 DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 4 DATE:	APP:	Shipment Promise Date: / /

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION ACTUATED CONTROL DAMPER	SPEC.NO. 12 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK	CUSTOMER: BRECO
FACILITY: PHELHAM BAY LANDFILL	
INO.:	JZ.PO.NO:	CUST.PO.NO.:

GENERAL	Manufacturer	AMERICAN WARMING AND VENTILATING DAMPER
	Model No.	#VC-412 OPPOSED BLADE
	Process Connection	NPT ☐ Socket Weld ☐ Flange ☐ ANSI Other:
	Type	Round ☐ Rectangular ☐
	Dimensions	I.D.■ O.D.☐ 48"W X 40"H
MATERIAL	Body	
	Blade	
	Shaft	
	Shaft Bearing	
	Packing	
	Seal	
	Max. Cv	
	Accessories	
ACTUATOR	Manufacturer	HONEYWELL (SUPPLY TO THE DAMPER MFG. BY J.Z.)
	Model No.	#M7284A-1009
	Type	Pneumatic ☐ Electrical ■
	Supply	PSIG 120 Volts
	Input Signal	PSIG 4-20 mA.DC
	Output	PSIG
	Action	Spring-Return ☐ Double-Acting ☐

QTY	TAG	Nominal Size INCH	Op. Press. PSIG	Op. Temp. °	Service	JZ Part No.
1	TCV-201A	48"WIDEX40"HIGH	AMBIENT		ACTUATED AIR DAMPER	020557

Notes: ENCLOSURE: NEMA 4 DAMPER TO BE OPEN @ 4 mA INPUT,CLOSED @ 20 mA
TCV-201A SHIP LOOSE

PREPARED : G.GORDON	DATE: 04/04/1995	REV 0 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 1 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 2 DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 3 DATE:	APP:	Shipment Promise Date: / /

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION MANUAL DAMPER	SPEC.NO. 13 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK	CUSTOMER: BRECO
FACILITY: PHELHAM BAY LANDFILL	
INQ.:	JZ.PO.NO: CUST.PO.NO.:

GENERAL	Manufacturer	AMERICAN WARMING AND VENTILATING DAMPER
	Model No.	#VC-412 08-HG
	Process Connection	NPT ☐ Socket Weld ☐ Flange ☐ ANSI Other:
	Type	Round ☐ Rectangular ☐
	Dimensions	I.D.■ O.D.☐ 48"W X 40"H
MATERIAL	Body	
	Blade	
	Shaft	
	Shaft Bearing	
	Packing	
	Seal	
	Max. Cv	
	Accessories	

QTY	TAG	Nominal Size INCH	Op. Press. PSIG	Op. Temp. °	Service	JZ Part No
1	TCV-201B	48"WIDEX40"HIGH	AMBIENT		MANUAL DAMPER	*-013

Notes: ACTUATOR: MANUAL QUAD PLATE AND HANDLE ATTACHED/THIS DAMPER IS HINGED ON ONE SIDE
TCV-201B SHIP LOOSE

PREPARED : G.GORDON DATE: 04/04/1995	REV 4 DATE: APP:	Release for Purchase: / /	
CHECKED : DATE: / /	REV 3 DATE: APP:	No. Vendor Lit. Req'd:	
SECT.APP.: DATE: / /	REV 2 DATE: APP:	Quotation Att'd: Yes No	
PROJ.APP.: DATE: / /	REV 1 DATE: 07/10/1995 APP: CL	Shipment Promise Date: / /	

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION FLASH-BACK ARRESTER	SPEC.NO. 14 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK		CUSTOMER: BRECO	
FACILITY: PHELHAM BAY LANDFILL		TAG.NO. : FA-104	
INQ.:	JZ.PO.NO:	CUST.PO.NO.:	QTY.: 1

GENERAL	Manufacturer	VAREC
	Model No.	5010-0-1
	Flame Check ☐ /	Flame Arrestor ■
	Process Connection	NPT ☐ Socket Weld ☐ Flanged ■ FF ANSI Other:
	DRAIN CONNECTION	1/2-IN NPT
MATERIALS	Housing	ALUMINUM
	Element	ALUMINUM

QTY	TAG	Nominal Size INCH	Op. Press. IN-W.C.	Op. Temp. ° F	Service	JZ Part No.
1	FA-104	10-IN			LAND FILL GAS	400810

Notes:

MOUNT: SKID ☐ FIELD ■ OTHER ☐ SHIP LOOSE

PREPARED : G.GORDON	DATE: 04/04/1995	REV 4 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 3 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 2 DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 1 DATE:	APP:	Shipment Promise Date: / /

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION POTENTIOMETER INSTRUMENTS TEMPERATURE CONTROLLER	SPEC.NO. 15 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK		CUSTOMER: BRECO	
FACILITY: PHELHAM BAY LANDFILL		TAG.NO. : TIC-201	
INQ.:	JZ.PO.NO:	CUST.PO.NO.:	QTY.:1

GENERAL	1	Service	TEMPERATURE CONTROLLER
	2	Function	Record ☐ Indicate ■ Control ■ Blind ☐ Transmit ☐
			Other:
	3	Type	Auto Bal. ■ Man Bal. ☐ Galv ☐ Other:
	4	Case	MFR STD ■ Nom Size Color: MFR STD ☐ Other:
	5	Mounting	Flush ■ Surface ☐ Rack ☐ Multi-case ☐ Other:
			For Multiple Case, See Spec. Sheet
	6	Enclosure Class	Gen Purpose ■ Weather Proof ☐ Explosion-Proof ☐ Class Other:
	7	Power Supply	117 V 60Hz ■ Other:
	8	Chart	Strip ☐ Circ ☐ Time Marks ☐ Range No.
			Chart Speed: Change Gears
	9	Scales	Type Range 1 2
	10	Printout	No. of Points Sec Per Point Full Travel Speed
			Print Character and Color Point Select ☐
	11	Selector Switches	No. and Form In Case ☐ External ☐
			Switch Cabinet Specs
XMTR	12	Trans Output	4-20 mA ☐ 10-50 mA ☐ 21-103 kPa (3-15 psig) ☐ Other:
			Input-Output Isolation ☐ For Receiver See Sheet
CONTROLLER	13	Control Modes	P =Prop(Gain), I =Integral(Auto Reset), D =Derivative(Rate),Sub: s =Slow, f =fast
			P ☐ PI ☐ PD ☐ PID ■ If ☐ Df ☐ Is ☐ Ds ☐
			Other: RANGE: 0 TO 2, 400 °F
	14	Action	On Meas. Increase Output: Increases ☐ Decreases ■
	15	Auto-Man Switch	None ☐ MFR STD ■ Specify:
	16	Set Point Adj.	Manual ■ External ■ Remote ☐ Specify: 1400 °F
	17	Manual Reg.	None ☐ MFR STD ☐ Other:
	18	Output	4-20 mA ■ 10-50 mA ☐ 21-103 kPa (3-15 psig) ☐ Other:
INPUT	19	Thermocouple Type	J(IC) ☐ K(CA) ■ T(CC) ☐ E(CHR-CON) ☐ Other:
			Ref Junction Comp ☐ Lead Resistance (Galv)
	20	Other Input	Resistance Temp Sensor ☐ Calibration
			Other: DIGITAL INPUT (2)
ALARMS	21	Alarm Switches	Quantity 2 Form SPDT 5 AMPS @ 120 VACR
	22	Function	Meas. Var. ■ Deviation ☐ Contacts to OPEN Measure BELOW S.P.
			Other:
	23		Front Adj. Back Adj.
OPTIONS	24	T/C Burnout Drive	None ☐ Upscale ■ Downscale ☐
	25	Accessories	Case Illuminator ☐
			Filter Reg. ☐ Other: AUXILIARY OUTPUT: (4-20mA)
	26	MFR & Model No.	HONEYWELL DC300K-E-203-10-0A00

Notes: CONTROL ACTION:REVERSE, CONTROLLER RANGE: 0-2400 °F, ALARM CONTACTS TO CLOSE ABOVE SETPOINT
TIC-201 MOUNTED IN PNL-101
UL LABLE REQUIRED
JZ PART NO. 404054

MOUNT: PANEL ■ SKID ☐ FIELD ☐ OTHER ☐

PREPARED : G.GORDON	DATE: 04/04/1995	REV 4 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 3 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 2 DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 1 DATE:	APP:	Shipment Promise Date: / /

JOHN ZINK COMPANY (JZ) A DIVISION OF KOCH ENGINEERING	SPECIFICATION CONTROL VALVES	SPEC.NO. 16
		S.O.NO. BF -A0012224
		PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK	CUSTOMER: BRECO
FACILITY: PHELHAM BAY LANDFILL	TAG.NO. : FCV-102/ZSO-102/ZSO-102/SV-103
INQ.: JZ.PO.NO:	CUST.PO.NO.: QTY.:1

GENERAL	1	Tag. No.		FCV 102							
	2	Service		LANDFILL GAS							
	3	Line No./Vessel No.									
	4	Line Size/Sched. No.									
BODY	5	Type of Body		BUTTERFLY							
	6	Body Size	Port Size	10"							
	7	Guiding	No. Of Ports		1						
	8	End Conn. & Rating		WAFER 150#							
	9	Body Material		C.S.							
	10	Packing Material		PTFE							
	11	Lubricator	Isolating Valve								
	12	Bonnet Type									
	13	Trim Form									
	14	Trim Material	Seat/Plug	316 S.S.							
			Shaft Mtl.								
	15	Required Seat Tightness		BUBBLE TIGHT							
	16	Max. Allow.,Sound Level dBA									
ACTUATOR	17	Model No. & Size		BETTIS CB525SR100		ACCESSORIES: OPEN		AND CLOSED LIMIT		SWITCHES:3R-021AFC	
	18	Type of Actuator		PNEUMATIC		PILOT		SOL. VALVE: ASCO #		EF8320G184	
	19	Close at	Open at	0 PSIG	100 PSIG						
	20	Flow Action to									
	21	Fail Position		CLOSED							
	22	Handwheel & Location									
POSITIONER	23	MFR. & Model No.									
	24	Filt Reg.	Gages	Bypass							
	25	Input Signal									
	26	Output Signal									
	27	Air Supply Pressure									
TRANSDUCER	28	MFR. & Model No.									
	29	Input Signal									
	30	Output Signal									
OPTIONS	31	Tubing and Fitting Mat'l		S.S.							
	32	OPEN/CLOSE SPEED CONTL VALVE		YES							
SERVICE	33	FLOW UNITS SCFM		LIQUID		STEAM		GAS LANDFILL GAS (METHANE)			
	34	Fluid		LANDFILL GAS							
	35	Quant. Max	C	3150							
	36	Quant. Oper.	C								
	37	Valve C	Valve FL								
	38	Norm. Inlet Press.	o P	1" W.C.							
	39	Max. Inlet Press.		12" W.C.							
	40	Max. Shut Off o P									
	41	Temp. Max. F	Operating F	350	100						
	42	Oper. sp. gr.	Mol. Wt.								
	43	Oper. Visc.	% Flash								
	44	% Superheat	% Solids								
	45	Vapor Press.	Crit. Press.								
	46	Predicted Sound Level dBA									
SHIPMENT	47	Manufacturer		XOMOX							
☐ SKID MOUNT	48	Model No.		#801-2-6-7-ST1							
■ SHIP LOOSE	49	JZ Part No.		402310							

PREPARED : G.GORDON	DATE: 04/04/1995	REV 0 DATE: APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 1 DATE: APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 2 DATE: APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 3 DATE: APP:	Shipment Promise Date: / /

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION MISCELLANEOUS INSTRUMENTS AUTO-DIALER	SPEC.NO. 17 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK		CUSTOMER: BRECO	
FACILITY: PHELHAM BAY LANDFILL			
INQ.:	JZ.PO.NO:	CUST.PO.NO.:	QTY.: 1

RACO MODEL # VSS-4C AUTOMATIC DIALER

4 DRY CONTACT INPUTS

CHANNEL 1: FLAME FAILURE (OPEN TO ALARM)

CHANNEL 2: UNIT OVERTEMPERATURE (OPEN TO ALARM)

CHANNEL 3: TANK LEAK (OPEN TO ALARM)

CHANNEL 4: TANK HIGH LEVEL (OPEN TO ALRAM)

1 DAUGHTER CARD ASSY

POWER: 120 V/60 Hz (20 HOUR BATTERY BACK-UP)

JZ PART NO. 404880

U.L. LABER REQUIRED

PREPARED : G.GORDON	DATE: 04/04/1995	REV 0 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 0 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 0 DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 0 DATE:	APP:	Shipment Promise Date: / /

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION IGNITION TRANSFORMER IGN.PANEL (PNL 103)	SPEC.NO. 18 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK	CUSTOMER: BRECO
FACILITY: PHELHAM BAY LANDFILL	TAG.NO. : PNL-103

IND.:	JZ.PO.NO:	CUST.PO.NO.:	QTY.: 1

TRANSFORMER	Manufacturer	WEBSTER
	Model No.	612-6A7
	Quantity	ONE (1)
	Primary Power Req.	120VAC
	Secondary Power Req.	6000V
	Tag Number	IT-1
	John Zink Part No.	002558
ENCLOSURE	Manufacturer	HOFFMAN
	Enclosure Model No.	A1412NF
	Quantity	ONE (1)
	Enclosure Type	NEMA 4
	Dimensions	O.D.■ I.D.□
	John Zink Part No.	015278
SUB-PANEL	Manufacturer	HOFFMAN
	Sub-Panel Model No.	A14P12
	John Zink Part No.	003527

Notes: ALL ITEMS TO BE U.L. LISTED

MOUNT: PANEL □ SKID □ FIELD ■ OTHER □ MOUNT ON STACK

PREPARED : G.GORDON	DATE: 04/04/1995	REV 4 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 3 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 2 DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 1 DATE:	APP:	Shipment Promise Date: / /

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION PROGRAMMABLE LOGIC CONTROLLER	SPEC.NO. 19 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK | CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INO.: | JZ.PO.NO: | CUST.PO.NO.:

MANUFACTURER : ALLEN BRADLEY

PROGRAMMABLE LOGIC CONTROLLER SYSTEM CONSISTING OF THE FOLLOWING COMPONENTS

ITEM	QTY	PART No.	DESCRIPTION	JZ Part No
1	1	1747-L40A	SLC-500 FIXED PLC, 24 INPUTS (120V,60HZ),16 OUTPUTS RELAY(120V/60HZ)	402023
			(120V/60 HZ POWER)	
2	1	1747-M1	EEPROM	036491

Notes:

MOUNT: PANEL ☒ SKID ☐ FIELD ☐ OTHER ☐

PREPARED : G.GORDON	DATE: 04/04/1995	REV 4 DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV 3 DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV 2 DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV 1 DATE:	APP:	Shipment Promise Date: / /

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION CONTROL PANEL BILL OF MATERIALS CONTROL POWER TRANSFORMER	SPEC.NO. 20 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK		CUSTOMER: BRECO	
FACILITY: PHELHAM BAY LANDFILL			
INO.:	JZ.PO.NO:	CUST.PO.NO.:	

ITEM	QTY	TAG NUMBER(s)	DESCRIPTION	JZ P/N
1	1	TX-1	HEVI-DUTY # HS5F3AS CONTROL TRANSFORMER	404388
			(240/480V PRIMARY / 120/240V SECONDARY / 3 KVA)	
			(RACK MOUNTED)	

NOTES: PANEL MTG.
U.L. LABEL REQUIRED

PREPARED : G.GORDON	DATE: 04/04/1995	REV △ DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV △ DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV △ DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV △ DATE:	APP:	Shipment Promise Date: / /

17/01.02 ADOPTED FROM ISA-20-1975

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION CONTROL PANEL BILL OF MATERIALS MAIN DISCONNECT AND FUSES	SPEC.NO. 21 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK		CUSTOMER: BRECO	
FACILITY: PHELHAM BAY LANDFILL			
INQ.:	JZ.PO.NO:	CUST.PO.NO.:	

ITEM	QTY	TAG NUMBER(s)	DESCRIPTION	JZ P/N
1	1	DS-1	GENERAL ELECTRIC TH3362SS 3P SAFETY SWITCH △1	*-021A
			600 VAC/ 60 AMP/3 POLE	
			(MOUNTED ON RACK)	
2	3	F1, F2, F3	GOULD # TRS40R 40 AMP FUSE △1	*-021B

NOTES:

PREPARED : G.GORDON	DATE: 04/04/1995	REV △ DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV △ DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV △ DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV △ DATE: 07/06/1995	APP: CL	Shipment Promise Date: / /

JOHN ZINK COMPANY JZ A DIVISION OF KOCH ENGINEERING	SPECIFICATION CONTROL PANEL BILL OF MATERIALS PANEL 102	SPEC.NO. 22 S.O.NO. BF -A0012224 PAGE 1 OF 1

LOCATION: NEW YORK CITY, NEW YORK | CUSTOMER: BRECO

FACILITY: PHELHAM BAY LANDFILL

INQ.: | JZ.PO.NO: | CUST.PO.NO.:

ITEM	QTY	TAG NUMBER(s)	DESCRIPTION	JZ P/N
1	1	PNL 102	HOFFMAN #A36H2408SS NEMA 4X ENCLOSURE WITH # A-39P24 PANEL	*-022
2	1	PDB-1	MARATHON #1433553 3 POLE POWER DISTRIBUTION BLOCK, 1 PRI., 6 SEC./ POLE	034502
3	1	PDB-3	MARATHON #1423570 3 POLE POWER DISTRIBUTION BLOCK, 1 PRI., 3 SEC./ POLE	'900034
4				
5				
6				
7	1	CB-6	WESTINGHOUSE #EHD2015 MOLDED CASE CIRCUIT BREAKER, THERMAL MAGNETIC, FIXED TRIP, 480V, 2-POLE, 15 AMP	404385
8	1	CB-7	WESTINGHOUSE #EHD1030 MOLDED CASE CIRCUIT BREAKER, THERMAL MAGNETIC, FIXED TRIP, 480V, 1-POLE, 30 AMP	404563
9				
10	1	M-3	CUTLER-HAMMER #AN16ANOAC M.S.,120V COIL, 1-N/O AUX. CONTACT, H-2005B HEATERS 3 PHASE, 3/4 HP, NEMA SIZE "00" 480V, 60 HZ.	405574
11				
12	25'		#6 AWG WIRE, WHITE, THHN	401151
13	50'		#6 AWG WIRE, BLACK, THHN	042962
14	20'		#8 AWG WIRE, BLACK, THHN	042963
15	25'		#12 AWG WIRE, WHITE, THHN	405575
16	50'		#12 AWG WIRE, BLACK, THHN	405576
17	35'		#2 AWG WIRE, BLACK, THHN	042960
18	30'		#2/0 AWG WIRE, BLACK, THHN	043151
19	25'		#4 AWG WIRE, BLACK, THHN	042961
20				
21				
22	1	FB-2	GOULD #60328R 30A ,600V 3 POLE FUSE BLOCK	404881
23	3	F-10,F-11,F-12	GOULD #TRS3R 600V, 3 AMP ,RK5 CLASS FUSE	404005
24	50'		#10 AWG WIRE, BLACK, THHN	042968

NOTES: U.L. LABEL REQUIRED

PREPARED : G.GORDON	DATE: 04/04/1995	REV △ DATE:	APP:	Release for Purchase: / /
CHECKED :	DATE: / /	REV △ DATE:	APP:	No. Vendor Lit. Req'd:
SECT.APP.:	DATE: / /	REV △ DATE:	APP:	Quotation Att'd: Yes No
PROJ.APP.:	DATE: / /	REV △ DATE:	APP:	Shipment Promise Date: / /

RIGID GALVANIZED CONDUIT

Wheatland TURF COMPANY

G.C. Monaco & Daughter, Inc
PELHAM BAY LANDFILL
RIGID STEEL CONDUIT

16010
2.1B

Hot-Dipped Galvanized Rigid Steel Conduit

DIMENSIONS

Trade Size (Inches)	Threads per inch	Inside Diameter (Inches)	Outside Diameter (Inches)	Wall Thickness (Inches)	Length without coupling (Feet and Inches)	Wheatland Minimum Weight per 100 ft. (10 ft. lengths with couplings)
½	14	0.622	0.840	0.109	9-11¼	80
¾	14	0.824	1.050	0.113	9-11¼	110
1	11½	1.049	1.315	0.133	9-11	164
1¼	11½	1.383	1.660	0.140	9-11	210
1½	11½	1.610	1.900	0.145	9-11	258
2	11½	2.067	2.375	0.154	9-11	343
2½	8	2.469	2.875	0.203	9-10½	583
3	8	3.068	3.500	0.216	9-10½	744
3½	8	3.548	4.000	0.226	9-10¼	856
4	8	4.026	4.500	0.237	9-10¼	1000
5	8	5.047	5.563	0.258	9-10	1342
6	8	6.065	6.625	0.280	9-10	1728

PACKAGING

Trade Size (Inches)	N.E.M.A. Color Code Thread Protectors	Pieces per Bundle	Quantity per Crane Lift	Feet per Lift	Wheatland Wt. per Crane Lift
½	Black	10	25 Bundles	2,500	2,000 lbs.
¾	Red	5	40 Bundles	2,000	2,200 lbs.
1	Blue	5	25 Bundles	1,250	2,050 lbs.
1¼	Red	3	34 Bundles	1,020	2,140 lbs.
1½	Black	3	34 Bundles	1,020	2,631 lbs.
2	Blue	—	50 Pieces	500	1,715 lbs.
2½	Black	—	25 Pieces	250	1,357 lbs.
3	Blue	—	25 Pieces	250	1,785 lbs.
3½	Black	—	20 Pieces	200	1,712 lbs.
4	Blue	—	20 Pieces	200	2,000 lbs.
5	Blue	—	15 Pieces	150	2,016 lbs.
6	Blue	—	10 Pieces	100	1,728 lbs.

D-15

Use of Wheatland Rigid Steel Conduit in Conformance to the 1984 National Electrical Code

Though the National Electrical Code deals primarily with proper field application, it presumes that the conduit meets the standards necessary to perform properly under approved conditions. Wheatland rigid steel conduit is made to provide all the qualities required for proper installation as specified in the Code.

For your convenience in designing and specifying raceway systems of rigid steel conduit, the applicable articles from the National Electrical Code are enumerated below.

ARTICLE 346—RIGID METAL CONDUIT

Use (346-1)—The use of rigid metal conduit shall be permitted under all atmospheric conditions and occupancies subject to the following.

(a) Protected by Enamel. Ferrous raceways and fittings protected from corrosion solely by enamel shall be permitted only indoors and in occupancies not subject to severe corrosive influences.

(b) Dissimilar Metals. Where practicable, dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of galvanic action. *Exception:* Aluminum fittings and enclosures shall be permitted to be used with steel rigid metal conduit, and also, steel fittings and enclosures shall be permitted to be used with aluminum rigid metal conduit.

(c) Corrosion Protection. Ferrous or nonferrous metal conduit, elbows, couplings and fittings shall be permitted to be installed in concrete, in direct contact with the earth, or in areas subject to severe corrosive influences where protected by corrosion protection and judged suitable for the condition.

Cinder Fill (346-3)—Conduit shall not be used in or under cinder fill where subject to permanent moisture. *Exception No. 1:* Where of corrosion-resistant material suitable for the purpose. *Exception No. 2:* Where protected on all sides by a layer of non-cinder concrete at least 2 inches thick. *Exception No. 3:* Where the conduit is at least 18 inches under the fill.

Wet Locations (346-4)—All supports, bolts, straps, etc. shall be of corrosion-resistant materials or protected against corrosion by corrosion-resistant materials.

Minimum Size (346-5)—Conduit smaller than ½ inch electrical trade size shall not be used. *Exception No. 1:* For underplaster extensions as permitted in Section 344-2. *Exception No. 2:* For enclosing the leads of motors as permitted in Section 430-145 (b)

Number of Conductors in Conduit (346-6)—The number of conductors permitted in a single conduit shall not exceed the percentage fill specified in the N.E.C. (See pages 6 and 7 for number of conductors permitted in each conduit trade size.)

Reaming and Threading (346-7)—

(a) Reamed. All cut ends of conduits shall be reamed or otherwise finished to remove rough edges.

(b) Threaded. Where conduit is threaded in the field, a standard conduit cutting die with a ¾-inch (19-mm) taper per foot (305 mm) shall be used.

Bushings (346-8)—Where a conduit enters a box or other fitting, a bushing shall be provided to protect the wire from abrasion unless the design of the box or fitting is such as to afford equivalent protection.

Couplings and Connectors (346-9)—

(a) Threadless. Threadless couplings and connectors used with conduit shall be made tight. Where buried in masonry or concrete, they shall be of the concrete-tight type. Where installed in wet locations, they shall be of the rain-tight type.

(b) Running Threads. Running threads shall not be used on conduit for connection at couplings.

Bends—How Made (346-10)—Bends of rigid metal conduit shall be so made that the conduit will not be injured and that the internal diameter of the conduit will not be effectively reduced. The radius of the curve of the inner edge of any field bend shall not be less than shown in Table 346-10.

Table 346-10
Radius of Conduit Bends (Inches)

Size of Conduit (In.)	Conductors Without Lead Sheath (In.)	Conductors With Lead Sheath (In.)
½	4	6
¾	5	8
1	6	11
1¼	8	14
1½	10	16
2	12	21
2½	15	25
3	18	31
3½	21	36
4	24	40
5	30	50
6	36	61

For SI units: (Radius) one inch = 25.4 millimeters.

Exception: For field bends for conductors without lead sheath and made with a single operation (one shot) bending machine designed for the purpose, the minimum radius shall not be less than indicated in Table 346-10 Exception.

Table 346-10 Exception
Radius of Conduit Bends (Inches)

Size of Conduit (In.)	Radius to Center of Conduit (In.)
½	4
¾	4½
1	5¾
1¼	7¼
1½	8¼
2	9½
2½	10½
3	13
3½	15
4	16
5	24
6	30

For SI units: (Radius) one inch = 25.4 millimeters.

Bends—Number in One Run (346-11) A run of conduit between outlet and outlet, fitting and fitting, or outlet and fitting shall not contain more than the equivalent of four quarter bends (360 degrees, total) including those bends located immediately at the outlet or fitting.

Supports (346-12)—Rigid metal conduit shall be installed as a complete system as provided in Article 300 and shall be securely fastened in place. Conduit shall be firmly fastened within 3 feet of each outlet box, junction box, cabinet or fitting. Conduit shall be supported at least every 10 feet. *Exception No. 1:* If made up with threaded couplings, it shall be permissible to support straight runs of rigid metal conduit in accordance with Table 346-12, provided such supports prevent transmission of stresses to termination where conduit is deflected between supports. *Exception No. 2:* The distance between supports may be increased to 20 feet for exposed vertical risers from machine tools and the like, provided the conduit is made up with threaded couplings, is firmly supported at the top and bottom of the riser, and no other means of intermediate support is readily available.

Table 346-12
Supports for Rigid Metal Conduit

Conduit Size (Inches)	Maximum Distance Between Rigid Metal Conduit Supports (Feet)
½-¾	10
1	12
1¼-1½	14
2-2½	16
3 and larger	20

For SI units: (Supports) one foot = 0.3048 meter.

Boxes and Fittings (346-13)—Boxes and fittings shall comply with the applicable provisions of Article 370.

Splices and taps (346-14) —Splices and taps shall be made only in junction boxes, outlet boxes or conduit bodies. See Article 370.

CONSTRUCTION SPECIFICATIONS

General (346-15)—Rigid metal conduit shall comply with (a) through (c) below.

(a) **Standard Lengths.** Rigid metal conduit as shipped shall be in standard lengths of 10 feet (3.05 m) including coupling, one coupling to be furnished with each length. Each length shall be reamed and threaded on each end. For specific applications or uses, it shall be permissible to ship lengths shorter or longer than 10 feet, (3.05 m), with or without couplings and with or without threads.

(b) **Corrosion-Resistant Material.** Nonferrous conduit of corrosion-resistant material shall have suitable markings.

(c) **Durably Identified.** Each length shall be clearly and durably identified in every 10 feet (3.05 m) as required in the first sentence of Section 110-21.

Maximum Number of Conductors in Trade Sizes of Conduit or Tubing

Conduit Trade Size (Inches)		½	¾	1	1¼	1½	2	2½	3	3½	4	5	6
Type Letters	Conductor Size AWG, MCM												
TW, T, RUH, RUW, XHHW (14 thru 6)	14	9	15	25	44	60	99	142					
	12	7	12	19	35	47	76	111	171				
	10	5	9	15	26	36	60	85	131	176			
	8	2	4	7	12	17	28	40	62	84	108		
RHW and RHH (without outer covering), THW	14	6	10	16	29	40	65	93	143	192			
	12	4	8	13	24	32	53	76	117	157			
	10	4	6	11	19	26	43	61	95	127	163		
	8	1	3	5	10	13	22	32	49	66	85	133	
TW, T, THW, RUH (6 thru 2), RUW (6 thru 2)	6	1	2	4	7	10	16	23	36	48	62	97	141
	4	1	1	3	5	7	12	17	27	36	47	73	106
	3	1	1	2	4	6	10	15	23	31	40	63	91
	2	1	1	2	4	5	9	13	20	27	34	54	78
	1		1	1	3	4	6	9	14	19	25	39	57
FEPB (6 thru 2), RHW and RHH (without outer covering)	0		1	1	2	3	5	8	12	16	21	33	49
	00		1	1	1	3	5	7	10	14	18	29	41
	000		1	1	1	2	4	6	9	12	15	24	35
	0000			1	1	1	3	5	7	10	13	20	29
	250			1	1	1	2	4	6	8	10	16	23
	300			1	1	1	2	3	5	7	9	14	20
	350				1	1	1	3	4	6	8	12	18
	400				1	1	1	2	4	5	7	11	16
	500				1	1	1	1	3	4	6	9	14
	600					1	1	1	3	4	5	7	11
	700					1	1	1	2	3	4	7	10
	750					1	1	1	2	3	4	6	9
THWN	14	13	24	39	69	94	154						
	12	10	18	29	51	70	114	164					
	10	6	11	18	32	44	73	104	180				
	8	3	5	9	16	22	36	51	79	106	136		
THHN, FEP (14 thru 2), FEPB (14 thru 8), PFA (14 thru 4/0), PFAH (14 thru 4/0), Z (14 thru 4/0), XHHW (4 thru 500MCM)	6	1	4	6	11	15	26	37	57	78	98	154	
	4	1	2	4	7	9	16	22	36	47	60	94	137
	3	1	1	3	6	8	13	19	29	39	51	80	116
	2	1	1	3	5	7	11	16	25	33	43	67	97
	1		1	1	3	5	8	12	18	25	32	50	72
	0		1	1	3	4	7	10	15	21	27	42	61
	00		1	1	3	3	6	8	13	17	22	35	51
	000		1	1	1	3	5	7	11	14	18	29	42
	0000		1	1	1	2	4	6	9	12	15	24	35
	250			1	1	1	3	4	7	10	12	20	29
	300			1	1	1	3	4	6	8	11	17	24
	350			1	1	1	2	3	5	7	9	15	21
	400				1	1	1	3	5	6	8	13	19
	500				1	1	1	2	4	5	7	11	16
	600				1	1	1	1	3	4	6	9	13
	700					1	1	1	3	4	5	8	11
	750					1	1	1	2	3	4	7	11
XHHW	6	1	3	5	9	13	21	30	47	63	81	129	195
	600				1	1	1	1	3	4	5	9	13
	700					1	1	1	3	4	5	7	11
	750					1	1	1	2	3	4	7	10
RHW	14	3	6	10	18	25	41	58	90	121	155		
	12	3	5	9	15	21	35	50	77	103	132		
	10	2	4	7	13	18	29	41	64	88	110		
	8	1	2	4	7	9	16	22	35	47	60	94	137
RHH (with outer covering)	6	1	1	2	5	6	11	15	24	32	41	64	93
	4	1	1	1	3	6	8	12	18	24	31	50	72
	3	1	1	1	3	4	7	10	16	22	28	44	63
	2		1	1	3	4	6	9	14	19	24	38	56
	1		1	1	1	3	5	7	11	14	18	29	42
	0		1	1	1	2	4	6	9	12	16	25	37
	00			1	1	1	3	5	8	11	14	22	32
	000			1	1	1	3	4	7	9	12	19	28
	0000			1	1	1	2	4	6	8	10	16	24
	250				1	1	1	3	5	6	8	13	19
	300				1	1	1	3	4	5	7	11	17
	350				1	1	1	2	4	5	6	10	15
	400				1	1	1	1	3	4	6	9	14
	500				1	1	1	1	3	4	5	8	11
	600					1	1	1	2	3	4	6	9
	700					1	1	1	1	3	3	6	8
	750						1	1	1	3	3	5	8

Maximum Number of Fixture Wires in Trade Sizes of Conduit or Tubing

Conduit Trade Size (Inches)	½					¾					1					1¼					1½					2				
Wire Types	18	16	14	12	10	18	16	14	12	10	18	16	14	12	10	18	16	14	12	10	18	16	14	12	10	18	16	14	12	10
PTF, PTFF, PGFF, PGF, PFF, PF, PAF, PAFF, ZF, ZFF	23	18	14			40	31	24			65	50	39			115	90	70			157	122	95			257	200	156		
TFFN, TFN	19	15				34	26				55	43				97	76				132	104				216	169			
SF-1	16					29					47					83					114					186				
SFF-1, FFH-1	15					26					43					76					104					169				
CF	13	10	8	4	3	23	18	14	7	6	38	30	23	12	9	66	53	40	21	16	91	72	55	29	22	149	118	90	48	37
TF	11	10				20	18				32	30				57	53				79	72				129	118			
RFH-1	11					20					32					57					79					129				
TFF	11	10				20	17				32	27				56	49				77	66				126	109			
AF	11	9	7	4	3	19	16	12	7	5	31	26	20	11	8	55	46	36	19	15	75	63	49	27	20	123	104	81	44	34
SFF-2	9	7	6			16	12	10			27	20	17			47	36	30	–		65	49	42			106	81	68		
SF-2	9	8	6			16	14	11			27	23	18			47	40	32			65	55	43			106	90	71		
FFH-2	9	7				15	12				25	19				44	34				60	46				99	76			
RFH-2	7	5				12	10				20	16				36	28				49	38				80	62			
KF-1, KFF-1, KF-2, KFF-2	36	32	22	14	9	64	55	39	25	17	103	89	63	41	29	182	158	111	73	49	248	216	152	100	67	406	353	248	163	110

Percent of Cross Section of Conduit and Tubing for Conductors

Number of Conductors	1	2	3	4	Over 4
All conductor types except lead-covered (new or rewiring)	53	31	40	40	40
Lead-covered conductors	55	30	40	38	35

Notes to Tables

1. Each of the tables apply only to complete conduit or tubing systems and are not intended to apply to short sections of conduit or tubing used to protect exposed wiring from physical damage.
2. Equipment grounding conductors, when installed, shall be included when calculating conduit or tubing fill. The actual dimensions of the equipment grounding conductor (insulated or bare) shall be used in the calculation.
3. When conduit nipples having a maximum length not to exceed 24 inches are installed between boxes, cabinets, and similar enclosures, the nipple shall be permitted to be filled to 60 percent of its total cross-sectional area.
4. See table on left, for allowable percentage of conduit or tubing fill.

Rigid Steel Conduit Specifications

Wheatland Hot-dipped Galvanized Rigid Steel Conduit is manufactured in conformance to standards established by the American National Standard Institute, the Underwriter s Laboratories and the Federal Specification. In preparing bids, it may be stated that Wheatland Rigid Steel Conduit conforms to:

- American National Standard Institute C80.1-1983
- Federal Specification WW-C-581e
- Underwriter s Laboratories Specification No. 6
- National Electrical Code—Article 346

UNDERWRITER S LABORATORIES SPECIFICATION NO. 6

The specifications for rigid steel conduit established by the Underwriter s Laboratories cover both the manufacture and testing of the conduit in detail. The sections referring to the qualifications of the conduit are condensed and summarized below. Be assured that Wheatland Hot-dipped Galvanized Rigid Steel Conduit meets the UL specifications in every way.

The Tube

Each tube used in the manufacture of rigid metal conduit shall be steel (or other suitable metal) and shall have a circular cross-section sufficiently accurate to permit the cutting of clean, true threads. The wall thickness shall be uniform through the length of the tube. The welding of all seams shall be thoroughly well done. The welded seam shall be free from metal trimmings, sharp edges and sharp projections.

Both the inside and outside surfaces of the tube shall be thoroughly cleaned so that the protective coating will have a smooth finish. Before the protective coating is applied, the interior surface of the tube shall be examined to be sure it is free from scale.

Each tube used for rigid metal conduit shall be capable of being bent cold into a quarter circle around a mandrel, the radius of which is four times the trade size of the tube, without developing cracks or opening a weld.

The Protective Coating

Both the inside and outside of ferrous metal rigid conduit shall be protected against corrosion by a coating of zinc (or enamel or equivalent corrosion-resistant coating). The coating shall be sufficiently elastic to prevent its cracking or flaking off when a finished sample of ½-inch conduit is tested up to a year after manufacture by bending it into a semi-circle, the inner edge of which has a radius of 3½ inches.

A protective coating of zinc shall be such that a sample of finished rigid ferrous-metal conduit will not show a fixed deposit of copper after four one-minute immersions in a standard copper sulfate solution.

The Threads

Each length of conduit is to be threaded on both ends and chamfered to remove burrs and sharp edges on the interior surface.

All threads are to be clean and full cut. If threads are cut after the protective coatings are applied, they shall be treated to prevent corrosion before the conduit is installed.

The Finished Conduit

Every piece of conduit is to be inspected prior to shipment to be sure it is free from poor coating, scale, burrs or fins, embossing on interior surfaces or other defects.

Each length of conduit shall be marked "rigid metal conduit" and indicate the type of material. In addition, it shall be marked with manufacturer's name or trade mark.

FEDERAL SPECIFICATION WW-C-581e

This specification covers zinc-coated rigid steel conduit in all common trade sizes. Its general requirements are that products furnished under this specification conform as applicable to ANSI C80.1 and UL 6 for rigid steel conduit.

Other provisions of WW-C-581e which should be noted when preparing bids are summarized here. For details on packaging and quality assurance, refer to the full specification.

Standard Commercial Product

The conduit shall, as a minimum, be the manufacturer's standard commercial product with any added features needed to comply with the requirements.

Identical Items

Conduit, couplings, elbows and nipples of the same classification furnished under any specific contract shall be physically and mechanically identical. No deviation will be acceptable without prior written approval of the contracting officer.

Material

All material shall be new and unused. Material not specified shall be of the same quality used for the intended purpose in commercial practice. Materials used shall be free from defects which would adversely affect the performance or maintainability of individual component or the overall assembly.

Fire and Casualty Hazards
Each contractor shall submit proof that the conduit proposed under this specification conforms to UL6. The UL listing mark may be accepted as evidence that the conduit conforms to this requirement.

Marking
Conduit shall be permanently marked in accordance with ANSI C80.1 and UL6.

Workmanship
All threaded portions of conduit shall be clean and undamaged. Plastic thread protectors shall be furnished on all exposed conduit threads. The exterior zinc coating, and all other protective coatings, including the interior coating and thread coating, shall completely and uniformly cover the metal substrate.

AMERICAN NATIONAL STANDARD INSTITUTE SPECIFICATION FOR ZINC-COATED RIGID STEEL CONDUIT

The ANSI Specification C80.1 is very precise and explicit in setting standards for rigid steel conduit. Wheatland's rigid steel conduit matches these standards in every way. It meets the general requirements of having an accurate circular cross section, a uniform wall thickness, a defect-free interior surface and continuously welded seams. It is thoroughly cleaned before coating so the protective coating adheres well and is smooth. The exterior surface is thoroughly and evenly coated with metallic zinc applied directly to the steel so that metal-to-metal contact and galvanic protection against corrosion are provided. The interior surface is protected by zinc for corrosion resistance

DETAILED REQUIREMENTS
Some of the pertinent detailed requirements of Specification C80.1 are interpreted and summarized below for your reference and assurance that Wheatland Rigid Steel Conduit is produced to precise standards

Zinc Coating
The zinc content of the coating on the outside surface shall be equivalent to a minimum thickness of 0.0008 inches.

Threading and Chamfering
Each length of conduit shall be threaded on both ends, and each end shall be chamfered or otherwise treated to remove burrs and sharp edges. If threads are cut after the zinc coating has been applied, the threads shall be treated with a protective coating to prevent corrosion before installation. This treatment shall not impair electrical continuity through couplings or fittings after installation.

Identification
Each length of conduit shall be identified with the manufacturer's name and trade mark and the words "Rigid Steel Conduit"

Threads
The number of threads per inch and the length of the threaded portion at each end of each length conduit shall be as shown in the accompanying table and shall conform to American Standard Pipe Threads. The perfect thread shall be tapered for its entire length, and the taper shall be 3/4 in/ft.

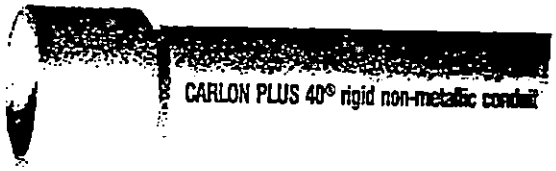
Dimensions of Threads for Rigid Steel Conduit, Zinc Coated

Nominal or Trade Size of Conduit (inches)	Threads per Inch	Pitch Diameter at End of Thread E_0	Length of Thread (Inches)	
		Taper ¾ Inch per Foot	Effective L_2	Overall L_6
⅜	18	0.6120	0.41	0.60
½	14	0.7584	0.53	0.78
¾	14	0.9677	0.55	0.79
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	11½	2.2690	0.76	1.06
2½	8	2.7195	1.14	1.57
3	8	3.3406	1.20	1.63
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CARLON PLUS 40® RIGID NON-METALLIC CONDUIT (Heavy Wall EPC)

For underground applications, encased in concrete or direct burial. Also for use in exposed or concealed applications above-ground.

- U.L. Listed
- Sunlight resistant
- Rated for use with 90°C conductors
- Reduced emissions of smoke and HCL
- Superior weathering characteristics



PLUS 40 Heavy Wall

Nom. Size	Cat. No.	O.D.	I.D.	Wall	Wt. Per 100 Feet	Feet Per Bundle
½	49005	.840	.622	.109	17	100
¾	49007	1.050	.824	.113	23	100
1	49008	1.315	1.049	.133	34	100
1¼	49009	1.660	1.380	.140	46	50
1½	49010	1.900	1.610	.145	55	50
2	49011	2.375	2.067	.154	73	50
2½	49012	2.875	2.469	.203	125	10
3	49013	3.500	3.066	.216	164	10
3½	49014	4.000	3.548	.226	198	10
4	49015	4.500	4.026	.237	234	10
5	49016	5.563	5.047	.258	316	10
6	49017	6.625	6.065	.280	412	10

Rigid non-metallic conduit is normally supplied in standard 10' lengths with one belled end per length. For specific requirements, it may be produced in lengths shorter or longer than 10', with or without belled ends.

See Section 16010, Part 2.1 PLEASE CORROSION R
Pg 3 of 3

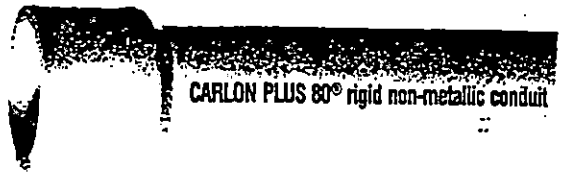
CARLON PLUS 80® RIGID NON-METALLIC CONDUIT (Extra Heavy Wall EPC-80)

For use in aboveground and below ground applications that are subject to severe physical abuse.

- U.L. Listed
- Sunlight resistant
- Rated for use with 90°C conductors

16010 - 2.1A

PVC GALVANIZED CONDUIT



PLUS 80 Extra Heavy Wall

Nom. Size	Cat. No.	O.D.	I.D.	Wall	Wt. Per 100 Feet	Feet Per Bundle
½	49405	.840	.546	.147	22	10
¾	49407	1.050	.742	.154	29	10
1	49408	1.315	.957	.179	43	100
1¼	49409	1.660	1.278	.191	59	50
1½	49410	1.900	1.500	.200	72	50
2	49411	2.375	1.939	.218	99	10
2½	49412	2.875	2.323	.276	152	10
3	49413	3.500	2.900	.300	212	10
4	49415	4.500	3.826	.337	310	10
5	49416	5.563	4.813	.357	431	10

Rigid non-metallic conduit is normally supplied in standard 10' lengths, with one belled end per length. For specific requirements, it may be produced in lengths shorter or longer than 10', with or without belled ends.

G.C. MONACO ELECTRIC & DAUGHTER, INC.
261 W. LINCOLN AVE.
MT. VERNON, NY 10550

SUPPORT OF CARLON RIGID NON-METALLIC CONDUIT IN ABOVEGROUND INSTALLATIONS

Distances between supports should be based on temperatures and the specific application. Because non-metallic conduit is lighter in weight, it does not require as strong a support system. The following chart illustrates the support requirements as outlined in the National Electric Code based on 50°C (122°F) air temperature and 90°C conductor temperature

Plastic conduit should always be installed away from steam lines, etc. Support straps should be tightened only enough to allow for lineal movement caused by expansion and contraction.

-L-85-16010

Conduit Size (in.)	Maximum Spacing Between Supports (feet)
½ - 1	3
1¼ - 2	5
2½ - 3	6
3½ - 5	7
6	8

FRESHKILL BAY LANDFILL
CONT # X75 WP
CONDUIT IN TRENCH

RIGID NON-METALLIC CONDUIT

Properties, Wire Fill Data and Weight Comparisons

2 of 3

See Section 16010, Part 2.1

PROPERTIES

Thermal

	ASTM Test	Typical Values
Co-efficient of Thermal Expansion-inch/inch/°C	D696	5.13×10^{-5}
Co-efficient of Thermal Expansion-inch/inch/°F (properties @73.4°F)	D696	2.89×10^{-5}
Heat Distortion °F at 264 psi	D648	162°F
Thermal Conductivity BTU (hr) (ft) (°F/in.)	N/A	1.3

Mechanical

	ASTM Test	Typical Values
Specific Gravity	D792	1.43
Tensile Strength (psi) @73.4°F	D638	6,000
Izod Impact ft lbs. /in. of notch	D256	0.65 - 1.5
Flexural Strength (psi)	D650	12,500
Compressive Strength (psi)	D695	9,000
Hardness (Durometer D)	D676	85

Electrical

	ASTM Test	Typical Values
Dielectrical Strength volts/mil	D149	1100
Dielectric Contant 60 CPS @ 30°C	D150	4.00
Power Factor 60 CPS @ 30°C	D150	1.93

Impedance (Volts lost per ampere per 100 feet)

	3Ø 90% P.F.	80% P.F.	1Ø 90% P.F.	80% P.F.
Steel Conduit	.0118	.0123	.0136	.0142
Plus 40	.0105	.0106	.0121	.0122

Using 250 MCM Cu. conductor. Comparable values for other conductor sizes.

WIRE FILL

Maximum Number of Conductors in Schedule 40 PVC Conduit

Table 3B (Based on Table 1, Chapter 9 of the N.E.C.)

Type Letters	Conductor Size AWG, MCM	Conduit Trade Size (Inches) ½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6
THWN,	14	13	24	39	69	94	154							
	12	10	18	29	51	70	114	164						
	10	6	11	18	32	44	73	104	160					
	8	3	5	9	16	22	36	51	71	106	136			
THHN, FEP (14 thru 2), FEPB (14 thru 8), PFA (14 thru 4/0) PFAH (14 thru 4/0)	6	1	4	6	11	15	26	37	57	76	98	125	154	
	4	1	2	4	7	9	16	22	35	47	60	75	94	137
	3	1	1	3	6	8	13	19	29	39	51	64	80	116
	2	1	1	3	5	7	11	16	25	33	43	54	67	97
	1		1	1	3	5	8	12	18	25	32	40	50	72
Z (14 thru 4/0) XHHW (4 thru 500MCM)	1/0		1	1	3	4	7	10	15	21	27	33	42	61
	2/0		1	1	2	3	6	8	13	17	22	28	35	51
	3/0		1	1	1	3	5	7	11	14	18	23	29	42
	4/0		1	1	1	2	4	6	9	12	15	19	24	35
	250			1	1	1	3	4	7	10	12	16	20	28
	300			1	1	1	3	4	6	8	11	13	17	24
	350			1	1	1	2	3	5	7	9	12	15	21
	400				1	1	1	3	5	6	8	10	13	19
	500				1	1	1	2	4	5	7	9	11	16
	600				1	1	1	1	3	4	5	7	9	13
	700					1	1	1	3	4	5	6	8	11
	750					1	1	1	2	3	4	6	7	11
XHHW	6	1	3	5	9	13	21	30	47	63	81	102	128	185
	600				1	1	1	1	3	4	5	7	9	13
	700					1	1	1	3	4	5	6	7	11
	750					1	1	1	2	3	4	6	7	10

Maximum Conductors in Schedule 80 PVC Conduit

Conductor Size AWG, MCM		Conduit Trade Size ½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"
# 14	THW	4	8	13	24	34	57	82	128		
	THHN	10	19	33	58	81	135	194	0		
12	THW	3	6	11	20	28	47	67	105	183	
	THHN	8	14	24	43	60	100	144	0		
10	THW	3	5	9	16	22	37	54	85	148	
	THHN	5	9	15	27	38	64	92	143		
8	THW	1	2	4	3	11	19	28	44	77	121
	THHN	1	4	7	13	18	31	45	70	123	195
6	THW	1	1	3	6	8	14	20	32	56	88
	THHN	1	3	5	9	13	22	32	50	88	140
4	THW	0	1	2	4	6	10	15	24	42	66
	THHN	1	1	3	6	8	13	20	31	54	86
3	THW	0	1	1	4	5	9	13	20	36	57
	THHN	1	1	2	5	7	11	17	26	46	73
2	THW	0	1	1	3	4	8	11	17	31	49
	THHN	1	1	1	4	5	9	14	22	38	61
1	THW	0	1	1	1	3	5	8	13	22	35
	THHN	0	1	1	3	4	7	10	16	28	45
0	THW	0	0	1	1	2	4	7	11	19	30
	THHN	0	1	1	2	3	6	8	13	24	38
00	THW	0	0	1	1	1	4	6	9	16	26
	THHN	0	1	1	1	3	5	7	11	20	32
000	THW	0	0	1	1	1	3	5	8	14	22
	THHN	0	0	1	1	2	4	6	9	16	26
0000	THW	0	0	1	1	1	3	4	6	11	18
	THHN	0	0	1	1	1	3	5	8	14	22
250	THW	0	0	0	1	1	1	3	5	9	14
	THHN	0	0	0	1	1	2	4	6	11	18
300	THW	0	0	0	1	1	1	3	4	8	13
	THHN	0	0	0	1	1	1	3	5	9	15
350	THW	0	0	0	1	1	1	2	4	7	11
	THHN	0	0	0	1	1	1	3	4	8	13
400	THW	0	0	0	0	1	1	1	3	6	10
	THHN	0	0	0	1	1	1	2	4	7	12
500	THW	0	0	0	0	1	1	1	3	5	8
	THHN	0	0	0	0	1	1	1	3	6	10
500	THW	0	0	0	0	0	1	1	1	4	7
	THHN	0	0	0	0	1	1	1	3	5	8
700	THW	0	0	0	0	0	1	1	1	3	6

WEIGHT COMPARISON

Carlon Plus 40 rigid non-metalic conduit compared to other rigid conduit in pounds per 1[illegible]et (approx.)

Nom. Size	Carlon Plus 40 Rigid Non-metallic Conduit	Aluminum	Electrical Metallic Tubing(EMT)	Intermediate Metal Conduit (IMC)	Rigid Steel (GALV)
½	17	27	30	57	79
¾	23	36	46	78	105
1	34	53	66	112	153
1¼	46	70	96	114	201
1½	55	86	112	176	246
2	73	115	142	230	334
2½	125	183	230	393	527
3	164	239	270	483	690
3½	198	288	350	561	831
4	234	340	400	625	982
5	318	465	Not Made	Not Made	1344
6	412	612	Not Made	Not Made	1770

See Section 16010, part

CORROSION RESISTANCE OF CARLON PLUS 40® AND PLUS 80® CONDUIT

Carlon Plus 40 and Plus 80 are generally acceptable for use in environments containing the chemicals below. These environmental resistance ratings are based upon tests where the specimens were placed in complete submergence i reagent listed. In many applications the Plus 40 and Plus 80 can be used in process areas where these chemicals are manufactured or used because worker safety requirements dictate that any air presence or splashing be at a very low level.

If there are any questions for specific suitability in a given environment, prototype samples should be tested under actual conditions.

Acetic Acid 0-20%
Acetic Acid 20-30%
Acetic Acid 30-60%
Acetic Acid 80%
Acetic Acid — Glacial
Acetic Acid Vapors
Acetylene
Adipic Acid
Alum
Aluminum Chloride
Aluminum Fluoride
Aluminum Hydroxide
Aluminum Oxychloride
Aluminum Nitrate
Aluminum Sulfate
Ammonia-Dry Gas
Ammonium Bifluoride
Ammonium Carbonate
Ammonium Chloride
Ammonium Hydroxide 28%
Ammonium Metaphosphate
Ammonium Nitrate
Ammonium Persulfate
Ammonium Phosphate — Neutral
Ammonium Sulfate
Ammonium Sulfide
Ammonium Thiocyanate
Amyl Alcohol
Anthraquinone
Anthraquinonesulfonic Acid
Antimony Trichloride
Aqua Regia
Arsenic Acid 80%
Arylsulfonic Acid
Barium Carbonate
Barium Chloride
Barium Hydroxide
Barium Sulfate
Barium Sulfide
Beet — Sugar Liquor
Benzine Sulfonic Acid 10%
Benzoic Acid
Bismuth Carbonate
Black Liquor (Paper Industry)
Bleach — 12.5% Active CL_2
Borax
Boric Acid
Brine
Breeder Pellets — Deriv. Fish
Bromic Acid
Bromine — Water
Butane
Butadiene
Butyl Alcohol
Butyl Phenol
Butylene
Butyric Acid
Calcium Bisulfite
Calcium Carbonate
Calcium Chlorate
Calcium Chloride
Calcium Hydroxide
Calcium Hypochlorite
Calcium Nitrate
Calcium Sulfate

Carbonic Acid
Carbon Dioxide Gas — Wet
Carbon Dioxide — Aqueous Solution
Carbon Monoxide
Caustic Potash
Caustic Soda
Chromic Acid
Chromic Hydrate
Chlorine Gas (Dry)
Chlorine Gas (Moist)
Chlorine Water
Chlorosulfonic Acid
Chrome Alum
Chromic Acid 10%
Chromic Acid 30%
Chromic Acid 40%
Chromic Acid 50%
Citric Acid
Copper Chloride
Copper Cyanide
Copper Fluoride
Copper Nitrate
Copper Sulfate
Cottonseed Oil
Cresylic Acid 50%
Crude Oil — Sour
Crude Oil — Sweet
Demineralized Water
Dextrin
Dextrose
Dichromic Acid
Distilled Phosphate
Ethylene Glycol
Ferric Chloride
Ferric Nitrate
Ferric Sulfate
Ferrous Chloride
Ferrous Sulfate
Fluorine Gas — Wet
Fluorine Gas — Dry
Formaldehyde Acid
Formic Acid
Freon
Fructose
Fruit Juice
Fuel Oil
Gasoline (Dry)
Gasoline (Wet)
Gelatin
Glue
Glycerine — Refined
Glycol
Glycerine (Glycerol)
Glucose
Gluconic Acid
Glue — Liquor (Paper Industry)
Heptane
Hydrazine Hydrate
Hydrochloric Acid 20%
Hydrochloric Acid 0% - 25%
Hydrochloric Acid 25% - 40%
Hydrocyanic Acid or
Hydrogen Cyanide

Hydrofluoric Acid 10%
Hydrofluorosilicic Acid
Hydrogen Phosphide
Hydrogen Sulfide — Dry
Hydrogen Sulfide — Aqueous Solution
Hydroquinone
Hydroxylamine Sulfate
Iodine
Kerosene
Lactic Acid 28%
Lauric Acid
Lauryl Chloride
Lauryl Sulfate
Lead Acetate
Lime Sulfur
Linoleic Acid
Linseed Oil
Lubricating Oils
Magnesium Carbonate
Magnesium Chloride
Magnesium Hydroxide
Magnesium Nitrate
Magnesium Sulfate
Maleic Acid
Malic Acid
Mercuric Chloride
Mercuric Cyanide
Mercurous Nitrate
Mercury
Methyl Sulfate
Methylene Chloride
Mineral Oils
Naphthalene
Nickel Chloride
Nickel Nitrate
Nitric Acid, Anydrous
Nitric Acid 20%
Nitric Acid 40%
Nitric Acid 60%
Nitrobenzene
Nitrous Oxide
Oils and Fats
Oils — Petroleum — (See Type)
Oleic Acid
Oxalic Acid
Palmitic Acid 10%
Perchloric Acid 10%
Phenylhydrazine Hydrochloride
Phosgene, Gas
Phosphoric Acid — 0—25%
Phosphoric Acid — 25-50%
Phosphoric Acid — 50-85%
Photographic Chemicals
Plating Solutions
Potassium Bicarbonate
Potassium Bichromate
Potassium Borate
Potassium Bromide
Potassium Carbonate
Potassium Chloride
Potassium Chromate
Potassium Cyanide
Potassium Dichromate
Potassium Ferricyanide

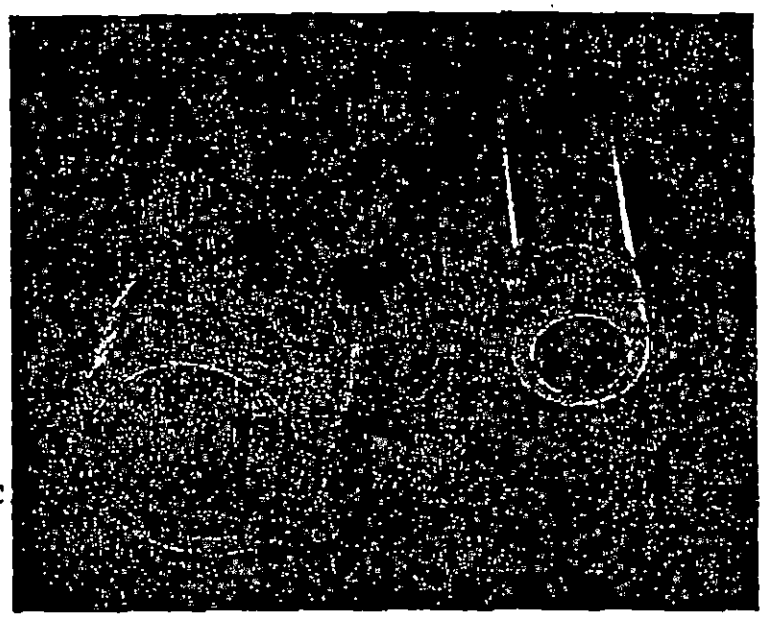
Potassium Ferrocyanide
Potassium Fluoride
Potassium Hydroxide
Potassium Nitrate
Potassium Perborate
Potassium Perchlorite
Potassium Permanganate 10%
Potassium Persulfate
Potassium Sulfate
Propane
Propyl Alchohol
Silicic Acid
Silver Cyanide
Silver Nitrate
Silver Plating Solutions
Sodium Acetate
Sodium Arsenite
Sodium Benzoate
Sodium Bicarbonate
Sodium Bisulfate
Sodium Bisulfite
Sodium Bromide
Sodium Chlorate
Sodium Chloride
Sodium Cyanide
Sodium Dichromate
Sodium Ferricyanide
Sodium Ferrocyanide
Sodium Fluoride
Sodium Hydroxide
Sodium Hypochlorite
Sodium Nitrate
Sodium Nitrite
Sodium Sulfate
Sodium Sulfide
Sodium Sulfite
Sodium Thiosulfate (Hypo)
Stannic Chloride
Stannous Chloride
Stearic Acid
Sulfur
Sulfur Dioxide — Gas Dry
Sulfur Trioxide
Sulfuric Acid — 0-10%
Sulfuric Acid — 10-75%
Sulfuric Acid — 75-90%
Sulfurous Acid
Tannic Acid
Tanning Liquors
Tartaric Acid
Titanium Tetrachloride
Triethanolamine
Trimethyl Propane
Trisodium Phosphate
Turpentine
Urea
Vinegar
Whiskey
White Liquor (Paper Industry)
Wines
Zinc Chloride
Zinc Chromate
Zinc Cyanide
Zinc Nitrate
Zinc Sulfate

16010 - 2.1A

OCAL-BLUE CONDUIT

1) The conduit is hot dipped galvanized after fabricaion.
2) The threads are hot dipped galvanized.
3) A coating of 1/2 mil acrylic epoxy over the entire pipe inside & out including the threads
4) A clear urethane coating over threads
5) A minimum 40 mil PVC coating on the outside
6) A nominal 2 mil blue urethane on the inside

G.C. MONACO&DAUGHTER,INC
PELHAM BAY LANDFILL
OCAL-BLUE CONDUIT

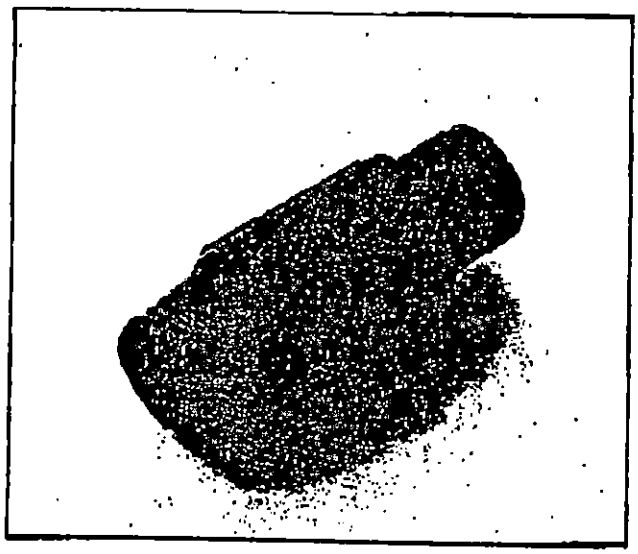


	OCAL-BLUE COATED CONDUIT							
Size in Inches	Outside Diameter Steel Only In Inches	Outside Diameter With PVC In Inches	Minimum Wall Thickness Steel Only In Inches	Minimum Wall Thickness With PVC In Inches	Inside Diameter In Inches	Cross Section Area In Square Inches	Length Without Couplings In Feet	Minimum Weight Per Foot In LBS.
1/2	.840	.880	.100	.140	.622	.304	9'11 1/4"	.79 lbs
3/4	1.050	1.090	.105	.145	.824	.533	9'11 1/4"	1.05 lbs
1	1.315	1.355	.123	.163	1.049	.864	9'11"	1.53 lbs
1 1/4	1.660	1.700	.126	.166	1.380	1.495	9'11"	2.01 lbs
1 1/2	1.900	1.940	.135	.175	1.610	2.036	9'11"	2.40 lbs
2	2.375	2.415	.140	.180	2.067	3.355	9'11"	3.32 lbs
2 1/2	2.875	2.915	.187	.227	2.499	4.788	9'10 1/2"	5.27 lbs
3	3.500	3.540	.195	.235	3.068	7.393	9'10 1/2"	6.83 lbs
3 1/2	4.000	4.040	.208	.248	3.548	9.866	9'10 1/4"	8.31 lbs
4	4.500	4.540	.218	.258	4.026	12.730	9'10 1/4"	9.73 lbs
5	5.563	5.603	.235	.275	5.047	20.006	9'10"	13.14 lbs
6	6.625	6.665	.260	.300	6.065	28.891	9'10"	17.46 lbs

D-14

OCAL-BLUE COUPLINGS

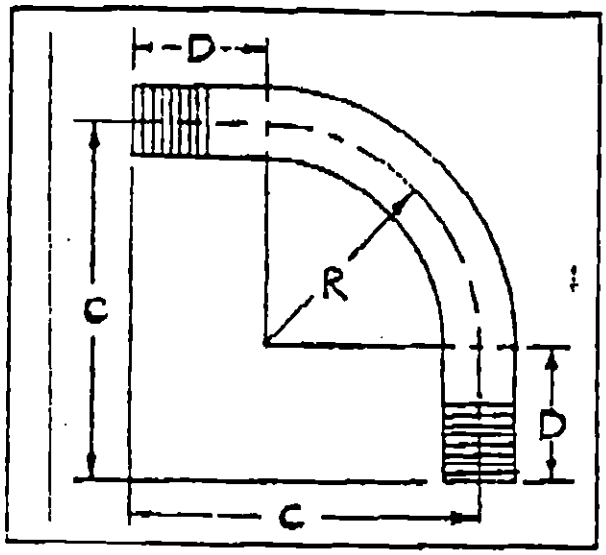
1) All couplings are coated with .0005" (1/2 mil) of epoxy acrylic inside & out
2) A 40 mil minimum PVC coating outside
3) A clear urethane coating inside
4) Molded ribs on outer coating
5) Couplings have straight threads (not tapered)
6) Couplings have patented sleeves to seal the connection



OCAL-BLUE COUPLINGS			
Coupling Size in Inches	Length of Metal in Inches	Total Length Including Sleeve	Weight in LBS.
1/2	1.625	4"	0.13
3/4	1.625	4"	0.19
1	2.000	4 15/16"	0.33
1 1/4	2.031	4 3/4"	0.43
1 1/2	2.062	4 7/8"	0.56
2	2.125	5 1/4"	0.77
2 1/2	3.187	6 5/8"	1.85
3	3.312	6 7/8"	2.70
3 1/2	3.406	7 1/8"	3.78
4	3.515	7 1/4"	3.08
5	3.953	7 3/8"	5.00
6	4.250	7 7/8"	6.00

OCAL-BLUE STANDARD AND LARGE RADIUS ELBOWS

1) OCAL-BLUE elbows are fabricated from ocal blue conduit
2) Both standard & special radiuses are available in 90°, 45°, 60° and 30°
3) Radiuses and degrees not listed are also available upon request



STANDARD RADIUS ELBOWS

Size In Inches	Radius "R" in Inches	Offset "C" in Inches	Straight End "D" in Inches	Unbent Length In Inches	Weight Per Each
1/2	4.00	6.60	2.12	11.25	0.73
3/4	4.50	7.25	2.75	12.50	1.07
1	5.75	8.63	2.88	14.75	1.93
1 1/4	7.25	10.44	3.19	17.75	2.85
1 1/2	8.25	11.63	3.38	19.75	4.26
2	9.50	13.31	3.81	22.50	6.50
2 1/2	10.50	16.50	5.75	28.00	11.50
3	13.00	18.75	5.79	32.00	18.00
3 1/2	15.00	22.96	7.96	39.50	26.25
4	16.00	23.18	7.96	39.50	32.00
5	24.00	34.90	10.90	59.50	70.00
6	30.00	43.44	14.40	76.00	100.00

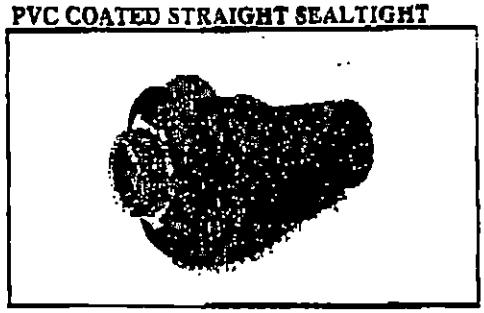
LARGE RADIUS ELBOWS

Radius "R" in Inches	12"	15"	18"	24"	30"	36"	42"	48"	60"
Offset "C"	1'9"	2'0"	2'4"	2'11"	3'5"	3'11"	4'6"	5'0"	6'0"
Straight End "D"	9"	9"	10"	11"	11"	11"	12"	12"	12"
Unbent Length	3'0"	3'6"	4'0"	4'11"	5'9"	6'6"	7'6"	8'6"	9'10"
Pipe Sizes Available	1 - 2 1/2" incl.	1-3" incl.	1-4" incl.	1-5" incl.	1-6" incl.	1-6" incl.	1-8" incl.	1-6" incl.	2 1/2 - 6" incl.

SEALTIGHT CONNECTORS

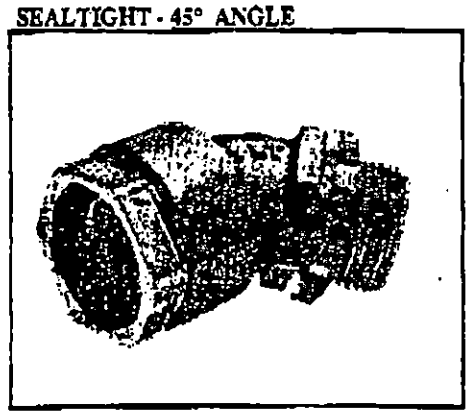
1) 40 mil minimum PVC exterior coating
2) Patented sleeves are designed to seal over sealtight conduit
3) Available also with a grounding lug (use suffix G)
4) Available in straight, 45° & 90°

PVC COATED STRAIGHT SEALTIGHT

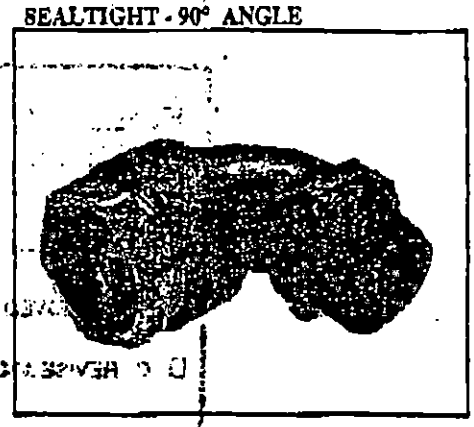


	SEALTIGHT CONNECTORS		
	STRAIGHT	45°	90°
Pipe Size	Catalog Number	Catalog Number	Catalog Number
1/2	ST1-2	ST1-245	ST1-290
3/4	ST3-4	ST3-445	ST3-490
1	ST1	ST145	ST190
1 1/4	ST11-4	ST11-445	ST11-490
1 1/2	ST11-2	ST11-245	ST11-290
2	ST2	ST245	ST290
2 1/2	ST21-2	ST21-245	ST21-290
3	ST3	ST345	ST390
4	ST4	ST445	ST490

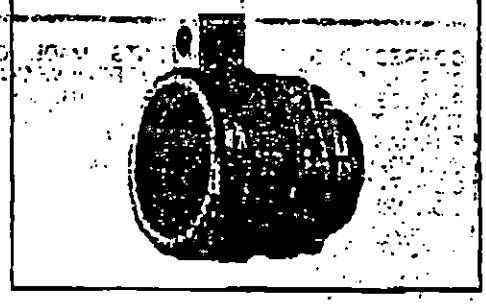
SEALTIGHT - 45° ANGLE



SEALTIGHT - 90° ANGLE



SEALTIGHT- STRAIGHT WITH GROUND

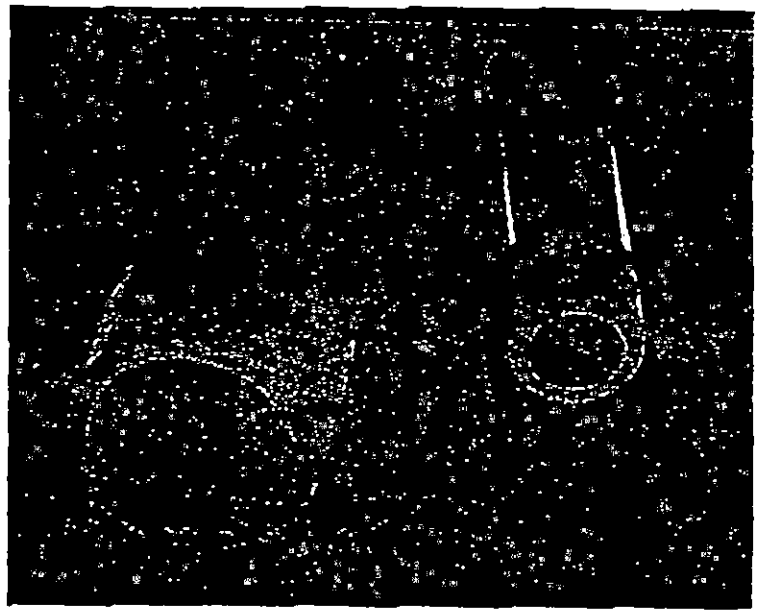


OCAL-BLUE CONDUIT

16010 - 2.1 A

OCAL-BLUE CONDUIT

1) The conduit is hot dipped galvanized after fabricaion.
2) The threads are hot dipped galvanized.
3) A coating of 1/2 mil acrylic epoxy over the entire pipe inside & out including the threads
4) A clear urethane coating over threads
5) A minimum 40 mil PVC coating on the outside
6) A nominal 2 mil blue urethane on the inside



	OCAL-BLUE COATED CONDUIT							
Size in Inches	Outside Diameter Steel Only In Inches	Outside Diameter With PVC In Inches	Minimum Wall Thickness Steel Only In Inches	Minimum Wall Thickness With PVC In Inches	Inside Diameter In inches	Cross Section Area In Square Inches	Length Without Couplings In Feet	Minimum Weight Per Foot In LBS.
1/2	.840	.880	.100	.140	.622	.304	9'11 1/4"	.79 lbs
3/4	1.050	1.090	.105	.145	.824	.533	9'11 1/4"	1.05 lbs
1	1.315	1.355	.123	.163	1.049	.864	9'11"	1.53 lbs
1 1/4	1.660	1.700	.126	.166	1.380	1.495	9'11"	2.01 lbs
1 1/2	1.900	1.940	.135	.175	1.610	2.036	9'11"	2.40 lbs
2	2.375	2.415	.140	.180	2.067	3.355	9'11"	3.32 lbs
2 1/2	2.875	2.915	.187	.227	2.469	4.788	9'10 1/2"	5.27 lbs
3	3.500	3.540	.195	.235	3.068	7.393	9'10 1/2"	6.83 lbs
3 1/2	4.000	4.040	.208	.248	3.548	9.866	9'10 1/4"	8.31 lbs
4	4.500	4.540	.218	.258	4.026	12.730	9'10 1/4"	9.73 lbs
5	5.563	5.603	.235	.275	5.047	20.006	9'10"	13.14 lbs
6	6.625	6.665	.260	.300	6.065	28.891	9'10"	17.46 lbs

PELHAM BAY LANDFILL
CONT. # 875 NO
SPEC SEC. # 16010
L-86-16010

G.C. MONACO ELECTRIC
& DAUGHTER, INC.
261 W. LINCOLN AVE.
MT. VERNON, NY 10550

OCAL-BLUE

PVC Coated Conduit with Blue Urethane Interior Coating

is the answer to internal corrosion, and is necessary because of the large quantities of corrosive atmosphere that are breathed into the conduit system.

