

Rev.	By	Rev. Description	Rev. Date							Num.	NOTE	
				Customer: INTI Power Inc. Customer PO: 20090811-002 End User: -- Project: EDC Tacoa Skid Tag: TBD Liquid Fuel Fowarding Pump Skid IFS Job Number: 24876 IFS Document Number: IL-24876-01								
B	CM	Issued For Approval	3-Sep-2009									
A	CM	Issued For Approval (internal)	14-Aug-2009									
INSTRUMENT LIST												
Seq.	Tag Number	Device Type	Description of Service	Range		Set Point	Engineering Units	P&ID Reference	Hook-Up Detail Reference	Manufacturer	Model Number	Comments
				Minimum (4mA / LRV)	Maximum (20mA / URV)	High High High Low Low Low						
1	PI-301 A/B/C	Pressure Indicator	Demin Pump Suction Pressure	30"	15	High High= N/A High= N/A Low= N/A Low Low= N/A	Hg/psig	P-24876-01	PRESSURE GAUGE- TYPE 1	Wika	9834737	Pressure Gauge - 1/2" NPT Process Connection, Acrylic Window, Black Fiberglass reinforced Thermoplastic Case. 316 SS Internals, 30" Hg - 0 -15 psig scale.
2	PI-300 A/B/C	Pressure Indicator	Demin Pump Discharge Pressure	0	160	High High= N/A High= N/A Low= N/A Low Low= N/A	psig	P-24876-01	PRESSURE GAUGE - TYPE 1	Wika	9834842	Pressure Gauge - 1/2" NPT Process Connection, Acrylic Window, Black Fiberglass reinforced Thermoplastic Case. 316 SS Internals, 0-160 psig scale.
3	PCV-300	Recirculation Pressure Regulator	Demin Pump Low Flow Protection	20	200	High High= 65 High= N/A Low= N/A Low Low= N/A	psig	P-24876-01	N/A	Cla-Val	550-01KO	Pressure Relief - Low Flow Protection, Pressure sustaining, 1-1/2" 150# RF Process Connections, 316 SS Construction, 0-125 gpm relief rate, 20 - 200 psig pilot set @ 65 psig
4	PSL-300 A/B/C	Pressure Switch	Demin Pump Discharge Pressure Low Switch	0	100	High High= N/A High= N/A Low= N/A Low Low= 55 Falling	psig	P-24876-01	PRESSURE SWITCH TYPE 1	Ashcroft	B4 24 XFS 07 (1/2" FNPT) 100 PSI	Pressure Switch - 1/2" NPT Process Connection, SPDT Switch, Epoxy Coated NEMA 4X Enclosure, Range 0 - 100 psig set @ 55 psig falling

Bourdon Tube Pressure Gauges

Solid-Front Process Gauge - SS Wetted Parts

Type 232.34 - Dry Case

Type 233.34 - Liquid-filled Case

WIKAI Datasheet 23X.34

Applications

- For applications with high dynamic pressure pulsations or vibration a liquid filled case and socket restrictor are available
- Suitable for corrosive environments and gaseous or liquid media that will not obstruct the pressure system
- Process industry: chemical/petrochemical, power stations, mining, on and offshore, environmental technology, mechanical engineering and plant construction

Special features

- Excellent load-cycle stability and shock resistance
- Solid front thermoplastic case
- Positive pressure ranges to 30,000 psi
- All lower mount connection gauges are factory prepared for liquid filling

(LBM: must install membrane prior to field filling)

Standard Features

Design

ASME B40.100

Sizes

4½" & 6" (115 & 160 mm) dial size

Accuracy class

± 0.5% of span (ASME B40.100 Grade 2A)

± 1.0% of span (ASME B40.100 Grade 1A)
(for 20,000 psi range and above)

Ranges

Vacuum / Compound to 200 psi

Pressure from 15 psi to 30,000 psi

or other equivalent units of pressure or vacuum

Working pressure

Steady: full scale value

Fluctuating: 0.9 x full scale value

Short time: 1.5 x full scale value

Operating temperature

Ambient: -40°F to +150°F (-40°C to +66°C) - dry

-4°F to +150°F (-20°C to +66°C) - glycerine filled

-40°F to +150°F (-40°C to +66°C) - silicone filled

Medium: max. +212°F (+100°C) (See Note 1 on reverse)

Temperature error

Additional error when temperature changes from reference temperature of 68°F (20°C) ±0.4% for every 18°F (10°C) rising or falling. Percentage of span.



Bourdon Tube Pressure Gauge Model 232.34

Weather protection

Weather resistant (NEMA 3 / IP54) - without membrane

Weather tight (NEMA 4X / IP65) - dry case or filled case with membrane installed

Pressure connection

Material: 316L stainless steel

Lower mount (LM) or lower back mount (LBM)
1/4" or 1/2" NPT with M4 internal tap

Restrictor

Material: Stainless steel (0.6 mm)

Bourdon tube

Material: 316L stainless steel

≤ 1,000 PSI: C-type

≥ 1,500 PSI: helical type

Movement

Stainless steel. Internal stop pin at 1.3 x full scale

Overload and underload stops - standard

Dampened movement - optional

Dial

White aluminum with black lettering, stop pin at 6 o'clock

Pointer

Black aluminum, adjustable

Case

Black fiberglass-reinforced thermoplastic (POCAN)

Solid front, blowout back

Turret-style case with built in rear flange lugs

Window

Clear acrylic with Buna-N gasket

Case filling

Glycerine 99.7% - Type 233.34

Cycle testing

400,000 - 2,000,000* cycles, depending upon pressure range

* Liquid filled

Note 1: The maximum continuous media temperature for this gauge is 212°F. However, higher temperatures can be maintained safely for short term exposure per table to the right. The user should consider temperature error and gauge component degradation when exposing gauge to any media or ambient temperature above 212°F. For continuous use in either ambient or media temperatures above 212°F, a diaphragm seal or other heat dissipating means is recommended. Consult factory for technical inquiries and application assistance.

