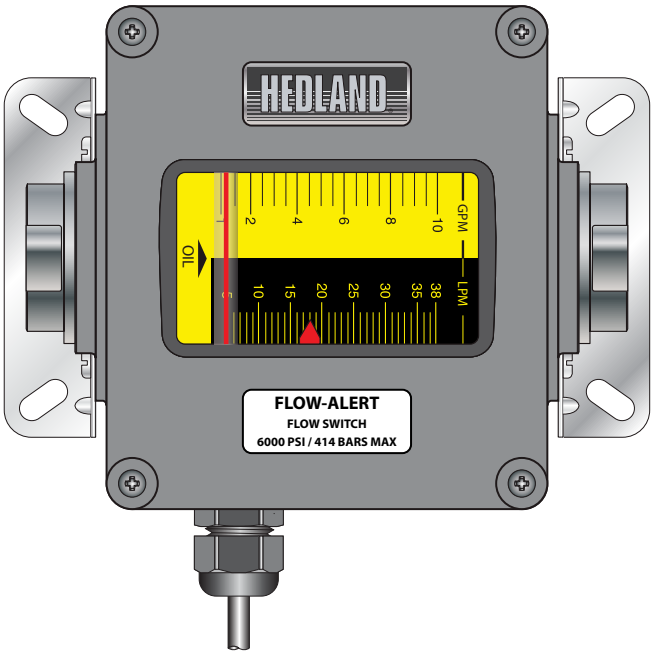
Hedland®
Variable Area Flow Meters

Flow-Alert

Flow Switch



Badger Meter

VAM-UM-00646-EN-03 (September 2014)

User Manual

CONTENTS

INTRODUCTION

The Flow-Alert flow meter combines the rugged proven technology of a direct reading, piston-type variable area flow meter, coupled with electrical contacts used to signal at selected flow rates. This combination is sealed against industrial contamination by a NEMA 12 and 13 (IP52/54) rated enclosure.

This product provides a local flow indication and automatically signals the operator or PLC if flow is too high or too low.

Uses of the Flow-Alert flow meter include: bearing lubrication, case drain verification, gun drill cooling and pump flow confirmation.

INSTALLATION

⚠CAUTION

THIS PRODUCT SHOULD BE INSTALLED AND SERVICED BY TECHNICALLY QUALIFIED PERSONNEL TRAINED IN MAINTAINING INDUSTRIAL CLASS FLOW INSTRUMENTATION AND PROCESSING EQUIPMENT.

⚠CAUTION

READ INSTRUCTIONS THOROUGHLY BEFORE INSTALLING THE UNIT. IF YOU HAVE ANY QUESTIONS REGARDING PRODUCT INSTALLATION OR MAINTENANCE, CALL YOUR LOCAL SUPPLIER FOR MORE INFORMATION.

⚠CAUTION

THIS METER MAY CONTAIN RESIDUAL AMOUNTS OF TEST FLUID AT THE TIME OF SHIPMENT. THIS FLUID SHOULD BE REMOVED PRIOR TO INSTALLATION AS THE FLUID MAY BE INCOMPATIBLE OR HAZARDOUS WITH SOME LIQUIDS OR GASES. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN DAMAGE TO THE EQUIPMENT.

⚠CAUTION

THIS STANDARD METER IS UNIDIRECTIONAL. ATTEMPTS TO FLOW FLUIDS IN THE OPPOSITE DIRECTION OF THE FLOW ARROW WILL RESULT IN THE METER ACTING AS A CHECK VALVE, CREATING A DEADHEADING SITUATION. IF THE DIFFERENTIAL PRESSURE MAGNITUDE IS GREAT ENOUGH, DAMAGE TO THE INTERNAL PARTS OF THE METER WILL RESULT.

⚠WARNING

DISCONNECT ELECTRICAL POWER BEFORE OPENING WIRING ENCLOSURE. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY OR DEATH AND/OR DAMAGE TO THE EQUIPMENT.

⚠WARNING

ALL WIRING SHOULD BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND MUST CONFORM TO ANY APPLICABLE STATE AND LOCAL CODES. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY OR DEATH AND/OR DAMAGE TO THE EQUIPMENT.

⚠CAUTION

AIR/GAS METERS ARE NOT OXYGEN CLEANED. USE WITH OXYGEN MAY CAUSE HAZARDOUS OR EXPLOSIVE CONDITIONS THAT MAY CAUSE SERIOUS PERSONAL INJURY AND/OR DAMAGE TO THE EQUIPMENT.

Installation Recommendations

The inline flow meter is a simple device to install. However, the following measures are recommended for reliable, trouble-free operation:

1. Piping should be accurately aligned and of correct length. The high pressure body of the flow meter can withstand shock and flow/pressure pulsation. Piping should be firmly supported by external mounting brackets, both upstream and downstream of the meter, to avoid any pipe flexing actions that could reduce meter life.
2. If the flow meter inlet or outlet is rigidly mounted, and the opposing port is connected to flexible hose, the end connected with the flexible hose must be rigidly mounted.
3. Use Teflon® tape for sealing NPT fitting.
4. Install a union near the inlet or outlet of the meter to facilitate quick and easy meter removal and inspection during periodic maintenance procedures.
5. Mount the meter either horizontally or vertically (flow arrow pointing to either side or straight up). If the meter must be mounted inverted, special inverted scales are available.
6. Verify the fluid is traveling in the direction of the flow arrow, see *Figure 1 on page 5*.
7. Systems that do not have filtration should be equipped with at least a 200 mesh (74 micron) filter. Most hydraulic systems already have much finer filtration. The meter will allow particulates to pass that would jam most valves and flow controls. Dirt, ferrous metal or sealing agents may lodge and cause malfunction. If the meter is jammed at a fixed position, follow cleaning and maintenance instructions.
8. Do not use thread locking compounds as thread sealant.
9. Do not install the flow meter near turbulence producing fittings such as elbows, reducers and close coupled valves for maximum reliability. The inline flow meter does not require flow straighteners or special lengths of straight inlet/outlet piping to stabilize turbulent flow patterns.
10. Do not install the meter near fast-acting valves. Fast-acting valves have the potential to create high magnitude hydraulic pressure spikes. These spikes can damage the internal components of the meter, resulting in inaccuracies or malfunction.
11. Do not allow unidirectional meters to be operated against the direction of the flow arrow. The standard flow meter is a unidirectional flow meter. The piston acts as a check valve to block flow in the reverse direction. This causes an excessive pressure differential, which can result in damage to internal meter components. The flow meter is also available in a modified design, which offers a reverse flow bypass feature to accommodate bidirectional flow.

NOTE: Inline meters with a reverse flow bypass feature are available. Consult factory for details.

Installing the Flow-Alert

1. See *Figure 1*. Mount the meter so fluid is traveling in the direction of the flow arrow.

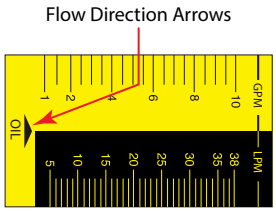


Figure 1: Flow direction arrows

2. See *Figure 2*. Select a mounting location that is suitable for viewing and product service. To connect the flow meter into the piping system, place an open-ended wrench onto the flow meter wrench flats adjacent to the pipe connection being installed. DO NOT wrench on the opposite end of the flow meter or leakage may result.