We start by manufacturing the rigid conduit and do our special Hot Dipped Galvanizing after fabrication. The galvanizing is done after the threading, producing Hot Dipped Galvanized threads and providing extra protection against corrosion.

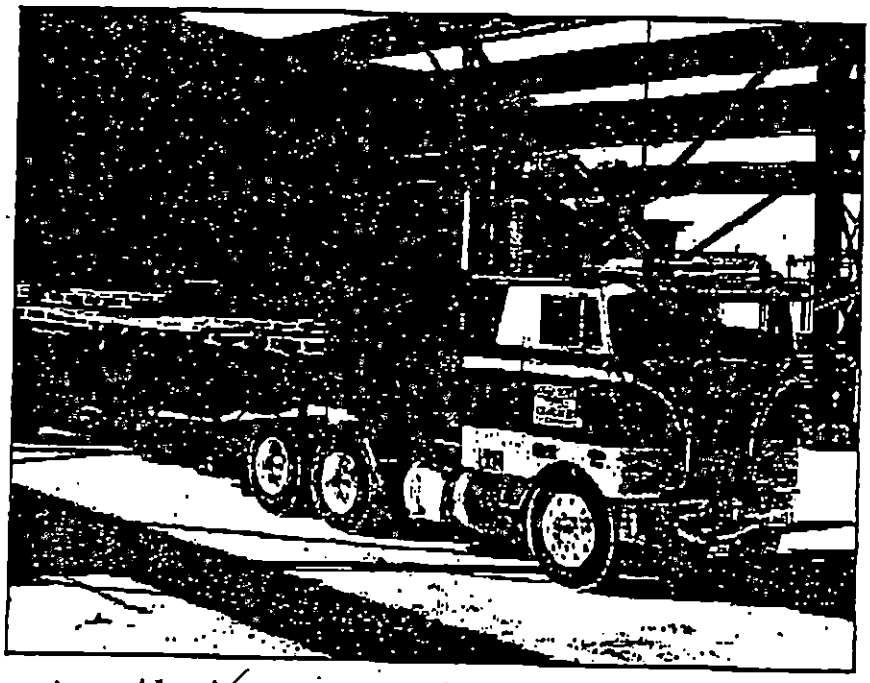
The PVC compounds are made from primary materials without the addition of fillers or secondary materials. The end result is sealing characteristics that outperform any other corrosion prevention system.

Occidental Coating Company also offers fittings, elbows, wireways, light fixtures, panel boards and other electrical accessories coated with the OCAL-BLUE process.

For custom orders, special colors or large quantities Occidental's manufacturing capabilities guarantee delivery time unmatched in the industry.

Finally, our reputation for dependability and customer service has made Occidental Coating Company the most trusted name in corrosion protection for the electrical industry.

OCAL coatings have been tested against more than 120 chemical solutions and have been proven the most effective, long-lasting corrosion protection systems available.

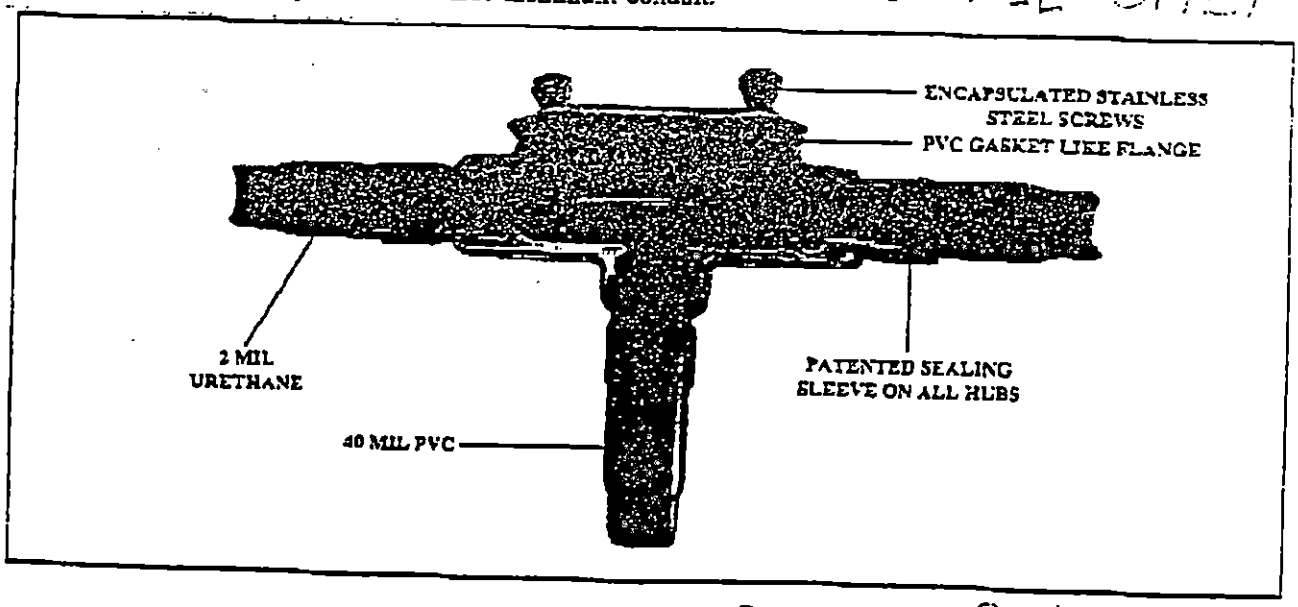


Aluminum

OCAL-BLUE PVC Coated Aluminum Conduit has the same corrosion protection qualities as regular OCAL-BLUE except that it combines the protection of OCAL-BLUE with lightweight copper-free aluminum conduit.

Occidental Coating company protects each shipment of OCAL-BLUE products with protective packaging for damage-free distribution.

STEEL OILL



G.C. MONACO ELECTRIC & DAUGHTER, INC.
261 W. LINCOLN AVE.
MT. VERNON, NY 10550

PELHAM BAY LANDFILL
CONT # 875 NP
SPEC SEC. #16010

CABLE RACKS FOR MANHOLE

16010 - 2.1 D

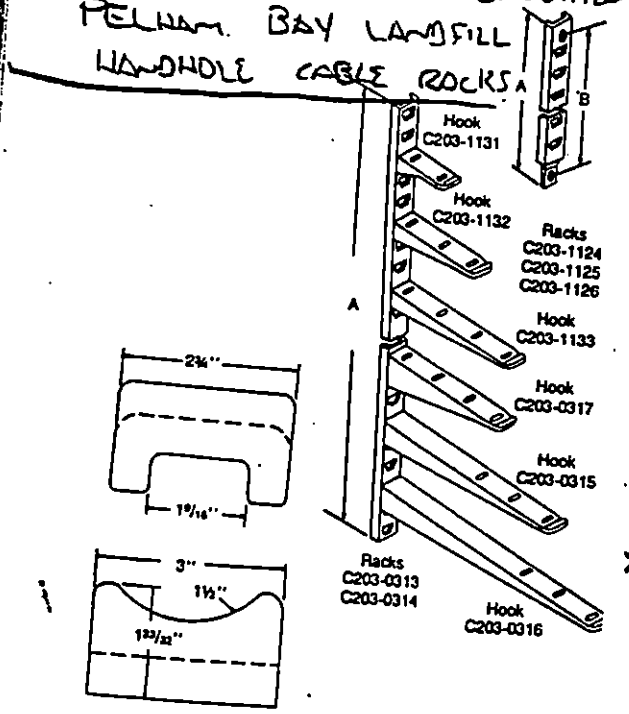
G.C. MONACO ELEC + DAUGHTER
PELHAM BAY LANDFILL
HANDHOLE CABLE RACKS

RACKS, UNDERGROUND CABLE

Channel-Steel Type

Cable Racks

Hot-dip galvanized racks with hook holes 1½" apart. Fasten to manhole or interior walls with ½" x 4" expansion bolts (not included). Mounting slots ⅝" x ¾" at top and bottom of 16", 24" and 30' lengths overlap for assembly in combinations for overall length desired.



No. C203-1120

Catalog Number	No. of Hook Holes	Dimensions A	Dimensions B	Wt. Per 100 Pcs.
		1½" x 7/16" x 7/16" Channel Steel		
†C203-1124	8	15"	13½"	162
†C203-1125	14	24"	22½"	230
†C203-1126	18	30"	28½"	260
C203-0313	37	55½"	–	570
C203-0314	47	70½"	–	720

For extra clearance from wall, see Supports, Cable Rack, page 5-36.
†REA Accepted.

Cable Rack Hooks

Hot-dip galvanized hooks with rounded surfaces have 5/16" x 13/16" slots for lock clips, below. For hooks with 0.080" plastisol coating, contact Chance ServiCenter.

Catalog Number	Length from Face of Rack	Channel Steel Size, Inches	Wt. per 100 Pcs.
†C203-1131	4"	1½ x 1½ x 7/16	42
†C203-1132 *C203-1128	7½"	1½ x 1½ x 7/16	96
†C203-1133 *C203-1129	10"	1½ x 1½ x 7/16	116
C203-0317	10"	1½ x 2 1/16 x 19/64	175
†C203-0315	14"	1½ x 1 19/64 x 7/16	204
†C203-0316	18"	1½ x 1 19/64 x 7/16	260

†REA Accepted.
*Plastisol coated.

No. L-1100

Cable Rack Insulator (White Glaze)

Catalog No.	Dimensions in Inches: Radius	Length Along Hook	Width	Approx. Ship. Wt., Lbs. Per 100 Pcs.
C203-1120	1½	3	2¾	80

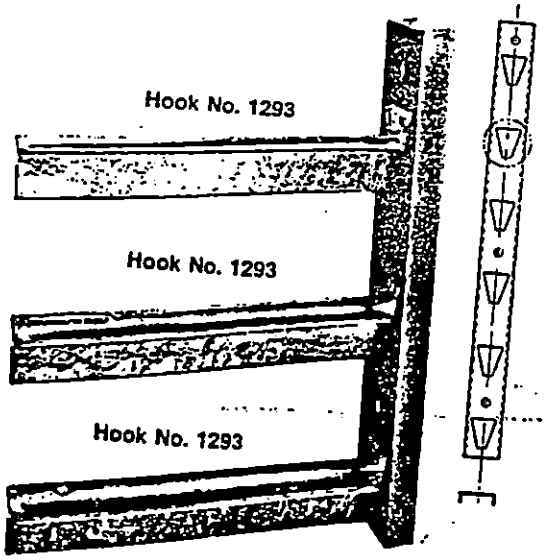
Cable Rack Hook Lock Clip

Catalog No.	Material	Size Inches	Approx. Ship. Wt., Lbs., Per 100 Pcs.
L-1100	Zinc	18 Ga. x ⅝	2

RACKS, UNDERGROUND CABLE

Heavy Channel-Steel Type

Made from 4" x 1 19/32" x 5/16" channel steel. Hot dip galvanized. Either expansion or anchor bolts can be used to mount them to the manhole wall. Pressed-steel hooks have stops to keep insulators from sliding off. Mounting holes ¾" on all except C203-0047 which has 7/16" mounting holes.

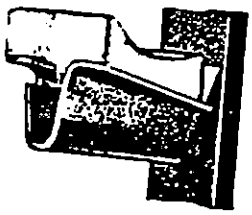


Rack No. R1473

Cable Racks

Catalog No.	No. of Slots	Hook Slot Spacing	Overall Length	Mtg. Hole Spacing	Approx. Ship. Wt., Lbs. Per 100 Pcs.
R1473	3	8	24	16	1000
R1474	4	8	32	24	1400
R1476	6	8	48	40	2100
*C203-0047	6	8	48	22¾ & 40	1000

*Same as R1476 except three mounting holes . . . lower right two slotted.



Insulator No. 1115

Cable Rack Hooks

Catalog No.	No. of Insulators Accommodated	Dimensions in Inches: Extension from Face of Rack	Overall Length	Steel Size	Approx. Ship. Wt., Lbs. Per 100 Pcs.
1292	2	10¼	12	12 Ga.	244
1293	3	16¾	18	12 Ga.	340

Cable Rack Insulators (White Glaze)

Catalog No.	Dimensions in Inches: Radius for Cable	Overall Length	Overall Width	Approx. Ship. Wt., Lbs. Per 100 Pcs.
1115	2¾	4½	2¾	134

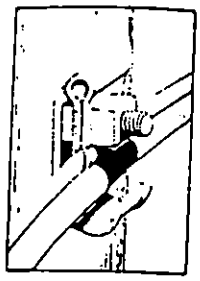
L-86-16do

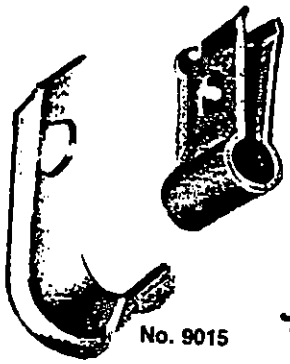
TEMP CABLE SUPPORTS FOR TRAILER POWER.

CHANCE

HANGER

Figure 8 Cable





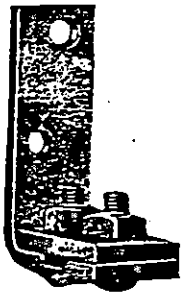
No. 9015

Used to support integrated messenger telephone cable — commo referred to as Figure 8 Cable. Hanger is in two parts, hook and cla both galvanized steel. Installed with a ½" machine bolt and two square nuts. One nut is placed between hook and clamp for spacing. The other is used to tighten the clamp member. Order nuts and bolts separately. Accommodates .109 or .134 solid messenger wire.

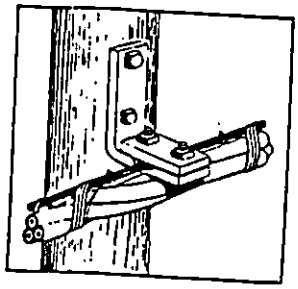
Catalog No.	Description	Approx. Ship. Wt., Lbs., Per 100 Pcs.
9015	Hook and Clamp	54

HANGERS, MESSENGER

Universal Type



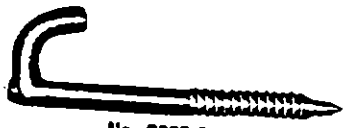
No. 7911



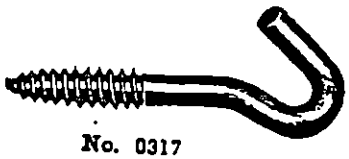
Used on corners and straight runs. Messenger is securely clamped by two ½" carbon-steel guy clamp bolts. Mounted with a ⅝" thru-bolt and a ½" lag screw, neither of which is included. Hot dip galvanized.

Catalog No.	Dimensions in Inches			Approx. Ship. Wt., Lbs. Per 100 Pcs.
	Steel Size	Ext. from Pole	Strand Size	
7911	½ x 2	4¼	5/16 to ½	370
7912	⅜ x 1¾	3¾	5/16 to ½	250

HOOKS, DRIVE AND SCREW



No. C205-0190

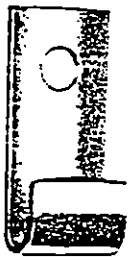


No. 0317

Hooks used to attach wedge type service drops and deadend clamps to crossarms, poles or buildings. No. C205-0190 Drive Hook is furnished with 7/16" fetter drive threads and a pilot point for easy starting. No. 0317 Screw Hook has ⅜" gimlet threads.

Catalog No.	Dimensions in Inches			Approx. Ship. Wt. Lbs. Per 100 Pcs.
	Thread Dia.	Lgth.	Overall Lgth.	
C205-0190	7/16	2½	4¾	27
0317	⅜	2	4	13

HOOKS, GUY



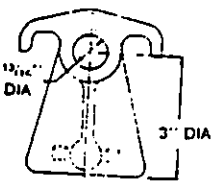
No. 6584

No. 5004

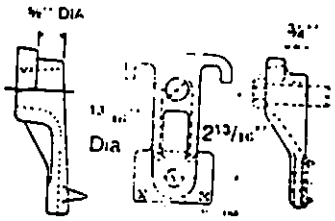
Keeps guy wire from creeping downward when pole is guyed sharply. Nos. 5001, and 5004 are used for storm guying. Hooks should be used under bolt heads for maximum shewr strength. For Guy hooks mounted on strain plates, see page 5-37.

Catalog No.	Description	Material Size, Inches	Hole Dia. Inches	Approx. Ship. Wt., Lbs. Per 100 Pcs.
5001	2-Bolt Storm	¼ x 1½ x 7	7/16 & 13/16	108
†5004	1-Bolt Storm, ¾"R	¼ x 1½ x 4½	11/16	79
†6584	1-Bolt Standard	7/16 x 1¾ x 4	11/16	78

†REA Acccepted.



C203-0169

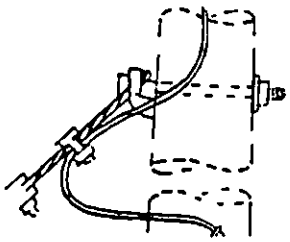


No. C203-0168

HOOKS, GUY, DUCTILE IRON

Ductile Iron — Hot Dip Galvanized — Less corrosive than malleable iron — No hydrogen or galvanizing embrittlement — Characteristically superior in withstanding shock loads.

Will accommodate a maximum guy strand of 7/16" diameter at a 90° angle to the pole. May be used for down guy attachment with excellent load holding capabilities. The guy strand loop may be made up on the ground to simplify installation.



Catalog No.	Type	Wgt. Per 100 Pcs.
†C203-0168	*2 Bolt	100 lbs.
C203-0169	1 Bolt	96 lbs.

*The mounting hole spacing 2 13/16" on center
†REA Accepted

L-87-1610

Triangle PWC, Inc.
A SUBSIDIARY OF TRIANGLE INDUSTRIES, INC.
P.O. Box 711 New Brunswick, New Jersey 08903

TP-250XH

16020-
2.1 B

PELHAM BAY LANDFILL

L-142

Everene® Insulation - 600 Volts (Cross-Linked Polyethylene)

EVERENE® BUILDING WIRE TYPE XHHW

application

Everene Insulated Type XHHW building wire is approved for circuits not exceeding 600 volts where the maximum operating temperature does not exceed 75°C in wet locations and 90°C in dry locations.

The National Electrical Code permits the use of Type XHHW wire in duct or conduit installed underground, in concrete slabs or other masonry in direct contact with earth, in wet locations, and where condensation and moisture accumulations within the raceway may occur. Also suitable for direct burial on non-code installations per IPCEA Pub. No. S-66-524, NEMA Pub. No. WC-7.

description

Everene Type XHHW building wire is lighter and smaller in diameter than rubber insulated wire which requires an additional covering of braid or a protective jacket.

Everene insulated building wire is highly resistant to abrasion, chemicals, ozone and crushing. In addition Everene has excellent resistance to sunlight, moisture and flame, and combines the superior electrical properties which borderline high molecular weight polyethylene with the thermal properties of rubber.

specifications

specifications:	Underwriters' Laboratories Standard No. 44 Type XHHW, Federal Specifications JC-30 and JC103E. IPCEA Pub. No. S-66-524 and NEMA Pub. No. WC-7.
conductor:	Copper or Aluminum.
insulation:	Everene (Cross-Linked Polyethylene)
cover:	none
voltage:	600
temperature:	75°C (Wet or Dry) Type XHHW 90°C (Dry Locations) Type XHHW 90°C (Wet or Dry Locations) Per IPCEA-NEMA Specifications

Conductors:

Copper:
Solid or concentric stranded soft copper is used, conforming with ASTM Specifications B3 or B8, and Underwriters' Laboratories Standard UL44 for Rubber insulated wires.

Aluminum:
Aluminum conductors No. 8 AWG solid and smaller shall be of three-quarter hard aluminum. Stranded conductors 8 AWG and larger shall be either three-quarter hard or hard aluminum in accordance with underwriters' laboratories standard UL44.

insulation:

Conductors are insulated with Everene (Cross-Linked Polyethylene) conforming to Underwriters' Laboratories requirements for types XHHW insulation, with a conductor operating temperature of 90°C in dry locations and 75°C in wet locations.

Everene also conforms to the requirements of IPCEA Pub. No. S-66-524 and NEMA Pub. No. WC-7 for cross-linked Polyethylene insulation suitable for use on power cables in wet or dry locations and conductor operating temperatures not exceeding 90°C.

outer covering:

No outer covering is required on Everene cables.

SINGLE CONDUCTOR EVERENE™

TYPE XHHW 600 VOLTS

Size Awg or MCM	No. of Strands	Insulation Thickness (MILS.)	Approx. O.D. (Inches)	Ampacity			
				Copper Conductors		Aluminum Conductors	
				XHHW 75°C	XHHW 90°C	XHHW 75°C	XHHW 90°C
14	1	30	.128	15	15 (T)	–	–
12	1	30	.145	20	20 (T)	15	15*
10	1	30	.166	30	30 (T)	25	25*
8	1	45	.224	45	50	40	40
14	7	30	.137	15	15 (T)	–	–
12	7	30	.165	20	20 (T)	15	15*
10	7	30	.178	30	30 (T)	25	25*
8	7	45	.241	45	50	40	40
6	7	45	.279	65	70	50	55
4	7	45	.327	85	90	65	70
2	7	45	.387	115	120	90	95
1	19	55	.448	130	140	100	110
1/0	19	55	.489	150	155	120	125
2/0	19	55	.534	175	185	135	145
3/0	19	55	.586	200	210	155	165
4/0	19	55	.644	230	235	180	185
250	37	65	.711	255	270	205	215
300	37	65	.766	285	300	230	240
350	37	65	.817	310	325	250	260
500	37	65	.949	380	405	310	330
600	61	80	1.060	420	455	340	370
750	61	80	1.165	475	500	385	405
1000	61	80	1.319	545	585	445	480

COPPER CONDUCTORS

(T) – The ampacities for type XHHW conductors for sizes 14, 12 & 10 AWG are the same as designated for 75°C conductors, per N.E.C. table 310-16.

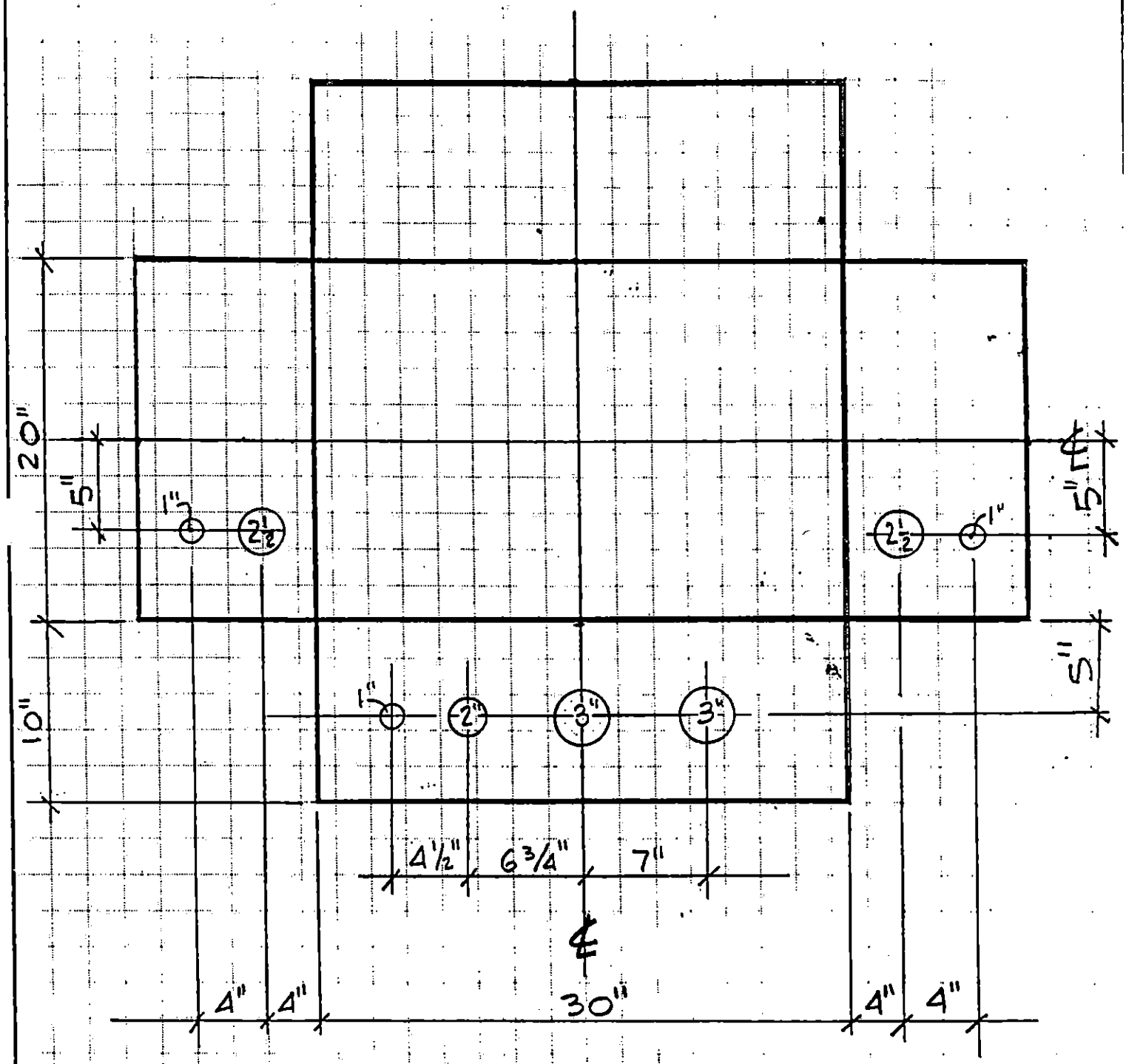
ALUMINUM CONDUCTORS

* – The ampacities for type XHHW conductors for sizes 12 & 10 AWG are the same as designated for 75°C conductors, per N.E.C. Table 310-18.

All ampacities are based on three (3) single conductor cables in conduit at a 30°C maximum ambient air temperature and 75°C or 90°C maximum conductor operating temperature.

G. C. MONACO ELECTRIC & DAUGHTER, INC.
261 West Lincoln Avenue
MOUNT VERNON, NEW YORK 10550
TEL.: 914 - 668-7858
FAX: 914 - 668 - 7997

JOB PELHAM BAY LANDFILL
SHEET NO. 1 OF 1
CALCULATED BY RC DATE 10/8/94
CHECKED BY DATE
SCALE NONE



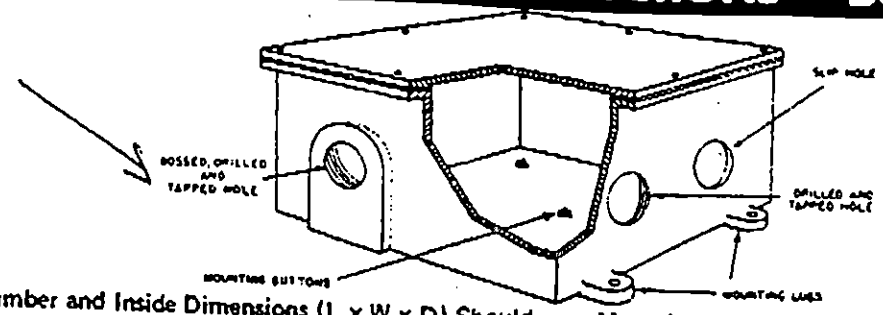
VIEW LOOKING INTO BOX
WITH SIDES LAID DOWN

SPRING CITY ELECTRICAL MFG. CO., SPRING CITY, PA. 19475

ORDERING INSTRUCTIONS - BOXES

L-127-16030

16030-2.1B



Catalog Number and Inside Dimensions (L x W x D) Should be specified.

Conduit Entrances — Sizes and Locations Should be furnished on a drilling template (or comparable sketch) similar to the Drilling Template shown on page 27. These templates, in pad form, are available upon request with small supply in pocket at back of binder.

Conduit Entrances — Types Should be specified as follows:

1. Slip Hole (drilled only — for conduit clearance).
2. Drilled and Tapped Hole (D&T). If Thread Chart in next column shows that the box wall thickness does not permit required number of threads, specify bosses.
3. Bossed, Drilled and Tapped hole to provide a minimum of five full threads (Boss-D&T).
4. Boss only, for drilling and tapping in field — specify conduit size.

Conduit Spacings Minimum spacing between conduit centers and their distance from corner and back of box are given in tables on page 27. When not specified, spacings will be selected at our discretion.

Mounting Lugs Standard on Types HF, HC-T, HC-S, RB, EX and DH boxes, optional on other types. Unless locations are otherwise specified, lugs will be placed on each long side of box and will be spaced and drilled to our standards. See additional mounting lug data in the tables on page 26.

Mounting Buttons For mounting equipment in back of box - location should be indicated on sketch or drilling template. Buttons are usually 3/8" high and 3/4" diameter with larger sizes available at the same price, and buttons are normally blind tapped for 1/4"-20 screws.

THREAD CHART

CONDUIT SIZE	NUMBER OF THREADS PER INCH	WALL THICKNESS REQUIRED INCHES		
		5 THREADS	3½ THREADS	3 THREADS
3/8"	16	9/32	7/32	3/16
1/2" to 3/4"	14	3/8	1/4	7/32
1" to 2"	11-1/2	7/16	5/16	9/32
2-1/2" to 6"	8	5/8	7/16	3/8

UL requirements: 1/4" minimum wall thickness, EX boxes — 5 threads, DH & DH-A boxes — 3-1/2 threads, other box styles — 3 threads.

ADDITIONAL BOX CHARGES

TABLE A (ALL BOX TYPES EXCEPT HF, HF-A & EX)

CONDUIT SIZE	DRILLING ONLY (SLIP HOLE) LIST	DRILLING & TAPPING (NO BOSS) LIST	BOSS ONLY NO TAPPING LIST	BOSS FOR 5 THREADS & TAPPING LIST
3/8", 1/2", 3/4", 1", 1-1/4", 1-1/2", 2", 2-1/2", 3", 3-1/2", 4", 4-1/2", 5", 6"	For Prices, contact Distributor or Sales Representative.			

TABLE B (BOX TYPES HF & HF-A)

CONDUIT SIZE	DRILLING & TAPPING (NO BOSS) LIST	BOSS FOR 5 THREADS & TAPPING LIST
3/8", 1/2", 3/4", 1", 1-1/4", 1-1/2", 2", 2-1/2", 3", 3-1/2", 4", 4-1/2", 5", 6"	For Prices, contact Distributor or Sales Representative.	

TABLE C (BOX TYPE EX)

DRILLING & TAPPING 5 THREADS LIST
**

MOUNTING LUGS WITH BOLT HOLES

BOX SIZE	NO. OF LUGS	LIST PRICE
Up to 6"L. x 4"W.	2 4	**
Sizes 6"L. x 6"W. Up to 12"L. x 4"W.	2 4	
Sizes 12"L. x 6"W. Up to 18"L. x 16"W.	2 4	
18"L. x 18"W. & Larger	4	

Mounting lugs are standard equipment on Box Types HF, HF-A and EX

HINGES

TYPE	LENGTH HINGED SIDE	BUTT HINGES PER BOX	LIST PRICE PER BOX
Stainless Steel Butt for JR boxes Stainless Steel Piano — 1 per box, all styles	Up to 12" 13" to 18" 19" to 24" 25" to 36"	2 2 3 3	**
Cast Ductile Iron for HF & EX boxes Cast Aluminum for HF-A boxes	Up to 24" Over 24"	2 3	

INTERIOR MOUNTING BUTTONS BLIND TAPPED FOR 1/4"-20

NUMBER PER BOX	LIST PRICE
1 2 3	**

HASPS & STAPLES GALVANIZED STEEL EXCLUDES LOCK

BOX SIZE	LIST PRICE
Up to 12" x 12"	**

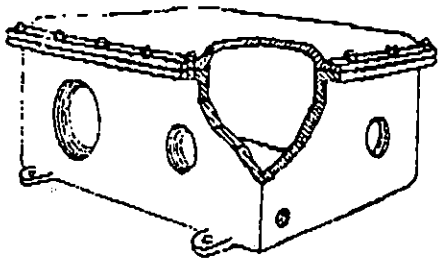
COMBINATION DRAIN-BREATHER FITTINGS, INCLUDES TAPPED HOLE

SIZE	LIST PRICE
3/8"	--

SPRING CITY ELECTRICAL MFG. CO., SPRING CITY, PA. 19475

EXPLOSION-PROOF JUNCTION BOXES — TYPE EX — for surface mounting

DUST-TIGHT AND EXPLOSION-PROOF
(NEMA 7, CLASS I, GROUP D)
(NEMA 9, CLASS II, GROUPS E,F & G)



Type EX boxes are explosion-proof as well as dust-tight. All joints are the metal-against-metal type with no gasket. The wide flanges are ground to very close tolerances and with the larger number of cap screws used in assembling provide an explosion-proof enclosure in hazardous concentrations of atmospheres containing gasoline, hexane, naphtha, benzene, butane, propane, alcohol, acetone, benzol, laquer solvent vapors or methane (NEMA 7). The generous radii where box walls meet back of box reduces usable inside depth.

Standard Construction:

1. Extra heavy cast iron box and cover
2. Hot-dip galvanized finish
3. Stainless steel cover screws
4. Mounting lugs

At Additional Cost:

(See page 24)

1. Drilled and tapped holes
2. Bosses to provide five full threads
3. Interior mounting buttons, blind tapped
4. Mounting plate
5. Hinges for covers - located on long side and right side unless otherwise specified

For ordering instructions, see pages 24 & 27

CATALOG NUMBER	INSIDE DIMENSIONS INCHES L x W x D	LIST PRICE	MAXIMUM CONDUIT SIZE*	APPROX. WEIGHT LBS.
EX 040402	4 x 4 x 2	For Prices, contact Distributor or Sales Representative.	3/4	15
EX 040404	4 x 4 x 4		2	21
EX 050504	5 x 5 x 4		2	24
EX 060604	6 x 6 x 4		2	39
EX 060606	6 x 6 x 6		2	48
EX 080404	8 x 4 x 4		2	38
EX 080604	8 x 6 x 4		2	47
EX 080606	8 x 6 x 6		2	50
EX 080804	8 x 8 x 4		2	57
EX 080806	8 x 8 x 6		2	72
EX 080808	8 x 8 x 8		2	78
EX 090804	8½ x 7½ x 4		2	65
EX 100804	10 x 8 x 4		2	69
EX 100806	10 x 8 x 6		2	84
EX 100808	10 x 8 x 8		2	92
EX 101004	10 x 10 x 4		2	83
EX 101006	10 x 10 x 6		2	100
EX 101008	10 x 10 x 8		2	110
EX 120604	12 x 6 x 4		2	60
EX 120606	12 x 6 x 6		2	70
EX 120804	12 x 8 x 4		2	80
EX 120808	12 x 8 x 8		2	120
EX 121204	12 x 12 x 4		2	115
EX 121206	12 x 12 x 6		2	140
EX 121208	12 x 12 x 8		2	160
EX 121210	12 x 12 x 10		2	175
EX 121212	12 x 12 x 12		2	195
EX 140806	14 x 8 x 6		2	120
EX 140808	14 x 8 x 8		2	135
EX 141006	14 x 10 x 6		2	138
EX 141008	14 x 10 x 8		2	154
EX 160606	16 x 6 x 6		2	140
EX 161204	16 x 12 x 4		2	180
EX 161206	16 x 12 x 6		2	210
EX 161208	16 x 12 x 8		2	240
EX 161210	16 x 12 x 10		2	270

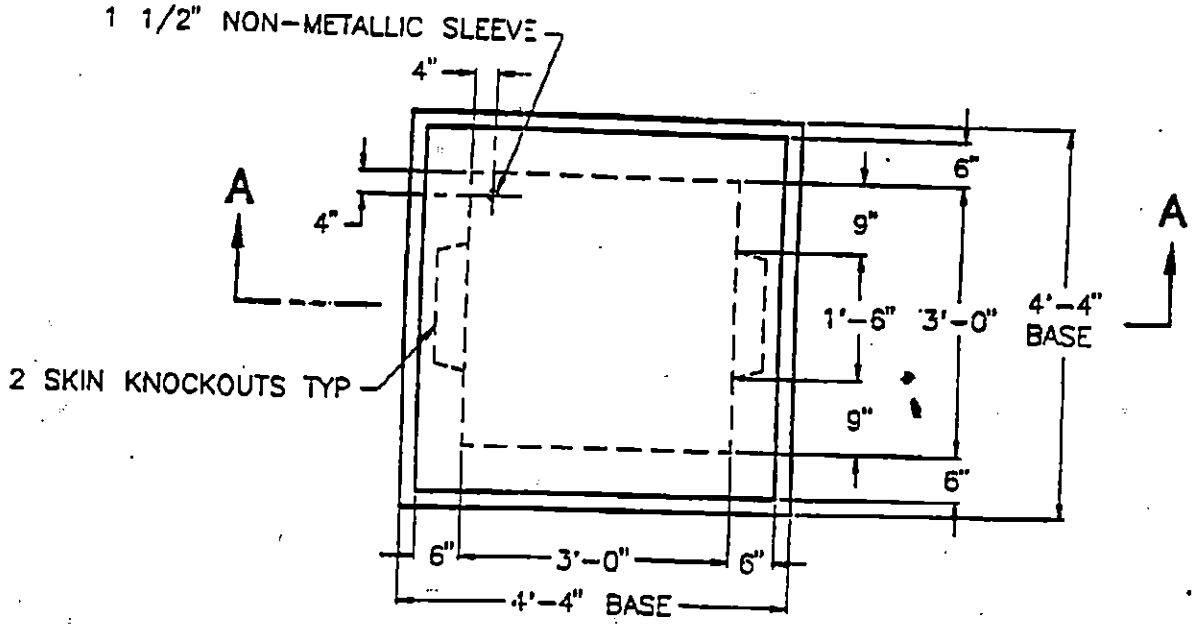
CATALOG NUMBER	INSIDE DIMENSIONS INCHES L x W x D	LIST PRICE	MAXIMUM CONDUIT SIZE*	APPROX. WEIGHT LBS.
EX 161212	16 x 12 x 12	For Prices, contact Distributor or Sales Representative.	2	295
EX 181806	18 x 18 x 6		2	290
EX 181808	18 x 18 x 8		2	345
EX 181812	18 x 18 x 12		2	450
EX 201006	20 x 10 x 6		2	180
EX 201008	20 x 10 x 8		2	210
EX 201208	20 x 12 x 8		2	280
EX 240404	24 x 4 x 4		2	100
EX 241206	24 x 12 x 6		2	230
EX 241208	24 x 12 x 8		2	260
EX 241210	24 x 12 x 10		2	290
EX 241212	24 x 12 x 12		2	330
EX 241806	24 x 18 x 6		2	300
EX 241808	24 x 18 x 8		2	330
EX 241810	24 x 18 x 10		2	370
EX 241812	24 x 18 x 12		2	400
EX 242408	24 x 24 x 8		2	580
EX 242412	24 x 24 x 12		2	725
EX 301208	30 x 12 x 8		2	305
EX 301210	30 x 12 x 10		2	335
EX 301212	30 x 12 x 12		2	370
EX 301808	30 x 18 x 8		2	390
EX 301810	30 x 18 x 10		2	425
EX 301812	30 x 18 x 12		2	455
EX 302408	30 x 24 x 8		2	490
EX 302410	30 x 24 x 10		2	525
EX 302412	30 x 24 x 12		2	570
EX 303008	30 x 30 x 8		2	725
EX 303010	30 x 30 x 10		2	900
EX 303012	30 x 30 x 12		2	1000
EX 321208	32 x 12 x 8		2	330
EX 340404	34 x 4 x 4		2	120
EX 362408	36 x 24 x 8		2	800
EX 362412	36 x 24 x 12		2	900
EX 363010	36 x 30 x 10		6	1100
EX 470906	46½ x 9 x 6		6	340

*Maximum size conduit entrance which will allow five full threads (required in all Type EX boxes) ... nesses. Larger conduit ...

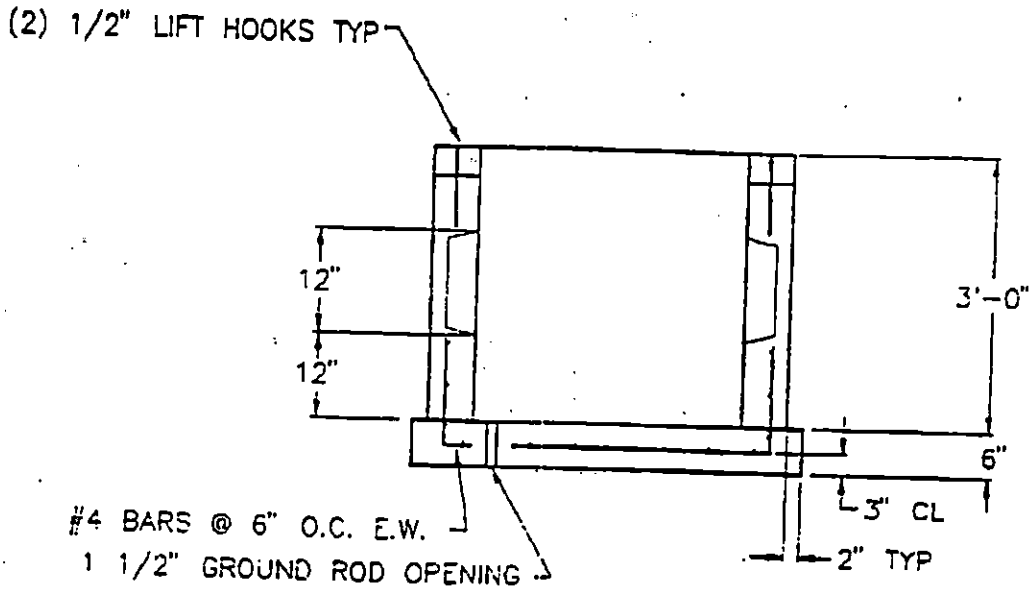
G.C. MONACO ELECTRIC
& DAUGHTER, INC.
261 W. LINCOLN AVE.
MT. VERNON, NY 10550

PELHAM BAY LANDFILL
CONT # 875 HP
CONCRETE ELEC HANDHOLE.

16030-
2.1 B



PLAN



SECTION A-A

L-93-16030

NOTES:
1. CONCRETE TO TEST 4000 P.S.I. @ 28 DAYS
2. REINFORCEMENT MEETS A.S.T.M. A-615 SPECIFICATIONS

AFCO Precast corp.
MAIN OFFICE
330 Orchard Road,
Lake Ronkonkoma,
NEW YORK, 11779
MANUFACTURES OF QUALITY PRECAST CONCRETE
PHONE (516) 654-3370 FAX (516) 654-3708

TITLE: 3'-0"x3'-0"x3'-0" HANDHOLE

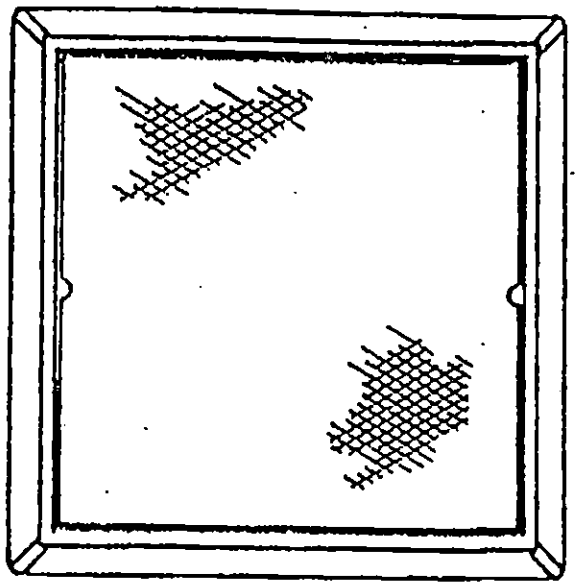
CATALOG NO: 3X3XOHH DRAWN BY: S.I.

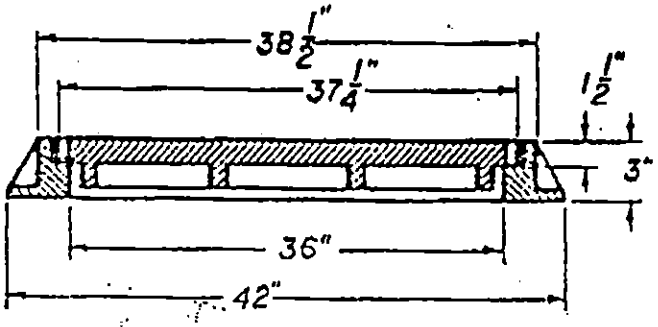
P-1233

PATTERN NO. 2804A

HEAVY DUTY will safely withstand A.A.S.H.T.O. H20-S16 Highway Loading and will support the heaviest wheel load permitted by State Governments.

16030-
2.1.B





This drawing shows the general configuration of the casting or castings to be supplied. Dimensions are approximate and may vary. Drawings should not be scaled where no dimensions are shown. Weight of castings is based on final dimension and is estimated only. There are no representations made concerning the suitability of the design or the materials specified by the manufacturer has no control whatsoever over the final application or installation of the product herein set forth.

G.C. MONACO ELECTRIC
& DAUGHTER, INC.
261 W. LINCOLN AVE.
MT. VERNON, NY 10550

PELHAM BAY LANDFILL
CONT #875 HP
CAST IRON COVER FOR ELEC H.H
L-82-16030

GRAY IRON		
SPECIFICATION	TENSILE STRENGTH	CLASS
ASTM A 48-83	30,000 psi	30B

CAMPBELL
Construction
Castings

Underground Duct Bank - Conduit & Wire

Conduit

Galvanized Rigid Steel Conduit

½" thru 6" Diameters

SPECIFICATIONS

INDUSTRY STANDARDS

UL 6 - Rigid Metal Electrical Conduit
Federal Spec. WWC-581-E - Conduit, Metal, Rigid, and Intermediate
ANSI Standard C80-1 - Rigid Steel Conduit, Zinc Coated

APPLICATIONS:

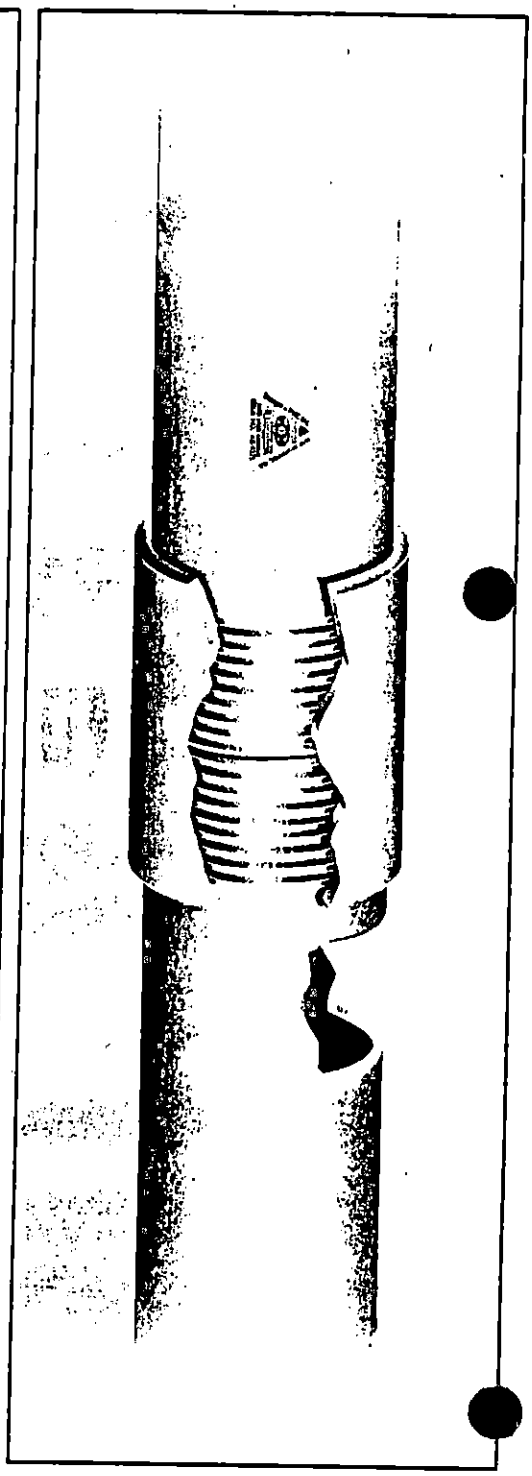
Galvanized Rigid Metal Conduit shall be installed in accordance with the National Electrical Code's Article 346 - "Rigid Metal Conduit."

- Under all atmospheric conditions and occupancies
- In concrete, in direct contact with earth or in areas subject to severe corrosive influences.
- In or under cinder fill where subject to permanent moisture when protected on all sides by a layer of non-cinder concrete not less than 2 inches thick; when the conduit is not less than 18 inches under the fill.

CONSTRUCTION:

Triangle PWC hot-dipped galvanized rigid steel conduit is produced from high grade raw steel pipe which has been thoroughly cleaned prior to final coating to insure permanent adhesion. It is completely protected from any corrosion by a special protection process:

1. The interior as well as the exterior are coated with a solid, unbroken layer of zinc. The tenacious bond between the zinc and steel layers is formed by the co-mingling of steel and zinc into a transitional steel/zinc alloy layer, providing the superior protective bonding of an alloyed interface.
2. The threads on the conduit are zinc coated after cutting by Triangle's exclusive Galv-Coat process.
3. The conduit is coated with a durable bichromate finish or other suitable treatments which prevent oxidation and white rust.



Triangle PWC, Inc.
P.O. Box 711 / New Brunswick, New Jersey 08903
Telephone (908) 745-5500

Conduit

Galvanized Rigid Steel Conduit

½" thru 6" Diameters

STANDARD SIZES

Trade Size of Conduit	Outside Diameter, Inches	Wall Thickness, Inches	Length Feet & Inches (without Coupling)	Approx. Weight Per 10 Lengths with Couplings	Quantity in Primary Bundle Feet	Quantity in Master Bundle Feet	Approx. Weight of Master Bundle
½	.840	.109	9'-11¼	81	100	2500	2025
¾	1.050	.113	9'-11¼	108	50	2000	2160
1	1.315	.133	9'-11"	155	50	1250	1938
1¼	1.660	.140	9'-11"	204	—	900	1836
1½	1.900	.145	9'-11"	249	—	800	1992
2	2.375	.154	9'-11"	336	—	600	2016
2½	2.875	.203	9'-10½"	548	—	370	2028
3	3.500	.216	9'-10½"	690	—	300	2070
3½	4.000	.226	9'-10¼"	861	—	250	2153
4	4.500	.237	9'-10¼"	982	—	200	1964
5	5.563	.258	9'-10"	1370	—	150	2055
6	6.625	.280	9'-10"	1812	—	100	1812

Suitable for Hazardous Location
Class I, Div. 2;
Class II, Div. 1 and 2;
Class III, Div. 1 and 2;
NEC 501-4(b), 502-4(a), 503-3(a)

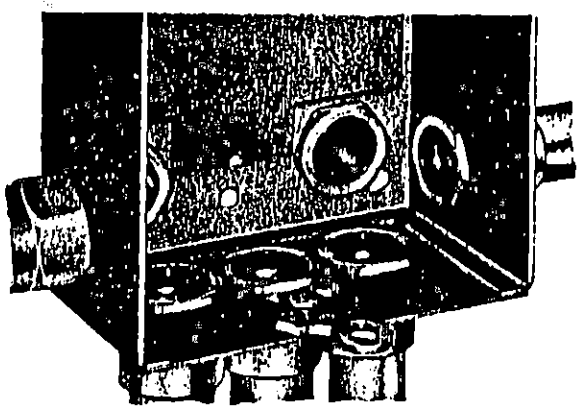
LISTED File #E14814A

File #13053

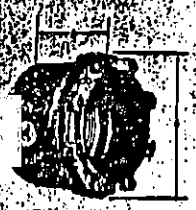
Trade Net Price Sheet
Effective October 5, 1987

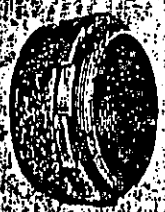
CF-2-1087

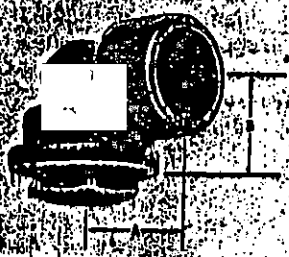
Threaded Rigid and IMC Conduit Hubs



Appleton's Uni-Seal Rigid Conduit Hubs eliminate the need for welded hubs. Efficiency of installation is built into the superior design; single wrench installation. Patented hex-hub wedge adaptor fits nearly flush against inside walls of enclosures; provides maximum wiring room. Simple two-piece construction. Protective insulated throats, positive grounding and water-tight sealing action. Flame/resistant insulated throat eliminates need for end bushings. Locking edge of body bites into enclosure wall, makes hub self-locking, eliminates the need for locknuts, provides continuous 360° pressure on both sides of enclosure wall, forms positive grounding and vibration-resistant connection. Built-in recessed neoprene gasket.







Catalog No.	Size	Hole Dia. Min.	Hole Dia. Max.	Wall Thickness Min.	Wall Thickness Max.	Dimensions A	Dimensions B	Wt. Lbs. Per 100	Ctn. Qty.	Std. Pkg.	Trade Net Price Per 100: Less Than Std./Ctn.	Carton Qty.	Standard Pkg.
Straight													
HUB-50	1/2	7/8	16/16 31/32	1/16 3/32	5/64 1/4	1 5/64	1 7/64	16.0	25	100	$540.80	$422.50	$338.00
HUB-75	3/4	1 3/32	1 5/32 1 7/32	1/16 3/32	5/64 1/4	1 7/64	1 3/8	23.0	25	100	613.20	479.06	383.25
HUB-100	1	1 11/32	1 13/32 1 15/32	1/16 3/32	5/64 1/4	1 1/4	1 23/32	39.0	10	50	767.76	599.81	479.85
HUB-125	1 1/4	1 11/16	1 25/32 1 27/32	1/16 3/32	5/64 5/16	1 51/64	2 5/16	77.0	5	25	959.28	749.44	599.55
HUB-150	1 1/2	1 15/16	2 1/32 2 3/32	1/16 3/32	5/64 5/16	1 53/64	2 5/8	92.0	5	10	1120.56	875.44	700.35
HUB-200	2	2 25/64	2 17/32 2 19/32	1/16 3/32	5/64 5/16	1 7/8	3 1/8	134.0	—	5	1454.40	....	909.00
HUB-250	2 1/2	2 57/64	3 1/64	3/32	5/16	2 25/64	3 5/8	236.0	1	5	....	2221.25	1777.00
HUB-300	3	3 33/64	3 41/64	3/32	5/16	2 31/64	4 5/16	310.0	1	2	....	3133.75	2507.00
HUB-350	3 1/2	4 1/64	4 1/8	3/32	5/16	2 9/16	4 13/16	400.0	—	1	....	....	3602.00
HUB-400	4	4 33/64	4 5/8	3/32	5/16	2 5/8	5 7/16	475.0	—	1	....	....	4505.00
HUB-500†	5	5 19/32	5 13/16	1/8	3/4	2 11/16	6 5/8	834.0	—	1	....	....	10,856.00
HUB-600†	6	6 21/32	6 7/8	1/8	3/4	2 11/16	7 11/16	1000.0	—	1	....	....	17,007.00
90°—Malleable Iron													
HUB-90 50	1/2	7/8	15/16 31/32	1/16 3/32	5/64 1/4	1 9/32	7/8	36.0	25	50	534.24	417.38	333.90
HUB-90 75	3/4	1 3/32	1 5/32 1 7/32	1/16 3/32	5/64 1/4	1 7/16	15/16	50.0	10	50	697.20	544.69	435.75
HUB-90 100	1	1 11/32	1 13/32 1 15/32	1/16 3/32	5/64 1/4	1 5/8	1 1/8	75.0	5	25	944.00	737.50	590.00

†U.S. Pat #3,059,663 | †Not UL Listed
Can. Pat #706,255

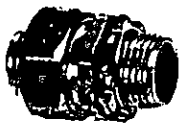
Available with PVC COATING—REFER TO FACTORY FOR PRICE AND DETAILS.

Discount Schedule CF-2
This Cancels CF-2-1087
Prices subject to change without notice.

Appleton ELECTRIC COMPANY

1701 W. Wellington Ave.
Chicago, Illinois 60657

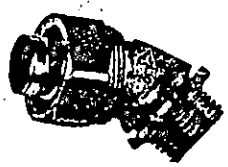
Liquid Tight "ST" Flexible Metal Conduit Connectors§



Steel 3/8"—1"

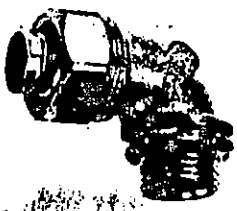
Malleable Iron 1 1/4"—6"

Catalog No.	Size	Wt. Lbs. Per 100	Ctn. Qty.	Std. Pkg.	Trade Net Price Per 100 Less Than Std./Ctn.	Carton Qty.	Standard Pkg.
Straight							
ST-38	3/8 flex, 1/2 hub	16.0	25	100	$ 260.32	$ 203.38	$ 162.70
~~ST-50~~	~~1/2~~	15.0	25	100	260.32	203.38	162.70
ST-75	3/4	22.0	25	50	372.48	291.00	232.80
ST-100	1	34.0	5	25	546.24	426.75	341.40
ST-125	1 1/4	84.0	5	25	940.40	734.69	587.75
ST-150	1 1/2	120.0	2	10	1336.32	1044.00	835.20
ST-200	2	165.0	1	5	....	1918.38	1534.70
ST-250	2 1/2	350.0	1	5	....	9238.75	7391.00
ST-300	3	450.0	1	5	....	10,400.00	8320.00
ST-350	3 1/2	525.0	1	5	....	12,318.75	9855.00
ST-400	4	664.0	1	5	....	12,318.75	9855.00
ST-500†	5	1000.0	—	1	....	....	17,779.00
ST-600†	6	1900.0	—	1	....	....	42,105.00



Steel 3/8"—1"
Malleable Iron 1 1/4"—4"

Catalog No.	Size	Wt. Lbs. Per 100	Ctn. Qty.	Std. Pkg.	Less Than Std./Ctn.	Carton Qty.	Standard Pkg.
45°							
ST-4538	3/8 flex, 1/2 hub	19.0	25	50	404.24	315.81	252.65
~~ST-4550~~	~~1/2~~	19.0	25	50	404.24	315.81	252.65
ST-4575	3/4	32.0	25	50	616.40	481.56	385.25
ST-45100	1	46.0	5	25	1249.44	976.13	780.90
ST-45125	1 1/4	103.0	5	25	1921.60	1501.25	1201.00
ST-45150	1 1/2	165.0	2	10	2321.60	1813.75	1451.00
ST-45200	2	245.0	1	5	....	2648.75	2119.00
ST-45250	2 1/2	760.0	1	5	....	11,706.25	9365.00
ST-45300	3	962.0	—	1	....	....	11,327.00
ST-45400	4	1512.0	—	1	....	....	12,873.00



Steel 3/8"—1"
Malleable Iron 1 1/4"—4"

Catalog No.	Size	Wt. Lbs. Per 100	Ctn. Qty.	Std. Pkg.	Less Than Std./Ctn.	Carton Qty.	Standard Pkg.
90°							
ST-9038	3/8 flex, 1/2 hub	22.8	25	50	404.24	315.81	252.65
~~ST-9050~~	~~1/2~~	23.0	25	50	404.24	315.81	252.65
ST-9075	3/4	39.0	10	50	616.40	481.56	385.25
ST-90100	1	62.0	5	25	1249.44	976.13	780.90
ST-90125	1 1/4	114.0	5	25	1920.00	1500.00	1200.00
ST-90150	1 1/2	195.0	2	10	2321.60	1813.75	1451.00
ST-90200	2	290.0	1	5	....	2648.75	2119.00
ST-90250	2 1/2	843.0	1	5	....	11,706.25	9365.00
ST-90300	3	1100.0	—	1	....	....	11,327.00
ST-90400	4	2100.0	—	1	....	....	14,626.00

AVAILABLE WITH PVC COATING—REFER TO FACTORY FOR PRICE AND DETAILS.

U.S. Pat 2,782,060
2,687,757
Can. Pat 507,070
708,255
†UL Listing Not Applicable

Discount Schedule ST
This Cancels ST-287.
Prices subject to change without notice.

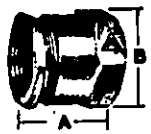
Appleton ELECTRIC COMPANY
1701 W. Wellington Ave.
Chicago, Illinois 60657

CF-2

Trade Net Price Sheet
Effective October 5, 1987

UL LISTED File #E14814 — CSA File #LR13053

CF-2-1087
Threaded Rigid Conduit and IMC Couplings and Connectors



½"-¾"—Steel


1"-6"—Malleable Iron

Catalog No.	Size	Dimensions A	Dimensions B	Dimensions C	Wt. Lbs. Per 100	Ctn. Qty.	Std. Pkg.	Trade Net Price Per 100: Less Than Std./Ctn.	Carton Qty.	Standard Pkg.
Three Piece Unions—Concrete Tight										
EC-50	½	1 7/16	1 7/16	—	16.5	10	100	$ 259.20	$ 202.50	$ 162.00
EC-75	¾	1 9/16	1 9/16	—	24.0	10	100	336.08	262.56	210.05
EC-100	1	1 11/16	2	—	58.0	5	25	642.08	501.63	401.30
EC-125	1¼	2⅛	2 7/16	—	98.0	5	25	1182.08	923.50	738.80
EC-150	1½	2 3/16	2 11/16	—	134.0	5	25	1488.00	1162.50	930.00
EC-200	2	2 7/16	3¼	—	198.0	5	25	2976.00	2325.00	1860.00
EC-250	2½	2⅝	3 13/16	—	255.0	2	10	6369.60	4976.25	3981.00
EC-300	3	2⅝	4⅝	—	394.0	1	10	....	7563.75	6051.00
EC-350	3½	2⅝	5 3/16	—	380.0	1	5	....	12,173.75	9739.00
EC-400	4	3 7/16	5 11/16	—	700.0	1	5	....	14,316.25	11,453.00
EC-500	5	3½	6 15/16	—	788.0	1	2	....	.....	23,596.00
EC-600	6	3½	8⅛	—	825.0	—	1	....	....	31,444.00
90° Female Gasketed Pulling Elbows—Watertight—Malleable Iron										
FFL-50	½	1 3/16	—	—	31.0	10	100	506.64	395.81	316.65
FFL-75	¾	1 11/32	—	—	46.0	10	50	590.24	461.13	368.90
FFL-100	1	1 19/32	—	—	76.0	5	25	991.52	774.63	619.70
FFL-125	1¼	3⅞	—	—	120.0	5	25	1326.40	1036.25	829.00
FFL-150	1½	4½	—	—	160.0	5	10	1878.40	1467.50	1174.00
FFL-200	2	5⅝	—	—	293.0	5	10	3041.60	2376.25	1901.00
90° Male to Female Gasketed Pulling Elbows—Watertight—Malleable										
MFL-50	½	1 3/16	1 7/16	15/32	36.0	10	100	506.64	395.81	316.65
MFL-75	¾	1 11/32	1 17/32	½	55.0	10	50	590.24	461.13	368.90
MFL-100	1	1 19/32	1¾	9/16	90.0	5	25	991.52	774.63	619.70
MFL-125*	1¼	3⅞	2⅝	15/16	141.0	5	25	1326.40	1036.25	829.00
MFL-150*	1½	4½	3	1	192.0	5	10	1878.40	1467.50	1174.00
MFL-200*	2	5⅝	3 11/16	1¼	335.0	5	10	3041.60	2376.25	1901.00
90° Female Pulling Elbows—Malleable Iron††										
PFFL-50	½	2 7/16	1⅛	—	49.0	10	100	944.00	737.50	590.00
PFFL-75	¾	2 23/32	1⅜	—	76.0	5	50	999.60	780.94	624.75
PFFL-100	1	3¼	1 23/32	—	121.0	5	20	1307.04	1021.13	816.90
90° Female Elbows††										
LF90-50	½	1½	—	—	39.0	10	100	.....	356.25	285.00
LF90-75	¾	1 11/16	—	—	53.0	10	100	.....	431.25	345.00
90° Male to Female Long Bushed Elbows—Malleable Iron††										
LMFL90-50	½	1¾	1 25/32	19/32	32.5	25	100	328.24	256.44	205.15
LMFL90-75	¾	2¼	2 9/32	11/16	50.0	5	25	451.92	353.06	282.45
LMFL90-100	1	2 21/32	2 11/16	¾	87.0	5	25	1034.88	808.50	646.80
LMFL90-125	1¼	3 5/16	3 11/32	1	126.0	5	20	1560.00	1218.75	975.00
LMFL90-150	1½	3 15/16	3 31/32	1 1/16	170.0	5	10	2659.20	2077.50	1662.00
LMFL90-200	2	4	4	1 1/16	410.0	1	10	.....	3025.00	2420.00
90° Male to Female Short Bushed Elbows—Malleable Iron††										
LMF90-50	½	1¼	1 13/32	½	23.0	25	100	258.08	201.63	161.30
LMF90-75	¾	1 7/16	1 11/16	13/16	36.0	25	100	352.80	275.63	220.50
LMF90-100	1	1 21/32	1 15/16	1	58.0	10	100	592.00	462.50	370.00
90° Male to Female Short Box Connectors—Malleable Iron††										
LMF90-50L	½	1¼	1 3/32	7/16	26.0	25	50	368.00	287.50	230.00
LMF90-75L	¾	1 7/16	1¼	7/16	34.0	25	50	470.40	367.50	294.00

††Not CSA Certified *Furnished with Removable Nipple

Discount Schedule CF-2
This Cancels CF-2-287.
Prices subject to change without notice.

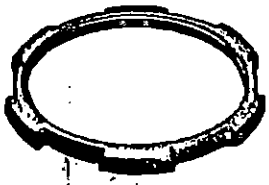
Appleton ELECTRIC COMPANY

1701 W. Wellington Ave.
Chicago, Illinois 60657

UL LISTED
File #E14814

Rigid Conduit and IMC Locknuts

½"—2" Steel



2½"—6" Malleable Iron

½"—2" Steel

2½"—6" Malleable Iron

Non-Locking Type

Catalog No.	Size	Dimensions A	Dimensions B	Dimensions C	Wt. Lbs. Per 100	Ctn. Qty.	Std. Pkg.	Trade Net Price Per 100: Less Than Std./Ctn.	Carton Qty.	Standard Pkg.
"Tiger Grip" Locknuts										
BL38	3/8	15/16	1/8	—	1.4	100	2500	$ 26.00	$ 20.31	$ 16.25
BL50	1/2	1 1/8	1/8	—	1.3	100	1000	15.52	12.13	9.70
BL75	3/4	1 3/8	5/32	—	2.4	100	1000	24.56	19.19	15.35
BL100	1	1 11/16	3/16	—	4.0	50	500	42.32	33.06	26.45
BL125	1 1/4	2 9/32	3/16	—	5.5	50	200	53.92	42.13	33.70
BL150	1 1/2	2 9/16	3/16	—	10.0	50	100	80.40	62.81	50.25
BL200	2	3 5/32	3/16	—	13.9	25	100	119.60	93.44	74.75
BL250	2 1/2	3 1/2	3/8	—	24.0	10	50	305.28	238.50	190.80
BL300	3	4 3/16	3/8	—	32.0	10	50	391.44	305.81	244.65
BL350	3 1/2	4 3/4	7/16	—	47.0	5	20	662.40	517.50	414.00
BL400	4	5 11/32	7/16	—	60.0	5	20	827.20	646.25	517.00
BL500	5	6 5/8	1/2	—	98.0	5	10	1761.60	1376.25	1101.00
BL600	6	7 7/8	9/16	—	160.0	5	10	3012.80	2353.75	1883.00
Gasketed Sealing Locknuts—Steel										
BLSG50	1/2	1 1/8	1/4	—	1.4	100	1000	83.20	65.00	52.00
BLSG75	3/4	1 7/16	1/4	—	2.6	100	1000	97.12	75.88	60.70
BLSG100	1	1 3/4	9/32	—	5.0	50	500	146.48	114.44	91.55
BLSG125	1 1/4	2 3/32	9/32	—	6.8	50	200	227.44	177.69	142.15
BLSG150	1 1/2	2 13/32	9/32	—	11.5	50	100	292.16	228.25	182.60
BLSG200	2	2 15/16	5/16	—	14.7	25	100	376.32	294.00	235.20
BLSG250	2 1/2	3 1/2	3/8	—	24.0	20	100	985.60	770.00	616.00
BLSG300	3	4 3/16	3/8	—	32.0	10	50	1523.20	1190.00	952.00
BLSG350	3 1/2	4 3/4	7/16	—	47.0	10	50	1852.80	1447.50	1158.00
BLSG400	4	5 11/32	7/16	—	60.0	5	25	2100.80	1641.25	1313.00
BLSG500	5	6 5/8	1/2	—	98.0	1	5	....	2867.50	2294.00
BLSG600	6	7 7/8	9/16	—	160.0	1	5	....	5112.50	4090.00
Grounding Locknuts—Malleable Iron										
GL-50	1/2	1 3/16	1/4	19/32	3.0	100	1000	97.44	76.13	60.90
GL-75	3/4	1 3/8	1/4	21/32	3.0	50	500	122.16	95.44	76.35
GL-100	1	1 11/16	1/4	1	5.0	50	500	168.00	131.25	105.00
GL-125	1 1/16	2 1/16	1/4	1 1/32	6.0	50	500	208.00	162.50	130.00
GL-150	1 1/2	2 11/32	1/4	1 1/8	7.0	50	500	257.60	201.25	161.00
GL-200	2	2 29/32	9/32	1 3/8	13.0	25	250	350.40	273.75	219.00
GL-250	2 1/2	3 19/32	1/4	1 7/8	18.0	10	100	656.00	512.50	410.00
GL-300	3	4 5/32	3/8	2 1/4	37.0	10	100	827.20	646.25	517.00
GL-350	3 1/2	4 7/8	3/8	2 1/2	45.0	5	50	1355.20	1058.75	847.00
GL-400	4	5 3/8	3/8	2 3/4	50.0	5	50	1728.00	1350.00	1080.00

U.S. Pat. #2,687,757
Can. Pat. #507,070

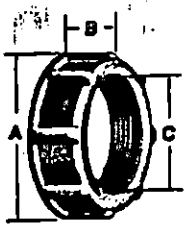
Appleton ELECTRIC COMPANY
1701 W. Wellington Ave.
Chicago, Illinois 60657

Trade Net Price Sheet
Effective October 5, 1987

CF-2-1087

UL LISTED

Rigid Conduit and IMC Bushings



Catalog No.	Size	Dimensions A	Dimensions B	Dimensions C	Wt. Lbs. Per 100	Ctn. Qty.	Std. Pkg.	Trade Net Price Per 100: Less Than Std./Ctn.	Carton Qty.	Standard Pkg.
Bushings—Malleable Iron										
BU50	1/4	1 1/16	11/32	19/32	2.0	100	1000	$ 30.00	$ 23.44	$ 18.75
BU75	3/4	1 1/4	3/8	13/16	3.2	100	1000	39.92	31.19	24.95
BU100	1	1 5/8	1/2	1	8.2	50	500	63.68	49.75	39.80
BU125	1 1/4	2	1/2	1 11/32	11.0	50	200	90.00	70.31	56.25
BU150	1 1/2	2 5/16	1/2	1 9/16	13.0	50	200	132.16	103.25	82.60
BU200	2	2 29/32	9/16	2	24.0	25	100	206.40	161.25	129.00
BU250	2 1/2	3 1/4	3/4	2 1/2	36.0	10	50	473.60	370.00	296.00
BU300	3	3 7/8	13/16	3	45.0	10	50	569.60	445.00	356.00
BU350	3 1/2	4 9/16	13/16	3 17/32	85.0	5	20	1161.60	907.50	726.00
BU400	4	5 1/16	13/16	4	100.0	5	20	1428.80	1116.25	893.00
BU500	5	6 5/16	1	4 7/8	155.0	1	10	....	2315.00	1852.00
BU600	6	7 7/16	1	5 7/8	265.0	1	10	....	4147.50	3318.00
Bushings—Insulated—Malleable Iron										
BU50 I	1/2	1 1/16	13/32	19/32	2.3	100	1000	103.68	81.00	64.80
BU75 I	3/4	1 1/4	7/16	13/16	2.7	100	1000	154.24	120.50	96.40
BU100 I	1	1 5/8	19/32	1	7.0	50	500	222.08	173.50	138.80
BU125 I	1 1/4	2	19/32	1 11/32	12.0	50	200	322.24	251.75	201.40
BU150 I	1 1/2	2 5/16	19/32	1 9/16	13.0	50	200	400.00	312.50	250.00
BU200 I	2	2 29/32	21/32	2	23.0	25	100	577.60	451.25	361.00
BU250 I	2 1/2	3 1/4	7/8	2 1/2	37.0	10	50	1144.00	893.75	715.00
BU300 I	3	3 7/8	29/32	3	41.0	10	50	1563.20	1221.25	977.00
BU350 I	3 1/2	4 9/16	15/16	3 17/32	87.5	5	20	1993.60	1557.50	1246.00
BU400 I	4	5 1/16	15/16	4	102.5	5	20	2521.60	1970.00	1576.00
BU500 I	5	6 5/16	1 3/16	4 7/8	160.0	1	10	....	4236.25	3389.00
BU600 I	6	7 7/16	1 3/16	5 7/8	271.0	1	10	....	6517.50	5214.00
Capped Bushings—Malleable Iron										
BUC50	1/2	1 1/16	11/32	—	2.7	100	1000	71.04	55.50	44.40
BUC75	3/4	1 1/4	3/8	—	4.0	100	1000	85.36	66.69	53.35
BUC100	1	1 5/8	1/2	—	8.0	50	500	108.56	84.81	67.85
BUC125	1 1/4	2	1/2	—	12.8	50	200	151.52	118.38	94.70
BUC150	1 1/2	2 5/16	1/2	—	16.0	10	100	204.80	160.00	128.00
BUC200	2	2 29/32	9/16	—	26.0	10	100	292.00	228.13	182.50
BUC250	2 1/2	3 1/4	3/4	—	44.0	5	50	828.80	647.50	518.00
BUC300	3	3 7/8	13/16	—	51.0	5	25	1145.60	895.00	716.00
BUC350	3 1/2	4 9/16	13/16	—	96.0	5	25	1681.60	1313.75	1051.00
BUC400	4	5 1/16	13/16	—	110.0	5	20	2340.80	1828.75	1463.00
Impact Resistant Plastic Bushings—105°C Temperature Rating										
BBU50	1/2	1 1/16	13/32	19/32	0.6	100	400	16.40	12.81	10.25
BBU75	3/4	1 5/16	13/32	25/32	0.8	100	400	25.36	19.81	15.85
BBU100	1	1 9/16	9/16	1	1.5	50	200	41.84	32.69	26.15
BBU125	1 1/4	1 29/32	9/16	1 5/16	2.3	25	100	58.24	45.50	36.40
BBU150	1 1/2	2 3/16	9/16	1 9/16	3.0	25	100	79.20	61.88	49.50
BBU200	2	2 11/16	5/8	2	4.0	25	50	144.48	112.88	90.30
BBU250	2 1/2	3 3/16	23/32	2 13/32	7.8	10	20	312.48	244.13	195.30
BBU300	3	3 27/32	3/4	3	10.0	10	20	344.40	269.06	215.25
BBU350	3 1/2	4 11/32	3/4	3 13/32	13.0	5	10	426.72	333.38	266.70
BBU400	4	4 27/32	25/32	3 20/32	11.0	5	10	523.20	408.75	327.00
BBU500	5	6 3/8	1	4 15/16	44.0	—	2	1155.20	902.50	722.00
BBU600	6	7 1/2	1	5 7/8	50.0	—	2	2235.20	1746.25	1397.00

Discount Schedule CF-2
This Cancels CF-2-287.
Prices subject to change without notice.