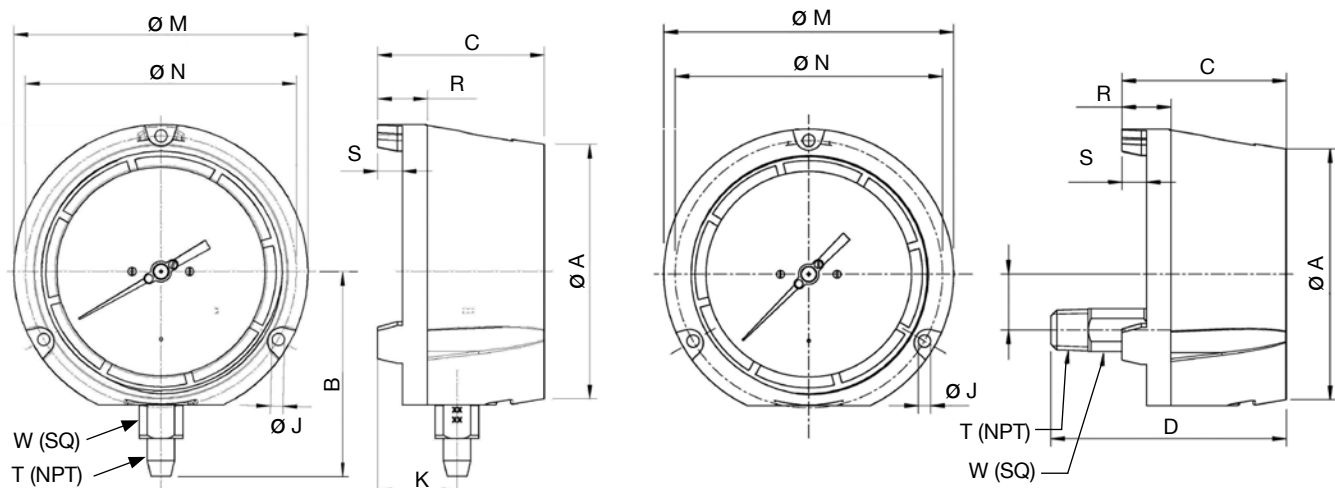
Optional extras

- Silicone dampened movement
- Panel mounting adaptor kit (field assembled)
- Silicone case filling
- Halocarbon case filling
- Cleaned for oxygen service
- Instrument glass or safety glass window
- Drag pointer (maximum reading indicator)
- Alarm contacts switches (magnetic or inductive)
- Special process connections
- Custom dial layout
- External zero adjustment

Short term, intermittent maximum media temperature limits
(Optional glass window required for all these temperatures)

500°F (260 °C) -	Dry Gauge
250°F (130°C) -	Liquid filled gauge
300°F (150°C) -	Dampened movement gauge

Dimensions



Size		A	B	C	D	J	K	L	M	N	R	S	T	W	Weight ¹	
4.5"	mm	128	103	84	120.3	6.3	40	28.5	148	136.5	25	12.5		22	2 lb.	dry
	in	5	4.06	3.31	4.74	0.248	1.57	1.12	5.83	5.37	0.99	0.49	1/2"	0.87	3 lb.	filled
6"	mm	164	122.5	88	123.4	7.1	40.2	28.5	190	177.8	25.4	12.7		22	3 lb.	dry
	in	6.46	4.82	3.46	4.86	0.28	1.58	1.12	7.5	7	1	0.5	1/2"	0.87	4 lb.	filled

¹ Weight without optional accessories

Ordering information

Pressure gauge model / Nominal size / Scale range / Size of connection / Optional extras required
Specifications and dimensions given in this leaflet represent the state of engineering at the time of printing.
Modifications may take place and materials specified may be replaced by others without prior notice.



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B-Series Switches – Pressure, Differential Pressure, Temperature & Hydraulic



FEATURES

B-Series switches have proven reliable in such harsh environments as:

- Offshore oil rigs
- Chemical and petrochemical plants
- Pulp and paper mills
- Steel mills
- Power plants
- Water and sewage-treatment plants
- Other corrosive environments

Ashcroft Inc. supplies highly reliable Ashcroft® switches and controls for industrial and process applications. We begin with rock-solid designs, matching the most appropriate technology with the safety and reliability requirements of the applications. The materials of construction are specified to Ashcroft's exacting standards, and product is built to last in the toughest applications. Our modern, responsive manufacturing facility is supported by an extensive network of stocking distributors and factory sales offices located in virtually every part of the world. Special application assistance is always just a telephone call away.

The Ashcroft B-Series switch line is designed to satisfy most switch requirements. Materials of construction have been selected for long life. A wide variety of precision switch elements are available to meet every application requirement, including hermetically sealed contacts for added reliability and safety. The actuators we use have been proven in more than 20 years of service in the world's plants and mills. Special designs are available for fire safety, NACE, limit control and other more stringent requirements. Simplicity and ease of use are stressed to improve reliability of the installation.

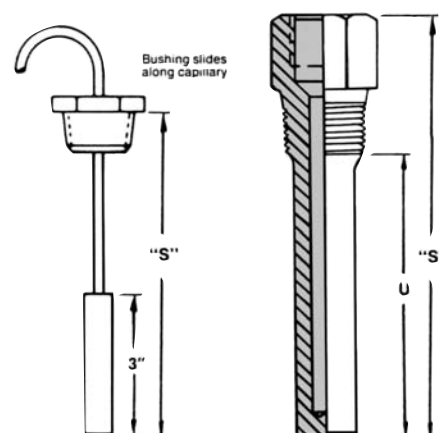
Applications include: pumps, compressors, washers, filters, degreasers, evaporators, recovery systems, food processing, ground support equipment, reverse osmosis systems, heat exchangers, hydraulic systems, lubrication systems, marine equipment, textile machinery, heating and air conditioning equipment.

Thermowells

Thermowells must be used on any application where the stem of the temperature switch may be exposed to pressure, corrosive fluids or high velocity. Additionally, the use of a thermowell permits instrument interchange or calibration check without disturbing or closing down the process.

Ashcroft temperature switches have bulb diameters to match $\frac{3}{8}$ " nominal bore thermowells. The bulbs have a sensitive portion length of 2" which can be used with $2\frac{1}{2}$ " "U" dimensioned thermowells or longer. For maximum accuracy, a thermowell's "U" dimension should be selected to permit complete immersion of the sensitive portion plus 1" when measuring the temperature of liquids; an extra 3" should be allowed when measuring the temperature of gases.

Thermowell bushings should be used with remote mount temperature switches. We recommend the standard 3" bulb and code 69 Series bushings for use with any thermowell "U" dimension. A split rubber grommet allows easy installation and "S" dimension adjustment.



B-Series Switches – Pressure, Differential Pressure, Temperature & Hydraulic

Temperature Switches

B-Series temperature switches feature a SAMA Class II vapor pressure thermal system. This system provides quick, accurate response to process temperature changes with negligible ambient temperature effects. This is inherent in the design due to the precise relation-

ship that exists between temperature and pressure according to the vapor pressure laws. A wide selection of sensing bulb and armored capillary lengths is available. The vapor pressure system design features small bulb sizes, making installation easy and cost-effective.