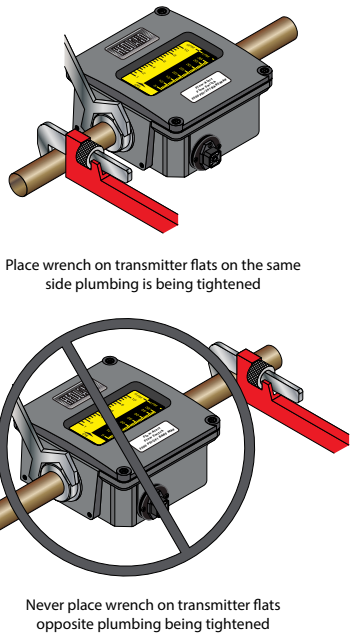
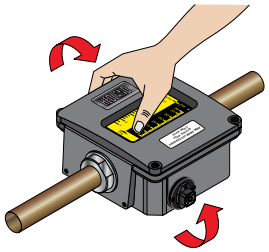
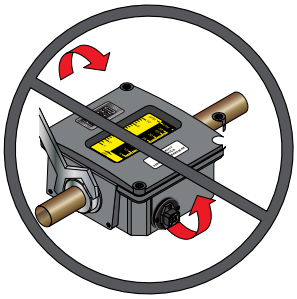


Figure 2: Installing the meter

3. See *Figure 3 on page 6*. After installation, rotate meter by hand to view flow scale.



Place wrench on transmitter flats on the same side plumbing is being tightened



Never place wrench on transmitter flats opposite plumbing being tightened

Figure 3: Rotating the meter

Electrical Connections

All Models

The strain relief connection on the outside of the enclosure is water tight. Be sure to consult local wiring codes before applying power. Some installations will require a rigid conduit. A conduit connection is accessible by removing the black strain relief connection from the outside of the enclosure.

Micro Switch Equipped Models

All meter sizes 1/4…1-1/2 in. are offered in single switch or double switch models. The single switch model is equipped with a 34 in. (863.6 mm) length of 4-wire #18 AWG type SO jacketed cable. The double switch model is equipped with an 18 in. (457.2 mm) length of 7-wire #16 AWG type SO jacketed cable.

One Switch (Four-Wire Cable)		**Two Switch (Seven-Wire Cable)**			
		Switch 1		**Switch 2**	
Red	Normally Closed (NC)	**Red**	Normally Closed (NC)	**Orange**	Normally Closed (NC)
Black	Normally Open (NO)	**Black**	Normally Open (NO)	**Blue**	Normally (NO)
White	Common	**White**	Common	**White/Black**	Common
Green	Ground			**Green**	Ground

Table 1: Micro switch wire functions

Brad Harrison Connector

A four-pin Brad Harrison® quick disconnect plug is available upon special order.

Four-Pin Connector	
Red	Normally Closed (NC)
Black	Normally Open (NO)
White	Common
Green	Ground

Table 2: Four-pin micro switch connector

NOTE: If the factory supplied cable is removed for hard wiring the meter, switches must be connected with 0.187" × 0.020" insulated flag terminals designed for the appropriate wire gauge for the application.

Reed Switch Models

Safe operation of the reed switch is dependent on not exceeding the maximum wattage for that switch.

For example, the normally open reed switch has a maximum power rating of 10 Watts. If the switch is to operate at 24V DC, the maximum current is found by dividing the wattage by the voltage.

$$I = \frac{W}{E} = \frac{10}{24} = 0.417A$$

Exceeding the maximum power rating for a particular switch will damage it.

All meter sizes 1/4…1-1/2 in. are offered in single switch or double switch models and come equipped with a four-pin Hirschmann connector. All units are quipped with a 15 ft (4.6 m) length of four wire #22 AWG type PVC jacketed cable.

Wiring Configurations

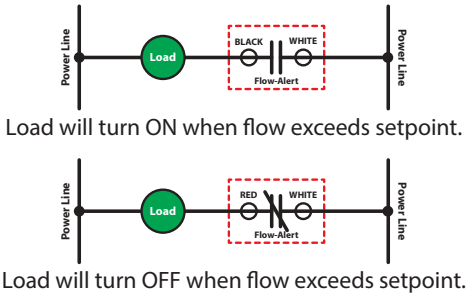


Figure 4: Loads within contact rating

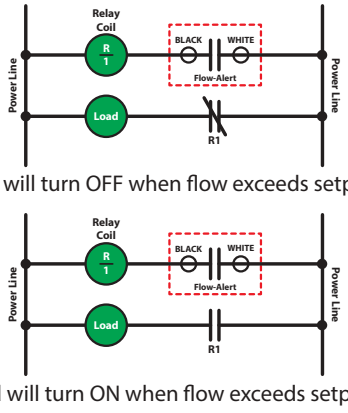


Figure 5: Loads outside contact rating

OPERATION

NOTE: See *"Application Information" on page 13* for application information and fluid charts.

Micro Switch Adjustment

1. Remove cover screws and front cover.

NOTE: On meters equipped with dual micro switches, the right side is the decreasing flow switch and the left side is the increasing flow switch.

2. Loosen the screws securing the switching roller and latching rollers to the guide bar. Turn each screw a maximum of one full turn.

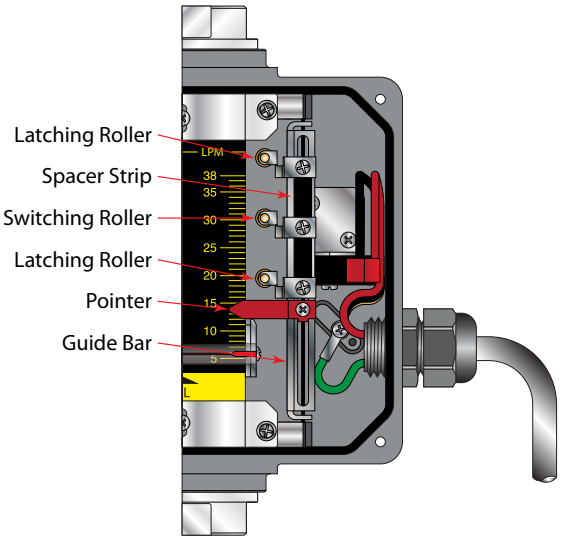


Figure 6: Snap switch adjustment

3. All rollers are secured as a set to the spacer strip. Slide the entire roller set until the pointer is at the desired setting.

NOTE: The spacer strip controls the maximum distance between rollers. This distance may be shortened when the switch setting is close to the end of the flow scale. Latching rollers may also be removed if the switch setting is close to the end of the flow scale.

4. Make sure the roller brackets are flush against the guide bar. Tighten the roller screws.
5. For dual switch models, repeat steps 1…4 for the left side switch setting.
6. Install the cover gasket and front cover and secure with screws. To properly seat the cover gasket, tighten cover screws in a crisscross pattern as show in *Figure 7*.

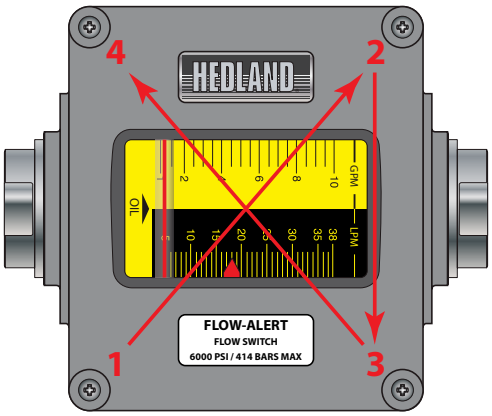


Figure 7: Cover screw tightening sequence

Reed Switch Adjustment

1/4 inch Models

1. Loosen the screw securing the switch assembly (see *Figure 8*).

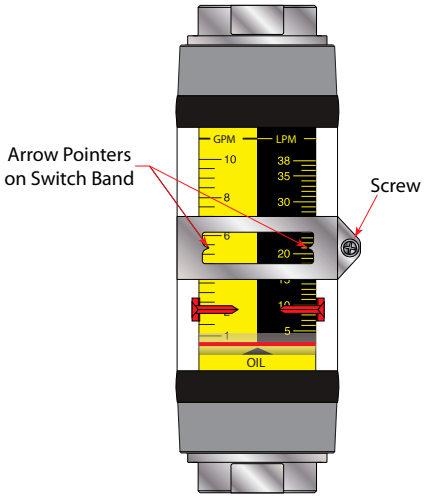


Figure 8: Reed switch adjustment (1/4" models)

2. Slide the switch assembly until the arrow pointers on the switch band are aligned with the desired flow rate indicated on the scale.
3. Tighten the screw.