Appleton ELECTRIC COMPANY

1701 W. Wellington Ave.
Chicago, Illinois 60657

Unilet® Conduit Outlet Bodies: Form 35®, Form 85, Mogul and LBD. Conduit Outlet Boxes: JB, GS, and SEH.

For Use with Rigid Steel, Rigid Aluminum, IMC, and EMT Conduit.

Applications

- Serve as pulling fittings.
- Make bends in conduit system.
- Provide openings for splicing.
- Connect and change direction of conduit runs.
- Allow connections for branch runs.
- Permit access to conductors for maintenance.
- Form 35, Form 85, JB, and GS when used with cover and gasket provide enclosed and gasketed raintight fit.
- Mogul Unilets have larger wiring chambers for heavy or numerous conductors.
- LBD Unilets have larger wiring chambers with specially designed covers to facilitate pulling stiff, heavy conductors.

Features: All Unilet conduit outlet boxes and bodies

- Malleable iron Unilets: high tensile strength and ductility. High corrosion-resistance; high impact and shock resistance.
- Aluminum Unilets: copper-free aluminum (max. 4/10ths of 1% copper content). Light weight, high corrosion resistance. Self-oxidizing, self-renewing.
- Roomy interiors: more wiring space.
- Smooth, rounded integral bushing in each hub protects conductor insulation.
- Accurately tapped, tapered threads for tight, rigid joints and ground continuity.

Features: Form 35

❶Exclusive built-in easy-pulling rollers in type C (1-1/4" thru 4") and type LB (1-1/4" thru 4")—eliminate damage when cable is pulled through hubs.

- Sizes with flat-back design ideal where fitting is mounted flat against surface.
- Complete line of conduit bodies, covers and receptacles.
- All covers have captive stainless steel screws to speed installation, prevent "freezing" of screws.
- Blank covers domed for extra wiring space.

Features: Form 85

❷Exclusive built-in easy-pulling rollers in type C (2-1/2" thru 4") and type LB (2-1/2" thru 4")—eliminate damage when cable is pulled through hubs.

Appleton® ELECTRIC COMPANY

1701 W. Wellington Ave.
Chicago, Illinois 60657

Unilet® Conduit Outlet Bodies: Form 35®, Form 85, Mogul and LBD. Conduit Outlet Boxes JB, GS, and SEH

For Use with Rigid Steel, Rigid Aluminum, IMC, and EMT Conduit.

- Light weight aluminum facilitates shipping, handling and installing.
- Sizes with flat-back design ideal where fitting is mounted flat against surface.
- Complete line of conduit bodies, covers and receptacles.
- All covers have captive stainless steel screws to speed installation, prevent "freezing" of screws.
- Blank covers domed for extra wiring space.

Features: Mogul Unilets

❸For installations requiring extra wiring space— excellent for heavy, stiff conductors.

- Raised cast covers for additional wiring area.
- Covers have captive stainless steel screws to speed installation, prevent "freezing" of screws.

Features: LBD Unilets

❹Serve as pulling fittings—ideal for heavy, difficult-to-bend conductors.

- Make 90° bends in conduit—straight pull through hubs in either direction.
- Excellent for use as conductor entrance to buildings, motors.
- Complete with gasketed covers.

Features: JB Series

❺Enclosed and gasketed boxes when used with hub or blank covers provide raintight fit.

- Suitable for exposed or concealed installations.
- Blind cover screw holes prevent conductor damage during installation, provide water tightness.
- Available in three inside depths—1-5/16", 2-1/16", and 3-1/8".
- Available with or without mounting lugs.
- Furnished with four tapped holes and two close-up plugs.
- Available in malleable iron or aluminum.
- Cushion fixture hangers enclosed and gasketed (vaportight).

Features: GS Series

❻Enclosed and gasketed boxes when used with hub or blank covers provide raintight fit.

- Extra wide mating surfaces of GS box and cover provide greater gasket contact for more positive seal.
- Suitable for exposed or concealed installations.
- GSU-20 can be fitted with connection block.
- Universal design—furnished with four threaded universal 3/4" hubs, four 3/4" to 1/2" reducers, and three close-up plugs.
- Furnished with mounting lugs.
- Cushion fixture hangers enclosed and gasketed (vaportight).

Features: SEH Series

❼Economy cast conduit outlet box.

- Take wiring devices designed for 4" octagonal outlet boxes.
- Two 8-32 screw holes tapped on 3-1/2" centers.

Standard Materials

- *Form 35 Unilet conduit outlet bodies:* malleable iron.
- *Form 85 Unilet conduit outlet bodies:* aluminum—copper-free (max. 4/10th of 1%). 1/2" thru 2"—pressure cast. 2-1/2" thru 4" sand cast.
- *Mogul Unilets and covers:* malleable iron.
- *LBD Unilets and covers:* malleable iron (some sizes also in aluminum).
- *Covers for Form 35 and 85:* blank—malleable iron, steel and aluminum. Duplex grounding receptacle—phenolic. Lamp receptacle—porcelain. Wiring device and switch covers—aluminum.
- *JB, GS, and SEH conduit outlet boxes and covers plus JB and GS fixture hangers:* malleable iron.
- *JB-A boxes and covers:* copper-free aluminum.
- *Gaskets:* Neoprene or composition fiber.

Standard Finishes

- *Form 35, Mogul and LBD malleable iron bodies:* triple-coat—(1) zinc electroplate, (2) dichromate, and (3) aluminum polymer enamel.
- *Form 85 and LBD aluminum bodies:* aluminum polymer enamel.
- *Form 35 Covers:* steel: zinc electroplate. Malleable iron, 1/2" thru 1-1/2": zinc electroplate and clear chromate. Malleable iron, 2" thru 4": triple-coat—(1) zinc electroplate, (2) dichromate, and (3) aluminum polymer enamel.
- *Mogul and LBD malleable iron covers:* triple-coat—(1) zinc electroplate, (2) dichromate, and (3) aluminum polymer enamel.
- *Form 85 stamped aluminum covers:* natural finish.
- *Form 85 and LBD cast aluminum covers:* aluminum polymer enamel.
- *Malleable iron conduit outlet boxes, GS fixture hangers, 3/4" JB and GS hub covers, and SEH hub covers:* triple-coat—(1) zinc electroplate, (2) dichromate, and (3) aluminum polymer enamel.
- *JB fixture hangers, JB and GS 1/2" hub and blank covers and SEH blank cast cover:* zinc electroplate and clear chromate.
- *SEH blank steel cover:* zinc electroplate.
- *Aluminum JB conduit outlet boxes:* aluminum polymer enamel.

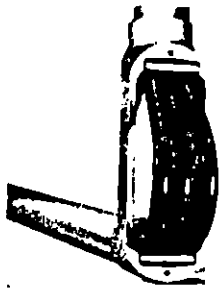
Code Approvals

- UL Standard 514.
- Federal Spec. W-C-586B.
- Suitable for classified location use in Class I, Division 2 areas, if installed in compliance with NEC 501-4(b).
- Appleton malleable iron products conform to ASTM A47-77, Grade 32510, which has the following properties: tensile strength, 50,000 psi; yield, 32,000 psi; and elongation, 10%.
- Appleton aluminum products are produced from a high strength copper-free (4/10 of 1% max.) alloy.

Related Cross References

- For explosion-proof conduit outlet bodies and boxes, see Catalog Section J.

Patented rollers make cable-pulling easier, eliminate insulation damage.

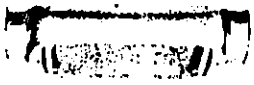
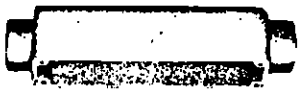
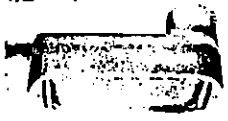
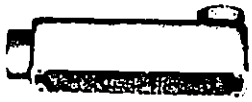


Appleton® ELECTRIC COMPANY

1701 W. Wellington Ave.
Chicago, Illinois 60657

Unilet™ Conduit Outlet Bodies: Form 35™ and Mogul, Malleable Iron; Form 85, Aluminum.

UNILETS® for Use with Threaded Rigid Metal Conduit and IMC.

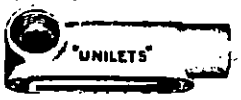
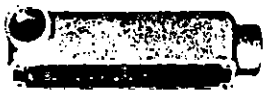
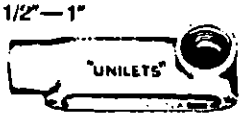
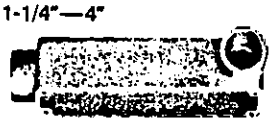
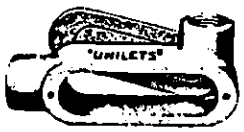
	Type	Size (Inches)	Catalog Number Malleable Iron Form 35	Catalog Number Malleable Iron Mogul	Catalog Number Aluminum Form 85
 1/2"—1"	**C** Patented Roller Feature—Listings in Bold Type	1/2	C50-M		C50-A
		3/4	C75-M		C75-A
		1	C100-M	MC100-M	C100-A
 1-1/4"—4" U.S. Pat. No. 3,020,332		1-1/4	**C125-M**	**MC125-M**	**C125-A**
		1-1/2	**C150-M**	**MC150-M**	**C150-A**
		2	**C200-M**	**MC200-M**	**C200-A**
 Mogul: 1"—4"		2-1/2	**C250-M**	**MC250-M**	**C250-A**
		3	**C300-M**	**MC300-M**	**C300-A**
		3-1/2	**C350-M**	**MC350-M**	**C350-A**
		4	**C400-M**	**MC400-M**	**C400-A**
 1/2"—1"	**E**	1/2	E50-M		E50-A
		3/4	E75-M		E75-A
		1	E100-M		E100-A
 1-1/4"—2"		1-1/4	E125-M		
		1-1/2	E150-M		
		2	E200-M		
 1/2"—1"	**LB** Patented Roller Feature—Listings in Bold Type	1/2	LB50-M		LB50-A
		3/4	LB75-M		LB75-A
		1	LB100-M	MLB100-M	LB100-A
 1-1/4"—4" U.S. Pat. No. 3,020,332		1-1/4	**LB125-M**	**MLB125-M**	**LB125-A**
		1-1/2	**LB150-M**	**MLB150-M**	**LB150-A**
		2	**LB200-M**	**MLB200-M**	**LB200-A**
 5"—6"		2-1/2	**LB250-M**	**MLB250-M**	**LB250-A**
		3	**LB300-M**	**MLB300-M**	**LB300-A**
		3-1/2	**LB350-M**	**MLB350-M**	**LB350-A**
		4	**LB400-M**	**MLB400-M**	**LB400-A**
		5	LB500-M		
		6	LB600-M		
 Mogul: 1"—4"					

Discount Schedule UD
Refer to Pricing Index for price, weight, and standard package

Appleton ELECTRIC COMPANY
1701 W. Wellington Ave.
Chicago, Illinois 60657

Unilet® Conduit Outlet Boxes: Form 35® and Mogul® Malleable Iron; Form 85, Aluminum

For Use with Threaded Rigid Metal Conduit and IMC.

	Type	Size (inches)	Catalog Number Malleable Iron Form 35	Catalog Number Malleable Iron Mogul	Catalog Number Aluminum Form 85
 1/2"—1"	LL	1/2	LL50-M		LL50-A
		3/4	LL75-M		LL75-A
		1	LL100-M	MLL100-M	LL100-A
 1-1/4"—4"		1-1/4	LL125-M	MLL125-M	LL125-A
		1-1/2	LL150-M	MLL150-M	LL150-A
		2	LL200-M	MLL200-M	LL200-A
		2-1/2	LL250-M	MLL250-M	LL250-A
		3	LL300-M	MLL300-M	LL300-A
		3-1/2	LL350-M	MLL350-M	LL350-A
 Mogul: 1"—4"		4	LL400-M	MLL400-M	LL400-A
 1/2"—1"	LR	1/2	LR50-M		LR50-A
		3/4	LR75-M		LR75-A
		1	LR100-M	MLR100-M	LR100-A
 1-1/4"—4"		1-1/4	LR125-M	MLR125-M	LR125-A
		1-1/2	LR150-M	MLR150-M	LR150-A
		2	LR200-M	MLR200-M	LR200-A
		2-1/2	LR250-M	MLR250-M	LR250-A
		3	LR300-M	MLR300-M	LR300-A
		3-1/2	LR350-M	MLR350-M	LR350-A
 Mogul: 1"—4"		4	LR400-M	MLR400-M	LR400-A
	LRL LRL Unilets have a double opening with blank cover on one side	1/2	LRL50-M		
		3/4	LRL75-M		
		1	LRL100-M		
		1-1/4	LRL125-M		
		1-1/2	LRL150-M		
		2	LRL200-M		
 1/2"—1"	T	1/2	T50-M		T50-A
		3/4	T75-M		T75-A
		1	T100-M	MT100-M	T100-A
 1-1/4"—4"		1-1/4	T125-M	MT125-M	T125-A
		1-1/2	T150-M	MT150-M	T150-A
		2	T200-M	MT200-M	T200-A
		2-1/2	T250-M	MT250-M	T250-A
		3	T300-M	MT300-M	T300-A
		3-1/2	T350-M	MT350-M	T350-A
 Mogul: 1"—4"		4	T400-M	MT400-M	T400-A

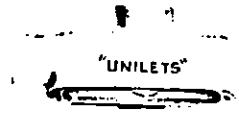
Discount Schedule UD
Refer to Pricing Index for price, weight, and standard package

Appleton® ELECTRIC COMPANY

1701 W. Wellington Ave.
Chicago, Illinois 60657

Unilet Conduit Outlet Bodies: Form 35, Malleable Iron; Form 85, Aluminum.

For Use with Threaded Rigid Metal Conduit and IMC.

	Type	Size (Inches)	Catalog Number Malleable Iron Form 35	Catalog Number Aluminum Form 85
	TA	1/2	TA50-M	
		3/4	TA75-M	
		1	TA100-M	
	TB	1/2	TB50-M	TB50-A
		3/4	TB75-M	TB75-A
		1	TB100-M	TB100-A
		1-1/4	TB125-M	TB125-A
		1-1/2	TB150-M	TB150-A
		2	TB200-M	TB200-A
 1/2"—1"  1-1/4"—2"	X	1/2	X50-M	X50-A
		3/4	X75-M	X75-A
		1	X100-M	X100-A
		1-1/4	X125-M	
		1-1/2	X150-M	
		2	X200-M	

Available for [illegible] (inches)*

Unilet Body	Flat Back	Round Back
Form 35		
C,LB	1/2 thru 2	2-1/2 and up
E	1/2 thru 1	1-1/4 thru 2
LL,LR,T	1/2 thru 2	2-1/2 and up
TB	1-1/4, 1-1/2	1/2, 3/4, 1, 2
X	1/2 thru 1	1-1/4 and up
Form 85		
C,LB,LL,LR,T	1/2 thru 2	2-1/2 thru 4
	1-1/4, 1-1/2	1/2, 3/4, 1, 2
	1/2 thru 1	

*All mogul Unilets are flat back design. All TA Unilets are round back design.

Discount Schedule UD
Refer to Pricing Index for price, weight, and standard package

Appleton ELECTRIC COMPANY
1701 W. Wellington Ave.
Chicago, Illinois 60657

Unions, Sealing Fittings, Flexible Couplings, Elbows, Drain/Breather, Close-Up Plugs: Explosion-Proof.

UNILETS® for Use with Threaded Metal Conduit.

Features: Non-Expansion Unions

❶Concentric ring interlocked design of 1/2", 3/4" and 1" sizes makes possible smaller diameter, allowing use in tighter spaces. 1-1/4" and larger UNY sizes have removable male nipple.

- Choice of malleable iron or aluminum.

Features: Expansion Unions

❷One-piece design eliminates need for disassembly during installation.

- Telescoping cylinder within cylinder design permits expansion or contraction.
- Standard or long types available.
- Small external diameters—excellent in restricted areas in wiring of pumps, motors, and other equipment.
- Internal phosphor bronze "bonding jumper" ring assures positive ground between telescoping cylinders.

Features: Sealing Fittings

❸Raintight construction.

- Removable nipple in male sealing fitting may be used interchangeably in top or bottom hub.
- EYSF/EYSM—for sealing vertical conduit. Large opening for damming and filling.
- ESUF/ESUM for sealing vertical or horizontal conduit. Pouring spout rotates 90°. Removable cover provides full access for damming. 2-1/2" thru 4" sizes have threaded cover openings for damming.
- EYF/EYM—close radius type for sealing vertical or horizontal conduit runs.
- EYDM Drain Sealing Fittings—close radius type for sealing vertical conduit runs. Access cover has drain valve for automatic draining of water accumulation above the seal.
- SF/SFM Drain Sealing Fittings—for sealing vertical conduit runs. Provide continuous, automatic draining of water accumulation above the seal.
- APELCO sealing cement is a specially formulated water soluble powder. Mixed to the proper proportions, it is poured in sealing fittings and hardens to contain and restrict the passage of gases and explosions in classified areas.
- Fiber Filler—makes dams around and between all conductors to prevent sealing compound from leaking while being poured in its liquid state.

Features: Flexible Couplings

❹Heavy duty design resists mechanical abuse. Watertight.

- Electrical conductivity equal to rigid conduit on a similar length basis—no bonding jumper required.
- Interior insulating liner protects conductors from abrasion under vibrating conditions.
- EXGJH—both end fittings are female, each furnished with a removable male nipple.
- EXLK—female end fitting with union at one end plus a female end fitting with a removable male nipple at the other end.

Standard Materials

- *UNY and UNF (Non-Expansion) Unions, 1/2" thru 1":* steel or aluminum.
- *UNY and UNF (Non-Expansion) Unions, 1-1/4" thru 6":* malleable iron or aluminum.
- *UNY and UNF Expansion Unions:* steel.
- *UNL Unions:* malleable iron and steel.
- *EYSF/EYSM, EYF/EYM and EYDM Seals:* malleable iron or aluminum.
- *ESUF/ESUM and SF/SFM Seals:* malleable iron.
- *EXGJH and EXLK Couplings, 1/2" thru 2":* outer bronze braid, inner brass core with insulating liner. End Fittings: 1/2" thru 1-1/4"—steel; 1-1/2" thru 2"—brass.
- *EXGJH Couplings, 2-1/2" thru 4":* outer stainless steel braid, inner stainless steel core with insulating liner and stainless steel end fittings.
- *PLG Close-Up Plugs:* malleable iron, steel, or aluminum.
- *BR Reducers:* malleable iron or aluminum.
- *EL and UNA Elbows:* malleable or cast iron.
- *ECDB Combination Drain/Breather:* stainless steel.

Standard Finishes

- *Unions, Malleable Iron—UNY and UNF (Non-Expansion), and UNL:* triple-coat—(1) zinc electroplate, (2) dichromate, and (3) aluminum polymer enamel.
- *Unions, Steel—UNY and UNF (Non-Expansion), and UNY and UNF (Expansion):* zinc electroplate.
- *Unions, Aluminum—UNY and UNF (Non-Expansion),* 1/2" thru 2"—natural finish; 2-1/2" thru 4"—aluminum polymer enamel.
- *Sealing Fittings, Malleable Iron—EYSF/EYSM, ESUF/ESUM, EYF/EYM, EYDM and SF/SFM:* triple-coat—(1) zinc electroplate, (2) dichromate, and (3) aluminum polymer enamel.
- *Sealing Fittings, Aluminum—EYSF/EYSM, EYF/EYM and EYDM:* aluminum polymer enamel.
- *Flexible Couplings—EXGJH and EXLK:* steel end fittings—zinc electroplate and clear chromate; braid—natural finish.
- *Close-up Plugs—PLG:* malleable iron—zinc electroplate and clear chromate; steel—zinc electroplate; aluminum—natural finish.
- *Bell Reducers—BR:* malleable iron—zinc electroplate and clear chromate; aluminum—natural finish.
- *Elbows, Malleable Iron—EL and UN:* triple-coat—(1) zinc electroplate, (2) dichromate, and (3) aluminum polymer enamel.
- *Combination Drain/Breathers, stainless steel—ECDB:* natural finish.

Options

- For EXGJH or EXLK Flexible Couplings, a special protective coating can be applied for use in severe corrosive atmospheres. Consult factory for details and pricing.

Compliances

- UL Standard 886
- Appleton malleable iron products conform to ASTM A47-77, Grade 32510, which has the following properties: tensile strength, 50,000 psi; yield, 32,000 psi; and elongation, 10%.
- Appleton aluminum products are produced from a high strength copper-free (4/10 of 1% max.) alloy.
- Class I, Div. 1 & 2, and Class II, Div. 1 & 2, if installed as follows: *Unions, Elbows, Plugs, Flex. Couplings*—NEC 501-4 (a)(b); *Seals*—NEC 501-5 (a)(b)(c)(d)(e) and NEC 502-5; *Drains*—NEC 501-5(f).

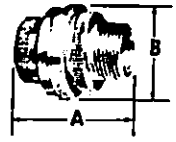
Appleton® ELECTRIC COMPANY

1701 W. Wellington Ave.
Chicago, Illinois 60657

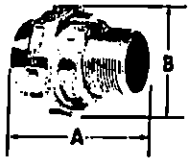
Class I, Groups A,B, •C,D
Class II, Groups E,F,G
Class III

Unions: UNY, UNF, and UNL; Explosion-Proof, Dust-Ignition-Proof

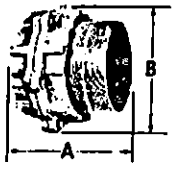
UNILETS® for Use with Threaded Metal Conduit.



1/2"— 1"

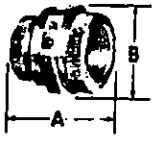


1-1/4"— 4"

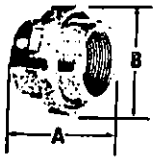


5"— 6"

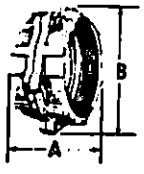
Size (Inches)	Dimen. in Inches A	Dimen. in Inches B	Dimen. in Millimeters A	Dimen. in Millimeters B	Catalog Number Steel (1/2" to 1") and Malleable (1-1/4" to 6")	Catalog Number Aluminum (1/2" to 4")
UNY Unions For connecting conduit to enclosure						
Male						
1/2	1.94	1.47	49.2	37.3	UNY50NR	UNY50NR-A
3/4-1/2‡	1.94	1.47	49.2	37.3	UNY75-50NR	UNY75-50NR-A
3/4	1.94	1.75	49.2	44.5	UNY75NR	UNY75NR-A
1	2.34	2.00	59.5	50.8	UNY100NR	UNY100NR-A
Male/Female (Removable Male Nipple)						
1-1/4	3.13	2.81	79.4	71.4	UNY125NR	UNY125NR-A
1-1/2	3.25	3.06	82.6	77.8	UNY150NR	UNY150NR-A
2	3.63	3.72	92.1	94.5	UNY200NR	UNY200NR-A
2-1/2	4.81	4.88	122.2	123.8	UNY250R	UNY250R-A
3	4.81	5.38	122.2	136.5	UNY300R	UNY300R-A
3-1/2	4.94	5.88	125.4	149.2	UNY350R	UNY350R-A
4	5.13	6.44	130.2	163.5	UNY400R	UNY400R-A
5	5.63	8.33	142.9	212.7	UNY500R	
6	5.75	9.63	146.1	244.5	UNY600R	



1/2"—1"

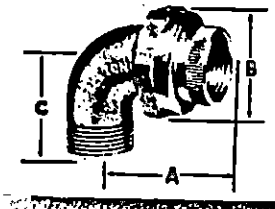


1-1/4"— 4"



5"— 6"

UNF Female Unions For connecting conduit to conduit						
1/2	1.47	1.47	37.3	37.3	UNF50NR	UNF50NR-A
3/4-1/2‡	1.47	1.47	37.3	37.3	UNF75-50NR	UNF75-50NR-A
3/4	1.47	1.75	37.3	44.5	UNF75NR	UNF75NR-A
1	1.72	2.00	43.7	50.8	UNF100NR	UNF100NR-A
1-1/4	2.19	2.81	55.6	71.4	UNF125NR	UNF125NR-A
1-1/2	2.19	3.06	55.6	77.8	UNF150NR	UNF150NR-A
2	2.31	3.72	58.7	94.5	UNF200NR	UNF200NR-A
2-1/2	3.38	4.88	85.7	123.8	UNF250R	UNF250R-A
3	3.38	5.38	85.7	136.5	UNF300R	UNF300R-A
3-1/2	3.38	5.88	85.7	149.2	UNF350R	UNF350R-A
4	3.50	6.44	88.9	163.5	UNF400R	UNF400R-A
5	3.88	8.38	98.4	212.7	UNF500R	
6	4.00	9.63	101.6	244.5	UNF600R	



	A	B	C	A	B	C	
UNL 90° Elbow Unions For connecting conduit to enclosure							
1/2-1/2	2.47	1.47	1.78	62.7	37.3	45.2	UNL50N
1/2-3/4†	2.47	1.75	1.78	62.7	44.5	45.2	UNL50-75N
3/4-1/2†	2.00	1.75	1.59	50.8	44.5	40.5	UNL75-50N
3/4-3/4	2.00	1.47	1.59	50.8	37.3	40.5	UNL75N

Shaded area indicates items suitable for Class I, Groups A and B, in addition to Class I, Groups C,D, Class II, Groups E,F,G, and Class III.

‡Size of right end is given first. †Male end given first.

Discount Schedule UD
Refer to Pricing Index for price, weight, and standard package

Appleton® ELECTRIC COMPANY

1701 W. Wellington Ave.
Chicago, Illinois 60657

Class I, Groups A,B, C,D
Class II, Groups E,F,G
Class III

Sealing Fittings: EYS and ESU; Explosion-Proof, Dust-Ignition-Proof, Raintight.

UNILETS® for Use with Threaded Metal Conduit.


1/2"—3" 4"


1/2"—3" 4"

Size (Inches)	Turning Radius† Inches	(cm)	APELCO Cement Req'd. Ozs.	(Grams)	Catalog Number Malleable Iron	Aluminum
EYS Vertical Conduit Seals						
Female						
1/2	1.81	(4.5)	2	(56.7)	EYSF-50	EYSF-50A
3/4	2.25	(5.7)	3	(85.1)	EYSF-75	EYSF-75A
1	2.38	(6.0)	5	(141.7)	EYSF-100	EYSF-100A
1-1/4	2.94	(7.5)	11	(311.8)	EYSF-125	EYSF-125A
1-1/2	3.50	(8.9)	19	(538.6)	EYSF-150	EYSF-150A
2	4.13	(10.5)	31	(878.8)	EYSF-200	EYSF-200A
2-1/2	4.75	(12.1)	46	(1304.1)	EYSF-250	EYSF-250A
3	5.63	(14.3)	82	(2324.7)	EYSF-300	EYSF-300A
4	6.50	(16.5)	92	(2608.2)	EYSF-400	EYSF-400A
Male/Female (Removable Male Nipple)						
1/2	1.81	(4.5)	2	(56.7)	EYSM-50	EYSM-50A
3/4	2.25	(5.7)	3	(85.1)	EYSM-75	EYSM-75A
1	2.38	(6.0)	5	(141.7)	EYSM-100	EYSM-100A
1-1/4	2.94	(7.5)	11	(311.8)	EYSM-125	EYSM-125A
1-1/2	3.50	(8.9)	19	(538.6)	EYSM-150	EYSM-150A
2	4.13	(10.5)	31	(878.8)	EYSM-200	EYSM-200A
2-1/2	4.75	(12.1)	46	(1304.1)	EYSM-250	EYSM-250A
3	5.63	(14.3)	82	(2324.7)	EYSM-300	EYSM-300A
4	6.50	(16.5)	92	(2608.2)	EYSM-400	EYSM-400A


1/2"—2" 2-1/2"—4"


1/2"—2" 2-1/2"—4"

ESU Vertical and Horizontal Conduit Seals						
Female						
1/2	1.25	(3.2)	4	(113.4)	ESUF-50	
3/4	1.25	(3.2)	4	(113.4)	ESUF-75	
1	1.38	(3.5)	5	(141.8)	ESUF-100	
1-1/4	1.56	(4.0)	8	(226.8)	ESUF-125	
1-1/2	2.06	(5.2)	19	(538.6)	ESUF-150	
2	2.19	(5.6)	27	(765.4)	ESUF-200	
2-1/2	2.69	(6.8)	36	(1020.6)	ESUF-250	
3	3.13	(7.9)	61	(1729.3)	ESUF-300	
3-1/2	3.44	(8.7)	89	(2523.1)	EYF-350	
4	3.69	(9.4)	114	(3231.8)	EYF-400	
Male/Female (Removable Male Nipple)						
1/2	1.25	(3.2)	4	(113.4)	ESUM-50	
3/4	1.25	(3.2)	4	(113.4)	ESUM-75	
1	1.38	(3.5)	5	(141.7)	ESUM-100	
1-1/4	1.56	(4.0)	8	(226.8)	ESUM-125	
1-1/2	2.06	(5.2)	19	(538.6)	ESUM-150	
2	2.19	(5.6)	27	(765.4)	ESUM-200	
2-1/2	2.69	(6.8)	36	(1020.6)	ESUM-250	
3	3.13	(7.9)	61	(1729.3)	ESUM-300	
3-1/2	3.44	(8.7)	89	(2523.1)	EYM-350	
4	3.69	(9.4)	114	(3231.8)	EYM-400	

[illegible] for use in Class I, Groups C,D; Class II, Groups E,F,G and Class III

†Turning radius with cover or plug removed.

Discount Schedule UD
Refer to Pricing Index for price, weight, and standard package

Appleton® ELECTRIC COMPANY

1701 W. Wellington Ave.
Chicago, Illinois 60657

*Class I, Groups A,B,C,D
*Class II, Groups E,F,G
*Class III

Sealing Fittings for Close Turning Radius: EY; Explosion-Proof, Dust-Ignition-Proof, Raintight.

UNILETS® for Use with Threaded Metal Conduit.

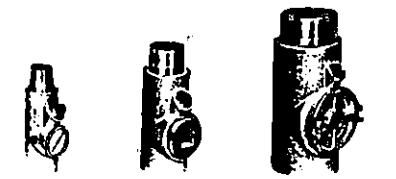
EY Vertical and Horizontal Conduit Seals for Close Turning Radius

Female EYF

1/2"— 1" 1-1/4"— 3" 3-1/2"—6"

Size (Inches)	Turning Radius† Inches	(cm)	APELCO Cement Req'd. Ozs.	(Grams)	Catalog Number Malleable Iron	Aluminum
Female						
1/2	1.06	(2.7)	1	(28.4)	EYF-50	EYF-50A
3/4	1.19	(3.0)	2	(56.7)	EYF-75	EYF-75A
1	1.38	(3.5)	4	(113.4)	EYF-100	EYF-100A
1-1/4	1.75	(4.5)	7	(198.4)	EYF-125	EYF-125A
1-1/2	2.06	(5.2)	13	(368.5)	EYF-150	EYF-150A
2	2.31	(5.9)	22	(623.7)	EYF-200	EYF-200A
2-1/2	2.69	(6.8)	36	(1020.6)	EYF-250	EYF-250A
3	3.13	(7.9)	61	(1729.3)	EYF-300	EYF-300A
3-1/2	3.44	(8.7)	89	(2523.1)	EYF-350	EYF-350A
4	3.69	(9.4)	114	(3231.8)	EYF-400	EYF-400A
5	4.69	(11.9)	202	(5726.6)	EYF-500	
6	5.38	(13.7)	230	(6520.4)	EYF-600	

Male EYM



1/2"— 1" 1-1/4"— 3" 3-1/2"—6"

Size (Inches)	Turning Radius† Inches	(cm)	APELCO Cement Req'd. Ozs.	(Grams)	Catalog Number Malleable Iron	Aluminum
Male/Female (Removable Male Nipple)						
1/2	1.06	(2.7)	1	(28.4)	EYM-50	EYM-50A
3/4	1.19	(3.0)	2	(56.7)	EYM-75	EYM-75A
1	1.38	(3.5)	4	(113.4)	EYM-100	EYM-100A
1-1/4	1.75	(4.5)	7	(198.4)	EYM-125	EYM-125A
1-1/2	2.06	(5.2)	13	(368.5)	EYM-150	EYM-150A
2	2.31	(5.9)	22	(623.7)	EYM-200	EYM-200A
2-1/2	2.69	(6.8)	36	(1020.6)	EYM-250	EYM-250A
3	3.13	(7.9)	61	(1729.3)	EYM-300	EYM-300A
3-1/2	3.44	(8.7)	89	(2523.1)	EYM-350	EYM-350A
4	3.69	(9.4)	114	(3231.8)	EYM-400	EYM-400A
5	4.69	(11.9)	202	(5726.6)	EYM-500	
6	5.38	(13.7)	230	(6520.4)	EYM-600	

Shaded area (1/2", 3/4", 1" malleable) indicates items suitable for Class I, Groups A and B as well as Class I, Groups C and D, Class II, Groups E, F and G and Class III.

***1/2", 3/4" or 1" Sizes Malleable:** Suitable for Class I, Groups A,B,C and D; Class II, Groups E,F and G, and Class III.

***1-1/4", 1-1/2" and 2" Sizes Malleable:** Suitable for Class I, Groups C and D; Class II, Groups E,F and G, and Class III. Consult factory for Class I, Group B location use.

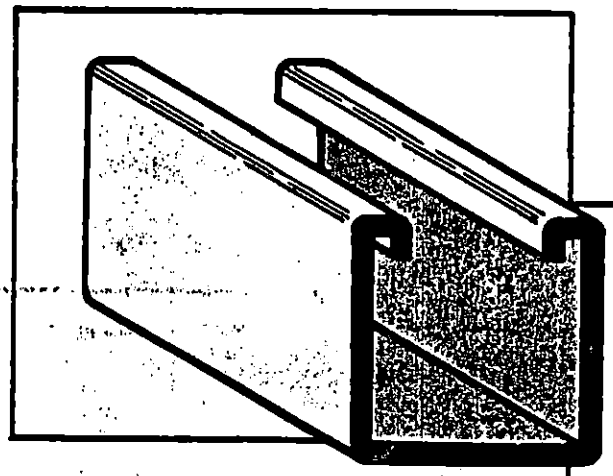
***2-1/2" thru 6" Sizes Malleable and 1/2" thru 4" Sizes Aluminum:** Suitable for Class I, Groups C and D; Class II, Groups E, F and G, and Class III.

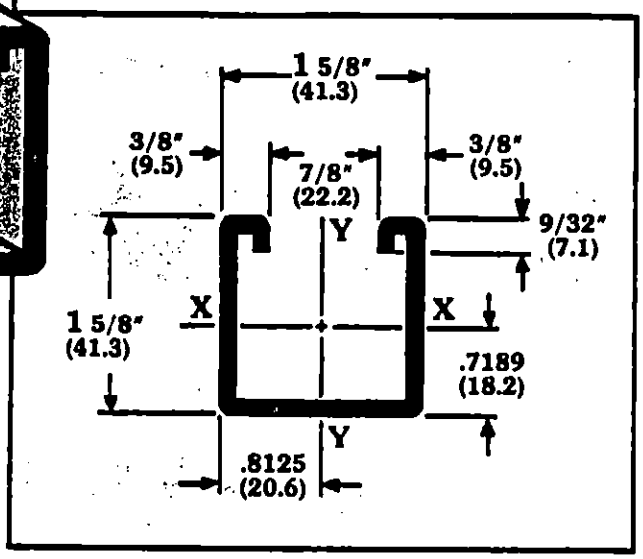
†Turning radius with cover or plug removed.

Discount Schedule UD
Refer to Pricing Index for price, weight, and standard package

Appleton ELECTRIC COMPANY
1701 W. Wellington Ave.
Chicago, Illinois 60657

B22 CHANNEL



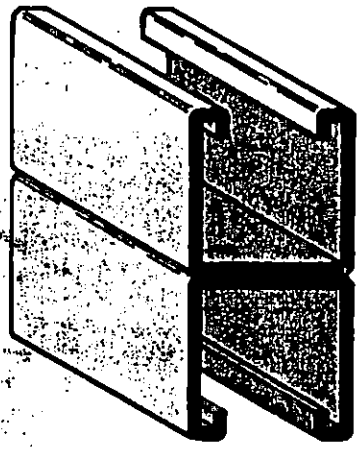


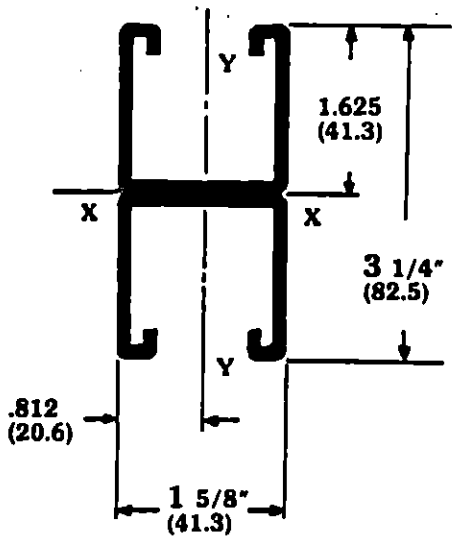
B22
WEIGHT: 1.90 Lbs./Ft. (2.83 kg/m)
THICKNESS: 12 Gauge (2.6 mm)
STANDARD LENGTHS: 10' (3.05 m) & 20' (6.09 m)
FINISHES: Plain, Dura-Green Epoxy and Pre-Galvanized

SECTION PROPERTIES

Channel	Weight		Areas of Section		X – X Axis						Y – Y Axis					
					Moment of Inertia (I)		Section Modulus (S)		Radius of Gyration (R)		Moment of Inertia (I)		Section Modulus (S)		Radius of Gyration (R)	
	lbs./ft.	kg/m	sq. in.	cm^2	$in.^4$	cm^4	$in.^3$	cm^3	in.	cm	$in.^4$	cm^4	$in.^3$	cm^3	in.	cm
B22	1.90	2.83	.559	3.61	.1850	7.70	.2042	3.34	.580	1.47	.2340	9.74	.2880	4.72	.653	1.66
B22A	3.80	5.65	1.118	7.21	.9379	39.04	.5772	9.46	.924	2.34	.4681	19.48	.5761	9.44	.653	1.66
B22X	6.70	9.97	1.950	12.58	4.1279	171.81	1.6935	27.75	1.450	3.68	1.1069	46.07	1.2064	19.77	.751	1.91

Calculations of section properties are based on metal thicknesses as determined by the AISI Cold-Formed Steel Design Manual.





B22A COMBINATION
Wt. 3.80 Lbs./Ft. (5.65 kg/m)

Triangle PWC, Inc.
P.O. Box 711 / New Brunswick, New Jersey 08903
Telephone (908) 745-5500

Building Wire

N-A® Type THHN OR THWN
90° C—600 Volts

SINGLE CONDUCTOR — TYPE THHN-THWN

Size AWG	Number of Strands	Vinyl Insulation	Nylon Jacket	O.D. Inch	AMPACITY†	Approx. Ship. Weight M/ft.
14	7	.015	.004	.11	15	16
12	7	.015	.004	.12	20	24
10	7	.020	.004	.15	30	37
*18	16	.015	.004	.09	6	8
*16	26	.015	.004	.10	8	12
14	19	.015	.004	.11	15	16
12	19	.015	.004	.13	20	24
10	19	.020	.004	.17	30	39
8	19	.030	.005	.22	55	64
6	19	.030	.005	.26	75	96
4	19	.040	.006	.33	95	154
3	19	.040	.006	.36	110	191
2	19	.040	.006	.39	130	236
1	19	.050	.007	.45	150	302
1/0	19	.050	.007	.49	170	375
2/0	19	.050	.007	.54	195	465
3/0	19	.050	.007	.59	225	578
4/0	19	.050	.007	.65	260	719
250 MCM	37	.060	.008	.72	290	858
300 MCM	37	.060	.008	.77	320	1021
350 MCM	37	.060	.008	.83	350	1182
400 MCM	37	.060	.008	.87	380	1350
500 MCM	37	.060	.008	.96	430	1662
600 MCM	61	.070	.009	1.06	475	2019
750 MCM	61	.070	.009	1.17	535	2502

*Listed as TFFN 90°C Appliance Wiring Material (60°C exposed to oil) and 90°C MTW
†90°C Ampacity based on not more than three type THHN single conductors in a raceway in free air at ambient temperature of 30°C.

Triangle PWC, Inc.

Building Wire

N-A® Type THHN OR THWN
90° C—600 Volts

SPECIFICATIONS

INDUSTRY STANDARDS

UL 83 - Thermoplastic insulated wire and cable
Fed. Spec. JC 30B - cable and wire, electrical

APPLICATION

Trioseal® (Polyvinyl Chloride) insulated, nylon jacketed Type THHN-THWN smallest diameter wire is an all purpose construction suitable for new construction or rewiring and is approved for 600 volt applications where the maximum operating temperature does not exceed 75°C for wet locations and 90°C for dry locations in accordance with the National Electrical Code's Article 310 - "Conductors for General Wiring" and Article 210 - "Branch Circuits."

Suitable for lighting and power in residential and industrial installations, machine tool, and appliance wire applications.

Type THHN or THWN Trioseal insulated-nylon jacketed wire permits greater utilization of existing space in raceways or conduit. The overall nylon jacket is abrasion resistant for easy pulling through conduit and is highly resistant to flame, acids, alkalis, chemicals, oil, gasoline and grease. The insulation is free stripping, bright and smooth.

CONSTRUCTION

Conductor:
Bare, annealed, solid per ASTM B-3 or stranded copper per UL-83.

Insulation:
High quality proprietary VW-1 rated polyvinyl chloride (Trioseal) compound rated at 90°C and listed by Underwriters' Laboratories.

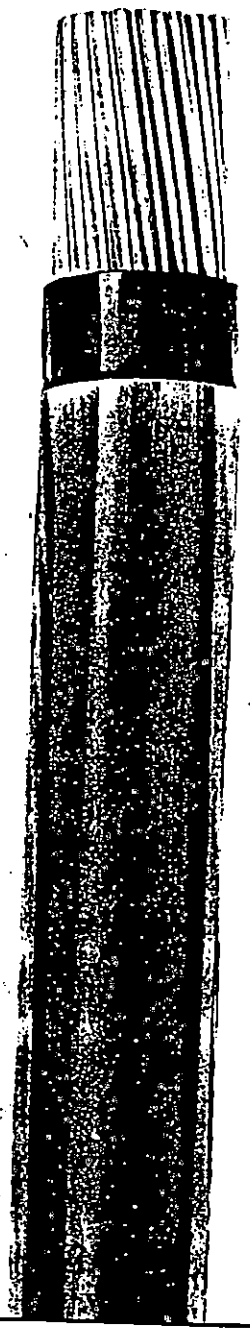
Insulation Covering:
Tough, heat and light stabilized, low moisture absorption nylon (N-A®: Nylon Armored) conforming to Underwriters' Laboratories requirements for Types THHN or THWN.

UL LISTINGS:

THHN - 90°C dry building wire
THWN - 75°C wet and dry building wire
MTW-90°C Machine tool wire
AWM-105°C appliance wire
Gasoline and Oil Resistant
VW-1 Rated
For OT Use - 1/0 AWG & larger, when identified
Sunlight Resistant - 1/0 AWG & larger, when identified

VOLTAGE:

600 volts
Note: Sizes 18 and 16 AWG listed as TFFN



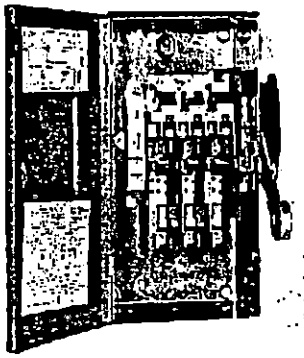
DRY TYPE TRANSFORMER

DH

WHEN ORDERING SPECIFY

- Catalog Number

- UL listed, File E5239.
- Meets UL 98 for enclosed switches and NEMA Std. KS-1.
- Suitable as service entrance equipment, except 1200A on grounded Wye systems, per NEC-230-95, and 4-pole switches.



K-series 60A, Type 3R

FUSIBLE 277/480 — 600 VOLTS — Provision for Class H fuses through 600A — Class L for 800A & 1200A

System	Amperes	Enclosure Type 1 Indoor		Enclosure Type 3R Rainproof		Type 4 & 4X ❶ Watertight		Enclosure Type 12 12/3R for 30-200A Industrial		Maximum Hp Ratings With Time Delay Fuses					
		Catalog Number	List Price	Catalog Number	List Price	Catalog Number	List Price	Catalog Number	List Price	1ø ac		3ø ac		dc	
										480V	600V	480V	600V	250V	600V
2 POLE, 480 VOLTS AC — 600 VOLTS AC OR DC ❷															
	30	DH261FGK	$ 277.	❸	---	DH261FWK	$ 1330.	DH261FDK	$ 422.	7-1/2	10	---	---	---	15
	60	DH262FGK	332.	❸	---	❸	---	DH262FDK	482.	20	25	---	---	---	25
	100	DH263FGK	617.	❸	---	❸	---	DH263FDK	713.	30	40	---	---	---	25
	200	DH264FGK	890.	❸	---	DH264FWK	4108.	DH264FDK	1085.	50	50	---	---	---	50
	400	DH265FGK	2339.	❸	---	❸	---	DH265FDK	2573.	---	---	---	---	50	---
	600	DH266FGK	3718.	❸	---	❸	---	DH266FDK	4117.	---	---	---	---	---	---
	800	DH267FGK	5576.	❸	---	❸	---	DH267FDK	6868.	---	---	---	---	---	---
	1200	❸	---	❸	---	---	---	---	---	---	---	---	---	---	---
3 POLE, 480 VOLTS AC — 600 VOLTS AC															
	30	DH361FGK	287.	DH361FRK	$ 468.	DH361FWK	1240.	DH361FDK	448.	7-1/2	10	15	20	---	---
	60	DH362FGK	347.	DH362FRK	546.	DH362FWK	1404.	DH362FDK	490.	20	25	30	50	---	---
	100	DH363FGK	676.	DH363FRK	855.	DH363FWK	2828.	DH363FDK	761.	30	40	60	75	---	---
	200	DH364FGK	937.	DH364FRK	1181.	DH364FWK	3949.	DH364FDK	1297.	50	50	125	150	---	---
	400	DH365FGK	2359.	DH365FRK	2815.	DH365FWK	7731.	DH365FDK	3045.	---	---	250	350	---	---
	600	DH366FGK	4463.	DH366FRK	5985.	DH366FWK	11747.	DH366FDK	4988.	---	---	400	500	---	---
	800	DH367FGK	8295.	DH367FRK	8702.	DH367FWK	13857.	DH367FDK	9125.	---	---	500	500	---	---
	1200	DH368FGB	9062.	DH368FRB❹	11151.	---	---	---	---	---	---	---	---	---	---
4 WIRE S/N (3 BLADES, 3 FUSES) 277/480 VOLTS AC — 600 VOLTS AC															
NEUTRAL	30	DH361NGK	320.	DH361NRK	543.	DH361NWK	1392.	DH361NDK	586.	7-1/2	10	15	20	---	---
	60	DH362NGK	373.	DH362NRK	588.	DH362NWK	1524.	DH362NDK	578.	20	25	30	50	---	---
	100	DH363NGK	664.	DH363NRK	906.	DH363NWK	3163.	DH363NDK	882.	30	40	60	75	---	---
	200	DH364NGK	972.	DH364NRK	1318.	DH364NWK	4398.	DH364NDK	1466.	50	50	125	150	---	---
	400	DH365NGK	2669.	DH365NRK	3138.	DH365NWK	7942.	DH365NDK	3214.	---	---	250	350	---	---
	600	DH366NGK	4351.	DH366NRK❹	5972.	DH366NWK	11548.	DH366NDK	5040.	---	---	400	500	---	---
	800	DH367NGK	7462.	DH367NRK	9192.	---	---	---	---	---	---	500	500	---	---
	1200	❸		❸		---	---	---	---	---	---	---	---	---	---
4 POLE, 480 VOLTS AC — 600 VOLTS AC											2ø 600V				
	30	DH461FGK	464.	---	---	---	---	---	---	---	25	15	20	---	---
	60	DH462FGK	546.	---	---	---	---	---	---	---	50	30	50	---	---
	100	DH463FGK	910.	---	---	---	---	DH463FDK	1047.	---	50	60	75	---	---
	200	---	---	---	---	---	---	DH464FDK	1787.	---	50	125	150	---	---
	400	DH465FGK	4150.	---	---	---	---	---	---	---	---	250	350	---	---
	600	DH466FGK	6763.	---	---	---	---	---	---	---	---	400	500	---	---

❶ UL Type 4X stainless steel enclosures through 200A, Type 4 painted steel for 100-800A. For stainless steel enclosure on 400-800A, add suffix -SS and consult factory for availability.
dc rating for 400-800A switches is 250V.

❷ Use outside poles or 3 pole switch, for ac rating only.

❹ For four pole applications use three pole switch and control pole, Cat. No. DS16CP, listed on Page DD-13. Consult factory for application data.

DS

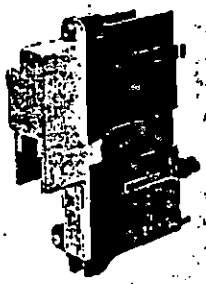
FIELD INSTALLED KITS AND ACCESSORIES — Only for K-Series Design Switches

See Page DD-5 For Factory Installed K-Series Switch Options

ADD-ON PARTS & KITS

For DG (200-600A), DH and DT (30-800A)

Switch Amperes	Description	Catalog Number	Price
30-800	Control Pole, for 2-3 Pole Switches For DH, 30-200A DT, 400-600A DG	DS16CP	$ 112.00
	Neutral Block		
30-60	DH Only	DH030NK	39.90
100	DH Only	DH100NK	55.00
30-100	DT Only	DT100NK	59.00
200	DT Only	DT200NK	104.00
200	DH Only	DH200NK	96.00
	DG – DH Type 1 & 3R		
200	DG – DH	DG200NK	67.00
400	DG – DH	DS400NK	185.00
600	DH Only	DS600NK	197.00
800	DH Only	DS800NK	413.00
		DS1200NK	413.00
	DT Neutral Kit		
400	DT Non-Fusible Only	DT400NK	152.00
600	DT Non-Fusible Only	DT600NK	191.00
400-600	DT Fusible Only	DS800NK	413.00
	Copper Body Lug Kit for 6 Lugs		
30	DH – DT	DS16CL	16.80
60	DH – DT	DS26CL	25.50
100	DH – DT	DS36CL	41.00
200	DH Only	DS46CL	63.00
400	DG – DH	DS56CL	127.00
600	DG – DH	DS66CL	127.00
30-800	Electrical Interlock, 1NO–1NC	DS200EK1	118.00
	2NO–2NC	DS200EK2	134.00
	Equipment Ground Lug		
30-100		DS100GK	5.90
200		DS200GK	22.80
400-800		DS468GK	131.00
	"J" Fuse Adapter for 1 Pole		
60	250V Fuse Size DH – DT	DS22JK	14.00
60	600V Fuse Size DH – DT	DS26JK	14.00
600	250 & 600V Fuse Size DH	DS600JK	104.00
	"J" Fuse Adapter for 6 Poles		
400	DT 600V Size	DT400JK	299.00
	"R" Fuse Clip Kit for 3 Poles		
30	250V Size	DS12FK	13.10
30	600V Size	DS16FK	13.10
60	250V Size	DS16FK	13.10
60	600V Size	DS26FK	13.10
100	250 & 600V Size	DS36FK	25.50
200	250 & 600V Size	DS46FK	37.80
400	250 & 600V Size	DS56FK	64.00
600	250 & 600V Size	DS66FK	64.00
	"T" Fuse Mounting Kit for 3 Poles		
200	DH 250V Size	DS426TK	53.00
	DH 600V Size	DS466TK	69.00
	"T" Fuse Mounting Kit for 1 Pole		
400	250V Size	DS526TK	45.20
	600V Size	DS566TK	67.00
600	250V Size	DS626TK	53.00
	600V Size	DS666TK	76.00
800	250V Size	DS726TK	79.00
	600V Size	DS766TK	91.00
	Crimp Lug Pad Kit for DG – DH		
400-600	Kit for 3 Poles	DS56CK	127.00
800	Kit for 1 Pole	DS76CK	57.00
400-800	Kit for Neutral	DS800CNK	330.00



DS16CP

CONTROL POLE DESCRIPTION

Operation — The K-Series Control Pole provides one Normally Open contact, late-make, early-break operation. It mounts in the same position and pre-drilled holes as a Neutral Block, directly connected to the power pole operating shaft. Direct connection and visible blades provide more secure electrical interlocking than handle linkage operation of a snap switch type of interlock. This reliability meets the requirements of many specifications for 4-pole switches when the fourth pole is required for secure electrical interlocking.

Wire Size Range — #16 to #12 AWG, copper conductors.

Ratings — 10A continuous, Ac or Dc.

Ac Code Rating A600			Dc Code Rating N600	
Volts Ac	Make	Break	Volts Dc	Make & Break
120V	60A	6A	125V	2.2A
240V	30A	3A	250V	1.1A
480V	15A	1.5A	600V	0.4A
600V	12A	1.2A		

FUSE PULLER KITS

Amperes	Description	Catalog Number	Price
30-60	For DH 3 Pole	DS30FP	$ 12.00
60	DH 3 Pole, 240V	DS30FP	12.00
60	DH 4 Pole	DS60FP	12.00
100	DH 3 Pole	DS100FP	27.30
200	DG – DH 3 Pole	DS200FP	64.00

CRIMP LUG ADAPTATION — DH30-200A

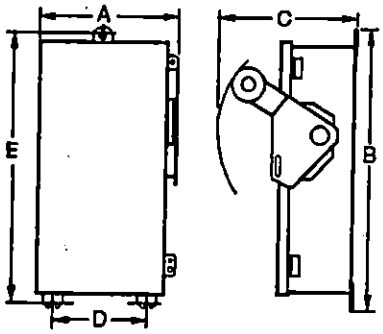
Heavy Duty Type DH Switches through 200A are adaptable to crimp lugs. Simply remove the box lugs.

DD

DH

HEAVY DUTY — Dimensions In Inches

Catalog Number	Wide A	High B	Deep C	Mounting D	Mounting E	Shipping Weight Lbs.
DH327FDK	26-3/8	71-3/4	14-1/4	20-1/4	70-1/2	230
DH327FGK	26-3/8	68-1/2	14-1/4	20-1/4	63-1/4	215
DH327FRK	26-3/8	69	14-1/4	20-1/4	63-1/4	225
DH327FWK ❶	26-3/8	71-3/4	14-1/4	20-1/4	70-1/2	230
DH327NGK	26-3/8	68-1/2	14-1/4	20-1/4	63-1/4	220
DH327NRK	26-3/8	69	14-1/4	20-1/4	63-1/4	230
DH328FGB	39-5/8	71	25-7/8	31	64	385
DH328FRB	39-5/8	71	25-7/8	31	64	400
DH328NGB	39-5/8	71	25-7/8	31	64	400
DH328NRB	39-5/8	71	25-7/8	31	64	405
DH361FDK	8-7/8	17-7/8	10-1/4	5-1/2	17	20
DH361FGK	8-7/8	16	10-1/4	6-1/2	14-1/2	14
DH361FRK	8-7/8	16-1/4	10-1/4	6-1/2	14-1/4	17
DH361FWK	8-7/8	17-7/8	10-1/4	5-1/2	17	21
DH361NDK	8-7/8	17-7/8	10-1/4	5-1/2	17	20
DH361NGK	8-7/8	16	10-1/4	6-1/2	14-1/2	17
DH361NRK	8-7/8	16-1/4	10-1/4	6-1/2	14-1/4	20
DH361NWK	8-7/8	17-7/8	10-1/4	5-1/2	17	22
DH361UDK	8-7/8	11-1/4	10-1/4	5-1/2	12	16
DH361UDK-LS	8-7/8	17-7/8	10-1/4	5-1/2	17	19
DH361UGK	8-7/8	16	10-1/4	6-1/2	14-1/2	14
DH361UGK-RS	8-7/8	10-3/8	10-1/4	5-1/2	8	11
DH361URK	8-7/8	16-1/4	10-1/4	6-1/2	14-1/4	16
DH361UWK	8-7/8	11-1/4	10-1/4	5-1/2	12	17
DH361UWK-LS	8-7/8	17-7/8	10-1/4	5-1/2	17	20
DH362FDK	8-7/8	17-7/8	10-1/4	5-1/2	17	14
DH362FGK	8-7/8	16	10-1/4	6-1/2	14-1/2	14
DH362FRK	8-7/8	16-1/4	10-1/4	6-1/2	14-1/4	17
DH362FWK	8-7/8	17-7/8	10-1/4	5-1/2	17	21
DH362NDK	8-7/8	17-7/8	10-1/4	5-1/2	17	20
DH362NGK	8-7/8	16	10-1/4	6-1/2	14-1/2	17
DH362NRK	8-7/8	16-1/4	10-1/4	6-1/2	14-1/4	20
DH362NWK	8-7/8	17-7/8	10-1/4	5-1/2	17	22
DH362UDK	8-7/8	11-1/4	10-1/4	5-1/2	12	16
DH362UDK-LS	8-7/8	17-7/8	10-1/4	6-1/2	17	19
DH362UGK	8-7/8	16	10-1/4	6-1/2	14-1/2	14
DH362UGK-RS	8-7/8	10-3/8	10-1/4	5-1/2	8	11
DH362URK	8-7/8	16-1/4	10-1/4	6-1/2	14-1/4	16
DH362UWK	8-7/8	11-1/4	10-1/4	5-1/2	12	17
DH362UWK-LS	8-7/8	17-7/8	10-1/4	5-1/2	17	20
DH363FDK	11-7/8	24	10-1/4	8-1/2	23-1/8	29
DH363FGK	11-7/8	22	10-1/4	9-1/2	20	22
DH363FRK	11-7/8	22	10-1/4	7-1/2	20	26
DH363FWK	11-7/8	24	10-1/4	8-1/2	23-1/8	29
DH363NDK	11-7/8	24	10-1/4	8-1/2	23-1/8	30
DH363NGK	11-7/8	22	10-1/4	9-1/2	20	23
DH363NRK	11-7/8	22	10-1/4	7-1/2	20	27
DH363NWK	11-7/8	24	10-1/4	8-1/2	23-1/8	30
DH363UDK	11-7/8	24	10-1/4	8-1/2	23-1/8	26
DH363UGK	11-7/8	22	10-1/4	9-1/2	20	20
DH363URK	11-7/8	22	10-1/4	7-1/2	20	22
DH363UWK	11-7/8	24	10-1/4	8-1/2	23-1/8	28
DH364FDK	16-3/4	34-3/8	11-5/8	12-1/2	33	55
DH364FGK	16-3/4	28-1/8	11-1/4	12	24	43
DH364FRK	16-3/4	28-1/2	11-1/4	12	24	51
DH364FWK	16-3/4	34-3/8	11-5/8	12-1/2	33	56
DH364NDK	16-3/4	34-3/8	11-5/8	12-1/2	33	56
DH364NGK	16-3/4	28-1/8	11-1/4	12	24	43
DH364NRK	16-3/4	28-1/2	11-1/4	12-1/2	24	52
DH364NWK	16-3/4	34-3/8	11-5/8	12-1/2	33	61
DH364UDK	16-3/4	34-3/8	11-5/8	12	33 ❶	51
DH364UGK	16-3/4	28-1/8	11-1/4	12	24	43
DH364URK	16-3/4	28-1/2	11-1/4	12	24	46



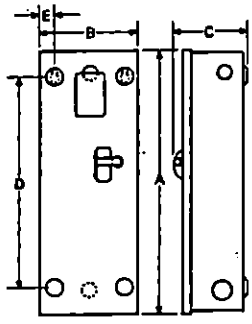
Catalog Number	Wide A	High B	Deep C	Mounting D	Mounting E	Shipping Weight Lbs.
DH364UWK	16-3/4	34-3/8	11-5/8	12-1/2	33	54
DH365FDK	25	63	14-1/4	19	61-3/4	102
DH365FGK	24	54-1/4	12-5/8	18	49	86
DH365FRK	24	54-3/4	12-5/8	18	49	94
DH365FWK ❶	25	63	14-1/4	19	61-3/4	107
DH365NDK	25	63	14-1/4	19	61-3/4	105
DH365NGK	24	54-1/4	12-5/8	18	49	90
DH365NRK	24	54-3/4	12-5/8	18	49	101
DH365NWK ❶	25	63	14-1/4	19	61-3/4	113
DH365UDK	25	63	14-1/4	19	61-3/4	86
DH365UGK	24	54-1/4	12-5/8	18	49	83
DH365URK	24	54-3/4	12-5/8	18	49	94
DH365UWK ❶	25	63	14-1/4	19	61-3/4	101
DH366FDK	25	63	14-1/4	19	61-3/4	139
DH366FGK	25	59-3/4	14-1/4	19	54-1/4	120
DH366FRK	25	60-1/4	14-1/4	19	54-1/4	129
DH366FWK ❶	25	63	14-1/4	19	61-3/4	147
DH366NDK	25	63	14-1/4	19	61-3/4	144
DH366NGK	25	59-3/4	14-1/4	19	54-1/4	125
DH366NRK	25	60-1/4	14-1/4	19	54-1/4	135
DH366NWK ❶	25	63	14-1/4	19	61-3/4	152
DH366UDK	25	63	14-1/4	19	61-3/4	113
DH366UGK	25	59-3/4	14-1/4	19	54-1/4	105
DH366URK	25	60-3/4	14-1/4	19	54-1/4	109
DH366UWK ❶	25	63	14-1/4	19	61-3/4	120
DH367FDK	26-3/8	71-3/4	14-1/4	20-1/4	70-1/2	235
DH367FGK	26-3/8	68-1/2	14-1/4	20-1/4	63-1/4	215
DH367FRK	26-3/8	69	14-1/4	20-1/4	63-1/4	225
DH367FWK ❶	26-3/8	71-3/4	14-1/4	20-1/4	70-1/2	235
DH367NGK	26-3/8	68-1/2	14-1/4	20-1/4	63-1/4	220
DH367NRK	26-3/8	69	14-1/4	20-1/4	63-1/4	230
DH367UDK	26-3/8	71-3/4	14-1/4	20-1/4	70-1/2	220
DH367UGK	26-3/8	68-1/2	14-1/4	20-1/4	63-1/4	210
DH367URK	26-3/8	69	14-1/4	20-1/4	63-1/4	220
DH367UWK ❶	26-3/8	71-3/4	14-1/4	20-1/4	70-1/2	225
DH368FGC	33-9/16	52-7/8	17-17/32	25-15/32	56-3/4	315
DH368FRC	33-9/16	52-7/8	17-17/32	25-15/32	56-3/4	315
DH368UGC	33-9/16	52-7/8	17-17/32	25-15/32	43-9/16	315
DH421FDK	12-3/4	17-7/8	10-1/4	9-1/4	17	28
DH421FGK	12-3/4	16	10-1/4	10	13-3/4	22
DH422FDK	16-1/4	24	10-1/4	12	23-1/8	37
DH422FGK		22	10-1/4	12-3/4	20	31
DH423FDK	16-1/4	24	10-1/4	12	23-1/8	45
DH423FGK	16-1/4	22	10-1/4	12-3/4	20	39
DH424FDK	16-3/4	34-3/8	11-5/8	12-1/2	33	56
DH461FGK	12-3/4	16	10-1/4	10	13-3/4	23
DH461UDK	12-3/4	17-7/8	10-1/4	9-1/4	17	24

❶ Suffix -SS, 4X stainless steel enclosure — 400 - 600A Dimensions: 25-1/8" Wide x 63" High x 14-1/4" Deep with 19" x 61-3/4" mounting
800A Dimensions: 26-3/8" Wide x 71-3/4" High x 14-1/4" Deep with 20-1/4" x 70-1/2" mounting

ENCLOSURE DIMENSIONS AND SHIPPING WEIGHTS

Not to be used for construction purposes unless approved.
Inches and Millimeters.

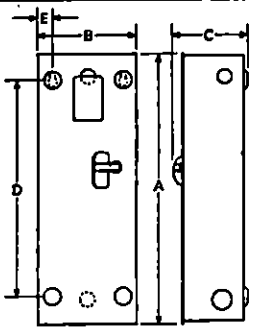
NEMA 1 Surface Mounted



Catalog Number	App. Wt. Lbs.	Max. Amps.	Dimensions A IN.	A MM	B IN.	B MM	C IN.	C MM	D IN.	D MM	E IN.	E MM	Conduit Sizes, Inches
2460S	4	60	8⅝	210	4⅝	117	2⅞	73					¾ x 1 x 1¼ KO x ½ KO
3100S	7	100	15⅜	390	6¼	159	3 13/16	98					1¼ x 1½ x 2 KO
2125S	7	125	14¼	365	6⅝	168	3½	89					½ x ¾ x 1 K, ½ KO ½ x ¾ KO
SCANZ25●	8	225	26¼	666	11 11/16	296	4⅝	117					1¼ x 1½ x 2 x 2¼ KO 1 x 1¼ x 1½ KO
SGCN100	6	100	14⅛	382	8⅝	210	3 5/16	99					1, 1¼, 1½, 2
SFDN100	12	100	17½	444	8 15/32	214	6 5/32	160	13 1/32	331	1 13/64	31	¼, ½, ¾, 1, 1¼, 1½, 2, 2½
SFDN150	15	150	23¼	591	8 15/32	214	6 5/32	160	18¾	476	1 13/64	31	¼, ½, ¾, 1, 1¼, 1½, 2, 2½
SEDN225*													
SJDN250	31	250	34 45/64	881	10 45/64	227	7 13/64	183	30	762	1⅞	48	¼, ½, 2, 2½, 3
SKDN400	53	400	38 13/16	986	11⅛	281	10 15/16	278	34	889	2 5/32	58	½, ¾, 1, 1½, 2, 2½, 3, 3½
SLDN600	81	600	45⅞	1165	14 5/16	364	12⅜	314	46 9/16	1183	1 27/32	48	½, ¾, 1, 1½, 2, 2½, 3, 3½
SNDN1200	178	1200	61 7/32	1555	21 7/16	545	15 13/32	391	61 27/32	1571	1 31/32	50	

*Availability to be announced.

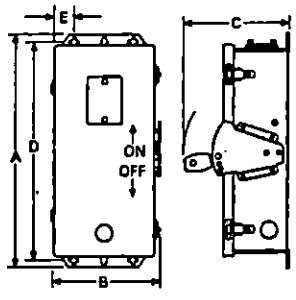
NEMA 1 Flush Mounted



Catalog Number	App. Wt. Lbs.	Max. Amps.	Dimensions A IN.	A MM	B IN.	B MM	C IN.	C MM	D IN.	D MM	E IN.	E MM	Conduit Sizes, Inches
2460F	4	60	8⅝	210	4⅝	117	2⅞	73					¾ x 1 x 1¼ KO, ½ KO
2125F	7	125	14¼	365	6⅝	168	3½	89					½ x ¾ x 1 KO, ½ KO
FCANZ25●	8	225	26¼	667	11 11/16	297	4⅝	118					½ x ¾ KO
FFDN100	12	100	18 13/16	478	9 23/32	247	6 5/32	160	13 1/32	331	1 55/64	47	¼, ½, ¾, 1, 1¼, 1½, 2, 2½
FFDN150	15	150	24 5/16	624	9 23/32	247	6 5/32	160	18¾	476	1 55/64	47	¼, ½, ¾, 1, 1¼, 1½, 2, 2½
FEDN225*													
FJDN250	32	250	36 1/64	915	12 15/64	311	7 13/64	183	30	762	1⅞	48	¼, ½, 2, 2½, 3
FKDN400	53	400	40⅛	1019	12⅜	314	10 15/16	278	34	889	2 15/16	75	¼, ½, ¾, 1½, 2, 2½, 3, 3½

*Availability to be announced.

