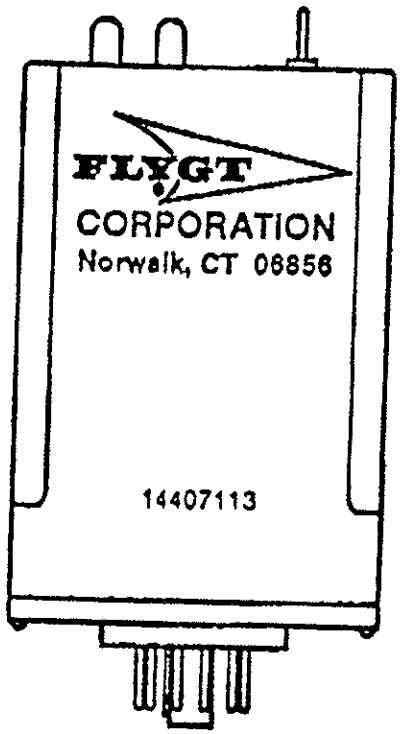
MINICAS II

(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

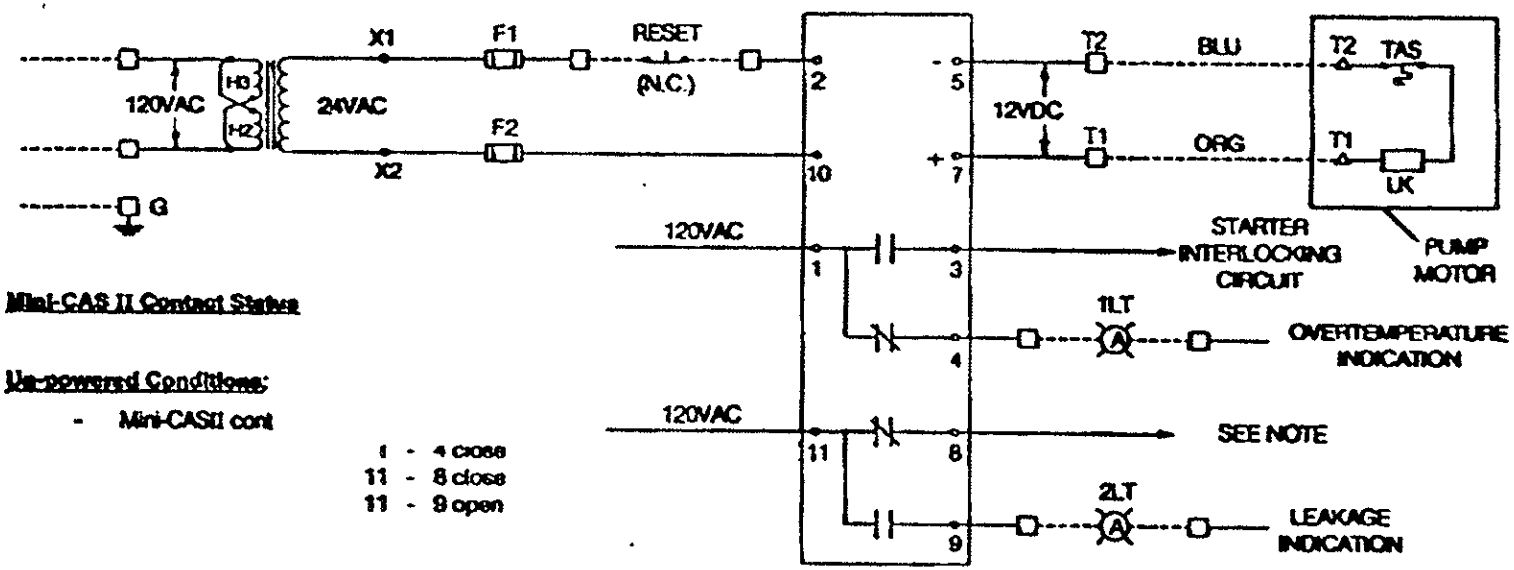
In the manual mode of operation, if an over temperature condition occurs, the unit will turn the pump off and lock it out. The only way power can be restored to the pump is by a manual restart, and only after the temperature has cooled to a point of safe operation.

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.

MINICAS II WIRING DIAGRAM



Mini-CAS II Contact Status

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 Rating - 16 AMPS @ 277VAC, PF = .6

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

11 Pin Socket Part Number - 14-40 70 97

NOTE: IT 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:

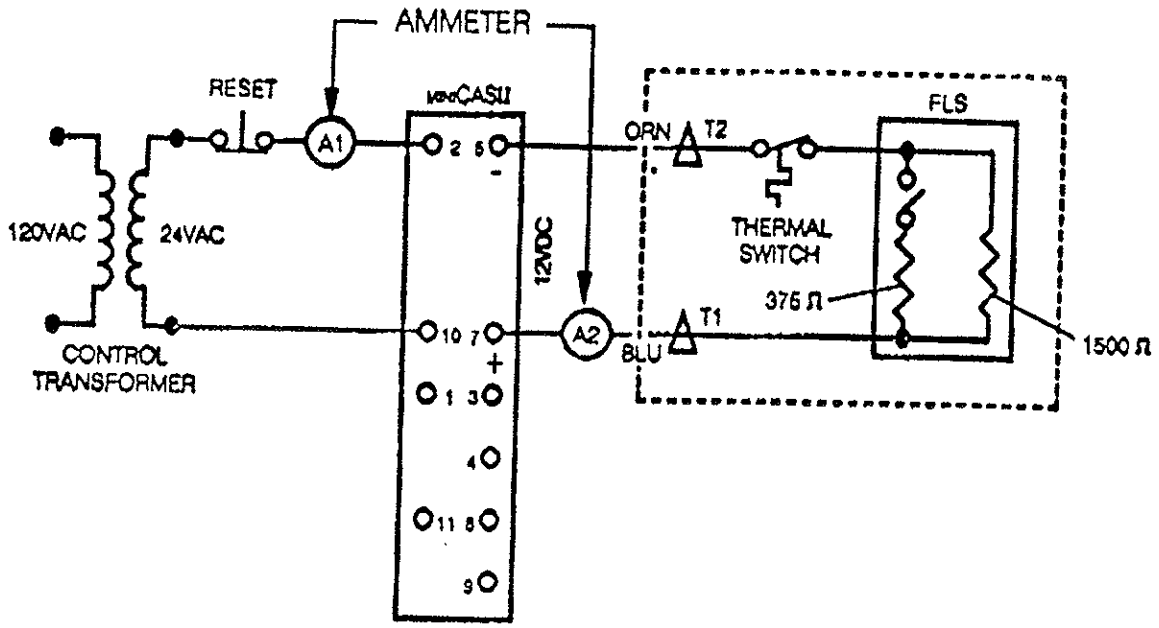
- Normal conditions: 4.80 mA
- Leakage conditions: 6.10 - 6.45 mA

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	>6 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

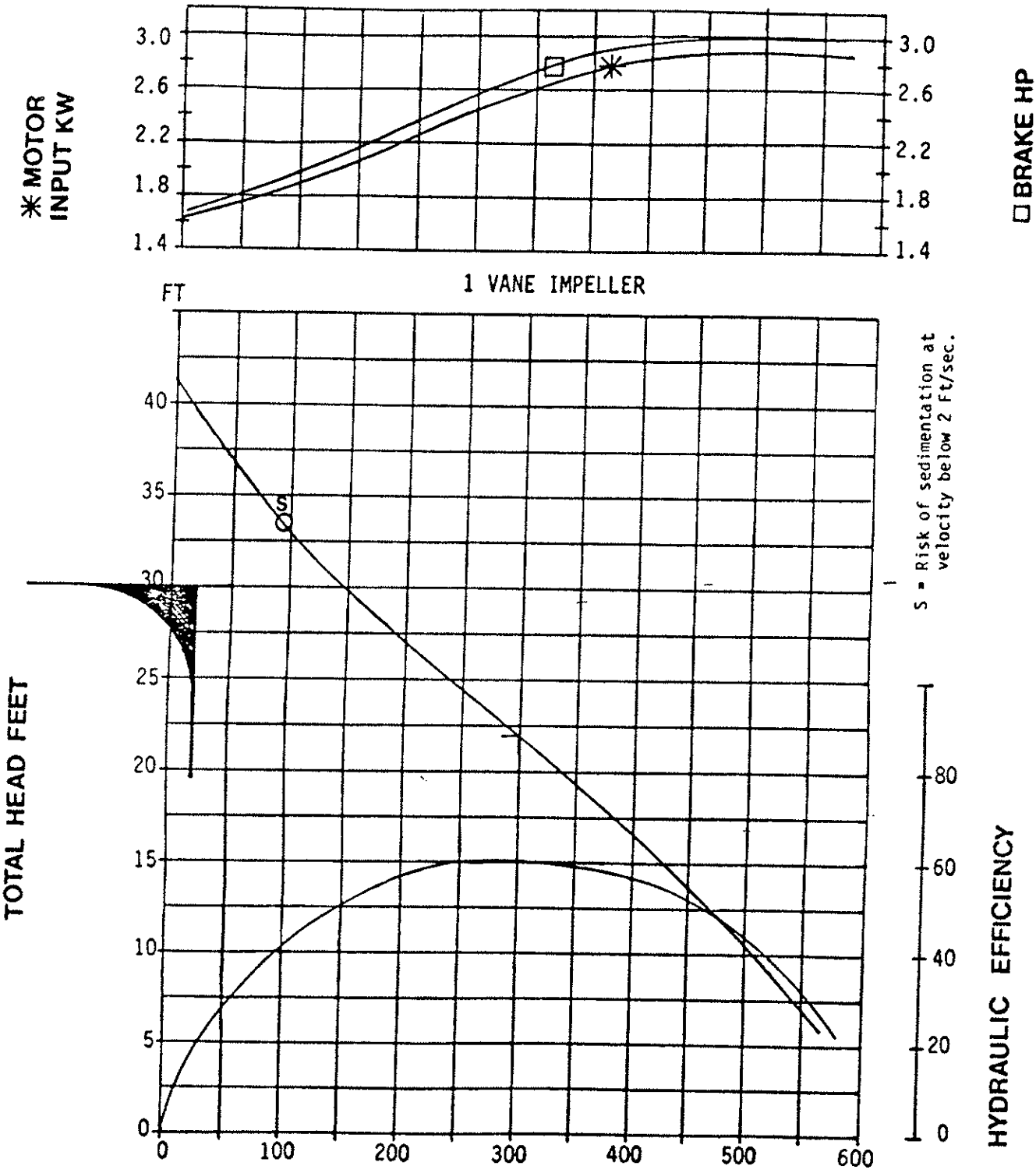
Equipment Serial No: _____ **Distr. Order No.** E18811

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 SUPERSEDES	PAGE 8/434 ISSUED 4/86



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

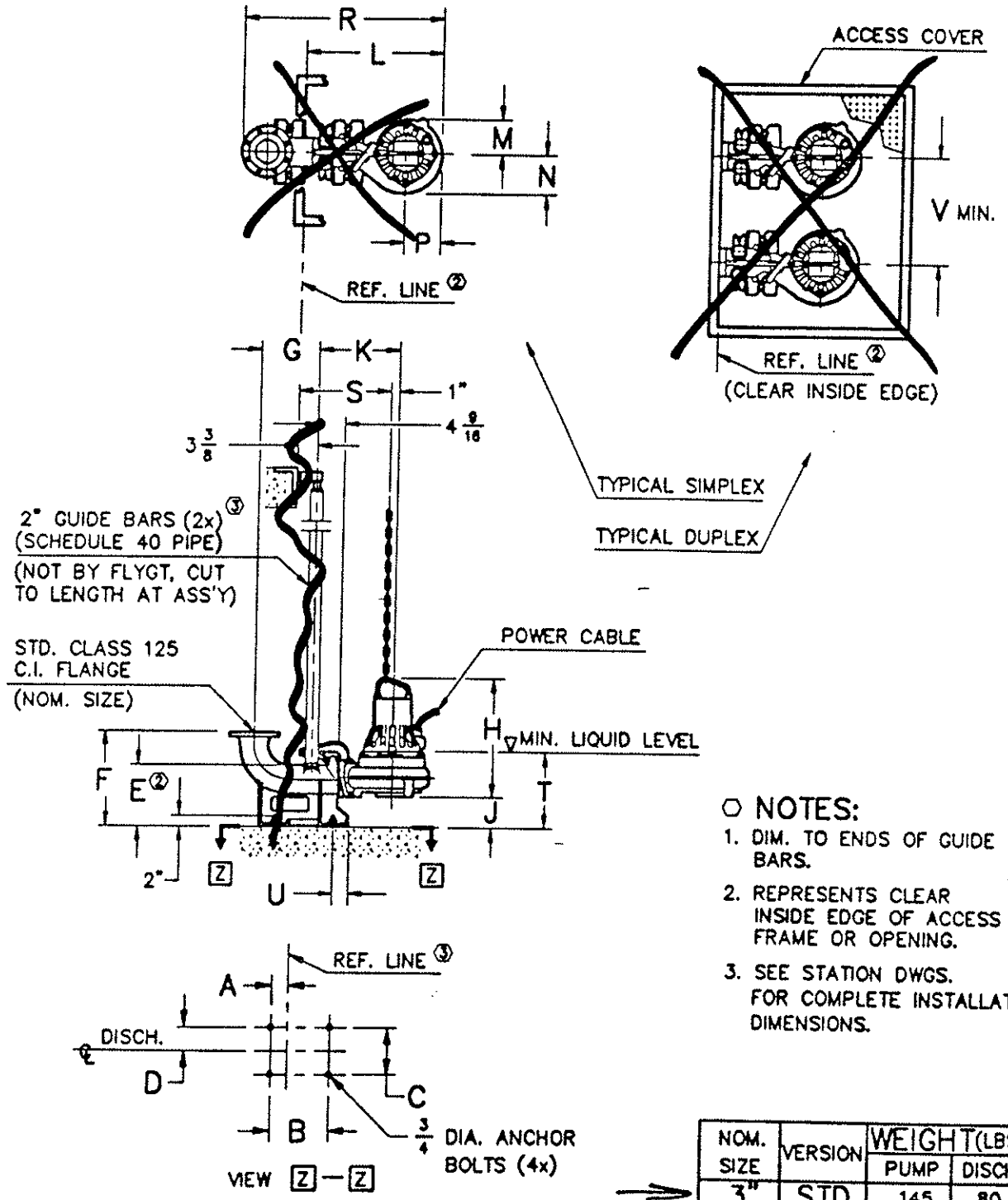
PERFORMANCE CURVES ARE BASED ON TESTS WITH CLEAR WATER AT AMBIENT TEMPERATURE.

FLYGT 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	DISCH
3"	STD	145	80
~~4"~~	~~STD~~	~~145~~	~~80~~

ALL DIMENSIONS IN INCHES

NOM. SIZE	VERSION	DIMENSIONAL CHART																			
		A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V
3"	STD	2 5/16	9 1/8	7 3/4	3 5/8	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 5/8	33 1/4	15 3/4	12 1/4	2 3/4	17 3/4
~~4"~~	~~STD~~	~~2 3/4~~	~~9 1/8~~	~~7 3/4~~	~~3 5/8~~	~~10 1/4~~	~~15 3/4~~	~~9 3/8~~	~~20~~	~~5~~	~~13 3/4~~	~~23 1/4~~	~~5 3/4~~	~~6 3/4~~	~~6 5/8~~	~~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	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 3.6	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
~~*2.9~~	~~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~~	~~0.82~~	~~0.69~~	~~0.63~~

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

PILOT

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)

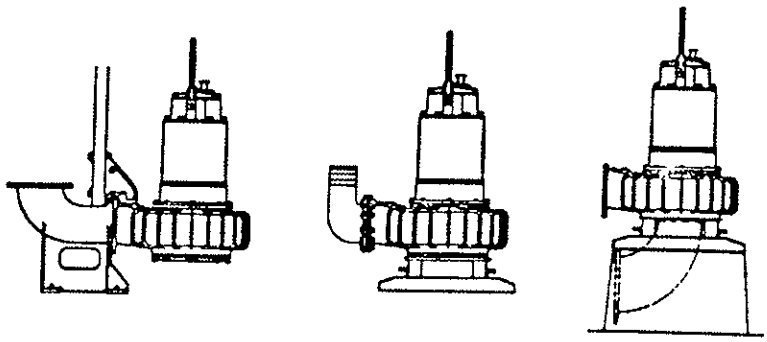
D:b
(speccppc)

Special Purpose Pumps

EXPLOSIONPROOF PUMPS

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
3955 (X)	74.0 - 148
3500 (X)	100.0 - 280
3530 (X)	100.0 - 300
3531 (X)	100.0 - 300
3601 (X)	100.0 - 300
3602 (X)	100.0 - 300

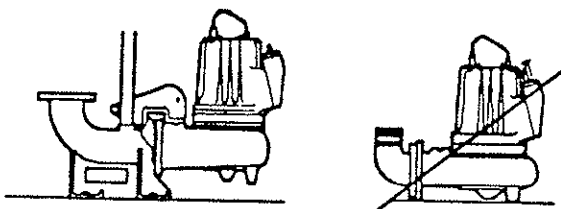
These units are special versions, model number suffix (X), of ITT Flygt's standard wastewater pumps constructed to meet explosionproof requirements and are Factory Mutual Systems approved for use in hazardous locations defined as Class 1, Division 1, Groups C and D (gasses and vapors) Class 2, Div.1, 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.

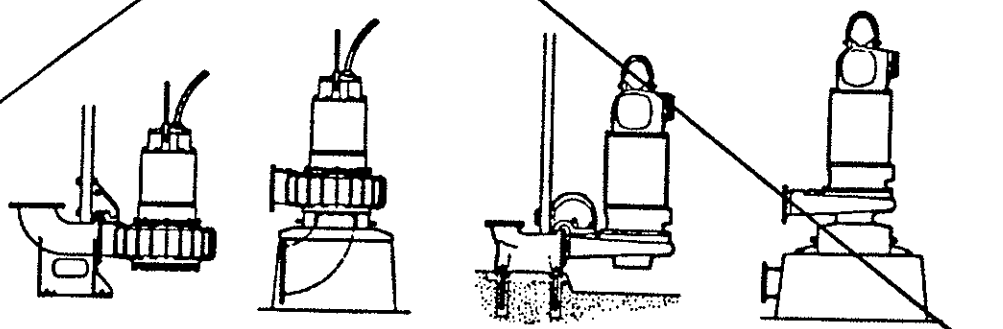


RAW WATER PUMPS

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.

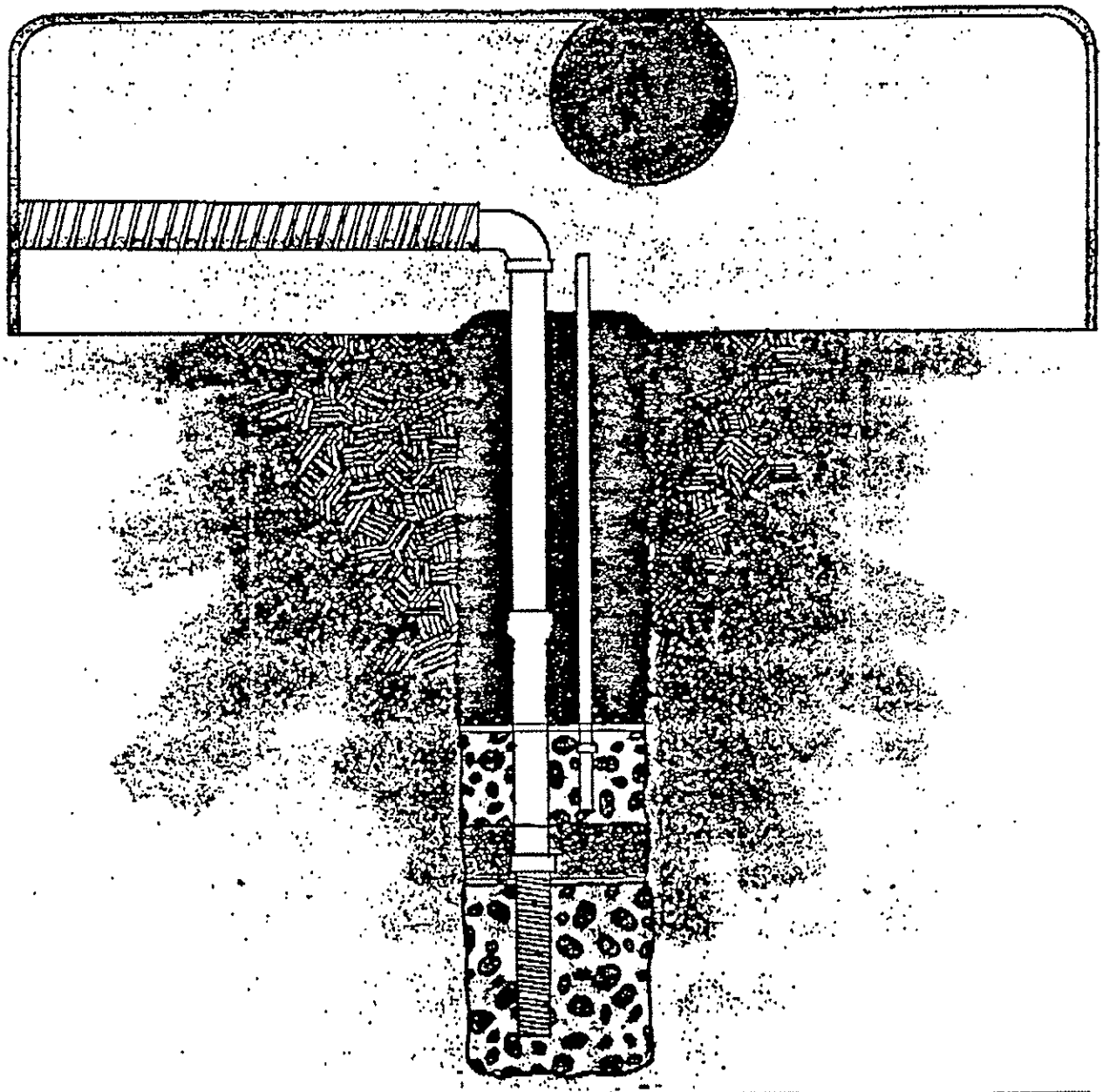


RP 3300 RT 3300 RP 3230 RT 3230

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.