1/4…1-1/2 inch Models

1. Remove cover screws and front cover.
2. Loosen the screw securing the switch assembly (see *Figure 9*).

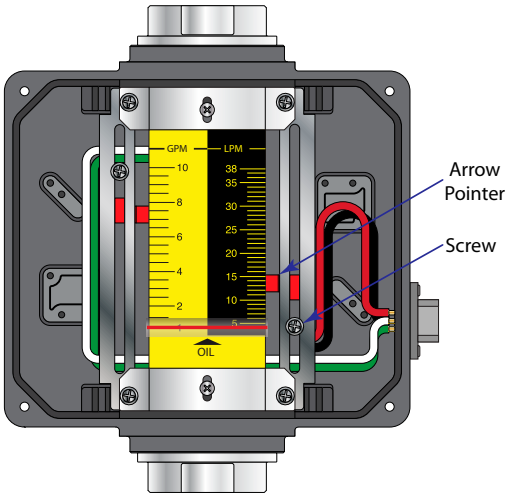


Figure 9: Reed switch adjustment (1/4"…1-1/2" models)

NOTE: On meters equipped with dual switches, the right side is the decreasing flow switch and the left side is the increasing flow switch.

3. Slide the switch assembly until the arrow pointer aligns with the desired flow rate indicated on the scale.
4. Tighten the screw.
5. For dual switch models, repeat steps 1…4 for the left side switch setting.
6. Install the front cover and gasket. To properly seat the cover gasket, tighten the cover screws in a crisscross pattern as shown in *Figure 7 on page 8*.

MAINTENANCE

Quick Recoupling

The piston type variable area flow meter is inherently less sensitive to shock and vibration than other variable area designs. The unique magnetic coupling also eliminates the need for mechanical linkages that can wear or loosen over the functional life of the meter.

However, a pressure spike or extreme flow surge can cause the piston to move at such rapid speed that it disconnects the piston magnet and the external indicator ring. If this occurs, use one of these procedures to recouple the magnet and the external indicator ring:

- If the system permits, simply change flow rate from "no flow" to "full flow" allowing the moving piston to magnetically recouple to the indicator ring.
- Remove the cover and manually reattach the external flow indicator to the internal magnet/piston assembly.
- For rigorous cyclical applications where decoupling may occur frequently, consult technical services.

⚠WARNING

DISCONNECT ELECTRICAL POWER BEFORE REMOVING THE METER COVER. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY OR DEATH AND/OR DAMAGE TO THE EQUIPMENT.

Switch Replacement

Micro Switch

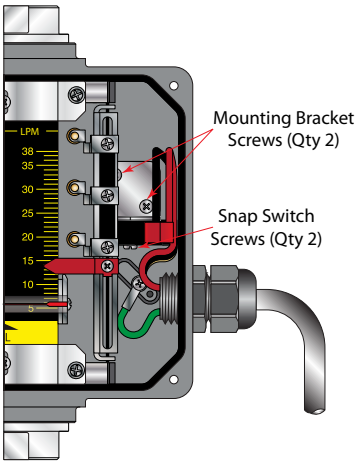


Figure 10: Micro switch

1. Disconnect the cable connection to the meter.
2. Remove the screws securing the cover and remove the cover.
3. Note the positions of the colored wire connections on the switch. Disconnect the wires from the switch.
4. Remove the two mounting bracket screws at the bottom of the meter.
5. Remove the mounting bracket/switch assembly from the meter. Remove the two screws that secure the switch to mounting bracket.
6. Install the new switch to the mounting bracket using the screws removed in step 5.
7. Install the wires to the terminals on the switch as marked in step 3.
8. Install the mounting bracket/switch assembly to the meter using the screws removed in step 4.
9. Install the front cover and gasket. To properly seat the cover gasket, tighten cover screws in a crisscross pattern as shown in *Figure 7 on page 8*.

Reed Switch

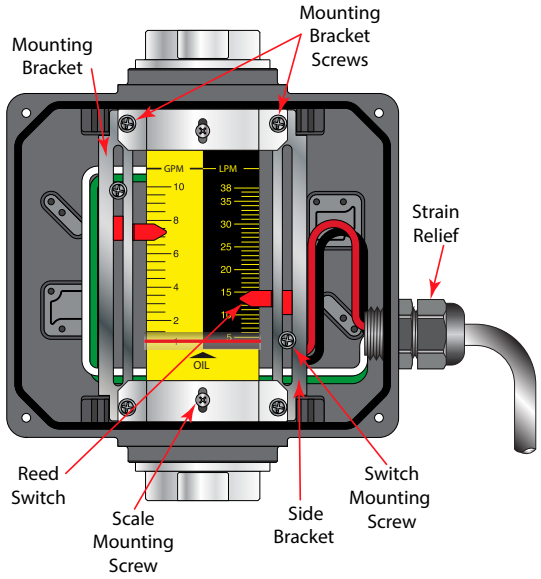


Figure 11: Reed Switch Replacement

1. Disconnect the Hirschmann connector and remove the connector from wires.
2. Remove the screws securing the cover and remove the cover.
3. Remove the two scale mounting screws.
4. Remove the screws securing the two mounting brackets and remove the brackets.
5. Loosen the two slide bracket screws.
6. Remove the switch mounting screw and remove the mounting block/switch assembly from slide bracket.
7. Remove the two mounting screws that secure the switch to mounting block and pointer. Make note of the switch position.
8. Install the new switch to the mounting block and pointer using the screws removed in step 7.
9. Remove the strain relief.
10. Install the mounting block/switch assembly to the slide bracket using the screw removed in step 6.
11. Tighten the slide bracket screws.
12. Install the strain relief.
13. Install the mounting brackets to the scale using the scale mounting screws. Do not fully tighten the screws.
14. Secure the mounting brackets using the screws removed in step 4.
15. Tighten the screws installed in step 10.
16. Solder the Hirschmann connector to the new switch wires.

NOTE: For 1/4…1 in. units, wire should be cut to 5 in. length. For 1-1/4 and 1-1/2 in. units, wire should be cut to 10 in. length.

17. Install the front cover and gasket. To properly seat the cover gasket, tighten the cover screws in a crisscross pattern as shown in *Figure 7 on page 8*.