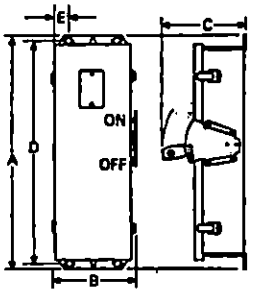
NEMA 12, 12K Dustproof



Catalog Number	App. Wt. Lbs.	Max. Amps.	Dimensions A IN.	A MM	B IN.	B MM	C IN.	C MM	D IN.	D MM	E IN.	E MM	Conduit Sizes, Inches
JFDN100	14	100	19 29/32	506	8 27/32	225	9 5/16	237	18 17/32	471	1 55/64	43	
JFDN150	18	150	25 21/32	652	8 27/32	225	9 5/16	237	24 9/32	617	1 55/64	43	
JEDN225*													
JJDN250	37	250	37 17/32	953	11 5/16	294	10 1/32	260	35 45/64	909	1 15/32	49	
JKDN400	58	400	41 11/16	1059	11 3/4	298	14 1/16	357	39 15/16	1014	1 31/32	50	
JLDN600	81	600	48 5/16	1227	14 29/32	379	15½	394	46 9/16	1183	1 55/64	48	
JNDPN800	110	800	63 13/32	1545	22	559	17⅝	448					
JNDN1200	170	1200	63 13/32	1545	22	559	17⅝	448	61 27/32	1571	1 31/32	50	
DFDN100	16	100	19 29/32	506	8 27/32	225	9 5/16	237					
DFDN150	19	150	25 21/32	652	8 27/32	225	9 5/16	237					
DJDN250	36	250	37 17/32	953	11 5/16	294	10 1/32	260					
DKDN400	53	400	41 11/16	1059	11 3/4	298	14 1/16	357					

*Availability to be announced.

NEMA 3R RFDN Through RNDN



Catalog Number	App. Wt. Lbs.	Max. Amps.	Dimensions A IN.	A MM	B IN.	B MM	C IN.	C MM	D IN.	D MM	E IN.	E MM	Conduit Sizes, Inches
2460R●	5	60	9 13/16	249	6 15/16	176	3 3/16	85					¾ x 1 x 1¼ KO x ½ KO
3100R●	10	100	15 1/16	382	12 3/8	314	4	101					1¼ x 1½ x 2 KO
2125R●	8	125	14¼	365	6⅝	168	3½	89					½ x ¾ x 1 KO
RCANZ25●●	8	225	26¼	668	11¾	299	5 1/32	130					½ x ¾ KO, ¾ KO
RGCN100●	6	100	14 1/16	382	7⅝	210	3 5/16	99					1, 1¼, 1½, 2, 2½
RFDN100	14	100	19 29/32	459	8 27/32	225	9 5/16	237	18 17/32	471	1 55/64	45	¼, ½, ¾, 1, 1¼, 2, 2½
RFDN150	19	150	25 21/32	603	8 27/32	225	9 5/16	237	24 9/32	617	1 55/64	45	¼, ½, ¾, 1, 1¼, 2, 2½
REDN225*													
RJDN250	40	250	37⅛	891	11 5/16	294	10 1/32	260	35 45/64	909	1 15/16	49	¼, ½, 2, 2½, 3
RKDN400	60	400	41 11/16	997	11¾	298	14 1/16	357	39 15/16	1014	1 31/32	50	¼, ½, ¾, 2½, 3, 3½
RLDN600	84	600	49 3/16	1227	14 29/32	379	15½	394	46 9/16	1183	1 55/64	48	¼, ½, ¾, 1, 1¼, 2, 2½
RNDN1200	175	1200	63 13/32	1615	22	559	17⅝	448	61 27/32	1571	1 31/32	50	

*Availability to be announced.

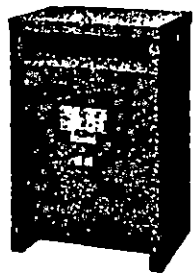
● To be discontinued.
●● The RCP, RCAN and RGCN NEMA 3R enclosures have top hinged front covers with a padlock hasp/latch. The cover must be raised to operate the breaker handle. All other NEMA 3R enclosures have an external side-operated handle mechanism.

Dry-Type Distribution, Energy Efficient 3 Phase, 60 Hz – Type DT-3

DESCRIPTION

Features • Specifications

- U.L. listed.
- Low operating costs when operated at 115°C or 80°C rise.
- 220°C insulating system provides extended life when operated at 115°C or 80°C rise.
- Manufactured in accordance with NEMA/ANSI, UL and IEEE standards.
- Overload capability of 15% for 115°C rise units operated at 150°C rise and 30% for 80°C rise units operated at 150°C rise.
- Drip proof enclosure.
- Core constructed from stacked laminations that are braced and dipped in resin to assure quiet operation.
- Furnished with primary and secondary terminal pads.
- Front and rear panels provide for easy installation and maintenance.
- All units 100% tested prior to being shipped.



LIST PRICES AND STYLE NUMBERS

kVA	Style No.	List Price	UIC Item 78-6680-	Full Capacity Taps	Type	Deg. C. Temp. Rise	Dimensions, (In.)❶ Height	Width	Depth	Wt. (Lbs.)	Frame	Wiring❷ Diagram	Weathershield Kit Style No.
480Δ Volts to 208Y/120 Volts													
15	V48M28B15A❸	$ 1967	14429	+ 2-2.5%, – 4-2.5%	DT-3	80	30⅛	20⅛	14⅛	230	910	280B	9715A69G02
30	V48M28B30R❸	2901	32542	+ 2-2.5%, – 4-2.5%	DT-3	80	30⅛	20⅛	14⅛	310	912	280B	9715A69G02
45	V48M28B45R❸	4351	32544	+ 2-2.5%, – 4-2.5%	DT-3	80	39⅜	26⅛	19⅛	480	914A	280B	9715A69G03
75	V48M28B75R❸	5801	32546	+ 2-2.5%, – 4-2.5%	DT-3	80	39⅜	26⅛	19⅛	600	915A	280B	9715A69G03
112.5	V48M28B12R❸	7329	32548	+ 2-2.5%, – 4-2.5%	DT-3	80	46½	26	20 3/16	760	916	280B	9715A69G04
150	V48M28B49P❸	9847	32550	+ 2-2.5%, – 4-2.5%	DT-3	80	56	31¼	24¼	1100	917	280B	9715A69G05
225	V48M28B22P❸	13772	32552	+ 2-2.5%, – 4-2.5%	DT-3	80	56	31¼	24¼	1300	918	280B	9715A69G05
300	V48M28B33R❸	16756	32553	+ 2-2.5%, – 4-2.5%	DT-3	80	75	44½	36	2600	919	275B	9715A69G06
500	V48M28B55R❸	24810	99910	+ 2-2.5%, – 4-2.5%	DT-3	80	80	57	42	4500	921A	275B	9715A69G15
15	V48M28F15B❸	1942	33340	+ 2-2.5%, – 4-2.5%	DT-3	115	25	20⅛	14⅛	215	909	280B	9715A69G01
30	V48M28F30R❸	2710	32556	+ 2-2.5%, – 4-2.5%	DT-3	115	30⅛	20⅛	14⅛	230	910	280B	9715A69G02
45	V48M28F45R❸	4084	32558	+ 2-2.5%, – 4-2.5%	DT-3	115	30⅛	20⅛	14⅛	310	912	280B	9715A69G02
75	V48M28F75R❸	5421	32560	+ 2-2.5%, – 4-2.5%	DT-3	115	39⅜	26⅛	19⅛	480	914A	280B	9715A69G03
112.5	V48M28F12R❸	6794	32562	+ 2-2.5%, – 4-2.5%	DT-3	115	39⅜	26⅛	19⅛	600	915A	280B	9715A69G03
150	V48M28F49P❸	9060	32564	+ 2-2.5%, – 4-2.5%	DT-3	115	46½	26	20 3/16	760	916	280B	9715A69G04
225	V48M28F22P❸	12520	32566	+ 2-2.5%, – 4-2.5%	DT-3	115	56	31¼	24¼	1100	917	280B	9715A69G05
300	V48M28F33P❸	15222	32568	+ 2-2.5%, – 4-2.5%	DT-3	115	56	31¼	24¼	1300	918	280B	9715A69G05
500	V48M28F55P❸	22290	32569	+ 2-2.5%, – 4-2.5%	DT-3	115	75	44½	36	2400	919	275B	9715A69G06
750	V48M28F77T	36223	32565	+ 2-2.5%, – 4-2.5%	DT-3	115	80	57	42	4500	921A	275B	9715A69G15
480Δ Volts to 208Y/120 Volts, Copper Windings													
15	V48M28B15CU❸	2708	33545	+ 2-2.5%, – 4-2.5%	DT-3	80	30⅛	20⅛	14⅛	230	910	280B	9715A69G02
30	V48M28B30CU❸	3996	33550	+ 2-2.5%, – 4-2.5%	DT-3	80	30⅛	20⅛	14⅛	310	912	280B	9715A69G02
45	V48M28B45CU❸	4810	33555	+ 2-2.5%, – 4-2.5%	DT-3	80	39⅜	26⅛	19⅛	480	914A	280B	9715A69G03
75	V48M28B75CU❸	7248	33560	+ 2-2.5%, – 4-2.5%	DT-3	80	39⅜	26⅛	19⅛	600	915A	280B	9715A69G03
112.5	V48M28B12CU❸	9644	33565	+ 2-2.5%, – 4-2.5%	DT-3	80	46½	26	20 3/16	760	916	280B	9715A69G04
150	V48M28B49CU❸	12599	33570	+ 2-2.5%, – 4-2.5%	DT-3	80	56	31¼	24¼	1100	917	280B	9715A69G05
225	V48M28B22CU❸	16799	33575	+ 2-2.5%, – 4-2.5%	DT-3	80	56	31¼	24¼	1300	918	280B	9715A69G05
300	V48M28B33CU❸	27267	33580	+ 2-2.5%, – 4-2.5%	DT-3	80	75	44½	36	2600	919	275B	9715A69G06
500	V48M28B55CU	34139	33585	+ 2-3.1%, – 2-3.1%	DT-3	80	76	60	50	4650	921AG	266GG	❹
15	V48M28F15CU❸	2343	33500	+ 2-2.5%, – 4-2.5%	DT-3	115	25	20⅛	14⅛	215	909	280B	9715A69G01
30	V48M28F30CU❸	3528	33505	+ 2-2.5%, – 4-2.5%	DT-3	115	30⅛	20⅛	14⅛	230	910	280B	9715A69G02
45	V48M28F45CU❸	4244	33510	+ 2-2.5%, – 4-2.5%	DT-3	115	30⅛	20⅛	14⅛	310	912	280B	9715A69G02
75	V48M28F75CU❸	6396	33515	+ 2-2.5%, – 4-2.5%	DT-3	115	39⅜	26⅛	19⅛	480	914A	280B	9715A69G03
112.5	V48M28F12CU	8510	33520	+ 2-2.5%, – 4-2.5%	DT-3	115	39⅜	26⅛	19⅛	600	915A	280B	9715A69G03
150	V48M28F49CU	11118	33525	+ 2-2.5%, – 4-2.5%	DT-3	115	46½	26	20 3/16	760	916	280B	9715A69G04
225	V48M28F22CU	14823	33530	+ 2-2.5%, – 4-2.5%	DT-3	115	56	31¼	24¼	1100	917	280B	9715A69G05
300	V48M28F33CU	19006	33535	+ 2-2.5%, – 4-2.5%	DT-3	115	56	31¼	24¼	1300	918	280B	9715A69G05
500	V48M28F55CU	30123	33540	+ 2-2.5%, – 4-2.5%	DT-3	115	75	44½	36	2400	919	275B	9715A69G06
750	V48M28F77CU	46620	32567	+ 1-3.5%, – 1-3.5%	DT-3	115	76	60	50	5400	921AG	286GG	❹
480Δ Volts to 240Δ Volts													
30	V48M24B30N	2901	32571	+ 2-2.5%, – 4-2.5%	DT-3	80	30⅛	20⅛	14⅛	310	912	280B	9715A69G02
45	V48M24B45P	4351	32573	+ 2-2.5%, – 4-2.5%	DT-3	80	39⅜	26⅛	19⅛	480	914A	281B	9715A69G03
75	V48M24B75P	5921	32575	+ 2-2.5%, – 4-2.5%	DT-3	80	39⅜	26⅛	19⅛	600	915A	281B	9715A69G03
112.5	V48M24B12P	7478	32577	+ 2-2.5%, – 4-2.5%	DT-3	80	46½	26	20 3/16	760	916	281B	9715A69G04
150	V48M24B49P	9847	32579	+ 2-2.5%, – 4-2.5%	DT-3	80	56	31¼	24¼	1100	917	281B	9715A69G05
225	V48M24B22P	13772	32581	+ 2-2.5%, – 4-2.5%	DT-3	80	56	31¼	24¼	1300	918	281B	9715A69G05
300	V48M24B33P	16749	32583	+ 2-2.5%, – 4-2.5%	DT-3	80	75	44½	36	2600	919	274B	9715A69G06
500	V48M24B55N	24810	32584	+ 2-2.5%, – 4-2.5%	DT-3	80	80	57	42	4500	921A	274B	9715A69G15
30	V48M24F30P	2710	32588	+ 2-2.5%, – 4-2.5%	DT-3	115	30⅛	20⅛	14⅛	230	910	281B	9715A69G02
45	V48M24F45P	4084	32588	+ 2-2.5%, – 4-2.5%	DT-3	115	30⅛	20⅛	14⅛	310	912	281B	9715A69G02
75	V48M24F75P	5421	32590	+ 2-2.5%, – 4-2.5%	DT-3	115	39⅜	26⅛	19⅛	480	914A	281B	9715A69G03
112.5	V48M24F12P	6794	32592	+ 2-2.5%, – 4-2.5%	DT-3	115	39⅜	26⅛	19⅛	600	915A	281B	9715A69G03
150	V48M24F49P	9060	32594	+ 2-2.5%, – 4-2.5%	DT-3	115	46½	26	20 3/16	760	916	281B	9715A69G04
225	V48M24F22P	12775	32596	+ 2-2.5%, – 4-2.5%	DT-3	115	56	31¼	24¼	1100	917	281B	9715A69G05
300	V48M24F33P	15222	32598	+ 2-2.5%, – 4-2.5%	DT-3	115	56	31¼	24¼	1300	918	281B	9715A69G05
500	V48M24F55N	22290	32599	+ 2-2.5%, – 4-2.5%	DT-3	115	75	44½	36	2600	919	274B	9715A69G06
750	V48M24F77N	36223	32569	+ 2-2.5%, – 4-2.5%	DT-3	115	80	57	42	4500	921A	274B	9715A69G15

❶ Not for construction. Refer to TCS47-720 by frame number for certification.
❷ For wiring diagram, refer to TCS47-730 by diagram number.
❸ Refer to Cutler-Hammer.
❹ Normally stock. Any style not normally stocked is available on a QWIK ENTRY (Q) suffix.

NOTE: Refer to Cutler-Hammer for availability of custom designs.

DISCOUNT SYMBOL DT-1

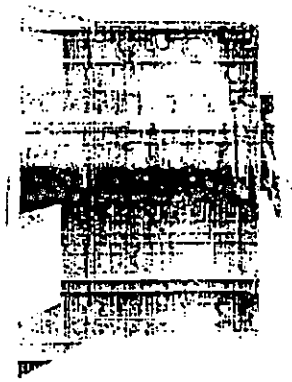
DH

Panel board, Transformer, Switches

WHEN ORDERING SPECIFY

- Catalog Number

- UL listed. File E5239.
- Meets UL 98 for enclosed switches and NEMA Std. KS-1.
- Suitable as service entrance equipment, except 1200A on grounded Wye systems, per NEC-230-95, and 4-pole switches.



K-series 60A, Type 1

NON-FUSIBLE — 240-600 VOLTS

System	Amperes	Enclosure Type 1 Indoor Catalog Number	Price	Enclosure Type 3R Raintight Catalog Number	Price	Type 4 & 4X ❶ Watertight Catalog Number	Price	Enclosure Type 12, 12/3R for 30-200A Industrial Catalog Number	Price	Maximum Hp Ratings 3φ ac 240V	600V	480V	600V	250
2 POLE, 240 VOLTS AC — 600 VOLTS AC OR DC ❷														
	30	DH261UGK	S 142	❸	---	❸	---	DH261UDK	S 249	7-1/2	10			
	60	❸	[illegible]	❸	---	❸	---	262UDK	297	20	25			
	100	263UGK	428.	❸	---	❸	---	263UDK	455.	30	40	---	---	---
	200	❸	---	❸	---	❸	---	264UDK	660.	50	50	---	---	---
	400	265UGK	1465.	❸	---	❸	---	265UDK	1625					
	600	266UGK	2600.	❸	---	❸	---	266UDK	2773.					
	800	267UGK	4141.	❸	---	---	---	267UDK	4513					
	1200	❹	---	❹	---	---	---	---	---					
3 POLE, 240 VOLTS AC — 600 VOLTS AC — 250 VOLTS DC (125A – AC														
	30	DH361UGK ❺	138.	DH361URK ❺	S240.	DH361UWK ❺	1015.	DH361UDK ❺	313.					
	30	361UGK-RS	138.	361URK-RS	246.	361UWK-LS	1015.	361UDK-LS	313					
	60	362UGK ❺	245.	362URK ❺	433.	362UWK ❺	1217.	362UDK ❺	410					
	60	362UGK-RS	245.	---	---	362UWK-LS	1217.	362UDK-LS	410					
	100	363UGK	399.	363URK	618.	363UWK	2497.	363UDK	570.	40	50	75	[illegible]	
	200	364UGK	581.	364URK	725.	364UWK	3398.	364UDK	767.	50	50	125	150	[illegible]
	400	365UGK	1347.	365URK	1896.	365UWK	6579.	365UDK	2021.	---	---	250	350	[illegible]
	600	366UGK	2466.	366URK	3781.	366UWK	9180.	366UDK	3252.	---	---	400	500	---
	800	367UGK	4973.	367URK	6647.	367UWK	12910.	367UDK	5431.	---	---	500	[illegible]	---
	1200	368UGB	6790.	368URB	9300.	---	---	---	---	---	---	---	---	---
4 POLE, 240 VOLTS AC — 600 VOLTS AC — 250 VOLTS DC ❺ ❼														
										3φ 240V	600V			
	30	DH461UGK	466	---	---	DH461UWK	[illegible]	DH461UDK	463.	10	25	[illegible]	[illegible]	
	60	462UGK	444.	---	---	[illegible]	---	462UDK	540.	20	50	50	60	
	100	463UGK	801.	---	---	[illegible]	---	463UDK	952.	30	50	60	75	[illegible]
	200	---	---	---	---	[illegible]	---	464UDK	1453.	50	50	125	150	---
	400	465UGK	2094.	---	---	---	---	---	---	---	---	250	350	---
	600	466UGK	3932.	---	---	---	---	---	---	---	---	400	500	---

❶ UL Type 4X stainless steel [illegible] 1200A. [illegible] stainless steel enclosure on 400-800A, add suffix -SS and [illegible] available.

❷ [illegible]

❸ [illegible]

❹ [illegible]

❺ [illegible]

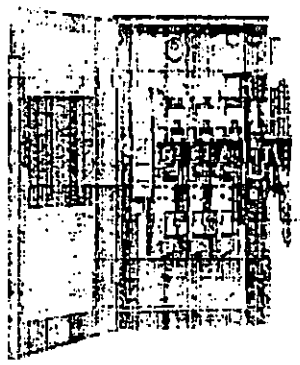
❻ [illegible]

❼ [illegible] Type 53. Consult factory for application data.

❽ Switch [illegible] number. Example: DH361UGK-CSA.

WHEN ORDERING SPECIFY

- Catalog Number



K-series 60A, Type 3R

- UL listed. File E5239.
- Meets UL 98 for enclosed switches and NEMA Std. KS-1.
- Suitable as service entrance equipment, except 1200A on grounded Wye systems, per NEC-230-95, and 4-pole switches.

FUSIBLE 277/480 — 600 VOLTS — Provision for Class H fuses through 600A — Class L for [illegible]

System	Amperes	Enclosure Type 1 Indoor Catalog Number	Price	Enclosure Type 3R Rainproof Catalog Number	Price	Type 4 & 4X ❶ Watertight Catalog Number	Price	Enclosure Type 12 12/3R for 30-200A Industrial Catalog Number	Price	Maximum Hp Rating With Time Delay Fuses: To 30 480V	To 30 600V	31-[illegible] 480V	31-[illegible] 600V	250V	600V
2 POLE, 480 VOLTS AC — 600 VOLTS AC OR DC ❷															
	30	DH261FGK	$ 273.	❸	---	DH261FWK	$ 1267.	DH261FDK	$ 402.	7-1/2	10	---	---	---	15
	60	262FGK	330.	❸	---	❸	---	262FDK	459.	20	25	---	---	---	25
	100	263FGK	644.	❸	---	❸	---	263FDK	679.	30	40	---	---	---	25
	200	264FGK	892.	❸	---	264FWK	3912.	264FDK	1033.	50	50	---	---	---	50
	400	265FGK	2247.	❸	---	❸	---	265FDK	2450.	---	---	---	---	50	
	600	266FGK	3541.	❸	---	❸	---	266FDK	3921.	---	---	---	---	---	
	800	267FGK	5310.	❸	---	❸	---	267FDK	6541.	---	---	---	---	---	---
	1200	❸	---	❸	---	---	---	---	---	---	---	---	---	---	
3 POLE, 480 VOLTS AC — 600 VOLTS AC															
	30	DH361FGK	264.	DH361FRK	$ 446.	DH361FWK	1181.	DH361FDK	446.	7-1/2	10	15	20	---	---
	60	362FGK	316.	362FRK	520.	362FWK	1337.	362FDK	467.	20	25	30	50	---	---
	100	363FGK	588.	363FRK	814.	363FWK	2693.	363FDK	725.	30	40	60	75	---	---
	200	364FGK	848.	364FRK	1125.	364FWK	3761.	364FDK	1235.	50	50	125	150	---	---
	400	365FGK	2228.	365FRK	2681.	365FWK	7363.	365FDK	2990.	---	---	250	350	---	---
	600	366FGK	4250.	366FRK	5700.	366FWK	11188.	366FDK	4750.	---	---	400	500	---	---
	800	367FGK	7000.	367FRK	8288.	367FWK	13197.	367FDK	8690.	---	---	500	500	---	---
	1200	368FGB	8630.	368FRB	10620.	---	---	---	---	---	---	---	---	---	---
4 WIRE SOLID BLADES, 3 FUSES) 277/480 VOLTS AC — 600 VOLTS AC															
	30	DH361NGK	305.	DH361NRK	517.	DH361NWK	1326.	DH361NDK	558.	7-1/2	10	15	20	---	---
	60	362NGK	355.	362NRK	560.	362NWK	1451.	362NDK	550.	20	25	30	50	---	---
	100	363NGK	632.	363NRK	863.	363NWK	3012.	363NDK	840.	30	40	60	75	---	---
	200	364NGK	926.	364NRK	1255.	364NWK	4189.	364NDK	1396.	50	50	125	150	---	---
NEUTRAL	400	365NGK	2542.	365NRK	2989.	365NWK	7564.	365NDK	3061.	---	---	250	350	---	---
	600	366NGK	4144.	366NRK	5688.	366NWK	10998.	366NDK	4800.	---	---	400	500	---	---
	800	367NGK	7107.	367NRK	8754.	---	---	---	---	---	---	500	500	---	---
	1200	368NGB	9013.	368NRB	11188.	---	---	---	---	---	---	---	---	---	---
4 POLE, 480 VOLTS AC — 600 VOLTS AC ❍															
											2o 600V				
	30	DH461FGK	442.	---	---	---	---	---	---	---	25	15	20	---	---
	60	462FGK	520.	---	---	---	---	---	---	---	50	30	50	---	---
	100	463FGK	867.	---	---	---	---	DH463FDK	997.	---	50	60	75	---	---
	200	---	---	---	---	---	---	464FDK	1702.	---	50	125	150	---	---
	400	465FGK	3952.	---	---	---	---	---	---	---	---	250	350	---	---
	600	466FGK	6441.	---	---	---	---	---	---	---	---	400	500	---	---

❶ UL Type 4X stainless steel enclosures through 100A. Type 4 painted steel to 400-800A. For standard [illegible] 400A, add suffix -SS and consult factory for availability.

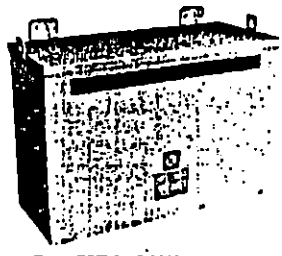
❷ Dc rating for 400-800A switches is 250V.

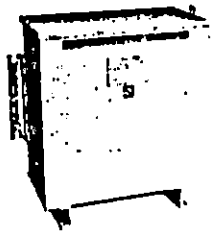
❸ Use outside poles of 3 pole switch, for dc rating [illegible].

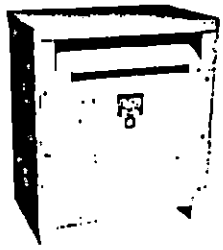
❍ For four pole applications use three pole switch [illegible] pole Cat. No. DS16CP, listed on Page 53. Consult factory for application data.

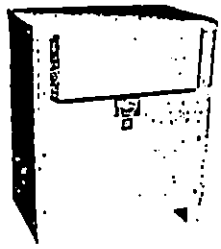
TRANSFORMERS
Dry-Type Distribution, General Purpose
3 Phase, 60 Hz – Types EPT and DT-3

DESCRIPTION


Type EPT 3-15 kVA


Type EPT 30 kVA


Type DT-3 30-1500 kVA


Type DT-3
With Optional Weatherahields

Type EPT Resin Encapsulated

Features • Specifications

- U.L. listed for indoor/outdoor mounting (600 volt class)
- Can be mounted in any position indoors. Outdoors mounts upright only
- All units 100% tested prior to being shipped.
- Constructed in accordance with NEMA, ANSI, ASA, and IEEE standards
- Totally enclosed-non-ventilated design permits installation in areas that contain dust, moisture or corrosive fumes
- As much as 40% smaller in cubic volume than equal Kva ratings in other dry-type designs
- Low sound levels permit installation in hospitals, hotels, schools and libraries.
- Large terminal compartment permits easier cable connections
- Immersion of core and coil in sand and resin provides rigid construction which attenuates sound and will withstand short circuit stresses up to 25 times normal load current for two seconds.
- 15 Kva and below has terminal compartment on the bottom.
- 30 Kva has terminal compartment at top. No knockouts.
- Lifting holes are provided.
- Flexible leads built into the unit for ease of making connections.

Type DT-3 Ventilated

Features • Specifications

- UL listed (600 volt class) 30 Kva thru 1000 Kva
- 150°C rise – 220°C total insulation system
- Drip proof enclosure
- Core is constructed from stacked laminations that are braced and dipped in resin to assure quiet operation
- All ratings are constructed in accordance with NEMA, ANSI, ASA and IEEE standards
- 100% tested to meet ANSI and NEMA sound levels
- The ventilated designs are furnished with terminal straps only.
- Front and rear panels are provided for easy installation and maintenance.

LIST PRICES AND STYLE NUMBERS

KVA	Style Number	List Price	Full Capacity Taps	Type	Deg. C. Temp. Rise	Dimensions, (In.)① Height	Width	Depth	Wt. (Lbs.)	Frame	Wiring② Diagram	Weathershield Kit Style No.
240Δ Volts to 208Y/120 Volts												
9	Y24G28T09M	$ 806	−2-5%	EPT	115	15⅛	16	9⁹⁄₁₆	160	103	70C	Not Required④
15	Y24G28T15M	1352	−2-5%	EPT	115	17⅜	20	8¹⁄₁₆	210	95	70C	
30	Y24M28T30M	2026	+2-2.5%, −4-2.5%	EPT	115	26⅛	25⅛	12¾	422	243	84C	
45	V24M28T45M	2080	+2-2.5%, −4-2.5%	DT-3	150	28¼	24	15¾	500	851	280C	783C426G01
75	V24M28T75M	3094	+2-2.5%, −4-2.5%	DT-3	150	38⅜	28	19¾	850	853	280C	783C426G02
112.5	V24M28T12M	4134	+2-2.5%, −4-2.5%	DT-3	150	38⅜	28	19¾	850	854	76C	783C426G02
150	V24M28T49M	5080	+2-2.5%, −4-2.5%	DT-3	150	45	31⅛	22⅛	950	855	76C	783C426G03
480Δ Volts to 208Y/120 Volts												
3①	Y48N28T03M	489	None	EPT	115	13⅛	15⁹⁄₁₆	8⁹⁄₁₆	70	201	71A	Not Required④
3①	Y48G28T03M	499	−2-2-5%	EPT	115	13⅛	15⁹⁄₁₆	8⁹⁄₁₆	70	201	70A	
6①	Y48N28T06M	561	None	EPT	115	15⅛	16⅛	7½	115	200	71A	
6①	Y48G28T06M	572	−2-5%	EPT	115	15⅛	16⅛	7½	115	200	70A	
6①	Y48D28T06M	583	+2-2.5%, −2-2.5%	EPT	115	15⅛	16⅛	7½	115	200	72B	
9①	Y48N28T09M	749	None	EPT	115	15⅛	16	9⁹⁄₁₆	160	103	71A	
9①	Y48G28T09M	764	−2-5%	EPT	115	15⅛	16	9⁹⁄₁₆	160	103	70A	
9①	Y48J28T09M	779	−4-2.5%	EPT	115	15⅛	16	9⁹⁄₁₆	160	103	72A	
9①	Y48D28T09M	779	+2-2.5%, −2-2.5%	EPT	115	15⅛	16	9⁹⁄₁₆	160	103	72B	
15①	Y48N28T15M	1176	None	EPT	115	17⅜	20	8¹⁄₁₆	210	95	71A	
15①	Y48G28T15M	1149	−2-5%	EPT	115	17⅜	20	8¹⁄₁₆	210	95	70A	
15①	Y48J28T15M	1149	−4-2.5%	EPT	115	17⅜	20	8¹⁄₁₆	210	95	72A	
15①	Y48D28T15M	1149	+2-2.5%, −2-2.5%	EPT	115	17⅜	20	8¹⁄₁₆	210	95	72B	
30①	Y48M28T30M	1995	+2-2.5%, −4-2.5%	EPT	115	26⅛	25⅛	12¾	422	243	84A	
30①	V48M28T30J	1534	+2-2.5%, −4-2.5%	DT-3	150	32	20⅛	14⅛	230	910	280B	7073C04G01
37.5①	V48M28T37J	1720	+2-2.5%, −4-2.5%	DT-3	150	32	20⅛	14⅛	310	911	280B	7073C04G01
45①	V48M28T45J	1846	+2-2.5%, −4-2.5%	DT-3	150	32	20⅛	14⅛	310	912	280B	7073C04G01
50①	V48M28T50H	2019	+2-2.5%, −4-2.5%	DT-3	150	37⅛	26⅛	19⅛	480	913	280B	7073C04G02
75①	V48M28T75H	2782	+2-2.5%, −4-2.5%	DT-3	150	37⅛	26⅛	19⅛	480	914	280B	7073C04G02
112.5①	V48M28T12G	3702	+2-2.5%, −4-2.5%	DT-3	150	37⅛	26⅛	19⅛	600	915	280B	7073C04G02
150①	V48M28T49J	4836	+2-2.5%, −4-2.5%	DT-3	150	46½	26	20⁹⁄₁₆	950	916	280B	7073C04G03
225①	V48M28T22K	6448	+2-2.5%, −4-2.5%	DT-3	150	56	29	24¼	1200	917	280B	7073C04G04
300①	V48M28T33J	8268	+2-2.5%, −4-2.5%	DT-3	150	56	29	24¼	1400	918	280B	7073C04G04
500①	V48M28T55F	13104	+2-2.5%, −4-2.5%	DT-3	150	75	44	36	2700	④	④	3720C94G05
750①	V48M28T77F	21294	+2-2.5%, −4-2.5%	DT-3	150	75	50	36	3300	④	④	3720C94G06
1000①	V48M28T11F	25688	+2-2.5%, −4-2.5%	DT-3	150	90	53	36	4900	④	④	3720C94G07

① Normally stock.
① Not for construction. Refer to TCS47-720 by frame number for certification.
② For wiring diagram, refer to TCS47-730 by diagram number.
③ NEMA 3R outdoor enclosure is standard for Westinghouse Type EPT.
④ Refer to SPTD.
Note: Refer to SPTD for availability of special designs.

TRANSFORMERS

Dry-Type Distribution, General Purpose 3 Phase, 60 Hz – Types EPT and DT-3

LIST PRICES AND STYLE NUMBERS, *Continued*

KVA	Style No.	List Price	UIC Item 78-6680-	Full Capacity Taps		Type	Deg. C Temp Rise	Height	Width	[illegible]in				
480Δ Volts to 208Y/120 Volts														
15	V48M28T15B③	$ 1377	33300	+2-2.5%,	−4-2.5%	DT-3	150	25	[illegible]	[illegible]				
30	V48M28T30K③	2032	32420	+2-2.5%,	−4-2.5%	DT-3	150	[illegible]	[illegible]					
37.5	V48M28T37K③	2279	32429	+2-2.5%,	−4-2.5%	DT-3	150	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
45	V48M28T45K③	2446	32427	+2-2.5%,	−4-2.5%	DT-3	150	[illegible]	[illegible]	[illegible]				
50	V48M28T50J③	2675	32430	−2-2.5%,	−4-2.5%	DT-3	150	[illegible]	[illegible]	[illegible]	[illegible]			
75	V48M28T75J③	3686	32433	−2-2.5%,	−4-2.5%	DT-3	150	37⅞	26⅛	19⅛	[illegible]	915	[illegible]	
112.5	V48M28T12H③	4905	32434	+2-2.5%,	−4-2.5%	DT-3	150	46½	26	20⁹⁄₁₆	760	916	280B	9715A
150	V48M28T49K③	6407	32432	−2-2.5%,	−4-2.5%	DT-3	150	56	31¼	24¼	1209	917	280B	9715A
225	V48M28T22L③	8543	32435	+2-2.5%,	−4-2.5%	DT-3	150	56	31¼	24¼	1443	918	280B	9715A
300	V48M28T33K③	10954	32422	−2-2.5%,	−4-2.5%	DT-3	150	75	44½	36	2400	919	275B	9715A
500	V48M28T55G③	17361	32423	+2-2.5%,	−4-2.5%	DT-3	150	75	44½	36	2900	920	275B	[illegible]
750	V48M28T77F	28213	32424	+2-2.5%,	−4-2.5%	DT-3	150	75	44½	40	4000	921	[illegible]	[illegible]
1000	V48M28T11F	34034	32425	+2-2.5%,	−4-2.5%	DT-3	150							
480Δ Volts to 208Y/120 Volts, Copper Windings														
					−4-2.5%	DT-3	[illegible]	25	20⅛	14⅛	172	909	[illegible]	[illegible]
15	V48M28T15CU③	1914	32366	[illegible]	−4-2.5%	DT-3	[illegible]	[illegible]	20⅛	14⅛	300	910	[illegible]	[illegible]
30	V48M28T30CU	2625	32368	[illegible]	−4-2.5%	DT		30⅛	20⅛	14⅛	370	912	[illegible]	[illegible]
45	V48M28T45CU	3399	[illegible]	[illegible]	−4-2.5%	[illegible]		[illegible]	26⅛	19⅛	550	914	[illegible]	[illegible]
75	V48M28T75CU	5127	[illegible]	[illegible]	−4-2.5%	DT		[illegible]	26⅛	19⅛	575	915	[illegible]	[illegible]
112.5	V48M28T12CU	6810	[illegible]		−4-2.5%	DT		[illegible]	26	[illegible]	850	9[illegible]1		
150	V48M28T49CU	8305	[illegible]		−4-2.5%	DT-3	[illegible]	56	31¼	24¼	1200	917	[illegible]	[illegible]
225	V48M28T22CU	11873	32378	+2-2.5%,	−4-2.5%	DT-3	150	56	31¼	24¼	1750	918	280B	9715A
300	V48M28T33CU	15224	32380	+2-2.5%,	−4-2.5%	DT-3	150	75	44½	36	3100	919	275B	9715A
500	V48M28T55CU	24127	38018	+2-2.5%,	−4-2.5%	DT-3	150	75	44½	36	3600	920	275B	9715
750	V48M28T77CU	39208	38019	+2-2.5%,	−4-2.5%	DT-3	150	75						
480Δ Volts to 240Δ Volts														
						EP	[illegible]	[illegible]	15[illegible]	8[illegible]	116	201	74A	
3	[illegible]	661	[illegible]	[illegible]		EP		[illegible]	16[illegible]	[illegible]	145	200	74A	
[illegible]	[illegible]	757	[illegible]	[illegible]		EP		[illegible]	16[illegible]	[illegible]	165	103	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	15[illegible]	[illegible]	[illegible]	98	[illegible]	
	[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	25¼	12¾	422	243	85A	
[illegible]	[illegible]	2641	[illegible]		[illegible]	[illegible]			29[illegible]	12[illegible]	660	244	85A	
[illegible]	[illegible]	2249	[illegible]		[illegible]				26[illegible]	[illegible]	[illegible]	907	[illegible]	
[illegible]	[illegible]	[illegible]			[illegible]				[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]				[illegible]	[illegible]	[illegible]	912	[illegible]	
45	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]	26[illegible]	[illegible]	470	914	[illegible]	
75	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]	26	19⅛	600	915	[illegible]	
112.5	[illegible]	[illegible]			[illegible]			[illegible]	26	20⁹⁄₁₆	760	916	[illegible]	
150	[illegible]	645[illegible]	[illegible]	[illegible]	−4-2.5%	[illegible]		[illegible]	31¼	24¼	1100	917	28[illegible]	[illegible]
225	[illegible]	9547	32312	−2-2.5%,	−4-2.5%	DT-3	150	[illegible]	31[illegible]	24[illegible]	1300	918	[illegible]	[illegible]
300	[illegible]	10954	[illegible]	[illegible]	−4-2.5%	DT-3	[illegible]	75	44½	36	2400	919	274[illegible]	[illegible]
500	[illegible]	1736[illegible]	[illegible]	[illegible]	−4-2.5%	[illegible]	[illegible]	75	44½	36	2900	920	274[illegible]	[illegible]
750	[illegible]	28213	32318	−2-2.5%,	−4-2.5%	DT-3	150	75	46½	36	4000	921	274[illegible]	[illegible]
[illegible]	[illegible]	34034	[illegible]	−2-2.5%,	−4-2.5%	DT-3	150							
480Δ Volts to 240Δ Volts with 120 Volts Lighting Tap on "B" Phase														
								[illegible]	20⅛	14⅛	132	909	[illegible]	
15	[illegible]	[illegible]	[illegible]	[illegible]	−4-2.5%			[illegible]	20[illegible]	14⅛	280	910	[illegible]	[illegible]
30	[illegible]	2244	[illegible]	[illegible]	−4-2.5%	[illegible]	[illegible]	30⅛	20⅛	14⅛	310	912	[illegible]	[illegible]
45	[illegible]	2876	[illegible]	[illegible]	−4-2.5%	[illegible]	[illegible]	27⅞	26⅛	19⅛	480	914	284E	[illegible]
75	[illegible]	[illegible]	[illegible]	[illegible]	−4-2.5%	[illegible]	[illegible]	27⅞	26	[illegible]	600	915	[illegible]	
112.5	V48M22T12N③	5340	32468	+2-2.5%,	−4-2.5%	DT-3	150	[illegible]	26	20⁹⁄₁₆	760	916	[illegible]	
150	V48M22T49N③	6697	32470	+2-2.5%,	−4-2.5%	DT-3	150	46½	31[illegible]	24¼	1100	917	280B	97
225	[illegible]	8859	32472	−2-2.5%,	−4-2.5%	DT-3	150	56	31½	24¼	1300	918	[illegible]	[illegible]
300	[illegible]	12237	32474	[illegible]	−4-2.5%	[illegible]	[illegible]	56	44½	36	2400	919	[illegible]	[illegible]
500	[illegible]	17616	[illegible]	[illegible]	−4-2.5%	[illegible]	[illegible]	75	44[illegible]	[illegible]	2900	920	[illegible]	
750	[illegible]	28648	[illegible]	[illegible]	−4-2.5%	[illegible]	[illegible]	[illegible]	46[illegible]	40	4000	921	[illegible]	[illegible]
1000	[illegible]	34424	[illegible]		−4-2.5%		[illegible]							
480Δ Volts to 480Y/277 Volts														
									16[illegible]	9⅞	165	103	77[illegible]	
9	V48D47T09[illegible]	1045	32476		−2-2.5%	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		
15	V48D47T15[illegible]	2038	32477		−2-2.5%	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	21[illegible]		
30	V48M47T30[illegible]	2859	32479	[illegible]	−4-2.5%	[illegible]	[illegible]	[illegible]	28⅛	14⅝	660	244	84[illegible]	
45	V48M47T45[illegible]	3442	[illegible]	[illegible]	−4-2.5%									
15	V48M47T15[illegible]	1344	[illegible]	[illegible]	−4-2.5%	[illegible]			[illegible]	[illegible]	[illegible]			
30	V48M47T30[illegible]	2199	32481	−2-2.5%,	−4-2.5%	DT-3	150	30⅜	20⅛	14⅛	310	912	[illegible]	
45	V48M47T45[illegible]	[illegible]	[illegible]	[illegible]	−4-2.5%		[illegible]	37⅞	26⅛	19⅛	480	914	280D	[illegible]
75	V48M47T75[illegible]	3572	[illegible]	[illegible]	−4-2.5%	[illegible]	[illegible]	37⅞	26⅛	19⅛	600	915	280D	[illegible]
112.5	V48M47T12[illegible]	5319	[illegible]	[illegible]	−4-2.5%	[illegible]		[illegible]	26	20⁹⁄₁₆	760	916	[illegible]	
150	V48M47T49[illegible]	6350	[illegible]	[illegible]	−4-2.5%	[illegible]		56	31[illegible]	24¼	[illegible]	[illegible]		
225	V48M47T22[illegible]	9291	32486	−2-2.5%,	−4-2.5%	DT-3	150	[illegible]	31[illegible]	24¼	[illegible]			
300	V48M47T33[illegible]	12056	[illegible]	[illegible]	−4-2.5%	[illegible]	[illegible]	[illegible]	44[illegible]	36	2400	91[illegible]	[illegible]	
500	V48M47T55[illegible]	15149	[illegible]	[illegible]	−4-2.5%				44[illegible]	36	[illegible]			
750	V48M47T77A	31116	32488	+2-2.5%,	−4-2.5%	DT-3	150	[illegible]						

① Not for construction. Refer to TCS47-720 by frame number for certification.

② For wiring diagram, refer to TCS47-730 by diagram number.

③ NEMA 3R outdoor enclosure is standard for Westinghouse Type EPT

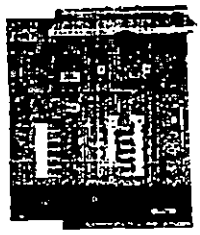
④ Lighting tap capacity limited to 5% of rated kVA.
Note: Refer to Westinghouse for availability of special designs.

Note: Contact Westinghouse for availability of special designs for hazardous locations – Type EPT only

Note: Stainless steel enclosures are available for Westinghouse Type EPT

③ Normally stock. Any style not stocked i on a QWIK ENTRY (Q) suffix

MAIN LUG LOAD CENTERS
1 Phase, 3 Wire, 120/240 Volts AC
22,000 Amp Interrupting Rating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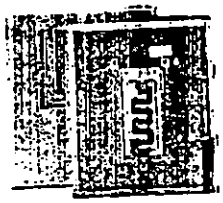
S612CG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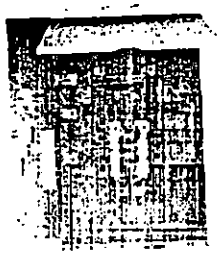
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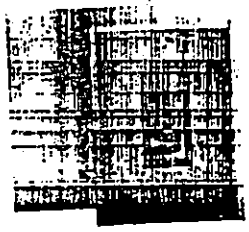

S816CD


S816R

LIST PRICES AND CATALOG NUMBERS

Main Rating	No. of 1" Spaces	Max. No. Single Pole	Indoor NEMA 1 Cat. No.	List Price	Ground Bus Kit⊖	Carton Weight lbs Qty	Box⊖ Style No.	Rainproof NEMA 3R Box⊖⊖ Style No.	Cat No.⊖	List Price	Carton Weight lbs Qty
Residential Load Centers			Combo Flush Surface								
125A 6-2/0 Al 6-1/0 Cu	2 2	6 6	S48F,S S48FG,SG	$ 54.70 50.40	GB6C GB6C		3C	2R	S48R	$ 72.90	54.5
125A 6-2/0 Cu/Al	6 Cover without Cu	12	S612C⊖ S612CG	51.70 57.40	GB6C GB6C	11	4C 4C	4R	S612R	78.00	13
	6 Cover with Cu	12	S612CD⊖ S612CDG	57.90 63.50	GB6C GB6C		4C				
	8 Cover without Cu	16	S816C⊖ S816CG	60.8 [illegible]	GB6C GB6C			8R	S816R	117.00	14
	8 Cover with Cu	16	S816CD⊖ S816CDG	70.[illegible] 80.70	GB6C GB6C						
	12	24	L121224CT	109.00	GB10C GB8C			[illegible]	L121224RT	187.00	20
	12	24	L121224CGT	114.00	GB10C,GB8C				L121624RT	207.00	[illegible]
	16	24	L121624CT	142.50	GB10C,GB8C			16	L202024RT	205.00	[illegible]
	20	24	L122024CT	160.00	GB10C,GB8C						
	24	24	L122424CT	175.00	GB10C,GB8C						
150A 3-2/0 Cu/Al	12	24	L151224CT	161.00	GB12C,GB10C		8C				
	16	30	L151630CT	170.00	GB12C,GB10C		8C				
	20	30	L152030CT	193.00	GB12C,GB10C		8C				
200A 1-250 MCM Cu Al	8	16						2R	L20816RT	209.00	26
	12	24	L201224CT	172.00	GB14C,		8C	2R	L201224RT	229.00	26
	20	40	L202040CT	224.00	(2)GB10C,GB12C		8C	6R	L202040RT	310.00	30
	24	40	L202440CT	247.00	(2)GB10C,GB12C	34	10C				
	30	40	L203040CT	266.00	(2)GB10C,GB12C	34	10C	9R	L203040RT	338.00	45
	40	40	L204040CT	364.00	(2)GB10C,GB12C	36	11C	10R	L204040RT	582.00	52
225A 2-300 MCM Cu/Al	42	42	L224242CT	398.00	(2)GB12C	23	11C				
Commercial Load Centers			Flush	Surface	List Price						
225A 2-300 MCM Cu Al	42	42	4242CFN⊖	4242CSN⊖	$618.00	28	14	37	4242CR1N	816.00	78
400A (1) 4/0-750 MCM Cu Al or	12	24	1224DFN	1224DSN	624.00	14	19	42	1224DR1N	716.00	71
(2) 3/0-400 MCM Al or	24	42	2442DFN	2442DSN	720.00	12	20	44	2442DR1N	999.00	80
(2) 3/0-300 MCM Cu	42	42	4242DFN	4242DSN	813.00	37	22	46	4242DR1N	1027.00	96
600A (2) 2-500 MCM Cu Al	42	42	4242EFN	4242ESN	1050.00	50	22	46	4242ER1N	1307.00	99

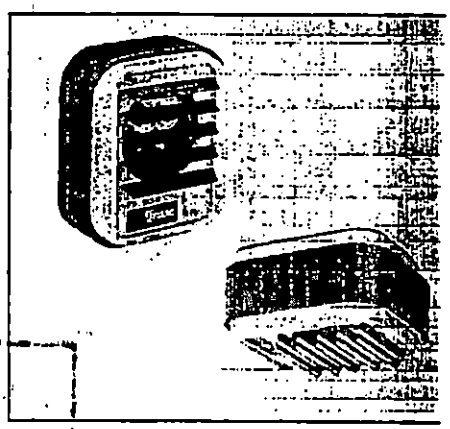
⊖ 22,000 AIC Ratings are maintained when BRH branch breakers are used. 22,000 AIC Rating maintained when BR, BD, BQC are used as branch breakers only in conjunction with a main BRH or WFPH Main Breaker.
⊖ Ground bus kits priced separately. See page 18.
⊖ Refer to page 19 for Box Style Number and Dimensions.
⊖ Raintight panels are provided with hub closer plates.
⊖ May be field converted to main breaker unit. Interior adjustability is standard.
⊖ To be discontinued.

QMARK®
A Division of Marley Electric Heating

TYPE MUH
UNIT HEATERS

[illegible] mounts either horizontally or [illegible]. Totally versatile. For factories, warehouses, garages, stores, shipping rooms, power stations, aircraft hangars. Can be used for primary, supplementary, spot, or dual-system [illegible].

- Wide range of optional control kits are field installable, increasing the MUM adaptability to the specification market.
- Totally enclosed aircraft heater with 10 power ratings; [illegible] Kw to 50 Kw heating output; 208, 240, [illegible] and 480V. 10,230 to 170,500 BTU/hr.
- 32 compatible models (no need to try to assemble a heating system from 70 or 80 models)
- Heavy gauge die-formed steel housing. Two-toned, smartly styled.
- Advanced pull-through air flow design draws air across heating element for more even air distribution and cooler element operation.
- Specially designed venturi outlet to meet that added throw as required in vertical position.
- Branch circuit fusing (when required).
- Completely enclosed fan motor.
- 1-or 3-phase wiring on 5 through 10 Kw 208/240V and 15 Kw 208V units (field inter-[illegible]).
- Aluminum-finned, copper clad steel sheath heating element has longer useful life, because of cooler sheath temperature and faster heat dissipation.
- 24V control transformer standard on most models, providing a safer and more accurate means of temperature control. 3 Kw and 5 Kw, 208-277V, have line voltage controls as standard. (24V control available on made-to-order basis.)
- Automatic reset linear thermal cut-out, capillary type, provides protection over entire length of element area. (Manual reset protection available on made-to-order basis.)
- 2-speed fan selector switch (25 to 50 Kw models).
- Fan delay feature eliminates cold drafts. Element heats up before fan cuts in, then fan continues to distribute heat after element shuts off.
- Ruggedly built, yet lighter weight for easier installation. No piping flues, valves, or traps.
- Individually adjustable discharge louvers to control air flow.
- Choice of optional diffusers for variety of air patterns, maximizing heat concentration and coverage in the vertical position.
- Meets all UL, NEC, and OSHA requireme[illegible] UL File No. E21609.



SELECTION CHART

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	10	3.0	[illegible]	[illegible]	[illegible]	[illegible]	350	800	27	208	1620	[illegible]	8	9	12	AWG 12	2
[illegible]	[illegible]	10	3.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	208/240	[illegible]	[illegible]	8	9	12	AWG 12	2
MUH03-21	277	10	3.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8	9	12	AWG 14	2
MUH03-41	480	30	3.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	800	[illegible]	480	[illegible]	[illegible]	8	9	12	AWG 14	2
MUH05-21	208	1-30	5.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12	AWG 10	2
MUH05-21	208/240	1-30	3.7/5.0	12.5/17.0	16.0/21.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12	AWG 10	2
MUH05-71	277	10	5.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12	AWG 10	2
MUH05-41	480	30	5.0	17.0	[illegible]	[illegible]	[illegible]	[illegible]	800	[illegible]	480	[illegible]	[illegible]	8	9	12	AWG 14	2
MUH-07-8	208	1-30	7.5	25.6	36.0	24	[illegible]	650	970	[illegible]	208	1600	[illegible]	9	14	18	AWG 6	3
MUH-07-2	208/240	1-30	5.6/7.5	19.1/25.6	27.0/31.3	24	[illegible]	650	970	37	208/240	1600	[illegible]	9	14	18	AWG 8	3
MUH-07-7	277	10	7.5	25.5	27.0	24	5B	650	970	37	277	1600	[illegible]	9	14	18	AWG 8	3
MUH-07-4	480	30	7.5	25.6	9.0	24	5B	650	970	37	480	1600	[illegible]	9	14	18	AWG 14	3
MUH-10-8	208	1-30	10.0	34.1	45.0	24	[illegible]	650	970	49	208	1600	[illegible]	9	14	18	AWG 4	3
MUH-10-2	208/240	1-30	7.5/10.0	25.6/34.1	36.0/42.0	24	[illegible]	650	970	49	208/240	1600	[illegible]	9	14	18	AWG 6	3
MUH-10-7	277	10	10.0	34.1	36.0	[illegible]	[illegible]	650	970	49	277	1600	[illegible]	9	14	18	AWG 6	3
MUH-10-4	480	30	10.0	34.1	12.0	24	[illegible]	650	970	[illegible]	480	[illegible]	[illegible]	9	14	18	AWG 14	3
MUH-15-8	208	1-30	15.0	51.2	72.0	24	[illegible]	910	1640	52	208	1530	[illegible]	11	20	35	AWG 2	5
MUH-15-2	208/240	30	11.2/15.0	38.2/51.2	31.3/36.1	24	[illegible]	910	1640	52	208/240	1530	[illegible]	11	20	35	AWG 6	5
MUH-15-4	480	30	15.0	51.2	18.0	24	5C	910	1640	52	480	1530	[illegible]	11	20	35	AWG 10	5
MUH-20-8	208	30	20.0	68.2	56	24	[illegible]	1320	2060	48	208	1500	[illegible]	12	23	41	AWG 4	6
MUH-20-2	208/240	30	15.0/20.0	51.2/68.2	41.2/48.0	24	[illegible]	1320	2060	48	208/240	1500	[illegible]	12	23	41	AWG 4	6
MUH-20-4	480	30	20.0	68.2	24.0	24	[illegible]	1320	2060	48	480	1500	[illegible]	12	23	41	AWG 10	6
MUH-25-2	208/240	30	18.7/25.0	63.8/85.2	52.0/60.0	24	[illegible]	2100/1600	2100/2030	38/44	208/240	1600/1375	[illegible]	13	29	50	AWG 3	9
MUH-25-4	480	30	25.0	85.2	30.0	24	[illegible]	2100/1600	2100/2030	38/44	480	1600/1375	[illegible]	13	29	50	AWG 8	9
MUH-30-8	208	30	30.0	[illegible]	[illegible]	[illegible]	[illegible]	2100/1600	2100/2030	45/53	208	1600/1375	[illegible]	12	29	50	AWG 1	9
MUH-30-2	208/240	30	22.5/30.0	76.7/102.3	63.0/72.0	[illegible]	[illegible]	2100/1600	2100/2030	45/53	208/240	1600/1375	[illegible]	12	29	50	AWG 2	[illegible]
MUH-30-4	480	30	30.0	[illegible]	36.0	[illegible]	[illegible]	2100/1600	2100/2030	45/53	480	1600/1375	[illegible]	12	29	50	AWG 6	[illegible]
MUH-40-2	208/240	30	30.0/40.0	102.3/136.4	83.4/96.4	[illegible]	[illegible]	3260/2600	3260/2900	49/49	208/240	1525/1420	[illegible]	15	29	60	AWG 1/0	1
MUH-40-4	480	30	40.0	136.4	48.0	[illegible]	[illegible]	3260/2600	3260/2900	49/49	480	1525/1420	[illegible]	15	29	60	AWG 4	1
MUH-50-8	208	30	50.0	170.5	139.0	[illegible]	[illegible]	3000/2600	3260/2900	53/61	208	1525/1420	[illegible]	15	29	60	AWG 4/0	1
MUH-50-2	208/240	30	37.5/50.0	127.5/170.5	104.2/120.4	[illegible]	[illegible]	3000/2600	3260/2900	53/61	208/240	1525/1420	[illegible]	15	29	60	AWG 3/0	1
MUH-50-4	480	30	50.0	170.5	60.0	[illegible]	[illegible]	3000/2600	3260/2900	53/61	480	1525/1420	[illegible]	15	29	60	AWG 3	1

NOTE:

1. All standard units are supplied with a low voltage control transformer and contactor (24V) except MUH-03 & 05, 208, 240, & 277 volt models. Low voltage control on these units is available on made to order. All units are also available on special order for 120 volt control; internal with transformer or external without transformer.
2. [illegible] CFM, [illegible] and RPM [illegible]
3. On dual phase units, maximum amp draw is listed for respective voltage.
4. 25 thru 50 Kw models have two speed motors and dual CFM ratings.

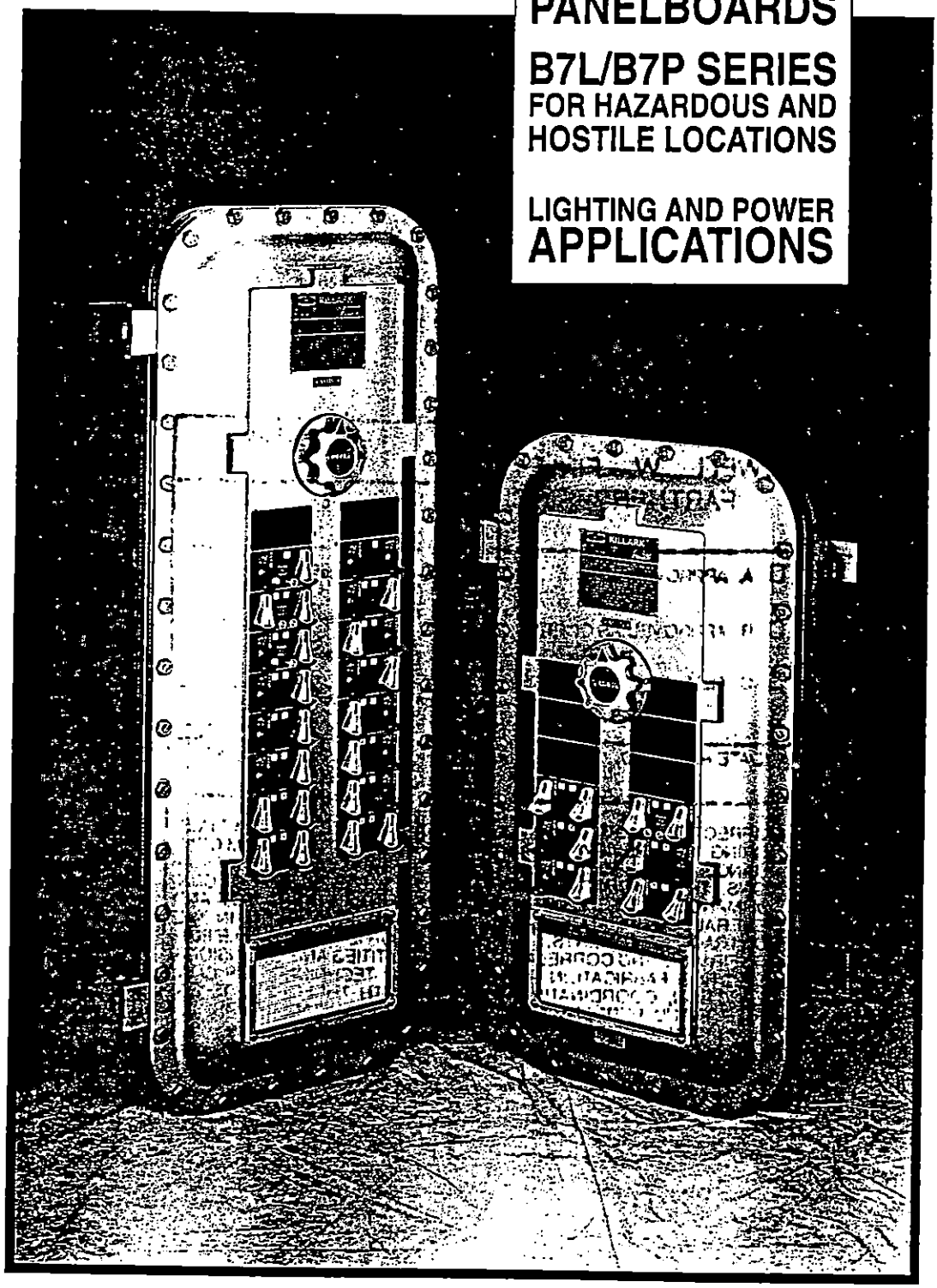
5A. Standard
5B. Optional - made to order - amp load unbalanced on 3 Phase
5C. [illegible] 3 Phase.

PRISM®

PANELBOARDS

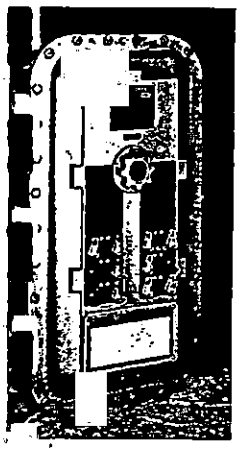
B7L/B7P SERIES
FOR HAZARDOUS AND HOSTILE LOCATIONS

LIGHTING AND POWER
APPLICATIONS



HUBBELL KILLARK

PRISM®



Circuit breaker panelboards from Killark fill a wide range of explosion-proof and weather-proof installation requirements for circuit protection and equipment control.

B7L/B7P SERIES

CLASS I, DIV 1&2 GROUPS B,C,D
CLASS II, DIV 1&2 GROUPS E,F,G
CLASS III, DIV 1&2
NEMA 3, 4, 4X, 7BCD, 9EFG
EXPLOSION-PROOF
DUST-TIGHT
WEATHERPROOF

APPLICATIONS

PRISM Panelboards are for use in:

- Hazardous locations due to the presence of flammable gasses or vapors, combustible dust, or easily ignitable fibers and flyings, and areas which are subject to corrosion, weather and dampness.
- Petroleum Refineries, Chemical and Petrochemical plants with indoor and outdoor processes.
- Applications requiring overcurrent and short circuit protection of lighting, appliances, heating and motor circuits.

PANELBOARD ORDERING INFORMATION

1 - Select basic panelboard with the following criteria in mind:
  a) Number of poles (spaces) required.
  b) Type of breaker desired.
  c) Type wiring system needed.
  d) Main Breaker is desired.
2 - Select branch breakers from page 6 based on frame, number of poles, amperage and type. Make sure breakers selected are compatible with panelboard selected.
3 - Refer to page 6 for additional options!
4 - See page 7 for detailed ordering instructions and example.

Panelboard Series	Type	Circuit Breaker Frame Type	Maximum Voltage
B7L	Lighting	Westinghouse Quicklag	240 Volt
B7P	Power	Westinghouse Series C	600 Volt

STANDARD MATERIALS

- Enclosure - Copper Free Aluminum (less than 4/10 of 1% copper).
- Main Breaker Handle - Copper Free Aluminum.
- Cover bolts - 316 Grade Stainless Steel.
- Flange Gasket "O" Ring - Buna-N Nitrile.
- Branch Breaker Operators - Valox Thermoplastic Polyester handle molded onto 316 stainless steel shaft with neoprene "O" ring.
- Hinges are Copper Free Aluminum with stainless steel pin and hardware.
- Mounting Lugs 1/4" thick 6061-T651 Aluminum.

STANDARD FINISH

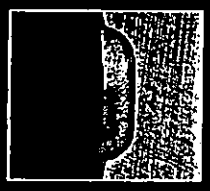
- Grey Silver Lacquer Paint.

THIRD PARTY CLASSIFICATIONS

UL Classified CSA Certified (CSA Cert. Est.9/93)

B7L/B7P SERIES QUALITY FEATURES

Take a closer look . . .

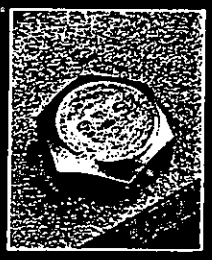


Recessed Notches in Flange

Open cover easier with prying instrument without flange damage.

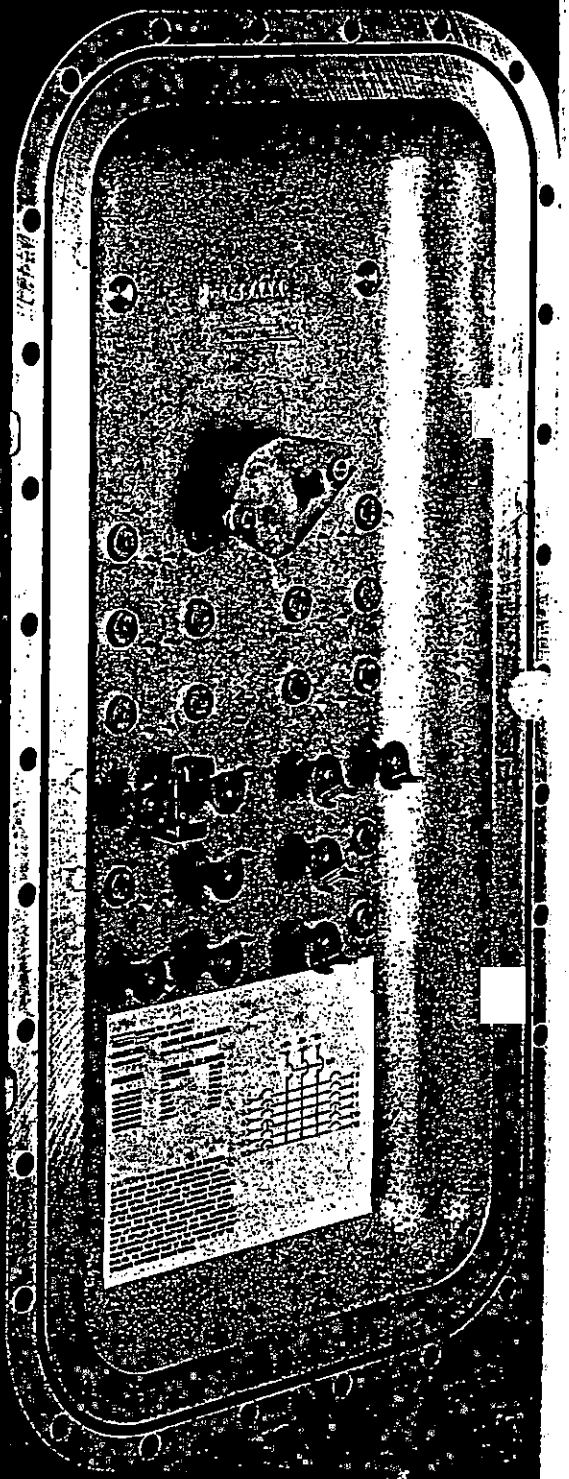
Gasketed Flange

Nitrile (Buna-N) Gasket located inside cover bolts to prevent water from seeping into enclosure.



Quick Release, Captivated Cover Bolts of 316 Grade Stainless Steel

Triple-lead bolts require only 3 1/2 turns to disengage. Stainless steel (316) for maximum protection from corrosion.

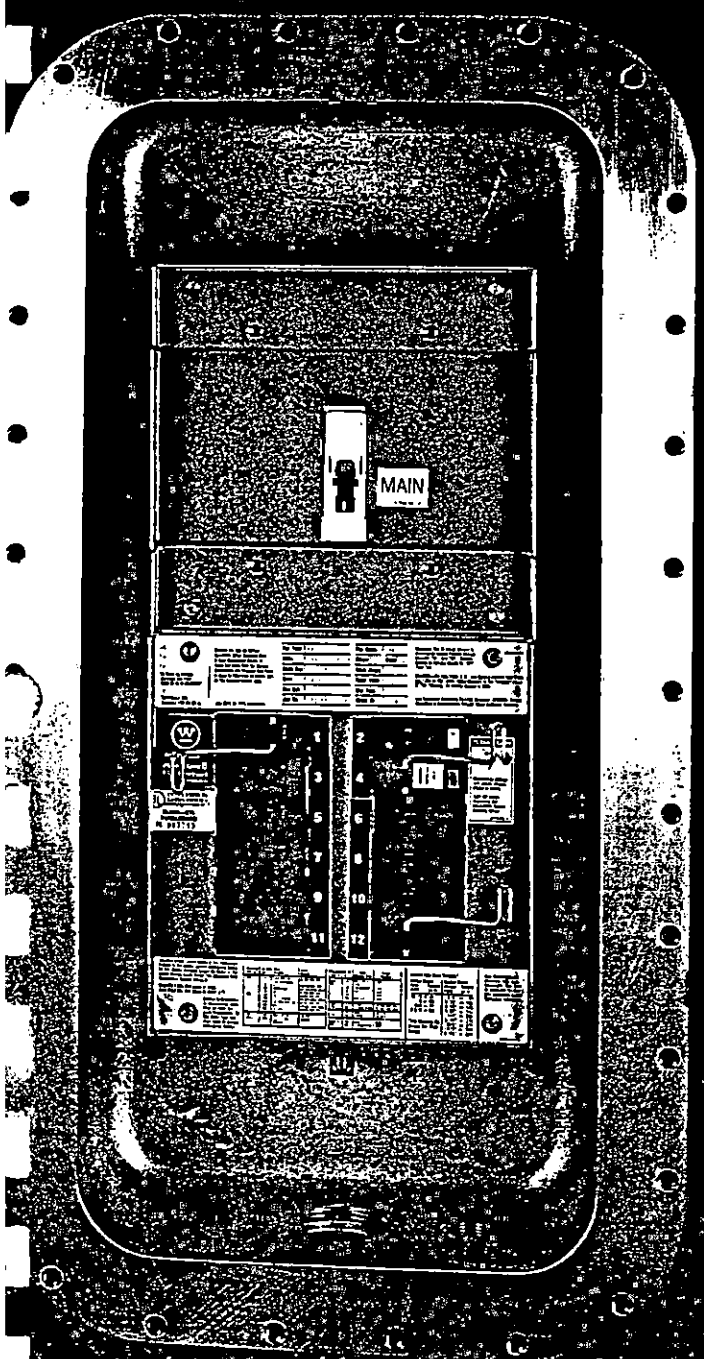


Wiring Room
To meet latest NEC wire bend requirements.

Top Feed Panel
Standard. With bottom feed optional.

UL Classified and CSA Certified
CLASS I, DIVISIONS 1&2, GROUPS B.C.D
CLASS II, DIVISIONS 1&2, GROUPS E.F.G
CLASS III, DIVISIONS 1&2

Rated For Hostile Corrosive Environments; Indoors and Outdoors
NEMA 3- Protection from falling rain.
NEMA 4-4x - Protection from hose directed water and corrosion.



Standard Electrical Components
B7L - Westinghouse Quicklag Breakers
B7P - Westinghouse Series C Breakers

Buss Bars
- *B7L - Main buss is tinplated aluminum. Copper available as option.*
- *B7P - Copper standard.*

Main Lugs
Mechanical solderless type, approved for CU or AL conductors.

Ductile Mounting Lugs
High strength yet ductile aluminum alloy.
Can adjust to irregular surface.
Slotted for easier mounting.

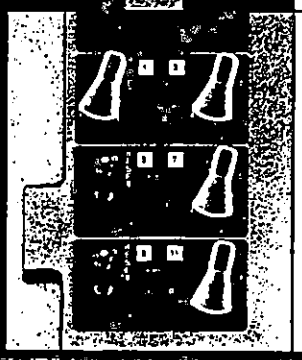
Copper-Free Aluminum Construction
High strength, light weight, corrosion resistant.

Conduit Openings Supplied Standard
Sufficient quantity and size for incoming power and branch circuits.
Optional sizes and locations available.
Suitable for field installation of drain and breather.

Solid Neutral Standard
Single phase 3 wire.
Three phase 4 wire.

Hinged Cover
Installed as standard providing an extra measure of safety and convenience.

MAIN BREAKER HANDLE
- Provisions for lock "on" or "off" positions.
- Minimum number of parts for trouble free operation.
- Spring-loaded to prevent breakage of breaker toggle.
- "O" ring on shaft.



BRANCH BREAKER HANDLE
- Provisions to lock all branch breakers in "on" or "off" positions.
- "O" ring gasket on all shafts.
- Spring-loaded so that cover can be closed regardless of breaker/handle position.
- Lifts and rotates into place.
- Identification of On-Trip-Reset-Off is positive.
- B7L lighting panel predrilled and factory plugged for maximum number of branch circuits. Permits addition of breaker handles and spaces plus changing of 1-2-3 pole breakers in field.

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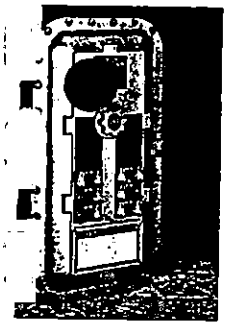
B7L SERIES LIGHTING PANELBOARDS



B7L SERIES
CLASS I, DIV 1&2 GROUPS B,C,D
CLASS II, DIV 1&2 GROUPS E,F,G
CLASS III DIV 1&2
NEMA 3, 4, 4X, 7BCD, 9EFG
EXPLOSION-PROOF
DUST-TIGHT
WEATHERPROOF

Westinghouse type BA circuit breaker 1,2 or 3 pole.

Catalog numbers on this page are for the basic panelboard enclosure only with a panel interior chassis containing main lugs or main breaker as illustrated. Internal branch breakers and external handles are NOT included in basic enclosure catalog number and must be ordered as separate items. Refer to pages 6 & 7 for part numbers of branch breakers and detailed ordering instructions.

BRANCH CIRCUIT LOADS

The interior panel chassis supplied in B7L panel is limited to a maximum of 140 amperes at any one connection point. Breakers of 50 thru 100 amps must be installed opposite breakers of smaller amperage so as not to exceed the 140 ampere limitation.