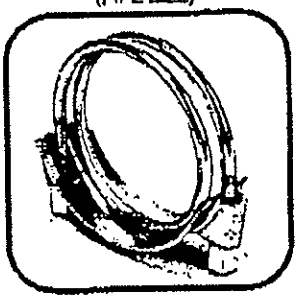
Smooth bore for unrestricted flow.

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

DISTRIBUTED BY:

Kanaflex® CORPORATION
800 Woodlands Parkway
Vernon Hills, IL 60061

SECTION 6

Universal StopCocks®

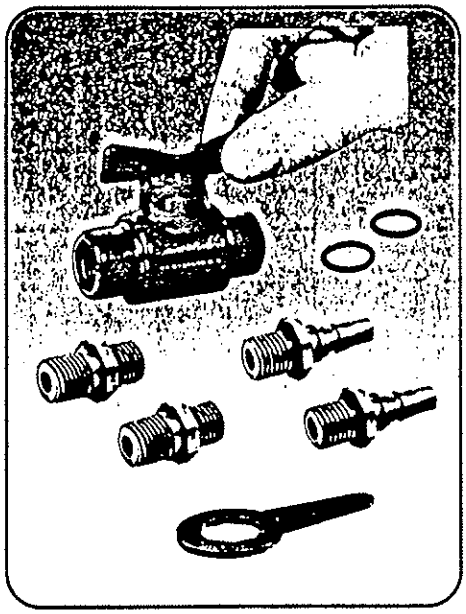
Test Point - Gas Wellheads

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.

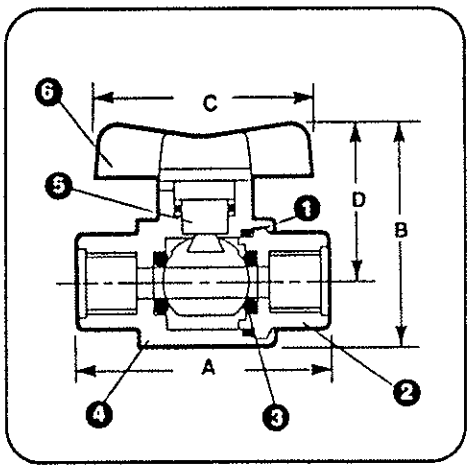
Engineering Specifications

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.



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



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

HAYWARD 900 Fairmount Avenue, Elizabeth, New Jersey 07207

Propane and Nitrogen Cylinders

WORTHINGTON PROPANE CYLINDERS

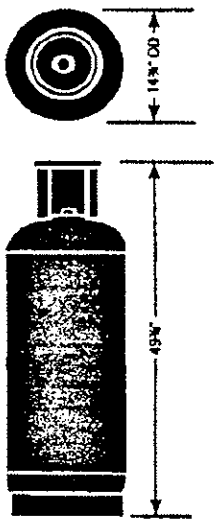
WORTHINGTON PROPANE CYLINDERS: EXCEPTIONAL QUALITY, SERVICE AND SELECTION FOR ALL APPLICATIONS.

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.

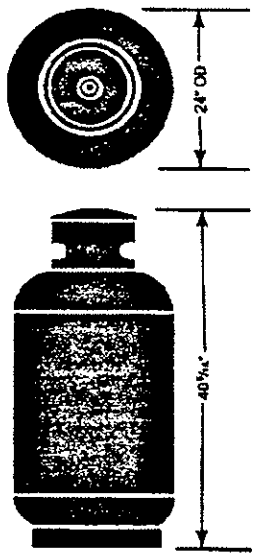
- 15 sizes (in pounds): 4¼, 6, 10, 11, 20, 25, 30, 40, 60, 100, 200 and 420 lb. Also aluminum forklift cylinders in 20, 33½ and 43½ lb.
- Up to 30-inch diameter.
- Rust/corrosion-resistant finish: polyurethane paint on sizes 4¼ lb. through 100 lb. Larger sizes are powder coated.
- Cylinders are manufactured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

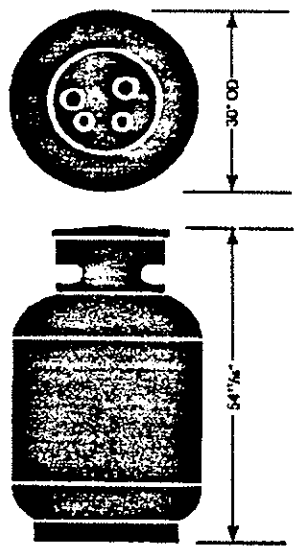
DOT-4BW-240



200 LB.

LP-Gas Capacity (approx. gal.) (LP)	45.8
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)	95.6
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

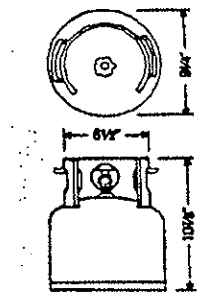
P.O. Box 391
1085 Dearborn Drive
Columbus, Ohio 43085
614/438-3013
FAX 614/438-3083

Top valves are 10% bleeder valves

UG TANKS by WORTHINGTON

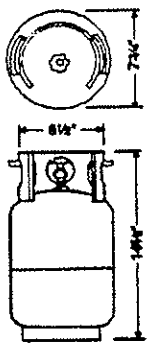
CAMPING, RECREATIONAL VEHICLES, GAS GRILLS, COOKING, HEATING AND COMMERCIAL-INDUSTRIAL USES...WORTHINGTON MAKES A SIZE TO FIT THE NEED!

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



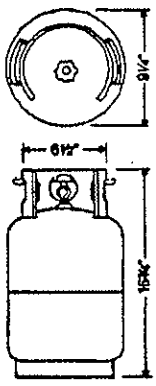
4¼ LB.

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.) . . 9¼
DOT-4BA-240



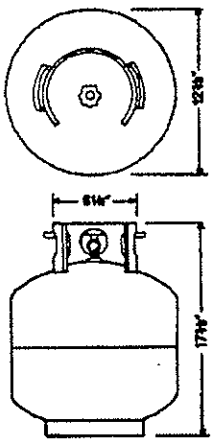
6 LB.

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



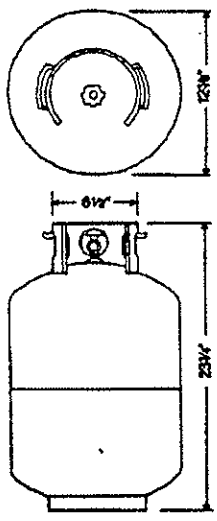
11 LB.

LP-Gas Capacity
(approx. gallons) (LP) . 2.5
Water Capacity (lbs.) . 28.2
Tare Weight (lbs.) 13.2
Cyl. Volume (cu. in.) . . 726
Collar Height (in.) 4
Footring Dia. o/s (in.) 7¹³⁄₁₆
DOT-4BA-240



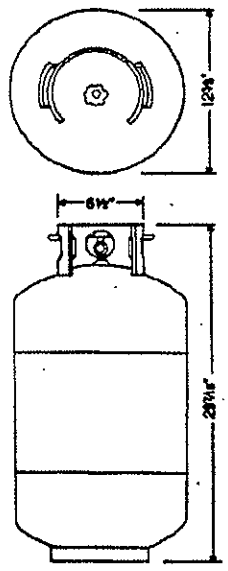
20 LB.

LP-Gas Capacity
(approx. gallons) (LP) . . . 5
Water Capacity (lbs.) . 47.7
Tare Weight (lbs.) 18.9
Cyl. Volume (cu. in.) . 1323
Collar Height (in.) . . . . . 4"
Footring Dia. o/s (in.) 7¹³⁄₁₆
DOT-4BA-240



30 LB.

LP-Gas Capacity
(approx. gallons) (LP) . . . 7
Water Capacity (lbs.) . 71.5
Tare Weight (lbs.) 26.5
Cyl. Volume (cu. in.) . 1983
Collar Height (in.) . . . . . 4"
Footring Dia. o/s (in.) 7¹³⁄₁₆
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.) 7¹³⁄₁₆
DOT-4BW-240

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

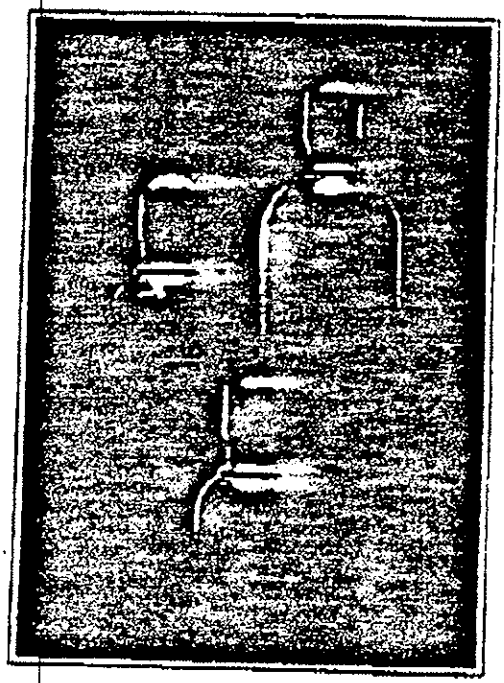
UG WORTHINGTON CYLINDERS
SUBSIDIARY OF WORTHINGTON INDUSTRIES, INC.

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 Cu.ft. @70F	O.D. Inches	Length Inches	Nom. Wall Inches	Weight Lbs.	Water Capacity 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
			222.25	1282.7	6.10	51.40	43.40
256	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

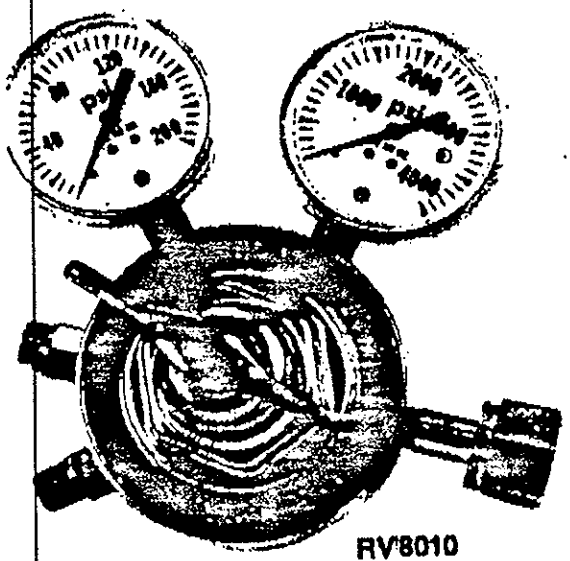
WORTHINGTON CYLINDER CORPORATION

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



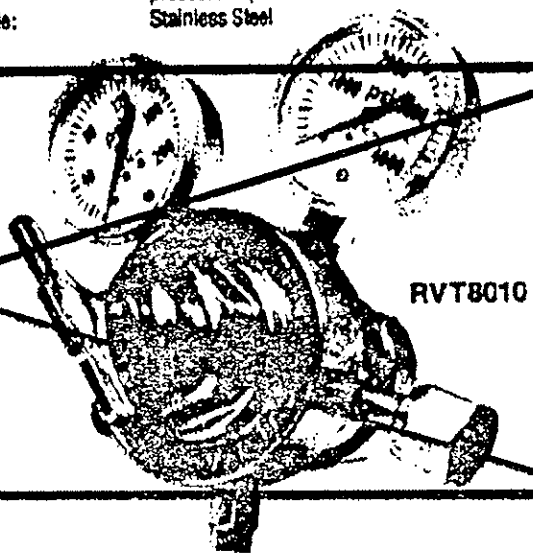
RV8010

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+, ++
Seat:	Stem-type safety check, closes with inlet pressure impact
Nozzle:	Stainless Steel

RVT-80 SERIES

TWO STAGE REGULATORS



RVT8010

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.

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 Ⓤ.L. Listed

RV 8015 - Nitrogen

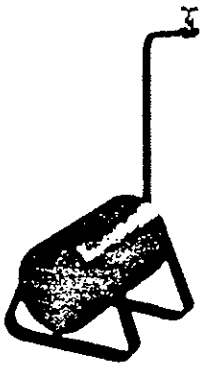
GOSS

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.

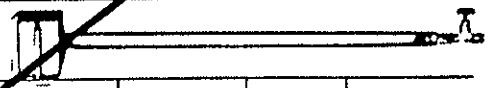
Blue-Jet Vapor Torches

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	37 in.	4½ lb.	250,000	11 lb /hr	BP-10	2⅜ in
AP-15	25 in.	4 lb	200,000	9 lb /hr	BP-11	2 in
AP-16	21 in.	4⅛ lb	200,000	9 lb /hr	BP-12	2 in. x 3 in

Torches with Steel Tubing Burners

AP-10A

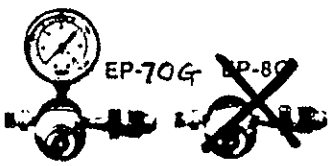
AP-6 Has two grips for easy handling.

AP-25

Torch No.	Length	Weight	Approx. BTUs at 40 PSI	Approx. Gas Usage at 40 PSI	Tip	Tip Diameter
AP-6/AP-10A	38⅛ in.	3¼ lb	225,000	10 lb./hr.	BP-8	3/8
AP-25	22 in	1⅛ lb	225,000	10 lb./hr.	BP-6TE	2⅜ in

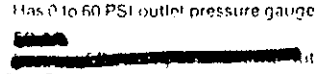
Regulators

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 rating 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—1 Body only, no fittings
EP-60—1 P.O.L. inlet, ⅜ in. flare outlet
EP-60—2 P.O.L. inlet, ⅜ in. flare outlet
EP-60—3 P.O.L. inlet, LH hose outlet
EP-60—4 T-Block inlet, ⅜ 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.

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

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.

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

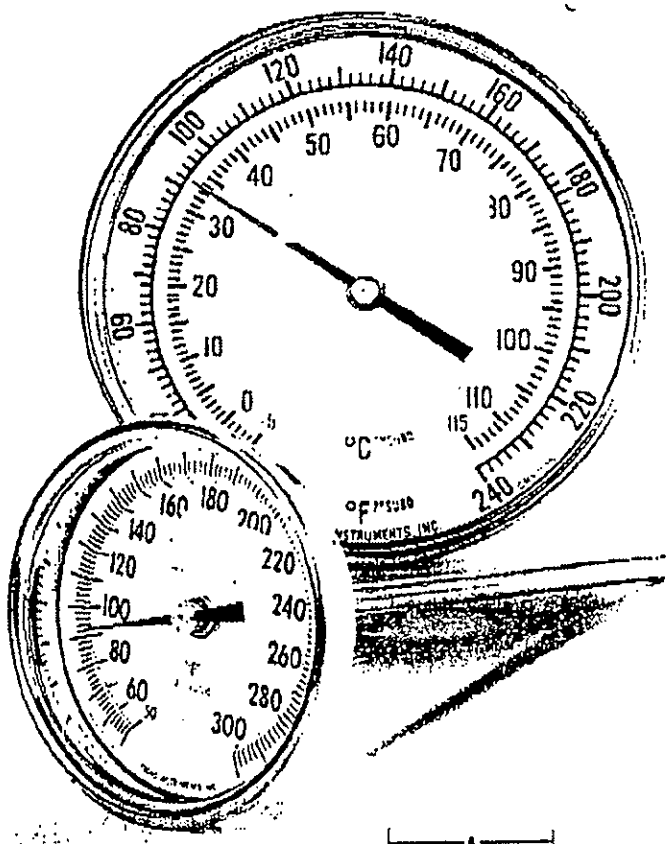
*LP-70 Regulator with dust cap and heavy duty inlet nut

90° BACK ANGLE FORM

DIAL SIZES: 3" to 5"

Model 30 & 50 Bi-Metal Thermometers

3946K

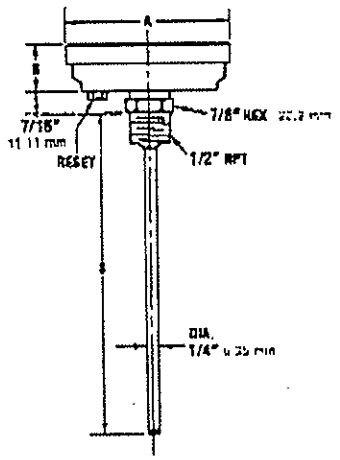


Dial Size	A	B	S (stem length)
3" 76.2 mm	3 1/4" 82.55 mm	15/16" 23.81 mm	as specified
5" 127 mm	5 1/4" 133.35 mm	15/16" 23.81 mm	as specified

ALL DIMENSIONS ± 1/16" (1.58 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°	10 to 150°	10°	1°
50 to 400°	50°	5°	10 to 200°	20°	2°
50 to 500°	50°	5°	10 to 260°	20°	2°
150 to 750°	100°	10°	65 to 400°	50°	5°
*200 to 1000°	100°	10°	95 to 540°	50°	5°

*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.

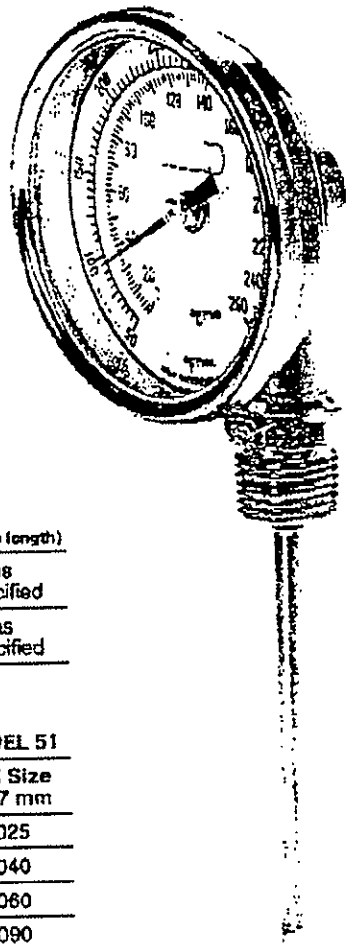
See General Specifications on page 2 for construction features and for available accessories and options.

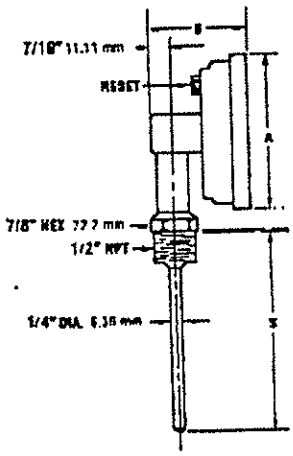
STRAIGHT FORM 90° RIGHT/LEFT ANGLE FORM

DIAL SIZES: 3" & 5"

Model 31 & 51 Bi-Metal Thermometers

3756K





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

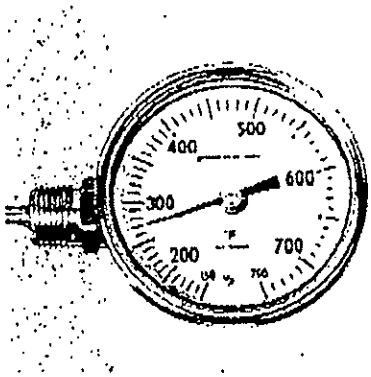
ALL DIMENSIONS ± 1/16" (1.58 mm)

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	304.8	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°
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°	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 550°	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

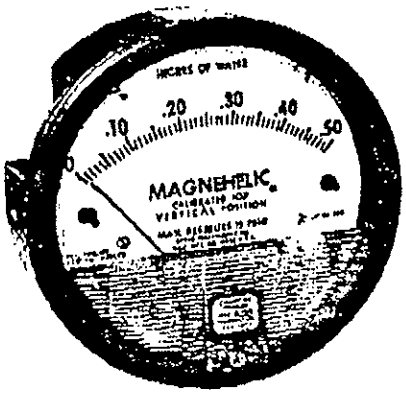
The catalog number shown indicates only the dial size, angle form and stem length. For complete, descriptive part number please use the tables listed on page 13.

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.



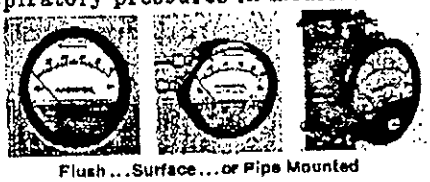
Patent Nos. 4,030,365
5,012,678

To be provided:

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

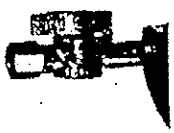
Select the Dwyer Magnehelic® gage for high accuracy — guaranteed within 2% of full scale — and for the wide choice of 81 ranges available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® movement, it quickly indicates low air or non-corrosive gas pressures — either positive, 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 4⅜₆" 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 4¹³⁄₁₆" 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

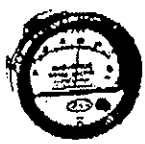
Ambient temperature range: 20° to 140° F.*
Rated total pressure: – 20" Hg. to 15 psig.†
Overpressure: Relief plug opens at approximately 25 psig.
Connections: ⅛" NPT female high and low pressure taps, duplicated – one pair side and one pair back.
Housing: Die cast aluminum. Case and aluminum parts triclite-dipped 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 ¼" 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 ⅜₆" 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.

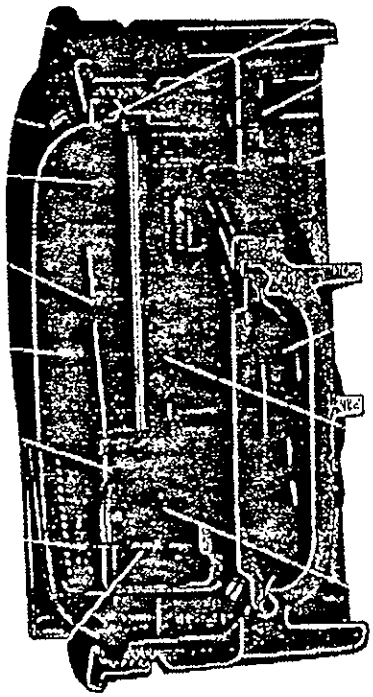
Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on helix shaft.