Cartridge Cleaning

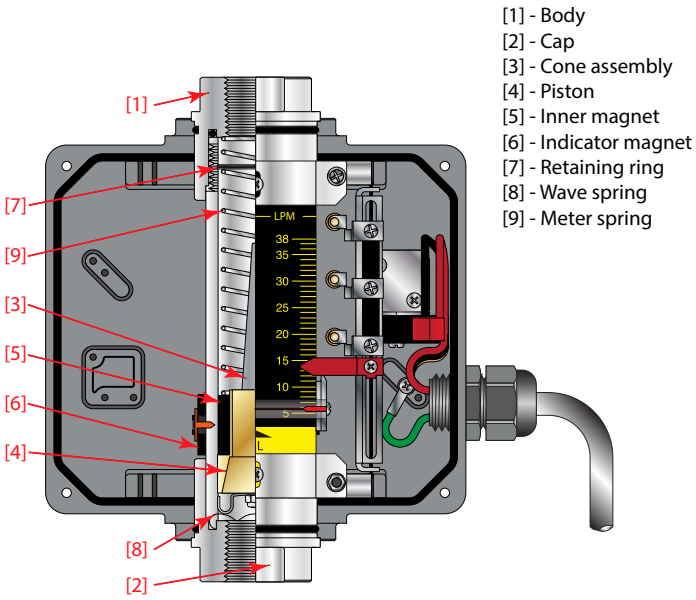


Figure 12: Cartridge Components

1. Disconnect the meter cable.
2. Remove the meter from the line. Remove excess piping from the meter.

⚠WARNING

BEFORE ATTEMPTING TO REMOVE THE METER FROM THE LINE, CHECK THE SYSTEM TO CONFIRM THAT LINE PRESSURE HAS BEEN REDUCED TO ZERO PSI. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY OR DEATH AND/OR DAMAGE TO THE EQUIPMENT.

NOTE: It is not necessary to remove the aluminum housing from the meter to remove it from the line.

3. Thoroughly wipe off the entire meter surface using mild detergent or isopropyl alcohol.

⚠CAUTION

DO NOT USE AROMATIC HYDROCARBONS, HALOGENATED HYDROCARBONS, KETONES, OR ESTER BASED FLUIDS ON THE POLYCARBONATE LENS. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN DAMAGE TO THE METER.

4. Remove the inlet end fitting, retaining spring and metering cone/spider plate assembly from the cartridge.
5. Gently push the cartridge assembly towards the outlet port while holding the magnetic indicator assembly in place.
6. The cartridge internal parts are secured with a retaining ring. Remove the retaining ring and the remaining internal parts from the cartridge.

NOTE: If internal parts do not slide freely from cartridge, use a wooden dowel inserted into the outlet port of the meter to push the parts out.

7. Place all parts on a clean work surface. Clean and inspect all parts. Replace any that appear worn or damaged. Check inlet port O-ring for damage and replace if required.
8. Reassemble the spring, piston/magnet assembly and retaining ring in the cartridge.
9. Gently push the cartridge assembly into the housing while holding the magnetic flow indicator in position.
10. Install the metering cone/spider plate assembly and retaining spring, and secure with the inlet fitting.
11. Reinstall the meter to the line. Reconnect the electrical power.

APPLICATION INFORMATION

Liquid

Viscosity Effect (SUS/cSt)
The design uses a precision machined, sharp-edged orifice and biasing calibration spring that assures operating stability and accuracy over the wide viscosity range, common to many fluids. High flow models of each meter size provide good accuracy over a viscosity range of 40…500 SUS (4.2…109 cSt).

Density Effect (specific gravity)
Any fluid density change from stated standards has a proportional effect on meter accuracy. Special scales can be supplied if actual specific gravity decreases accuracy beyond application limits. Corrections for more or less dense fluids can be made to standard scales using the following correction factor:

$\sqrt{\frac{1.0}{Specific\ Gravity}}$ for water/water-based meters

$\sqrt{\frac{0.876}{Specific\ Gravity}}$ for petroleum-based meters

Pneumatic

NOTE: Pressure and temperature readings must be taken at the flow meter inlet to ensure accurate correction factors.

The pneumatic flow meter is offered with a standard graduated dual scale, calibrated for air in standard cubic feet per minute (scfm) at 1.0 sg (70° F @ 100 psi) and liter per second (lps) at 1.0 sg (21° C @ 6.9 bar).

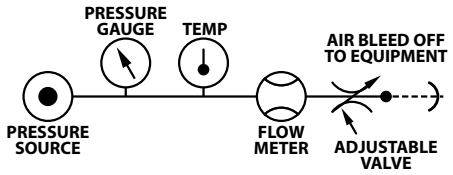


Figure 13: Pneumatic flow meter

CONVERSION CHART

The conversion chart provides a series of simplified mathematical formulas to adjust the graduated scale for changes in pressure (*Table 3*), temperature (*Table 4*), and/or specific gravity (*Table 5*).

Note: Special scales can be made to accommodate other pressures, temperatures and specific gravity.

The conversion chart can also be used to adjust the multi-pressure flow scale to indicate flow rates in applications beyond the parameters stated on the scale.

To adjust the pressures beyond (above or below) scale limits:

1. Locate the point at which the brightly colored indicator line intersects the vertical 100 Psig pressure line.
2. Divide this reading by the pressure correction factor (f_1) indicated in *Table 3*.

To adjust for changes in temperature:

1. Divide the 100 Psig flow rate reading by the temperature correction factor (f_2).

To adjust for changes in specific gravity:

1. Establish the square root of the new specific gravity.
2. Divide the 100 Psig flow rate reading by the Specific Gravity Correction Factor (f_3)

Conversion Chart

Determine flow rates using different pressures and temperatures.

$$scfm\,(actual) = \frac{scfm\,(indicated)}{f_1 \times f_2 \times f_3}$$

Where
f_1 = conversion factor for inlet pressure
f_2 = conversion factor for inlet temperature
f_3 = conversion factor for inlet specific gravity

psig	25	50	75	100	125	150	175	200	225	250
BAR	1.7	3.5	5.2	6.9	8.6	10.4	12.1	13.8	15.5	17.2
kPa	172	345	517	689	862	1034	1207	1379	1551	1724
f_1	1.700	1.331	1.131	1.000	0.902	0.835	0.778	0.731	0.692	0.658
$f_1 = \sqrt{\frac{114.7}{14.7 + psig}}$				$f_1 = \sqrt{\frac{7.914}{1.014 + BAR}}$			$f_1 = \sqrt{\frac{790.857}{101.357 + kPa}}$			

Table 3: Pressure correction factor

°F	+10	+30	+50	+70	+90	+110	+130	+150	+170	+190
°C	–12.2	–1.1	+909	+21.0	+32.1	+43	+54	+65	+76	+88
f_2	0.942	0.962	0.981	1.000	1.018	1.037	1.055	1.072	1.090	1.107
$f_2 = \sqrt{\frac{460 + °F}{530}}$					$f_2 = \sqrt{\frac{273 + °C}{293}}$					