All models feature $\pm 1.0\%$ percent of

span setpoint repeatability with very high overtemperature ratings.

These standard designs perform well in applications where shock and vibration could be a problem and should be used with Ashcroft thermowells for bulb protection and ease of installation and maintenance.

STANDARD TEMPERATURE RANGE SELECTION

Nominal Range ⁽¹⁾		Maximum Temperature	Approximate Deadband ⁽¹⁾ Switch Element				
°F	°C	°F	20, 26, 27	21, 24, 31	50	22	32, 42
-40 to 60	-40 to 16	400	1.0-2.0	3.0-8.0	1.5-5.5	1.4-6.0	8.0-16.0
0 to 100	-20 to 40	400	1.5-3.0	5.0-12.0	2.2-8.5	1.5-7.5	9.0-20.0
75 to 205	20 to 95	400	1.5-3.5	8.0-16.0	2.5-12.0	2.0-9.0	10.0-24.0
150 to 260	65 to 125	400	1.5-3.0	5.0-12.0	2.2-8.5	2.0-9.0	10.0-24.0
235 to 375	110 to 190	500	1.5-3.5	5.0-12.0	2.5-8.5	2.0-9.0	10.0-24.0
350 to 525 ⁽³⁾	175 to 275	700	2.0-4.5	8.0-16.0	3.2-12.0	2.5-10.0	15.0-34.0
500 to 750 ⁽²⁾	260 to 400	900	4.0-8.0	16.0-30.0	7.2-24.0	5.0-23.0	30.0-50.0

NOTES:

- 1 All deadbands given in °F.
- 2 Available with remote mount thermal systems only.
- 3 Not available with 2 $\frac{3}{4}$ " stem.
- 4 Dual switch element multiply single switch element value by 1.6 for approximate deadband.
- 5 Set and reset points must fall within the adjustable range.

B-Series Switches – Pressure, Differential Pressure, Temperature & Hydraulic

Pressure & Differential Pressure Switches

B-Series pressure, differential pressure and vacuum switches use two different actuators depending on setpoint requirements. For setpoints between 2 and 3000 psi, the simple, rugged diaphragm-sealed piston actuator is used. This design features high reliability and choice of actuator seal materials for virtually every application. An optional welded design is also available for setpoints up to 1000 psi for

of construction.

All standard models feature ± 1 percent of range setpoint repeatability and a minimum of 400 percent of range proof pressures.

These standard designs perform well in applications where shock and vibration could be a problem and may be used in conjunction with Ashcroft diaphragm seals in extreme services such as slurries or abrasive process fluids.

maximum reliability. This design is available in 316 SS or Monel. Differential pressure models use a unique, dual diaphragm-sealed piston design that features very high static operating pressures and small size.

For setpoints between 4.5 and 150 inches of H₂O, a large diaphragm is used for increased sensitivity in both pressure and differential pressure designs with good choice of materials

PRESSURE/VACUUM SWITCHES

Nominal Range ⁽¹⁾			Overpressure Ratings		Approximate Deadband ⁽²⁾ Switch Element				
			Proof psi	Burst psi	20, 26, 27	21, 24, 31	50	22	32, 42
Vacuum									
-30" Hg	-760mm Hg	-100 kPa	250	400	0.3-0.7	1.5-3.0	0.5-2.2	0.4-1.5	2.1-4.2
Compound									
-15" H ₂ O/ 15" H ₂ O	-375mm H ₂ O/ 375mm H ₂ O	-3.7 kPa/ 3.7 kPa	20	35	0.15-.75/ 0.15-.75	1.5-2.5/ 1.5-2.5	0.45-2.0/ 0.45-2.0	0.5-1.2/ 0.5-1.2	2.1-3.5/ 2.1-3.5
-30" H ₂ O/ 30" H ₂ O	-760mm H ₂ O/ 760mm H ₂ O	-7.5 kPa/ 7.5 kPa	20	35	0.30-.60/ 0.30-.60	1.5-2.5/ 1.5-2.5	0.45-2.0/ 0.45-2.0	0.5-1.5/ 0.5-1.5	2.1-3.5/ 2.1-3.5
-30" Hg/ 15 psi	-760mm Hg/ 1.0 kg/cm ²	-100 kPa/ 100 kPa	250	400	0.5-1.0/ 0.3-0.7	2.0-3.0/ 0.5-1.5	0.75-2.5/ 0.5-1.0	0.7-1.8/ 0.7-1.4	2.8-4.2/ 0.7-2.1
-30" Hg/ 30 psi	-760mm Hg/ 2.0 kg/cm ²	-100 kPa/ 200 kPa	250	400	1.0-1.5/ 0.3-0.8	3.0-6.0/ 1.0-2.0	1.2-4.5/ 0.7-1.5	1.4-2.4/ 0.4-1.3	4.2-8.4/ 1.4-2.8
-30" Hg/ 60 psi	-760mm Hg/ 4.0 kg/cm ²	-100 kPa/ 400 kPa	250	400	2.0-3.0/ 0.7-1.5	5.0-9.0/ 3.0-5.0	2.5-7.0/ 1.1-4.0	2.8-4.5/ 1.0-2.3	7.0-12.0/ 4.2-7.0
Pressure									
10" H ₂ O	250mm H ₂ O	2.5 kPa	20	35	0.2-0.5	1.0-2.0	0.35-1.5	0.4-1.0	1.4-2.8
30" H ₂ O	750mm H ₂ O	7.5 kPa	20	35	0.3-0.6	1.5-2.5	0.45-2.0	0.5-2.0	2.1-3.5
60" H ₂ O	1500mm H ₂ O	15 kPa	20	35	0.5-1.3	1.5-3.5	0.9-2.5	0.7-3.0	2.1-5.0
100" H ₂ O	2500mm H ₂ O	25 kPa	20	35	0.6-1.6	2.5-5.5	1.1-4.0	1.0-4.0	3.5-7.7
150" H ₂ O	3750mm H ₂ O	37 kPa	20	35	1.0-2.5	4.5-8.5	1.7-6.5	2.0-6.0	6.0-12.0
15 psi	1.0 kg/cm ²	100 kPa	500	1500	0.1-0.35	0.5-1.5	0.2-1.0	0.4-1.0	0.7-2.1
30 psi	2.0 kg/cm ²	200 kPa	500	1500	0.1-0.50	0.5-1.5	0.3-1.0	0.4-1.0	0.7-2.1
60 psi	4.0 kg/cm ²	400 kPa	500	1500	0.3-1.0	1.0-3.5	0.7-2.5	0.6-2.0	1.4-5.0
100 psi	7.0 kg/cm ²	700 kPa	1000	3000	0.5-1.7	1.5-5.0	1.1-3.5	1.0-4.5	2.1-7.0
200 psi	14 kg/cm ²	1400 kPa	1000	3000	1-3	5-13	2-9	3.0-7.5	7.0-18.2
400 psi	28 kg/cm ²	2800 kPa	2400	3000	4-7.5	5-24	5.5-15	4.0-11.0	7.0-33.6
600 psi	42 kg/cm ²	4200 kPa	2400	3000	4-11	9-30	7-20	5.0-23.0	12.6-42
1000 psi	70 kg/cm ²	7000 kPa	12000	18000	7-30	30-110	18-70	15-80	42-154
3000 psi	210 kg/cm ²	2100 kPa	12000	18000	15-60	80-235	37-160	30.0-230	112-329