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 hammerloid. 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 pitot 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	.10

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

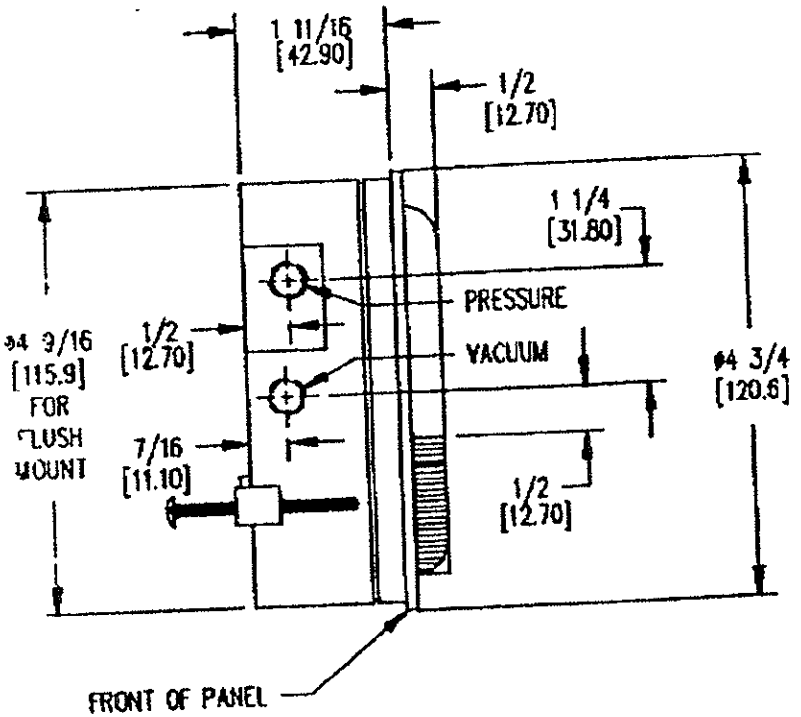
Scale No. 2402 Blank Scale Specify Range

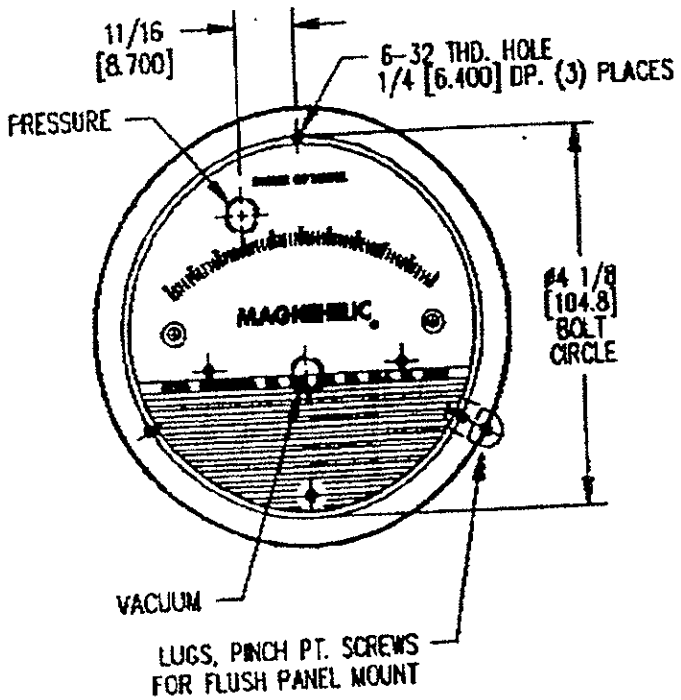
Model 2000-00N, Range – .05 to + .20" W.C. For room pressure monitoring.

Hg Qty

* - 0-5" .10

" .20





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

NO	CHANGES	BY/DATE	DATE	NAME	MATERIAL
			10-06-94	OUTLINE DIMENSIONS 2000 MAGNEHELIC GAGE	
			DWN BY CAT		FINISH
			CHKD EJB		DWYER INSTRUMENTS, INC. MICHIGAN CITY, INDIANA 46360 U.S.A.
	REDRAWN PER ECR #2633	CAT 10-06-94	APPD EJB	ACADR12	FR. NO. 12-700060-00

Gas Flow meter

SUBMITTALS ON KURZ THERMAL MASS FLOWMETERS

PROJECT: Pelham Bay Landfill

CUSTOMER: Breco Mechanical

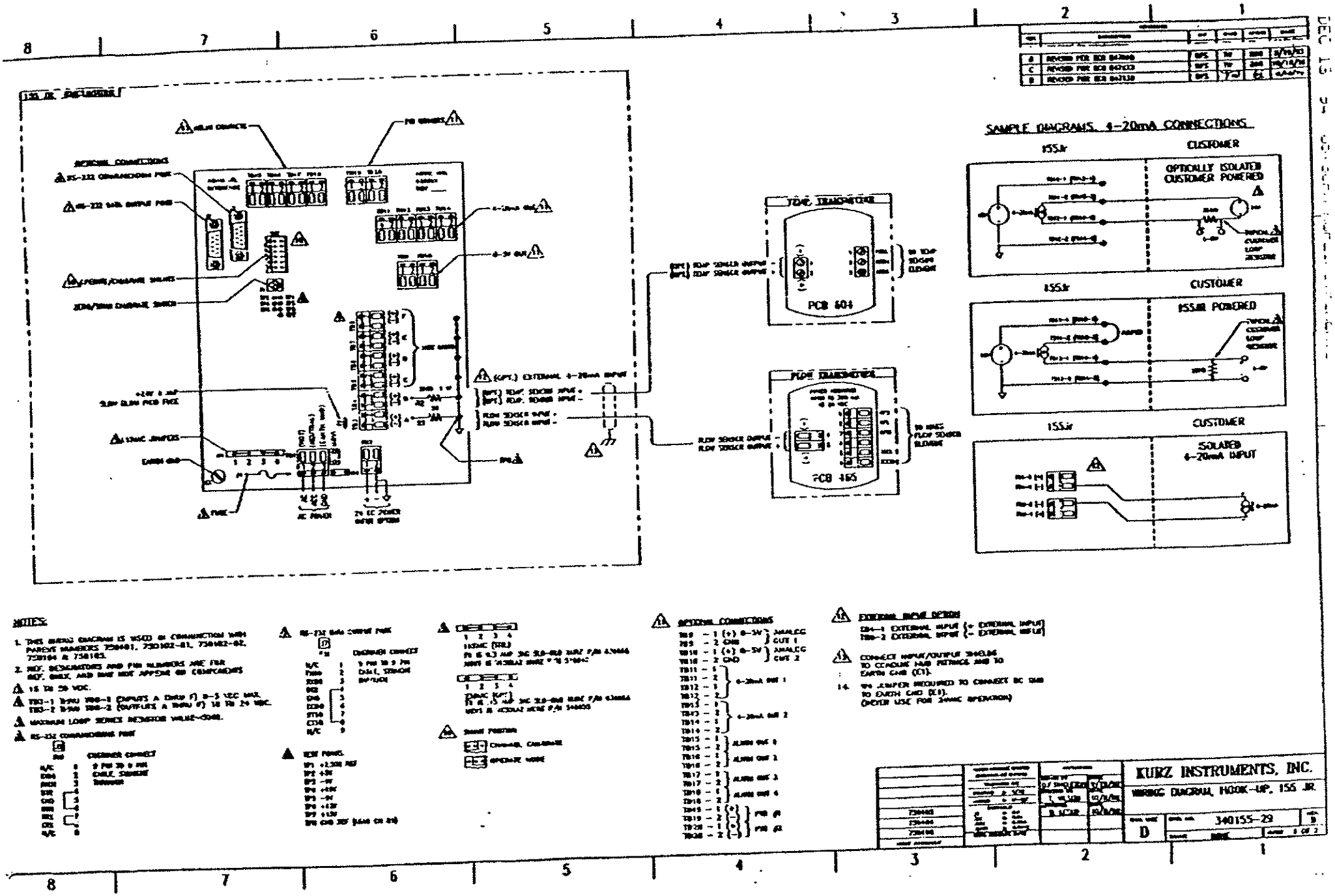
PURCHASE ORDER NUMBER: 1305

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

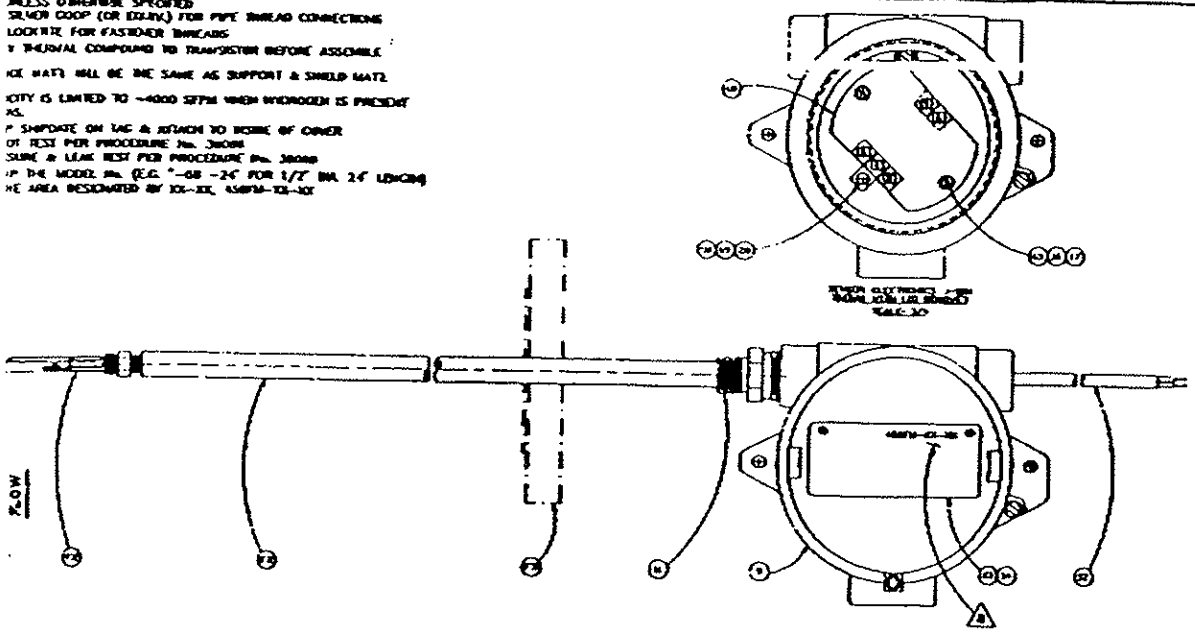
Submitted by: Industrial Representatives, Inc.
P.O. Box 421
Clifton, NJ 07015
(201) 471-2614

Date: February 22, 1995



Submittal Page 2

UNLESS OTHERWISE SPECIFIED
SILVER SOLDER (OR EQUIV.) FOR PIPE THREAD CONNECTIONS
LOCKWIRE FOR FASTENER THREADS
T THERMAL COMPOUND TO TRANSISTOR BEFORE ASSEMBLE
ICE MATL WILL BE THE SAME AS SUPPORT & SHIELD MATL
XCITY IS LIMITED TO ~4000 SFPM WHEN HYDROGEN IS PRESENT
XS.
P SHIPDATE ON TAG & ATTACH TO BOSS OF CONDUIT
OF TEST PER PROCEDURE No. 38088
SURE & LEAK TEST PER PROCEDURE No. 38088
IP THE MODEL No. (E.G. "-08 -24" FOR 1/2" DIA 24" LENGTH)
HE AREA DESIGNATED BY XX-XX, 4588M-XX-XX



FEATURE 1			
SENSOR MATERIAL	750801/750852		QTY.
316SS	1300229-03		1
HAST. C276	1300229-05		1
ADEL	1300229-00		1
TANIUM	1300229-00		1
ARD NICKEL-CHROME IN 316SS	1300229-00		1
TANIUM NITRIDE IN 316SS	1300229-00		1
PECIAL	1300229-00		1

FEATURE 2							
UPPORT & SHIELD MATL	LENGTH	750839 SUPPORT	750839 SHIELD	750852 SUPPORT	750852 SHIELD	QTY.
316SS	3"	1500041-00	150007	1500040-00	150008	1
	6"	1500041-02	150007	1500040-00	150008	1
	12"	1500041-04	150007	1500040-00	150008	1
	24"	1500041-06	150007	1500040-00	150008	1
	36"	1500041-08	150007	1500040-00	150008	1
	48"	-	-	1500040-02	150008	1
	60"	-	-	1500040-03	150008	1
316SS	SPECIAL	1500041-00	150007	1500040-00	150008	1
HAST. C276	3'-60"					
HAST. C276	SPECIAL					
ONEL	3'-60"					
ONEL	SPECIAL					
TANIUM	3'-60"					
TANIUM	SPECIAL					
PECIAL	3'-60"					
PECIAL	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
88	SPECIAL RANGE/UNITS			

FEATURE 4			
OPTION	IR1 PROTECTION CIRCUIT	PART No.	QTY.
00	NO IR1 PROTECTION CIRCUIT	-	-
01	TECHNOLOGICK ATTACHED		

FEATURE 5 / 6				
OPTION	SUPPORT WITH WELDED FLANGE	750854	750852	QTY.
00	NO FLANGE	-	-	-
01	1/2" ASA R.F., 150#	1502146-01	150247-01	1
02	1/2" ASA R.F., 300#	1502146-02	150247-02	1
11	3/4" ASA R.F., 150#	1502146-03	150247-03	1
12	3/4" ASA R.F., 300#	1502146-04	150247-04	1
20	1" ASA R.F., 150#	1502146-05	150247-05	1
22	1" ASA R.F., 300#	1502146-06	150247-06	1
30	1-1/2" ASA R.F., 150#	1502146-07	150247-07	1
32	1-1/2" ASA R.F., 300#	1502146-08	150247-08	1
88	SPECIAL	1502146-00	150247-00	1

FEATURE 6			
OPTION	SPECIALTY GAS CALIBRATION	PRESSURE RANGE	
00	AIR	0-600	PSIG
04	AIR	0-650	
08	AMMONIA (NH_3)	0-650	
10	ARGON (Ar)	0-150	
12	BUTANE (C_4H_{10})	0-15	
14	CARBON DIOXIDE (CO_2)	0-150	
16	DRY CHLORINE (Cl_2)	0-150	
18	ETHANE (C_2H_6)	0-150	
22	ETHYLENE (C_2H_4)	0-150	
24	HELIUM (He)	0-150	
26	HYDROGEN (5) (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
88	SPECIAL	SPECIFY	

ITEM	PART NO.	DESCRIPTION	QTY.
1	980006	WASHER, #6, MICA, RECT.	20
1	198296	SCR, #6-48, 5/16LG, CAPTIVE	19
1	980085	WASHER, #6, SHOULDER, NYLON	18
2	190108	WASHER, #8, INT. LOCK.	17
2	198101	STAND-OFF, #8-32, 3/8" LG. M/F	16
2	980067	SCR, #8-32, 3/4" LG, PHL. FHL.	15
2	190394	SCR, #2-56, 3/16 LG, PHL. SS.	14
1	170087	LABEL, 450M	13
1	380008-10	CABLE, 2 COND. SHIELDED, PVC, 18 GA. 10FT.	12
1	420838	PCB ASSY, 4638M	11
1	190480	J-BOX, BOLLARD DMC.	10
			9
			8
			7
1	SEE CHART	FEATURE 6: SPECIAL GAS CALIBRATION	6
1		FEATURE 5: SUPPORT WITH FLANGE	5
1		FEATURE 4: IR1 PROTECTION CIRCUIT	4
1		FEATURE 3: CALIBRATION RANGE	3
1		FEATURE 2: SUPPORT & SHIELD	2
1	SEE CHART	FEATURE 1: SENSOR MATL	1

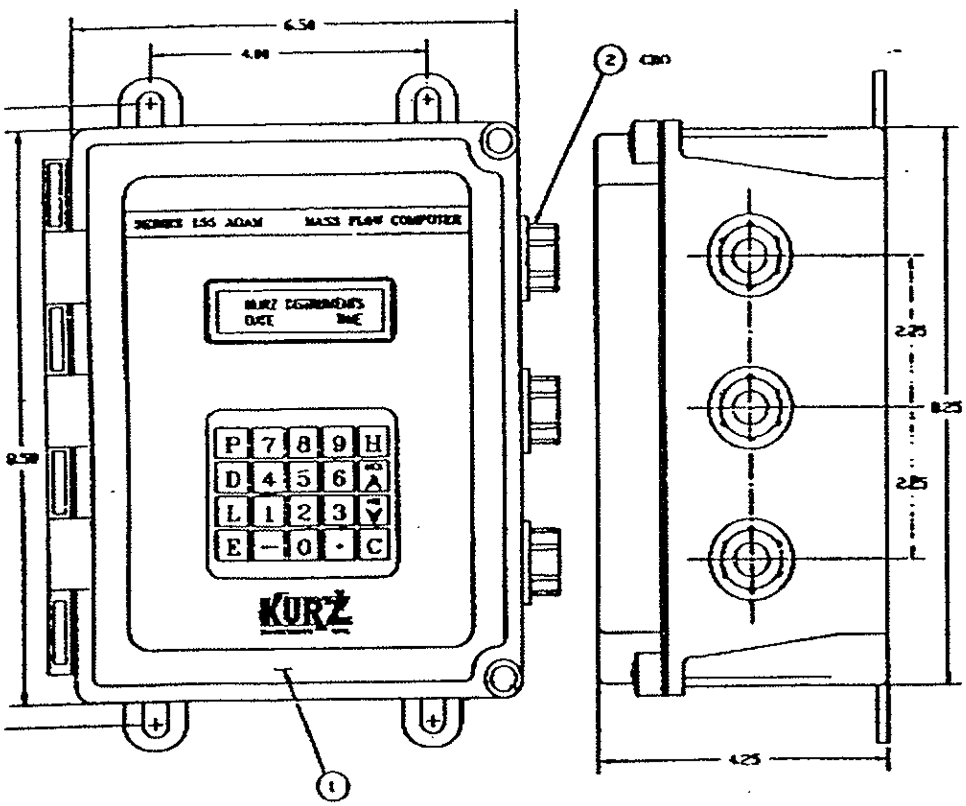
PARTS LIST

PROBE NUMBER F1 F2 F3 F4 F5 F6

KURZ INSTRUMENTS, INC.

SERIES 450 PROBE ASSY.
-FR-08/SC-TA-AT-XX

D



OPT	4-20mA OUTPUTS OPTION
00	NO 4-20mA OUTPUTS
04	1 EXTERNALLY POWERED, AC/DC ISOLATED, OR 1 AC ISOLATED, SELF-POWERED
05	2 EXTERNALLY POWERED, AC/DC ISOLATED OR 2 AC ISOLATED, SELF-POWERED

FEATURE 2

OPT	0-5VDC OUTPUTS OPTION
00	NO 0-5VDC OUTPUTS
01	(1) 0-5VDC OUTPUT
02	(2) 0-5VDC OUTPUTS

FEATURE 3

OPT	ALARM RELAYS/ CONTROL DRIVER OUTPUTS
00	NO ALARM OR CONTROL DRIVER OUTPUTS
05	4 ALARM RELAY OUTPUTS, 5 AMP, 24 VAC/DC
06	1 FLOW CONTROL DRIVER FOR KURZ 730 CONTROL VALVE
07	4 ALARM RELAYS, ONE FLOW CONTROL DRIVER FOR KURZ 730 CONTROL VALVES

FEATURE 4

OPT	ZERO/SPAN CALIBRATOR OPTION
00	NO CALIBRATOR
01	ZERO/SPAN TOOL CALIBRATOR

FEATURE 5

OPT	INPUT POWER OPTION
04	115 VAC, 50/60 Hz
02	230 VAC, 50/60 Hz
03	24 VDC ±/2% REGULATION
04	24 VAC, 50/60Hz
99	SPECIAL

FEATURE 6

OPT	RS-232C TERMINAL COMM. AND DATA PORTS
00	RS-232C TERMINAL COMM. PORT ECHOS DISPLAY/KEYPAD AND ALLOWS USE OF A COMPUTER TERMINAL FOR PROGRAMMING
04	RS-232 SERIAL DATA OUTPUT PORT
99	SPECIAL

FEATURE 7

OPT	PRINTER OPTION
00	NO PRINTER

FEATURE 8

OPT	SOFTWARE VERSION CHIP SET
00	KAS-RC, STANDARD SOFTWARE, INCLUDES FLOW CONTROL & VTM
02	KAS-RC INCLUDES OPTION 01 AND "FLOW PERFECT" REDUNDANT SENSOR ARRAY CONFIGURATION CONNECTION FACTOR
99	SPECIAL

PARENT NUMBER — F1 F2 F3 F4 F5 F6 F7 F8

NOTES:

1. REMOVE AND REPLACE EXISTING ITEMS WITH THE FOLLOWING WHEN 230 VAC OPTION IS SELECTED.
   F1 IS .315 AMP 3AG SLO-BLO KURZ P/N 630054
   ADD 1E VOLTAGE MARKER P/N 540065
2. FOR WIRING DIAGRAM, HOOK-UP, SEE DWG 340435-20.

5	2	750443	10-32 LOCKWASHER
4	2	750443	10-32 HEX NUT
3	1	140305	GROUND BUS BAR, ADAM JR.
2	3	040437	FTC. HUB, 1/2 NPT
1	1	750104	ASSY, ADAM JR. SWITCH PC ENCL.
ITEM	QTY	PART NUMBER	DESCRIPTION

PARTS LIST

REV	DESCRIPTION	BY	DATE
A	RELEASED PER ECO 07938	DPS	6/5/92
B	REVISED PER ECO 013668	DPS	6/30/93

KURZ INSTRUMENTS, INC.