Table 4: Temperature correction factor

$f_3 = \sqrt{Sp.Gr.}$

Table 5: Specific Gravity correction factor

Fluid	Specific Gravity	Correction Factor		Aluminum	Brass	T316SS	T303SS	Viton®	EPR	Polycarbonate	Nylon	Pyrex
		Oil	Water									
Acetic Acid (Air Free)	1.06	0.909	0.971	C	N	R	R	R	R	C	N	R
Acetone	0.79	1.053	1.125	R	R	R	R	N	R	N	R	R
Alcohol Butyl (Butanol)	0.83	1.027	1.098	C	C	R	R	C	R	R	R	R
Alcohol Ethyl (Ethanol)	0.83	1.027	1.098	C	C	R	R	C	R	R	N	R
Ammonia	0.89	0.992	1.060	R	C	R	R	N	R	N	C	R
Benzine	0.69	1.127	1.204	C	R	R	C	R	N	N	R	R
Carbon Disulphide	1.26	0.834	0.891	R	N	R	R	R	N	N	R	R
Castor Oil	0.97	0.950	1.015	C	R	R	C	R	N	C	C	R
Cotton Seed Oil	0.93	0.970	1.037	C	R	R	R	R	N	R	R	R
Ethylene Glycol 50/50	1.12	0.884	0.945	R	R	R	R	R	R	R	C	R
Freon II	1.46	0.774	0.828	R	R	R	R	R	N	R	R	R
Gasoline	0.70	1.119	1.195	R	R	R	R	R	N	C	R	R
Glycerin	1.26	0.834	0.891	R	R	R	R	R	R	R	C	R
Kerosene	0.82	1.033	1.104	R	R	R	R	R	N	R	R	R
Liquid Propane (LPG)	0.51	1.310	1.400	R	R	R	R	R	N	N	R	R
Mineral Oil	0.92	0.976	1.042	R	N	R	R	R	N	R	R	R
Naphtha	0.76	1.074	1.147	R	N	R	R	R	N	C	R	R
Perchloroethylene	1.62	0.735	0.786	C	N	R	R	R	N	N	N	R
Petroleum Oil	0.876	1.000	1.068	R	R	R	R	R	N	R	R	R
Phosphate Ester	1.18	0.862	0.921	R	R	R	R	N	R	N	R	R
Phosphate Ester Base	1.26	0.833	0.891	R	R	R	R	N	R	N	R	R
Phosphoric Acid (Air Free)	1.78	0.701	0.749	N	N	R	N	R	N	R	N	R
Sea Water	1.03	0.922	0.985	N	N	C	C	N	R	R	R	R
Synthetic Petroleum Base	1.00	0.936	1.000	R	C	R	R	R	N	R	R	R
Water	1.00	0.936	1.000	N	R	R	R	N	R	R	R	R
Water Glycol 50/50	1.07	0.905	0.967	R	R	R	R	R	N	R	R	R
Water-in-Oil	0.93	0.970	1.037	R	R	R	R	N	R	R	R	R

R = Recommended
N = Not Recommended
C = Consult Factory

Table 6: Fluid selection chart

Fluid	Specific Gravity	Correction Factor of Standard Scale	Internal Body Material				External Pressure Seals		Dust Guards		
			Aluminum	Brass	T316SS	T303SS	Viton®	EPR	Polycarbonate	Nylon	Pyrex®
Air	1.00	1.000	R	R	R	R	R	R	R	R	R
Argon (A)	1.38	1.175	R	R	R	R	R	R	R	R	R
Carbon Dioxide (CO_2)	1.53	1.237	R	R	R	R	R	R	R	R	R
Freon 11 (CCl_3F)	4.92	2.218	R	R	R	R	R	R	R	R	R
Freon 12 (CCl_2F)	4.26	1.060	R	R	R	R	R	R	R	R	R
Helium (HE)	0.14	0.374	R	R	R	R	R	R	R	R	R
Hydrogen (H_2)	0.07	0.265	R	R	R	R	R	R	R	R	R
Natural Gas	0.60	0.775	C	C	R	C	R	N	C	R	R
Nitrogen (N_2)	0.97	0.985	C	C	R	R	R	R	R	R	R
Oxygen (O_2)	1.10	1,049	R	R	R	R	R	R	R	R	R
Propane (C_3H_8)	1.57	1.253	R	R	R	R	R	R	N	R	R

R = Recommended
N = Not Recommended
C = Consult Factory

Table 7: Fluid selection chart (gases)