DIFFERENTIAL PRESSURE SWITCHES

Nominal Range ⁽¹⁾			Pressure Ratings		Approximate Deadband ⁽²⁾ Switch Element				
			Static Working Pressure	Proof psi	20, 26, 27	21, 24, 31	50	22	32, 42
30" H ₂ O	750mm H ₂ O	7.5 kPa	5.4	21.6	0.3-0.6	1.5-2.5	0.45-2.0	0.5-2.0	2.1-3.5
60" H ₂ O	1500mm H ₂ O	15 kPa	5.4	21.6	0.5-1.3	1.5-3.5	0.9-2.5	0.7-3.0	2.1-5.0
100" H ₂ O	2500mm H ₂ O	25 kPa	5.4	21.6	0.6-1.6	2.5-5.5	1.1-4.0	1.0-4.0	3.5-7.7
150" H ₂ O	3750mm H ₂ O	37 kPa	5.4	21.6	1.0-2.5	4.5-8.5	1.8-6.5	2.0-6.0	6.3-12.0
15 psid	1.0 kg/cm ²	100 kPa	500	2000	0.5-1.0	2.0-5.0	0.7-3.5	0.7-1.4	2.8-7.0
30 psid	2.0 kg/cm ²	200 kPa	500	2000	1.0-2.0	2.0-5.0	1.5-3.5	1.4-2.8	2.8-7.0
60 psid	4.0 kg/cm ²	400 kPa	500	2000	2.0-4.0	3.0-6.0	3.0-4.5	2.8-5.6	4.2-8.5
100 psid	7.0 kg/cm ²	700 kPa	1000	4000	4.0-10.0	11.0-20.0	7.0-15.0	6.0-14.0	16.0-28.0
200 psid	14.0 kg/cm ²	1400 kPa	1000	4000	5.0-15.0	12.0-40.0	10.0-26.0	7.0-21.0	17.0-56.0
400 psid	28.0 kg/cm ²	2800 kPa	1000	8000	10.0-20.0	20.0-60.0	15.0-40.0	14.0-28.0	28.0-84.0
600 psid	42.0 kg/cm ²	4200 kPa	1000	8000	20.0-40.0	80.0-150.0	30.0-115.0	30.0-56.0	112.0-210.0

Values shown are for zero static working pressure.

NOTES:

- Switches may generally be set between 15% and 100% of nominal range on increasing pressure. Consult factory for applications where setpoints must be lower.
- All deadbands are given in English units as shown in the nominal range column. Deadbands shown are for switches with Buna N diaphragm. Approximate deadbands for optional diaphragms:

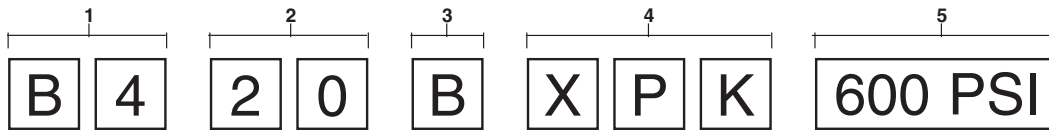
Viton:
Teflon:
Stainless Steel:
Monel:
Dual Switch Element:

Multiply Buna N value by 1.4
Multiply Buna N value by 1.2
Multiply Buna N value by 1.7
Multiply Buna N value by 1.7
Multiply single switch element value by 1.6 for approximate deadband.

B-Series Switches – Pressure, Differential Pressure, Temperature & Hydraulic

B-SERIES PRESSURE AND DIFFERENTIAL PRESSURE SWITCH MODEL NUMBER:

To specify the exact switch desired, select entries from appropriate tables as shown in example below.



1 – ENCLOSURE	
B4	Pressure switch, Type 400, watertight enclosure meets NEMA 3, 4, 4X, 13 and IP66 requirements.
B7	Pressure switch, Type 700, explosion-proof enclosure meets Div. 1 & 2, NEMA 7, 9 and IP66 requirements.
D4	Differential pressure switch, Type 400, watertight enclosure meets NEMA 3, 4, 4X, 13 and IP66 requirements.
D7	Differential pressure switch, Type 700, explosion-proof enclosure meets Div. 1 & 2, NEMA 7, 9 and IP66 requirements.

3 – ACTUATOR SEAL					
Code and Material	Process Temperature Limits °F ⁽⁹⁾	Range			
		Vac. "H ₂ O	0-600 psi	1000 psi	3000 psi
B – Buna-N	0 to 150	•	•	•	•
V – Viton	20 to 300	•	•	•	
T – Teflon	0 to 150	•	•	•	•
S – 316L ⁽⁸⁾	0 to 300		•	•	
P – Monel ⁽⁸⁾	0 to 300		•	•	

4 – OPTIONS	5 – RANGE
Use table from page 6	Select from table on page 4

NOTES:

- 1 Standard switch.
- 2 Not available with psid ranges.
- 3 Dual switches are 2 SPDT snap-action switches, not independently adjustable.
- 4 Wires cannot be terminated inside B400 switch enclosure.
- 5 Not available with type 700 enclosure.
- 6 Estimated dc. rating, 2.5A, 28 Vdc (not UL listed).
- 7 Estimated dc rating, 0.4A, 120 Vdc (not UL listed).
- 8 Available on pressure only.
- 9 Ambient operating temperature limits –20 to 150°F, all styles, setpoint shift of ±1% of range per 50°F temperature change is normal. Switches are calibrated at 70°F reference.