ASSY., ADAM JR., FIBERGLASS ENCLOSURE

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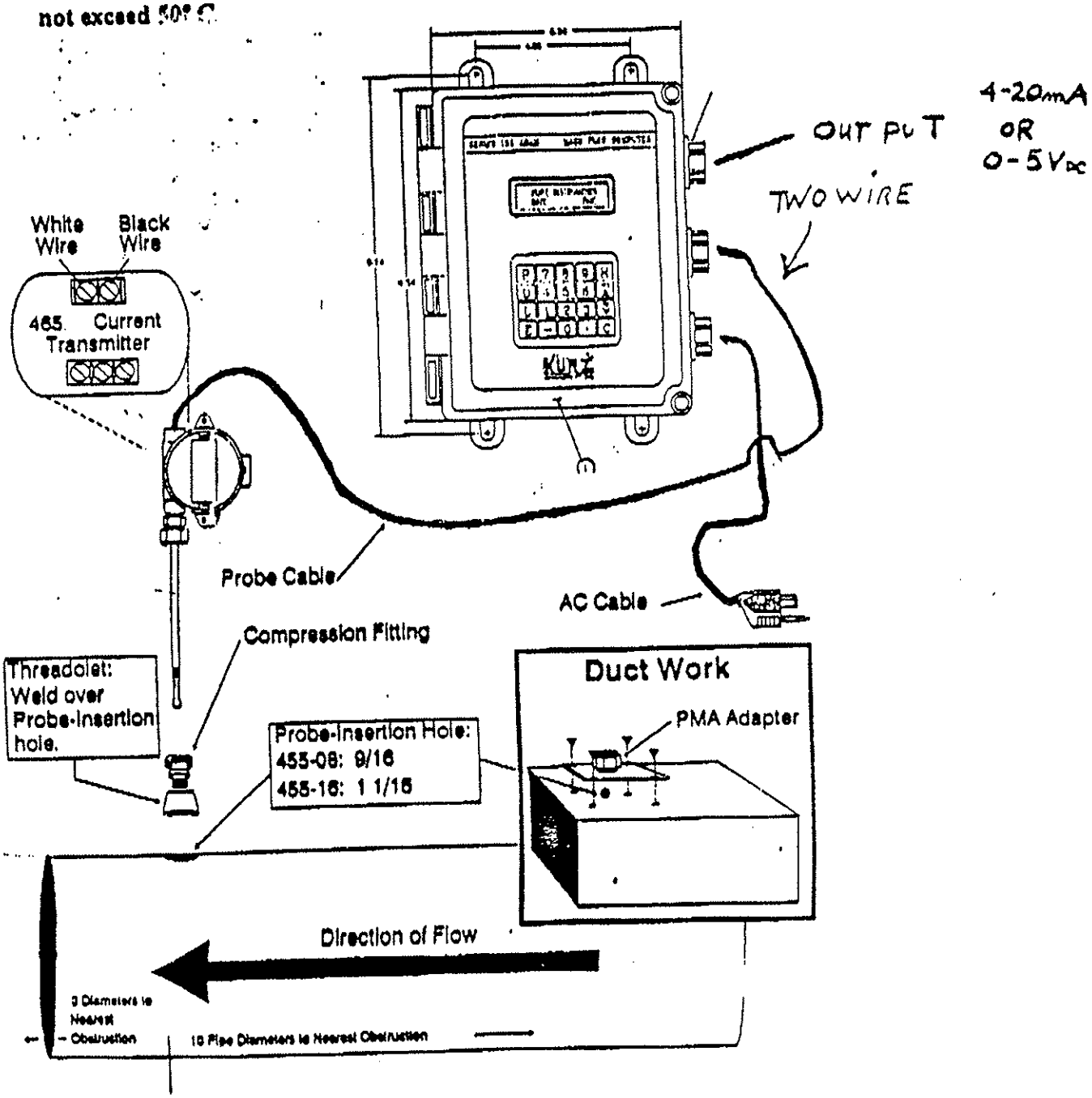
Submittal Page 4

Quick Set-Up Guide

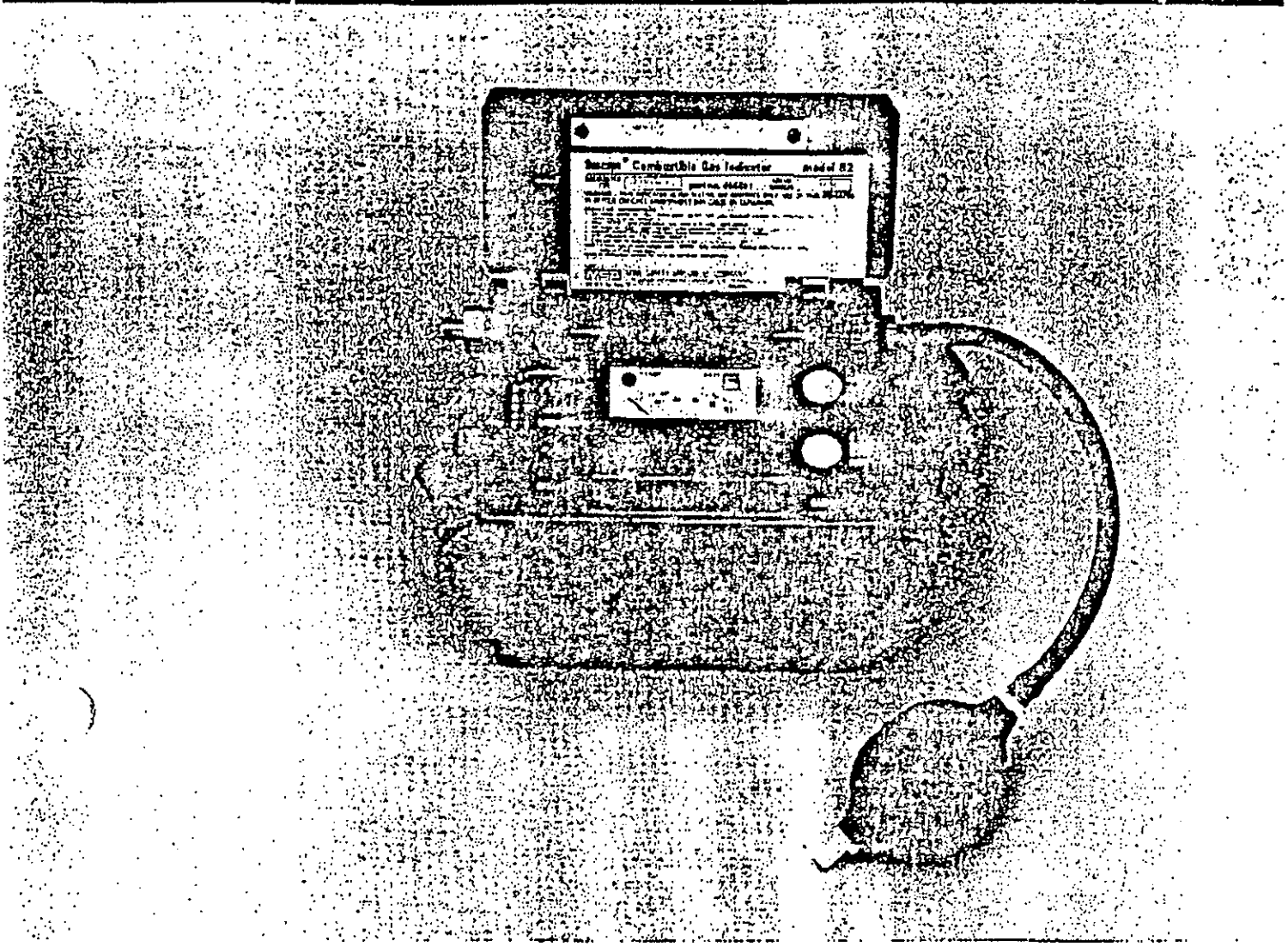
The quick set-up chart below summarizes much of the information presented in [redacted] manual. It does not, however, contain all the information you may need for safe and satisfactory installation of your 455. Kurz Instruments recommends that you read the manual before attempting installation.

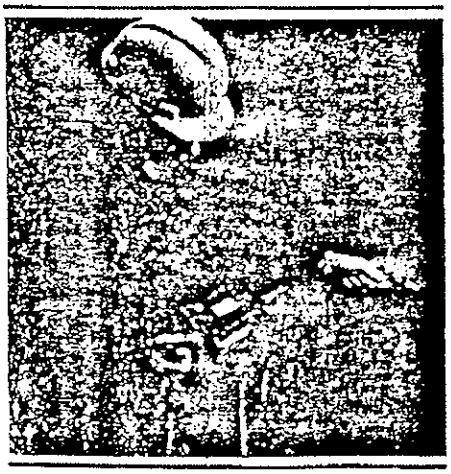
Important Note: Do NOT install the junction box close to a hot duct or stack. The ambient temperature around the junction box should not exceed 50° C.



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. 4,127,024 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 *

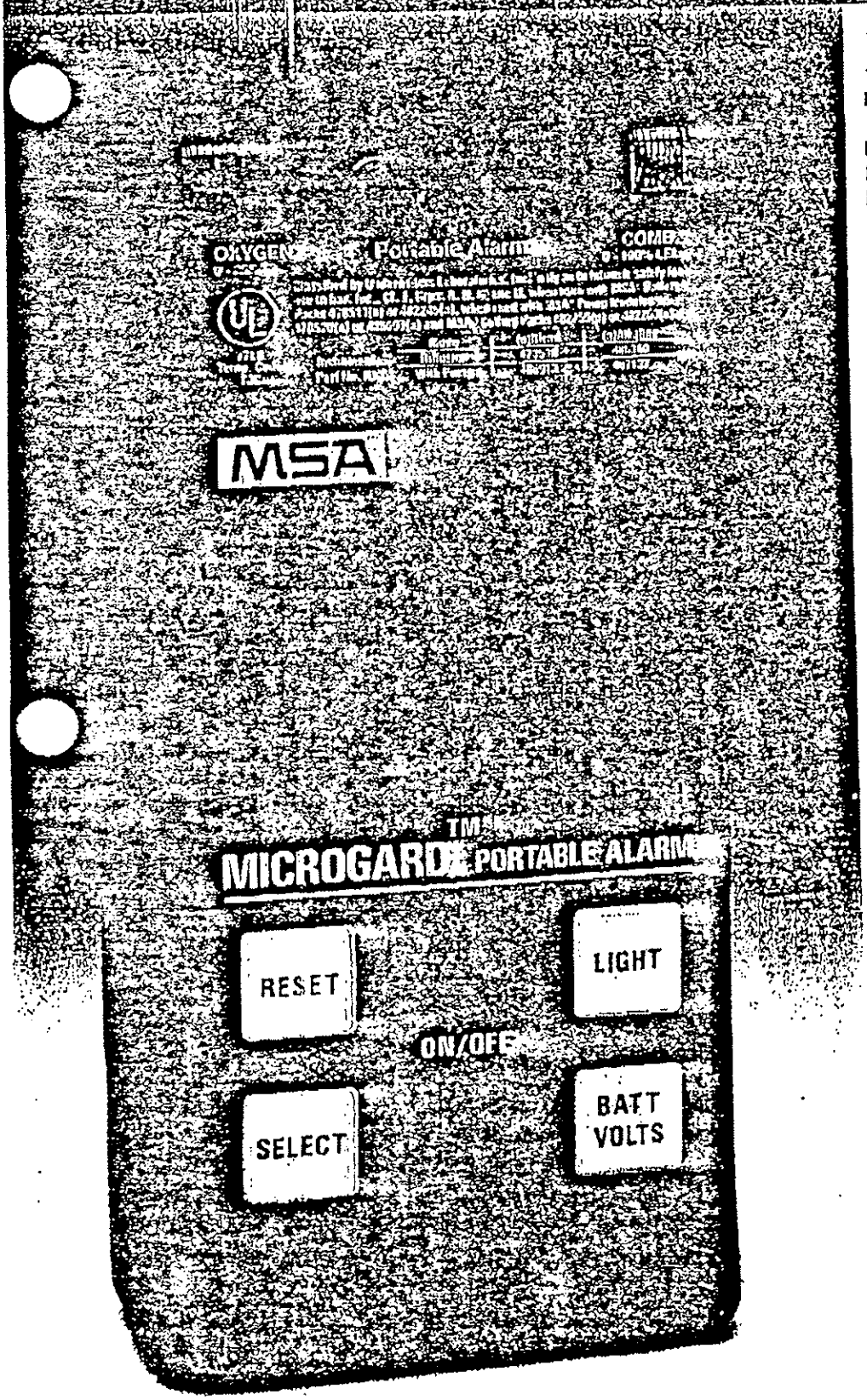
ACCESSORIES

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



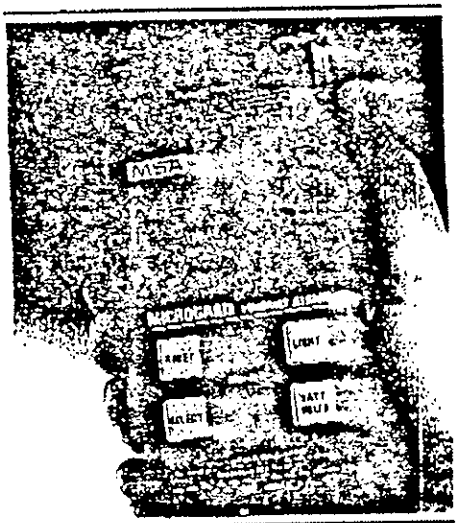
FEATURES

- 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.

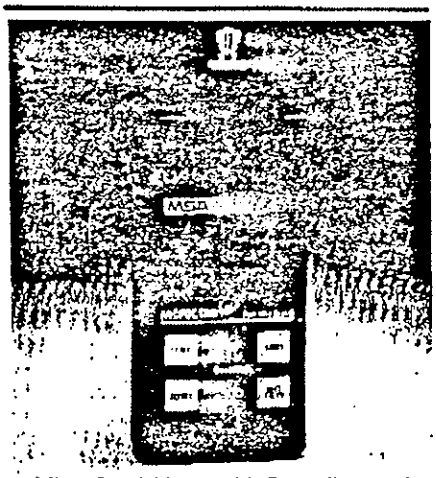
MicroGard combustible gas circuitry features either one of two combustible gas calibrations and readouts, depending upon model: 0-100% LEL (Lower Explosive Limit) with a general-purpose Pentane calibration, and 0-5% Methane-by-volume calibration; the latter model is primarily suited for gas utility and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

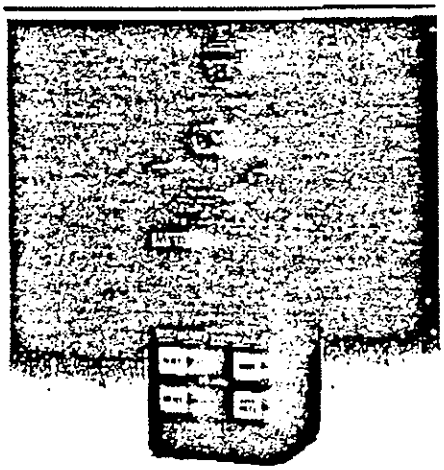
MicroGard oxygen circuitry monitors the atmosphere for both oxygen-deficient and oxygen-enriched conditions. If oxygen concentrations, as measured by the partial pressure of oxygen, rise above the factory setpoints of 23% or below 19.5%, the Oxygen Alarm LED and buzzer will sound. Both the combustible 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.

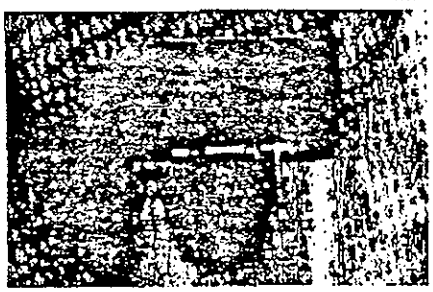
two-stage alarm. In the first stage, "BATT" appears in the display, to warn of impending battery shutdown. When battery condition falls below levels to properly operate the instrument, audible and visual alarms activate and the display blanks.

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 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.*



Pocket clip and protective screen covering sensors.

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	485369	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

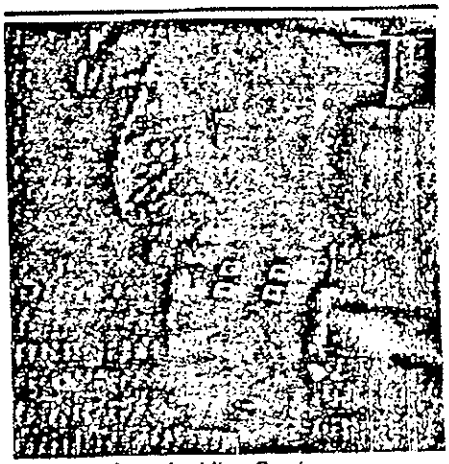
478510	Battery Pack, Nicad Rechargeable, for Instrument
482245	Battery Pack, Alkaline, for Instrument
482255	Battery Pack, Nicad Rechargeable, for Pump Module
482259	Battery Pack, Alkaline for Pump Module
633546	Battery, Alkaline, "C", Duracell MN1400
473840	Pushbutton boot, rubber
629250	Alarm Buzzer
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.

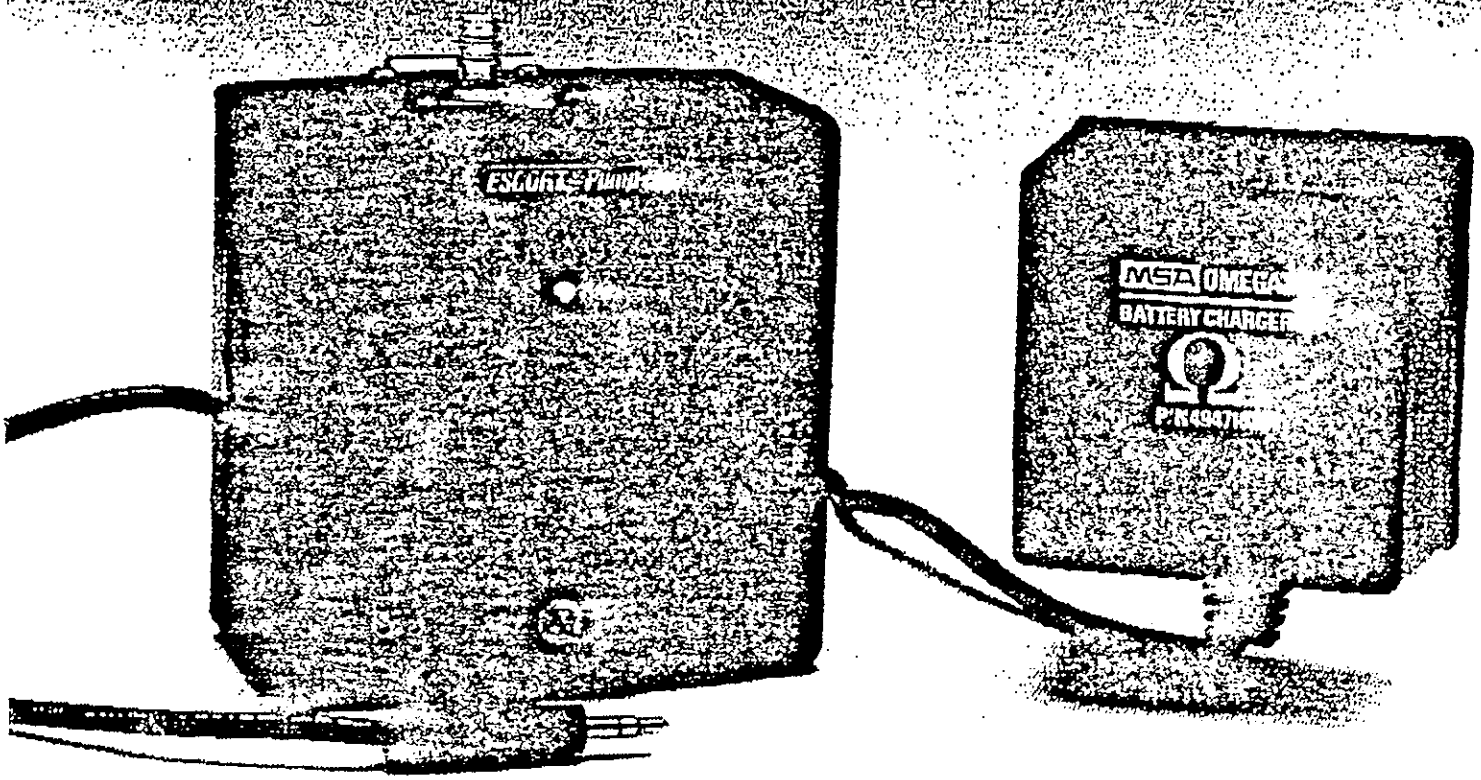
Corporate Headquarters: P.O. Box 426, Pittsburgh, PA 15230 USA.

Data Sheet 08-00-40

Printed in U.S.A. 9301(L)

ESCORT SAMPLING PUMP

08-00-01



FEATURES

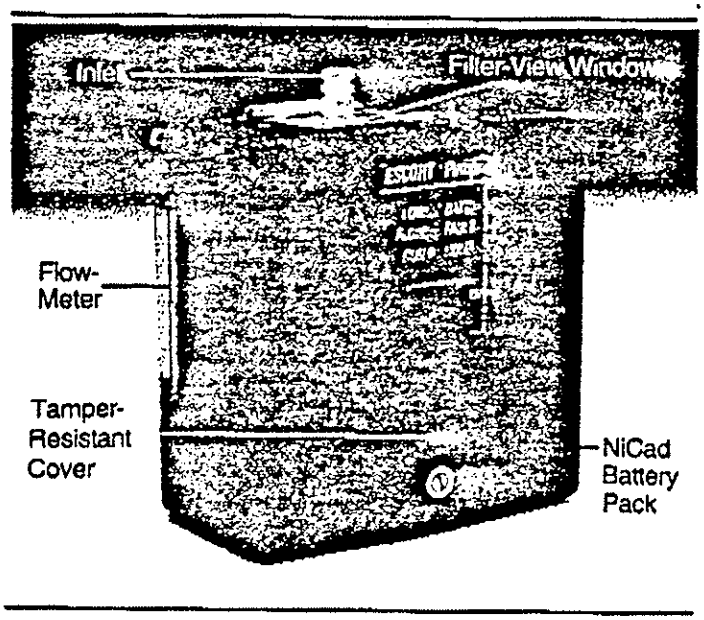
- Resistant to water spray while running
- Inlet filter traps moisture and particulate matter
- Stainless steel impregnated ABS plastic case provides RFI/EMI protection
- Weighs only 19 ounces
- Exceptionally quiet operation
- Elapsed time readout
- Flow-Fault Indicator shows if sample inlet is blocked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

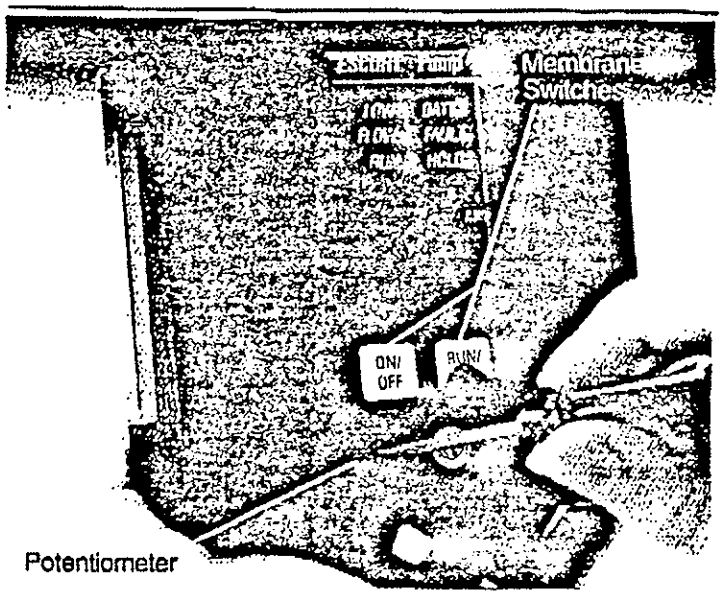
DESCRIPTION

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.