Flow vs Pressure Drop

Petroleum Fluids

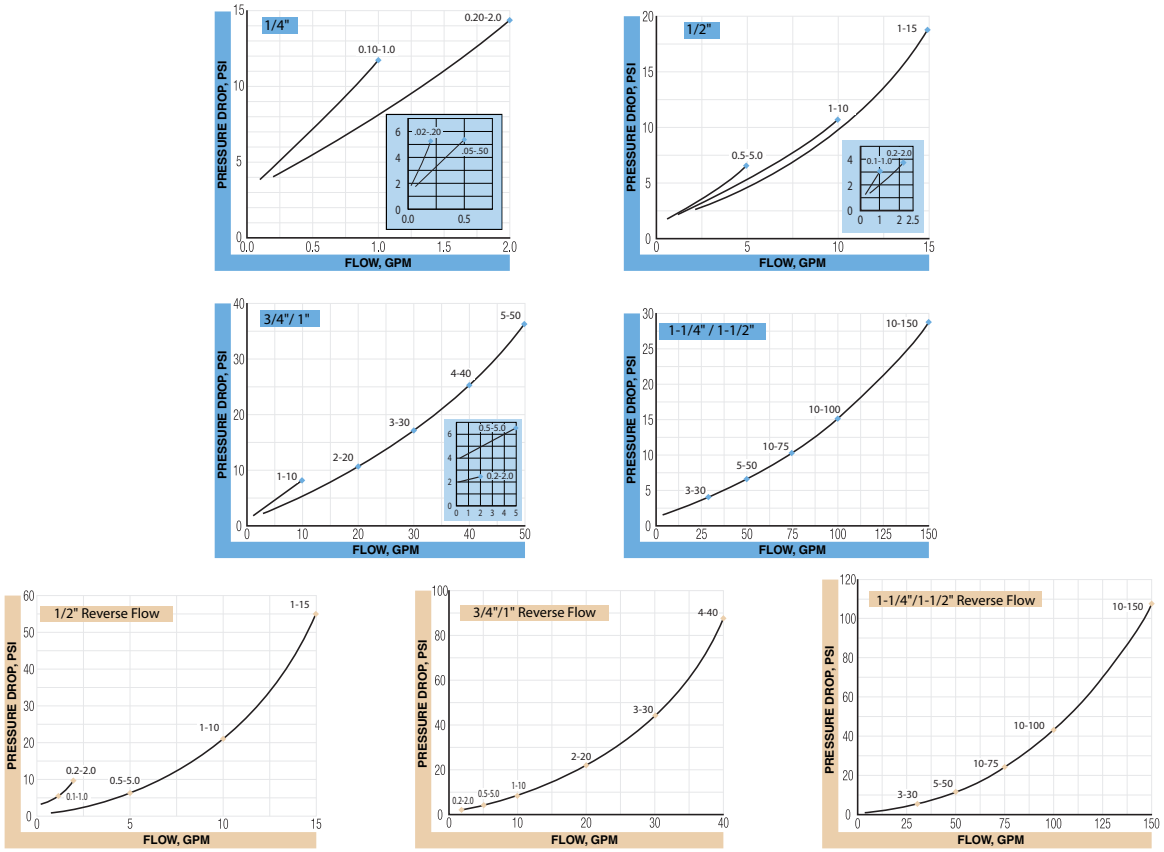


Figure 14: Petroleum fluids flow vs pressure drop

Phosphate Esters

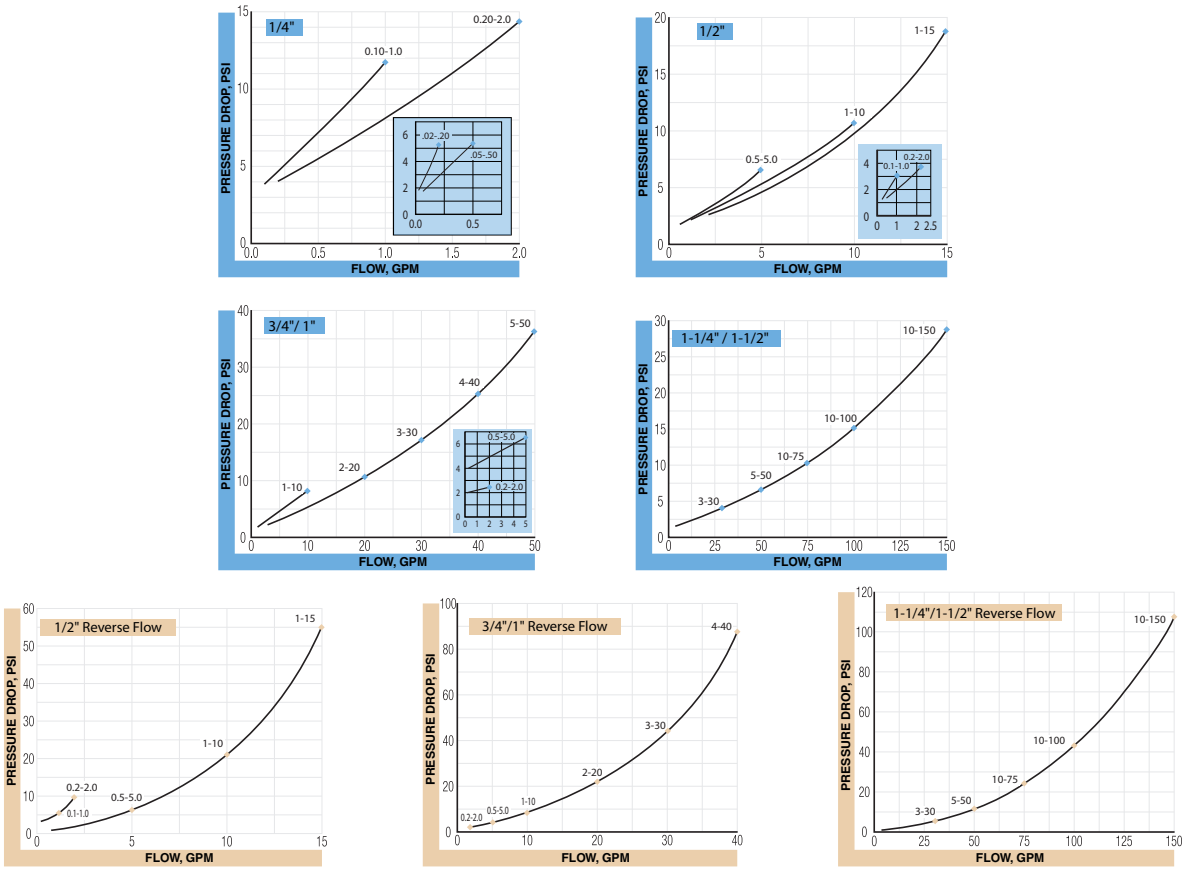


Figure 15: Phosphate esters flow vs pressure drop

A.P.I. Oil

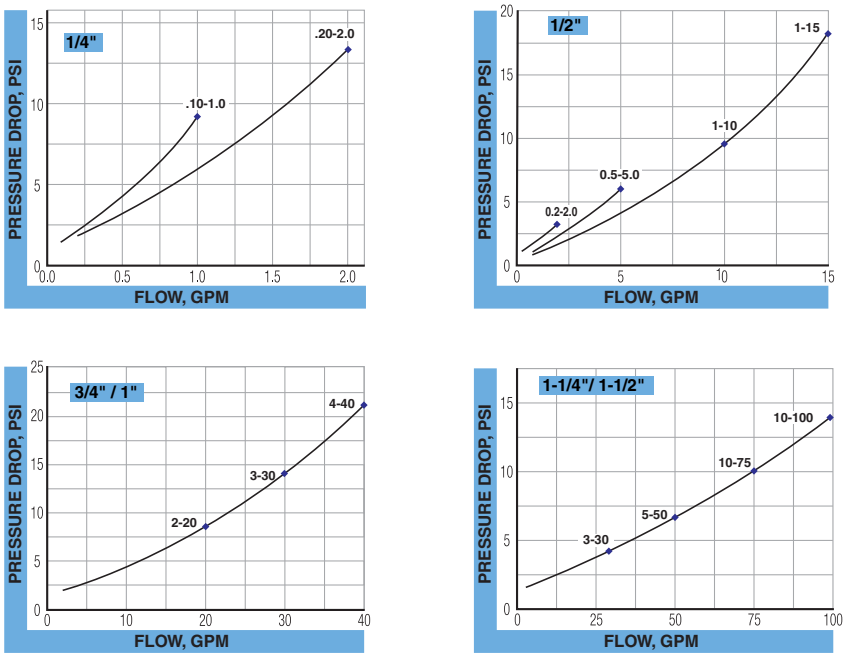


Figure 16: A.P.I. oil flow vs pressure drop

Water-Based Fluids

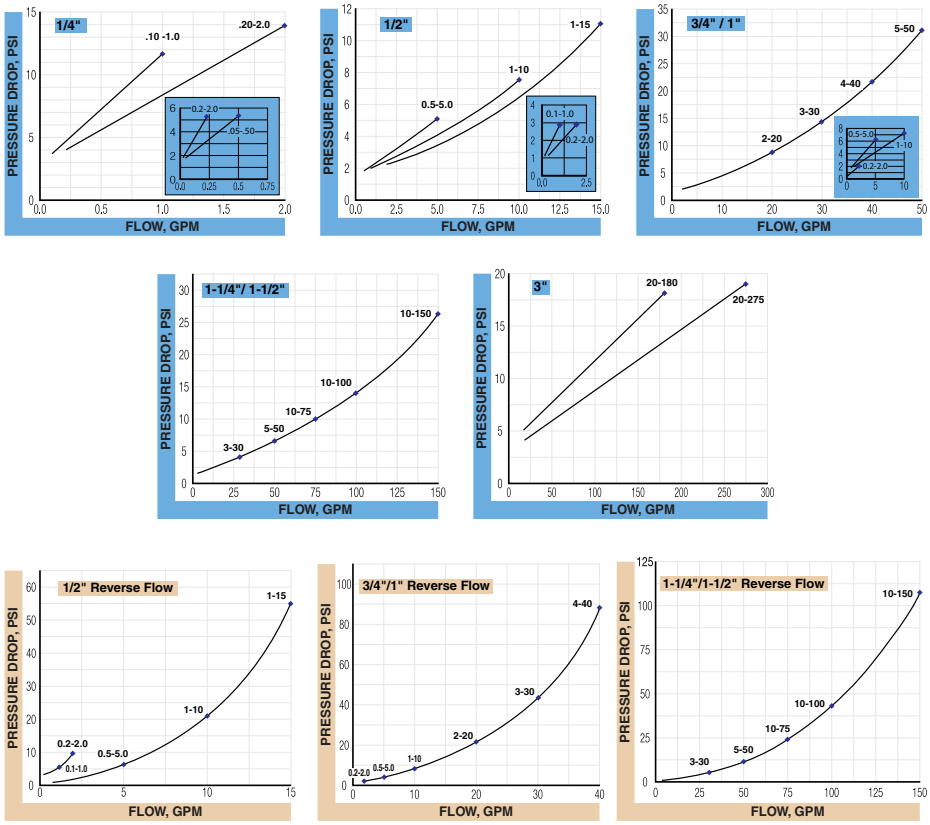


Figure 17: Water-based fluids flow vs pressure drop

Water

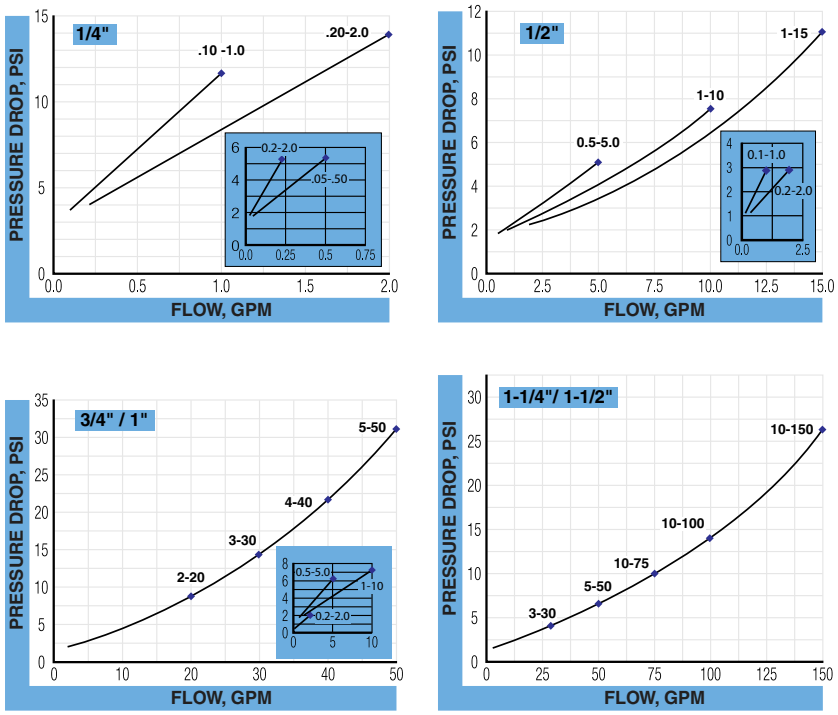


Figure 18: Water flow vs pressure drop

Caustic and Corrosive Liquids

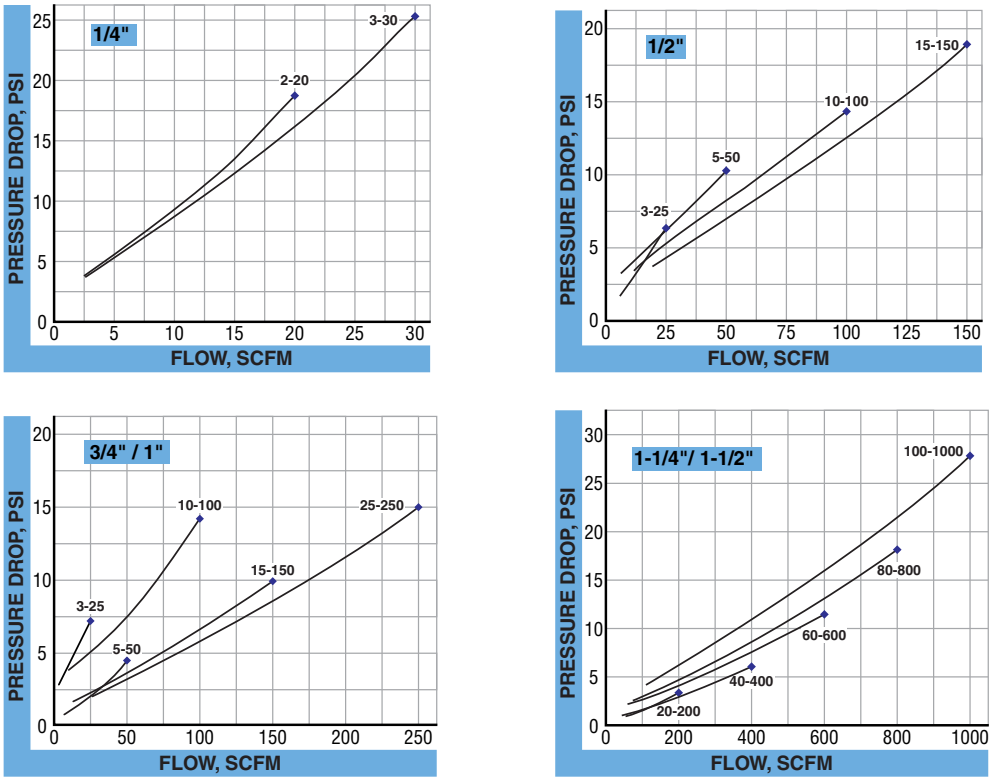


Figure 19: Caustic and corrosive liquids flow vs pressure drop

Air/Compressed Gases

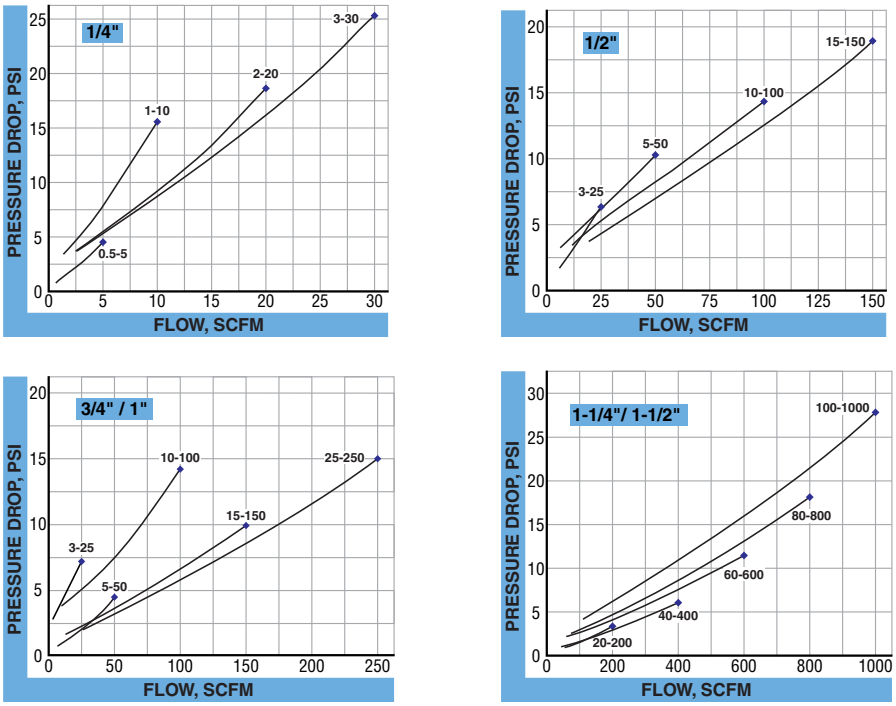


Figure 20: Air and compressed gasses flow vs pressure drop

Air/Caustic and Corrosive Gases

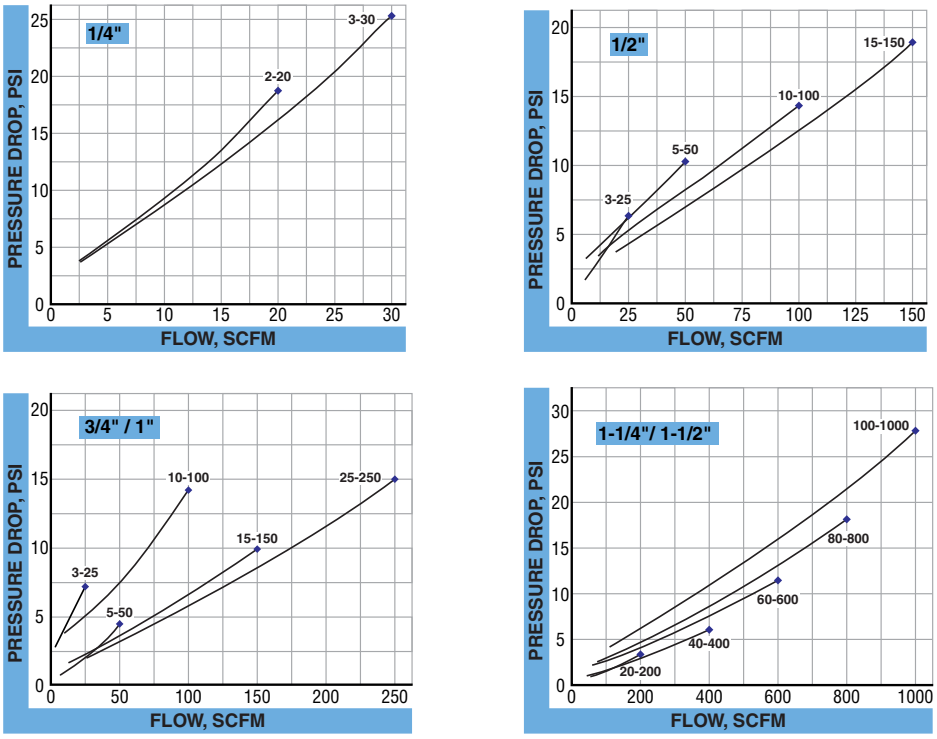


Figure 21: Air/caustic and corrosive gasses flow vs pressure drop

SPECIFICATIONS

Enclosure Rating	NEMA 12 & 13 (equivalent to IP52 & 54)	
Temperature Range	–20…240° F (–20…116° C)	
Pressure Rating Aluminum/ Brass	Liquids (1/4…1-1/2")	3500 psi (241 bar) maximum with a 3:1 safety factor