CIRCUIT BREAKER RATINGS

Type	Poles	Volts	Interrupting Capacity
BAB	1 2 3	120 120/240 240	10,000 AIC
BABSWN	1 2	120/240 120/240	10,000 AIC
QBGF	1 2	120 120/240	10,000 AIC
QBGFEP	1 2	120 120/240	10,000 AIC

BASIC PANELBOARD ENCLOSURE LESS BRANCH BREAKERS

PANEL WITHOUT MAIN BREAKER (MAIN LUGS ONLY)

Electrical Rating	Number of Branch Poles	Main Lug Rating	Basic Enclosure and Chassis Catalog Number	Enclosure Box Size	Main Wire Range
Single Phase 3 Wire with Solid Neutral 120/240 VAC	12	100	B7L20 - 112 - ML100	A	E
	18	100	B7L29 - 118 - ML100	B	G
	18	225	B7L41 - 118 - ML225	C	F
	24	100	B7L29 - 124 - ML100	B	G
	24	225	B7L41 - 124 - ML225	C	F
	30	100	B7L41 - 130 - ML100	C	G
	30	225	B7L41 - 130 - ML225	C	F
	36	225	B7L41 - 136 - ML225	C	F
	42	225	B7L50 - 142 - ML225	D	F
Three Phase 4 Wire with Solid Neutral 120/208 VAC	12	100	B7L20 - 312 - ML100	A	E
	18	100	B7L29 - 318 - ML100	B	G
	18	225	B7L41 - 318 - ML225	C	F
	24	100	B7L29 - 324 - ML100	B	G
	24	225	B7L41 - 324 - ML225	C	F
	30	100	B7L41 - 330 - ML100	C	G
	30	225	B7L41 - 330 - ML225	C	F
	36	225	B7L41 - 336 - ML225	C	F
	42	225	B7L50 - 342 - ML225	D	F

PANEL WITH MAIN BREAKER

Electrical Rating	Number of Branch Poles	Main Breaker AMP Rating	Main Breaker Frame	Basic Enclosure and Chassis Catalog Number	Enclosure Box Size	Main Wire Range
Single Phase 3 Wire with Solid Neutral 120/240 VAC	12	100	EHD	B7L29 - 112 - MBE100	B	H
	18	100	EHD	B7L41 - 118 - MBE100	C	H
	24	100	EHD	B7L41 - 124 - MBE100	C	H
	24	225	CA	B7L41 - 124 - MBC225	C	I
	30	100	EHD	B7L41 - 130 - MBE100	C	H
	30	225	CA	B7L50 - 130 - MBC225	D	I
	36	225	CA	B7L50 - 136 - MBC225	D	I
	42	225	CA	B7L50 - 142 - MBC225	D	I
Three Phase 4 Wire with Solid Neutral 120/208 VAC	12	100	EHD	B7L29 - 312 - MBE100	B	H
	18	100	EHD	B7L41 - 318 - MBE100	C	H
	24	100	EHD	B7L41 - 324 - MBE100	C	H
	24	225	CA	B7L41 - 324 - MBC225	C	I
	30	100	EHD	B7L41 - 330 - MBE100	C	H
	30	225	CA	B7L50 - 330 - MBC225	D	I
	36	225	CA	B7L50 - 336 - MBC225	D	I
	42	225	CA	B7L50 - 342 - MBC225	D	I

PANEL WITH BACK FEED MAIN BREAKER

Single Phase 3 Wire with Solid Neutral 120/240 VAC	12	100	BAB	B7L29 - 112 - MBB100	B	J
	18	100	BAB	B7L29 - 118 - MBB100	B	J
	24	100	BAB	B7L41 - 124 - MBB100	C	J
	30	100	BAB	B7L41 - 130 - MBB100	C	J
Three Phase 4 Wire with Solid Neutral 120/208 VAC	12	100	BAB	G1 B7L29 - 312 - MBB~~100~~40	B	J
	18	100	BAB	B7L29 - 318 - MBB100	B	J
	24	100	BAB	B7L41 - 324 - MBB100	C	J
	30	100	BAB	B7L41 - 330 - MBB100	C	J

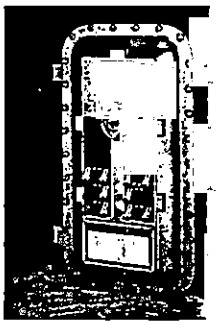
Main Breaker Panel includes main breaker and its price in basic enclosures part number.
Note: Refer to Page 6 - For branch breaker. Page 6 - For options. Page 7 - For order information. Page 8 - For dimensions and wire sizes.

B7P SERIES POWER PANELBOARDS

Westinghouse Series "C" Circuit Breakers 1-2 or 3 pole.

Catalog numbers on this page are for the basic panelboard enclosure only with a panel interior chassis containing main lugs or main breaker as illustrated. Internal branch breakers and external handles are NOT included in the basic enclosure catalog number and must be ordered as separate items. Refer to pages 6 & 7 for part numbers of branch breakers and detailed ordering instructions.

B7P SERIES
CLASS I, DIV 1&2 GROUPS B,C,D
CLASS II, DIV 1&2 GROUPS E,F,G
CLASS III, DIV 1&2
NEMA 3, 4, 4X, 7BCD, 9EFG
EXPLOSION-PROOF
DUST-TIGHT
WEATHERPROOF



CIRCUIT BREAKER RATINGS

Type	Poles	Maximum Volts AC	Maximum Volts DC	Amperes Symmetrical 240AC	277AC	480AC	500AC	125DC	250DC
EHD	1	277	125	--	14000	--	--	10000	--
	2&3	480	250	18000	--	14000	--	--	10000
FDB	2&33	250	250	18000	--	14000	14000	--	10000

PANEL WITHOUT MAIN BREAKER (MAIN LUGS ONLY)

Electrical Rating	Number of Branch Poles	Main Lug Ratings Amps	Basic Enclosure and Chassis Catalog Number	Enclosure Box Size	Main Wire Range
3 Phase 4 Wire with Solid Neutral Up to 600 VAC	6	100	B7P20 - 306 - ML100	A	K
	12	100	B7P29 - 312 - ML100	B	K
	12	225	B7P29 - 312 - ML225	B	L
	18	225	B7P41 - 318 - ML225	C	L
	21	100	B7P41 - 321 - ML100	C	K
	27	225	B7P50 - 327 - ML225	D	M

PANEL WITH MAIN BREAKER

Electrical Rating	Number of Branch Poles	Main Breaker Max Volts	Main Breaker Amps	Main Breaker Frame	Basic Enclosure and Chassis Catalog Number	Enclosure Box Size	Main Wire Range
3 Phase 4 Wire with Solid Neutral Up to 600 VAC	6	480	100	EHD	B7P29 - 306 - MBE100	B	K
	6	600	100	FDB	B7P29 - 306 - MBF100	B	K
	12	600	225	JDB	G B7P41 - 312 - MBJ~~225~~ 200	C	L
	15	480	100	EHD	B7P41 - 315 - MBE100	C	K
	15	600	100	FDB	B7P41 - 315 - MBF100	C	K
	18	600	225	JDB	B7P50 - 318 - MBJ225	D	L
	21	480	100	EHD	B7P50 - 321 - MBE100	D	N
	21	600	100	FDB	B7P50 - 321 - MBF100	D	N

PANEL WITH BACK FEED MAIN BREAKER

3 Phase 4 Wire with Solid Neutral Up to 600 VAC	9	480	100	EHD	B7P29 - 309 - MBE100	B	K
	9	600	100	FDB	B7P29 - 309 - MBF100	B	K
	18	480	100	EHD	B7P41 - 318 - MBE100	C	K
	18	600	100	FDB	B7P41 - 318 - MBF100	C	K
	24	480	100	EHD	B7P50 - 324 - MBE100	D	K
	24	600	100	FDB	B7P50 - 324 - MBF100	D	K

BASIC PANELBOARD ENCLOSURE LESS BRANCH BREAKERS

Main Breaker Panel includes main breaker and its price in basic enclosures part number.
***Note:** Refer to Page 6 - For branch breaker. Page 6 - For options. Page 7 - For order information. Page 8 - For dimensions and wire sizes.*

POWER PANEL AVAILABLE OCTOBER 1993

B7L/B7P SERIES PANELBOARDS

BRANCH CIRCUIT BREAKERS

Panel Type	Breaker Location						
(1) Single Phase	SPACE	B7BLA1000		B7BLC1000	B7BLE1000	B7BPK1000	
	15	B7BLA1015	G-1	B7BLC1015	B7BLE1015	B7BPK1015	
	20	B7BLA1020	G-1	B7BLC1020	B7BLE1020	B7BPK1020	
	30	B7BLA1030		B7BLC1030	B7BLE1030	B7BPK1030	
	40	B7BLA1040				B7BPK1040	
	50	B7BLA1050				B7BPK1050	
	60	B7BLA1060				B7BPK1060	
	70	B7BLA1070				B7BPK1070	
	90	-				B7BPK1090	
	100	B7BLA1100				B7BPK1100	
(2) Double Pole	SPACE	B7BLA2000	B7BLF2000	B7BLC2000	B7BLE2000	B7BPK2000	B7BPL2000
	15	B7BLA2015	B7BLF2015	B7BLC2015	B7BLE2015	B7BPK2015	B7BPL2015
	20	B7BLA2020	B7BLF2020	B7BLC2020	B7BLE2020	B7BPK2020	B7BPL2020
	30	B7BLA2030		B7BLC2030	B7BLE2030	B7BPK2030	B7BPL2030
	40	B7BLA2040		B7BLC2040	B7BLE2040	B7BPK2040	B7BPL2040
	50	B7BLA2050				B7BPK2050	B7BPL2050
	60	B7BLA2060				B7BPK2060	B7BPL2060
	70	B7BLA2070				B7BPK2070	B7BPL2070
	90	B7BLA2090				B7BPK2090	B7BPL2090
	100	B7BLA2100				B7BPK2100	B7BPL2100
(3) Three Pole	SPACE	B7BLB3000	B7BLF3000			B7BPK3000	B7BPL3000
	15	B7BLB3015	B7BLF3015			B7BPK3015	B7BPL3015
	20	B7BLB3020	B7BLF3020			B7BPK3020	B7BPL3020
	30	B7BLB3030				G B7BPK3030	B7BPL3030
	40	B7BLB3040				G B7BPK3040	B7BPL3040
	50	B7BLB3050				B7BPK3050	B7BPL3050
	60	B7BLB3060				B7BPK3060	B7BPL3060
	70	B7BLB3070				G B7BPK3070	B7BPL3070
	90	B7BLB3090				B7BPK3090	B7BPL3090
	100	B7BLB3100				B7BPK3100	B7BPL3100
	110						B7BPL3110
	125						B7BPL3125
	150						B7BPL3150

Notes:

1) B7L panels are factory drilled for maximum number of single pole branch breaker handles and B7P for maximum number of 3 pole branch breaker handles as standard.
2) Part numbers illustrated above include external handle, trip mechanism, locking tab and internal breaker.
   Refer to page 7 for complete ordering information and examples.
3) Space = External handle, shaft and trip mechanism installed to allow for future installation of breaker.
4) Ground Fault & Equipment protection breakers include external pushbutton for each breaker to test ground fault sensing circuit and the mechanical operation of breaker.
5) Switch Neutral Breaker note. A two pole breaker has one pole for breaking from main buss and one pole that breaks neutral. Three pole breaker consists of two poles for breaking from main buss and one pole that breaks neutral.

ACCESSORIES / OPTIONS

To be ordered as separate item with notation on order for assembly into enclosure.

Description	Catalog Number
Drain & Breather[1] NEMA 3, 7CD, 9 EFG	SU-3
Drain & Breather [1]NEMA 3, 7BCD, 9EFG (not CSA)	SU-3B
Grounding Kit 100 AMP	KIT-251 G-1
225 AMP	KIT-252 G
Special Baked Epoxy Finish	B7SF
Copper Buss and lugs for B7L series	B7CU
Eye bolts for ease of installation [2]	B7EB
Change 100 Amp Buss to 225 amp B7P series	B7ML225
Change 225 Amp Buss to 400 amp B7P series	B7ML400
Separate Grounded Neutral Terminal (24ckt)	B7GNT24
Separate Grounded Neutral Terminal (42ckt)	B7GNT42
Main lugs at bottom	B7MLBTN
Change standard conduit size and location	B7SPNPT

1. Installation of drain and breather will void the NEMA 4-4X Rating of panelboard. Drain and breather will be installed into a standard conduit opening provided in box.
2. Lifting eyebolts are installed in two conduit openings located in top of box and are to be removed after installation.

B7L/B7P SERIES PANELBOARDS

SPECIFICATION AND ORDERING INFORMATION

PANEL SELECTION FACTORS

Basic information required when specifying panelboards is as follows:

- Environment
- Service (Voltage/Frequency/Phase)
- Interrupting Capacity
- AMP Rating of Main (Lugs Only or Breaker)
- Branch Breaker (Type/Number of Poles/Amperage)

ORDERING INFORMATION

Specifying and ordering a complete panelboard assembly requires the selection of three components. (1) Basic Panel, (2) Branch Breaker and (3) Options (if required). This method of cataloging permits a wide variety and maximizes circuit flexibility in our panelboard offering. Components supplied in each of these selections include:

1) Basic Panelboard Enclosures (pages 4-5)
   - Explosion-proof enclosure consisting of box and cover.
     - Cover predrilled and plugged for maximum number of branch breaker handles. (handles not supplied)
     - Box supplied with conduit openings.
   - Main circuit breaker and external handle. (when specified)
   - Panelboard internal chassis with buss bars but less branch circuit breakers.

2) Branch Circuit Breakers (page 6).
   - Internal circuit breaker
   - External handle mechanism with internal tripping mechanism.
   - Test pushbutton for GFI (when ordered)
   - Lockout shield with on-off-trip-reset identification.

3) Options - Accessories (page 6)
   - As required

ORDERING EXAMPLE

Specification is for a 3 phase 120/208 volt panel with 100 Amp main lugs complete with (4) single pole 20 Amp, (2) double pole 20 Amp and (1) three pole 30 Amp branch breakers with a separate grounded neutral terminal.

Branch Breaker Total =	(4)	1Pole	=	4 Poles Total
	(2)	2Pole	=	4 Poles Total
	(1)	3Pole	=	3 Poles Total
				Total 11 Branch Poles

Specification / Ordering Example

B7L20 - 312 - ML100	(Basic panelboard enclosure)
with:	
(4) B7BLA1020	(1 Pole 20 Amp Branch)
(2) B7BLA2020	(2 Pole 20 Amp Branch)
(1) B7BLB3030	(3 Pole 30 Amp Branch)
(1) B7GNT24	(Separate Grounded Neutral Terminal)

CATALOG LOGIC

Panelboard catalog number logic for basic enclosure.

B7 L 20 - 1 12 - ML 100

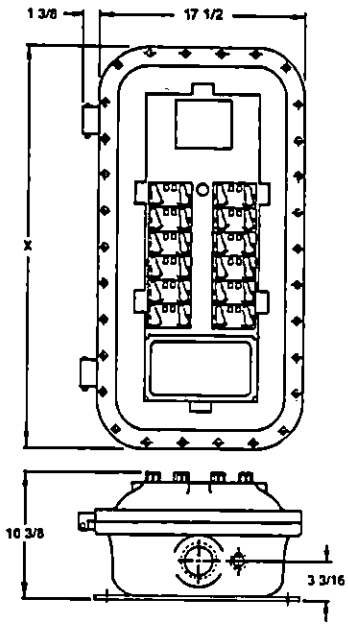
- 100 — Mains Amp Rating
- ML — Mains: ML = Main Lugs Only; MBB, MBC, MBE, MBF, MBJ — Main Breaker: BAB, CA, EHD, FDB, JD
- 12 — # Of Branch Poles
- 1 — 1 = Single Phase, 3 = Three Phase
- 20 — Nominal Inside Length of Box: 20 - 29 - 41 - 50
- L — L = Lighting, P = Power
- B7 — Constant For PRISM Series Enclosures

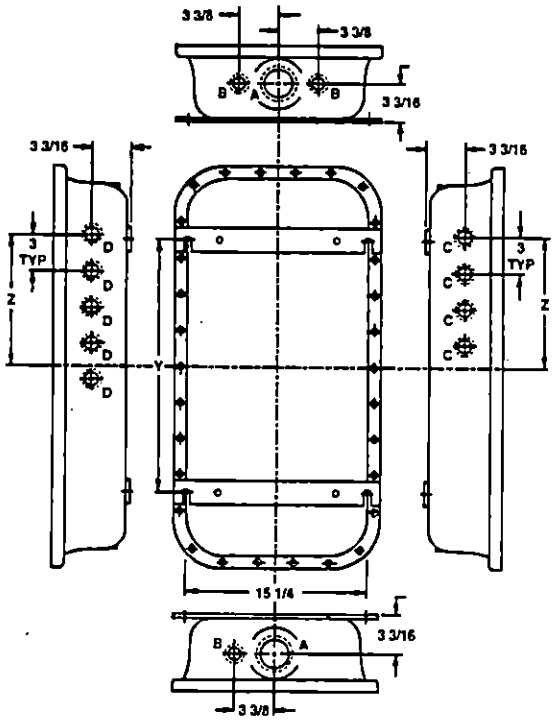
PRISM®

B7L/B7P SERIES PANELBOARDS

DIMENSIONAL DATA

Enclosure Size				Conduit Size			Conduit Quantity			
Size	Box Number									
A	MXB - 13207	24 3/8	13	2	1	6 7/8	2	3	3	4
B	MXB - 13297	33 3/8	21	2 1/2	1	10 7/8	2	3	4	5
C	MXB - 13417	45 3/8	33	3	1	16 7/8	2	3	5	6
D	MXB - 13507	54 3/8	42	3	1	21 3/8	2	3	6	7



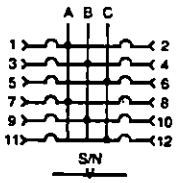


WIRE INFORMATION

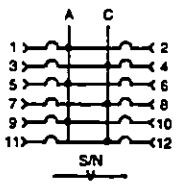
E	F	G	H	I	J	K	L	M	N
#12 - #1	#6 - 250MCM	#12 - 1/0	#14 - 1/0	2/0 - 250MCM	#14 - #1	#6 - 2/0	#6 - 4/0	#2 - 4/0	#2 - 2/0

WIRING DIAGRAMS

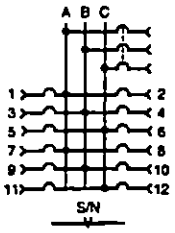
Main Lug Only
Three Phase 4-Wire
Solid Nuetral
120/208 VAC



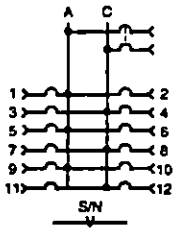
Main Lug Only
Single Phase 3-Wire
Solid Nuetral
120/240 VAC



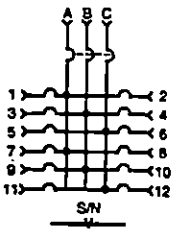
Chassis Mounted
Main Breaker
Three Phase 4-Wire
Solid Neutral
120/208 VAC



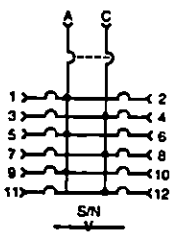
Chassis Mounted
Main Breaker
Single Phase 3-Wire
Solid Neutral
120/240 VAC



Vertical
Main Breaker
Three Phase 4-Wire
Solid Neutral
120/208 VAC



Vertical
Main Breaker
Single Phase 3-Wire
Solid Neutral
120/240 VAC



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Telephone (314) 531-0460 • FAX: (314) 531-7164
Hubbell Canada Inc. • 870 Brock Road South • Pickering, Ontario L1W 1Z8
Telephone (416) 839-1138 • FAX: (416) 839-9108

Zenith Product Bulletin

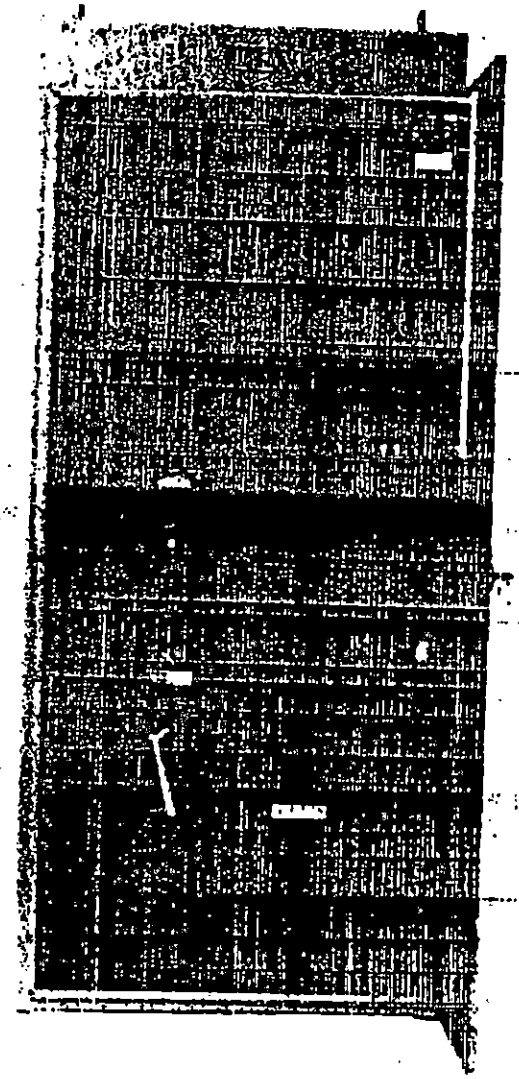
A Product Bulletin Dedicated to Informing the Electrical Community

TB-17
Revision
December, 1992

Some emergency power installations require multiple automatic transfer switches, each feeding a specific load. In many such installations, where non-critical loads are being served, specifications may call for manual or non-automatic transfer switches that are manually operated because operating personnel are present and the loads are not of a critical nature requiring unattended automatic operation

Because of the less critical function of these non-automatic transfer switches there have been no specific requirements set forth and, as a result, devices such as double throw disconnect switches have been used. Since the non-automatic transfer switches are part of the emergency power supply system they should have the same electrical ratings as the automatic transfer switches feeding the more critical loads. In the event of a short circuit the non-automatic transfer switches must have the same withstand current ratings as the automatic transfer switches and they must be as rugged and dependable.

To meet this need, Zenith has developed the ZTSM series electrically operated, mechanically held non-automatic transfer switches. These units feature the same rugged construction as the ZTS series of automatic transfer switches and are supplied with the same electrical ratings and mechanical features. The ZTSM series is electrically operated by means of push buttons or double throw switches mounted on the switch enclosure or at a remote location. Unlike the disconnect switches mentioned above, the ZTSM series offers additional protection by incorporating normal and alternate source voltage sensing relays that will not permit the switch to be manually transferred unless the source to which it is being transferred is at 90% of its rated voltage. In addition, the ZTSM series is tested and listed per UL-1008 standards. Double throw disconnect switches are not.



ZTSM160F 1600 AMP 4 Pole Non-Automatic Transfer Switch

ZTSM Series Non-Automatic Transfer Switch Features:

- U.L. & C.S.A. Listed
- Amperage sizes, 40, 80, 100, 150, 225, 260, 400, 600, 800, 1000, 1200, 1600, 2000, 3000
- Poles: 2, 3, or 4
- Available for operation on all standard voltage systems
- Withstand Current Ratings: Same as ZTS series automatic transfer switches
- Available in standard and delayed transition versions
- Bypass/Isolation units (ZBTS Series) also available

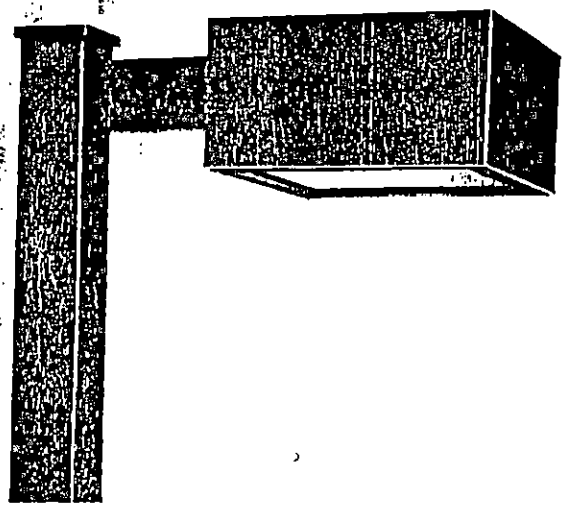
Luxmaster Classic 400

Side Mount

High Pressure Sodium
200 to 400 Watts

Metal Halide
~~250 &~~ 400 Watts

SERIES LM



FEATURES

- One piece formed aluminum housing with clean precision formed edges
- Hydroformed captive and tethered optical assembly
- Easily installed Power-Pad® assembly
- Dacron polyester gasketing around optical assembly to provide a barrier to contaminates
- Durable baked-on acrylic enamel finish
- Ideal for applications:
  - Parking lots
  - Apartment and condominium complexes
  - Single-store shopping centers
  - Malls

Ordering Data

High Pressure Sodium

Primary Volts	Ballast Type	Power Factor	Power Pad	Lamp Housing
LUXMASTER CLASSIC 200 WATT HIGH PRESSURE SODIUM				
120/208 240/277*	Regulated	High	LMS20AM1	LMSXXXXX3MFSX
120	Regulated	High	LMS20A12	LMSXXXXX3MFSX
208	Regulated	High	LMS20A20	LMSXXXXX3MFSX
240	Regulated	High	LMS20A24	LMSXXXXX3MFSX
277	Regulated	High	LMS20A27	LMSXXXXX3MFSX
480	Regulated	High	LMS20A48	LMSXXXXX3MFSX
LUXMASTER CLASSIC 250 WATT HIGH PRESSURE SODIUM				
120/208 240/277*	Regulated	High	LMS25AM1	LMSXXXXX3MFSX
120	Regulated	High	LMS25A12	LMSXXXXX3MFSX
208	Regulated	High	LMS25A20	LMSXXXXX3MFSX
240	Regulated	High	LMS25A24	LMSXXXXX3MFSX
277	Regulated	High	LMS25A27	LMSXXXXX3MFSX
480	Regulated	High	LMS25A48	LMSXXXXX3MFSX
LUXMASTER CLASSIC 400 WATT HIGH PRESSURE SODIUM				
120/208 240/277*	Regulated	High	LMS40AM1	LMSXXXXX3MFSX
120	Regulated	High	LMS40A12	LMSXXXXX3MFSX
208	Regulated	High	LMS40A20	LMSXXXXX3MFSX
240	Regulated	High	LMS40A24	LMSXXXXX3MFSX
277	Regulated	High	LMS40A27	LMSXXXXX3MFSX
480	Regulated	High	LMS40A48	LMSXXXXX3MFSX

*MULTI-VOLT LUMINAIRES: All multi-volt luminaires are pre-wired for 120 volt operation, but are easily field-reconnectable for 208, 240, or 277 volt operation.

NOTES

1. **STANDARD DISTRIBUTION IS TYPE 3.** For **IES TYPE 5 DISTRIBUTION** change the 3 in the lamp housing catalog number to 5. (Example: LMSXXXXX3MFSX to LMSXXXXX5MFSX.)
2. **STANDARD FINISH** is dard bronze. Other colors available, contact factory if required.
4. **LAMPS** are not included, order separately.
5. **50 HERTZ BALLAST** is available for all luminaires. Contact factory fo information.
6. For more information, contact your local American Electric representative.

Metal Halide

Primary Volts	Ballast Type	Power Factor	Power Pad	Lamp Housing
LUXMASTER CLASSIC 250 WATT METAL HALIDE				
120/208 240/277*	Regulated	High	LMH25AM1	LMHXXXXX3MFSX
120	Regulated	High	LMH25A12	LMHXXXXX3MFSX
208	Regulated	High	LMH25A20	LMHXXXXX3MFSX
240	Regulated	High	LMH25A24	LMHXXXXX3MFSX
277	Regulated	High	LMH25A27	LMHXXXXX3MFSX
480	Regulated	High	LMH25A48	LMHXXXXX3MFSX
LUXMASTER CLASSIC 400 WATT METAL HALIDE				
120/208 240/277*	Regulated	High	LMH40AM1	LMHXXXXX3MFSX
120	Regulated	High	LMH40A12	LMHXXXXX3MFSX
208	Regulated	High	LMH40A20	LMHXXXXX3MFSX
240	Regulated	High	LMH40A24	LMHXXXXX3MFSX
277	Regulated	High	LMH40A27	LMHXXXXX3MFSX
480	Regulated	High	LMH40A48	LMHXXXXX3MFSX

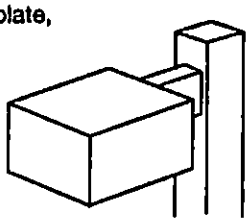
***MULTI-VOLT LUMINAIRES: All multi-volt luminaires are pre-wired for 120 volt operation, but are easily field-reconnectable for 208, 240, or 277 volt operation.**

NOTES

1. **STANDARD DISTRIBUTION IS TYPE 3. For IES TYPE 5 DISTRIBUTION-** change the 3 in the lamp housing catalog number to 5. (Example: LMHXXXXX3MFSX to LMHXXXXX5MFSX.)
2. **STANDARD FINISH** is dark bronze. Other colors available, contact factory if required.
3. **LAMPS** are not included, order separately.
4. **50 HERTZ BALLAST** is available for all luminaires. Contact factory for information.
5. For more information, contact your local American Electric representative.

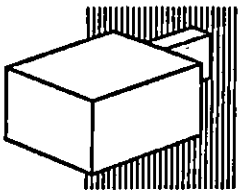
Options / Accessories

Pole mount, secured with solid steel plate, attaches luminaire directly to round or square pole. Full length mounting screws secure luminaire, arm and pole.



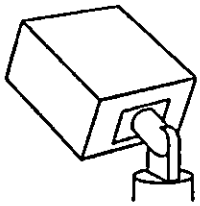
Catalog Number **-LMPX**

Wall mount arm secures luminaire to wall plate with full length mount screws. Full length mounting screws secure luminaire to arm and wall plate.



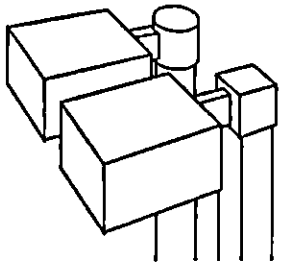
Catalog Number **-LMWX**

Adjustable knuckle for pole attachment of luminaire. Makes a smooth transition from pole to luminaire.



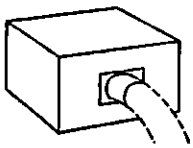
Catalog Number **-LMKX**

Square/round tenon adaptor mounts on top of round or square pole for luminaire attachment. Makes a smooth transition from pole to luminaire. Available mounting arrangements listed below.



Catalog Number	Description
LMTX	Square Tenon with 1 Arm
LM1X	Square Tenon with 2 Arms at 90°
LM2X	Square Tenon with 2 Arms at 180°
LM3X	Square Tenon with 3 Arms
LM4X	Square Tenon with 4 Arms
LM5X	Round Tenon with 1 Arm
LM6X	Round Tenon with 2 Arms at 90°
LM7X	Round Tenon with 2 Arms at 180°
LM8X	Round Tenon with 3 Arms at 90°
LM9X	Round Tenon with 3 Arms at 120°
LM0X	Round Tenon with 4 Arms at 90°

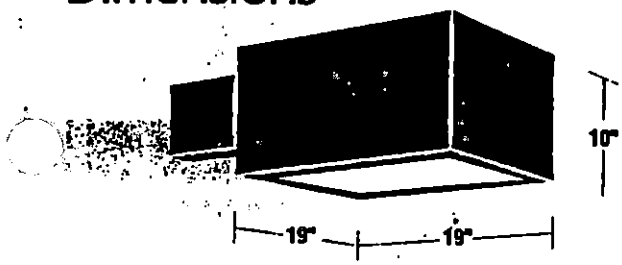
Mast arm mount—Luminaire is attached to curved mast arm for mounting to pole or structure.



Catalog Number **-LMMX**

Field installed **photoelectric control** available, contact factory for more information.

Dimensions



Effective projected area is 2.3 sq. ft.

Photometric Test Reports

Lens Type	Lamp Watts and Type	Socket Position	NEMA Type	Report Number
LUXMASTER CLASSIC SERIES LM				
Glass	200W–400W HPS	Fixed	V-M-C	AE40001
Glass	250W MH	Fixed	V-M-C	AE41121
Glass	400W MH	Fixed	V-M-C	AE41091
Glass	200W–400W HPS	A-2	III-M-C	AE41501
Glass	250W MH	Fixed	III-M-C	AE41511
Glass	400W MH	Fixed	III-M-C	AE41491

Complete photometric reports are available for all products. Consult your local American Electric representative.

SQUARE STRAIGHT STEEL POLES

For use with floodlight luminaires such as MINILITER®, MAGNULITER®, SPORTSLITER®, as well as Magnu-Series architectural luminaires.

STEEL SSP SERIES

Square Straight Shaft — One-piece construction, steel tubing.

Pole Top — All poles available with 2⅜" O.D. tenons or machined to accept side mounted Magnu-Series luminaires.

Handhole — Group I and II poles only have 3" x 4" reinforced frame. Group III poles have 4" x 6" frame. Both include cover. Ground lug standard.

Base — Steel plate type base with two-piece base cover.

Anchor Bolts — Four "L" shaped bolts per set with two nuts and two washers each. Bolt template included.

Standard Finish — Rust preventive primer.

ORDERING INFORMATION

Catalog Number (1)	Pole Height		Wind Load Rating (2)						Pole Size	Base Square	Anchor Bolt Size (3)	Bolt Circle (3)	Bolt Projection (3)	Pole Weight	
			80 MPH		100 MPH		120 MPH								
	Ft.	M	EPA	Wt.	EPA	Wt.	EPA	Wt.						lbs.	kgs.
GROUP I															
SSP-410X-XX	10	3.0	21.7	540	13.3	330	9.3	200	4.0"	9.0"	¾"x30"x3"	8.0"	3.87"	88	39.9
SSP-412X-XX	12	3.7	17.7	440	10.7	265	7.0	160	4.0"	9.0"	¾"x30"x3"	8.0"	3.87"	98	44.5
SSP-414X-XX	14	4.3	14.6	365	8.6	215	5.2	130	4.0"	9.0"	¾"x30"x3"	8.0"	3.87"	110	49.9
SSP-416X-XX	16	4.9	12.2	305	7.0	175	3.7	100	4.0"	9.0"	¾"x30"x3"	8.0"	3.87"	122	55.3
SSP-418X-XX	18	5.5	10.3	255	5.6	135	2.5	75	4.0"	9.0"	¾"x30"x3"	8.0"	3.87"	135	61.2
SSP-420X-XX	20	6.1	8.7	215	4.5	105	—	—	4.0"	9.0"	¾"x30"x3"	8.0"	3.87"	147	66.7
SSP-425X-XX	25	7.6	6.0	150	3.2	81	—	—	4.0"	9.0"	¾"x30"x3"	8.0"	3.87"	178	80.1
SSP-430X-XX	30	9.1	7.4	175	2.5	100	—	—	4.0"	11.0"	1"x36"x4"	10-12"	4.12"	381	171.4
GROUP II															
SSP-518X-XX	18	5.5	28.3	705	16.9	420	10.4	250	5.0"	11.0"	¾"x30"x3"	11.0"	3.87"	239	108.4
SSP-520X-XX	20	6.1	24.8	620	14.5	360	8.4	210	5.0"	11.0"	¾"x30"x3"	11.0"	3.87"	263	119.3
SSP-525X-XX	25	7.6	19.2	480	10.7	265	4.2	145	5.0"	11.0"	¾"x30"x3"	11.0"	3.87"	322	146.1
SSP-530X-XX	30	9.1	6.0	150	4.0	150	—	—	5.0"	11.0"	¾"x30"x3"	11.0"	3.87"	381	171.4
GROUP III															
SSP-630X-XX	30	9.1	21.0	525	11.1	285	3.7	155	6.0"	13.0"	1"x36"x4"	12.0"	4.12"	458	207.7
SSP-635X-XX	35	10.7	15.8	395	7.3	180	—	—	6.0"	13.0"	1"x36"x4"	12.0"	4.12"	530	240.4
SSP-640X-XX	40	12.2	12.4	310	4.9	120	—	—	6.0"	13.0"	1"x36"x4"	12.0"	4.12"	602	273.1

(1) Catalog Number, as listed, does not include tenons or machining for side mounting. Desired fixture mounting must be specified by substituting for all X's in Catalog Number.

(2) Maximum allowable EPA is based on steady winds of 80 and 100 MPH with gusts to 104 and 130 MPH respectively, 120 MPH steady winds with 156 MPH gusts. All calculations are based on a minimum yield of 46,000 PSI.

(3) Factory supplied template must be used when setting anchor bolts. Hubbell Lighting will deny any claim for incorrect anchorage placement resulting from failure to use factory supplied template.

OPTIONS

Illustrations and complete descriptions can be found on page 34.

Description	Suffix
Weatherproof receptacle	M18
LEKTROCOTE® finish	M50 thru M53
Hubbell Seal (internal coating)	M55

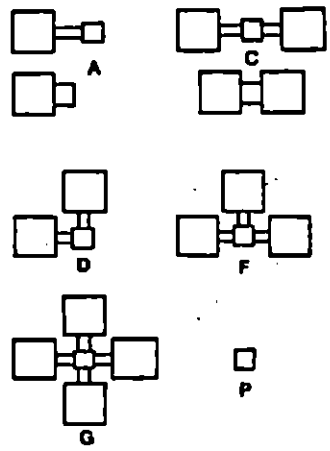
CATALOG LOGIC

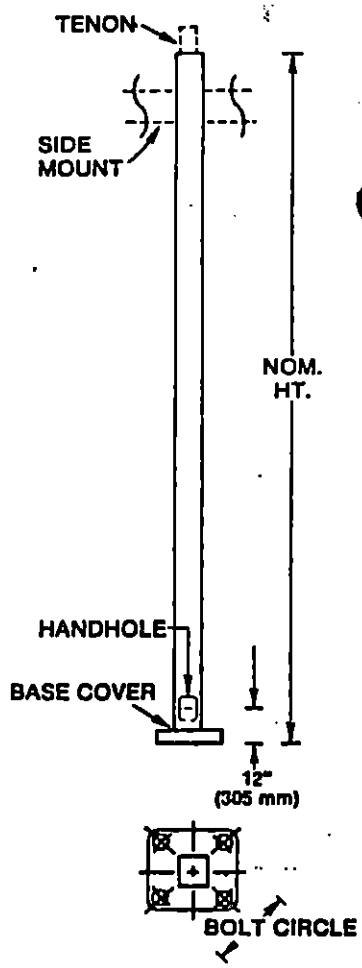
S S P — 4 10 X — X X — M X X

- **Pole Cross Section**: S - Square
- **Pole Material**: S - Steel
- **Base Type**: P - Steel Plate
- **Shaft Size**: Square Style 4 - 4.0" to 4.9", 5 - 5.0" to 5.9", 6 - 6.0" to 6.9"
- **Nominal Pole Height** (See Ordering Information)
- **Top Type**: 1 - 2⅜" O.D. Tenon, 6 - Side Mount
- **Options** (See Above)
- **Fixture Arm Size (Holes)**: 0 - None, Tenon only; 1 - LUMASQUARE® II; 2 - Magnu Series
- **Mounting Arrangement For Side - Mount Magnu-Series***: A - One fixture; C - Two fixtures at 180°; D - Two fixtures at 90°**; F - Three fixtures at 90°**; G - Four fixtures at 90°**; P - Tenons only

*Verify loading requirement based on allowed EPA.
**For proper mounting clearance use MAA-10 arm.

MOUNTING ARRANGEMENTS

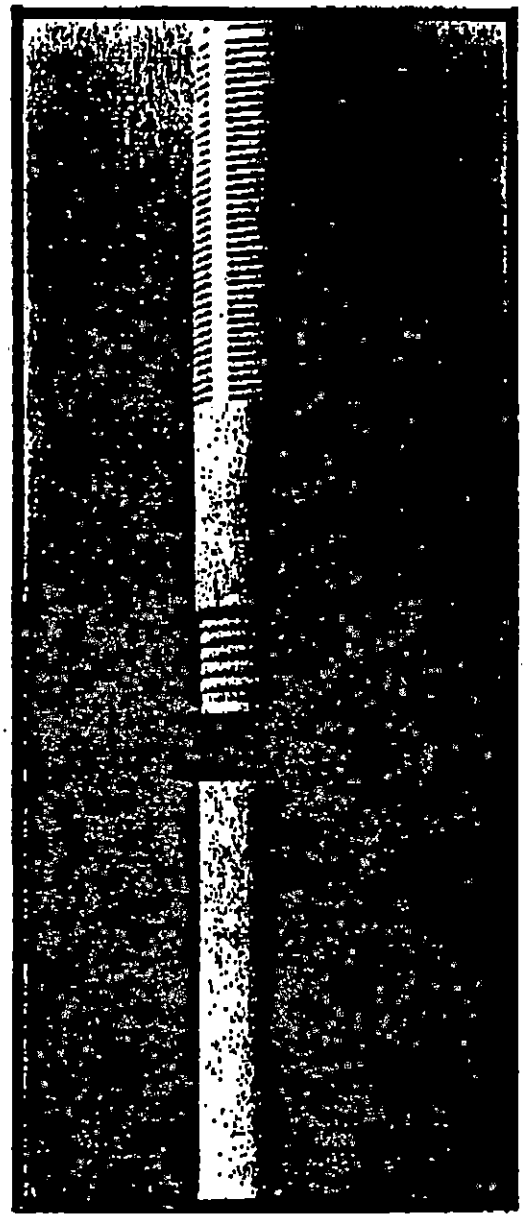




HUBBELL® Lighting Division

Monitoring wells

MONITORING SCREENS AND CASINGS



FLUSH THREADED POLYVINYL CHLORIDE SCREENS AND CASINGS

PVC Flush Threaded Joints eliminates contamination caused by solvent.

All PVC Products are manufactured without ink to prevent unwarranted contaminated readings.

SIZES AVAILABLE

Pipe Dim:
1/2" O.D. thru 12" O.D.
Screen Lengths:
2.5', 5', 10', 20'
Casing Lengths:
2.5', 5', 10', 20'
Slot Sizes:
.006 and up

ACCESSORIES AVAILABLE

Flush Threaded Points and Plugs and Caps.
Locking Caps.
TEFLON®, Viton, or Neoprene. "O" Rings.

MORRIS Industries, Inc.

Pompton Plains, NJ (201) 835-6600 (800) 835-0777 Fax #: (201) 835-7414 • Machanicville, NY (518) 664-7776 (800) 835-6591 Fax #: (518) 664-2006 • Durham, Conn. (203) 349-1777 (800) 232-2777 Fax #: (203) 349-9363 • Dillsburg, Penn. (717) 432-9651 (800) 857-7724 Fax #: (717) 432-1150

MONOFLEX

POINTS, PLUGS AND CAPS

SLIP AND FLUSH JOINT ACCESSORIES

PVC Plugs and Points fit I.D. of Pipe.

PVC Fittings are riveted into threaded ends.

SIZES AVAILABLE

½" thru 12" I.D. or O.D.

MORRIS Industries, Inc.

Pompton Plains, NJ
(201) 835-6500
(800) 835-0777
Fax #: (201) 835-7414

Mechanicville, NY
(518) 664-7776
(800) 835-6591
Fax #: (518) 664-2006

Durham, Conn.
(203) 349-1777
(800) 232-2777
Fax #: (203) 349-9363

Dillsburg, Penn.
(717) 432-9681
(800) 637-7724
Fax #: (717) 432-1150

PELTONITE® BENTONITE PELLETS

SEALING AGENT

DESCRIPTION:

PELTONITE is a sealing agent manufactured by ROCTEST offering great possibilities in the treatment of water problems in civil engineering works.

PELTONITE is the commercial name given to pre-formed bentonite balls, the bentonite used being of the high sodium mineral type.

APPLICATIONS:

PELTONITE can certainly find a wide range of applications and its usage is only limited by the ingenuity of those involved with water problems.

Typical applications are:

— sealing of all types of piezometer holes.

— sealing of large size dewatering wells and of wellpoints.

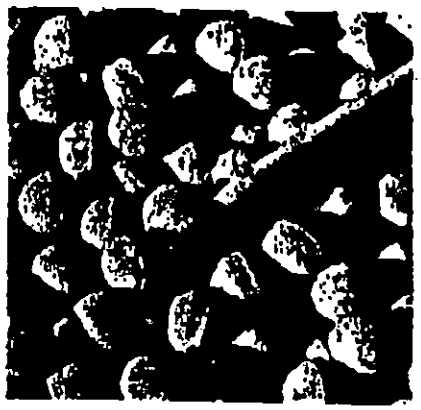
— sealing the bottom of open end caissons.

— sealing of detrimental infiltration through rock discontinuities.

WHY SHOULD YOU USE PELTONITE?

PELTONITE has many advantages:

- scientific proof has been made of the high quality seals obtained with bentonite pellets and this without the need of any special tamping tool.
- the probability of obtaining a satisfactory seal over the old method of using hand-rolled bentonite balls is highly increased.
- the bentonite balls are of uniform size and shape.
- their small size, spherical shape and high density improve their settling characteristics in water.
- jamming problems as they settle are almost eliminated.
- they are easy to handle.
- they considerably cut down the time usually needed to perform a good quality seal and consequently, reduce equipment and labor costs involved in an installation.
- they come in conveniently packed rigid 50 lb. drums which are re-sealable, thus minimizing waste.
- storage of **PELTONITE** is independant of temperature conditions.



PELTONITE balls are small spheres ⅜" in diameter.

Useful information:

The following table gives the weight of PELTONITE needed to perform a 1 foot seal for different borehole diameters.

HOLE DIA. (in)	2	3	4	5	6	7	8
WEIGHT OF PELTONITE (lb)	3	4	7	11	15	20	27

Specifications:

SIZE:	⅜" dia. (10 mm.)
DENSITY:	1.8
DRY BULK DENSITY:	75 lb/ft³ (1260 kg/m³)
SWELL FACTOR:	greater than 10 when unconfined and fully saturated.
STANDARD PACKAGE:	50 lb (22.7 kg) per barrel

MORRIS Industries, Inc.

Pompton Plains, NJ
(201) 835-6500
(800) 835-0777
Fax #: (201) 835-7414

Mechanicville, NY
(518) 664-7775
(800) 835-8591
Fax #: (518) 664-2006

Durham, Conn.
(203) 349-1777
(800) 282-2777
Fax #: (203) 349-9363

Dillsburg, Penn.
(717) 432-9651
(800) 637-7724
Fax #: (717) 432-1150

MORIE SCREENINGS

Typical Physical Analysis

#1 Well Gravel

Inches	MM.	Sieve No.	Cum. Grams	% Ret.	% Pass.
.0661	1.700	12	0.8	0.8	99.2
.0555	1.410	14	14.2	13.4	85.8
.0469	1.190	16	45.3	31.1	54.7
.0394	1.000	18	74.6	29.3	25.4
.0331	.850	20	95.3	20.7	4.7
.0278	.710	25	98.4	3.1	1.6
.0234	.600	30	99.3	0.9	0.7
.0197	.500	35	99.7	0.4	0.3
.0165	.425	40	99.9	0.2	0.1

Typical Chemical Analysis

SiO_2	99.390
Fe_2O_3	.240
Al_2O_3	.190
TiO_2	.120
CaO	.010
MgO	.004
L.O.I.	.046

Acid solubility (1:1 HCL) .08 to .11%
Sp. Gr. - 2.64 to 2.66

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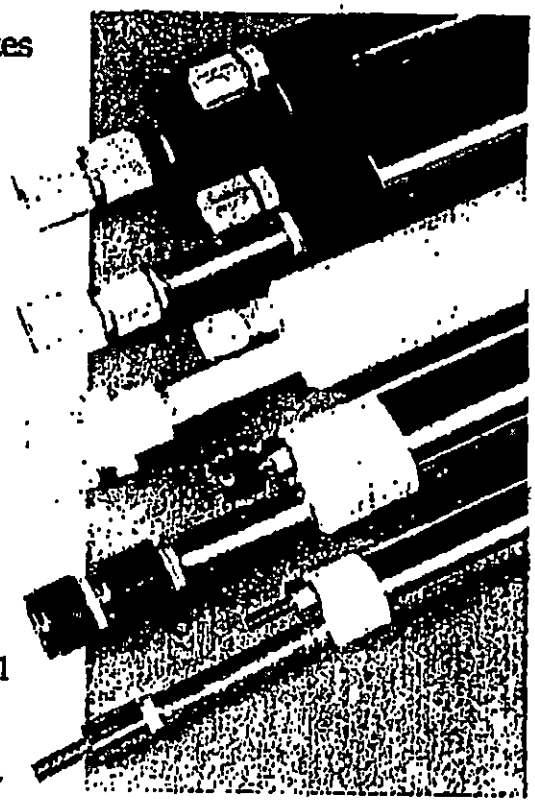
GROUNDWATER SAMPLING EQUIPMENT

Pneumatic Bladder Sampling Pumps

Well Wizard pumps come in an unmatched range of sizes and materials—plus a 10-year warranty.



THE BEST PUMPS FOR YOUR PROJECT-GUARANTEED!

No matter how demanding your application, we've got the pump. Need samples from over 600 feet? Testing in the ppb range? What about other tough sample collection problems—aggressive/corrosive environments, non-standard well casings, difficult site conditions? No matter what the challenge, QED makes a pump that will do the job better.

So much better, we guarantee it. Dedicated Well Wizard bladder pumps with protective intake screens are guaranteed for ten years against pump failure. They'll keep on working or QED will repair or replace them free. Nobody else in the business offers this level of protection.

PURGE AND SAMPLE WITH THE SAME PUMP

In many situations, a Well Wizard bladder pump can be used for both purging and sampling. For low purge volumes, a standard model (1100, 1200, or 1300-series) may be the choice. Model T1200 is most commonly used. For greater volumes, a high-rate 1500-series Power Pump will cut purging times (and labor costs) by approximately 50%.

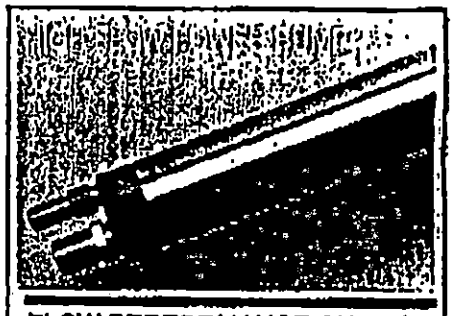
The advantages are obvious. A single-pump system is simple to specify and install; extremely economical; and delivers unmatched bladder-pump sample quality. Large purge volumes may require the use of an accessory, such as a Purge Mizer™ inflatable packer or a purge pump; see pp. 18-19 for details.

SPECIFICATIONS:

MODEL NO.	BODY MATERIAL	BLADDER MATERIAL	INTAKE SCREEN	FITTING MATERIAL*	MAXIMUM LIFT (ft.)	LENGTH (Dimension in inches)	DIA	WEIGHT (lbs)
T1100	Teflon	Teflon	Opt	Teflon	250	40.33	1.66	4
P1101	PVC	Teflon	†	Polypro	300	40.85	1.66	3
P1101S	PVC	Teflon	Std	Polypro	300	40.85	1.66	3
P1101H	PVC	Teflon	Opt	316 S.S.	600	40.75	1.66	3
ST1101P	316 S.S.	Teflon	Std	316 S.S.	1000	40.50	1.66	10
T1200	Teflon/316 S.S.	Teflon	Opt	316 S.S.	300	41.14	1.50	5
P1201	PVC/316 S.S.	Teflon	~~Opt~~	Polypro	300	41.23	1.50	4
P1201H	PVC/316 S.S.	Teflon	Opt	316 S.S.	600	41.37	1.50	4
T1300	Teflon/316 S.S.	Teflon	Opt	316 S.S.	200	46.75	1.00	3
Power Pumps								
P1500	PVC/316 S.S.	Teflon	Opt	316 S.S.	200	93.00	1.50	9
T1500	Teflon/316 S.S.	Teflon	Opt	316 S.S.	200	93.00	1.50	9

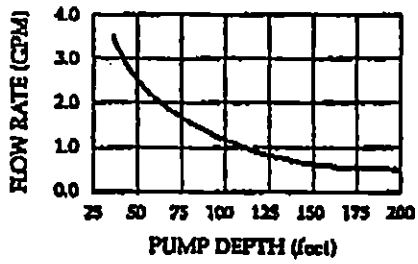
* T1300 requires Clamp Tool No. 35168 for field attachment of tubing. Clamps are provided w/ pump.

† This model cannot be retrofitted with screen. If screen is desired, order P1101S.



FLOW PERFORMANCE CURVE:

1500 Series Pumps



Note: Flow rates are based on pump submergence of 25 feet and operating gas pressure of 100 psi from 3111HR Air Source/Controller. Call for flow rates under other conditions.

TO BUILD THE BEST, START WITH THE BEST MATERIALS

Bladder pump design allows construction of the highest quality materials, with consistent usage throughout the pump. All parts and fittings that contact the sample are matched for compatibility and better performance. You will achieve accurate sampling with the greatest cost-efficiency by choosing the proper pump material.

Teflon®/PTFE

For maximum sample accuracy at low contaminant levels, and longest pump life in harsh chemical environments, QED uses only the finest duPont Teflon® and other PTFE resins available.

Stainless Steel

All stainless steel is not the same. Electropolishing stainless steel has been proven to give the most inert finish for preserving water quality, with lower porosity to help it resist corrosion. That's what we use in all QED stainless parts, rather than interior alloys with little or no protective finish. (Stainless steel pumps are not recommended for low metal sampling levels, high acid, high dissolved solids, or reducing conditions.)

PVC

Polyvinyl chloride is an economical alternative when monitoring doesn't require stainless steel. We use only NSF-grade PVC, extruded specifically for QED with no markings or lubricants to contaminate the sample.

CERTIFIED CLEAN

Lab-Certified Cleaning

All Well Wizard pumps pass through a rigorous cleaning procedure, and are laboratory-certified to be free of all EPA 601, 602, base neutral, and acid extractable contaminants.

Production parts are batch-treated in laboratory cleaning solution at 130°F and are rinsed with 130°F tap water. Parts are then washed with purified water (filtered, treated with activated carbon and a series of ion exchange columns). Assembly and testing steps also use purified water.

A special 24-hour water extraction test is then run, and the water analyzed; pumps that don't test clean are run through the procedure again until they do. Preassembled pumps are issued a reference number when they have been certified clean and are sealed in polyethylene bags for protection until they are installed.

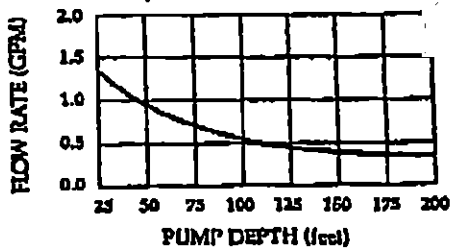
The "Secret" Of Bladder Durability

It's no secret. We start with the most inert polymers available...go through all the process variables to find the toughest formulations...test each batch of bladder material for the equivalent of decades of service to assure reliable performance... and protect bladders with easy-to-replace inlet screen cartridges to reduce abrasion and wear.

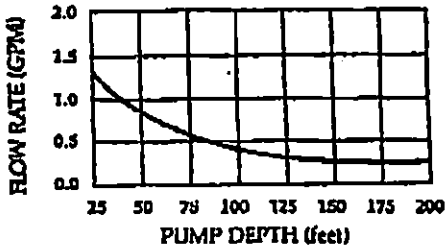
If a bladder does malfunction, QED supplies a quick-change kit so you can easily replace just the bladder sleeve—in the field, with no waiting.

FLOW PERFORMANCE CURVES:

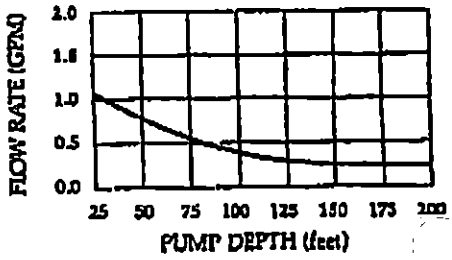
1100 Series Pumps



1200 Series Pumps



1300 Series Pumps



Note: Flow rates are based on pump submergence of 25 feet and operating gas pressure of 100 psi from 3111HR Air Source/Controller. Call for flow rates under other conditions.

FIELD REPLACEABLE BLADDERS:

FOR PUMP NO.	W/ CLAMP TOOL	W/O CLAMP TOOL
T1100	14055	14065
P1101	14057	14067
1200 Series	35315	35320
1500 Series	35858	35857

14026	Complete Bladder Cartridge Teflon (for T1100)
14002	Complete Bladder Cartridge PVC/Teflon (for P1101)
35314	Bladder Replacement Tool Kit 1 - 35052 Clamp Hand Tool 1 - 35312 Pin Punch

Note: All kits contain 2 bladder sleeves and seal replacement sets. 35315 includes pin punch.

INTAKE SCREENS (Protect Bladders):

MODEL NO.	DESCRIPTION
35200	Optional S.S. Screen for 1200 & 1500 Series Pumps

Note: Intake screens must be used to qualify for 10-year warranty.

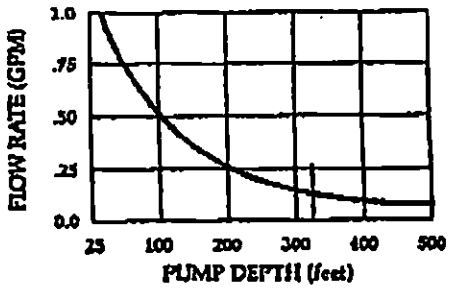
WELL WIZARD ON VIDEO

Well Wizard Operation & Maintenance

A user's manual on video, this 17-minute tape is packed with valuable, easy-to-follow instructions. Sections on installation, operation, and troubleshooting are color-coded for quick reference. Learn from the experts about sample pumps, purge pumps, inflatable packers, and pneumatic controllers. Included with every Well Wizard System.

DEEP WELL FLOW CURVE:

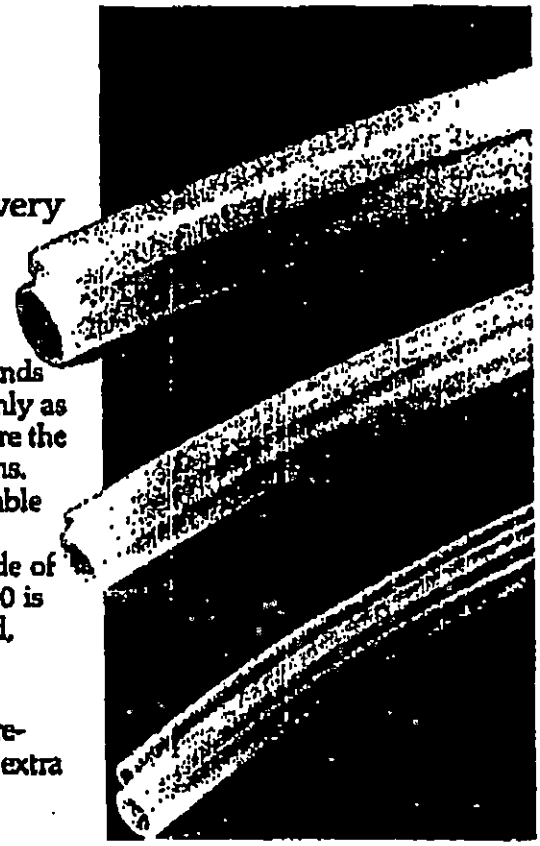
1100 Series Pumps



Note: Flow rates based on pump submergence of 25 feet. Depths to 320 feet based on operating gas pressure of 155 psi from 3111HPE Air Source/Controller.

*Even greater depths (to 1000 feet) are possible; consult QED for details.

Sample and Purge Tubing



A critical component of any monitoring system, tubing assemblies in a variety of materials fulfill every need.

PROTECT YOUR SAMPLES WITH THE BEST TUBING

QED has always recognized that ground water monitoring demands the highest material standards. This applies to tubing; a sample is only as good as the tubing it runs through. QED tubing enhancements ensure the ultimate accuracy of ground water samples for monitoring programs.

Twin-line bonded tubing makes handling, installation, and portable water level probe use easier. Economical Teflon-lined polyethylene bonded tubing is our most popular choice, with Teflon on the inside of the sample discharge tubing where it's really needed. Model PT5100 is used most often. Other tubing set choices include all-Teflon bonded, polyethylene bonded, and polypropylene bonded (for deep wells).

All tubing is controlled-quality, virgin-grade material, without printing. Standard tubing assemblies are cut to exact length and pre-assembled to well cap and pump per customer specifications at no extra cost. Bulk tubing is also available; inquire for details.

Teflon is a duPont trademark; material may be an equivalent PTFE.

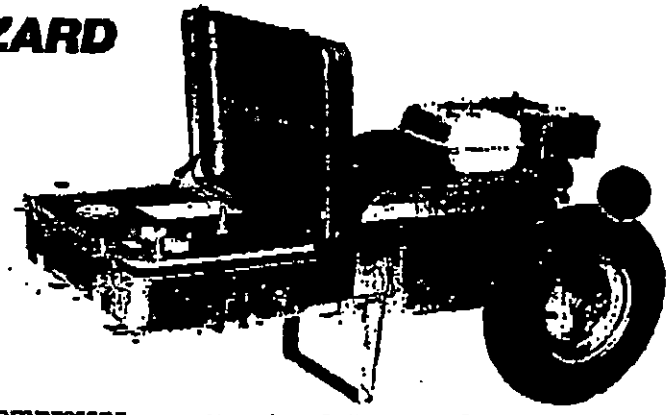
SPECIFICATIONS:

MODEL NUMBER	MATERIAL	AIR SUPPLY (inches) O.D.	AIR SUPPLY (inches) I.D.	DISCHARGE (inches) O.D.	DISCHARGE (inches) I.D.	MAX OPER PRESSURE PSI	MAX DEPTH (feet)	MIN BEND RADIUS (inches)	TUBING BOND TYPE	PUMP TYPE	PUMP MODEL NUMBERS
P5100	Polyethylene	0.250	0.170	0.500	0.375	200	400	2.50	Continuous	Sampling	1100 and 1200 Series
PT5100	Teflon-lined PE	0.250	0.170	0.500	0.375	200	400	2.50	Continuous	Sampling	1100 and 1200 Series
TS110	Teflon	0.250	0.170	0.500	0.375	240	500	3.00	Continuous	Sampling	T1100 and T1200 Series
PRS100	Polypropylene	0.250	0.170	0.500	0.375	300	600	2.50	Cable Wrap	Sampling	P1101H and P1201H Series
P5000	Polyethylene	0.250	0.170	0.375	0.250	300	600	1.25	Continuous	Sampling	T1300
PT5000	Teflon-lined PE	0.250	0.170	0.375	0.250	300	600	1.25	Continuous	Sampling	T1300
TS010	Teflon	0.250	0.170	0.375	0.250	300	600	2.50	Continuous	Sampling	T1300
PRS010	Polypropylene	0.250	0.170	0.375	0.250	300	600	1.25	Cable Wrap	Sampling	T1300
P5200	Polyethylene	0.250	0.170	0.250	0.170	300	600	1.00	Continuous	Sampling	1100 and 1200 Series
PTS200	Teflon-lined PE	0.250	0.170	0.250	0.170	300	600	1.00	Continuous	Sampling	1100 and 1200 Series
TS200	Teflon	0.250	0.170	0.250	0.170	320	600	1.50	Continuous	Sampling	1100 and 1200 Series
P5610	Polyethylene	0.500	0.375	0.750	0.625	150	200*	4.00	Continuous	Purge	HR4100, HR4500/4500LB, HR4600
PT5610	Teflon-lined PE	0.500	0.375	0.750	0.625	150	200*	4.00	Continuous	Sampling	1500 Series
TS600	Teflon	0.500	0.375	0.750	0.625	150	200*	9.00	Teflon Ring	Purge	HR4200, HR4700/HR4700LB

*Maximum pump depth recommendations reflect limits of efficient purge pumping.

Controllers/Air Sources

Workhorse controller/compressor carts provide self-contained portable performance.



3111LR Controller/Compressor Cart

RUGGEDLY CONTRUCTED, EASILY PORTABLE

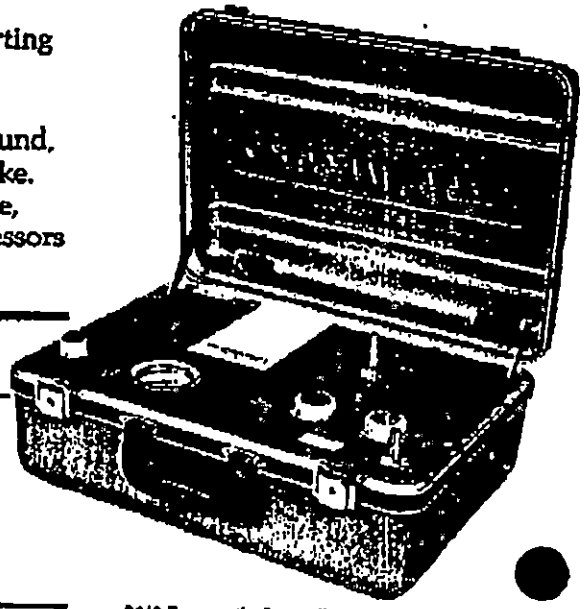
Most of our customers choose the 3111 series controller/compressor carts. They combine field-proven pneumatic controllers with performance-engineered compressors, powered by reliable, fast-starting 4 HP Honda gasoline engines. Model 3111LR is the most popular choice.

The most durable, portable, all-in-one pump-driving system around, the 3111 series operates every sampling and purging system we make. It's simple and self-contained, optimized for maximum performance, reliability, and ease of use. Finishing touches include oilless compressors for maximum contamination protection.

SPECIFICATIONS:

MODEL NO.	DESCRIPTION
3111LR	Standard controller/compressor cart drives pumps to 200 ft. lift; 4 HP Honda engine, high output compressor (4.3 SCFM at 100 psi), with model 3013 controller mounted on the anti-vibration braced cart, with easy wheel/handle breakdown; 89 lbs.
3111LH	High pressure model controller/compressor cart provides lifts to 320 ft. with high pressure compressor (2.1 SCFM at 165 psig) and model 3013H high pressure controller, otherwise similar to model 3111LR above; 93 lbs.

Note: Economy models available with Briggs & Stratton engines: 3111HR standard lift, 3111HP high pressure.



3013 Pneumatic Controller

THE MOST RELIABLE CONTROLLERS IN THE INDUSTRY

Versatile Well Wizard 3013 series controllers are fully adjustable, can operate high-rate purge pumps at full capacity and still be throttled down to 0 psi for EPA-recommended low flow rates for sampling.

One-person portability, fast set-up, and unattended cycling greatly reduce labor costs, and QED systems come complete—no extra charges for hoses, batteries, chargers or other necessary equipment.

All standard and high pressure models are compatible with a wide range of gas sources. Optional Pump Manifold lets one controller run three sampling pumps within a 20-foot radius. High pressure models allow lifts to 1000 feet. Pneumatic design provides sophisticated control with no batteries or electrical supply. And it's tough: Well Wizard controllers have been left out in the rain, dropped from trucks, even had their lids ripped off—and still kept on working.

SPECIFICATIONS:

MODEL NO.	LOGIC	MAXIMUM SUPPLY PRESSURE (PSI)	MAXIMUM PUMP DEPTH (feet)	WEIGHT (lbs)	LENGTH (Dimensions in inches)	WIDTH	HEIGHT
3013	Pneumatic	125	250	22	18	14.50	6.75
3013H	Pneumatic	300	600	26	18	14.50	6.75
3013UH	Pneumatic	500	1000	32	18	14.50	6.75

EXTRA CONTROLLER PERFORMANCE BUILT IN

Pneumatic Power

3013 series controllers have all-pneumatic design for maximum reliability. No battery to drain, no long waits for recharging or replacement batteries—if you've got pressure, you've got power. Third-generation pneumatic controls provide inherent shock and moisture resistance for real ruggedness.

Electronic Efficiency

Model 350 has uniquely efficient circuits that work for 100 hours on one set of inexpensive, readily available AA batteries. Its MIL-SPEC circuit board delivers continued performance in all conditions. Warning light shows a full day's power remaining, so you won't get left out in the field.

ACCESSORIES:

MODEL NO.	DESCRIPTION
3000	Multiple Pump Manifold
3017	Low Submergence Adaptor

SAMPLE PRO

Portable Water Level Meter

Get accurate, repeatable measurements quickly and easily at all depths.

Model 6000SS

CONVENIENT, RELIABLE PERFORMANCE

Static water level measurement is faster, easier, and more precise than ever with Sample Pro™ 6000 Series flat tape water level meters.

The compact electronic probe, standard in stainless steel, is specially designed to eliminate false readings caused by cascading water, and fits easily in wells, boreholes, and standpipes. Kink-resistant flat tape is permanently marked in 1/50th ft. increments, allowing repeatable depth measurements accurate to 1/100th ft.

Kevlar strands reinforce the tape for improved stretch resistance; the Kevlar connects to bolted metal for a stronger probe/tape connection and better water-tight seal, protecting against probe failure.

SIMPLE OPERATION AND DECONTAMINATION

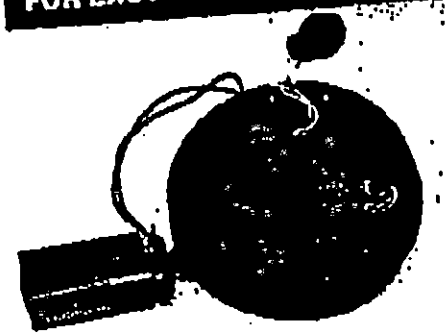
The probe and cable are lowered from the easy-to-carry, free-standing reel. Visual and audio alarms indicate contact with static water; depth measurement is taken directly from the tape. A built-in sensitivity control allows adjustment to fit varying water conductivity conditions. The unit operates for up to a year on a single, easily-replaceable 9 volt battery.

Decontamination is easier than ever. The meter electronics can be removed by disconnecting a single plug; the whole reel/tape/probe assembly can then be simply washed down or even totally immersed for thorough cleaning between wells.

OPTIONS AND ACCESSORIES

Seven standard models are available with inch or metric markings in a range of cable lengths from 100' to 650' and 50 to 150 meters. Lengths up to 1500' can be special ordered; please inquire.

Accessories include a padded protective carrying bag and a tape guide which keeps the cable from rubbing on the edge of the well casing, for reduced tape wear, easier lowering and raising, and more precise, repeatable measurements.



Removable Electronics Assembly

SPECIFICATIONS:

Probes:	Stainless steel (w/ strain relief), 5/8" diameter x 5" long
Tape:	Flat tape, PVC with Kevlar and tinned copper conductors, markings at 1/50' intervals or 1 centimeter intervals for metric
Power:	One standard 9V battery
Reel:	Small, free-standing with carrying handle and winding knob, brake, probe holder, battery test, on-off switch, sensitivity adjustment (Model 6000QSS uses larger reel)

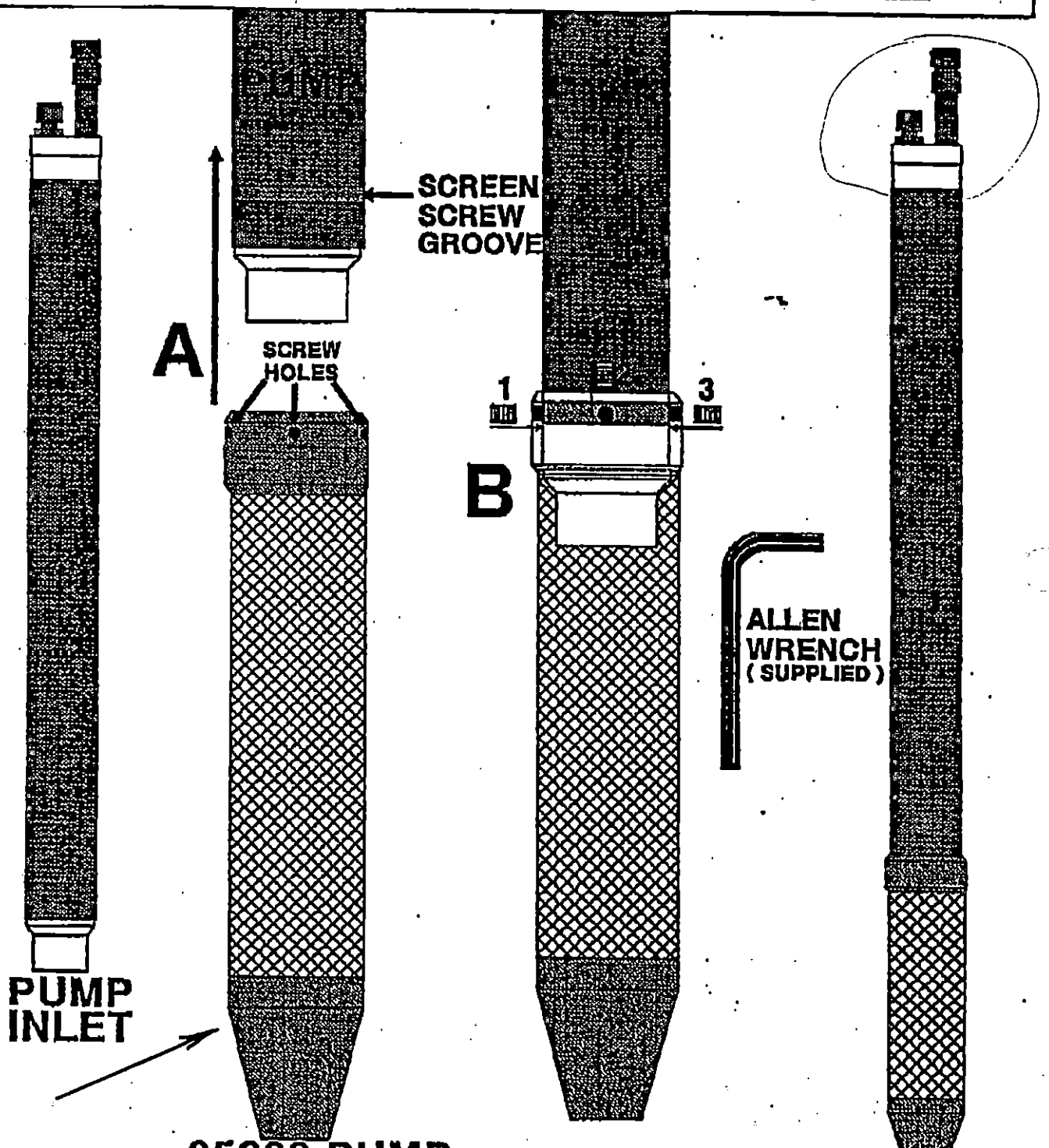
Depth Options:

MODEL NO.	TAPE LENGTH	METRIC MODELS	TAPE LENGTH
6000YSS	100 ft.	M6000-50	50 meters
6000MSS	300 ft.	M6000-100	100 meters
6000SS	150 ft.	M6000-150	150 meters
6000QSS	650 ft.		