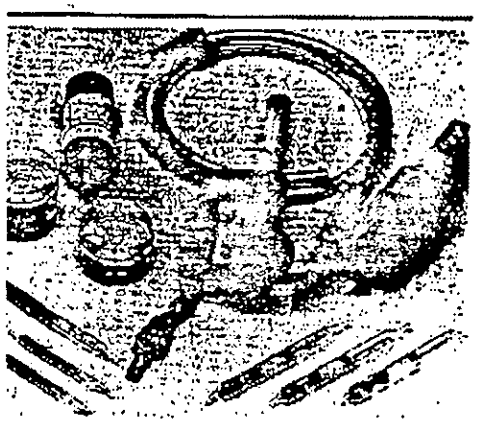
The four-digit elapsed time readout is a liquid crystal display (LCD) that shows cumulative minutes of operation for easy calculation of time-weighted averages (TWAs). It retains the last reading when the pump is off, in the hold mode, or in the event of flow blockage or low-battery shut-down.

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.

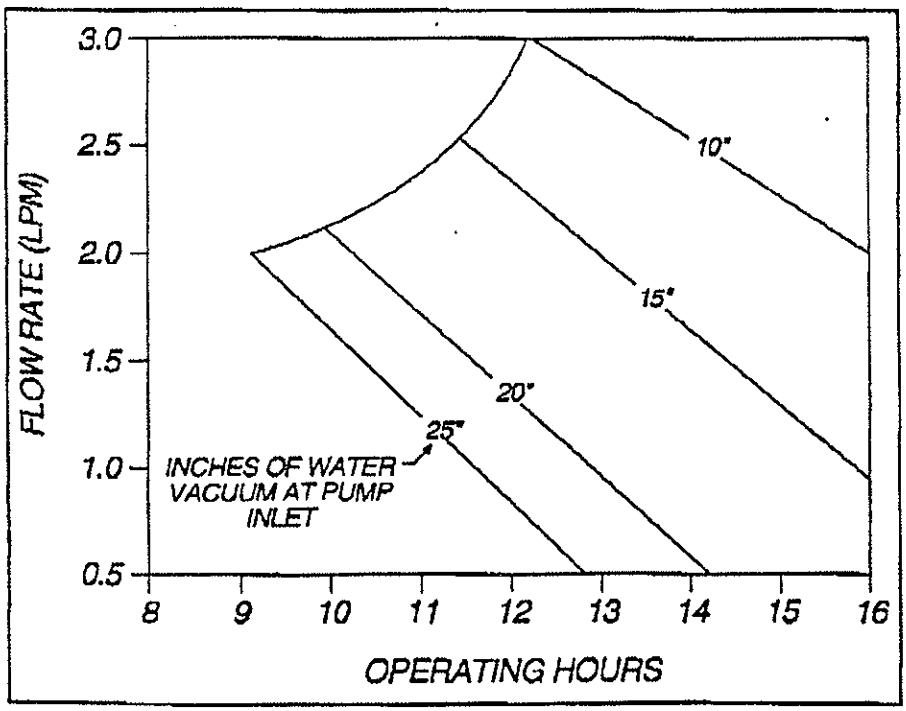
When the flow control potentiometer is turned to increase or decrease the sampling flow rate, the error amplifier output causes the motor drive circuit to increase or decrease pump speed. When the flow signal reaches the set-point level, the pump is held at a constant speed, and hence, sample flow is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

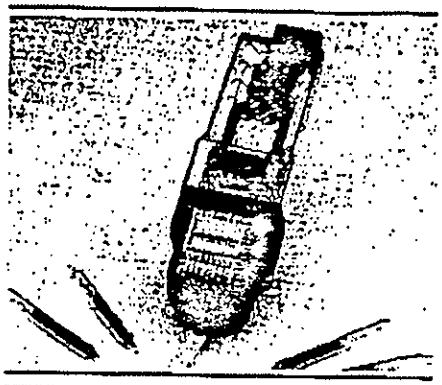
Part No.	Description
803371	Escort Pump Kit, includes: pump, tubing, screwdriver (for potentiometer adjustment), and instruction manual
* 802876	Escort Pump Kit, same as above, but includes single-unit 110v Omega Charger.
802877	Escort Pump/Gemini Sampler Kit, includes: Part Nos. 802876 and 497697
802626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

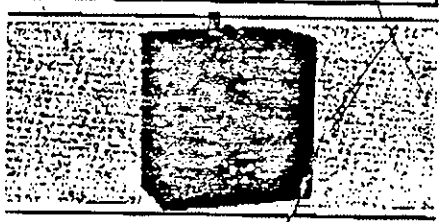
Gemini® Twin-Port Sampler

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.

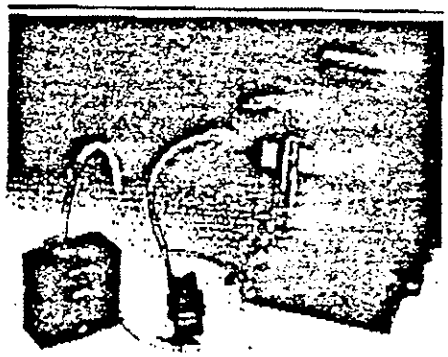


Tamper-Evident Labels

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 08-00-01

Printed in U.S.A. 1407(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**

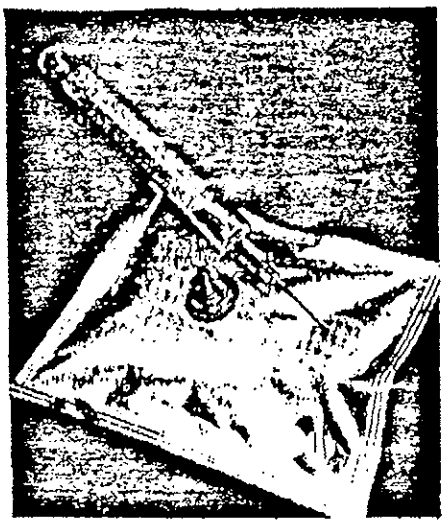


FIG. 1

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.

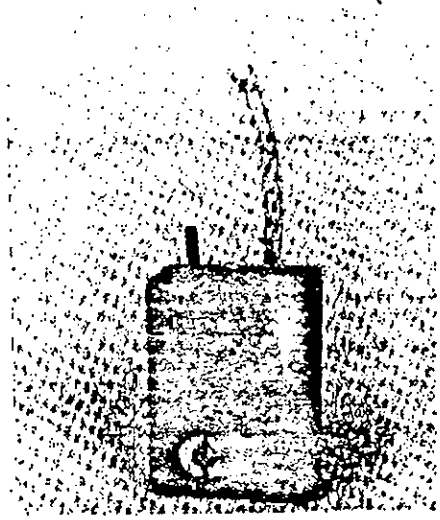


FIG. 3

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

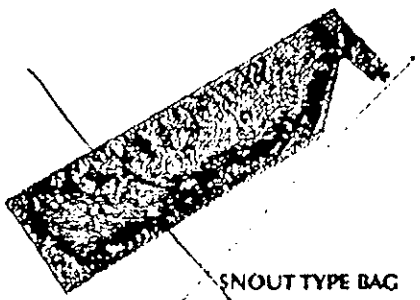
Cali-5-Bond™ GAS SAMPLING BAGS

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™

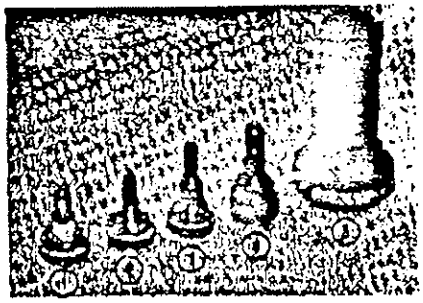
- Secure, self-closing valve
- Cannot be opened or left opened accidentally. NO LOST SAMPLES!
- Fits any standard Luer taper syringe barrel
- Eliminates dangerous needles
- Lasts indefinitely
- Use with Hann-Pump™ and with Quik-Mate™ Connector

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

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 8 (a)	1.0	18.15	17.50	16.90
GSB - PCC / 1	pillow (cc)	8 x 9.5 (b)	1.0	18.15	17.50	16.90
GSB - S / 1.2	snout	8 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 / fire / 1.38" / threaded cap (1/4" OD)	N / C	3.85
V - CHR-S/1.12	CHR / fire / 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 / fire / 1.38" / threaded cap (1/4" OD)	N / C	$ 3.85
STC - CHR-S-1.12	CHR / fire / 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

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

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: 05.10.04

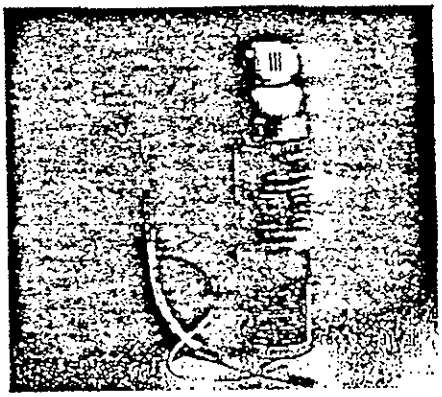
Calibration Check Kits

A 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

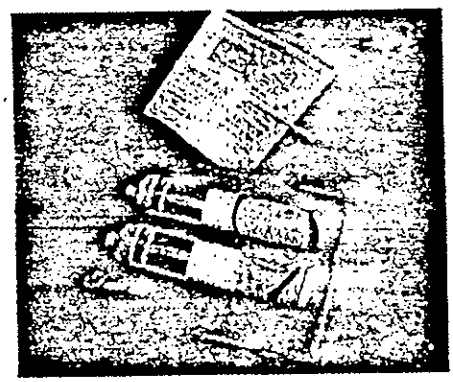
Instrument	*Squirt Gas Cylinder*	*Combustible*		*Oxygen*	*Carbon Monoxide*	*Hydrogen Sulfide*	*Balance*
		Methane	*Pentane Simulant*				
Explosimeter	815307	2.5%	See cylinder	—	—	—	Air
Gasport	814350	2.5%	—	15% O_2	60 ppm CO	—	Nitrogen
Passport	814497	1.3%	52% LEL	15% O_2	60 ppm CO	—	Nitrogen
MiniCO*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

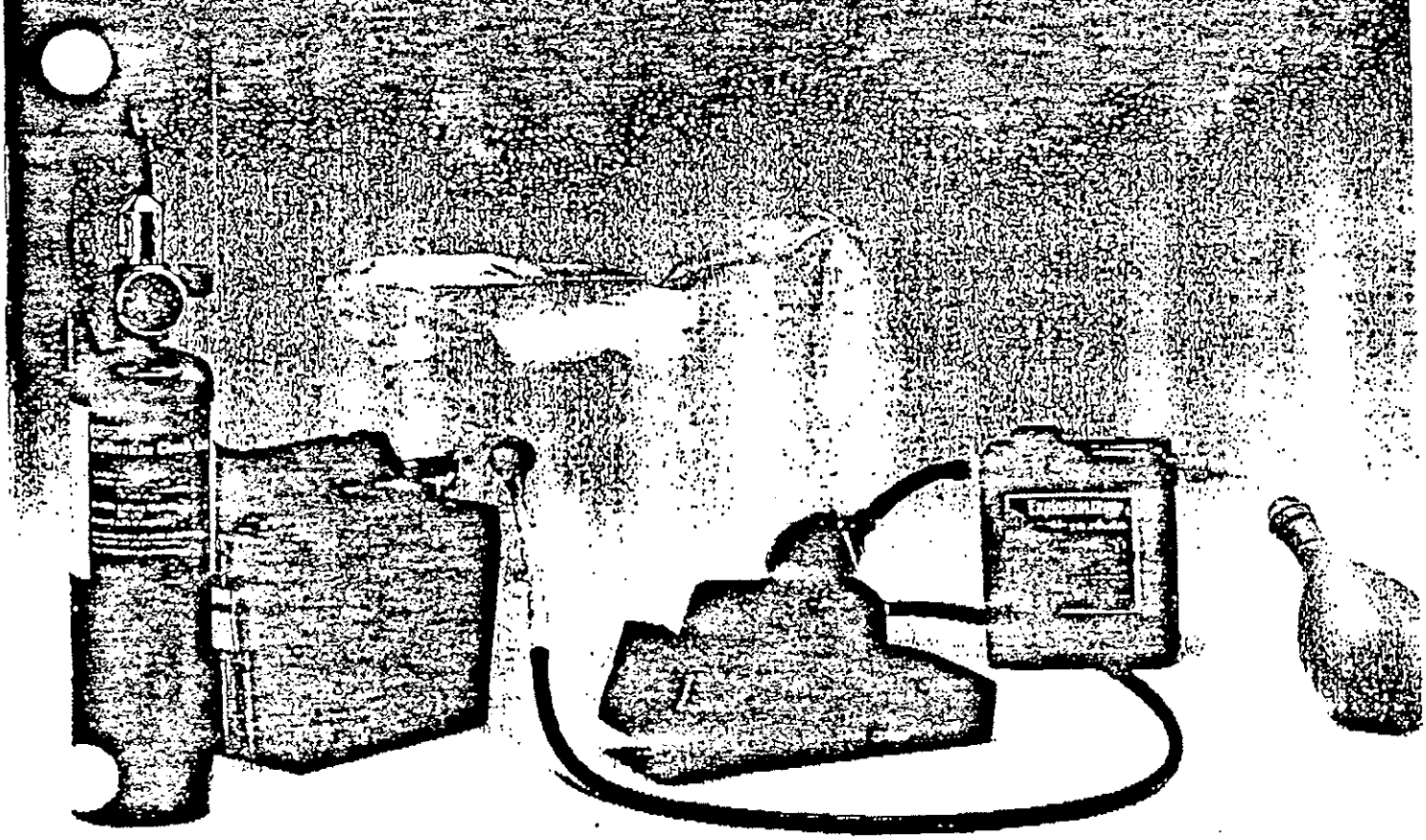
Calibration Check Gas

Cylinders for Model R Calibration Check Kits

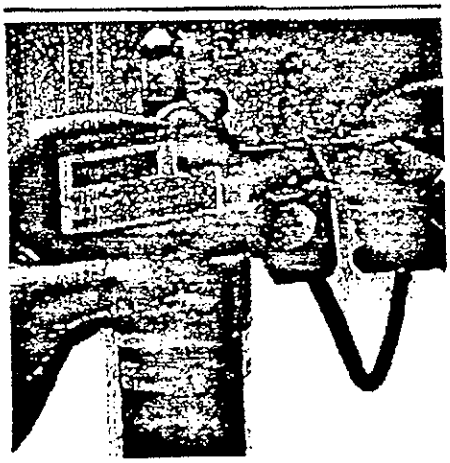
	Concentration	*Background*	*Part No.*
	1.25% Methane	Air	461047
	2.0% Methane	Air	459945
*	2.5% Methane	Air	459942
	0.75% Pentane	Air	466193
	1000 ppm Pentane	Air	476303
	0.75% Pentane/15.0% Oxygen	Nitrogen	476304
	0.6% Propane	Air	459943
	8% Butane	85% N_2/15% CO_2	460345
	0.8% Hydrogen	Air	459946
	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 check 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.

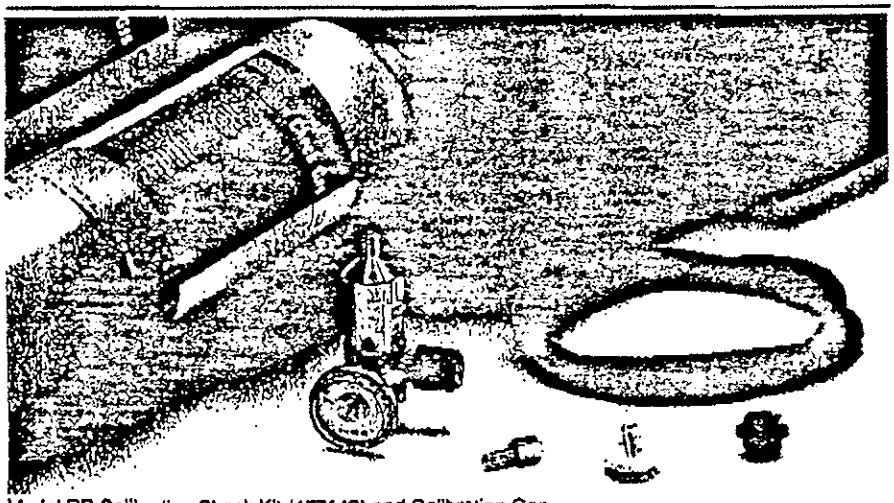
Ampoule-type check kits are used fc specific toxic gases and eliminate the need for gas cylinders, regulators or constant temperature devices.

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		
477888	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.

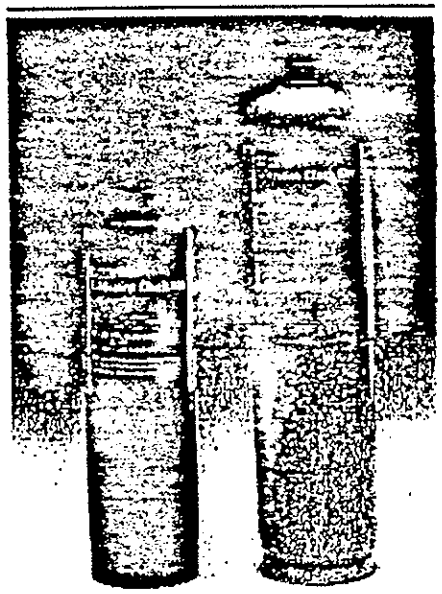
The cylinders of calibration check gas for use with Model RP Kits are lightweight steel containers (or aluminum in the case of hydrogen sulfide) approximately 14-1/4 inches high and 3-1/2 inches in diameter and, depending upon the type of cylinder, contain 100 liters of a specified gas mixture of a known (±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 Methane 50% LEL	459945 459942
	Model RP	477149	Methane 50% LEL	491041
Gascope Indicators Models 60, 62, 62S	Model R	476609	Methane 40% LEL Methane 50% LEL	459945 459942
Explosimeter® Indicators (all) Models 2, 2A, 2B, 2C, 3, 4, 5	Model RP	477150	Methane 50% LEL	491041
	Aerosol	454380	Methane 40% LEL Methane 50% LEL	96329 463464
Explosilarm® Portable Alarms Model 102 (0-10%/0-100% LEL) Model 100 (0-100% LEL)	Model R	476610	Pentane 6.7% LEL Pentane 50% LEL	476303 466193
Spotter® Methane Detector	Model R	476610	Methane 40% LEL Methane 50% LEL	459945 459942
Spotter Model QII	Model R	476610	Pentane 50% LEL	466193
Methane Monitoring System Models V, VI, VII	Model R	476610	Methane 25% LEL Methane 40% LEL Methane 50% LEL	461047 459945 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 CO 60 ppm CO 150 ppm CO 300 ppm	477888 461768 459944 461769
MiniCO 2000 Indicator	Model R	476610	CO 20 ppm CO 60 ppm CO 150 ppm CO 300 ppm	477888 461768 459944 461769
	Model RP	477149	CO 60 ppm CO 300 ppm	478191* 473180
Mini H_2S® Indicator Mini H_2S 2000 Indicator	Model RP	477149	H_2S 10 ppm H_2S 40 ppm	467898 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 D2248, 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.

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:** 882 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:** 0.87 oz.

Analysis (mixed):

Pigment by weight		70.4%
Zinc Dust (ASTM D520, Type I)	65.4%	
Silicates	4.1%	
Yellow Iron Oxide	0.6%	
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 cleaned per SSPC-SP10. Minimum surface preparation will 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 epoxy. Consult the Sherwin-Williams data sheet for Tile Clad II Epoxy, Heavy Duty Epoxy, Bild & Finish Epoxy or Recoatable Epoxy for specific system recommendations.

9.01

PRODUCT DATA

(MC-56, A24)

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
  1 ct. Hi-Mil Sher-Tar Epoxy B69B40/B60V40 @ 16-20 mils DFT
  Total 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. Tie 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. Tie 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 ox. 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 60°F: Xylene R2K4
  Above 60°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, wirebrushing 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 7.06c

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 (260C)
*No. 20 Safety Orange Up to 500F (260C)
*No. 21 Safety Green ... Up to 500F (260C)
*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 Colors No. 900-SA Over Zinc Clad B69V1/B69D2 Primer

*Colors No. 1 through No. 19 & 21-22 .. Up to 500F (260C)
Except No. 18 ..... Up to 450F (232C)

7.06c 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. 3 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 more closely resemble the original color, and will 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.

METAL:
Unprimed sandblasted metal, apply two coats of No. 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 217-818
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: 16-24 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 using a sharp, angular abrasive for optimum surface profile. Coat blast-cleaned surfaces within 8 hours 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	842	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 OVEREXPOSURE: 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.

SECTION 7

MANUFACTURER'S PRODUCT SPECIFICATION

Schedule 40 & 80 PVC Industrial Pipe

ESLON THERMOPLASTICS

- Gas Extraction Wells - PVC Pipe, Fittings, & Valves

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, 1-800-438-7691, or approved equal.