2 – SWITCH ELEMENT SELECTION		
Order Code	Switch Elements UL/CSA Listed SPDT	
20⁽⁷⁾	Narrow deadband ac	15A, 125/250 Vac
21	Ammonia service	5A, 125/250 Vac
22⁽⁶⁾	Hermetically sealed switch, narrow deadband	5A, 125/250 Vac
23	Heavy duty ac	22A, 125/250 Vac
24⁽¹⁾	General purpose	15A, 125/250/480 Vac ½A, 125 Vdc ¼A, 250 Vdc; 6A, 30 Vdc
25⁽²⁾	Heavy duty dc	10A, 125 Vac or dc, ⅛ HP, 125 Vac or dc
26⁽⁷⁾	Sealed environment proof	15A, 125/250 Vac
27	High temperature 300°F	15A, 125/250 Vac
28⁽⁵⁾	Manual reset trip on increasing	15A, 125/250 Vac
29⁽⁵⁾	Manual reset trip on decreasing	15A, 125/250 Vac
31	Low level (gold) contacts	1A, 125 Vac
32	Hermetically sealed switch, general purpose	11A, 125/250 Vac 5A, 30 Vdc
42	Hermetically sealed switch, gold contacts	1A, 125 Vac
50	Variable deadband	15A, 125/250 Vac
UL/CSA Listed Dual (2 SPDT)		
61⁽⁷⁾	Dual narrow deadband	15A, 125/250 Vac
62⁽⁷⁾	Dual sealed environment proof	15A, 125/250 Vac
63	Dual high temp. 300°F	15A, 125/250 Vac
64	Dual general purpose	15A, 125/250/480 Vac ½A, 125 Vdc ¼A, 250 Vdc
65	Dual ammonia service	5A, 125/250 Vac
67^(4,6)	Dual hermetically sealed switch, narrow deadband	5A, 125/250 Vac
68⁽⁴⁾	Dual hermetically sealed switch, general purpose	11A, 125/250 Vac 5A, 30 Vdc
70	Dual low level gold contacts	1A, 125 Vac
71⁽⁴⁾	Dual hermetically sealed switch, gold contacts	1A, 125 Vac

B-Series Switches – Pressure, Differential Pressure, Temperature & Hydraulic

B-SERIES TEMPERATURE SWITCH MODEL NUMBER:

To specify the exact switch desired, select entries from appropriate tables as shown in example below.

1	2	3	4	5	6
T	4	2	0	T	0
				5	030
				X	N
				H	150° to 260°F

1 – ENCLOSURE	
T4	Temperature switch, Type 400, watertight enclosure meets NEMA 3, 4, 4X, 13 and IP66 requirements.
T7	Temperature switch, Type 700, explosion-proof enclosure meets Div. 1 & 2, NEMA 7, 9 and IP66 requirements.

2 – SWITCH ELEMENT SELECTION		
Order Code	Switch Elements UL/CSA Listed SPDT	
20⁽⁷⁾	Narrow deadband ac	15A, 125/250 Vac
21	Ammonia service	5A, 125/250 Vac
22⁽⁶⁾	Hermetically sealed switch, narrow deadband	5A, 125/250 Vac
23	Heavy duty ac	22A, 125/250 Vac
24⁽¹⁾	General purpose	15A, 125/250/480 Vac ½A, 125 Vdc ¼A, 250 Vdc; 6A, 30 Vdc
25	Heavy duty dc	10A, 125 Vac or dc, ½ HP, 125 Vac or dc
26⁽⁷⁾	Sealed environment proof	15A, 125/250 Vac
27	High temperature 300°F	15A, 125/250 Vac
28⁽⁵⁾	Manual reset trip on increasing	15A, 125/250 Vac
29⁽⁵⁾	Manual reset trip on decreasing	15A, 125/250 Vac
31	Low level (gold) contacts	1A, 125 Vac
32	Hermetically sealed switch, general purpose	11A, 125/250 Vac 5A, 30 Vdc
42	Hermetically sealed gold contacts	1A, 125 Vac
50	Variable deadband	15A, 125/250 Vac
UL/CSA Listed Dual (2 SPDT)		
61⁽⁷⁾	Dual narrow deadband	15A, 125/250 Vac
62⁽⁷⁾	Dual sealed environment proof	15A, 125/250 Vac
63	Dual high temp. 300°F	15A, 125/250 Vac
64	Dual general purpose	15A, 125/250/480 Vac ½A, 125 Vdc ¼A, 250 Vdc
65	Dual ammonia service	5A, 125/250 Vac
67^(4,6)	Dual hermetically sealed switch, narrow deadband	5A, 125/250 Vac
68⁽⁴⁾	Dual hermetically sealed switch, general purpose	11A, 125/250 Vac 5A, 30 Vdc
70	Dual low level gold contacts	1A, 125 Vac
71⁽⁴⁾	Dual hermetically sealed switch, gold contacts	1A, 125 Vac

3 – THERMAL SYSTEM SELECTION			
Direct Mount			
Order Code	System Material	Style	
TS	316 SS	Rigid	
Remote Mount			
Order Code	System Material	Line Length	Style ⁽⁹⁾
T05	316 SS	5´	Capillary with 302 SS Spring Armor
T10	316 SS	10´	
T15	316 SS	15´	
T20	316 SS	20´	
T25	316 SS	25´	

4 – BULB LENGTH SELECTION		
Direct Mount		
Order Code	"S" Dimension	Minimum Thermowell "U" Dimension
027⁽⁸⁾	2¾"	—
040	4"	2½"
060	6"	4½"
090	9"	7½"
120	12"	10½"
Remote Mount		
030⁽⁹⁾	3"	2½"

5 – OPTIONS	
Use table on page 7	

6 – STANDARD TEMPERATURE RANGE SELECTION	
Adjustable Range	
°F	°C
–40 to 60	–40 to 16
0 to 100	–40 to 40
75 to 205	20 to 95
150 to 260	65 to 125
235 to 375	110 to 190
350 to 525	175 to 275
500 to 750 ⁽²⁾	260 to 400

NOTES:

- Standard switch.
- Available with remote mount thermal systems only.
- Dual switches are 2 SPDT snap-action switches, not independently adjustable.
- Wires cannot be terminated inside T400 switch enclosure.
- Not available with Type 700 enclosure.
- Estimated dc rating, 2.5A, 28 Vdc (not UL listed).
- Estimated dc rating, 0.4A, 120 Vdc (not UL listed).
- Not available on 350 to 525°F.
- Consult factory on remote mount for bulb lengths other than 3'.