	Gases (1/4…1-1/2")	1000 psi (69 bar) maximum with a 10:1 safety factor
Pressure Rating Stainless Steel	Liquids (1/4…1/2")	6000 psi (414 bar) maximum with a 3:1 safety factor
	Liquids (3/4…1-1/2")	5000 psi (345 bar) maximum with a 3:1 safety factor
	Gases (1/4…1-1/2"): 1500 psi (103 bar) maximum with a 10:1 safety factor	
Accuracy	±2% of full scale	
Repeatability	±1%	
Pressure Drop	See *"Flow vs Pressure Drop" on page 17* for specific meter information	

Micro Switch

Single or double switch, pre-wired single-pole, double-throw (SPDT), UL recognized and CSA certified switch	
Type	SPDT
Contact Rating	V AC: 250V, 10 Amp
	V DC: 125V, 0.5 Amp
Cable Single Switch	34 in. (864 mm), 4-wire, #18 AWG, SO jacket
Cable Dual Switch	18 in. (457 mm), 7-wire, #16 AWG, SO jacket

Reed Switch

Single or double reed switch, pre-wired single-pole, single-throw normally open (SPST-NO); or single-pole, single-throw normally closed (SPST-NC); UL recognized and CSA certified switch	
Type	SPST
Contact Rating	Maximum see *Figure 1 on page 5* Normally open, 10 Watts Normally closed, 5 Watts
Voltage (maximum at switching)	Normally open, 50V DC Normally closed, 50V DC