ASTM MEMBER

NAPD

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

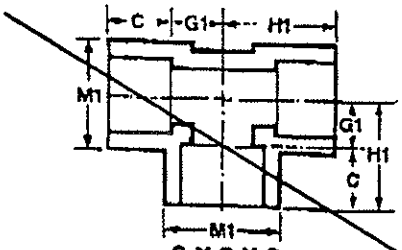
MEMBER NATIONAL ASSOCIATION OF PLASTICS DISTRIBUTORS NAPD

NSF

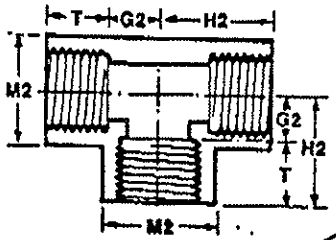
SCHEDULE 80 PVC FITTINGS

ESLON THERMOPLASTICS

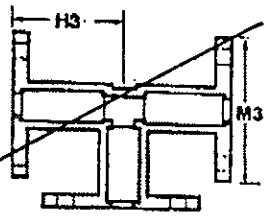
Tees



S X S X S
FIG. 801



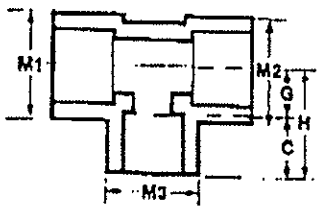
T X T X T
FIG. 802



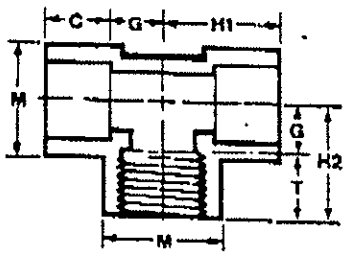
FLG X FLG X FLG
FIG. 822

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 1/16	8317	3/4	1 13/64	29/32	.143	—	—	—	—
¾	1 7/16	8302	1 1/64	1 19/32	37/64	.182	1 1/4	8318	27/32	1 13/64	17/32	.194	—	—	—	—
1	1 3/4	8303	1 9/64	1 27/32	45/64	.265	1 27/32	8319	1	1 31/64	9/16	.288	4 1/2	8830	3 1/2	1.500
1¼	2 1/8	8304	1 17/64	2 5/32	57/64	.393	2 1/32	8320	1 1/8	1 45/64	5/8	.558	4 5/8	8831	3 1/2	2.284
1½	2 1/8	8305	1 25/64	2 13/32	1 1/64	.522	2 23/64	8321	1 5/32	2 1/64	13/32	.732	5	8832	4 1/2	2.440
2	2 15/16	8306	1 1/2	2 25/32	1 5/32	.865	3 1/32	8322	1 9/32	2 1/8	1 21/64	.930	6	8833	4 1/2	3.790
2½	3 5/64	8307	1 25/32	3 11/32	1 5/16	1.500	3 9/16	8323	1 13/32	2 1/32	1 1/64	1.380	7	8834	5 1/2	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	7 1/2	8835	5 1/2	7.830
4	5 1/4	8309	2 1/4	4 5/8	2 1/16	3.690	5 7/16	8325	1 11/32	3 1/4	2 5/32	3.690	9	8836	6 1/2	15.610
6	7 11/32	8310	3	6 9/16	3 1/16	8.875	—	—	—	—	—	—	11	8837	8 1/8	28.543
8	9 7/8	8311	4	8 1/2	4 1/2	19.140	—	—	—	—	—	—	—	8838	10 1/16	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 3/8	1 3/8	1 5/16	8330	7/8	1 1/2	1 9/32	0.150
1 × 1 × ¾	1 3/4	1 3/4	1 3/8	8332	1 1/16	1 3/4	1 5/16	0.245
1½ × 1½ × 1	2 3/8	2 3/8	1 3/4	8335	1 5/32	2 5/32	1 5/8	0.455
2 × 2 × 1	2 7/8	2 7/8	1 9/16	8338	1 5/32	2 1/2	1 13/32	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 1/4	4	2 3/4	8340	1 1/2	3 9/32	1 25/32	1.710
4 × 4 × 3	5 5/16	5 1/16	4	8342	1 7/8	4 3/16	2 5/16	3.095
6 × 6 × 4	7 5/16	7 1/16	5 1/4	8345	2 3/8	6 1/2	3 1/4	7.830
8 × 8 × 6	9 3/4	9 1/4	7 1/16	8346	3 1/16	7 1/2	4 1/2	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	3/8	7/8	1 1/8	1 5/16	1/4	0.140
¾	1 1/2	8361	1/2	1 1/32	1 5/16	1 15/32	3/8	0.195
1	1 15/16	8362	5/8	1 5/32	1 27/32	1 27/32	1/2	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

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A Susquehanna Company

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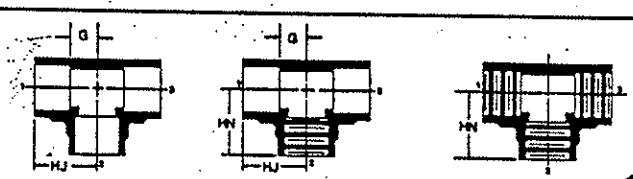
HI-STRENGTH SCHEDULE 80™ PRESSURE FITTINGS DIMENSIONAL DATA

PVC & CPVC TYPE I FITTINGS FOR IPS SCHEDULE 80 PIPE

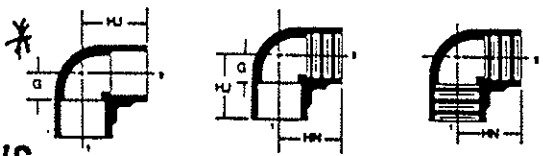
TEES



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	59/64	21/64	.05	N.A.	.05
⅜ †	003	9/64	1	13/32	.09	N.A.	.07
½	005	25/64	1 3/32	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	23/32	.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 23/32	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 5/8	15.51		

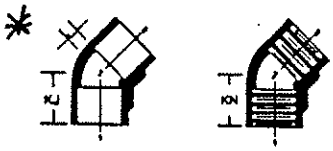
90° ELBOWS



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	59/64	21/64	.04	N.A.	.04
⅜ †	003	1 9/64	1	13/32	.06	N.A.	.05
½	005	1 25/64	1 3/32	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	23/32	.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 23/32	3 31/64	1 55/64	1.87	1.79	1.93
4	040	4 13/32	4 5/64	2 23/64	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



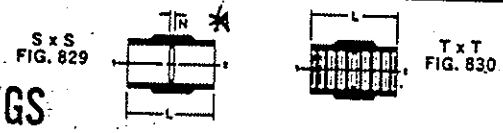
S x S FIG. 817 | T x T FIG. 819

SIZE	SIZE CODE	KJ SLIP	KN THREAD	J —	WEIGHTS * FIG. 817	FIG. 819
¼ †	002	51/64	49/64	11/64	.04	.03
⅜ †	003	51/64	13/16	13/64	.06	.04
½	005	1 9/64	1 1/64	5/32	.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	.23
1¼	012	1 21/32	1 27/64	13/32	.35	.33
1½	015	1 45/64	1 1/2	31/64	.40	.39
2	020	2 5/32	1 23/32	21/32	.69	.57
2½ †	025	2 15/32	2 19/64	47/64	1.08	1.27
3	030	2 21/32	2 27/64	25/32	1.40	1.43
4	040	3 5/32	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

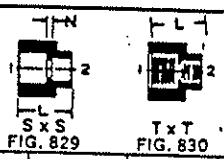
SIZES AND DIMENSIONS

COUPLINGS



SIZE	SIZE CODE	L SLIP	L, THREAD	N	WEIGHTS* FIG. 829	WEIGHTS* FIG. 830
¼	002	1²³⁄₆₄	1⁹⁄₃₂	³⁄₃₂	.03	.03
⅜	003	1⅝	1²¹⁄₆₄	⅛	.04	.04
½	005	1⁸⁷⁄₆₄	1⁴¹⁄₆₄	⅛	.07	.07
¾	007	2⁹⁄₆₄	1²³⁄₃₂	⁵⁄₆₄	.10	.09
	010	2²⁵⁄₆₄	2⅛	⁵⁄₆₄	.16	.16
1¼	012	2²¹⁄₃₂	2⁵⁄₁₆	⅝₂	.24	.21
1½	015	2²⁹⁄₃₂	2⅞	⅝₂	.30	.26
	020	3⅝₂	2⅝₂	⅝₂	.43	.36
2½	025	3¾	3²⁵⁄₆₄	¼	.81	.89
	030	4	3²³⁄₆₄	¼	1.23	1.20
	040	4⅜	3²³⁄₃₂	¼	2.12	1.82
	060	6⁵⁄₁₆	N.A.	⁵⁄₁₆	6.97	N.A.
	080	8⁵⁄₁₆	N.A.	⁵⁄₁₆		N.A.

REDUCER COUPLINGS



SIZE	SIZE CODE	L SLIP	L THREAD	N	WEIGHTS* FIG. 829	WEIGHTS* FIG. 830
½ x ¼	052	1⅝	1⁷⁄₁₆	³⁄₃₂	.06	.05
½ x ⅜	073	1¾	1¹³⁄₃₂	³⁄₃₂	.06	.06
¾ x ½	101	2	1²⁵⁄₃₂	³⁄₃₂	.10	.09
1 x ½	130	2⅛	1²⁷⁄₃₂	³⁄₃₂	.16	.14
1 x ¾	131	2¼	1⅞	³⁄₃₂	.15	.14
1¼ x ¾	167	2⅜	1²⁷⁄₃₂	³⁄₃₂	.21	.19
1¼ x 1	168	2½	2³⁄₃₂	³⁄₃₂	.23	.22
1½ x 1	211	2⅝	2⅛	³⁄₃₂	.28	.25
1½ x 1¼	212	2¾	2⅝₂	³⁄₃₂	.31	.27
2 x 1½	251	3	2¾	³⁄₃₂	.44	.38
2½ x 2	292	3⅛	2¾	⅜	.75	.71
3 x 2	338	3⅜	2⅞	⅜	1.01	.95
4 x 3	422	4⅛	3⅝	¼	1.65	1.64
6 x 4	532	10¼	N.A.	3½	6.90	N.A.
8 x 6	585	9⅛	N.A.	2¹⁄₁₆	7.04	N.A.

REDUCER BUSHINGS

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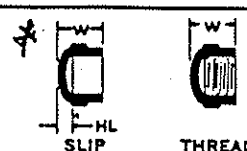
FAX: 908-753-1291

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	1⁵⁄₁₆	⅜₂	.01	1⁵⁄₁₆	.01	1½₂	
½ x ¼	072	1⁷⁄₁₆	⅜	.02	1⁷⁄₁₆	.02	1½₂	
½ x ⅜	073	1⁷⁄₁₆	¾	.02	1⁷⁄₁₆	.02	1½₂	
¾ x ¼	098						1½₂	
¾ x ⅜	099	1⁹⁄₁₆	1¼				1½₂	
¾ x ½	101	1½₂	1³⁄₃₂	.04	1½₂	.04	1½₂	
1 x ¼	128	1⁹⁄₁₆	1⁵⁄₁₆				1⅛	.02
1 x ⅜	129	1⁹⁄₁₆	1⁵⁄₁₆				1¹³⁄₃₂	
1 x ½	130	1¹³⁄₃₂	½	.07	1¹³⁄₃₂	.08	1¹³⁄₃₂	
1 x ¾	131	1¹³⁄₃₂	¹³⁄₃₂	.06	1¹³⁄₃₂	.06	1¼	.04
1¼ x ½	166	1¹⁷⁄₃₂	²¹⁄₃₂	.14	1¹⁷⁄₃₂	.14	1⁵⁄₁₆	
1¼ x ¾	167	1¹⁷⁄₃₂	¹⁷⁄₃₂	.12	1¹⁷⁄₃₂	.13	1⁵⁄₁₆	
1¼ x 1	168	1¹⁷⁄₃₂	¹³⁄₃₂	.09	1¹⁷⁄₃₂	.08	1½₂	.07
1½ x ½	209	1²¹⁄₃₂	²⁵⁄₃₂	.19	1²¹⁄₃₂	.19	1½	
1½ x ¾	210	1²¹⁄₃₂	²¹⁄₃₂	.17	1²¹⁄₃₂	.18	1½	
1½ x 1	211	1²¹⁄₃₂	¹⁷⁄₃₂	.14	1²¹⁄₃₂	.13	1½	
1½ x 1¼	212	1²¹⁄₃₂	¹³⁄₃₂	.08	1²¹⁄₃₂	.17	1⅝	.06
2 x ½	247	1²⁵⁄₃₂	²⁹⁄₃₂	.32	1²⁵⁄₃₂	.20	1½	
2 x ¾	248	1²⁵⁄₃₂	²⁵⁄₃₂	.30	1²⁵⁄₃₂	.33	1½	
2 x 1	249	1²⁵⁄₃₂	²¹⁄₃₂	.25	1²⁵⁄₃₂	.30	1½	
2 x 1¼	250	1²⁵⁄₃₂	¹⁷⁄₃₂	.20	1²⁵⁄₃₂	.21	1½	
2 x 1½	251	1²⁵⁄₃₂	¹³⁄₃₂	.17	1²⁵⁄₃₂	.10	1¹³⁄₃₂	.12
2½ x 1½	291	2³⁄₃₂	²⁹⁄₃₂	.40	2³⁄₃₂	.40	2⅛	
2½ x 2	292	2³⁄₃₂	¹³⁄₃₂	.27	2³⁄₃₂	.34	1²⁷⁄₃₂	.22
3 x 1¼	336	2⅜	¹⁵⁄₁₆				2⅜	
3 x 1½	337	2⅜	¹⁵⁄₁₆				2⅜	
3 x 2	338	2³⁄₃₂	²⁹⁄₃₂	.61	2³⁄₃₂	.62	1²⁵⁄₃₂	.34
3 x 2½	339	2³⁄₃₂	¹³⁄₃₂	.38	2³⁄₃₂	.46		
4 x 2	420	2⅝	1⅛	1.14	2⅝	1.13	2³⁄₃₂	
4 x 3	422	2⅝	¾	1.07	2⅝	1.00	2³⁄₃₂	
6 x 4	532	6⅛	4⅛	3.50				

SCHEDULE 80 PVC AND CPVC FITTINGS

SIZES AND DIMENSIONS

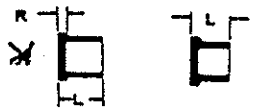
CAPS



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	1 1/32	.03	.03
½	005	1 9/32	1 3/32	1 3/32	.05	.05
¾	007	1 29/64	1 15/64	29/64	.07	.06
1	010	1 21/32	1 33/64	17/32	.12	.11
1¼	012	1 55/64	1 5/8	39/64	.16	.16
1½	015	2 1/16	1 23/32	1 1/16	.22	.22
2	020	2 19/64	1 55/64	51/64	.37	.30
2½ †	025	2 23/32	2 25/64	31/32	.60	.61
3	030	3 1/32	2 25/32	1 5/32	.92	.93
4	040	3 41/64	3 1/8	1 25/64	1.48	1.37
6	060	4 61/64	N.A.	1 61/64	5.11	N.A.
8	080	6 1/2	N.A.	2 1/2		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 1/4	1 3/4	3/4	.028	.030
¾	007	1 3/16	1	1/2	.047	.041
1	010	1 3/4	1 1/4	1/4	—	.059
1¼	012	1 17/32	1 3/32	1/2	.115	.106
1½	015	1 11/16	1 11/32	5/8	.164	.131
2	020	1 7/8	1 7/8	3/8	.241	.198
2½	025	N.A.	2	N.A.	N.A.	N.A.
3	030	2 1/32	2	1/2	.463	.441
4	040	2 5/8	2 1/8	3/8	.955	.750

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PVC-IPS SCHEDULE 80 SOCKET DIMENSIONS

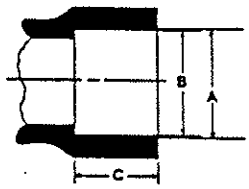

TABLE II

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 I 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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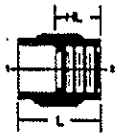
SCHEDULE 80 PVC AND CPVC FITTINGS

SIZES AND DIMENSIONS

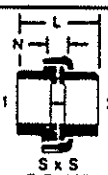
FEMALE ADAPTERS



S x T
FIG. 835

SIZE	SIZE CODE	L	HL	WEIGHTS*
¼ †	002	1 9/16	1 1/16	.03
⅜ †	003	1 7/16	1 1/16	.04
½	005	1 ¾	1 3/16	.07
¾	007	1 55/64	55/64	.10
1	010	2 13/64	1 3/64	.16
1¼	012	2 27/64	1 3/64	.22
1½	015	2 9/16	1 7/64	.28
2	020	2 23/32	1 3/64	.41
2½ †	025	3 ½	1 ¾	.88
3	030	3 ¾	1 49/64	1.20
4	040	4 15/64	1 55/64	1.92

UNIONS

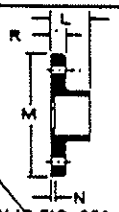


S x S
FIG. 897

T x T
FIG. 898

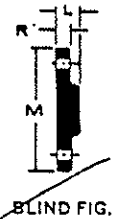
SIZE	SIZE CODE	L SLIP	N SLIP	L THREAD	WEIGHTS* FIG. 897	WEIGHTS* FIG. 898
¼	002	1 55/64	39/64	1 55/64	.08	.08
⅜	003	1 57/64	25/64	1 57/64	.12	.10
½	005	2 13/32	21/32	2 13/32	.22	.23
¾	007	2 9/16	9/16	2 9/16	.30	.30
1	010	2 31/32	23/32	2 31/32	.42	.44
1¼	012	3 1/8	5/8	3 1/8	.64	.60
1½	015	3 7/16	19/32	19/32	.75	.69
2	020	3 43/64	43/64	2 51/64	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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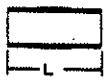
PHONE 908-753-2500
FAX 908-753-1291

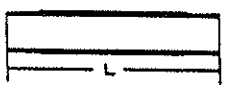
SIZE	SIZE CODE	NO. OF HOLES	DIAM. OF BOLTS	DIAM. OF BOLT CIRCLE	M	R	FIG. 851 L	FIG. 851 N	FIG. 851 WTS.*	FIG. 852 L	FIG. 852 WTS.*	FIG. 853 L	FIG. 853 WTS.*
½	005	4	½	2.38	3.50	.41	1 5/32	⅛	.21	2 3/32	.20	½	.19
¾	007	4	½	2.75	3.88	.47	1 5/32	⅛	.28	3 1/32	.28	9/16	.28
1	010	4	½	3.13	4.25	.53	1 5/32	⅛	.39	1⅛	.39	21/32	.39
1¼	012	4	½	3.50	4 5/8	.60	1 7/16	⅛	.50	1 3/16	.50	¾	.52
1½	015	4	½	3.88	5	.66	1 7/16	⅛	.64	1½	.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 25/32	1.50	1	1.60
3	030	4	⅝	6.00	7½	.89	2 3/32	3/32	1.88	1 27/32	1.87	1⅛	2.13
4	040	8	⅝	7.50	9	1.09	2 13/32	3/32	3.04	1 13/16	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	1⅜	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
1	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	422	2⅞	423	4												

2-1/2"-6" Safe Block™ True Union Ball Valves

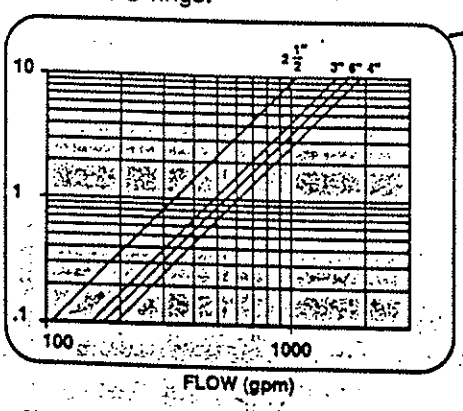
Hayward 2-1/2" through 6" Safe Block True Union Ball Valves are rated to 225 psi. They provide quick quarter turn shut off and eliminate the need for unions.

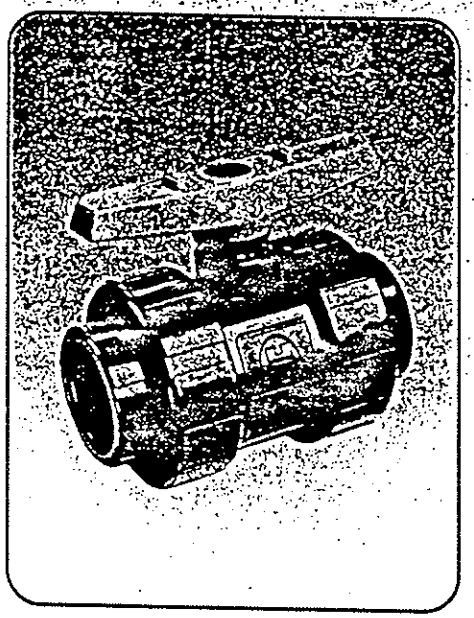
Hayward True Union Valves are safe blocked in all sizes and materials. Large size Hayward safe blocked valves feature O-ring backed, reversible teflon seats. This provides a low running and seating torque which extends the cycle life of the valve. Furthermore, should the seats ever become scratched or 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.



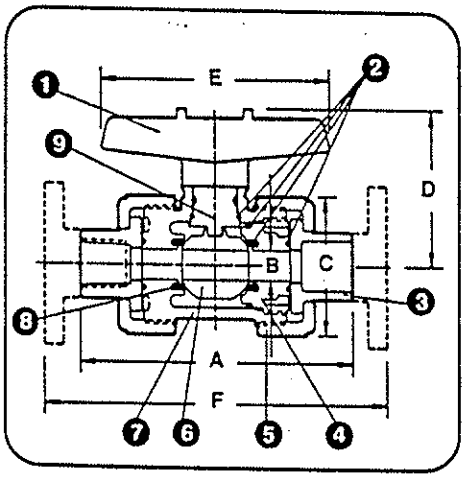


Features

- 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	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

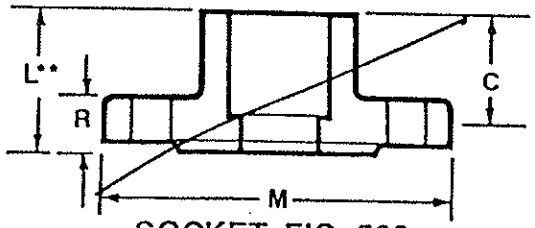
Size	Material	End Connection	Seals	Pressure Rating
2½"-4"	PVC	Socket, Threaded	Viton	225 psi @ 70° F non shock
3"-4"	CPVC	or Flanged	EPDM	
6"	PVC	Flanged	Viton or EPDM	
3"-4"	PPL	Threaded or Flanged	Viton	

Engineering Specifications

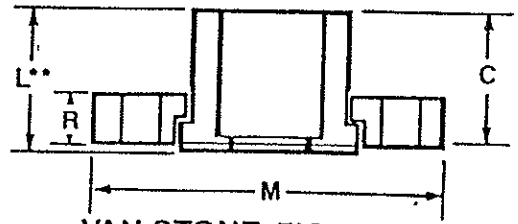
All True Union Ball Valves 2-1/2" through 6" shall be PVC (Polyvinyl Chloride), CPVC (Chlorinated Polyvinyl Chloride) or Polypropylene with (Socket, Threaded, or Flanged) end connections. Seals shall be (Viton or EPDM) with Teflon seats. Valves 2-1/2" through 4" valve shall be a full port design, 6" 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.