ACCESSORIES:

MODEL NO.	DESCRIPTION
36059	Tape guide
36060	Carrying bag

1200 SERIES PUMP INLET SCREEN ATTACHMENT SLIDE SCREEN OVER PUMP INLET AND ALIGN THE SCREEN'S SCREW HOLES OVER TOP OF THE SCREEN SCREW GROOVE OF THE PUMP'S BODY. HOLD SCREEN IN PLACE WHILE THREADING THE SCREEN'S 3 SET SCREWS, (USING THE PROVIDED ALLEN WRENCH), THROUGH THE SCREEN SCREW HOLES AND INTO THE PUMP SCREEN SCREW GROOVE. TIGHTEN SCREWS AN EQUAL DISTANCE IN ON ALL 3 SIDES TO PROVIDE A FIRM HOLD ON ALL SIDES. MAKE SURE SCREEN IS FIRMLY ON BEFORE INSERTING DOWN WELL.



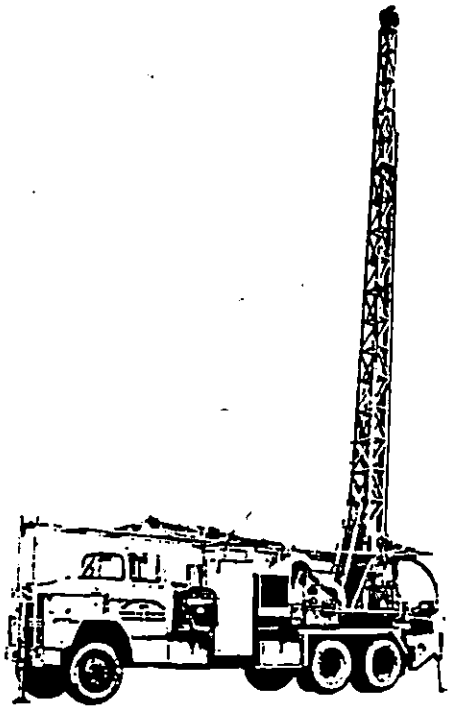
35200 PUMP INLET SCREEN

(OPTIONAL)

MORETRENCH AMERICAN

BUCKET DRILL RIGS

EXTRACTION WELL DRILLING EQUIPMENT



BUCKET DRILL

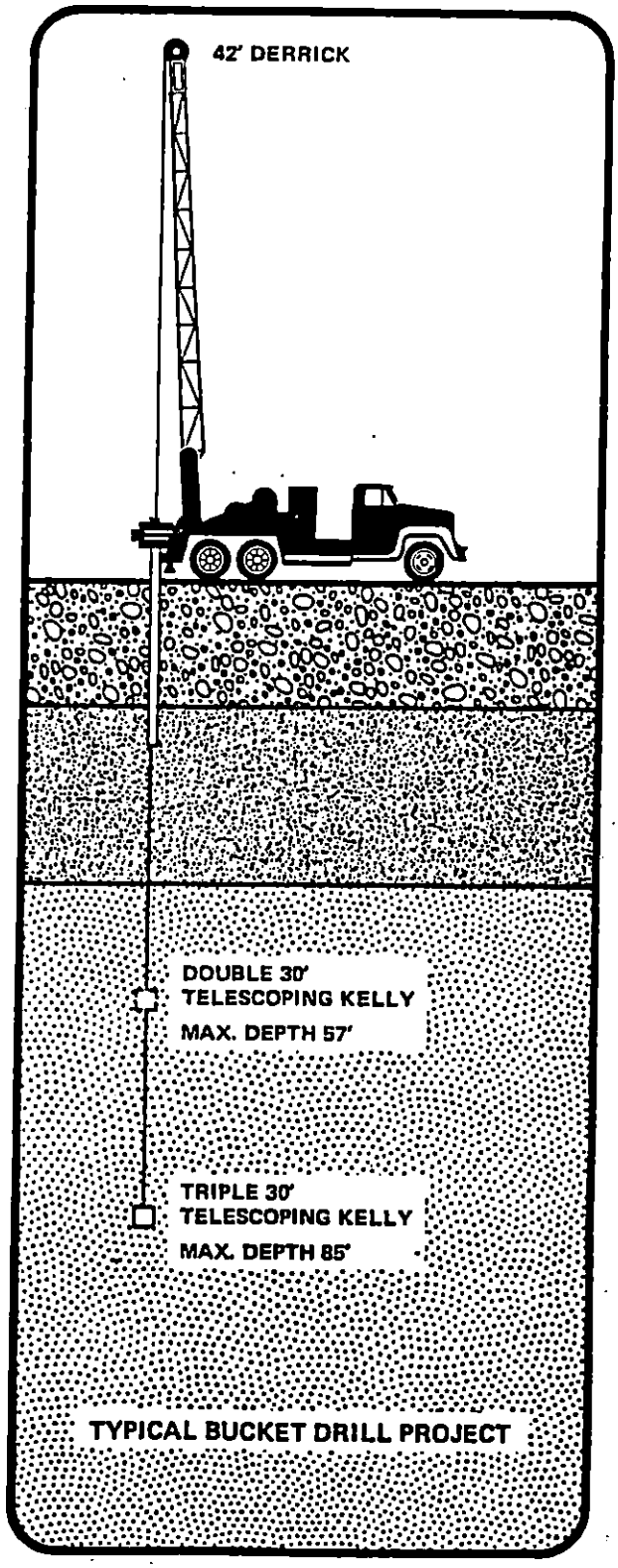
A heavy duty model with 7000-pound double drum hoist. The 52-inch ring gear takes buckets to 48 inches in diameter. With a triple telescoping Kelly and 39-foot derrick, depths to 85 feet can be reached. By use of a stem, depths to 105 feet are possible.

Moretrench American uses the Bucket Drill to predrill excavations for the installation of Moretrench dewatering wells.

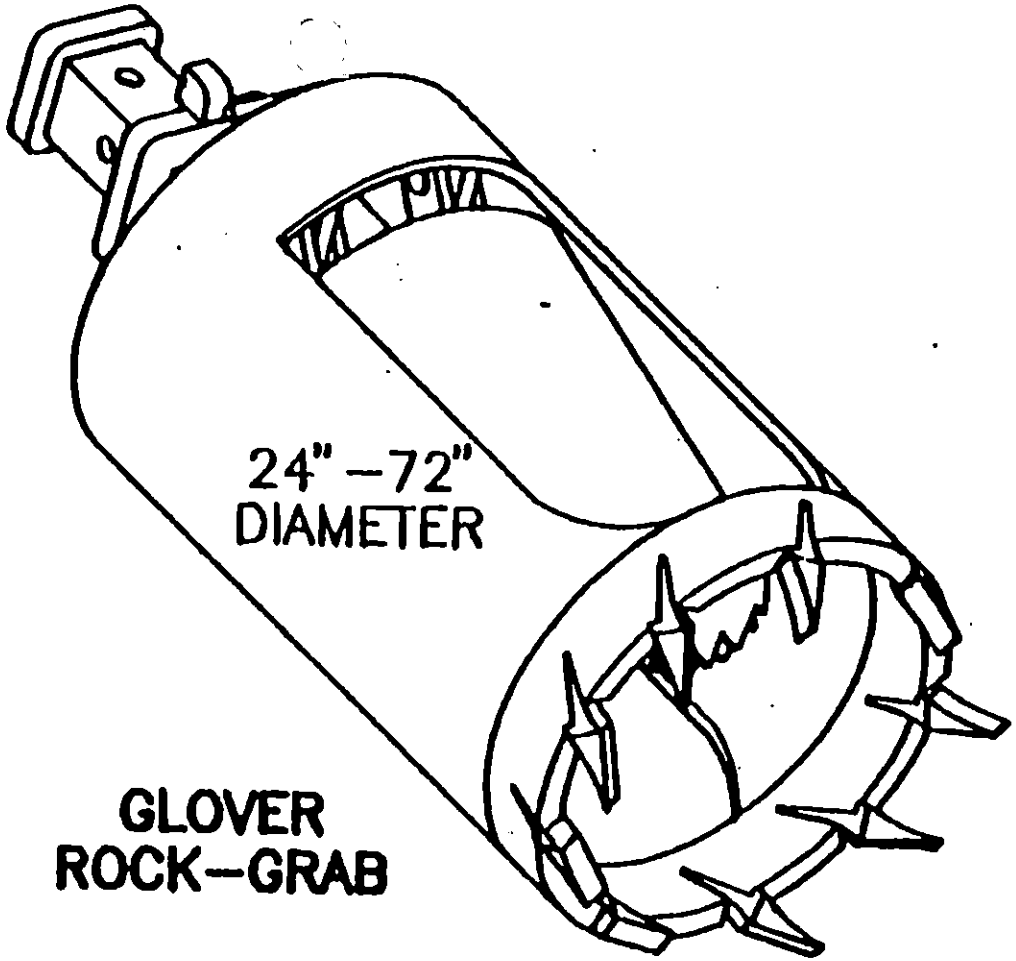
Revert or bentonite is used as a drilling fluid to support the sides of the excavation.

Moretrench American wellscreens and select sand or gravel filters are installed upon completion of the drilling operation.

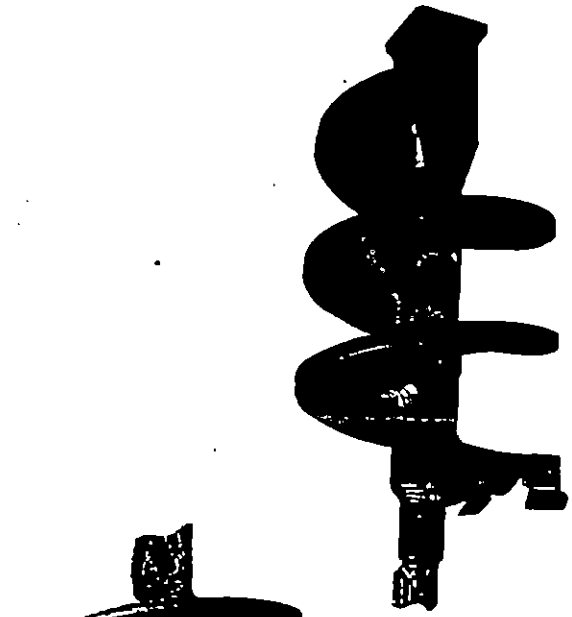
Submersible pumps are used as the pumping tool for deep wells.

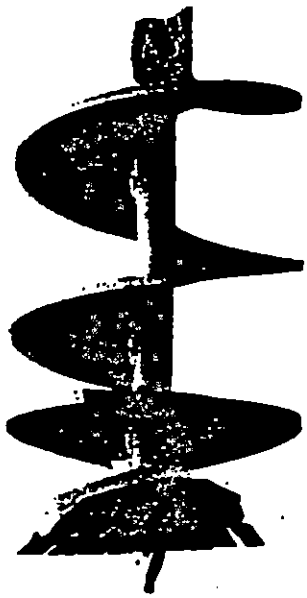


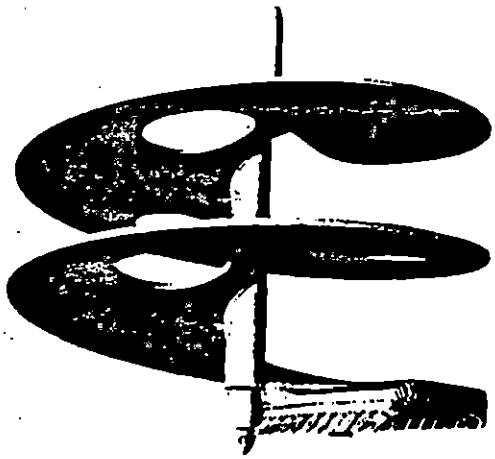
TYPICAL BUCKET DRILL PROJECT



GLOVER
ROCK–GRAB







SPADE TOOTH STEP AUGER

This auger incorporates a step-tooth design minimizing "walking" tendencies. It uses spade type teeth mounted in discrete positions both radially and in elevation. Full contact with the surface being drilled results in stability and continuous penetration in materials such as soft limestone, clay, shale, compacted sand and gravel. Worn teeth are easily removed and replaced. This auger performs well in a wide range of drillable materials that otherwise requires more than one tool for efficient drilling production.

SINGLE FLIGHT, DOUBLE CUTTING EDGE AUGERS

These augers incorporate features of both the single flight, and double flight augers. The auger has two cutting edges for which a full line of cutting edge configurations is offered. The first leading edge of the flights cuts and conveys material up the auger. The opposing cutting edge is on a partial flight and serves to balance cutting forces when starting a shaft. This auger offers the advantage of double flight augers without reducing efficient conveyance of materials. Less tool weight and lower cost are also advantages to this design when compared to a double flight auger.

MUDDING AUGERS

The principle purpose of a mudding auger is to drill and mix cuttings into a slurry. The openings placed in the auger's flights allow circulation of materials through the tool and complement mixing effects as the auger is rotated while alternately raised and lowered. The openings also provide a vacuum/pressure relief that results in increased speed and ease in which the auger may be raised and lowered in the shaft. Flight holes also serve to eliminate problems which result from pulling a partial vacuum in unstable materials that may result in wall collapse and shaft deformation. Mudding augers may also be used for typical drilling production. They are available in single or double flight configurations and may be equipped with a variety of cutting edges.

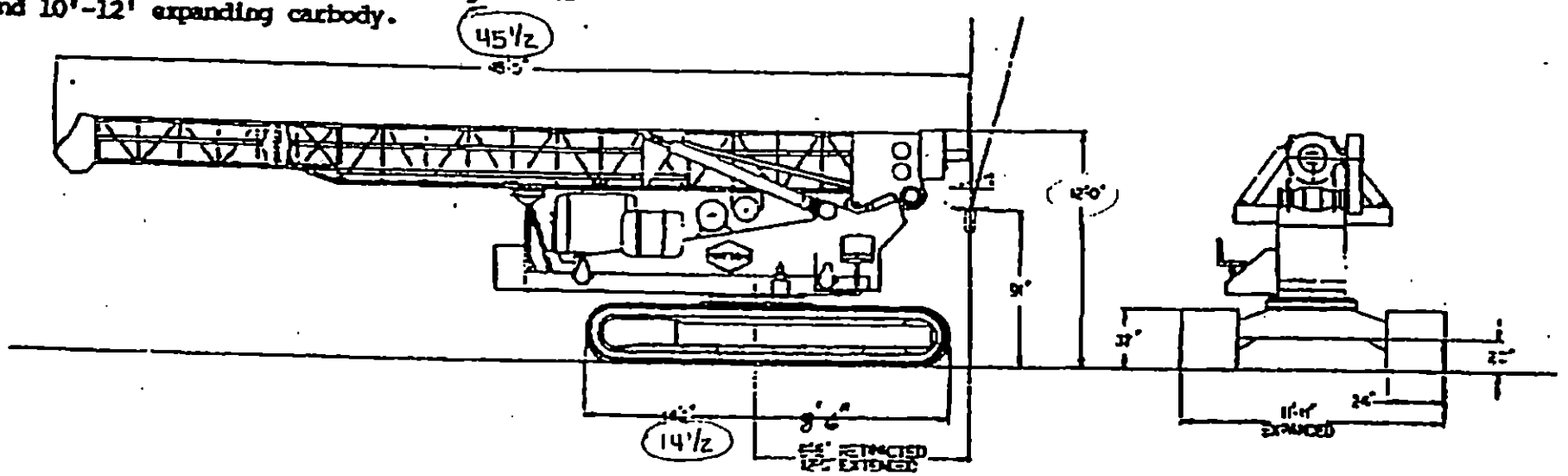
0.3

gross

Notes

1. Dimensions for standard 60' drill depth unit.
   Approximate unit weight - 64,000#

2. Standard crawler unit has dual swing motors
   and 10'-12' expanding carbody.



66,000 10' Wide

SUBMISSION FOR PIEZOMETERS

PROCEDURE

I. Piston Tube Sampling

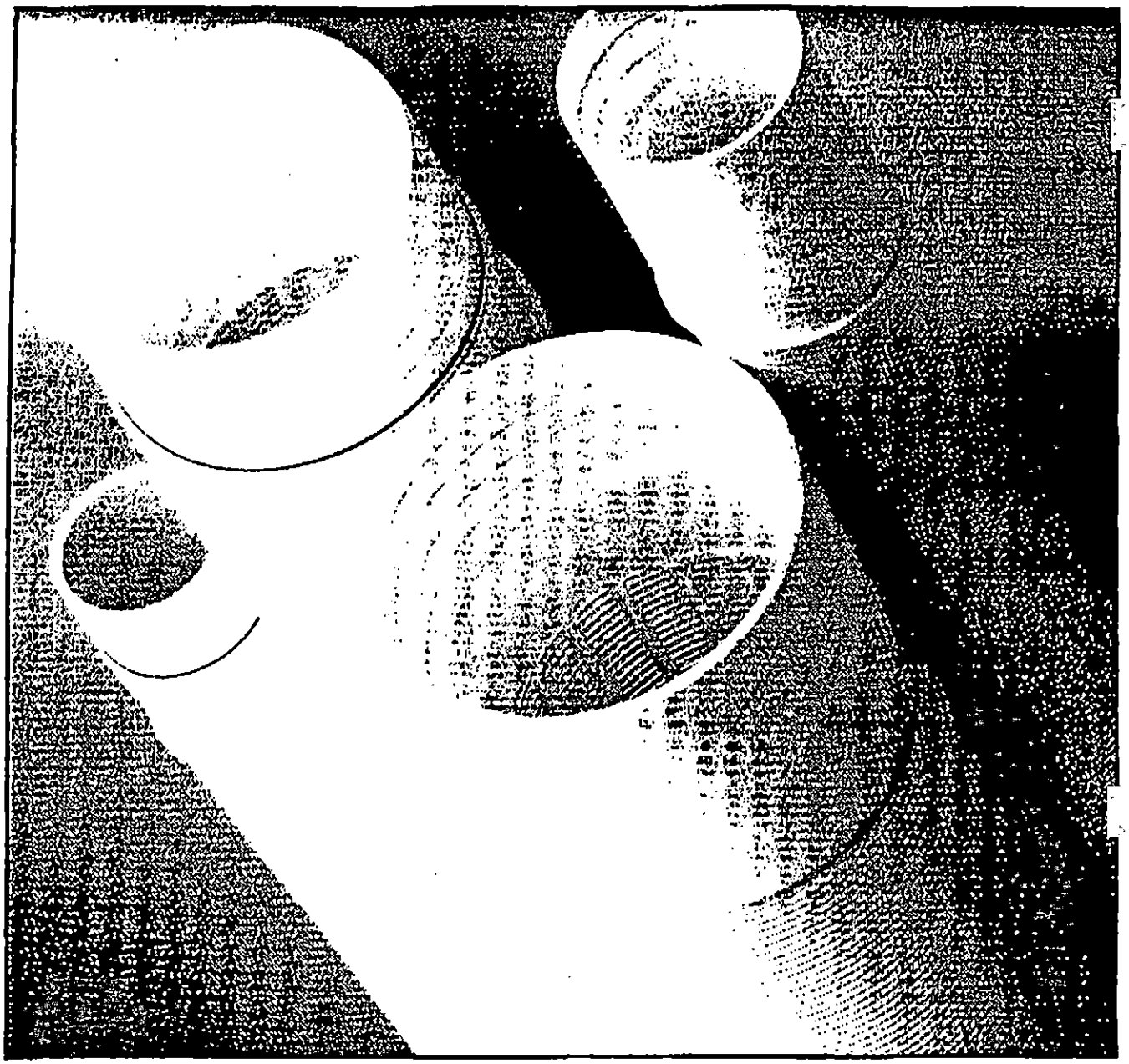
To retrieve samples of the slurry wall backfill, we propose to proceed as outlined below:

- Minimum 8" O.D. hollowstem augers will be advanced to the prescribed depth. The diameter of the hollowstem will be minimum 4 1/4".
- Upon reaching the target depth, a nominal 3" I.D. piston tube sampler measuring 24" in length will be pressed to its full depth.
- The tube will be withdrawn and the sample turned over to BET.
- The augered hole will be backfilled with a cement-bentonite grout in the proportion of 1 bag of portland cement, 4 to 6 pounds of dry bentonite to 7 gallons of water.

II. Piezometer Installation

- Minimum 8" O.D. hollowstem augers will be advanced to depth. The hollowstem will be minimum 4 1/4" I.D. A wooden plug will be placed in the lead auger prior to drilling.
- Upon reaching completion depth, the hollowstem will be flushed with clear water to remove any fines and to stabilize the hole for piezometer construction.
- Minimum 1 1/4" I.D. PVC piezometer assemblies will be inserted in the hollowstem conforming to the depth requirement of the specifications.
- Filter gravel will be placed by tremie as the augers are withdrawn to a point 6" above the screen as specified.
- Above the filter gravel, * cement-bentonite grout will be placed via a grout pump and tremie pipe.
- The piezometer will be completed with cap, protective casing and lean concrete as specified.

* 7 GAL. H_2O
1 BAG (94#) PORTLAND CEMENT
5# BENTONITE POWDER



PVC Vee-Wire® Screens

- Only continuous slot, wire-wrapped non-metallic screens available without a restricting pipe base.
- More open area per foot than any other non-metallic screen available. Allows more water to enter at lower velocities, which reduces turbidity and enables a more representative sample to be collected.
- Exceptionally strong due to sonically welded PVC wire and rods.
- Thermally-attached fittings (through 6PS), eliminate solvent welding in the field, which can endanger sampling accuracy.

PVC Slotted Pipe

- Use Johnson screens™ slotted PVC pipe when monitoring applications do not require the performance of Vee-Wire® screen.
- Meets Wheelabrator Engineered Systems Inc.'s high standards of quality.
- Slots are cleaned to remove stringers and burrs.

MORIE SCREENINGS

Typical Physical Analysis

#1 Well Gravel

Inches	MM.	Sieve No.	Cum. Grame	% Ret.	% Pass.
.0661	1.700	12	0.8	0.8	99.2
.0555	1.410	14	14.2	13.4	85.8
.0469	1.190	16	45.3	31.1	54.7
.0394	1.000	18	74.6	29.3	25.4
.0331	.850	20	95.3	20.7	4.7
.0278	.710	25	98.4	3.1	1.6
.0234	.600	30	99.3	0.9	0.7
.0197	.500	35	99.7	0.4	0.3
.0165	.425	40	99.9	0.2	0.1

Typical Chemical Analysis

SiO_2	99.390
Fe_2O_3	.240
Al_2O_3	.190
TiO_2	.120
CaO	.010
MgO	.004
L.O.I.	.046

Acid solubility (1:1 HCL) .08 to .11%
Sp. Gr. - 2.64 to 2.66

THE MORIE COMPANY, INC.

MINERS OF INDUSTRIAL SAND AND GRAVEL

Main Office: 1201 N. High St., Millville, NJ 08332

800/257-7034 • in N.J. 800/521-0485 • Fax # 609/327-4107

GEORGIA SILICA DIVISION
Junction City, GA 31812
404/269-3294 • Fax # 404/269-3191

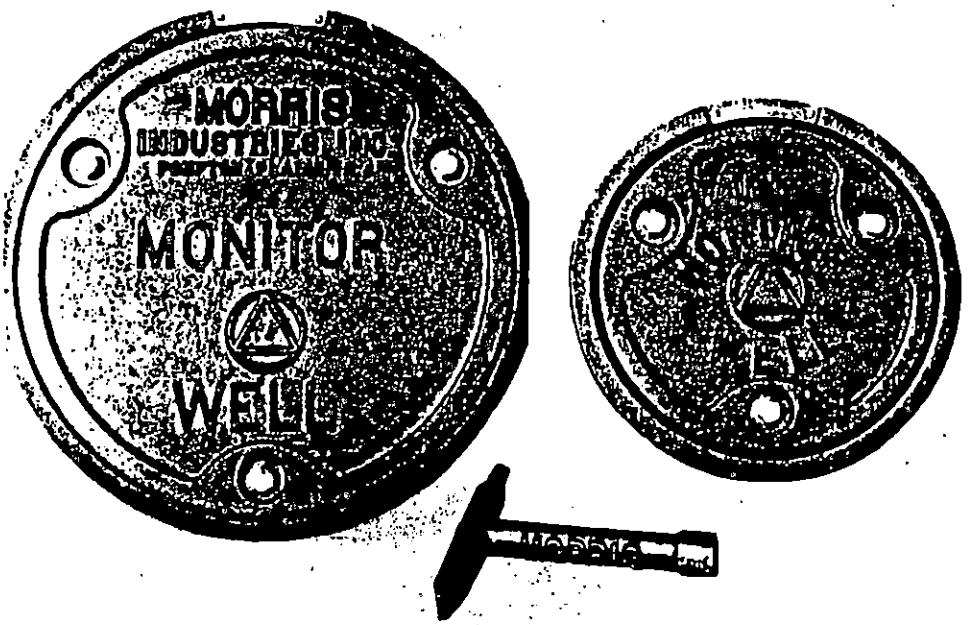
ALABAMA SILICA DIVISION
Tuscaloosa, AL 35401
205/758-8353

TENNESSEE SILICA DIVISION
Camden, TN 38320
901/584-8201

MORRIS

WATERTIGHT MANHOLE

12" inch 8" inch



- MADE FROM STEEL CONSTRUCTION
- WATERTIGHT
- EASY ACCESS
- INCLUDES MULTI-PURPOSE WRENCH
- IDENTIFICATION PLATE
- AVAILABLE WITH STEEL OR 20 GAUGE GALVANEALED SKIRT
- MANHOLES EXCEED THE H-20 AASHTO LOAD RATING
- TESTED IN ACCORDANCE WITH FEDERAL SPECIFICATION #RR-F-621D

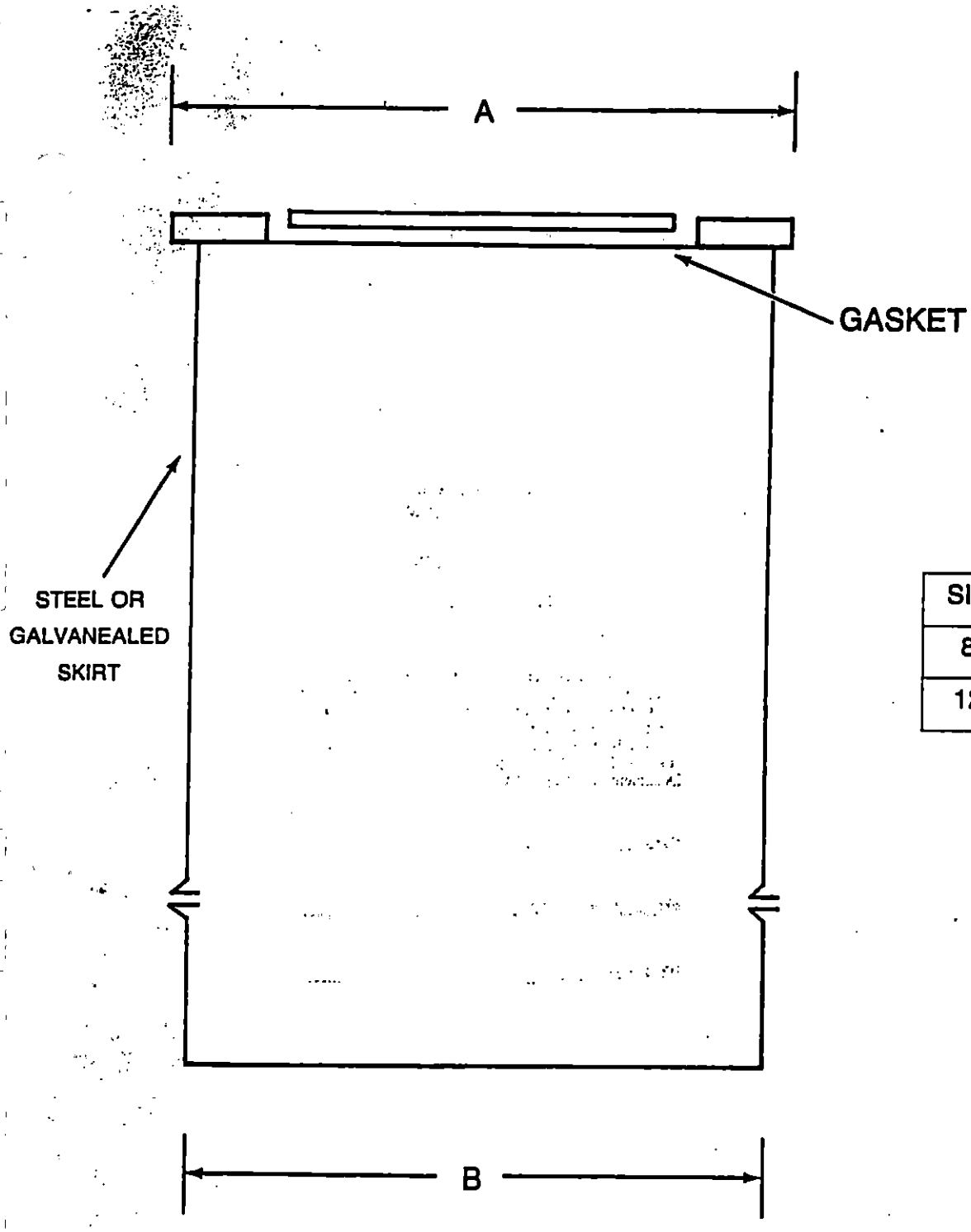
AVAILABLE THRU **MORRIS industries, inc.**

777 Route 23
Pompton Plains, NJ 07444
(800) 835-0777
Fax # (201) 835-7414

44 Route 146
Mechanicville, NY 12118
(800) 635-6591
Fax # (518) 664-2006

21 Commerce Circle
Durham, Conn. 06422
(800) 232-2777
Fax # (203) 349-9363

975 West Siddonsburg Road At US 1
Dillsburg, Penna. 17019
(800) 637-7724
Fax # (717) 432-1150



DIMENSIONS

SIZE	A	B
8"	9 3/4"	8 5/8"
12"	13 1/8"	12 1/2"

PRODUCT NUMBERS FOR ORDERING

PART #	DESCRIPTION
318100600	8" WATERTIGHT MANHOLE W/6" STEEL SKIRT
318101200	8" WATERTIGHT MANHOLE W/12" STEEL SKIRT
318101800	8" WATERTIGHT MANHOLE W/18" STEEL SKIRT
318100751	8" WATERTIGHT MANHOLE W/7½" GALVANEALED SKIRT
318101201	8" WATERTIGHT MANHOLE W/12" GALVANEALED SKIRT
318131201	12" WATERTIGHT MANHOLE W/12" GALVANEALED SKIRT

BRECO MECHANICAL GROUP, INC.
201 SAW MILL RIVER ROAD
YONKERS, NEW YORK 10701

*TEL. (914) 963-3600 * FAX (914) 963-3989*

WELL AND PIEZOMETER ABANDONMENT PROCEDURES

Per Section 02677 of the Specifications, the following describes the proposed method of abandoning the existing wells.

1. The wells will be located in the field. The outer protective casing will be removed.

2. A mixture of cement, bentonite and water will be used as a grout mixture for grouting the existing wells. The grout mix design will be as follows:

Portland Cement	94 Lbs.
Powdered Bentonite	4-6 Lbs.
Water	8-10 Gals.

3. The cement-bentonite grout will be mixed and pumped through a tremie pipe 3 feet from the bottom of the well to the top of the well.

4. A well abandonment report will be kept in accordance with Paragraph 1.3.B and Paragraph 1.7 of Section 02677. The report form that will be used is attached.

5. After 24 hours the well will be inspected for settlement of the grout previously placed. If any settlement occurred, additional grout will be placed in the well.

6. After the wells have been grouted, the inner casing shall be removed to 4 to 5 feet below ground surface. The remaining portion of the hole will be backfilled.

cwpdocs/abandonm

BRECO MECHANICAL GROUP, INC.

WELL ABANDONMENT REPORT

PROJECT: 876 HP
LOCATION: Pelham Landfill
Bronx, N.Y.

SPEC. SECTION: 02677

WELL NO: _____

TYPE WELL: _____

SIZE (DIAMETER): _____

DEPTH: _____

DEPTH OF GROUT LOSS: _____

AMOUNT OF GROUT: _____

DEPTH OF GROUT (STAGES):

A. _____ F. _____
B. _____ G. _____
C. _____ H. _____
E. _____ J. _____

CASING CONDITIONS: _____

_____

_____

STATIC WATER LEVEL: _____

DEPTH OF SEAL: _____

CHANGES DURING SEALING: _____

REMARKS: _____

_____

_____

DATE OF CLOSURE: _____

TIME STARTED: _____

TIME COMPLETED: _____

COMPLETED BY: _____

BENTONITE PELLET SEALS

PureGold®
Groundwater Monitoring Products

AMERICAN COLLOID COMPANY
Water/Mineral Division

American Colloid Company's PureGold® Product Line

American Colloid Company has specifically engineered the PureGold® product line to meet the strict regulatory requirements of the groundwater monitoring industry. PureGold® products are produced from the highest quality bentonite clays. Each product consists of a blend of pure, dried bentonite clays without polymers or organic additives. PureGold® products are formulated under strict quality control standards. The products have been analyzed for inorganics using the EP Toxicity Test Method, and for organic priority pollutants using U.S. EPA CLP procedures. The analytical results were below EP Toxicity maximum concentration limits for inorganics and below CLP detection limits for organics.

PRODUCT NAME	USE
PureGold® Gel	A 90 bbl. yield, polymer free drilling fluid. Used for maintaining borehole integrity in unstable geologic formations.
PureGold® Grout	A high solids bentonite grout. A safe substitute for cement. Used for sealing the annulus of groundwater monitoring wells and abandoning boreholes.
PureGold® Tablets	Bentonite tablets available in 1/2", 3/8" and 1/4" diameters. Used for sealing the annulus of groundwater monitoring wells.
PureGold® Doughnut	A bentonite cylinder. Used for sealing the annulus of groundwater monitoring wells.
PureGold® Chips	Bentonite chips available in two sizes: 1/4" to 3/8" and 3/8" to 3/4". Used for abandoning shallow boreholes. (< 100')
PureGold® Lube	A bentonite based tool joint lubricant. For use in environmental drilling where petroleum based lubricants are not allowed.
PureGold® Grouter	A grout mixer available in two models. Used for mixing and pumping high solids bentonite grouts.
Marsh Funnel & Cup Mud Balance	Test equipment for measurement of drilling fluids and grout.

1500 W. Shure Drive • Arlington Heights, Illinois 60004-1434 • (708) 392-4600 • Fax (708) 506-6199

CETCO

COLLOID ENVIRONMENTAL TECHNOLOGIES COMPANY

Groundwater Division

TECHNICAL DATA SHEET

PureGold® Chips

NSF CERTIFIED

Description: PureGold® Chips are natural sodium bentonite screened to 1/4" to 3/8" in size.

Recommended Use: For sealing shallow boreholes, decommissioning wells, providing an interface between bentonite grouts and cement, and as a backfill for ground rod installations.

Characteristics:

- Chemically stable, results from TCLP Metals Analysis are below RCRA limits for hazardous constituents.
- Provides a high solids clay seal.
- Prevents infiltration of surface contamination.
- Provides a permanent flexible seal.
- Can be used to seal abandoned holes, conductor pipe and seismic shot holes.
- Forms a low resistivity contact to grounding rods.

Mixing and Application: Bagged material should be screened of fines before placing in hole. Material should be poured slowly down hole to prevent bridging or binding. If installed in the unsaturated zone, water should be added at two foot intervals to assure adequate hydration.

Bulk Density: 69.25 lbs./ft^3

Packaging: PureGold® Chips are packaged in 50 lb. Multi-wall weather resistant bags, 48 bags per pallet, and shrinkwrapped.

1350 W. Shure Drive • Arlington Heights, Illinois 60004-1440 • (708) 392-5800 • FAX (708) 506-6150
A wholly owned subsidiary of American Colloid Company

010201001GCEC

PRODUCT APPLICATION QUANTITIES

HOLE DIA.IN.	CU. FT./ LIN.FT.	1/2" TABLETS LBS./FT.	3/8" TABLETS LBS./FT.	1/4" TABLETS LBS./FT.	COURSE CHIPS LBS./FT.	MEDIUM CHIPS LBS./FT.	VOL.CLAY GROUT LBS./FT.	PUREGOLD GROUT LBS./FT.
2	0.02	1.66	1.73	1.76	1.47	1.51	0.31	0.50
4	0.09	6.63	6.93	7.04	5.87	6.04	1.25	1.98
5	0.14	10.36	10.83	11.01	9.18	9.44	1.95	3.10
6	0.20	14.92	15.59	15.85	13.21	13.60	2.81	4.46
7	0.27	20.31	21.23	21.57	17.99	18.51	3.82	6.07
8	0.35	26.53	27.72	28.18	23.49	24.17	4.99	7.93
9	0.44	33.57	35.09	35.66	29.73	30.59	6.31	10.04
10	0.55	41.45	43.32	44.03	36.71	37.77	7.79	12.40
12	0.79	59.68	62.38	63.40	52.86	54.39	11.22	17.85
14	1.07	81.23	84.90	86.29	71.94	74.03	15.28	24.30
16	1.40	106.10	110.89	112.71	93.97	96.69	19.95	31.74
18	1.77	134.29	140.35	142.64	118.93	122.37	25.25	40.17
20	2.18	165.78	173.27	176.10	146.83	151.08	31.18	49.59
24	3.14	238.73	249.51	253.59	211.43	217.56	44.89	71.41
30	4.91	373.02	389.85	396.23	330.36	339.93	70.15	111.58
36	7.07	537.14	561.39	570.58	475.72	489.50	101.01	160.67
Density (lbs./cu.ft.)		75.99	79.42	80.72	67.30	69.25	70.32*	75.55**

* When mixed with water according to instructions at 20% solids.
** When mixed with water according to instructions at 30% solids.

Note: All application rates assume true borehole size. Adjustments should be made for irregular borings and formation loss.

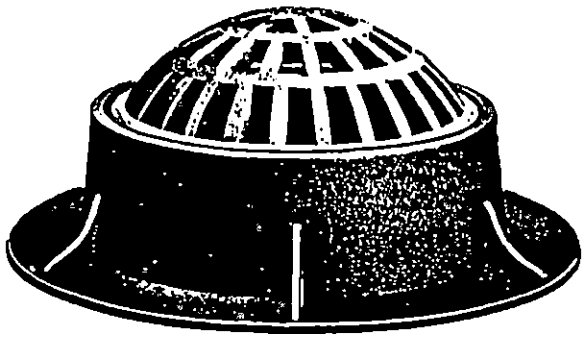
Cu. Ft. per Lin. Ft.	Hole Diameter (inches)	Casing Diameter 2	4	6	8	10	12	14	16	20	24	30
		VOLUME OF ANNULUS (Cubic Feet/Linear Feet)										
0.02	2											
0.09	4	0.07	0.00									
0.14	5	0.11	0.05									
0.20	6	0.17	0.11	0.00								
0.27	7	0.25	0.18	0.07								
0.35	8	0.33	0.26	0.15	0.00							
0.44	9	0.42	0.35	0.25	0.09							
0.55	10	0.52	0.46	0.35	0.20	0.00						
0.79	12	0.76	0.70	0.59	0.44	0.24	0.00					
1.07	14	1.05	0.98	0.87	0.72	0.52	0.28	0.00				
1.40	16	1.37	1.31	1.20	1.05	0.85	0.61	0.33	0.00			
1.77	18	1.75	1.68	1.57	1.42	1.22	0.98	0.70	0.37			
2.18	20	2.16	2.09	1.99	1.83	1.64	1.40	1.11	0.79	0.00		
3.14	24	3.12	3.05	2.95	2.79	2.60	2.36	2.07	1.75	0.96	0.00	
4.91	30	4.89	4.82	4.71	4.56	4.36	4.12	3.84	3.51	2.73	1.77	0.00
→ 7.07	36	7.05	6.98	6.87	6.72	6.52	6.28	6.00	5.67	4.89	3.93	2.16

CP MANHOLES - FRAMES AND GRATES

R-2560 Series
Beehive Grates with Frames

Suitable for drainage in circumstances where clogging of a flat grating is a problem. Excellent for roadside or earth ditch catch basins.

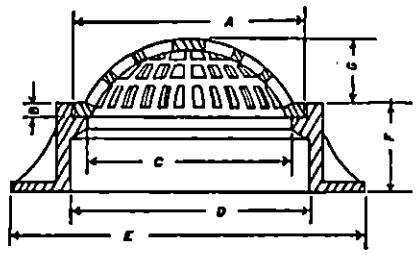
Qty = 4



Illustrating
R-2560-E

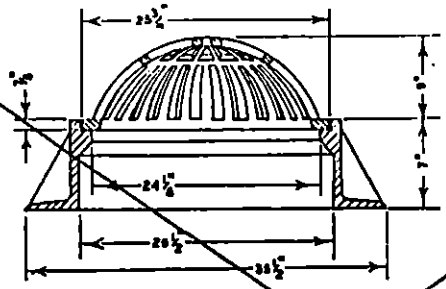
Catalog No.	Dimensions in inches A	B	C	D	E	F	G	Wt. Lbs.
-2560-A	12	1	11	12½	19	4	4	80
-2560-B	15½	1¼	15	15	21	5	3	120
R-2560-C	18	1¼	16½	20½	30	8	4	190
-2560-C1	22	1½	20	23	28	4	4½	195
-2560-C2	22	1½	20½	24	28¼	6	4½	270
-2560-D	22	1½	20	24½	35	9	4½	315
R-2560-D1	22	1½	20	23	28	4	7	210
R-2560-D2	22	1½	20½	24	28¼	6	7	285
-2560-D3	22	1½	20	24½	35	9	7	345
-2560-E	23	1½	21	25½	36	9	7	340
-2560-EA	25¾	⅞	24⅛	26½	35½	4	6	265
R-2560-EB	25¾	⅞	24⅛	26½	35½	4	9	285
-2560-E1	25¾	⅞	24⅛	26½	35½	7	6	285
-2560-E2	25¾	⅞	24⅛	26½	35½	7	9	300
-2560-E5	25¾	⅞	24⅛	26½	35½	8	6	345
R-2560-E6	25¾	⅞	24⅛	26½	35½	8	9	365
R-2560-E7	25¾	⅞	24⅛	26½	35½	9	6	350
-2560-E8	25¾	⅞	24⅛	26½	35½	9	9	365
-2560-E9	25¾	⅞	24⅛	26½	35½	10	6	360
-2560-E10	25¾	⅞	24⅛	26½	35½	10	9	385
R-2560-F	29	1⅜	27	38	46	10	6	520
-2560-G	32	1½	30	36	46	7	4	535

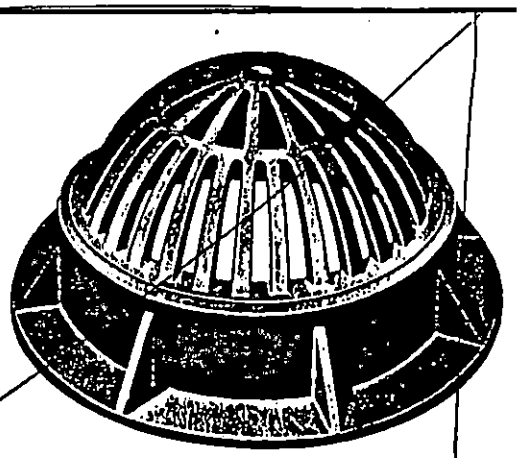
Furnished standard with ground bearing surfaces.



R-2561 High Beehive Grate and Frame

otal Weight 300 Pounds





R-2561-A

Same as above except with 6" high beehive grate.

tal Weight 285 Pounds

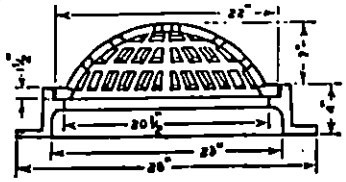
Furnished standard with ground bearing surfaces.

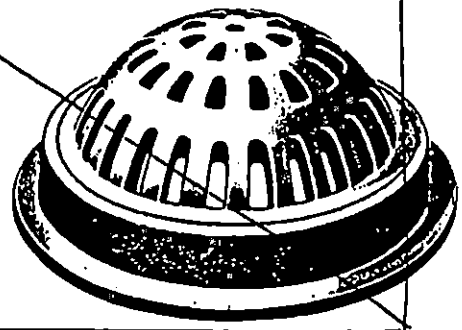
R-2563 Beehive Grate and Frame

Designed to fit in bell of 24" sewer pipe.

tal Weight 210 Pounds

rnished standard with ound bearing surfaces.



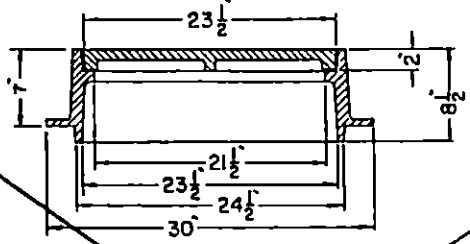


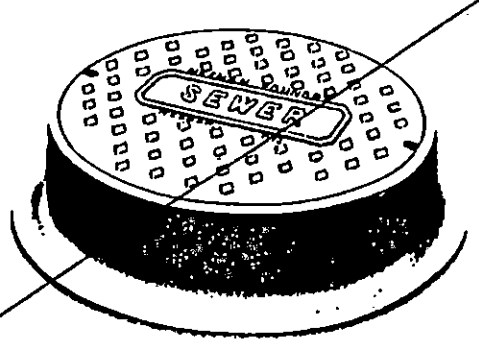
NEENAH FOUNDRY COMPANY

R-1708 Manhole Frame, Solid Lid

Heavy Duty

Total Weight 360 Pounds

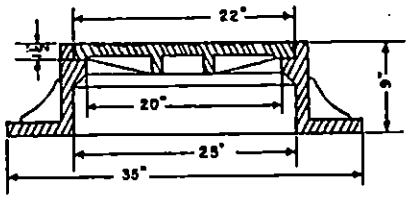


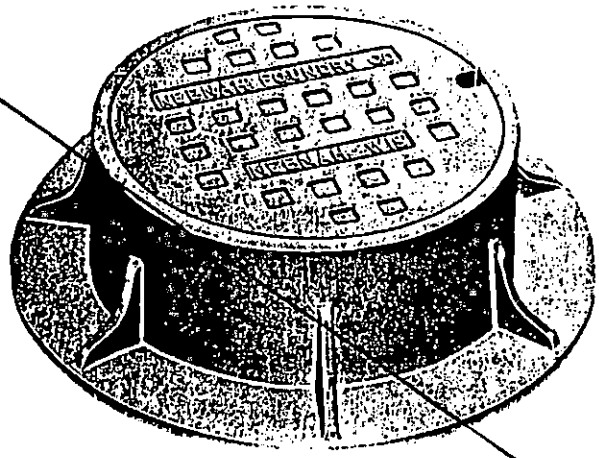


R-1710 Manhole Frame, Solid Lid

Heavy Duty

Total Weight 310 Pounds

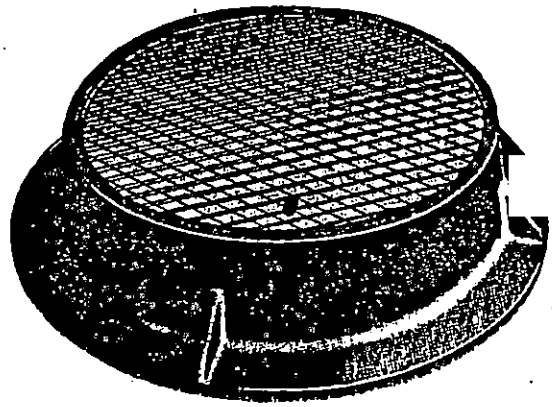




R-1711-A Manhole Frame, Solid Lid

Heavy Duty

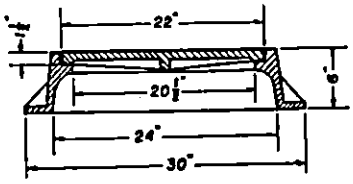
Total Weight 220 Pounds



~~R-1711-B~~

~~Light Duty~~

~~Total Weight 175 Pounds~~

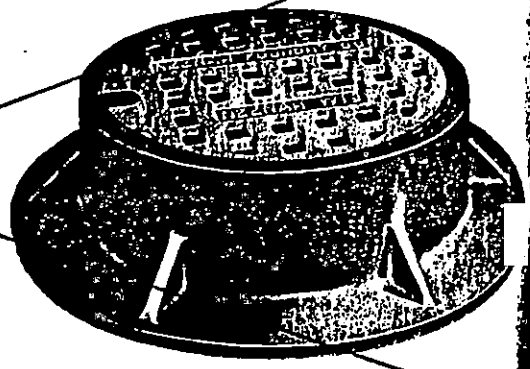


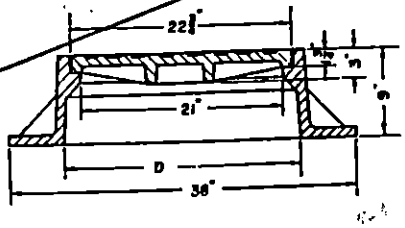
R-1712 Series Manhole Frames, Solid Lids

Heavy Duty

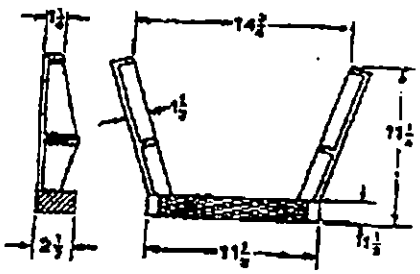
Catalog No.	D	Wt. Lbs.
R-1712	24½"	540
R-1712-B	26"	445
R-1712-C	26"	390*

*Furnished with platen lid, similar to R-1706-1.





03310-1.5



PATTERN NUMBER 2587
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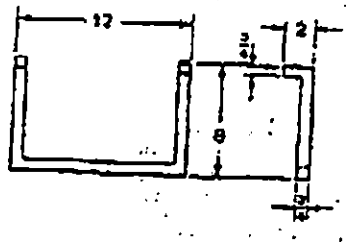

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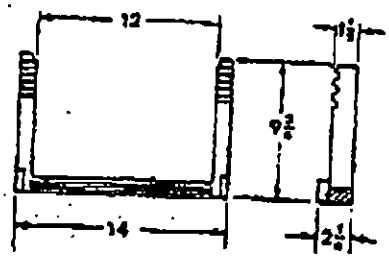

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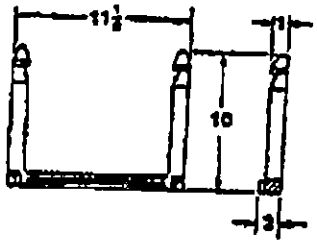

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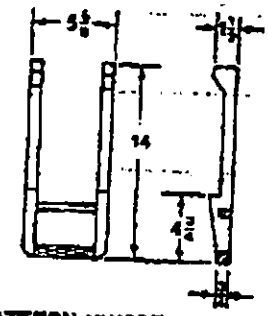

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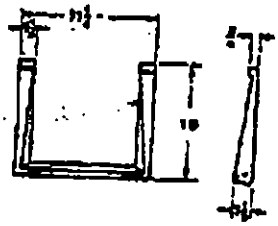

PATTERN NUMBER 2588-4
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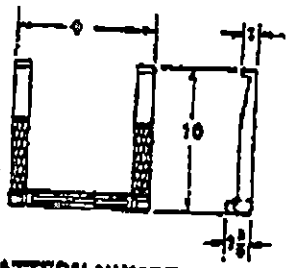
Manhole Steps



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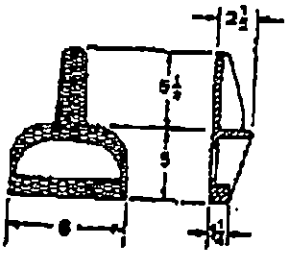

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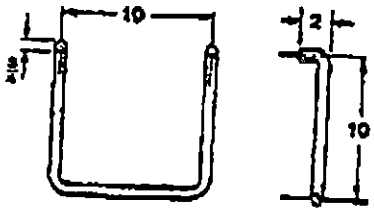

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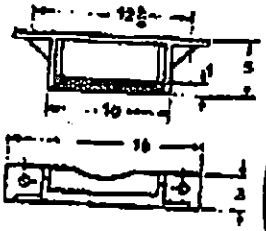

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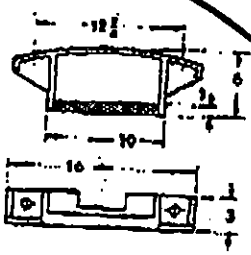
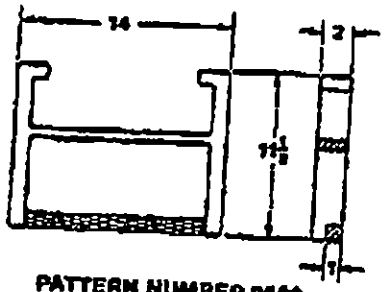


PATTERN NUMBER 2592-1
(2592 226)



PATTERN NUMBER 2650
(2650 228)
U.S. Government Standard

CAMPBELL FOUNDRY COMPANY 800 Bergen Street, Harrison, New Jersey 07029

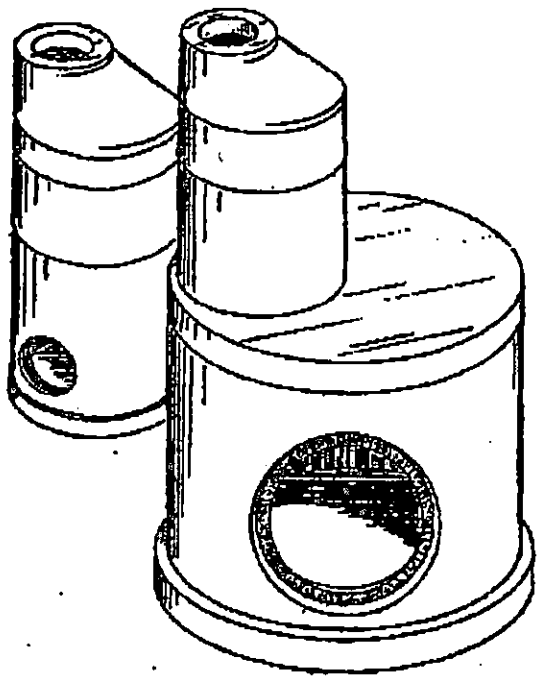
TOTAL P.01

Drawing: D-7

03316 – 1.5

A-LOK®

MANHOLE PIPE CONNECTOR FOR SANITARY SYSTEMS



US PATENTS

3,796,406	3,813,107
3,832,438	4,159,829
4,508,355	4,073,048

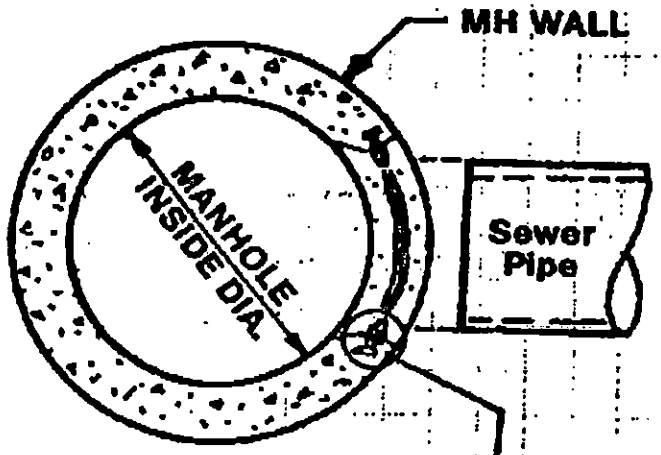
CANADIAN PATENTS

996,150	971,997
1,085,889	1,077,892

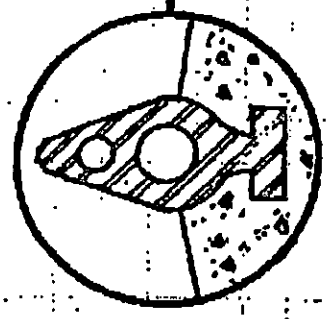
A-LOK® PRODUCTS INC.

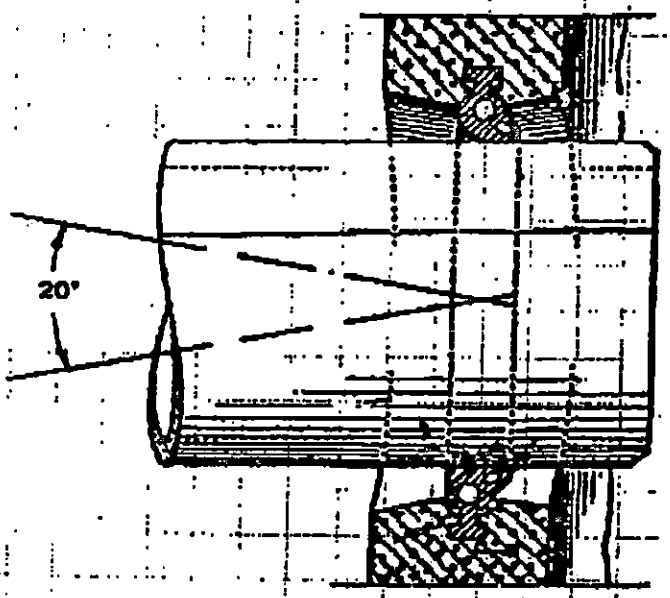
P.O. BOX 1647
TULLYTOWN, PA 19007
1-800-822-ALOK

697 MAIN STREET
TULLYTOWN, PA 19007
(215) 547-3366



CROSS SECTION
OF A-LOK BEFORE INSTALLATION





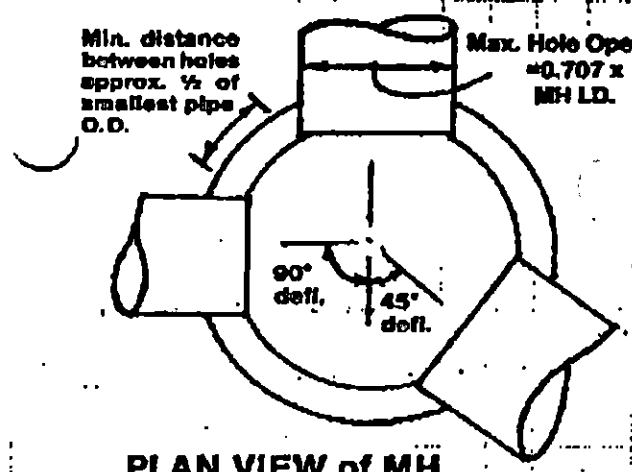
CROSS SECTION
OF A-LOK AFTER INSTALLATION

Drawing: # D-8-A

DESCRIPTION:

The A-LOK is a high performance flexible connector designed to produce a positive watertight connection for pipes entering precast manholes and other concrete structures. The rubber connector is compounded from a polyisoprene blend whose performance has been proven to be excellent for use in sanitary systems.

Integral placement of the connector in the concrete wall is achieved by use of a two part precision mandrel with a positive securing system to "lock in" connectors on the correct line and grade.



PLAN VIEW of MH

ADVANTAGES:

1.) A-LOK functions on pure compression, making field installation quick and easy. Clean and lubricate both connector and pipe; center pipe in connector and insert.

2.) The A-LOK connector assures a positive watertight connection, providing 10 degrees of omnidirectional deflection to eliminate infiltration and shear due to settlement or ground movement. This flexibility permits immediate backfill enhancing project safety, and overcoming the problems normally encountered with water, running sand and other unstable trench conditions.

3.) On larger diameter pipe when size prohibits it being installed in a flat plane the physical configuration of the A-LOK allows it to be cast in a curve with a radius progression of rotation. This design has resulted from years of extensive research and development and causes no loss in compression or deflection.

MANHOLE DIA.	MAX. PIPE SIZE O.D. From Straight thru to 45° Defl.	MAX. PIPE SIZE O.D. If 90° Defl.
4 ft.	31½ in.	25 in.
5 ft.	42 in.	32 in.
6 ft.	51 in.	38 in.
7 ft.	59 in.	44 in.
8 ft.	73½ in.	50 in.

SPECIFICATIONS & TESTING:

1.) Available for pipes from 4" through 60" inside diameter.

2.) The A-LOK meets all material and performance requirements of A.S.T.M. Standard C-923 titled "Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes." Some of the requirements are given in the attached tables.

RESILIENT TEST REQUIREMENTS of A.S.T.M. C-923

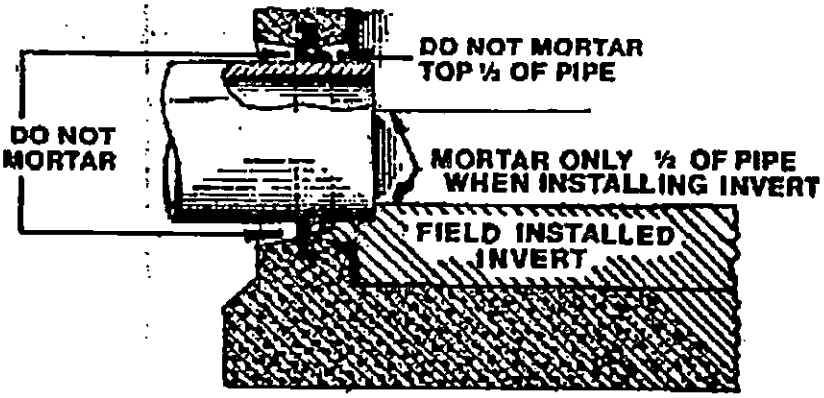
Test	Test Requirements	ASTM Method
Chemical resistance:		
1 N sulfuric acid	no weight loss	D 543, at 22 C for 48 h
1 N hydrochloric acid	no weight loss	
Tensile strength	1200 psi or 8.3 MPa, min	D 412
Elongation at break	350%, min	
Hardness	±5 from the manufacturer's specified hardness	D 2240 (Shore A durometer)
Accelerated oven-aging	decrease of 15%, max, of original tensile strength, decrease of 20%, max, of elongation	D 573, 70 ± 1 C for 7 days
Compression set	decrease of 25%, max, of original deflect'	D 395, Method B, at 70 C for 22 h
Water absorption	increase [illegible], max, of [illegible] by weight	D 471, Immerse 0.75 by 2 in. or 19 by 25 mm specimen in distilled water at 70 °C for 48 h
Ozone resistance	rating 0	D 1171
Low-temperature brittle point	no fracture at −40 C	D 746
Tear resistance	200 lbf/in. or 35 kN/m	D 624, Method B

A-LOK INSTALLATION INSTRUCTIONS

A-LOK is a compression gasket sized to fit pipe barrel. Entry pipe should have a smooth outside surface and the correct diameter. Clean and lubricate A-LOK and pipe end which will be inserted into A-LOK. Care should be taken to lube the entire portion of pipe which will slide through A-LOK. When pipe barrel is lubricated, pipe can be reversed or deflected without twisting A-LOK rubber. Pipe can be installed in either direction from inside or outside of manhole. If pipe is cut, care should be taken to allow no sharp edges. A slight bevel is preferred as a lead and this should also be lubricated. Entry adapters are available if necessary to enhance centering and coupling of pipe to manhole. Pipe bedding on outside of manhole is critical as non-rigid pipe may ovate if not bedded correctly. Mortling trowel should be run between pipe and A-LOK after installing to remove any mud, stone, or excess lubricant.

WARNING

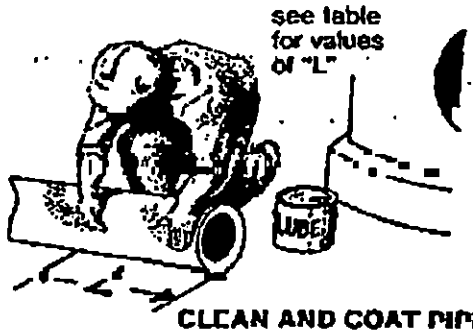
Because of the A-LOK connector's ability to insure a flexible, watertight joint, it is our strong recommendation that no mortar be placed around the connector at all on the outside of the structure and that no mortar be placed around the top half of the connector on the inside when completing the invert work. The use of mortar in either of these areas would eliminate the flexibility for which the connector is designed, and cause problems of shear.



1

CLEAN & LUBRICATE GASKET

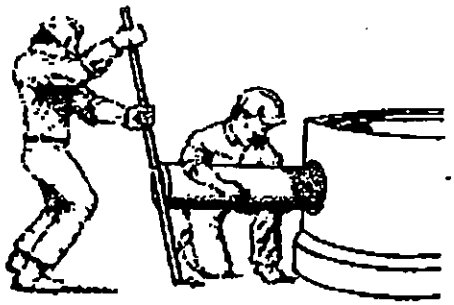
2



CLEAN AND COAT PIPE WITH LUBRICANT

"L" Inches FROM END

3



CENTER UP PIPE & PUSH HOME

PIPE DIA.	"L" MIN.
4"	12"
6"	"
8"	"
10"	"
12"	"
15"	"
16"	18"
18"	"
21"	24"
24"	"
27"	"
30"	"
33"	"
36"	"
42"	"
48"	"
54"	"
60"	"

A-LOK® PRODUCTS INC.

P.O. BOX 1647
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(215) 547-3366

A-LOK PIPE TO MANHOLE CONNECTOR INSTALLATION

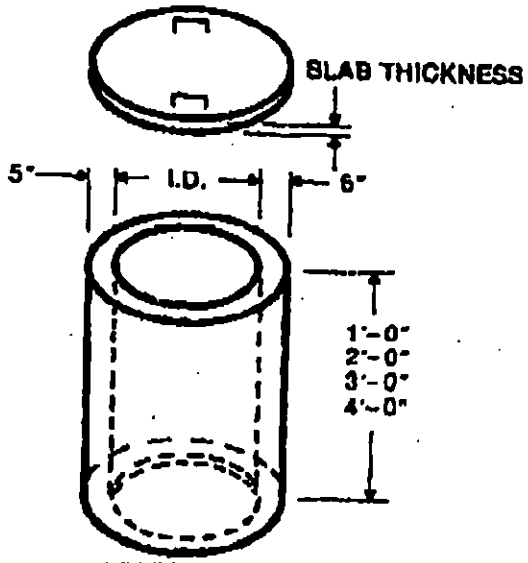
6893

FORT MILLER
THE FORT MILLER CO. INC

Precast MH Extension

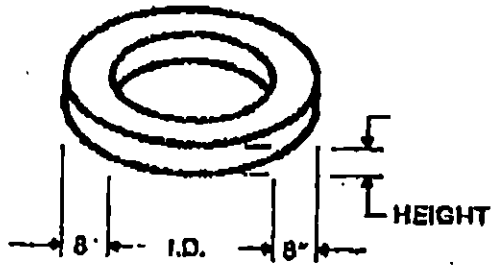
Grade & Access Extensions

CONCRETE:	4000 PSI
REINFORCEMENT:	ASTM A615 - GRADE 60 ASTM A185 - GRADE 65
ENTRAINED AIR:	5.0% - 9.0%



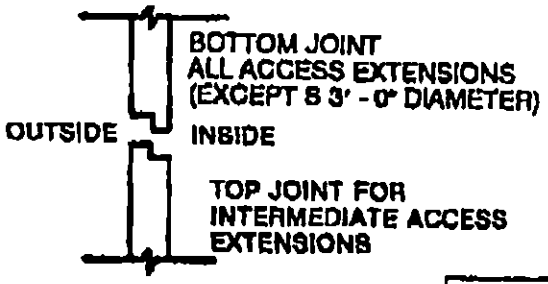
ACCESS EXTENSION

(INTERMEDIATE EXTENSIONS AVAILABLE)



GRADE EXTENSION

DESIGNED FOR AASHTO H-20 LOADING
30% IMPACT
SOIL PRESSURE 120 PCF



ACCESS EXTENSION JOINT DETAIL

WEIGHTS, LBS

GRADE EXTENSIONS		
I.D.	HEIGHTS AVAILABLE	LBS PER INCH OF HEIGHT
2' - 0"	4", 6", 8", 10"	68
2' - 6"	3", 5", 7", 9"	80

ACCESS EXTENSIONS			
I.D.	SLAB THICKNESS	SLAB WEIGHT	LBS PER FOOT
2' - 0"	3"	238	480
2' - 6"	4"	433	578
3' - 0"	4"	570	665

DESIGN CASE 1 (TRAFFIC)

L-X PRODUCT DATA

SHEET NO. 4.50

03310-1.5

EPOLON
22 BLACK MASTIC

PRODUCT DESCRIPTION: A heavy duty, interior/exterior, multi-mil, two component, coal tar epoxy compound. Specifically designed for the protection of steel and concrete in immersion service or where unusual resistance to severe humidity, corrosion, fresh or salt water immersion, abrasion, impact or general chemical attack is required.

RECOMMENDED USES: For use on: properly prepared steel and concrete surfaces such as concrete pipes, plant equipment, sewerage plants, cooling towers, underground tanks, barges, bulkheads, bridges, conveyors or sludge vessels and various chemical plants. Do not use for potable water service.

PERFORMANCE STANDARDS:

APPLICABLE STANDARDS: Meets performance requirements of Steel Structures Painting Council SSPC-16-68T and Corps of Engineers Specification C200a.

CHEMICAL RESISTANCE:

Immersion	Frequent Contact	Occasional Contact
Salt Solutions	Solvents	Organic Acids
Fresh Water	Alcohols	Mineral Acids
Crude Oil	Vegetable Oils	Oxidizing Agents
Alkalies.	Petroleum Products	

GENERIC TYPE: Coal Tar Epoxy-Polyamide

FINISH: Semi-gloss

RECOMMENDED FILM THICKNESS:
Wet: 11 - 14 Mils
Dry: 8 - 10 Mils

THEORETICAL COVERAGE:
115 - 145 Sq. Ft./Gallon at
8 - 10 Mils Dry Film Thickness

DRYING TIME @ 75°F HUMIDITY 50%:
To Touch: 4 Hours
To Handle: 8 Hours
To Recoat: 18 Hours and within
72 Hours Maximum

MIXING RATIO: 4:1 By Volume

DRY HEAT RESISTANCE:
Continuous: 200°F
Intermittent: 250°F

REDUCER: EPOLON 145 REDUCER

APPLY BY: Airless Spray Recommended
Brush or Roller for small areas.