B-Series Switches – Pressure, Differential Pressure, Temperature & Hydraulic

B-SERIES HYDRAULIC PRESSURE SWITCH MODEL NUMBER:

To specify the exact switch desired, select entries from appropriate tables as shown in example below.



1 – ENCLOSURE	
H4	Hydraulic pressure switch, Type 400, watertight enclosure meets NEMA 3, 4, 4X, 13 and IP66 requirements.

2 – SWITCH ELEMENT SELECTION		
Order Code	Switch Elements UL/CSA Listed SPDT	
20⁽³⁾	Narrow deadband ac	15A, 125/250 Vac
21	Ammonia service	5A, 125/250 Vac
22	Hermetically sealed switch, narrow deadband	5A, 125/250 Vac
23	Heavy duty ac	22A, 125/250 Vac
24⁽¹⁾	General purpose	15A, 125/250/480 Vac 1½A, 125 Vdc ¼A, 250 Vdc; 6A, 30 Vdc
25	Heavy duty dc	10A, 125 Vac or dc, 1½ HP, 125 Vac or dc
26⁽³⁾	Sealed environment proof	15A, 125/250 Vac
27	High temperature 300°F	15A, 125/250 Vac
28	Manual reset trip on increasing	15A, 125/250 Vac
29	Manual reset trip on decreasing	15A, 125/250 Vac
32	Hermetically sealed switch, general purpose	11A, 125/250 Vac 5A, 30 Vdc
42	Hermetically sealed switch, gold contacts	1A, 125 Vac
UL/CSA Listed Dual (2 SPDT)		
61⁽³⁾	Dual narrow deadband	15A, 125/250 Vac
62⁽³⁾	Dual sealed environment proof	15A, 125/250 Vac
63	Dual high temp. 300°F	15A, 125/250 Vac
64	Dual general purpose	15A, 125/250/480 Vac 1½A, 125 Vdc ¼A, 250 Vdc
65	Dual ammonia service	5A, 125/250 Vac
70	Dual low level, gold contacts	1A, 125 Vac

3 – ACTUATOR SEAL		
Code and Material	Process Temperature Limits °F ⁽⁴⁾	
V – Viton	20 to 300	Viton O-Ring, Stainless Steel Pressure Connection

4 – OPTIONS
Use table from page 7

5 – STANDARD PRESSURE RANGE		
Range psi	Adjustable Setpoint Limits psi	Proof Pressure psi
1000	150-1000	12,000
2000	300-2000	12,000
3000	450-3000	12,000
5000	750-5000	10,000
7500	1125-7500	100,000

NOTES:

- 1 Standard switch.
- 2 Dual switches are 2 SPDT snap-action switches, not independently adjustable.
- 3 Estimated dc rating, 0.4A, 120 Vdc (not UL listed).
- 4 Ambient operating temperature limits –20 to 150°F, all styles, setpoint shift of ±1% of range per 50°F temperature change is normal. Switches are calibrated at 70° F reference.

B-Series Switches – Pressure, Differential Pressure, Temperature & Hydraulic

OPTIONAL FEATURES AND ACCESSORIES

B-SERIES SWITCH OPTIONS								
		Applicable Switch Series						
		Pressure		Differential Pressure		Temperature	H	
Code	Description	(psi)	(in. H ₂ O)	(psi)	(in. H ₂ O)	All Ranges		Notes
XBP	Wall Mounting Bracket in. H ₂ O		•		•			
XBX	1/2" Male NPT Bushing					•		
XCH	Chained Cover	•	•	•	•	•	•	
XC8	CSA Approval	•	•	•	•	•		11
XCN	ATEX Directive 94/9/EC EEx d IIC T6	•	•	•	•	•		
XFM	FM Approval – Single Element	•	•	•	•			17
	FM Approval – Dual Element	•	•	•	•			17
XFP	Fungus Proofing	•	•	•	•	•	•	
XFS	Factory Adjusted Setpoint	•	•	•	•	•	•	2
XG3	Belleville Actuator	•						16,17
XG5	UL Limit Control to 150" H ₂ O				•			1, 17
XG6	UL Limit Control to 600 psi	•						1, 17
XG7	Secondary Chamber with Vent	•						13
XG8	Steam Limit Control to 300 psi	•						7
XG9	Fire Safe Welded Actuator	•						7
XHS	High Static Differential Pressure			•				15
XHX	High Pressure, 40 psi, (static) d/p only		•		•			
	160 psi (proof) d/p only							
	100 psi (proof) pressure only (" H ₂ O)							
XJK	Left Conduit Connection	•	•	•	•	•	•	9
XJL	3/4" to 1/2" Reducing Bushing	•	•	•	•	•	•	
XJM	Metric Electrical Conduit Connection M20 x 1.5	•	•	•	•	•	•	
XK3	Terminal Block (700 Series only)	•	•	•	•	•		6
XLE	6 foot Leads on the Micro Switch	•	•	•	•	•	•	
XNH	Tagging Stainless Steel	•	•	•	•	•	•	
XNN	Paper Tag	•	•	•	•	•	•	
XPK	Pilot Light(s) Top Mounted	•	•	•	•	•	•	4
XPM	3/4" Sealed Conduit Connection with 16" Lead Wires	•	•	•	•	•	•	
XTA	316 Stainless Steel Pressure Connection for in. H ₂ O Range		•		•			
XTM	2" Pipe Mounting Bracket	•	•	•	•	•		
XUD	316 Stainless Steel Pressure Conn.			•				
X06	Pressure Connection: 1/2 NPT Male, 1/4 NPT Female	•	•	•	•			5
	316 Stainless Steel (Combination)							
X07	1/2 NPTF Press. Conn., 316 SS	•	•	•	•			10
X6B	Cleaned for Oxygen Service	•	•	•				3
	Diaphragm Seal	•	•	•	•			

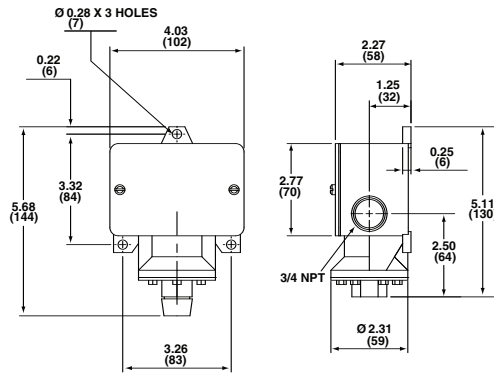
NOTES:

- 1 Buna N and Viton diaphragm.
- 2 Advise static or working pressure for differential pressure switches.
- 3 Buna N cannot be cleaned for oxygen service.
- 4 N/A on 700 Series.
- 5 Standard with 1000 and 3000 psi ranges. Bottom connection only on DP in H₂O ranges.
- 6 Terminal Blocks standard with 700 dual switches.
- 7 Stainless steel diaphragm only.
- 8 Pressure connection 1/4 NPTF.
- 9 Standard on 700 Series. N/A with DPDT element on 400 Series.
- 10 N/A with Monel diaphragm.
- 11 Standard on 400 Series.
- 12 N/A on 3000 psi range. Available with Teflon diaphragm only.
- 13 SS diaphragm required. Teflon diaphragm is the backup. NEMA 7 only.
- 14 Available in ranges vacuum to 600 psi. Not available with stainless steel or Monel diaphragm.
- 15 Buna N and Viton diaphragm – 15#D & 30#D only.
- 16 24, 32, 64 or 68 element only.
- 17 N/A on all combinations.
- 18 700 Series only.

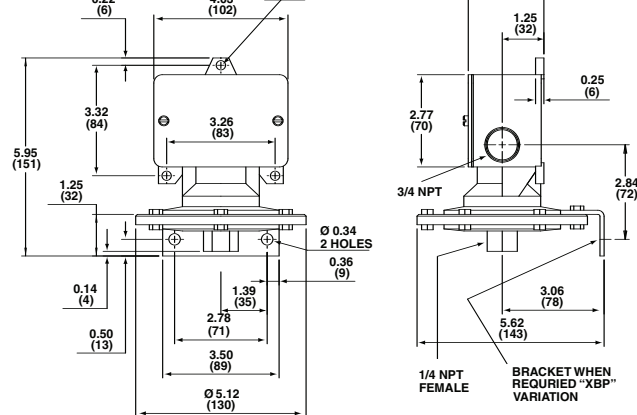
B-Series Switches – Pressure, Differential Pressure, Temperature & Hydraulic

Dimensions – 400 Series

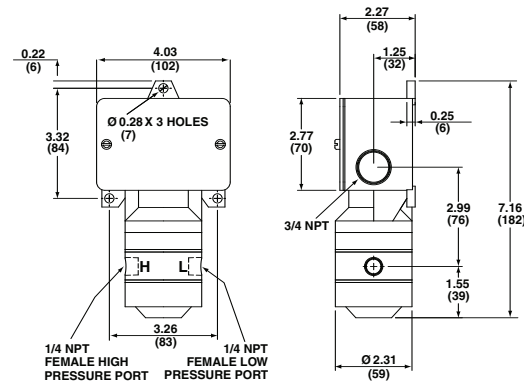
Pressure switch – psi ranges



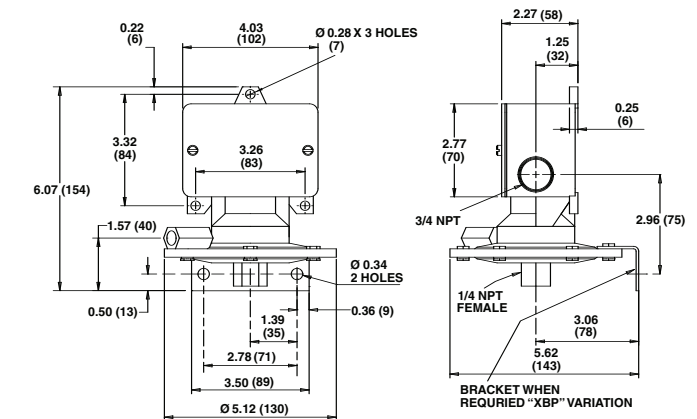
Pressure switch – inches of water ranges



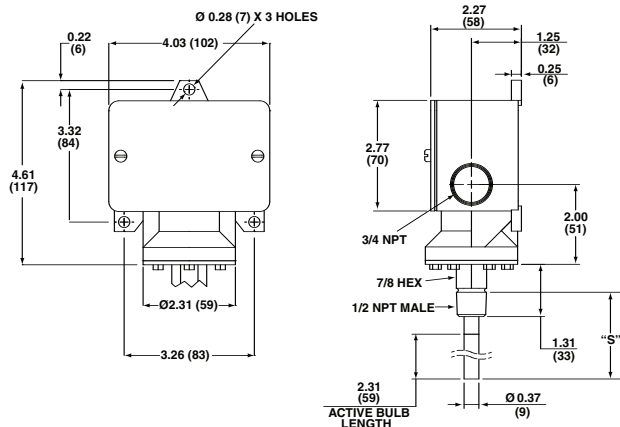
Differential pressure switch – psi differential ranges



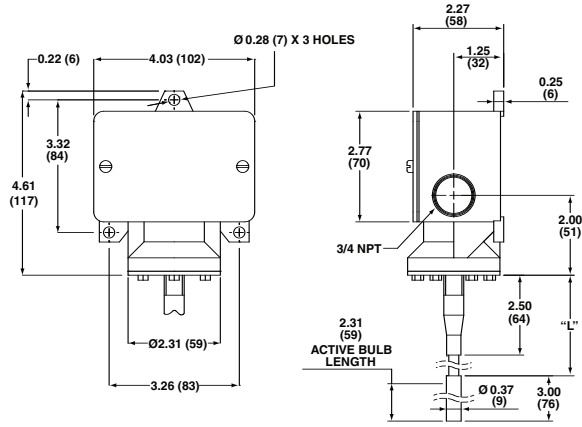
Differential pressure switch – inches of water ranges



Temperature switch – direct mount



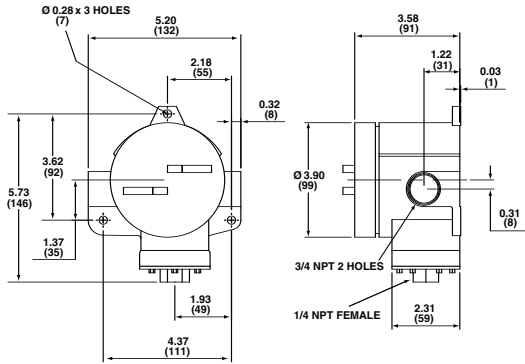
Temperature switch – remote mount



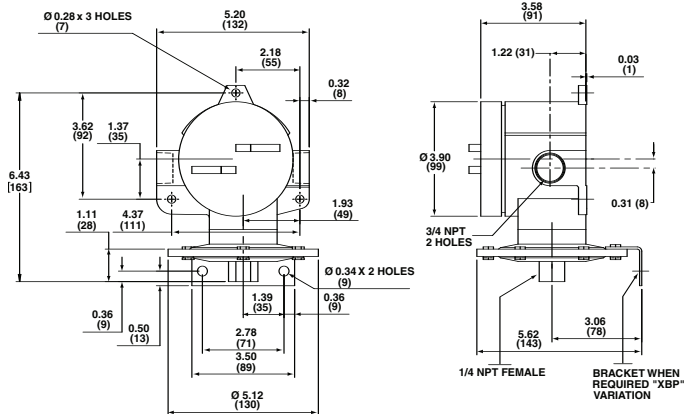
B-Series Switches – Pressure, Differential Pressure, Temperature & Hydraulic