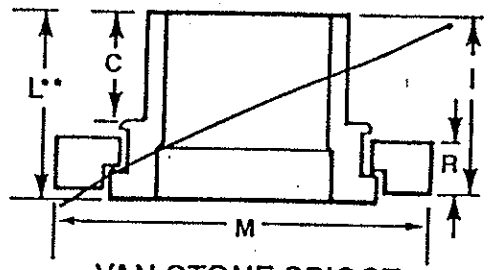
Nom. Pipe Size	Max. O.D. Dim. M	Part No.	Dimensions			No. Bolt Holes	Bolt Hole Dia.	Bolt Circle Dia.	Approx. Wt. (lb)
ONE PIECE FLANGES*			FIG. 509						
			L**	C†	R				
½	3½	5081	1 1/16	29/32	15/32	4	5/8	2 3/8	.198
¾	3 7/8	5082	1 3/16	1	½	4	5/8	2¾	.280
1	4½	5083	1 5/16	1 5/32	9/16	4	5/8	3⅛	.378
1¼	4 5/8	5084	1½	1¼	5/8	4	5/8	3½	.494
1½	5	5085	1½	1 3/8	23/32	4	5/8	3 7/8	.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



SOCKET FIG. 509



VAN STONE FIG. 509-VS



VAN STONE SPIGOT FIG. 509-VS-SPG

*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

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.

DRISCOPIPE

Driscopipe® 6400 Polyethylene Piping Systems

Contents

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.

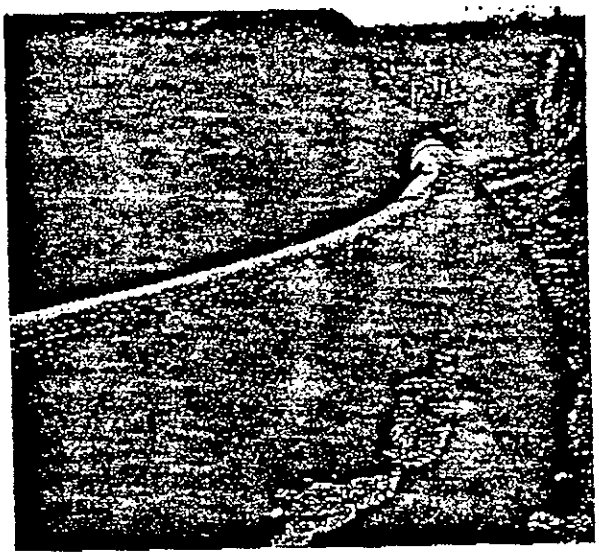
Phillips Petroleum and its subsidiaries, Phillips 66 Company and Phillips Driscopipe, Inc., form a totally integrated effort from the natural resource raw materials at the well head to the finished piping product. This total organization has been developing, testing and providing polyethylene compounds, 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 328	S	S
Dowell Carbon 325	S	S

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
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
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*	U	U
Propylene Dichloride 100%	S	S
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
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 90%	S	U
Sulfuric Acid 96-98%	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-94	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 326	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

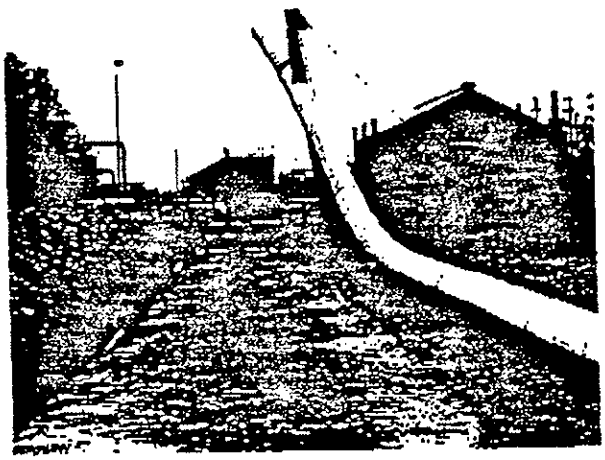
Toughness

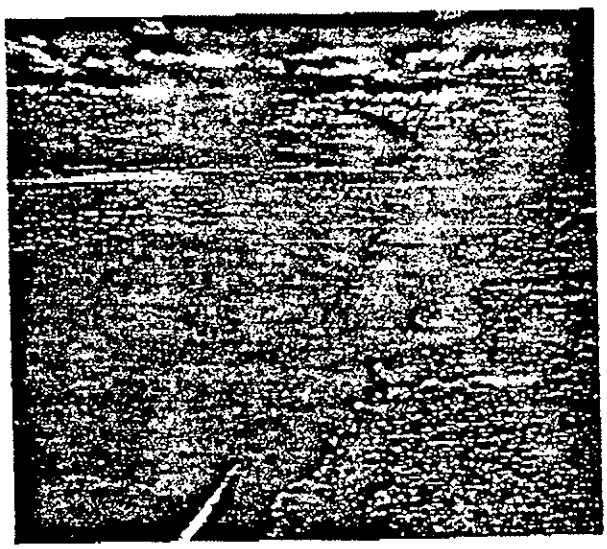
The overall "toughness" of Driscopipe 6400 is an important characteristic of the pipe. "Toughness" is derived from many of the chemical and physical properties of the material. The pipe is not brittle. It flexes, bends and absorbs impact loads over a wide temperature range of −180°F up to its softening 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.





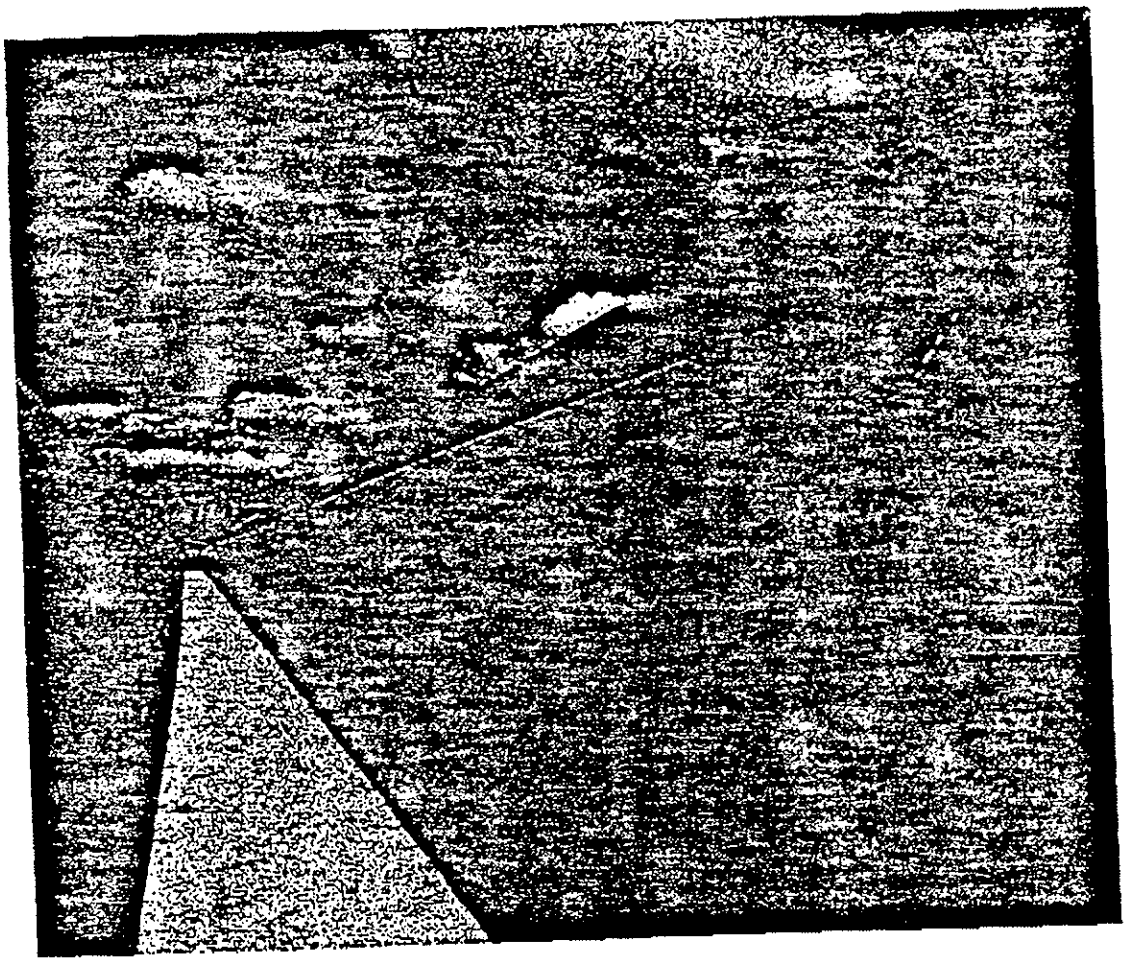
Flow Factors

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.

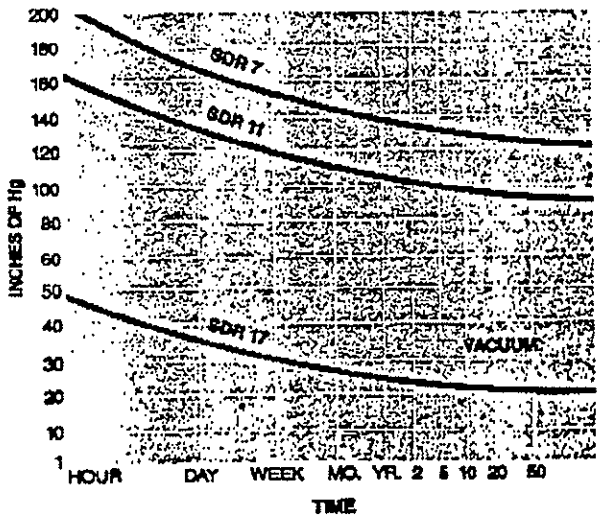
Typical cases of vacuum or suction pipelines are gravity flow, downhill siphon lines, pipelines which are cleaned by vacuum and gas gathering lines operating under vacuum. When subjected to a vacuum, a sufficiently heavy wall pipe must be selected to resist the collapsing forces. Basically, the pipe's 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



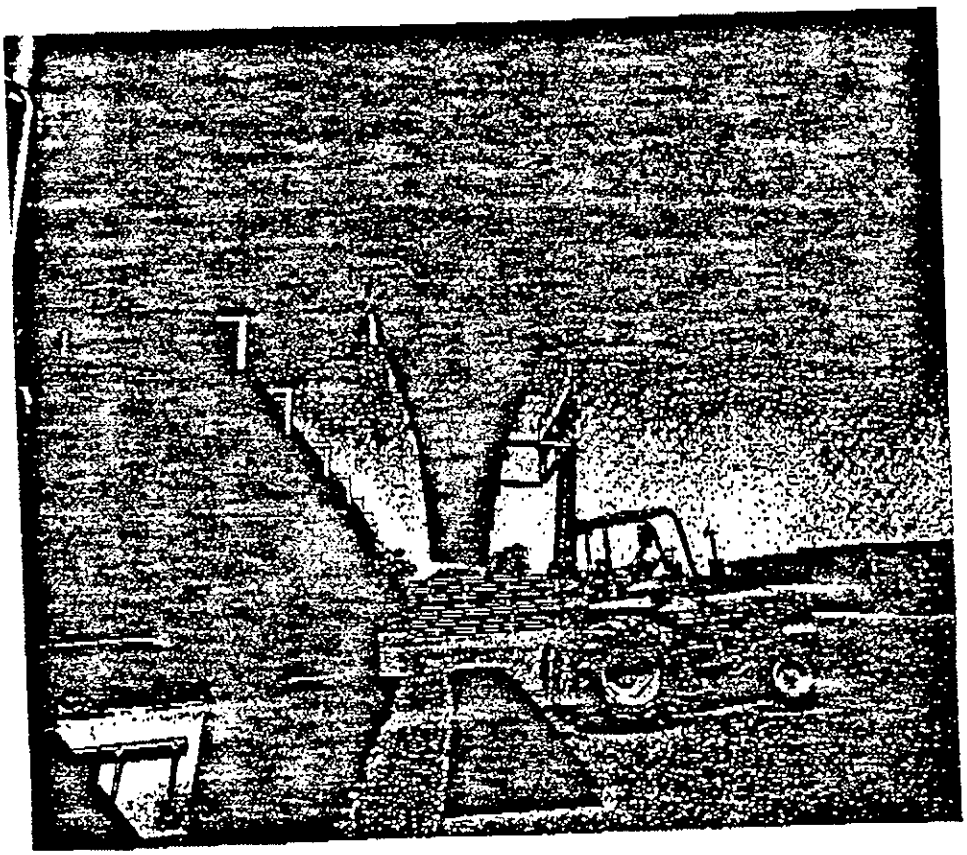
For many cases, as a general rule of thumb, DR 15.5 or lower DR pipe can be used safely at 70°F or lower temperatures to carry full vacuum. For vacuum pipeline fittings, lower DR (thicker wall) is selected for fabricating fittings. For example, a buried vacuum pipeline using DR 17 pipe would use fittings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



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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.

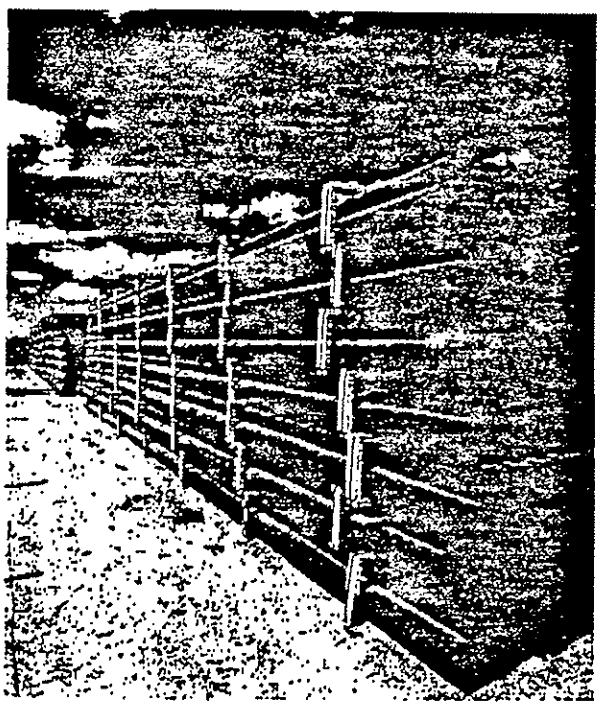
Applications

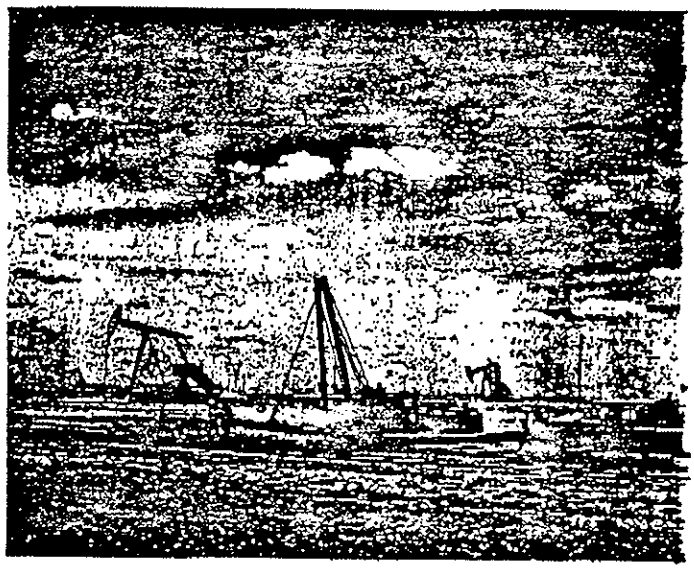
Driscopipe 6400 is extruded from a Type III, Class C, Category 5, Grade P34 compound as described in ASTM D 1248. It is classified as cell 345434C according to ASTM D 3350 and has the material designation of PE 3408. The pipe is manufactured to meet the requirements of ASTM D 2513 which is necessary 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.

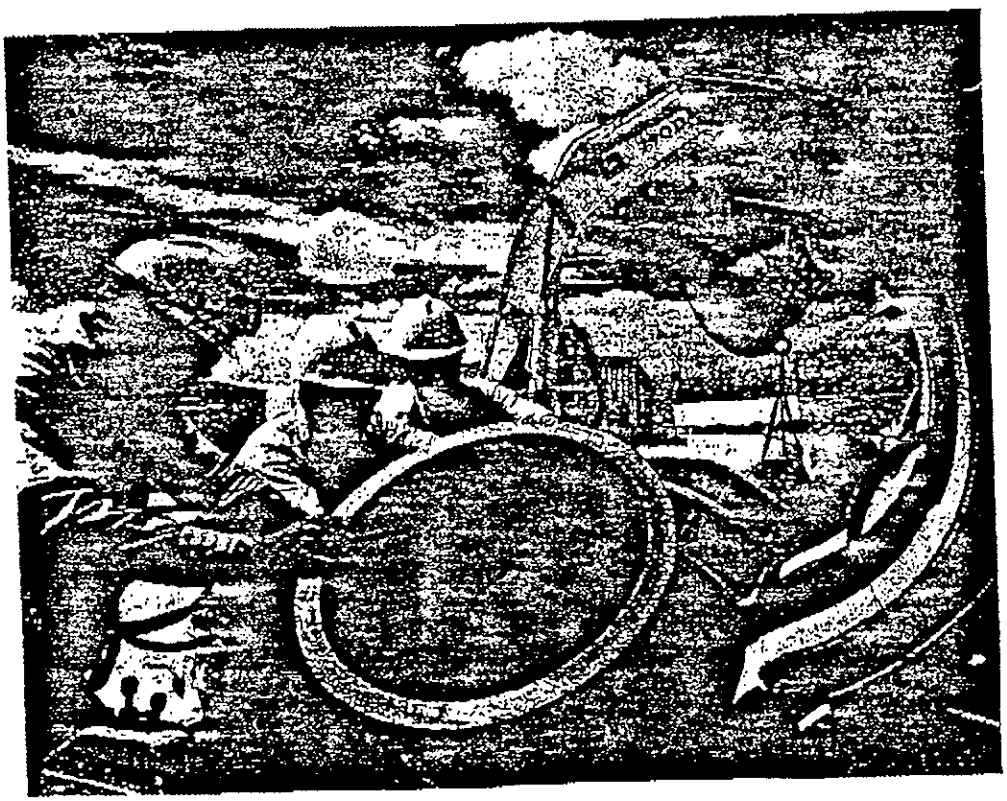
Environmental Service Factors

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



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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

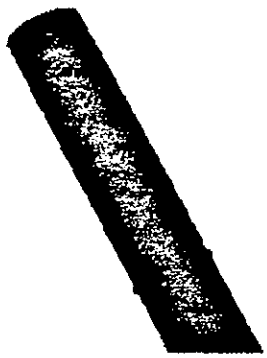


Figure 2
Tensile Pull Test

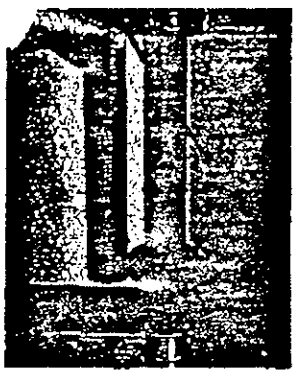
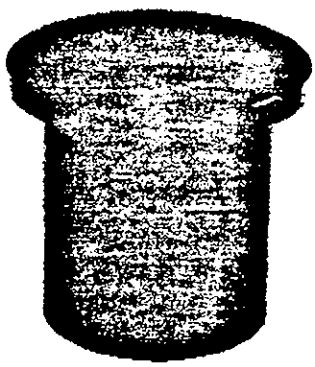


Figure 3
Molded Flange Adapter



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 1966. 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.

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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

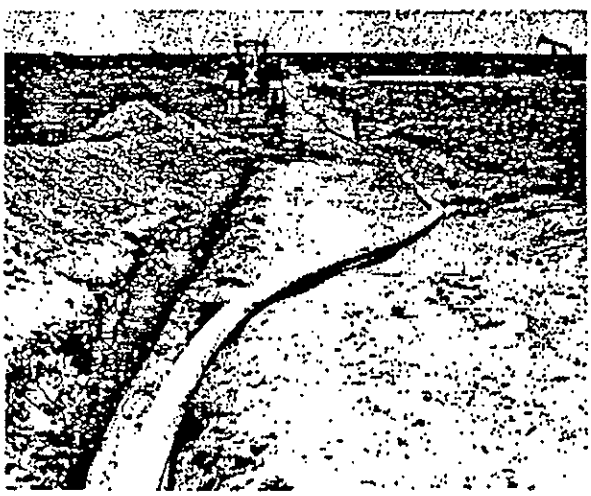
The width of the trench is usually determined by the diameter of the pipe. The pipe should have some slack and the trench should be wide enough to provide for good compaction of soil around the pipe. Detector tapes are available from other sources for pipeline detection.

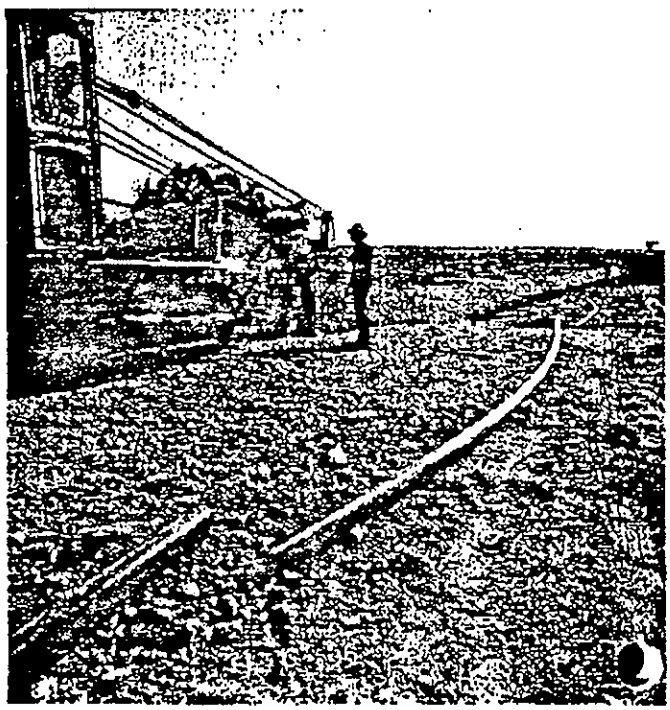
The depth of the trench should be sufficient to provide a minimum of 30 inches of cover. In cultivated areas this should be increased to 36 inches.