Current (maximum amps at switching, resistive load)	Normally open, 0.5 Amp Normally closed, 0.5 Amps
Initial contact resistance	0.100 Ohms
Cable	15 ft (4.6 m), 4-wire, #22 AWG, PVC jacket

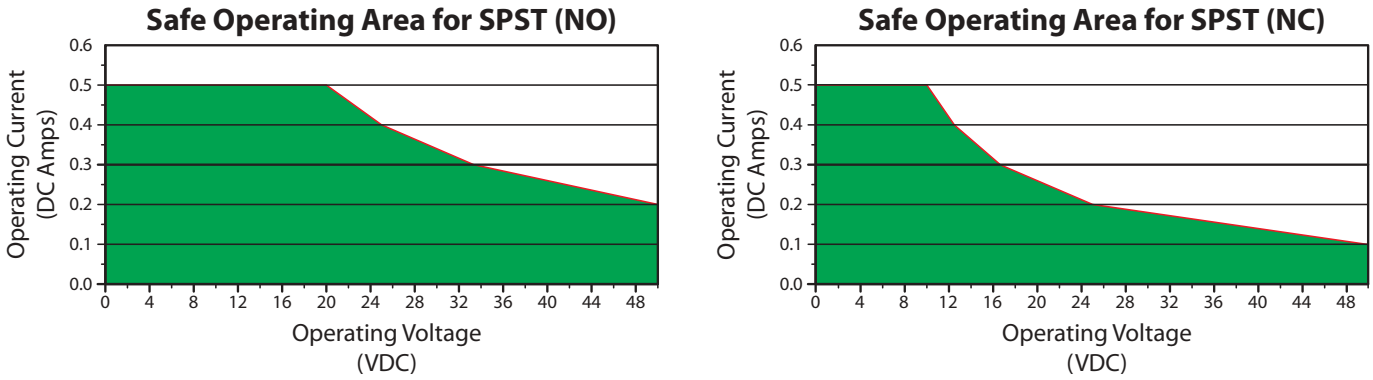


Figure 22: Reed switch power dissipation

DIMENSIONS

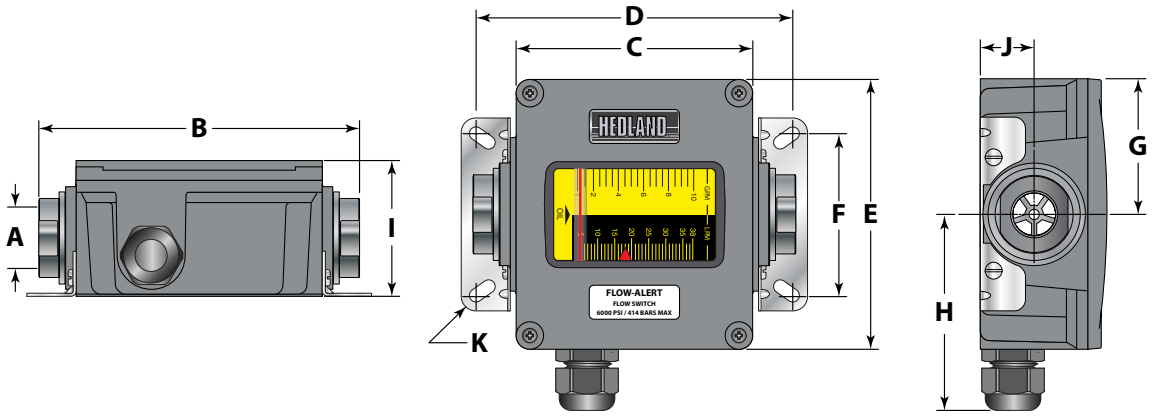


Figure 23: Dimensional information

Dimensions in. (mm)										
A Nominal Port Size	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
1/4 (SAE 6)	6.60 (168)	5.27 (134)	6.41 (163)	6.00 (152)	3.23 (82)	3.00 (76)	4.20 (107)	2.94 (75)	1.51 (38)	0.31 (8)
1/2 (SAE 10)	6.60 (168)	5.27 (134)	6.41 (163)	6.00 (152)	3.23 (82)	3.00 (76)	4.20 (107)	2.94 (75)	1.51 (38)	0.31 (8)
3/4 (SAE 12)	7.20 (183)	5.27 (134)	7.04 (179)	6.00 (152)	3.60 (91)	3.00 (76)	4.20 (107)	2.94 (75)	1.27 (32)	0.31 (8)
1 (SAE 16)	7.20 (183)	5.27 (134)	7.04 (179)	6.00 (152)	3.60 (91)	3.00 (76)	4.20 (107)	2.94 (75)	1.27 (32)	0.31 (8)
1-1/4 (SAE 20)	12.20 (310)	10.68 (271)	11.65 (296)	7.63 (194)	4.84 (123)	3.82 (97)	5.02 (128)	4.50 (114)	2.20 (56)	0.31 (80)
1-1/2 (SAE 24)	12. 20 (310)	10.68 (271)	11.65 (296)	7.63 (194)	4.84 (123)	3.82 (97)	5.02 (128)	4.50 (114)	2.20 (56)	0.31 (8)

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