APPLICATION CONDITIONS:
Relative Humidity: Up to 85%
Temperature: 50° - 100°F
Surface Temp.: 5°F above Dew Point

COLOR: Black

NUMBER OF COATS RECOMMENDED: Two

TOTAL SOLIDS:
Volume: 71 - 73%
Weight: 81 - 83%

NUMBER OF COMPONENTS: Two

INDUCTION TIME @ 75°F: 30 Minutes

POT LIFE @ 75°F (Mixed): Up to 8 Hours

FLASH POINT (Mixed): 80°F (TCC)

VOLATILE ORGANIC COMPOUND:
Less than 2.0 Pounds Per Gallon

WEIGHT PER GALLON (Mixed): 10.6 lbs average

VISCOSITY @ 77°F (Mixed): 100 - 110 Krebs Units

SHELF LIFE: Up to 24 Months at Recommended Storage Conditions

STORAGE CONDITIONS: Indoors at 45° - 100°F

PACKAGED: One and Five Gallon Kits
One Gallon Kit: 1 Gallon Container Component A part filled @ .8 Gallon
1 Quart Container Reactor B part filled @ .2 Gallon
Five Gallon Kit: 5 Gallon Container Component A part filled @ 4 Gallons
1 Gallon Container Reactor B

EPOLON
22 BLACK MASTIC

MIXING

Mix contents of each component thoroughly to obtain a uniform consistency and insure no pigment remains bottom of can. Pour the contents of the container marked "Reactor B" into the slack filled container marked "Component A" or in the ratio of 4 parts "Component A" to 1 part "Reactor B" by volume while under agitation. Continue agitation until the two components are thoroughly mixed. Allow to stand 30 minutes prior to application. Re-stir before using. Do not use mixed material beyond recommended pot life. Temperatures above 75°F will shorten pot life.

SURFACE PREPARATION

Prepare surface by method suitable for service and exposure. All surfaces must be dry, clean and free of all paint, rust and other foreign matter. Do not paint in dampness or temperatures below 50°F.

STEEL: All surface contamination including rust, mill scale, loose paint, old coatings, and all other foreign matter must be removed by dry abrasive blasting and coated within 8 hours or before visible rusting occurs. Surface profile of blast not to exceed 2 mils. Prior to blast cleaning, remove all visible deposits of oil and grease in accordance with Solvent Clean SP-1. Round off all rough welds and sharp edges and remove weld spatter. Minimum surface preparation: Immersion service - Near White Blast SP-10. Non-immersion service - Commercial Blast SP-6.

CONCRETE: New concrete must age at least 60 days before coating. Form release agents, curing compounds, salts, all previous coatings, hardeners, and other foreign matter will interfere with adhesion and must be removed and surface properly prepared by mechanical abrasion, abrasive blast, or acid etching. Surface must be swept or vacuumed to remove all spent abrasives, dust and other foreign matter. Minimum surface preparation is acid etch with a 15% muriatic acid solution creating a grainy surface texture, flush and rinse completely and allow to dry thoroughly.

SPECIFICATION

STEEL, IMMERSION, (Near-White Blast SP-10):
2 coats: EPOLON 22 BLACK MASTIC. Total dry film thickness: 16 mils minimum.

STEEL, NON-IMMERSION, (Commercial Blast SP-6):
1st coat: EPOLON RUST INHIBITOR 15 RED.
Finish with: 1 coat: EPOLON 22 BLACK MASTIC.

GALVANIZED METAL OR NON FERROUS METALS, RUST FREE (Solvent Clean SP-1):
1st coat: METAL BOND 47 PRIMER.
Finish with: 2 coats: EPOLON 22 BLACK MASTIC.

CONCRETE, NEW OR UNPAINTED WOOD:
1st coat: EPOLON 22 BLACK MASTIC (reduced 1 quart per gallon with EPOLON 145 REDUCER).
Finish with: 1 coat: EPOLON 22 BLACK MASTIC. Total dry film thickness: 16 mils minimum.

Allow 5 days curing time at recommended temperature and humidity before putting tank in service. Do not apply over previously painted surfaces.

REDUCER

If thinning is required:
Up to one pint per gallon of EPOLON 145 REDUCER.

RECOMMENDED EQUIPMENT
(or Equivalent)

AIRLESS SPRAY:
Standard airless equipment such as the Graco President or Bulldog 30:1 pump ratio. Inbound pressure 80 - 100 psi and .019" to .023" fluid tip.

Use a 50% overlap with each pass of gun. Airless spray recommended for best film build and to minimize spray dust. EPOLON 22 BLACK MASTIC may be applied, if required, to small areas only by brush and roller. Film build obtained will depend primarily upon the skill and technique of the applicator. In most cases when using brush or roller, a second coat will be necessary to achieve recommended film thickness. Use a short bristle brush or medium nap roller (do not use long nap lambs wool cover). Keep roller saturated with material, working coating into all irregularities. Be sure proper film thickness is obtained. Special attention should be given to sharp edges, boltheads, flanges, rivets, corners, welds and other irregular surfaces to insure they receive proper film thickness equivalent to that recommended for all other adjacent areas.

When applying two coats, be sure first coat is properly cured. Excessive film thickness or conditions of poor ventilation require longer dry times. Excessive humidity or condensation on the surface during curing may result in a surface haze or blush. This should be removed by water washing before recoating. When recoating after 72 hours of application of initial first coat, surface coating must be brush blasted or abraded prior to application.

NOTE: Curing time is extended at temperatures below 70°F and shortened above 70°F. At low temperatures (50°F) curing speed is greatly retarded.

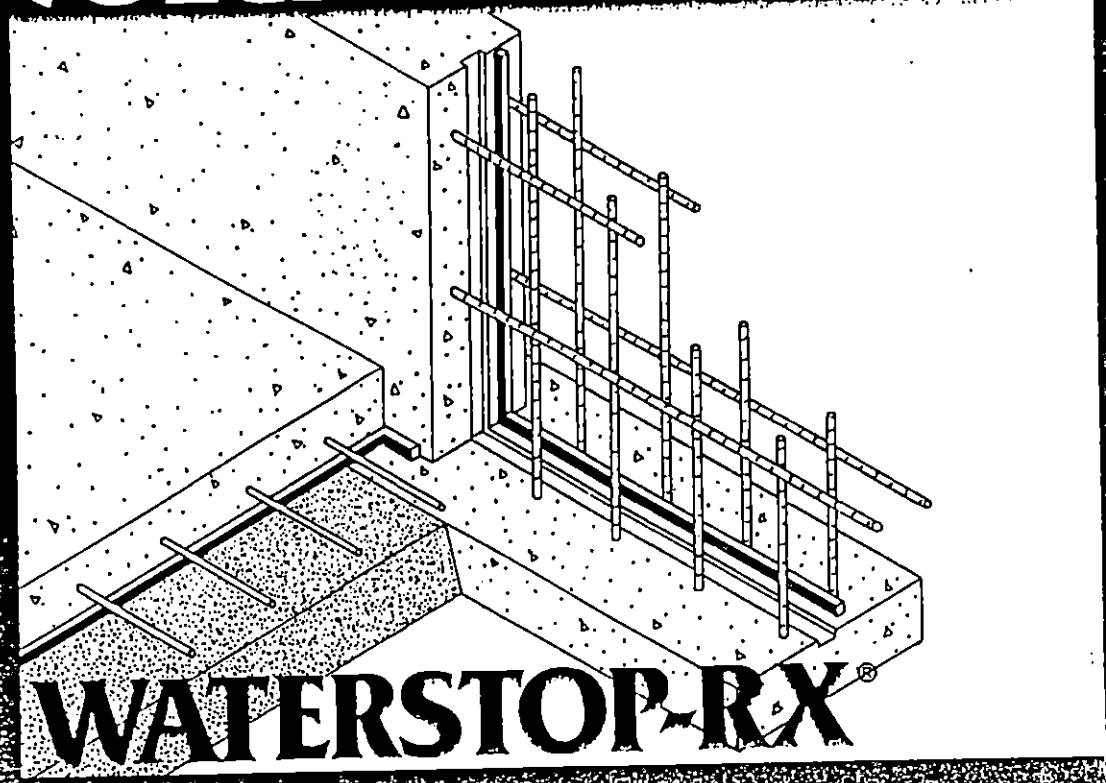
WARNING: FLAMMABLE. Contains xylene, glycol ethers and epoxy resin. Keep away from heat, sparks and open flame. Do not take internally. Explosion proof and non-sparking equipment should be used. May irritate eyes and skin. Prolonged breathing of vapors may irritate respiratory tract causing headache, nausea and dizziness. Use only with adequate ventilation. Avoid contact with skin and breathing of vapors of spray mist. Close container tightly and wash hands properly after each use. Keep out of reach of children. Refer to Material Safety Data Sheet prior to use.

FOR INDUSTRIAL USE ONLY • BY PROFESSIONAL APPLICATORS

CON-LUX Coatings, Inc. Talmadge Road, Box 847 Edison, N.J. 08818-0847
201-287-4000

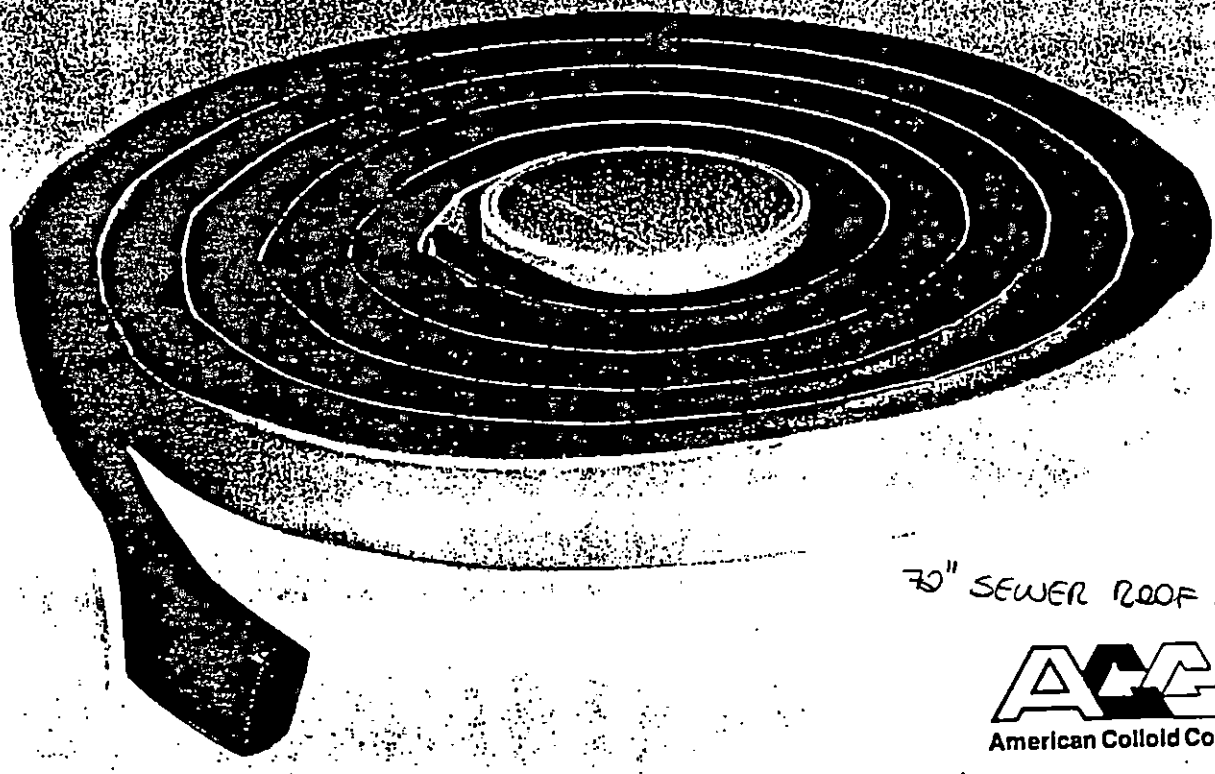
03250/AME
BuyLine 3563

VOLCLAY®



WATERSTOP-RX®

Fast, effective, permanent sealing for concrete joints.



70" SEWER ROOF SLAB

American Colloid Company

Waterstop-RX® helps save time, money... and concrete structures.

stalling conventional waterstops in con-
ete joints is an important (but normally time-consuming) part of concrete construction. It can also be very labor-intensive, reducing e profitability of the job. Most important, nventional waterstops offer only a partial lution to water infiltration, leaving architects, engineers, and contractors open to liability problems.

Iclay® Waterstop-RX® solves water infiltration oblems. It's easy to apply even by a single, inexperienced laborer, cutting installation time in half. It eliminates split-forming and licing. And, its self-healing properties sure that concrete joints remain protected ermanently.

How Waterstop-RX works

he key to Waterstop-RX is its western odium bentonite base. Specified for more than 20 years for foundation waterproofing, bentonite swells in contact with water, forming n impenetrable gel. This property also llows bentonite products to fill in small acks in concrete.

Waterstop-RX comes in a coil. It is applied y adhering the material to the **butt end of** e **concrete** with RX Primer or concrete cut ails—an operation that requires a single laborer. Then pour or place the next section of concrete to complete the joint. No split orming, splicing, or bonding is required as ith conventional waterstops.

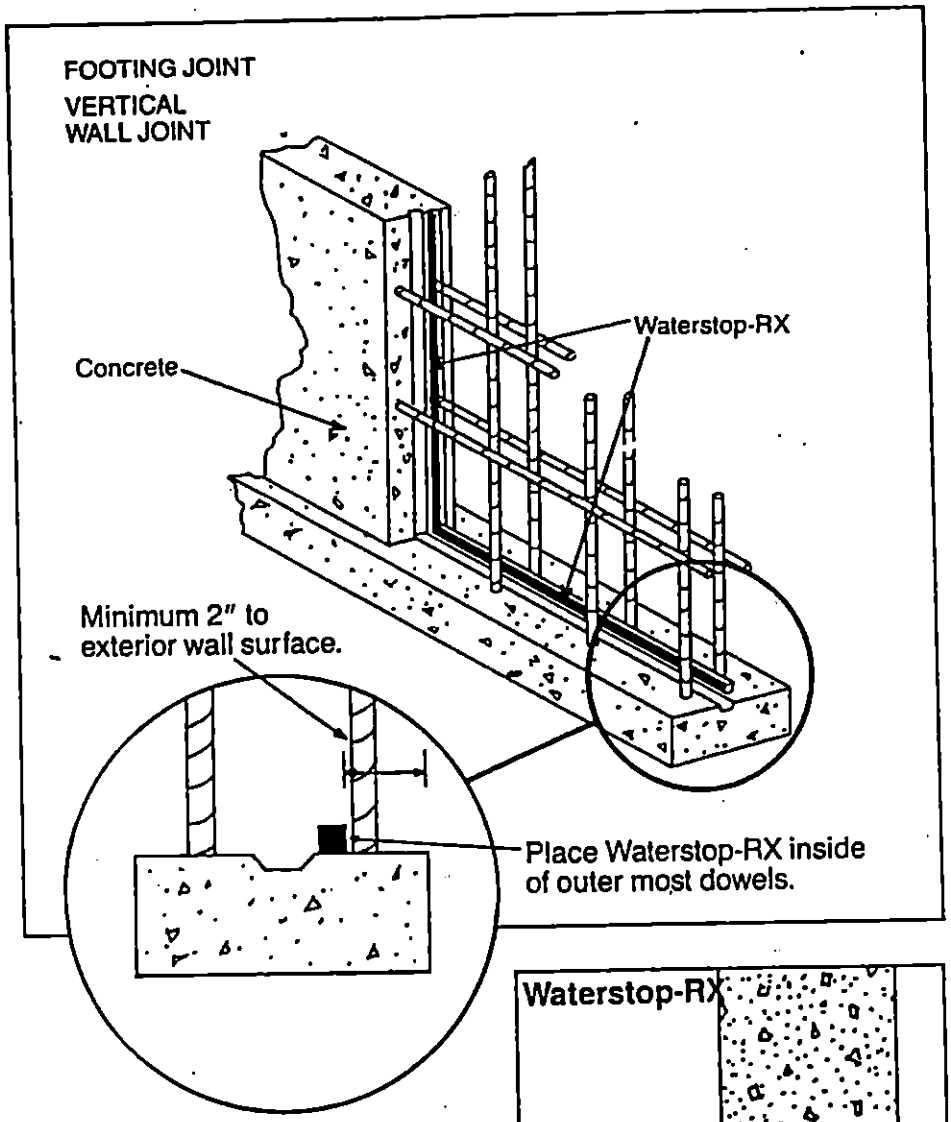
Upon hydration, Waterstop-RX swells to form a self-healing compression seal that ompletely locks out water. This action also revents water migration along the waterstop and in keyways as an extra protection against penetration.

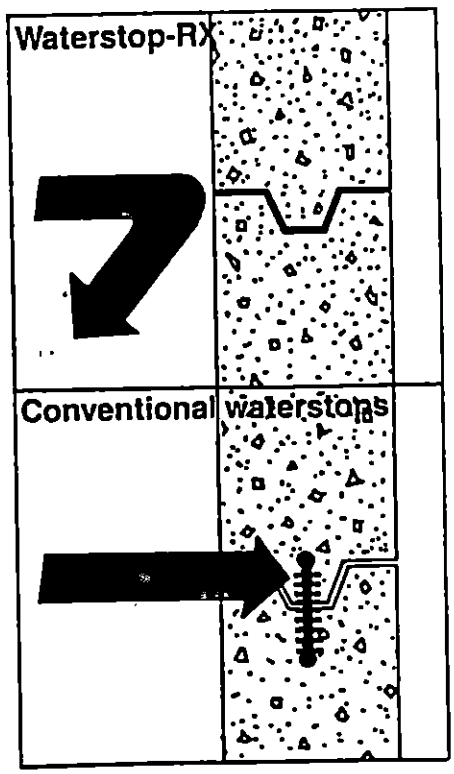
All-weather application

Waterstop-RX has been engineered for use under virtually all temperature conditions. Unlike other popular joint sealants, Waterstop-RX does not become stiff and brittle in cold weather nor spongy and difficult to work with in hot weather. As a result, Waterstop-RX does not have to be heated in cold weather, saving time and money. It also remains totally flexible without shrinking, hardening, or oxidizing regardless of the length of time it is exposed to the elements.

Safe to use

Because Waterstop-RX is non-toxic, no special handling equipment is required. It is clean to the touch, and does not contain any material which can discolor or irritate the skin, helping eliminate lost man-hours.





Waterstop comparison

Upon contact with water, Waterstop-RX swells to form a compression seal that repels water completely. No migration along the waterstop or keyway is allowed.

Water is stopped by a damming effect of hydrostatic pressure, but is allowed to remain inside the joint. This allows lateral movement along the waterstop or in the keyway. If a weak point is found, water can then enter away from the point of original contact, making repair difficult and costly.

Installation procedures

Surface preparation

Joint surfaces should be clean and dry. For best results, Waterstop-RX Primer should be applied to the joint surface prior to adhering Waterstop-RX, especially on vertical joints. The primer creates a tacky surface which allows for excellent adhesion to the concrete.

Positioning

Waterstop-RX is adhered to the butt end of the previous concrete pour and should be positioned a minimum of 2" from the exterior joint surface. Concrete cut nails, Waterstop-RX Primer, or both must be used to secure Waterstop-RX in place to prevent displacement of the material during the pour.

Waterstop-RX may also be installed in a cast in place recess at the exterior side of the joint. In this situation, precautions must be taken to protect Waterstop-RX from hydration prior to backfilling and backfill must be compacted to 85% modified proctor minimum, adjacent to the joint. The recess at the exterior of the joint should match the dimension of Waterstop-RX.

The ends of individual Waterstop-RX coils should be butted together—never overlapped.

Applications

Waterstop-RX is ideal for use on many types of poured in place and below grade precast concrete applications. There should be a minimum of 2" of concrete cover separating the exterior face of the Waterstop-RX from the exterior side of the joint.

NOTE: In cases of lightweight concrete or insufficient coverage, consult the manufacturer.

Use On:

Precast concrete wall panel systems

Septic tanks and sewage treatment plants

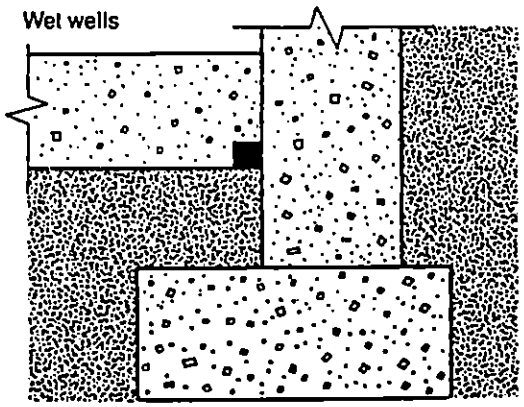
Sanitary and storm sewer manholes

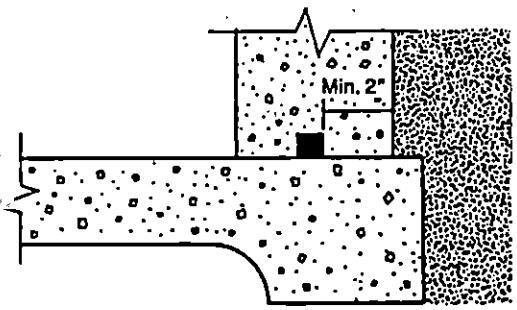
Pipe (round, oval, flatbase, elliptical, and arch types)

Cold joints in foundation slabs or walls below grade

Burial vaults Utility vaults Box culverts

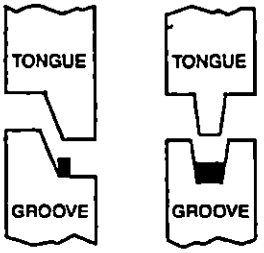
Wet wells



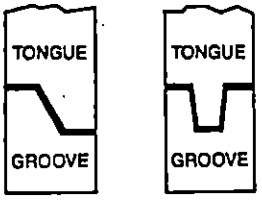


Typical sections showing placement of Waterstop-RX

When sealing manholes—septic tanks—vaults—utility boxes

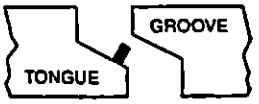


OPEN JOINT

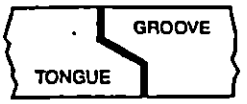


CLOSED JOINT

When sealing concrete pipe and culverts

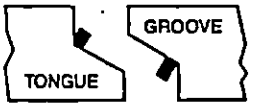


OPEN JOINT

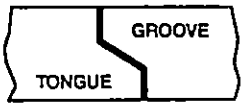


CLOSED JOINT

When a single coil of Waterstop-RX is used, apply as close as possible to the leading edge of the tongue as illustrated.



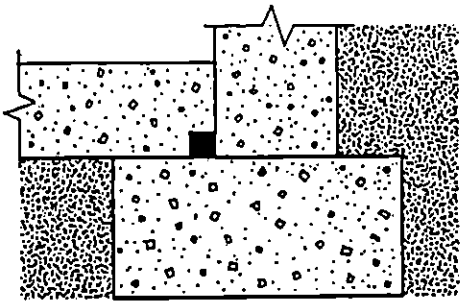
OPEN JOINT

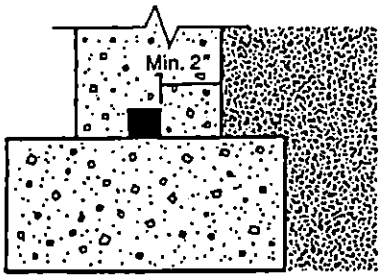


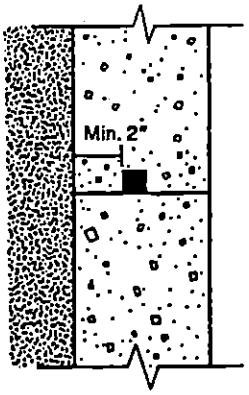
CLOSED JOINT

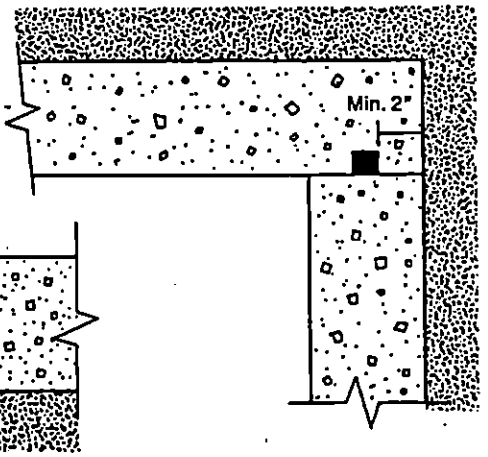
When a double coil of Waterstop-RX is used, apply one coil on the rear sliding surface of the tongue and another coil on the rear sliding surface of the groove or bell as illustrated.

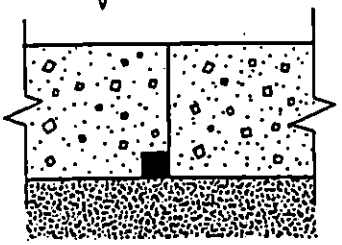
Typical Details











Waterstop-RX® Technical Information

volclay Waterstop-RX® is a flexible strip of bentonite waterproofing compound, coiled in two sizes. Dimensions and other specifications are as follows:

Dimensions	1" × ¾" × 16'6"	¾" × ⅜" × 25'0"
Weight	.50 lbs./ft. minimum	.165 lbs./ft. minimum
Carton Contents	100 L/F	150 L/F
Carton Weight	50 lbs.	25 lbs.
Carton Size	14" × 14" × 10"	14" × 14" × 10"
Pallet Size	4' × 4'	4' × 4'

Chemical Composition

Material	Test Method	Waterstop-RX Results
Butyl Rubber-Hydrocarbon (% by weight)	ASTM D-297	24.9%
Bentonite	SS-S-210-A	75.0%
Volatile matter	ASTM D-6	Below 1%

NOTE: Contains no asbestos fibers or asphaltics.

Physical Properties

Property	Test Method	Waterstop-RX Results
Specific gravity at 77°F	ASTM D-71	1.57
Softening point	ASTM D-30	N/A
Penetration	ASTM D-217 150 GTL 300 GTL	 58 85
Flash point	ASTM D93-97	365
Min. head pressure	Hydrostatic pressure test	231 ft. (100 psi)
Accelerated aging	(Mechanical oven 4 hrs. @ 212° F)	Maintained 99% solids
Flow resistance	(¾" overhead joint exposed to 135° F for 7 days)	No flow
Storage life		Indefinite
Adhesion to clean, dry concrete		Excellent
Application temperature range		5° to 125°F
Service temperature range		−40° to 212°F

Notice: The information presented here is believed to be correct. However, since it is provided without charge and without specific knowledge of the intended use or application of its product, American Colloid Company assumes no obligation or liability with respect to such use or application, and makes no warranty, either expressed or implied, as to the application or use of such product, or to the use or infringement of any patent or other proprietary rights of American Colloid Company or others with respect to such application or use.

Seal concrete joints quickly and permanently with the waterstop that heals itself—Waterstop-RX. For more information, contact your American Colloid Company distributor, or contact us direct.

Distributed by:

Limitations

In conditions where severe ground water contamination is expected, please consult the manufacturer for compatibility information. Waterstop-RX should be confined within a concrete joint with a minimum 2" concrete cover to the exterior of the joint surface. Waterstop-RX may also be installed in a cast-in-place recess at the exterior side of the joint. In this situation, precautions must be taken to protect Waterstop-RX from hydration prior to backfilling and backfill must be compacted to 85% of modified proctor minimum adjacent to the joint. The cast in place recess should match the dimension of the Waterstop-RX being used.

An exposed length of coil should not be submerged for extended periods of time. If Waterstop-RX exhibits considerable swelling prior to confinement in the joint, it must be replaced with new material. To avoid displacement of Waterstop-RX during or prior to concrete placement, cut nails and/or Waterstop-RX Primer must be used to hold the material in place. Proper care should be taken during concrete placement to avoid displacing the Waterstop-RX strip. Waterstop-RX is not an expansion joint product and should not be used as such.

NOTE: In cases of lightweight concrete or insufficient coverage, consult the manufacturer.

Warranty

American Colloid Company warrants its materials to be of good quality and will replace material proved to be defective. In no instance will American Colloid Company be liable for labor costs or incidental damage associated with the use of this product, unless stated in a warranty for a specific project.

Document

This brochure contains information to supplement information service available from American Colloid Company's Building Materials Division and from local distributors.

Application Assistance

Local distributors of Waterstop-RX are qualified to aid in solving problems related to use of this product. In the event that your needs are special or you have an unusual situation, your local Waterstop-RX distributor will arrange to have a factory representative contact you for personal assistance.

American Colloid Company
Building Materials Division
1500 W. Shure Drive
Arlington Heights, IL 60004
1-312-392-4600 FAX 1-312-506-6199
1-708-392-4600* TELEX ITT 4330321
*(After Nov. 1st, 1989)
Sales Offices:
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Newton, MA 02166 • 1-617-965-0895
Suite 400 • 6525 Corners Parkway
Norcross, GA 30092 • 1-404-263-7601
23015 Del Lago Drive, Suite 1014
Laguna Hills, CA 92653 • 1-714-380-7420

Form No. WS-200 689 36.6M Printed in U.S.A.

RECONSTRUCTION OF EXISTING 30" and 72" SEWERS BY INSITU FORM LINING

TECHNICAL DATA SHEET

CoRezyn VE8319

CoRezyn VE8319 is a thixotropic, non-promoted, corrosion resistant, Bisphenol-A Epichlorohydrin based vinyl ester resin formulated for Insituform.

TECHNICAL DATA

TYPICAL LIQUID RESIN PROPERTIES:

Viscosity, (Brookfield Model LVT)	
#3 spindle @ 20 rpm, cps	3,200
Thixotropic Index	3.6
SPI Gel Time, 1.0% Active BPO, 180°F Oil Bath	
Gel Time, 150 to 190°F, minutes	16
Percent Non-Volatile	59
Weight per gallon, pounds	8.75

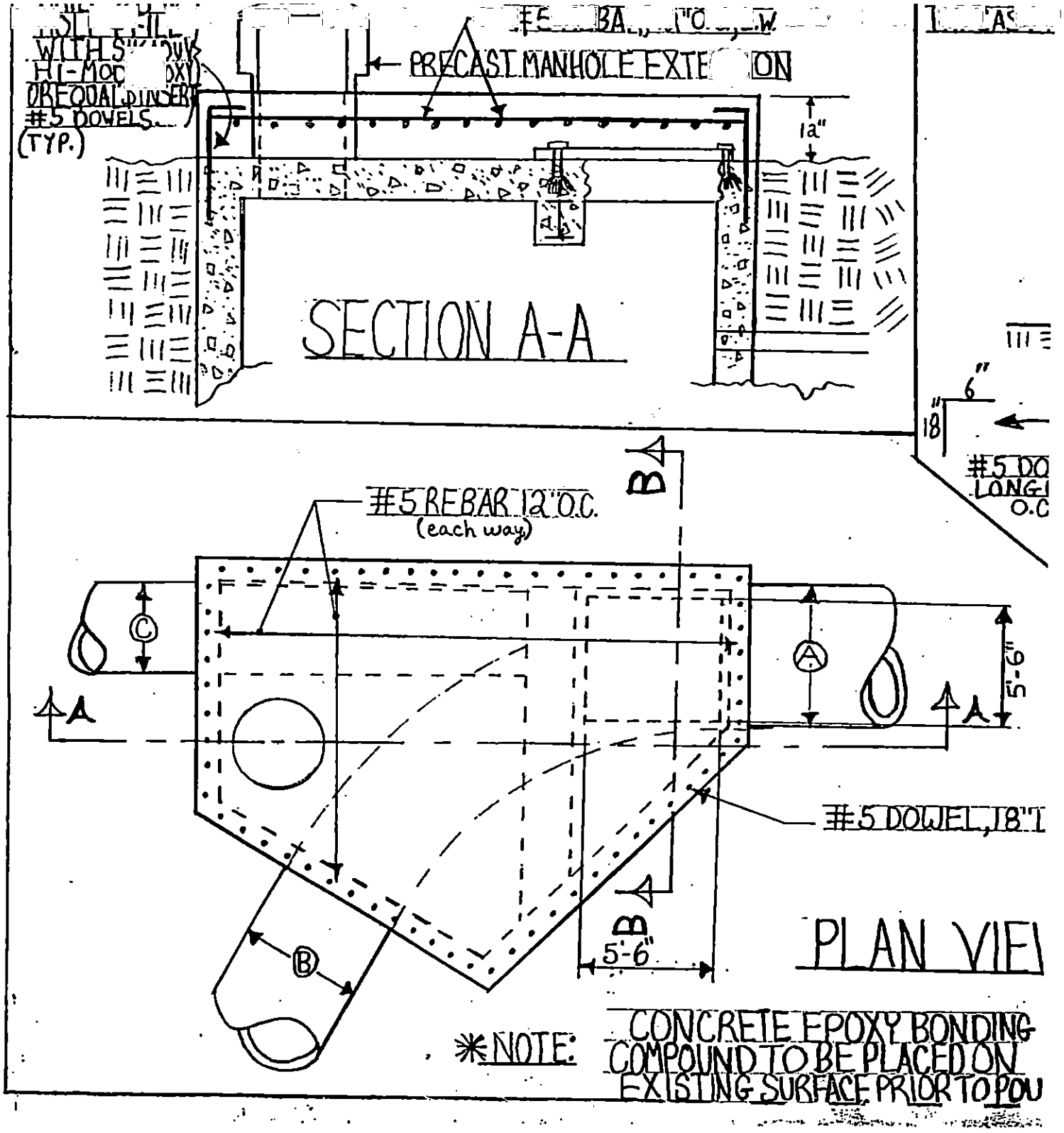
TYPICAL PROPERTIES OF A 1/8TH INCH THICK CLEAR CASTING:

Flexural Strength, psi, ASTM D790	18,000
Flexural Modulus, psi x 10^5, ASTM D790	4.5
Tensile Strength, psi, ASTM D638	11,600
Tensile Modulus, psi x 10^5, ASTM D638	4.7
Percent Elongation, ASTM D2583	5.0
Barcol Hardness, 934-1, ASTM D2583	54
Heat Distortion, °F, ASTM D648	210

TYPICAL PROPERTIES OF A 6mm INSITUFORM FELT LAMINATE

Esperox 570P, weight percent	1.0	0.0
Percadox 16N, weight percent	0.0	1.0
Trigonox C, weight percent	0.5	0.5
Flexural Strength, psi, ASTM D790	11,300	11,200
Flexural Modulus, psi x 10^5, ASTM D790	4.9	5.0
Tensile Strength, psi, ASTM D638	7,100	7,000
Tensile Modulus, psi x 10^5, ASTM D638	5.2	5.4
Percent Elongation, ASTM D2583	2.13	2.00

This Technical Data Sheet supersedes any issued prior to 10/1/91. DJH


PRECAST MANHOLE EXTE ON
WITH
HI-MOD
#5 DOWELS
(TYP.)
12"
SECTION A-A
6"
18"
#5 DO
LONGI
O.C
#5 REBAR 12" O.C.
(each way)
B
C
A
5'-6"
A
#5 DOWEL, 18" L
B
5'-6"
B
PLAN VIEW
*NOTE: CONCRETE EPOXY BONDING COMPOUND TO BE PLACED ON EXISTING SURFACE PRIOR TO POU

NEOPRENE BOOT CONNECTION-
INFILTRATION LEAKING
TRENCH

McMASTER-CARR
supply company

P.O. BOX 440 • NEW BRUNSWICK, NJ 08903-0440

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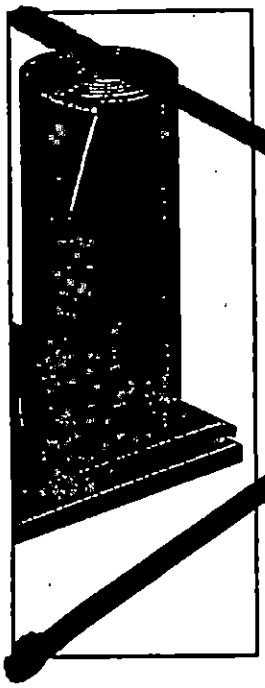
PLANT LOCATION

Dayton, New Jersey, U.S.A.

MAIL ADDRESS

P.O. Box 440
New Brunswick, NJ 08903-0440 U.S.A.

High-Grade Neoprene Rubber Sheeting

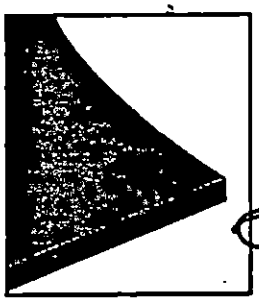


- *Color: Black* • *Durometer Hardness, Shore A: Soft, 35-45; Medium, 45-55; Firm, 55-65; Hard, 65-75*
- *Tensile Strength: 1500 psi* • *Temperature Range: −20° to +170° F*

The high tensile strength of 1500 psi makes this premium grade rubber a great choice for the most demanding applications. It takes rough handling with minimal abrasion and maintains its resiliency after extended compression. This neoprene has better resistance to oil, heat, ozone, oxidation, and flame than natural rubber. Appli[illegible] include belting, mountings, seals, diaph[illegible], and insulation. Neoprene has all the s[illegible] resistance to general chemicals, except o[illegible]trated acids, as natural rubber. Meets A[illegible]-2000-86E, Type BC and military specificati[illegible]L-R-3065.

Thic[illegible]	Soft No.	Soft NET EACH	Medium No.	Medium NET EACH	Firm No.	Firm NET EACH	Hard No.	Hard NET EACH
12" x 12[illegible]EETS								
1/16"	8568K511	$2.64	8568K611	[illegible]	8568K711	$2.36	8568K811	$2.48
3/32"	8568K512	4.14	8568K612	[illegible]	8568K712	3.64	8568K812	3.68
1/8"	[illegible]568K513	4.82	8568K[illegible]	4.18	8568K713	4.50	8568K813	4.21
3/16"	[illegible]K514	6.50	856[illegible]	5.61	8568K714	5.68	8568K814	5.50
1/4"	8568[illegible]	7.03	[illegible]K615	6.50	8568K715	7.47	8568K815	6.75
3/8"	8568K5[illegible]	9.22	[illegible]K616	8.59	8568K716	10.08	8568K816	8.78
1/2"	8568K517	[illegible]	8568K617	11.59	8568K717	13.38	8568K817	11.68
3/4"	8568K518	[illegible]	8568K618	15.43	8568K718	17.86	8568K818	13.58
1"	8568K51[illegible]	[illegible]	8568K619	20.55	8568K719	23.62	8568K819	17.34
12" x 24" SHEETS								
1/16"	85[illegible]1	4.77	[illegible]K621	4.55	8568K721	4.29	8568K821	4.45
3/32"	[illegible]K522	6.25	856[illegible]2	7.13	8568K722	6.55	8568K822	6.65
1/8"	[illegible]568K523	8.08	8568K6[illegible]	7.58	8568K723	8.10	8568K823	7.58
3/16"	8568K524	11.89	8568K624	[illegible]0.63	8568K724	10.60	8568K824	10.11
1/4"	8568K525	12.91	8568K625	[illegible]	8568K725	13.69	8568K825	12.37
3/8"	8568K526	17.10	8568K626	15.[illegible]	8568K726	10.68	8568K826	16.20
1/2"	8568K527	23.30	8568K627	21.48	[illegible]K727	24.75	8568K827	21.65
[illegible]	8568K528	30.38	8568K628	28.62	856[illegible]28	33.36	8568K828	30.22
[illegible]	8568K529	39.88	8568K629	38.42	8568K[illegible]	44.16	8568K829	38.58
Thick.	No.	NET/LIN. FT.	No.	NET/LIN. FT.	No.	NET/LIN[illegible]	No.	NET/LIN. FT.
36" WIDE ROLLS								
1/16"	8568K11	$6.43	8568K31	$6.12	8568K19	$5.77	[illegible]K41	$6.00
3/32"	8568K12	10.08	8568K32	9.62	8568K21	8.04	85[illegible]2	8.96
1/8"	8568K13	11.71	8568K33	10.20	8568K22	10.93	8568K[illegible]	10.23
3/16"	8568K14	15.60	8568K34	13.95	8568K23	14.15	8568K44	13.25
1/4"	8568K15	20.52	8568K35	15.60	8568K24	17.95	8568K45	[illegible]
3/8"	8568K16	22.78	8568K36	21.22	8568K25	24.89	8568K46	21[illegible]
1/2"	8568K17	31.07	8568K37	28.62	8568K26	33.00	8568K47	28.6[illegible]
3/4"	8568K58	44.20	8568K68	44.20	8568K78	44.20	8568K88	44.20
1"	8568K59	59.90	8568K69	59.90	8568K79	59.90	8568K89	59.90

Commercial-Grade Neoprene Rubber Sheeting



- *Color: Black* • *Temperature Range: −20° to +220° F*
- *Tensile Strength: 1000 psi* • *Durometer Hardness, Shore A: 45-55*

Tensile strength of 1000 psi gives this commercial-grade neoprene the ability to handle most general purpose applications. It is great for gaskets, pump and tank flanges, diaphragms, shock absorbers, and insulation. This rubber stands up well to oil, abrasion, and weather. The rubber conforms to irregular flange joints, and it seals under minimum bolt loads.

Thick.	12" x 12" Sheets No.	12" x 12" Sheets NET EACH	12" x 24" Sheets No.	12" x 24" Sheets NET EACH	36" Wide Rolls No.	36" Wide Rolls NET/LIN. FT.
1/32"	9455K31	$3.13	9455K21	$4.06	9455K1	$5.30
1/16"	9455K32	3.32	9455K22	4.71	9455K2	6.18
[illegible]	9455K33	3.94	9455K23	7.09	9455K3	9.24
1/8"	9455K34	5.35	9455K24	9.51	9455K4	12.40
3/16"	9455K35	6.94	9455K25	12.28	9455K5	15.99
1/4"	9455K36	9.49	9455K26	16.58	9455K6	21.62
3/8"	9455K37	12.00	9455K27	22.42	9455K7	29.23
1/2"	9455K38	14.93	9455K28	26.86	9455K8	35.14

[illegible]ndustrial-Grade Cloth-Inserted [illegible]eoprene Rubber Sheeting

- *Color: [illegible]* • *Temperature Range: −20° to +[illegible]*
- *Tensile Str[illegible] 1000 psi* • *Durometer Har[illegible], Shore A: 45-55*

Fabri[illegible]nforcement provides the [illegible]ngth needed for stress ap[illegible]lions such as gasketing [illegible] diaphragm packing. A 6.7-oz. [illegible]on ply is inserted per 1/16" of [illegible] thickness. Sheets resist abr[illegible] oil, and weather. Meets ASTM [illegible]0-75E, Type BC.

Thick.	12" x 12[illegible]eets No.	12" x 12[illegible]eets NET EACH	12" x 24" Sheet[illegible] No.	12" x 24" Sheet[illegible] NET EACH	48" Wide Rolls No.	48" Wide Rolls NET/LIN. FT.
1/16"	86[illegible]1	$5.63	8698K51	$9.88	86[illegible]	$12.55
3/32"	[illegible]K72	8.17	8698K52	14.30	8698[illegible]	18.18
1/8"	[illegible]698K73	10.89	8698K53	19.05	8698K[illegible]	[illegible]24.23
[illegible]	8698K74	14.63	8698K54	26.00	8698K34	[illegible]
[illegible]	8698K75	17.31	8698K55	31.18	8698K35	[illegible]

[illegible]emium-Grade Nylon-Inserted [illegible]oprene Rubber Sheeting

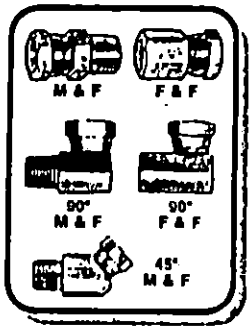
- *Color: Bl[illegible] Temperature Range: −40° t[illegible]20° F*
- *Tensile Strength [illegible]00 psi* • *Durometer [illegible]ness, Shore A: 65-75*

[illegible] inserts give rubber [illegible]ter tensile strength and de[illegible]bility than cloth plies, making it better for diaphragm packing. A [illegible]-oz. nylon ply is inserted for [illegible] 1/16" of thickness. Resistant to as[illegible]n, oil, and weather. Meets AST[illegible]2000-2BE715.

Thick.	12" x [illegible] Sheets No.	12" x [illegible] Sheets NET EACH	12" x 24" Shee[illegible] No.	12" x 24" Shee[illegible] NET EACH	48" Wide Rolls No.	48" Wide Rolls NET/LIN. FT.
1/16"	[illegible]K31	$6.09	8599K31	$12.05	[illegible]K11	$20.43
3/32"	[illegible]99K32	8.88	8599K32	15.76	8[illegible]12	26.71
1/8"	8599K33	11.99	8599K33	21.40	8599[illegible]	36.29
[illegible]	8599K34	15.27	8599K34	27.50	8599K[illegible]	46.66
[illegible]	8599K35	18.26	8599K35	33.22	8599K1[illegible]	61.92

Hose Accessories

Hydraulic Hose Swivel Adapters



Designed to prevent hose stress due to twisting during assembly, these easy-to-assemble adapters are excellent for confined areas.

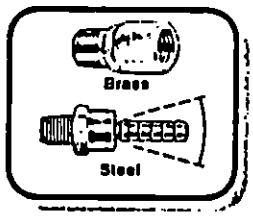
Adapters are made of steel with a corrosion-resistant finish. To minimize piping leaks, the swivel ends of each adapter have dry seal pipe threads.

Adapters are available in straight or angle styles, male pipe × female pipe swivel, or female pipe × female pipe swivel.

Threads Pipe Swivel NPT × NPS	Straight Male & Female No.	NET EACH	Straight Female & Female No.	NET EACH	90° Elbows Male & Female No.	NET EACH
1/8" × 1/8"	5340K11	$0.87	5340K21	$0.96	5340K31	$1.93
1/4" × 1/4"	5340K12	1.11	5340K22	1.21	5340K32	1.91
3/8" × 3/8"	5340K13	1.49	5340K23	1.51	5340K33	2.36
1/2" × 1/2"	5340K14	1.67	—	—	5340K34	2.87
1/2" × 1/2"	5340K15	1.89	5340K25	1.93	5340K35	2.98
3/4" × 3/4"	5340K17	3.23	5340K27	2.96	5340K37	4.92

Threads Pipe Swivel NPT × NPS	90° Elbows Female & Female No.	NET EACH	45° Elbows Male & Female No.	NET EACH
1/8" × 1/8"	5340K41	$1.95	5340K51	$1.68
1/4" × 1/4"	5340K42	1.87	5340K52	1.87
3/8" × 3/8"	5340K43	2.38	5340K53	2.26
1/2" × 3/8"	—	—	5340K54	3.11
1/2" × 1/2"	5340K45	3.04	5340K55	3.00
3/4" × 3/4"	5340K47	4.79	5340K57	4.64

Pneumatic In-Line Hose Swivels



Full 360° hose swivel helps eliminate the nagging problem of hose twisting and kinking. . . especially at critical connection points in air lines. Choose from brass or steel construction.

BRASS CONSTRUCTION– Include threaded male on one end and female on the other end. Pressure rating is 300 psi.

NPT M × F	No.	NET EACH
1/4" × 1/4"	4480K11	$2.59
3/8" × 3/8"	4480K12	5.29

STEEL CONSTRUCTION– Have threaded 1/4" male NPT on one end, female hose end or swivel barb on the other end. Black oxide finish.

Description	No.	NET EACH
Male 1/4" NPT × Swivel Barb for 1/4" ID Hose	5302K63	$4.79
Male 1/4" NPT × Swivel Barb for 3/8" ID Hose	5302K64	4.79
Male 1/4" NPT × 1/4" NPT [illegible]	[illegible]	[illegible]

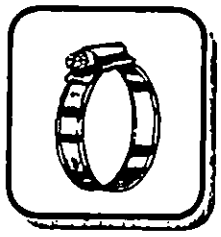
360° Hydraulic Hose Swivel Joints

Designed for a 90° angle connection with a full 360° swivel, these joints eliminate annoying hose twisting and kinking. Joints prevent excessive flexing which means no more long radius bends. Ideal for use in most applications where hose moves, bends, and twists.

Plated steel construction. Threaded male on one end and female on the other end. May be used for hydraulic applications up to 3000 psi.

NPT Thread M × F	No.	NET EACH
1/4" × 1/4"	5381K15	$28.51
3/8" × 3/8"	5381K16	23.61
1/2" × 1/2"	5381K17	25.36
3/4" × 3/4"	5381K18	31.01
1" × 1"	5381K36	49.17

316 Stainless Steel Unperforated Worm Drive Hose Clamps



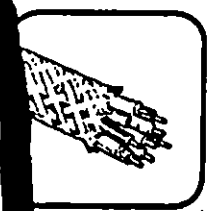
Extra-wide band threads are stamped, leaving the unperforated clamps smooth on the inside—the risk of damage to your hose is eliminated.

Made of 316 stainless steel, these clamps are ideal for use in environments with an aggressive atmosphere and high risk of corrosion. The joining of the band to the housing is arranged so that the least possible deviation from a circular shape arises while the clamps are being tightened. The bands and screw threads are properly pitched-virtually immune to vibration back-off. Band width is 3/4". Slotted hex head screws are 5/16".

Clamps are sold in packages of 10.

Clamp Diameter inches Min.	Max.	Range mm Min.-Max.	No.	NET/PKG
7/16	3/4	11- 17	45945K61	$13.26
1/2	7/8	13- 20	45945K62	13.92
5/8	1 1/16	15- 24	45945K63	13.92
3/4	1 3/16	19- 28	45945K64	14.64
7/8	1 7/16	22- 32	45945K65	14.64
1 1/16	1 5/8	26- 38	45945K66	15.36
1 1/4	1 7/8	32- 44	45945K67	15.78
1 1/2	2 1/16	38- 50	45945K68	18.40
1 3/4	2 3/8	44- 56	45945K69	16.80
2	2 11/16	50- 65	45945K71	17.28
2 5/16	3 1/8	58- 75	45945K72	18.15
2 11/16	3 1/2	68- 85	45945K73	18.94
3	3 7/8	77- 95	45945K74	19.87
3 7/16	4 9/16	87-112	45945K75	21.19
4 1/8	5 9/16	104-138	45945K76	22.70
5 1/8	6 9/16	130-165	45945K77	22.91
6 1/8	7 1/8	155-181	45945K78	25.50
7 1/32	8 1/8	180-206	45945K79	27.45
8 1/16	9 1/32	205-232	45945K81	29.10
9 1/32	10 1/8	231-572	45945K82	31.34
10 1/8	11 1/8	256-283	45945K83	32.93
11 1/8	12 1/8	282-308	45945K84	34.66

Flexible Braided Sleeving



Protect hose, wire bundles, and cable from abrasion with this flexible, sturdy braided sleeving. Cut sleeving with scissors. . .no heat, chemicals, or other tools are needed for installation.

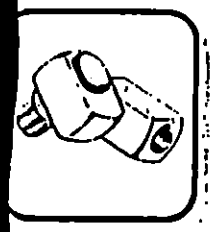
TINNED COPPER—Furnished in an expanded form, the sleeving does not have to inch-its-way over the material to be protected. . .the material can easily be fed through the enlarged sleeve. The sleeve's diameter is reduced when it is pulled lengthwise over the material for a neat, smooth fit.

[illegible]% shielding over the nominal diameter is provided.

[illegible]OLYESTER— Material is impervious to salt water, fuels, most [illegible]ning solvents, hydraulic fluids, lubricating oils, and antifreeze. [illegible]ving is also fungus-resistant. Supplied in a nonexpanded form. [illegible]aximum recommended service temperature is 257° F.

[illegible]inal	No.	NET/ FOOT 1-49	50-Up
[illegible]NED COPPER			
[illegible]	5537K26	$0.65	$0.52
[illegible]	5537K27	.95	.76
[illegible]"	5537K28	1.29	1.03
[illegible]LYESTER			
[illegible]"	5547K26	.67	.56
[illegible]"	5547K27	1.07	.89
[illegible]	5547K28	1.25	1.04

Bi-Directional 360° Pneumatic Hose Swivels



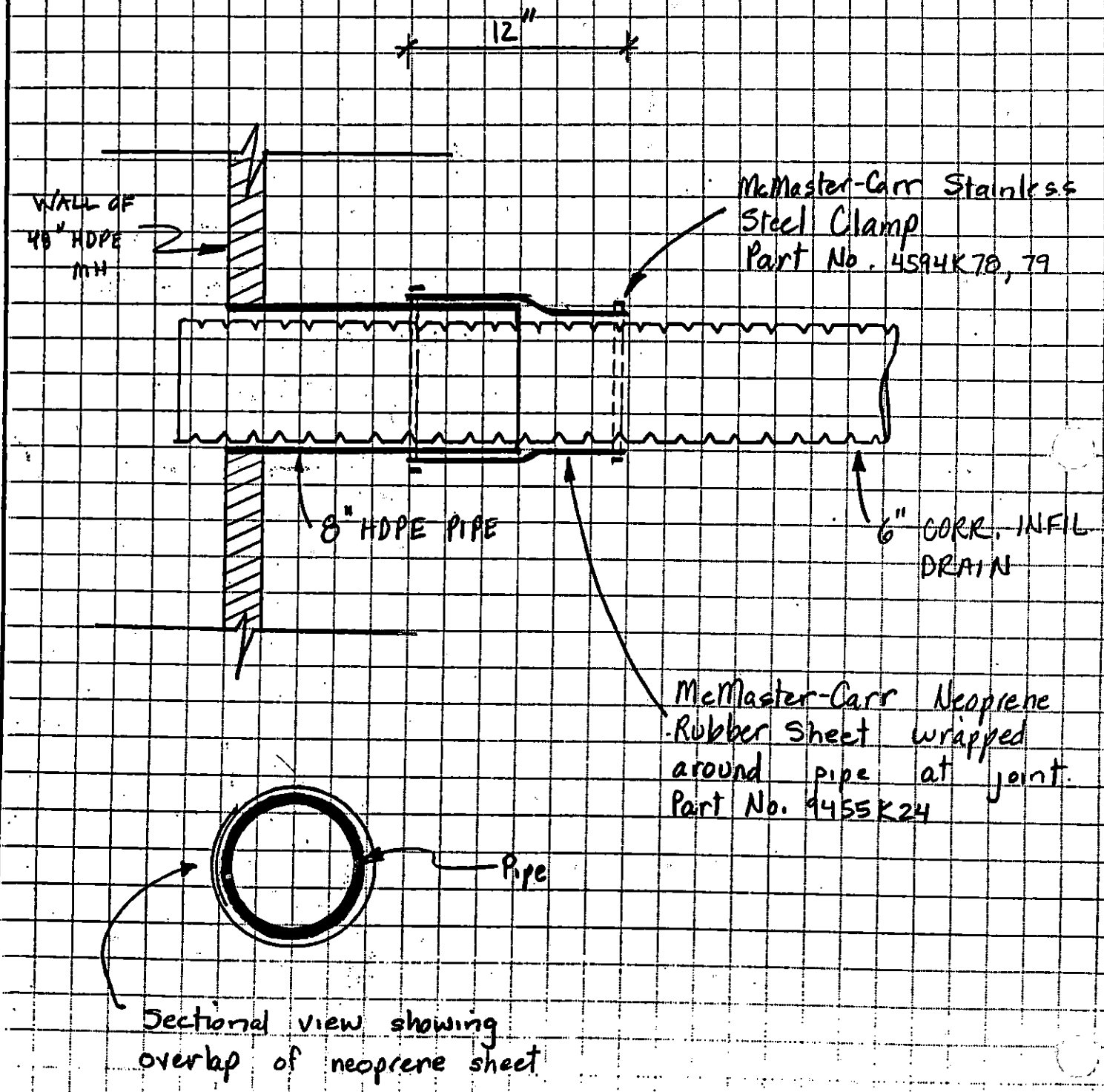
Improve tool maneuverability and extend hose life. Units swivel 360° at two locations to allow air hose to drop straight to the floor. . .no matter how the tool is held. The male pipe thread screws directly into most air tools and accepts male pipe thread hose fittings and standard quick-change adapters. Maximum psi: 150.

NOTE: Do NOT use these swivels on percussion tools or in areas of high mechanical abuse.

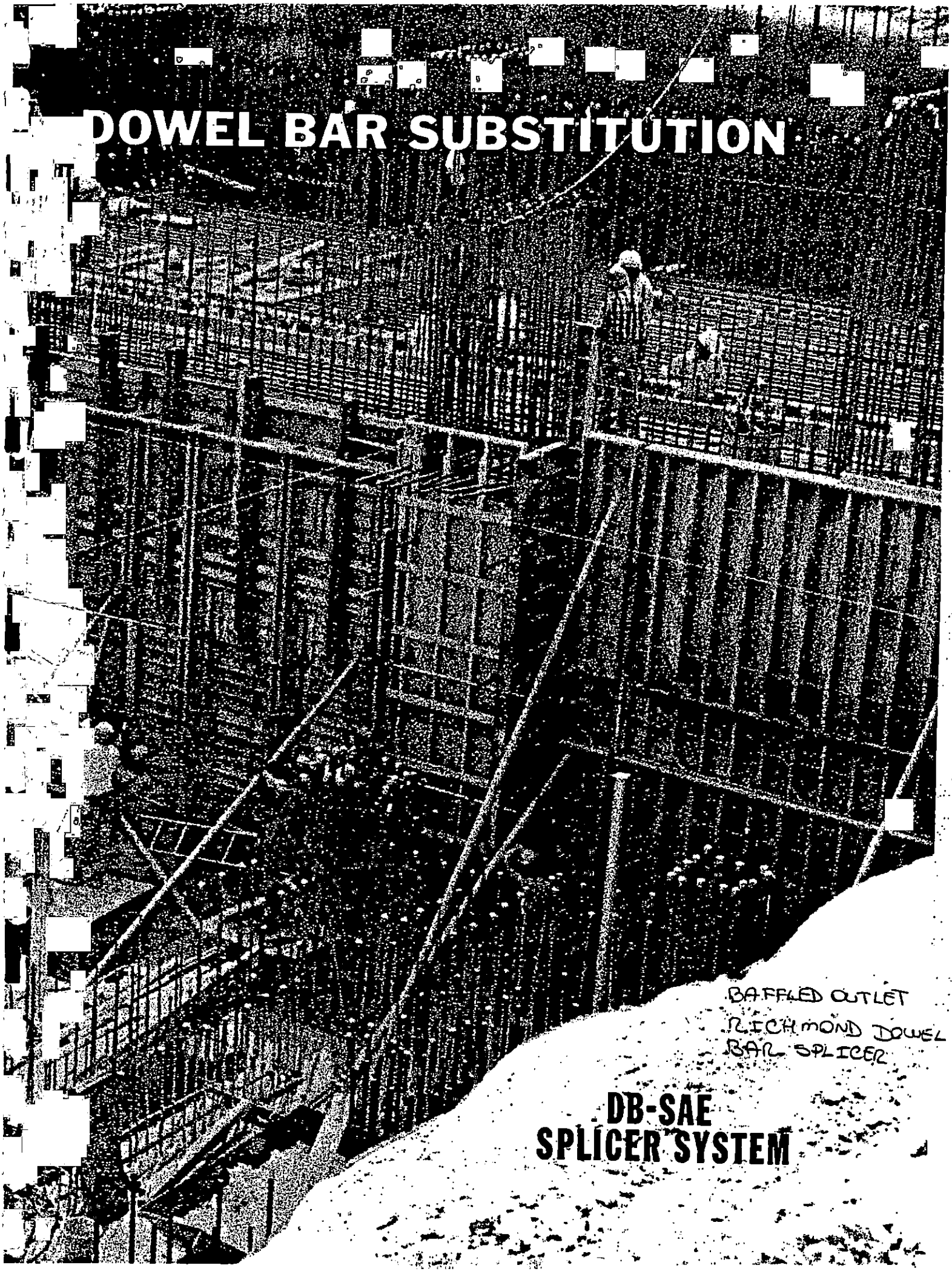
Size	No.	NET EACH
1/4" NPT	91095K81	$12.68
3/8" NPT	91095K82	22.83
1/2" NPT	91095K83	38.87

BRECO MECHANICAL GROUP, INC.
201 Saw Mill River Road
YONKERS, NEW YORK 10701

JOB _____
SHEET NO. 1 OF 1
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE Neoprene Boot Connections



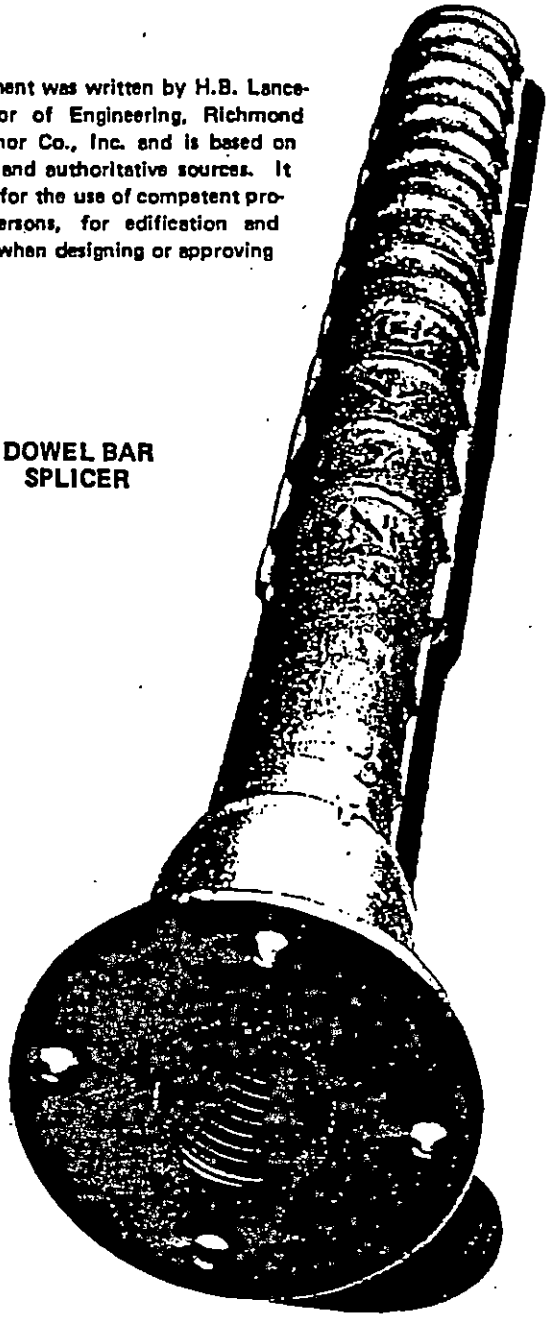
DOWEL BAR SUBSTITUTION



BAFFLED OUTLET
RICHMOND DOWEL
BAR SPLICER

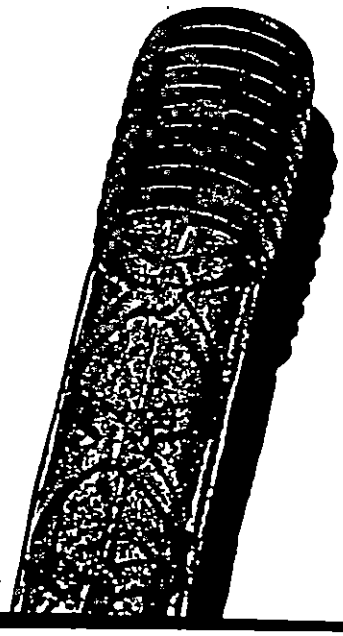
DB-SAE SPLICER SYSTEM

This Document was written by H.B. Lancelot, Director of Engineering, Richmond Screw Anchor Co., Inc. and is based on facts, tests and authoritative sources. It is intended for the use of competent professional persons, for edification and evaluation, when designing or approving a project.



DOWEL BAR SPLICER

Patent Pending



DOWEL-IN

INTRODUCTION:

Richmond published the first dowel bar substitution brochure in 1974. Since that time Richmond has continued to study, develop and manufacture anchorages and splice devices to meet the ever increasing demands from the construction industry. This brochure is the fruition of that effort, a second generation dowel bar substitution system with improved design, strength and economics.

DEVELOPMENT:

As good as the initial dowel bar substitution system is, the continuing study revealed unexpected barriers and hesitancies among engineers against a system based on wire insert splice mechanisms. To remove these objections a system was needed that would be readily identified, familiar to handle, easy to use and compatible to standard codes and practices. From this reasoning came the Dowel Bar Splicer, manufactured from standard deformed rebar. . . a simple, yet unique, splice connection.

DESIGN:

The Dowel Bar Splicer and Dowel-In are fabricated from standard rebar material and are designed to achieve full rebar loads, threading does not reduce bar area. Dowel-Ins are furnished with rolled UNC threads in nominal diameters of 5/8", 3/4", 7/8", 1" and rolled UN threads in nominal diameters of 1-1/8", 1-1/4", 1-7/16" and 1-9/16". Splicers are furnished in corresponding sizes and threads. These sizes are suitable for splicing # 4 through # 11 bars and/or substituting for # 4 through # 11 protruding dowels. The Splicer is available in straight or hooked configurations with single or double receivers. Dowel-Ins are available straight or hooked. Both the Splicer and Dowel-In are available cut to required length.

HOW TO USE THE CHARTS:

The Splicer data and Dowel Bar Substitution information is presented in Tables 1, 2, 3, 4 and 5. Table 1 is a quick comparison of dowel diameters to appropriate dowel substitution options. For example, specification documents might require No.4 dowels. To find the proper substitution, enter Table 1 at No. 4 and proceed across the Table noting that the substitution will be composed of a No. 5 bar Splicer with 5/8" diameter internal thread and a No. 4 bar Dowel-In with 5/8" diameter external rolled thread. This simple procedure can be repeated for any given dowel size.

To determine proper lap splice lengths, use Tables 2 and 3. When hooked bars are specified, use Table 4 for load requirements. Tension splices may be achieved by adhering to Table 5 or Table 1.

NOTE: All illustrated applications lend themselves to any continuous splice requirement.

SPECIFIED OR REQUIRED DOWEL BAR SIZE			
BAR SIZE	GRADE 60 REBAR LOADS – lbs.		
	P_y	1.25 P_y	$P_{ult.}$
#4	12,000	15,000	18,000
#5	18,600	23,250	27,900
#6	26,400	33,000	39,600
#7	36,000	45,000	54,000
#8	47,400	59,250	71,100
#9	60,000	75,000	90,000
#10	76,200	95,250	114,300
#11	93,600	117,000	140,400

RECOMMENDED DOWEL BAR SPLICER AND DOWEL - IN SIZES						
SYSTEM THREAD SIZE	DB - SAE BAR SIZE	DOWEL - IN BAR SIZE	SYSTEM STRESS AREA (min.)	GRADE 60 REBAR LOADS – lbs.		
				P_y	1.25 P_y	$P_{ult.}$
5/8" - 11UNC	#5	#4	.20	12,000	15,000	18,000
3/4" - 10 UNC	#6	#5	.31	18,600	23,250	27,900
7/8" - 9 UNC	#7	#6	.44	26,400	33,000	39,600
1" - 8UNC	#8	#7	.60	36,000	45,000	54,000
1-1/8" - 8UN	#9	#8	.79	47,400	59,250	71,100
1-1/4" - 8UN	#10	#9	1.00	60,000	75,000	90,000
1-7/16" - 8UN	#11	#10	1.27	76,200	95,250	114,300
1-9/16" - 8UN	#11	#11	1.56	93,600	117,000	140,400

TABLE 1: Recommended Dowel Bar Splicer and Dowel-In Sizes

GRADE 40	f'_c = 3,000 psi					f'_c = 5,000 psi					MIN. COMP. SPLICE
	TENSION DEVELOPMENT				COMP. DEV.	TENSION DEVELOPMENT				COMP. DEV.	
BAR SIZE	ℓ_d	$1.3\ell_d$	$1.7\ell_d$	$2.0\ell_d$	ℓ_d	ℓ_d	$1.3\ell_d$	$1.7\ell_d$	$2.0\ell_d$	ℓ_d	
4	12	12	14	16	8	12	12	14	16	8	12
5	12	13	17	20	9	12	13	17	20	8	13
6	13	17	22	26	11	12	16	20	24	9	15
7	18	23	30	35	13	14	18	24	28	11	18
8	23	30	39	46	15	18	23	30	36	12	20
9	29	38	50	58	17	23	29	38	45	14	23
10	37	48	63	74	19	29	37	49	57	15	25
11	46	59	78	91	20	35	46	60	71	17	28

TABLE 2: Required Development and Lap Lengths — Grade 40

GRADE 60	f'_c = 3,000 psi					f'_c = 5,000 psi					MIN. COMP. SPLICE
	TENSION DEVELOPMENT				COMP. DEV.	TENSION DEVELOPMENT				COMP. DEV.	
BAR SIZE	ℓ_d	$1.3\ell_d$	$1.7\ell_d$	$2.0\ell_d$	ℓ_d	ℓ_d	$1.3\ell_d$	$1.7\ell_d$	$2.0\ell_d$	ℓ_d	
4	12	16	20	24	11	12	16	20	24	9	12
5	15	20	26	30	14	15	20	26	30	11	13
6	19	25	33	38	16	18	23	31	36	14	15
7	26	34	45	53	19	21	27	36	42	16	18
8	35	45	59	69	22	27	35	45	54	18	20
9	44	57	74	88	25	34	44	58	68	20	23
10	56	72	94	111	28	43	56	73	86	23	25
11	68	89	116	137	31	53	69	90	106	25	28

TABLE 3: Required Development and Lap Lengths — Grade 60

Table 1 is a direct comparison of dowel diameters and appropriate substitution options.

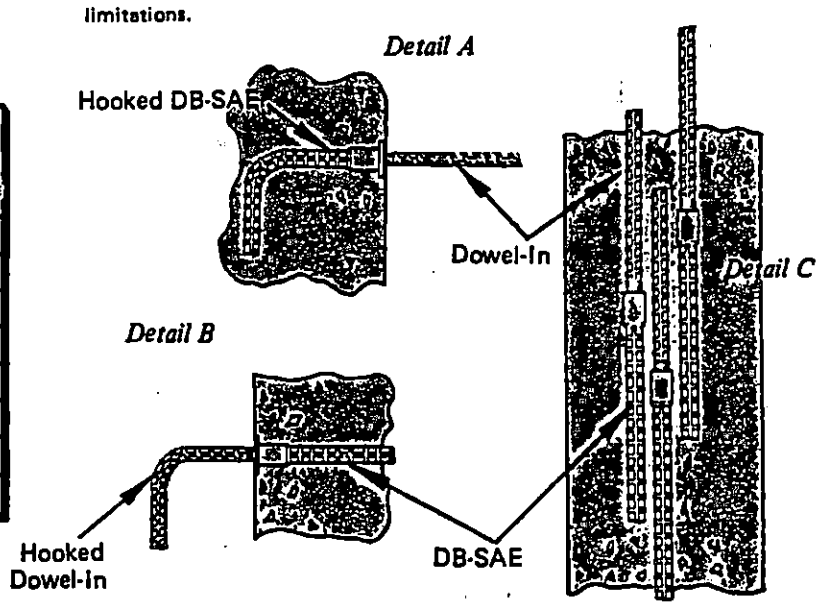
Tables 2 and 3 summarize required development and lap lengths for concrete strengths of 3,000 and 5,000 psi per ACI Standard 318-77.

Tension: $\ell_d = .04A_b \frac{f_y}{\sqrt{f'_c}}$; min. $.0004f_y d_b$ or 12 inches.

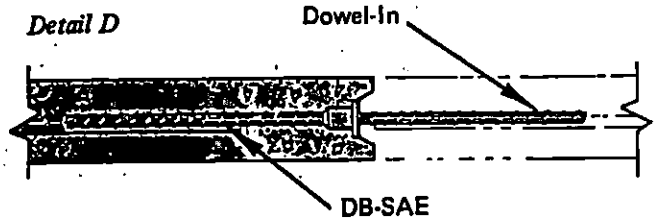
Compression Development Length: $\ell_d = .02f_y \frac{d_b}{\sqrt{f'_c}}$; min. $.0003f_y d_b$ or 8 inches.

Compression Splice: Compression ℓ_d; min. $.0005f_y d_b$ or 12 inches.

Consult ACI Standard 318-77, Chapter 12, for multipliers and limitations.



Detail D



Detail E

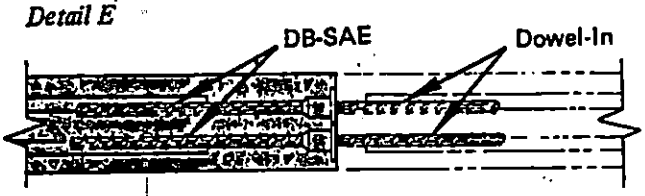


Table 4 identifies the maximum tensile force for hooked rebar as a function of concrete compressive strength. These values were generated by applying the equations and information found in Chapter 12 of ACI Standard 318-77.

Table 5 is arranged to address tension splices such as depicted in Detail F. The other details show but a few examples of the many splice configurations possible.