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.

HDPE COLLECTION PIPE JOINT DETAILS (LEACHATE COLLECTION)

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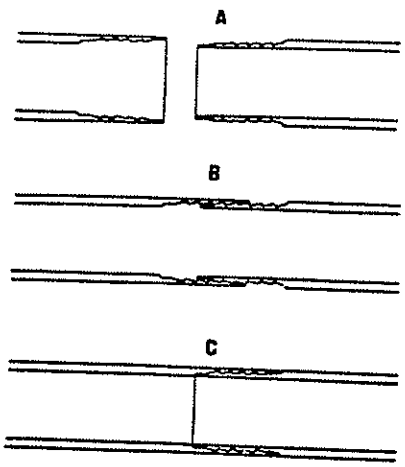
2.8B



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.

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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

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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.

Effective date: September 1992

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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

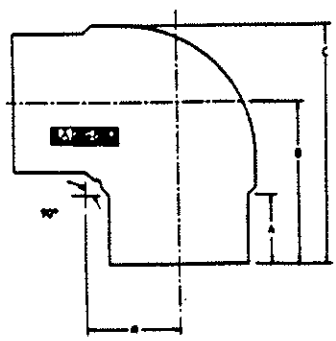
Nominal Size		Type **	psi †	Dimensions, inches A	B	C	R	WT. LBS.
2"	SDR 9.3 11	Molded	190 160	2.9	4.5	5.7	2.0	1
	SDR 7 11	fab'd	200 120	3.0	10.2	11.4	8.7	1 1
	SDR 9.3 11 17	Molded	190 160 100	3.0	5.1	6.9	2.5	2
3"	SDR 7 11 17	fab'd	200 120 75	3.0	10.8	12.5	9.8	4 3 2
	SDR 9.3 11 17 26	Molded	190 160 100 64	3.0	5.8	8.0	3.0	3
4"	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

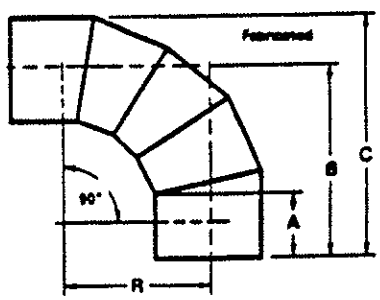
Nominal Size		Type **	psi †	Dimensions, inches A	B	C	R	WT. LBS
14"	SDR 7 11 17 26	fab'd	200 120 75 48	8.0	31.0	38.0	27.1	165 100 52 35
16"	SDR 7 11 17 26	fab'd	200 120 75 48	10.0	38.1	46.1	33.1	175 152 140 110
18"	SDR 11 17 26	fab'd	120 75 48	10.0	39.1	48.1	34.1	234 170 130
20"	SDR 11 17 26	fab'd	120 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



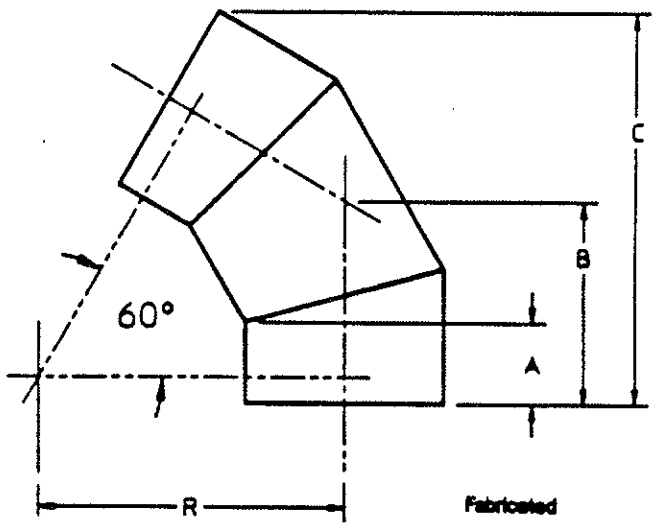


DRISCOPIPE

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
	SDR 11		120					.5
3"	SDR 7	fab'd	200	3.0	6.5	11.3	9.8	2
	SDR 11		120					1
	SDR 17		75					1
4"	SDR 7	fab'd	200	5.0	10.0	16.9	14.2	4
	SDR 11		120					3
	SDR 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
	SDR 11		120					10
	SDR 17		75					6
	SDR 26		48					4
8"	SDR 7	fab'd	200	6.0	13.2	23.5	19.4	24
	SDR 11		120					17
	SDR 17		75					12
	SDR 26		48					9
10"	SDR 7	fab'd	200	6.0	13.8	25.3	20.4	35
	SDR 11		120					28
	SDR 17		75					17
	SDR 26		48					10
12"	SDR 7	fab'd	200	8.0	17.9	32.4	26.5	65
	SDR 11		120					51
	SDR 17		75					36
	SDR 26		48					25
14"	SDR 7	fab'd	200	8.0	18.3	33.5	27.1	95
	SDR 11		120					63
	SDR 17		75					45
	SDR 26		48					35
16"	SDR 11	fab'd	120	10.0	22.4	40.5	33.1	100
	SDR 17		75					72
	SDR 26		48					55
18"	SDR 11	fab'd	120	10.0	23.0	42.2	34.1	130
	SDR 17		75					94
	SDR 26		48					80
20"	SDR 11	fab'd	120	11.0	23.1	43.4	30.5	150
	SDR 17		75					100
	SDR 26		48					74
21.5	SDR 11	fab'd	120	11.0	23.6	44.7	31.3	194
	SDR 17		75					140
	SDR 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
	SDR 17		75					140
	SDR 26		48					115
24"	SDR 11	fab'd	120	11.0	24.3	46.8	32.5	247
	SDR 17		75					178
	SDR 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
	SDR 17		75					200
	SDR 26		48					160
30"	SDR 17	fab'd	75	10.0	26.8	53.1	41.1	270
	SDR 26		48					220
800mm (31.496)	SDR 17	fab'd	75	10.0	26.9	53.9	40.9	197
	SDR 26		48					165
32"	SDR 17	fab'd	75	10.0	27.0	54.4	41.1	205
	SDR 26		48					170
36"	SDR 17	fab'd	75	10.0	28.1	57.8	43.1	400
	SDR 26		48					300
42"	SDR 17	fab'd	75	10.0	30.3	63.0	46.1	460
	SDR 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

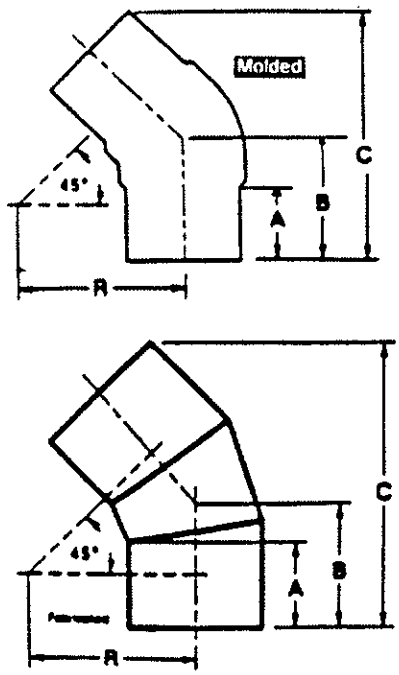
Non-listed sizes, contact your Driscopipe representative.

DRISCOPIPE

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 11	Molded	190 160	3.0	5.0	9.8	3.6	2
	SDR 7 11	fab'd	200 120	3.0	5.4	10.4	9.8	2 1
4"	SDR 9.3 11 17 26	Molded	190 160 100 64	3.0 / 3.0	5.0	10.1	3.8	3
	SDR 7 11	fab'd	200 120	5.0	8.5	16.1	14.2	4 3
5"	SDR 11	fab'd	120	5.0	8.9	17.1	16.0	5
6"	SDR 9.3 11 17 26	Molded	190 160 100 64	3.0 / 3.0	7.0	12.0	9.6	9
	SDR 7 11	fab'd	200 120	6.0	10.6	20.5	18.3	10 8
8"	SDR 11	Molded	160	6.0	10.0	17.3	9.6	16
	SDR 7 11 17 26	fab'd	200 120 75 48	6.0	11.0	21.9	19.4	25 20 9 6
10"	SDR 11	Molded	160	6.0	13.3	22.8	17.5	40
	SDR 7 11 17 26	fab'd	200 120 75 48	6.0	11.5	23.4	20.4	30 29 20 15
12"	SDR 11	Molded	160	7.5	15.8	27.0	20.0	70
	SDR 7 11 17 26	fab'd	200 120 75 48	8.0	15.0	30.0	26.5	57 49 35 28
14"	SDR 7 11 17 26	fab'd	200 120 75 48	8.0	15.3	30.9	27.1	95 65 45 35
16"	SDR 7 11 17 26	fab'd	200 120 75 48	10.0	18.7	37.6	33.1	125 99 70 50
18"	SDR 11 17 26	fab'd	120 75 48	10.0	19.1	39.0	34.1	139 95 85

Nominal Size		Type **	psi †	Dimensions, inches A	B	C	R	WT. LBS
20"	SDR 11 17 26	fab'd	120 75 48	11.0	21.1	43.1	37.7	190 110 75
21.5	SDR 11 17 26	fab'd	120 75 48	11.0	21.4	44.1	38.4	196 138 97
22"	SDR 11 17 26	fab'd	120 75 48	11.0	21.5	44.5	38.7	198 140 100
24"	SDR 11 17 26	fab'd	120 75 48	11.0	221.9	45.9	39.7	255 180 116
26"	SDR 11	fab'd	120	10.0	20.8	44.7	38.1	280
28"	SDR 11 17 26	fab'd	120 75 48	10.0	21.2	46.1	39.0	250 200 150
30"	SDR 17 26	fab'd	75 48	10.0	21.8	47.9	41.1	250 180
800mm (31.496)	SDR 17 26	fab'd	75 48	10.0	21.9	48.6	40.9	245 200
32"	SDR 17 26	fab'd	75 48	10.0	22.1	48.9	41.1	250 200
36"	SDR 17 26	fab'd	75 48	10.0	22.9	51.8	43.1	400 275
42"	SDR 17 26	fab'd	75 48	10.0	24.1	56.0	46.1	410 350
48"	SDR 26	fab'd	48	10.0	25.4	60.2	49.1	647



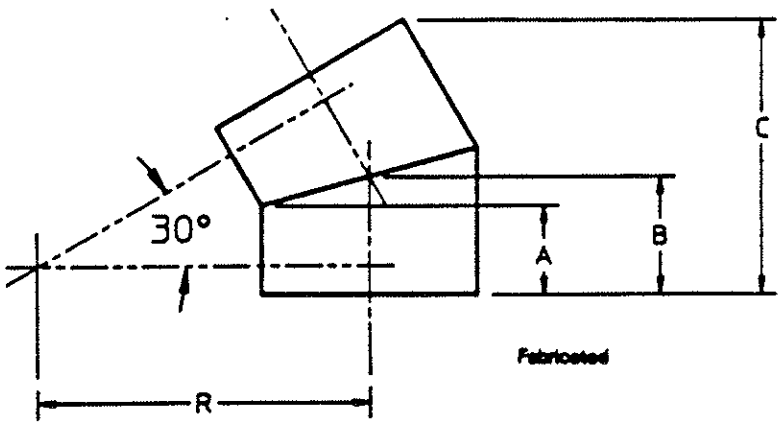
** FAB'D Ells are not fully pressure rated, see "TECHNICAL CONSIDERATIONS".

† 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
	SDR 11		120	(3.0)	(3.3)	(6.8)	(8.7)	.5
3"	SDR 7	fab'd	200	3.0	3.5	7.4	9.8	1
	SDR 11		120	(3.0)	(3.5)	(7.4)	(9.8)	1
	SDR 17		75	(3.0)	(3.5)	(7.4)	(9.8)	.5
4"	SDR 7	fab'd	200	5.0	5.6	11.6	14.2	3
	SDR 11		120	(5.0)	(5.6)	(11.6)	(14.2)	2
	SDR 17		75	(5.0)	(5.6)	(11.6)	(14.2)	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
	SDR 11		120	(6.0)	(6.9)	(14.5)	(18.3)	6
	SDR 17		75	(6.0)	(6.9)	(14.5)	(18.3)	4
	SDR 26		48	(6.0)	(6.9)	(14.5)	(18.3)	3
8"	SDR 7	fab'd	200	6.0	6.9	14.5	18.3	15
	SDR 11		120	(6.0)	(6.9)	(14.5)	(18.3)	10
	SDR 17		75	(6.0)	(6.9)	(14.5)	(18.3)	6
	SDR 26		48	(6.0)	(6.9)	(14.5)	(18.3)	4
10"	SDR 7	fab'd	200	6.0	7.4	16.6	20.4	20
	SDR 11		120	(6.0)	(7.4)	(16.6)	(20.4)	16
	SDR 17		75	(6.0)	(7.4)	(16.6)	(20.4)	11
	SDR 26		48	(6.0)	(7.4)	(16.6)	(20.4)	7
12"	SDR 7	fab'd	200	8.0	9.7	21.3	26.5	38
	SDR 11		120	(8.0)	(9.7)	(21.3)	(26.5)	29
	SDR 17		75	(8.0)	(9.7)	(21.3)	(26.5)	20
	SDR 26		48	(8.0)	(9.7)	(21.3)	(26.5)	14
14"	SDR 7	fab'd	200	8.0	9.9	22.0	27.1	46
	SDR 11		120	(8.0)	(9.9)	(22.0)	(27.1)	36
	SDR 17		75	(8.0)	(9.9)	(22.0)	(27.1)	24
	SDR 26		48	(8.0)	(9.9)	(22.0)	(27.1)	18
16"	SDR 11	fab'd	120	10.0	12.1	26.7	33.1	58
	SDR 17		75	(10.0)	(12.1)	(26.7)	(33.1)	40
	SDR 26		48	(10.0)	(12.1)	(26.7)	(33.1)	28
18"	SDR 11	fab'd	120	10.0	12.4	27.7	34.1	75
	SDR 17		75	(10.0)	(12.4)	(27.7)	(34.1)	53
	SDR 26		48	(10.0)	(12.4)	(27.7)	(34.1)	40
20"	SDR 11	fab'd	120	11.0	13.7	30.5	30.5	85
	SDR 17		75	(11.0)	(13.7)	(30.5)	(30.5)	58
	SDR 26		48	(11.0)	(13.7)	(30.5)	(30.5)	42
21.5	SDR 11	fab'd	120	11.0	13.9	31.3	36.1	111
	SDR 17		75	(11.0)	(13.9)	(31.3)	(36.1)	80
	SDR 26		48	(11.0)	(13.9)	(31.3)	(36.1)	63
22"	SDR 11	fab'd	120	11.0	14.0	31.5	36.1	111
	SDR 17		75	(11.0)	(14.0)	(31.5)	(36.1)	80
	SDR 26		48	(11.0)	(14.0)	(31.5)	(36.1)	65
24"	SDR 11	fab'd	120	11.0	14.2	32.5	37.5	141
	SDR 17		75	(11.0)	(14.2)	(32.5)	(37.5)	100
	SDR 26		48	(11.0)	(14.2)	(32.5)	(37.5)	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
	SDR 17		75	(10.0)	(13.8)	(32.7)	(39.0)	120
	SDR 26		48	(10.0)	(13.8)	(32.7)	(39.0)	90
30"	SDR 17	fab'd	75	10.0	14.0	33.7	41.1	125
	SDR 26		48	(10.0)	(14.0)	(33.7)	(41.1)	100
800mm (31.496)	SDR 17	fab'd	75	10.0	14.2	34.4	40.9	133
	SDR 26		48	(10.0)	(14.2)	(34.4)	(40.9)	108
32"	SDR 17	fab'd	75	10.0	14.2	34.4	40.9	135
	SDR 26		48	(10.0)	(14.2)	(34.4)	(40.9)	110
36"	SDR 17	fab'd	75	10.0	14.8	36.7	43.1	200
	SDR 26		48	(10.0)	(14.8)	(36.7)	(43.1)	150
42"	SDR 17	fab'd	75	10.0	15.6	39.7	46.1	250
	SDR 26		48	(10.0)	(15.6)	(39.7)	(46.1)	200
48"	SDR 26	fab'd	48	10.0	16.4	42.7	43.1	304



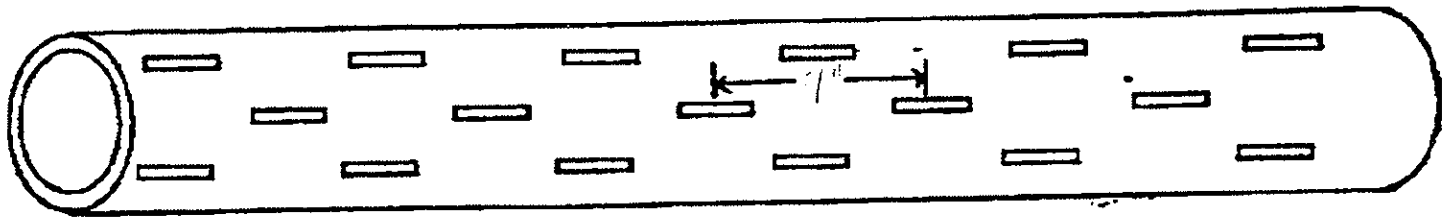
** FAB'D Ells are not fully pressure rated, see "TECHNICAL CONSIDERATIONS".

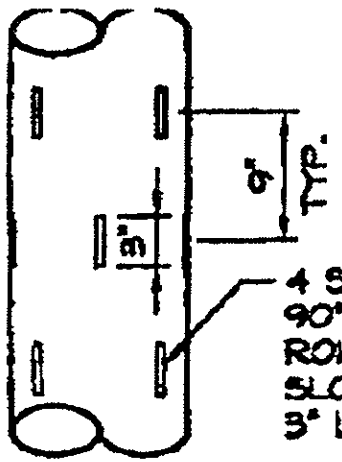
† PSI @ 73.4 degrees F. ( ) = duplication

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





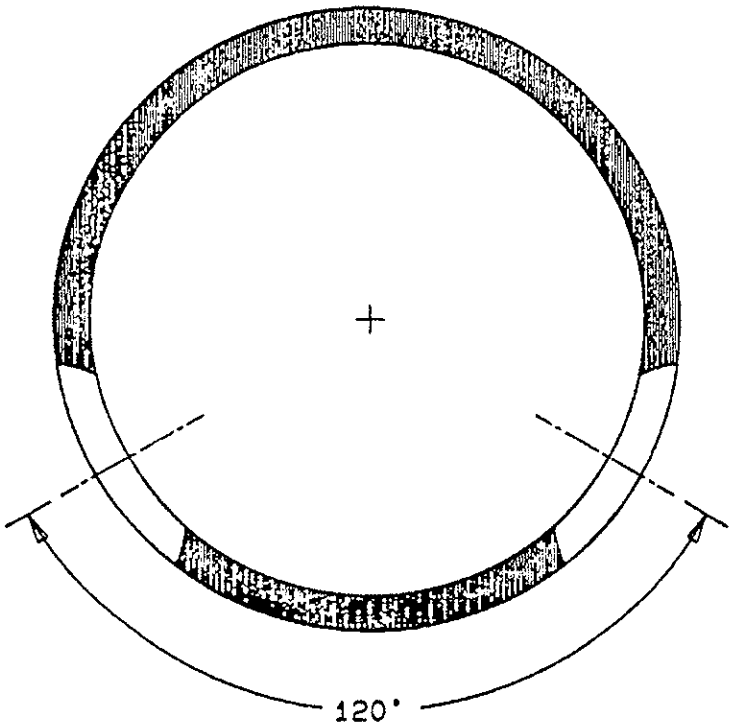
4 SLOTS PER ROW 90° APART. ADJACENT ROWS STAGGERED 45°. SLOTS TO BE 1/8" WIDE, 3" LONG @ 9" O.C.

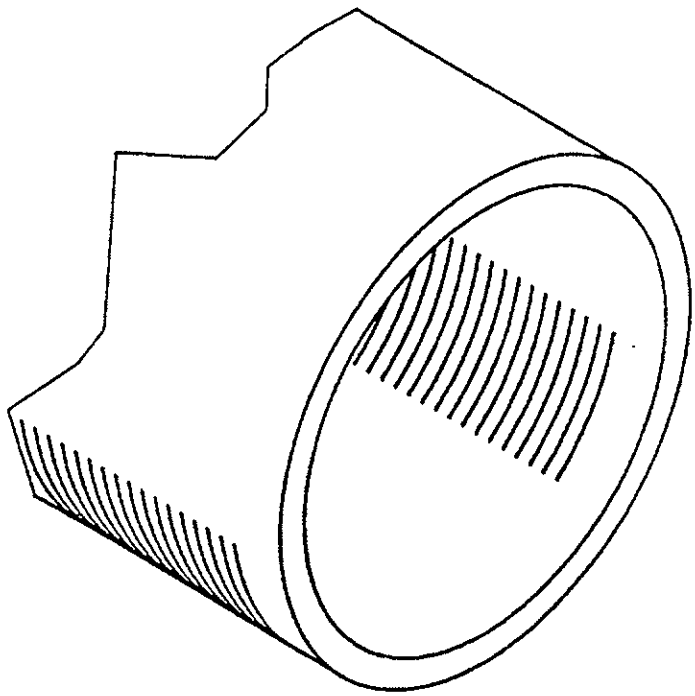
PIPE DIA. 4" SCH. 80
O.D. 4.500 I.D. 3.786
MIN. WALL .337 LENGTH 10/20'
END P x P SLOT WIDTH .125 LENGTH 3"
SPACING 9" o.c. CENTERS # ROWS 8
PATTERN 8 rows of slots.
CONFIGURATION 45° apart, staggered.

BEDROCK ENTERPRISES, INC.
P.O. BOX 747
FORKED RIVER, NEW JERSEY 08731
(609) 693-9434
FAX# 609-971-8708

Date 11-17-99	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

HYD061