GRADE 40 REBAR SIZE	CONCRETE STRENGTH		
	3,000 PSI	4,000 PSI	5,000 PSI
	ALL BARS	ALL BARS	ALL BARS
4	3,944	4,554	5,091
5	5,113	7,058	7,891
6	8,676	10,018	11,201
7	11,831	13,661	15,274
8	15,577	17,987	20,110
9	19,718	22,768	25,456
10	25,042	28,916	32,329
11	30,760	35,519	39,711

GRADE 60 REBAR SIZE	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS
4	5,915	5,915	6,831	6,831	7,637	7,637
5	9,169	9,169	10,589	10,587	11,837	11,837
6	10,845	13,014	12,523	15,027	14,001	16,801
7	11,831	17,746	13,661	20,492	15,274	22,910
8	15,577	23,366	17,987	26,981	20,110	30,165
9	19,718	29,577	22,768	34,153	25,456	38,184
10	25,042	33,389	28,916	38,554	32,329	43,106
11	30,760	35,887	35,519	41,438	39,711	46,330

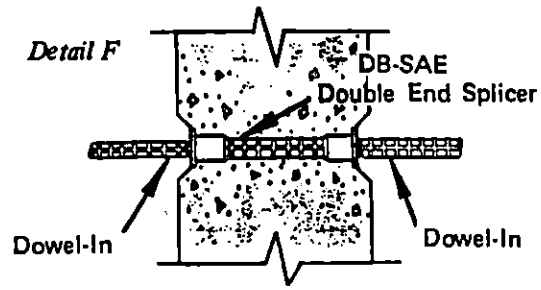
TABLE 4: Grades 40 and 60 Rebar Maximum Tensile

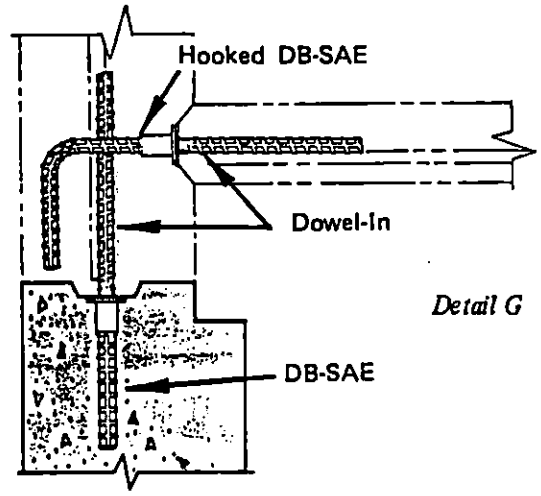
SPLICER SIZE	SPLICER THREAD SIZE	SPLICER ULT. LOAD
#5	5/8" - 11UNC	20,340
#6	3/4" - 10 UNC	30,060
#7	7/8" - 9UNC	41,490
#8	1" - 8UNC	54,450
#9	1-1/8" - 8UN	71,100
#10	1-1/4" - 8UN	90,000
#11	1-7/16" - 8UN	114,300
#11	1-9/16" - 8UN	140,400

DOWEL - IN SIZE	REBAR LOADS - lbs.	
	GRADE 60	
	P_y	$1.25\ P_y$
#4	12,000	15,000
#5	18,600	23,250
#6	26,400	33,000
#7	36,000	45,000
#8	47,400	59,250
#9	60,000	75,000
#10	75,200	90,250
#11	93,600	117,000

TABLE 5: Direct Splice Comparisons

Detail F



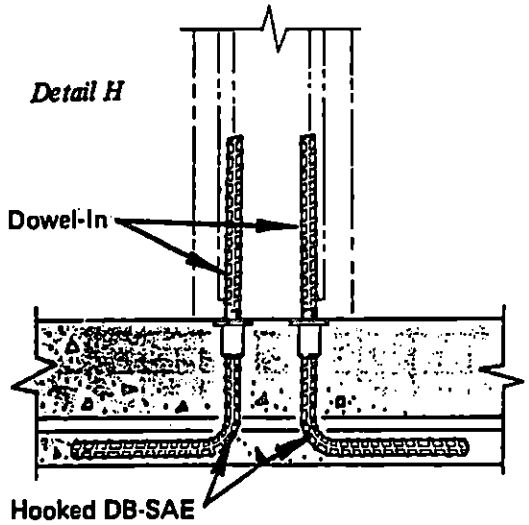


Detail G

ASTM STANDARD REINFORCING BARS			
BAR SIZE DESIGNATION NUMBER	WEIGHT	NOMINAL DIAMETER	
	POUNDS PER FOOT	DIAMETER INCHES	CROSS SECTIONAL AREA – Sq. Inches
3	0.376	0.375	0.11
4	0.668	0.500	0.20
5	1.043	0.625	0.31
6	1.502	0.750	0.44
7	2.044	0.875	0.60
8	2.670	1.000	0.79
9	3.400	1.128	1.00
10	4.303	1.270	1.27
11	5.313	1.410	1.56

TABLE 6: Reinforcing Steel Data

Detail H

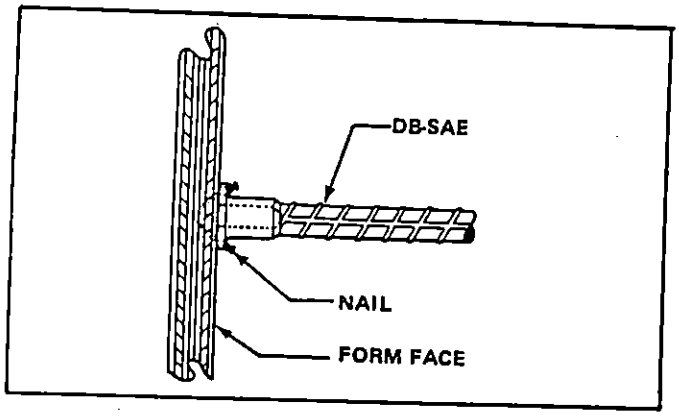


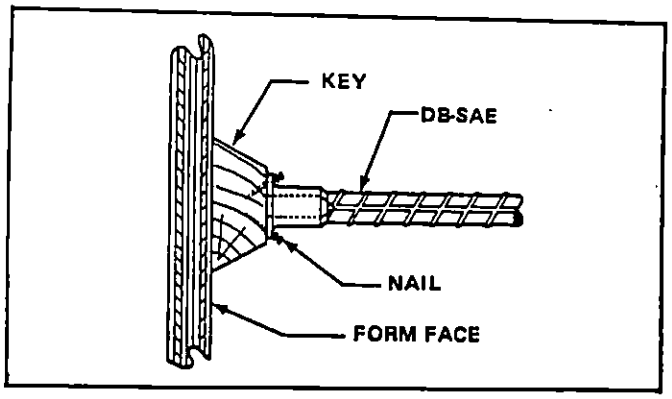
TYPICAL SETTING METHODS:

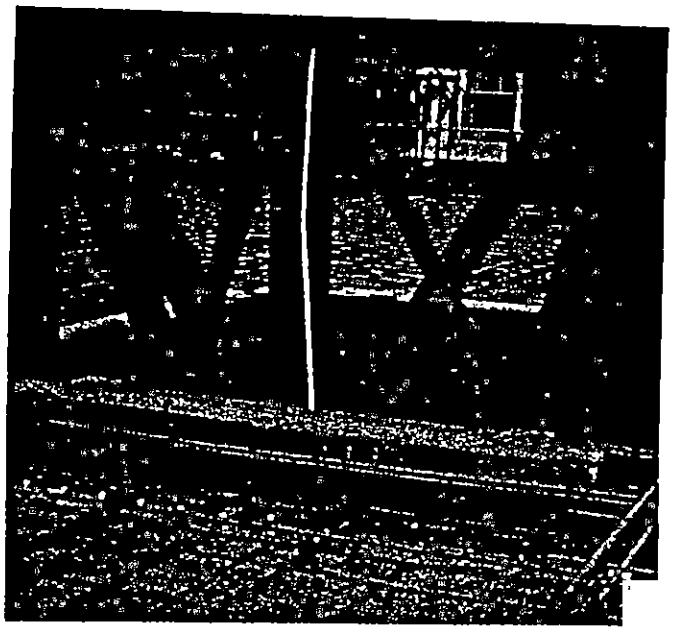
Setting methods for the Dowel Bar Splicer are simple and straight forward. The unit can easily be nailed directly to the form face utilizing the nail holes in the integral flange. See sketch below.

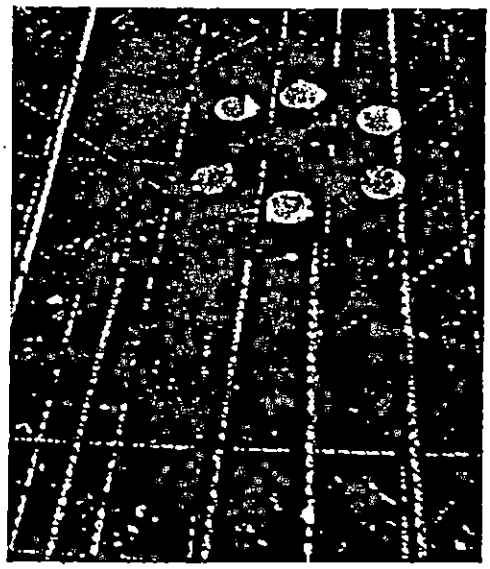
To incorporate a keyway it is again easily accomplished - no holes to drill, no dowels to drive in. Simply gang the DB-SAE Splicers to the keyway and nail the keyway to the form. See sketch below.

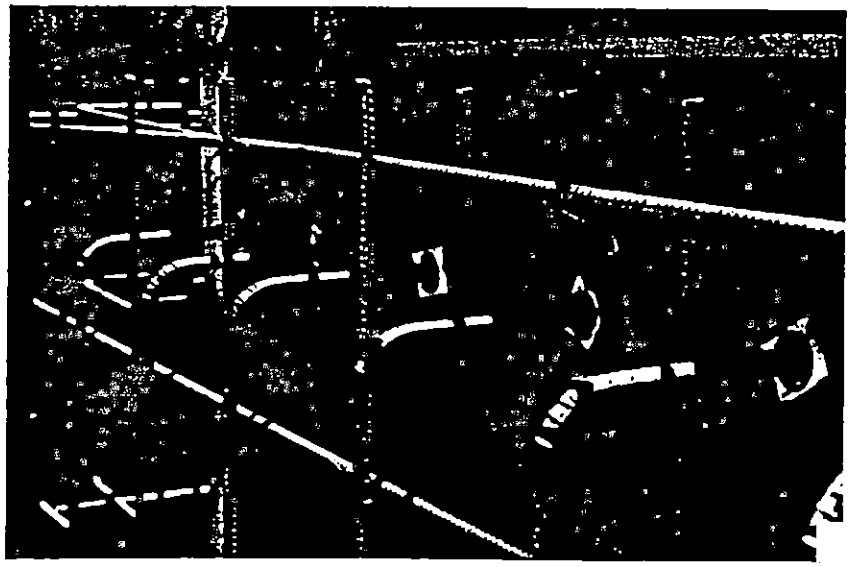
On metal faced modular forms small screws are often used to firmly set and position the splicer units.











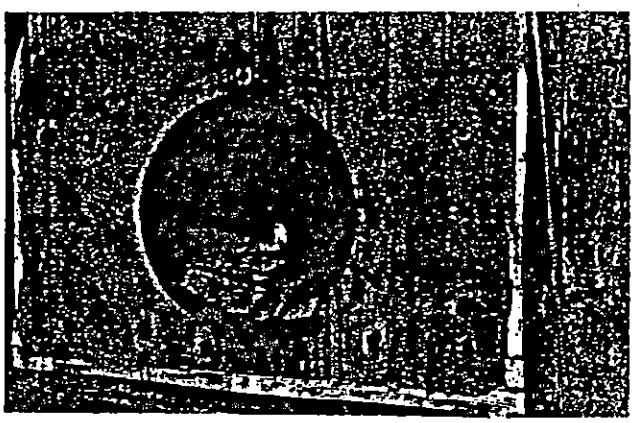
REBAR SPLICE SPECIFICATIONS:

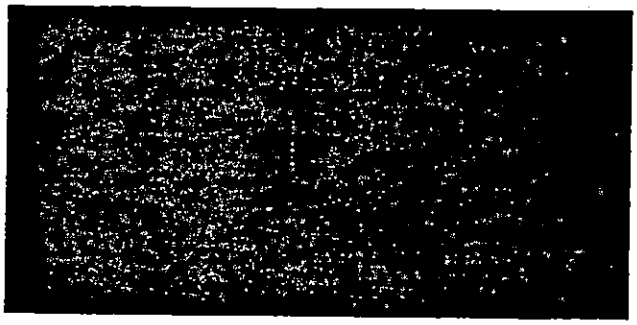
In order to facilitate ease of construction and to provide continuity of reinforcing steels through construction joints and routine splices, the appropriate authority may at their option utilize the Dowel Bar Substitution and Splice System as manufactured by Richmond Screw Anchor Co., Inc. or and approved equal.

For dowel bar substitution and rebar splice systems, other than Richmond Screw Anchor Co., Inc.'s DB-SAE Splicer, the contractor shall submit manufacturer's literature, product samples and certified test reports to the appropriate authority.

Test reports shall show yield and ultimate tensile load capacities. All male threads shall be rolled (UN or UNC), cut threads are not permitted.

Tension failure must occur in the nominal bar diameter of the Dowel-In.



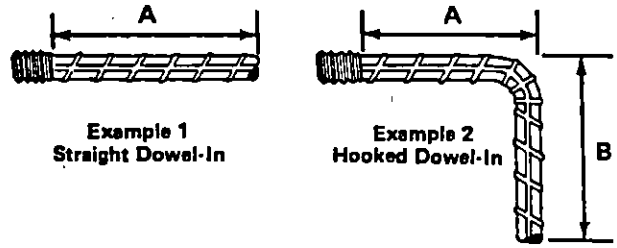


HOW TO ORDER:

Reference Table 1 on page 3 for correct Dowel-In/ DB-SAE sizes.

DOWEL-IN (DI)

Give desired bar size (should be equivalent to rebar being substituted for on the structural drawings), length, symbol and name. If a hooked configuration is required also give A and B dimensions shown below.

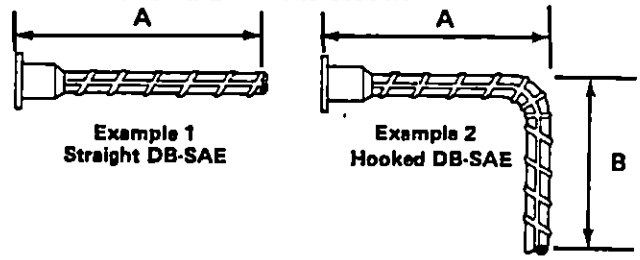


Example 1 : #6 bar, 24" DI Dowel-In

Example 2: #6 bar, 12" x 9", DI Hooked Dowel-In

DOWEL BAR SPLICER (DB-SAE)

Give bar size of DB-SAE required (normally one size larger than the Dowel-In, check Table 1 for correct size), length, symbol, name and size of Dowel-In to be used in conjuction with the splicer. If a hooked configuration is required also give dimensions A and B shown below.

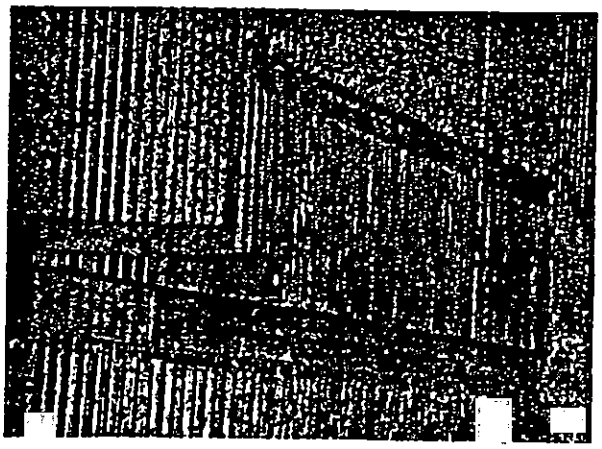


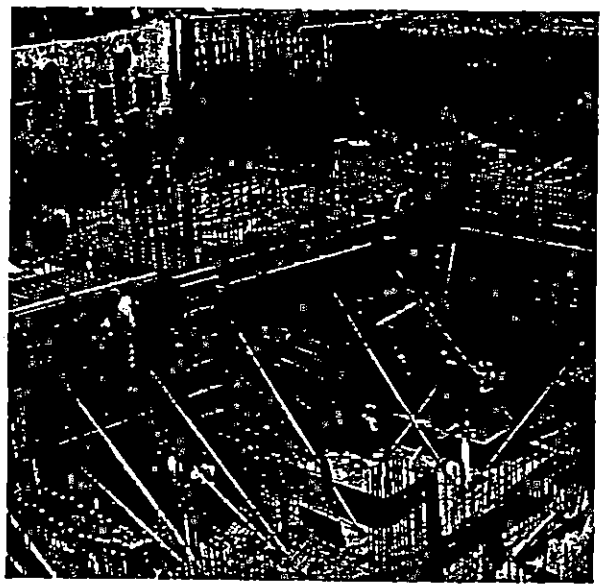
Example 1: # 7 x 24" DB-SAE Dowel Bar Splicer for a # 6 Dowel-In.

Example 2: #7 x 12" x 9" hooked DB-SAE Dowel Bar Splicer for #6 Dowel-In.

NOTE:

All tolerances per CRSI Design Manual criteria. All bends assumed 90° unless otherwise stated.





ADVANTAGES:

Richmond's Dowel Bar Splicer has been engineered, tested and proven to meet, or exceed, field standards and design/engineering practices. It achieves excellent compatibility with normal procedures and has the rewarding benefits of improved costs and time saving.

The unit is strong, easy to use and readily identified as rebar material. The application requires no special tools, the easy installation accomplishes forming simplicity. No extra elements, such as mechanical wedges, nuts, collars, couplers or thermite material, are required. Routine cutting, threading, bending, etc., can easily be handled in the field.

The "bottom line" — the Dowel Bar Splicer assures strong, safe and fast dowel bar substitutions. Broken-off and/or bent dowel bars are eliminated and bruised shins, gouged backs and scraped scalps will be less likely. Best of all, though, you will improve forming costs and reduce forming and form stripping hassles.

Call or write for additional information, Richmond provides engineered layouts and details for dowel bar substitution requirements.

"QUALITY CONCRETE ACCESSORIES."

RICHMOND

SCREW ANCHOR CO., INC.

7214 Burns St., Richland Hills,

Ft. Worth, Tex. 76118

Telephone 817/284-4981

MEMBER CRSI

aci

1. PRODUCT NAME

Richmond Screw Anchor Company Rebar Splicing Systems: DB-SAE—Dowel Bar Splicer System* Coupler Splice System** Half Coupler (for welding) Splice System**

2. MANUFACTURER

Richmond Screw Anchor Company
7214 Burns Street
Fort Worth, Texas 76118
Phone: (817) 284-4981
FAX: (817) 284-4504

3. PRODUCT DESCRIPTION

Mechanical connection devices for splicing reinforcement bars in concrete structures. The DB-SAE Dowel Bar Splicer System is a two-piece, standard splicing technique (splicing bars of equal size) that eliminates protruding dowels. The Coupler Splice System and Half Coupler Splice System are a means to achieve standard splicing (equal bar sizes) and/or transition splicing (bars of different sizes).

Richmond Rebar Splice Systems are manufactured in the USA from domestic rebar material and are composed of a Splicer (DB-SAE or Coupler) and a Dowel-In (DI).

Basic Use: Richmond mechanical connections are suitable for joining reinforcement bars end to end. The mechanical connections accommodate bar sizes #4 through #14. Mechanical connections are a convenient alternative to lap splicing and/or butt welding. Typical applications include the splicing of reinforcement bars in monolithic structures, rebar anchorage, future expansion and dowel bar substitution at construction joints.

Composition and Materials: Richmond mechanical connections are manufactured from deformed or smooth bar meeting ASTM A615 material specifications; other grades are available upon request. Mechanical connections and reinforcement bars may be epoxy coated to meet applicable corrosion resistant criteria.

Limitations: Usage of mechanical connections may be controlled by governing building codes.

4. TECHNICAL DATA

Applicable Standards/Guides/Codes: (ACI 318 Building Code Requirements for Reinforced Concrete) American Concrete Institute; (ICBO) International Conference of Building Officials; City of Los Angeles Department of Building and Safety; New York Board of Standards and Appeals; (AASHTO) American Association of State Highway and Transportation Officials; (ASTM A615) American Society for Testing and Materials; Corp of Engineers CW-03210 Civil Works Construction Guide for Steel Bars; (CRSI) Concrete Reinforcing Steel Institute.

Load Test Data: Richmond Screw Anchor Company provides test data and appropriate test reports. Static, dynamic, fatigue and seismic test data is available. Such data is derived from tests performed in accordance with ACI, ICBO, AASHTO, ASTM and CRSI.

Safety Factors: The ACI building code establishes the minimum splice capacity as follows: "A full mechanical connection shall develop in tension or compression, as required, at least 125 percent of specified yield strength (fy) of the bar." For mechanical anchorage, the ACI code establishes the following safety criteria: "Any mechanical device capable of developing the strength of the reinforcement without damage to concrete may be used as anchorage." Splicing or anchorage, Richmond Screw Anchor Company mechanical connections achieve full strength of the bars connected. For ASTM A615 grade 60 material the full capacity is at least 150 percent of the specified yield (fy).

5. INSTALLATION

Monolithic: Rebar mats/cages may be placed or prefabricated; individual reinforcement bars may be mechanically spliced, incorporating various Richmond splice devices. The mechanical connection is achieved by screwing the male (Dowel-In) into the female (Splicer or Coupler). Pretorque is not necessary; however, all elements must be fully engaged and secure.

Dowel Bar Substitution and Anchoring: The female (Splicer) will be positioned and secured in the formwork, rebar or bulkheads prior to placing concrete. After concrete has cured, the forms are removed. Prior to a secondary pour, the Dowel-In (DI) will be threaded into the Splicer. Wrench-tightening is not required; however, all elements must be fully engaged and appropriately aligned.

6. AVAILABILITY AND COST

Availability: Richmond Screw Anchor Company splice devices are available worldwide. See page 6 for the nearest plant and/or sales office.

Cost: Prices are available at the branch office locations.

7. WARRANTY

Richmond Screw Anchor Company splice devices are manufactured according to strict quality assurance specifications. They are warranted to be free from manufacturing defects and to perform as represented in writing (provided that the product is installed and used in accordance with the manufacturer's instructions).

8. MAINTENANCE

No special requirements.

9. TECHNICAL SERVICES

Additional product information or technical information is available by contacting Richmond.

10. FILING SYSTEMS

Electronic SPEC-DATA®
SPEC-DATA® II
Concrete Construction Source Book

03200

BAFFLED OUTLETS-
SUPPLEMENTAL INFORMATION

*Patented **Patent pending

SPEC-DATA®

This Spec-Data sheet conforms to editorial style prescribed by The Construction Specifications Institute. The manufacturer is responsible for technical accuracy.

Richmond Screw Anchor Company
Aug 990
3
CONCRETE REINFORCEMENT
Mechanical Rebar Splicing System

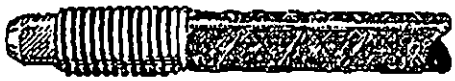
Dowel Bar Splicer (DB-SAE)

DB-SAE Dowel Bar Splicer

The DB-SAE Splicer is a one-piece unit integrally forged from grade 60 rebar material. It is available in #4 through #11 sizes and is designed to achieve 150 percent of specified yield (full mechanical ultimate). DB-SAEs are available straight (cut to length), hooked, double-ended, thread-ended or bolt-headed in plain or epoxy coated. It is also possible to order the Splicer with a reduced washer and/or a clipped washer.

Dowel-In (DI)

DI Dowel-In - #4, #5 and #6 configuration with chamfered nose.

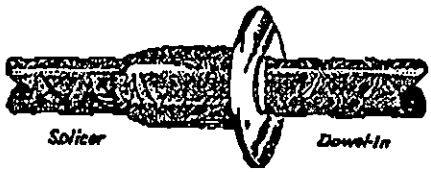


DI Dowel-In - #7 through #11 configuration with pilot nose.

The Dowel-In (DI) is manufactured from grade 60 rebar material and is available in sizes corresponding to the DB-SAE Splicer. The end of the Dowel-In is enlarged by forging before threading so that the cross-sectional area of the bar is not reduced during threading operations, thus assuring a strength capacity of 150 percent of the specified yield. Dowel-Ins are configured to facilitate easy installation of the splice. They can be easily assembled by hand. On large projects, such as highway paving, a centrifugal chuck on an electric or air powered drill motor will speed installation.

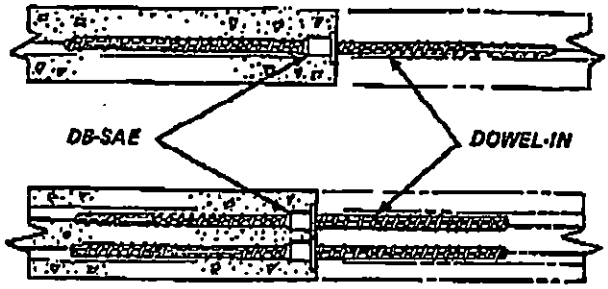
Dowel-Ins are available straight or hooked, plain or epoxy coated.

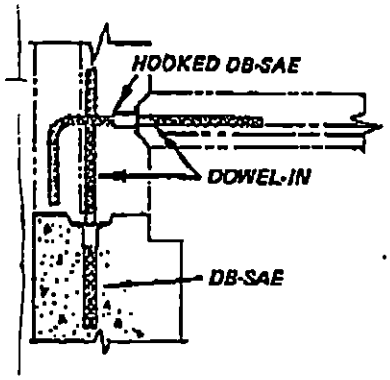
Completed Splice



Both pieces of the completed splice are manufactured from equal size bar stock.

Typical Applications





Splice Size Recommendations

SPECIFIED OR REQUIRED DOWEL BAR SIZE				RECOMMENDED DOWEL BAR SPLICER AND DOWEL-IN SIZES						
BAR SIZE	GRADE 60 REBAR LOADS – lbs.			SYSTEM THREAD SIZE	DB-SAE BAR SIZE	DOWEL-IN BAR SIZE	SYSTEM STRESS AREA (sq. in.)	GRADE 60 REBAR LOADS – lbs.		
	F_y	$1.25\ F_y$	$F_{ult.}$					F_y	$1.25\ F_y$	$F_{ult.}$
#4	12,000	15,000	18,000	5/8" 11UNC	#4	#4	.20	12,000	15,000	18,000
#5	18,600	23,250	27,900	3/4" 10UNC	#5	#5	.31	18,600	23,250	27,900
#6	26,400	33,000	39,600	7/8" 9UNC	#6	#6	.44	26,400	33,000	39,600
#7	36,000	45,000	54,000	1" 8UNC	#7	#7	.60	36,000	45,000	54,000
#8	47,400	59,250	71,100	1-1/8" 8UN	#8	#8	.79	47,400	59,250	71,100
#9	60,000	75,000	90,000	1-1/4" 8UN	#9	#9	1.00	60,000	75,000	90,000
#10	76,200	95,250	114,300	1-7/16" 8UN	#10	#10	1.27	76,200	95,250	114,300
#11	93,600	117,000	140,400	1-5/16" 8UN	#11	#11	1.56	93,600	117,000	140,400

TABLE 1: Recommended Dowel Bar Splicer and Dowel-In Sizes

Typical Setting Methods

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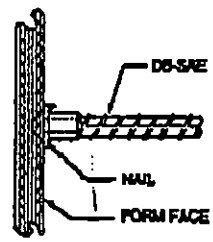

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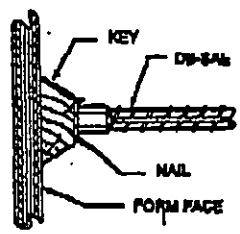

Test Data

Supportive test data consists of static tensile testing, static compression testing, progressive step function, cyclic tensile tests and fatigue tests suitable for establishing S-N curves.

(DB-SAE) SPLICER SIZE	(DI) DOWEL-IN SIZE	CROSS SECT. AREA (sq. in.)	THREAD SIZE	AVERAGE YIELD LOAD (lbs.)	AVERAGE ULT. LOAD (lbs.)
#4	#4	0.20	½"-11 UNC	13,220	19,300
#5	#5	0.31	⅝"-10 UNC	20,700	31,470
#6	#6	0.44	¾"-9 UNC	36,450	48,700
#7	#7	0.60	1.0"-8 UNC	48,870	61,750
#8	#8	0.79	1⅛"-8 UN	51,840	77,800
#9	#9	1.00	1¼"-8 UN	62,800	94,850
#10	#10	1.27	1⅜"-8 UN	83,020	124,540
#11	#11	1.56	1⅝"-8 UN	100,160	145,830

TABLE 9: DB-SAE/Dowel-In Splice Static Test Summary

Static tensile tests are continuously being compiled to insure quality. These test programs easily exceed known building code requirements.

STRESS LEVEL		.55fy	.75fy	.90fy	1.00fy	RESERVE STATIC TENSILE LOAD
CYCLES/SEC.		8-28	8-28	8-28	8-28	
CYCLES		25,000	12,500	4,000	1,000	
CUMULATIVE CYCLES		25,000	37,500	41,500	42,500	
DB-SAE BAR SIZE	DI BAR SIZE	NUMBER OF CYCLES SURVIVED VERSUS NUMBER OF SAMPLES				RESERVE STATIC TENSILE LOAD
#4	#4	6/6	6/6	6/6	6/6	19,800
#5	#5	6/6	6/6	6/6	6/6	28,700
#6	#6	6/6	6/6	6/6	6/6	40,500
#7	#7	6/6	6/6	6/6	6/6	48,900
#8	#8	6/6	6/6	3/6	3/6	55,600
#9	#9	6/6	6/6	3/6	3/6	86,700
#10	#10	5/5	5/5	0/5	0/5	—
#11	#11	6/6	6/6	6/6	6/6	135,100

TABLE 10: DB-SAE/Dowel-In Dynamic Test Summary

The purpose of the progressive cyclic tests was to demonstrate the seismic resistance capacities of the Richmond Splice System. Cyclic testing began at 55 percent of the specified yield (60,000 psi) for 25,000 cycles, stepping to 75 percent (fy) for an additional 12,500 cycles, stepping again to 90 percent (fy) for another 4,000 cycles, finally stepping to 100 percent (fy) for 1,000 cycles. As a result of this test series, each splice reached a stress range of 90-100 percent of the specified yield (60,000 psi) and the total number of cycles of each splice exceeded 41,500 cycles. Units exceeding 42,500 cycles were further tested to evaluate the reserve static tensile load.

Number of Cycles @	Stress Level \ Splice Size	#5	#6	#8	#11
	15,000 psi	2,000,000	2,000,000	2,000,000	2,000,000
	RESERVE STATIC TENSILE				
		27,900 lbs.	42,600 lbs.	80,100 lbs.	144,900 lbs.

Number of Cycles @					
	25% Fy	2,000,000+	2,000,000+	2,000,000+	TESTS IN PROGRESS
	50% Fy	103,710	216,510	179,290	
	75% Fy	59,540	45,240	29,765	
	RESERVE STATIC TENSILE				
		0	0	0	0

TABLES 11 AND 12: DB-SAE/Dowel-In Fatigue Test Summary

The fatigue test programs were performed to illustrate the merits of the Richmond Splice System design philosophy of upset and upsized threads relative to the nominal rebar area. All specimens exceeded 2,000,000 cycles at 15,000 psi, 25 percent of the specified yield (60,000 psi). Upon completing 2,000,000 cycles, the tests were stopped and the specimens were statically tensiled to failure to evaluate the reserve strength capacity. A second test series was initiated to develop S-N behavior characteristics of the splice system.

RICHMOND
SCREW ANCHOR CO.
7214 Burns Street,
Fort Worth, Texas 76118
(817) 284-4981

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Phone 717/695-3163,
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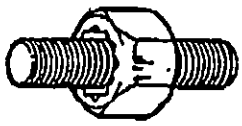
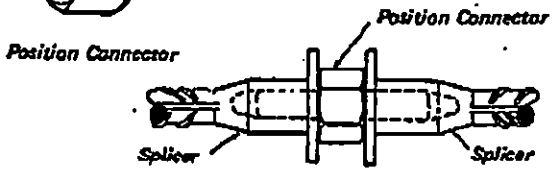
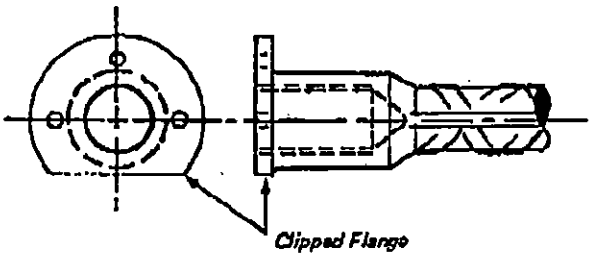
Position Connector





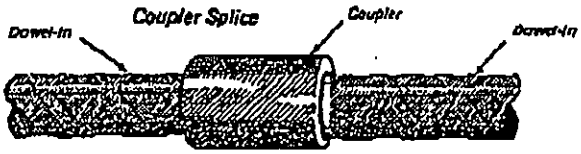
The Position Connector is a left and right hand threaded stud with a free fit hex nut keyed to the hex bar stock of the stud. Right hand and left hand DB-SAE Splicers may be connected and drawn together, using this method, when hooked bar alignment is critical.

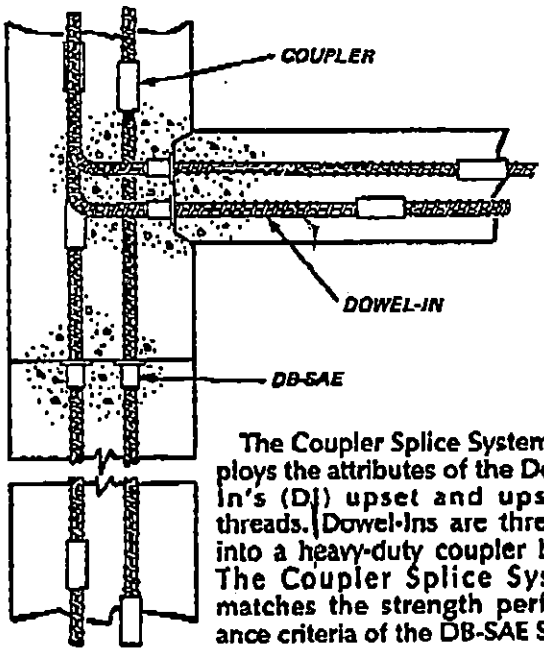
Clipped Flange



The Splicer's flange may be supplied clipped as needed to insure adequate concrete cover or to avoid interferences with other objects. Flange may be clipped in more than one direction as required.

Coupler Splice System



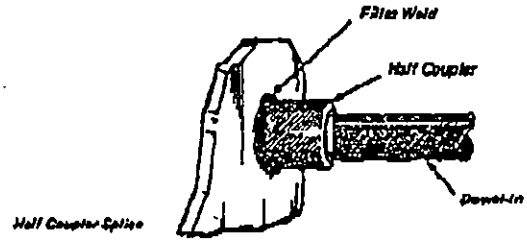


The Coupler Splice System employs the attributes of the Dowel-In's (DI) upset and upsized threads. Dowel-Ins are threaded into a heavy-duty coupler body. The Coupler Splice System matches the strength performance criteria of the DB-SAE Splice System in all aspects. A unique advantage of the Coupler is that it also behaves as a position connector. The Coupler can be advanced beyond the thread region of the Dowel-In and then returned to final position, joining a second Dowel-In to the first.

COUPLER SELECTION GUIDE				
DI Size	Thread Size	COUPLER Size	STRENGTH (lbs.)	
			1.25Fy	Fu
#4	5/8" -11UNC	7/8" x 2"	15000	18000
#5	3/4" -10UNC	1-1/8" x 2-1/4"	23250	27900
#6	7/8" - 9UNC	1-1/4" x 2 1/2"	33000	39600
#7	1" - 8UNC	1-1/2" x 4"	45000	54000
#8	1-1/8" - 8 UN	1-5/8" x 4-3/8"	59250	71100
#9	1-1/4" - 8 UN	1-7/8" x 4-5/8"	75000	90000
#10	1-7/16" - 8 UN	2-1/8" x 5-1/4"	95250	114300
#11	1-9/16" - 8 UN	2-1/4" x 5-1/2"	117000	140400
#14	1-7/8" - 8 UN	2-7/8" x 6"	168750	202500

TABLE 7: Coupler Selection Guide

Half Coupler Splice For Welding

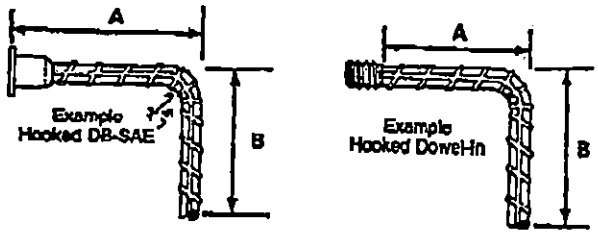


HALF COUPLER SELECTION GUIDE				
DI Size	Thread Size	COUPLER Size	STRENGTH (lbs.)	
			1.25Fy	Fu
#4	5/8" -11UNC	7/8" x 1-1/8"	15000	18000
#5	3/4" -10UNC	1-1/8" x 1-1/4"	23250	27900
#6	7/8" - 9UNC	1-1/4" x 1-3/8"	33000	39600
#7	1" - 8UNC	1-1/2" x 2-3/4"	45000	54000
#8	1-1/8" - 8 UN	1-5/8" x 3"	59250	71100
#9	1-1/4" - 8 UN	1-7/8" x 3-1/8"	75000	90000
#10	1-7/16" - 8 UN	2-1/8" x 3-1/2"	95250	114300
#11	1-9/16" - 8 UN	2-1/4" x 3-3/4"	117000	140400
#14	1-7/8" - 8 UN	2-7/8" x 3-7/8"	168750	202500

TABLE 8: Half Coupler Selection Guide

The Half Coupler Splice is simply a shorter version of the Coupler Splice, suitable for welding to steel components such as soldier piles, weld plates, steel frame structure and special bulkheads. A Half Coupler accommodates only one Dowel-In. The capacity of the Half Coupler may be limited by field welding conditions.

Hooked Splicer and Hooked Dowel-In



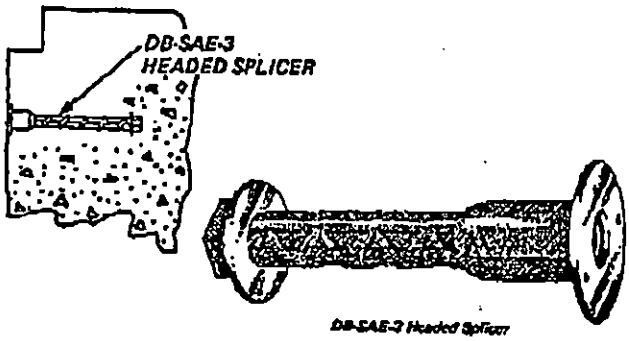
Hooked dowels may be substituted with a hooked DB-SAE or hooked Dowel-In. Hooked DB-SAEs and DIs will meet or exceed those requirements as defined in ACI 318. All bars are bent using the appropriate pin diameter. (See the table for dimensions). The "B" dimension can be any length necessary to meet building requirements.

Bar Size	# 4	# 5	# 6	# 7	# 8	# 9	# 10	# 11
Min. "A" Dimension	5"	5"	6"	7"	9"	12"	14"	15"
Bend Diameter	6d					8d		

TABLE 2: Hooked Rebar Bend Dimensions

The "A" dimension may be reduced, using bending pin diameters less than ASTM and code requirements.

Headed Splicer



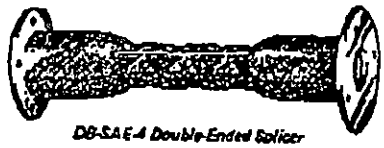
RECOMMENDED DB-SAE-3 SPLICER AND DOWEL-IN SIZES						
SYSTEM THREAD SIZE	DB-SAE-3 BAR SIZE	EMBED LENGTH (120)	LOAD CAPACITY	DOWEL-IN BAR SIZE	DOWEL-IN LOAD CAPACITY 1.25Py	DOWEL-IN LOAD CAPACITY 1.5Py
5/8" 11UNC	#4	6"	18,000	#4	15,000	18,000
3/4" 10 UNC	#5	7.5"	27,000	#5	22,250	27,000
7/8" 9 UNC	#6	9"	39,000	#6	33,000	39,000
1" 8UNC	#7	10.5"	54,000	#7	45,000	54,000
1 1/8" 8UN	#8	12"	71,100	#8	59,250	71,100

TABLE 3: Recommended DB-SAE-3 Headed Splicer and Dowel-In-Sizes

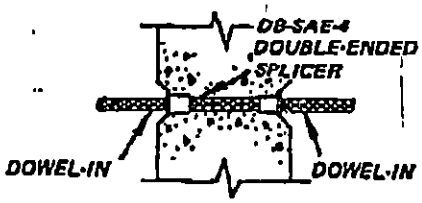
The Headed Splicer is a convenience connector. It is designed to eliminate hooked bar congestion. It also provides excellent end anchorage and may be used for common structural anchorage provisions for light standards, signs, posts, fixtures, etc. The anchor may be modified to support greater loads than shown.

Double-Ended Splicer

The Double-Ended Splicer is a device for establishing a direct load path through a concrete section, thus avoiding multiple hooked bars or protruding dowels. It also helps to eliminate bar congestion. Oftentimes it is configured in a "U" shape for special applications. See miscellaneous components.



DB-SAE-4 Double-Ended Splicer



Typical Specification

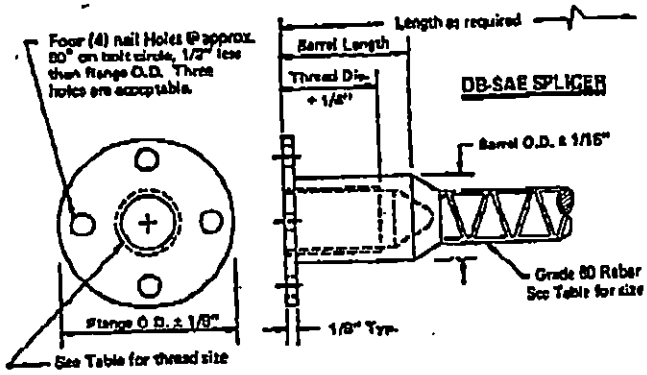
The Richmond Dowel Bar Splicer System, consisting of the Dowel Bar Splicer (DB-SAE) and Dowel-In (DI), shall be used in splicing of rebar. The Dowel Bar Splicer (DB-SAE) shall be forged from ASTM A615 Grade 60 deformed rebar material, free of external welding or machining. It shall be furnished with an integral nailing flange and threaded with UNC or UN thread to a depth equal to 1.0 times the nominal thread diameter plus ¼". The Dowel-In (DI) shall be fabricated from ASTM A615 grade 60 deformed rebar material with thread corresponding to the DB-SAE Splicer. The completed splice, utilizing the Dowel Bar Splicer and Dowel-In shall meet 150 percent of the specified bar yield strength (fy) exceeding tensile requirements of American Concrete Institute (ACI) Specification 318, "Building Code Requirements for Reinforced Concrete" and the Corp of Engineers Specification CW-03210, "Civil Works Construction Guide Specification for Steel Bars, Welded Steel Wire Fabric and Accessories for Concrete Reinforcement."

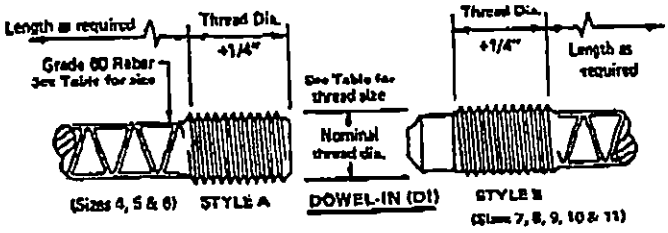
Compliance

Richmond Dowel Bar Splicer System complies with the following standards, guides, codes and/or specifications:

- American Concrete Institute ACI 318
- International Conference of Building Officials (ICBO) Report #4028
- City of Los Angeles Research Report RR24518
- State Departments of Transportation
- Corp of Engineers Specification CW03210
- Concrete Reinforcing Steel Institute

Splicer Dimensions

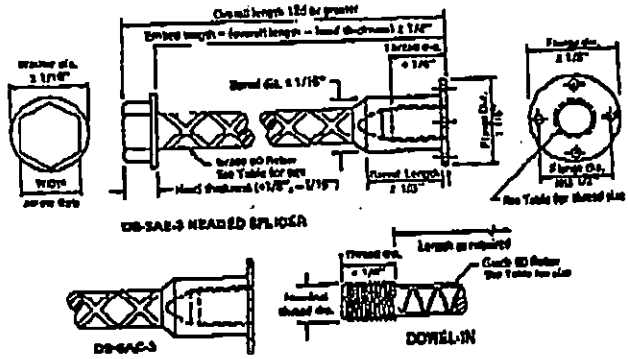




DB-SAE SPLICER					DOWEL-IN (DI)	
Bar Size	Thread Size	Barrel Length	Barrel O.D.	Flange O.D.*	Bar Size	Thread Size
# 4	5/8 - 11UNC	1-1/4"	7/8"	1-7/8"	# 4	5/8 - 11UNC
# 5	3/4 - 10UNC	1-1/2"	1"	2"	# 5	3/4 - 10UNC
# 6	7/8 - 9UNC	1-3/4"	1 1/4"	2-3/8"	# 6	7/8 - 9UNC
# 7	1 - 8UNC	1-15/16"	1-3/8"	2-1/2"	# 7	1 - 8UNC
# 8	1-1/8 - 8UN	2-1/16"	1-9/16"	2-1/2"	# 8	1-1/8 - 8UN
# 9	1-1/4 - 8UN	2-1/4"	1-11/16"	2-3/4"	# 9	1-1/4 - 8UN
# 10	1-7/16 - 8UN	2-5/8"	1-15/16"	3"	# 10	1-7/16 - 8UN
# 11	1-9/16 - 8UN	2-11/16"	2-1/8"	3-1/8"	# 11	1-9/16 - 8UN

*DB-SAE Splicer may be manufactured with reduced flange.

TABLE 4: DB-SAE Splicer and Dowel-In Dimensions



DB-SAE-3 HEADED SPLICER						HEX HEAD		
Bar Size (d)	Thread Size	Barrel Length	Barrel Dia.	Flange Dia.	Minimum Capacity* (125d)	Width Across Flats	Width Dia.	Head Thk.
# 4	5/8"-11UNC	1-1/4	7/8	1-7/8	18,000	7/8	1-3/8	1/2
# 5	3/4"-10UNC	1-1/2	1	2	27,000	7/8	1-5/8	1/2
# 6	7/8"-9UNC	1-3/4	1 1/4	2-3/8	39,500	1-1/16	1-7/8	5/8
# 7	1"-8UNC	1-15/16	1-3/8	2-1/2	54,000	1-1/16	2	5/8
# 8	1-1/8"-8UN	2-1/16	1-9/16	2-1/2	71,100	1-5/16	2-1/8	5/8

*- Normalized for 3,000 psi normal weight concrete and restricted to mechanical capacity of bar and further limited to Dowel-In capacity.
d - Nominal diameter of bar.

TABLE 5: DB-SAE-3 Headed Splicer Dimensions

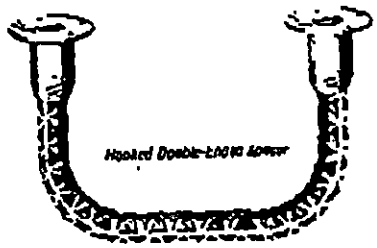
DB-SAE-3 Bar Size	Edge (Shear)* (12d)	Edge (Tension)* (5d)	Spacing (16d)
# 4	6.0"	2.5"	8.0"
# 5	7.5"	3.125"	10.0"
# 6	9.0"	3.750"	12.0"
# 7	10.5"	4.375"	14.0"
# 8	12.0"	5.000"	16.0"

* Shear and tension refers to the loading condition. If the Dowel-In is subjected to both shear and tension loading, the edge distance for shear will govern.

TABLE 6: DB-SAE-3 Headed Splicer Setting

Miscellaneous Components

Hooked Double-Ended Splicer



Hooked Double-Ended Splicer is used to alleviate restrictive concrete space envelopes, such as narrow beams and columns, etc. Other applications may be performed, i.e., insert or anchor cages for attaching sign posts, light poles or other structural fittings. These units may be laced together to provide patterns for 2, 4 or more bolts.

Thread-Ended Splicer

The Thread-Ended Splicer is used to provide a continuous mechanical splice connector to insure reinforcement continuity. The mechanical connector suitable for attaching to the thread end is shown in Table 7, Coupler Selection Guide.

DELTA TESTING LABO'
23 SOUTH MACQUESTEN PARKWAY • MOUN
PHONE (914) 699-0056 • FAX

Post-it® Fax Note 7671	Date 6/23	# of pages ▸ 3
To FRANK BARBELLA	From D. Keitenbaum	
Co./Dept. BARBELLA	Co. DEL	
Phone #	Phone #	
Fax # 908-534-1697	Fax #	

SLURRY MIXING PLANT

DESIGN MIX REPORT

L-138-02168

Date: June 23, 1994

02168

Project No. KD-1

CLIENT: Barbella Environmental Technology, Inc.
P.O. Box 273
Salem Industrial Park, Bldg. 8
Whitehouse, NJ 08888
Att: Mr. Fred Barbella

PROJECT: Pelham Bay Landfill Remediation, NYC

SUBJECT: **Trial Mix Design in accordance with NYC Building Code Section C27-605.**

STRENGTH REQUIRED: 4000 + 1200 psi . . . **@28 days**

SUPPLIER: Casa Redimix Concrete Co.

MATERIALS: Typical as submitted by supplier:

CEMENT: Norval Type II (Cal. No. 236-59-SM)
FINE AGGREGATE: L.I. Natural
COARSE AGGREGATE: New York Traprock, Clinton Point
ADMIXTURE: W.R. Grace Daravair Air Entrainment
ADMIXTURE: W.R. Grace WRDA Hycol - Water Reducer

PASSING SIEVE SIZE	F.A. (sand)	C.A. (#67 stone)
1"	—	100
3/4"	—	97.6
3/8"	100	21.3
#4	96.3	4.8
#8	81.5	—
#16	71.5	—
#30	51.1	—
#50	26.6	—
#100	7.7	—
Fineness Modulus	2.71	6.76
Specific Gravity	2.64	2.81
Unit Weight Dry Rodded	105.6#	99.0#

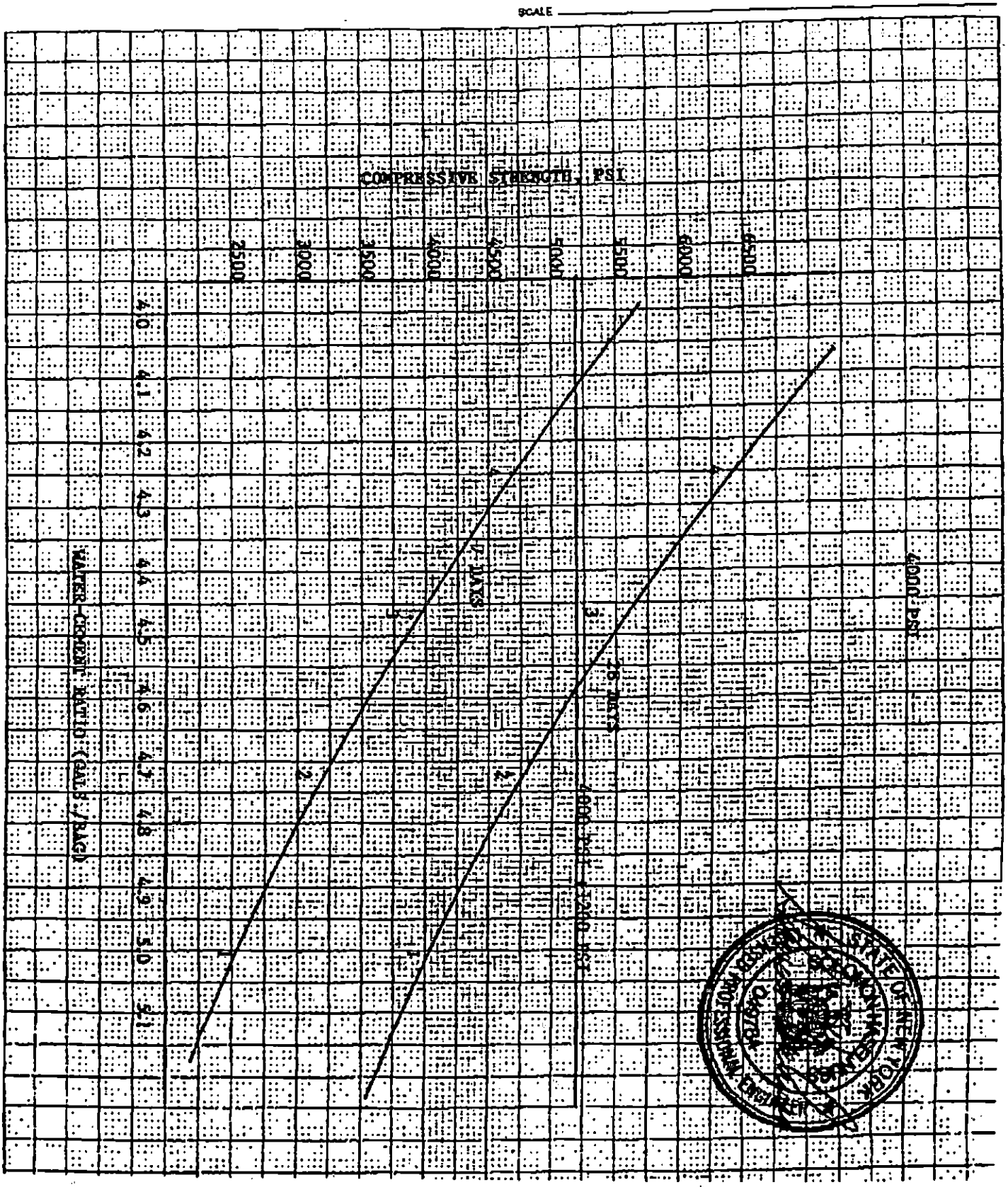
STATE OF NEW YORK
ELCHON HASELNUS
049784
LICENSED PROFESSIONAL ENGINEER

cc: bet(2),file,blg.

F-5

DELTA TESTING LABORATORIES, INC.
23 South MacQuesten Parkway
Mount Vernon, New York 10550
Phone: (914) 699-0056

PROJECT PELHAM BAY LANDFILL REMEDIATION, NYC
SHEET NO. 3 OF 3
CALCULATED BY SH DATE 6/23/94
CHECKED BY DATE
SCALE



DELTA TESTING LABORATORIES, INC.

Date: 6/23/94

Project No. KD-1

WEIGHTS PER CUBIC YARD

	1	2	3	4
Cement, lbs.	564	611	658	705
Sand, lbs.	1380	1310	1250	1240
Stone, lbs.	1800	1800	1800	1800
Total Water, gals. (lbs.)	30.1(250.7)	30.7(255.7)	31.3(260.7)	31.9(265.7)
Admix. DARAV. oz.*	4.8	5.2	5.6	6.0
Admix. WRDA oz.*	16.9	18.3	19 7	21 2
Air Content, %	5.5	6.0	6.5	6.5
Slump, inches	3.0	3.5	3.75	4.0
Unit Weight, #/c.f.	147.95	147.29	146.99	148.54
W/C Ratio, gals./bag	5.02	4.72	4.47	4.25
lbs./lbs.	.44	.42	.40	.38

*Based on manufacturer's recommendations

COMPRESSIVE STRENGTHS

7 Days PSI	3000	3930	3840	4730
	3010	3400	3910	4640
Average	3005	3395	3875	4685
28 Days PSI	4200	4640	5310	6370
	4220	4780	5380	6510
	4340	4710	5420	6460
	4270	4680	5330	6430
Average	4260	4700	5360	6440

Based on the above results, we suggest mix # 3, for 4000 psi concrete +1200 psi.

STATE OF NEW YORK
SOLOMON HASELKORN
049784
LICENSED PROFESSIONAL ENGINEER

DEP

New York City
Department of
Environmental
Protection

Bureau of
Environmental
Engineering

96-05 Horace Harding
Expressway
Corona, NY
11368-6107
718-595-6001

Marilyn Gelber
Commissioner

H.F. VOGEL, P.E.
Deputy Commissioner

July 1, 1994

Re: Contract 875 H.P.
Pelham Bay
Landfill Remediation
Concrete Mix Design

BARBELLA
Environmental Technology, Inc.
P.O. Box 273, Salem Industrial Park,
Whitehouse, New Jersey 08888

Attention: Mr. Michael Lattiers
Project Manager

Gentlemen:

Reference is made to your Letter of Transmittal, dated 6/23/94, (telefaxed copy received on 6/29/94) requesting approval of Normal Weight (4000 psi + 30%), Size #67 Coarse Aggregate, Concrete Mix for approval. We have reviewed the four trial runs of this mix that were run at the approved Delta Testing Laboratories, Inc.. Mix Run #3 is approved for use on the referenced contract as follows:

Normal Weight 875 H-P (Run #3)

Materials	Weight, per cubic yard
Cement, Norval, Type II ASTM C150:	658 Lbs.
Fine Aggregate, SSD L.I. Natural: (ASTM C33)	1250 Lbs.
Coarse Aggregate, SSD N.Y. Trap Rock (ASTM C33) Clinton Point:	1800 Lbs.
Admixtures	
1. Air Entraining Agent, WR Grace Daravair, 6.5% (ASTM C260) and (ASTM C185)	5.6 oz,
2. WRA, WR Grace WRDA Hycol ASTM C494, Type A:	19.7 oz.

Slump, in. (ASTM C187)	3.75 in.
Unit Weight, pcf	146.99 pcf
Water Cement Ratio	
gals/Bag	4.47
Lb/Lb	0.40
Yield, cu. ft.	27.13
Compressive Strength, psi (ASTM C109)	
7 day, Average of 2 cylinders:	3875 psi
28 day, Average of 4 cylinders:	5360 psi

Please note that the mix as indicated above is approved subject to full compliance with the pertinent specifications of the contract.

Very truly yours,

ORIGINAL SIGNED BY

George Cakiades, P.E.
Chief, Division of Safety
and Materials Assurance

JPS/GC/im

xc: Ramaglia/Durig
Gordon
Gelfand/Meakin
Ciancia (Woodward Clyde)
Cakiades
Bhagtani
Stein
Sehgal
File

National® Brand 45-605 Eye-Ease® 45-305 2-Pack Made in USA

975-HP YELHAM BOILY

REINFORCED SLAB FOR SLURRY WALL CAP

CONSTRUCTION DETAILS

	Initials	Date
Prepared By		
Approved By		

BARBELLA ENVIRONMENTAL TECHNOLOGY, INC

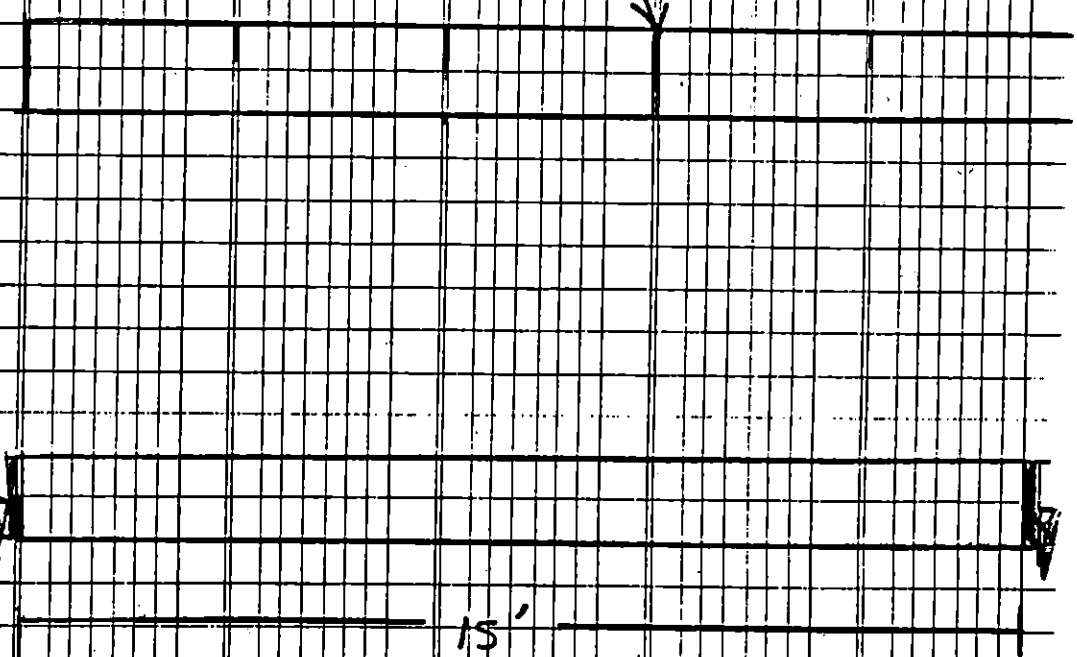
FORMWORK - WOODEN, STAKED & PINNED @ SLAB EDGES

FINISH - SCREED, FLOAT, TROWEL, BROOM

MATERIALS - CONCRETE IN ACCORDANCE WITH NYC BUILDING CODE SECTION C27-605
4000 PSI @ 28 DAYS

CONSTRUCTION JOINTS:
MAXIMUM SPACING @ 20' by SAWCUT METHOD @ 3/4" DEEP

AT 60' INTERVALS, USE HORNBOARD (ASPHALT IMPREGNATED EXPANSION JOINT FILLER)



10/7/94

S
R
P

Date: 10/5/94
Calculations by: M.A.
Checked by:
Date checked:

Project: Barbella Environmental Technology Road
* PELHAM BAY LANDFILL

Given: #4 @ 18", Grade 60

$.20 in^2 \cdot \frac{60}{75} = .16 in^2 \cdot \frac{12}{18} = .107 in^2$

Equals: D11 @ 12", Grade 75

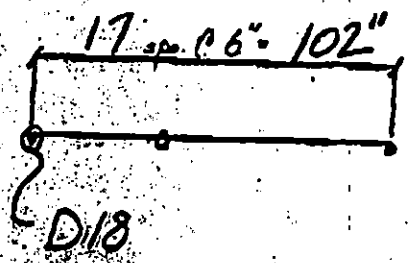
Given: #6 @ 12", Grade 60

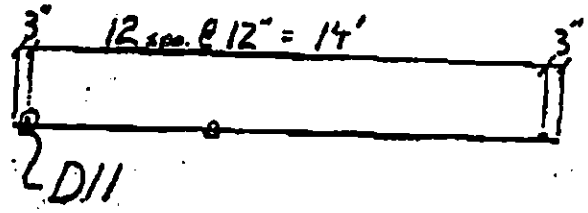
$.44 in^2 \cdot \frac{60}{75} = .352 in^2 \cdot \frac{6}{12} = .176 in^2$

Equals: D18 @ 6", Grade 75

Sheet Style: 6" x 12" D18/D11 8'-6" x 14'-6" (3.3)

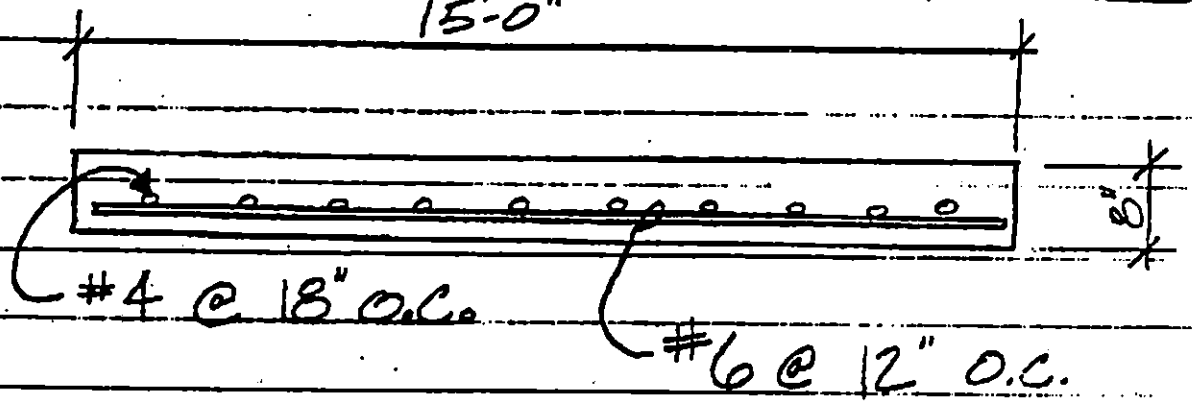
Sheet Sketch:





Structural Reinforcement

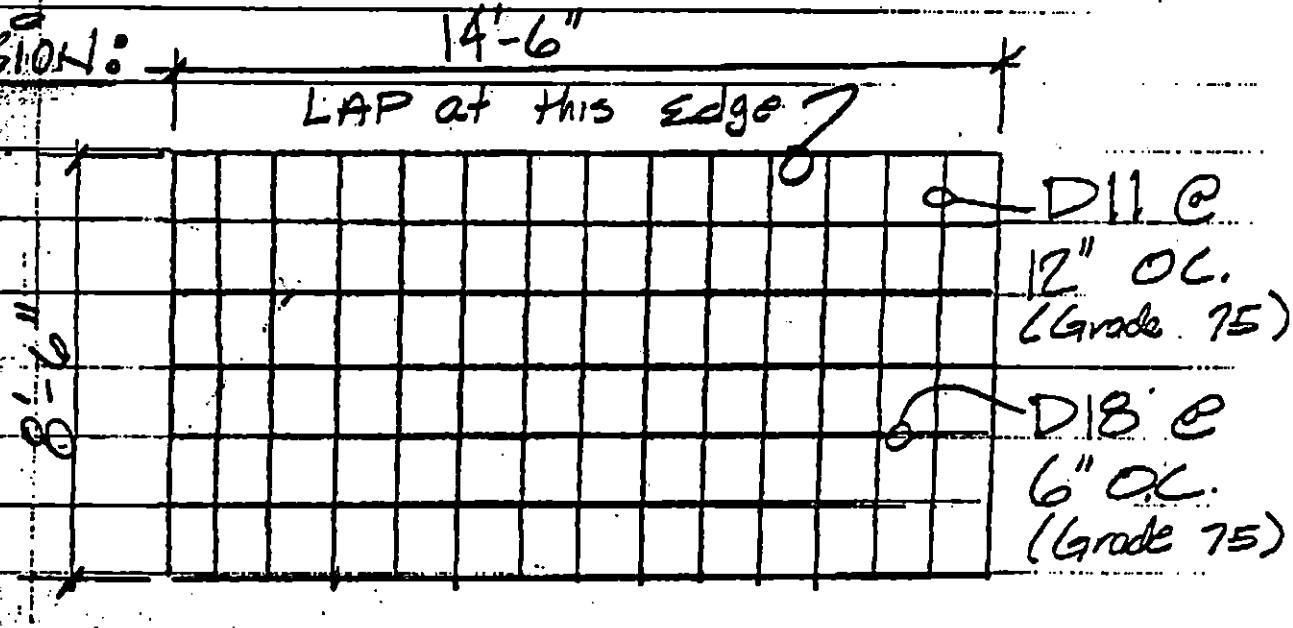
Roadway For:
Borbella Enuironmental Technology
* PELHAM BAY LANDFILL



Total of 1350 LF of this slab.

REBAR ON PLANS

VERSION:



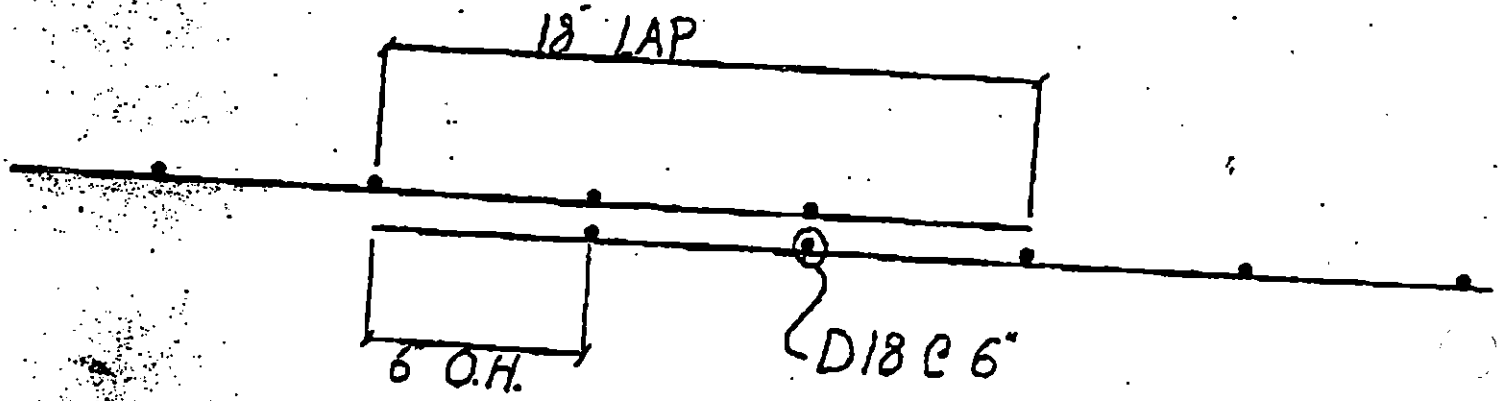
TOTAL - D11 x D18

DETAIL OF MAT

Date:
Calculations by:
Checked by:
Date checked:

* BARBENA ENVIROMENTAL
- PELHAM BAY LANDFILL

18" LAP SPLICE DETAIL



Structural Reinforcement

HORNBOARD

Asphalt Impregnated Fiber Expansion Joint Filler

DESCRIPTION

HORNBOARD Asphalt impregnated Fiber Expansion Filler is composed of tough, resilient, cellulose fibers securely bonded together with a uniform impregnation of bituminous binder and performed into strips or sheets. The material is strong but lightweight; cuts and handles easily; resists breakage. It will not extrude from the joint under normal compression and service temperatures, and does not embrittle in cold weather.

Installation is easy: HORNBOARD will not twist, break or deform with ordinary handling. It cuts cleanly, places readily, stays strong and sound through many years of repeated expansion/contraction cycles.

USE

HORNBOARD is a general, multi-purpose filler for expansion joints in all types of heavy concrete construction. It is specifically engineered for commercial, industrial and public works applications.

LIMITATIONS

HORNBOARD should not be used in conjunction with polysulfide, acrylic or other polymer-base joint sealants.

SPECIFICATIONS

Designed to comply with:
AASHTO Spec. M 213-74
ASTM Spec. D 1751-83
Fed. Spec. H H-F-341f, Type I
Corps of Engineers Spec. CRD C 508-72
FAA Spec. P 501-2.4 & P610-2.7 (1968)

SIZES

Lengths: 10' & 5'
Widths: 3" to 48" in 1/2" increments
Thickness: 3/8", 1/2", 3/4", 1"

B-1085-21

AC Horn INC
Atlanta, Dallas, Los Angeles, Passaic, NJ
Bensenville, IL, Beltsville, MD

HEADQUARTERS: 12119 CONWAY ROAD, BELTSVILLE, MD 20705-1302
TELEPHONE: (301) 470-3377 TOLL FREE: 800-654-0402

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Slurry wall Construction.

BENTONITE Corporation

BARA-KADE® 90
Slurry Trench Soil Sealing Grade - 200 Mesh

Typical Physical and Chemical Properties*

X-RAY ANALYSIS

94%	Montmorillonite
4%	Quartz
1%	Feldspars
1%	Calcite

CHEMICAL ANALYSIS

SiO_2	63.31%
Al_2O_3	21.43%
Fe_2O_3	3.83%
CaO	0.63%
MgO	2.32%
Na_2O	2.45%
K_2O	0.31%
Bound Water	5.72%

SCREEN ANALYSIS	TYPICAL	SPECIFICATION
Dry Screen, percent minus 200 mesh	77	70 min
Wet Screen, percent plus 200 mesh	1.9	4 max
Wet Screen, percent plus 325 mesh	3.2	5 max
SLURRY PROPERTIES (6% Suspension)		
Viscosity, FANN® 600 rpm	37	30 min
Apparent Viscosity, cps	18.5	
Plastic Viscosity (PV)	12	
Yield Point, lb/100 ft^2	13	3 x PV max
Filtrate, 30 minutes @ 100 psi	12	15.0 cm^3 max
Yield - 42 gal bbl of 15 cps slurry/ton	95	91 min
Filter Cake	3/32	
Marsh Funnel, seconds/quart	36	
OTHER PROPERTIES		
Moisture, percent	8.0	10 max
Free Swell (ml)	25	
Specific Gravity	2.79	
pH, 6% suspension	9.2	
Bulk Density (lbs per ft^3) compacted	72	

* The typical physical and chemical values listed are not to be construed as rigid specifications. Metals listed in the chemical analysis are complexed in the mineral. They do not necessarily exist as free oxides.
BARA-KADE® 90 meets or exceeds API specification 13A, Section 4.

11/4/93.tpcp.23

1999 Broadway, Suite 4300 - Denver, Colorado 80202 - Phone (303) 291-2940 - Fax (303) 291-2950