Dimensions – 700 Series

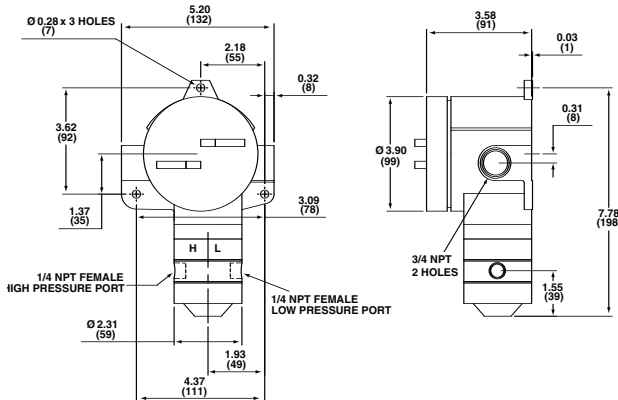
Pressure switch – psi ranges



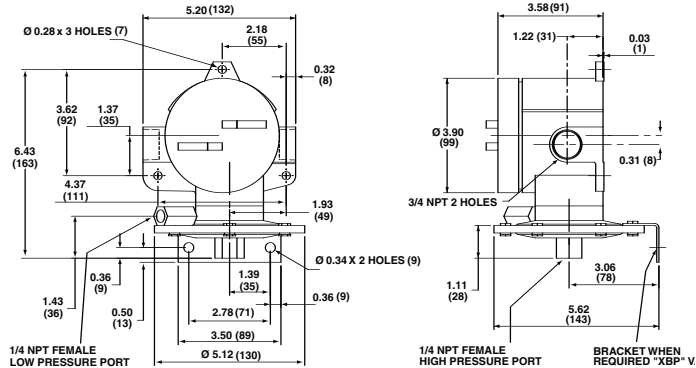
Pressure switch – inches of water ranges



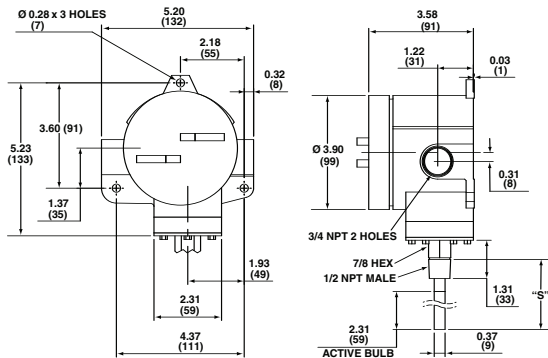
Differential pressure switch – psi differential ranges



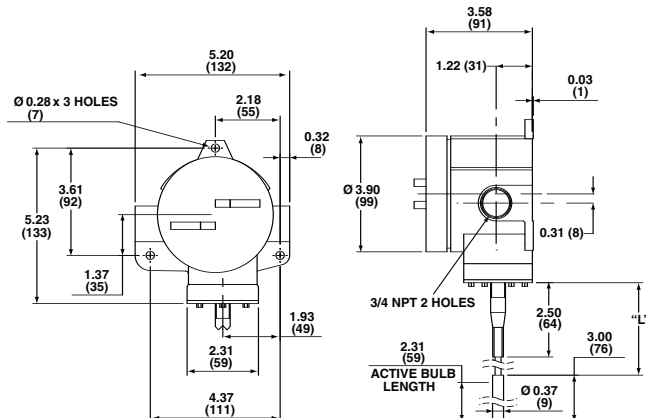
Differential pressure switch – inches of water ranges

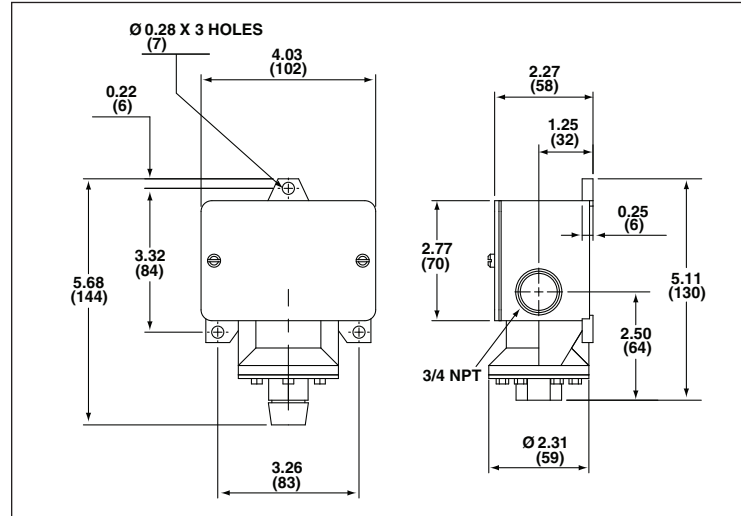


Temperature switch – direct mount



Temperature switch – remote mount



B400 – Vac-600 psi Pressure Switch**B400 Dimension Drawing – 70A861**



PCV-300

550-01
(Full Internal Port)
MODEL
6550-01
(Reduced Internal Port)

CLA-VAL™ Pressure Relief, Pressure Sustaining Valve



- **Accurate Pressure Control**
- **Optional Check Feature**
- **Fast Opening – maintains line pressure**
- **Slow Closing – prevents surges**
- **Completely Automatic Operation**

The Cla-Val Model 550-01 Pressure Relief Valve is a hydraulically operated, pilot-controlled, modulating valve designed to maintain constant upstream pressure within close limits. This valve can be used for pressure relief, pressure sustaining, back pressure, or unloading functions in a by-pass system.

In operation, the valve is actuated by line pressure through a pilot control system, opening fast to maintain steady line pressure but closing gradually to prevent surges. Operation is completely automatic and pressure settings may be easily changed.

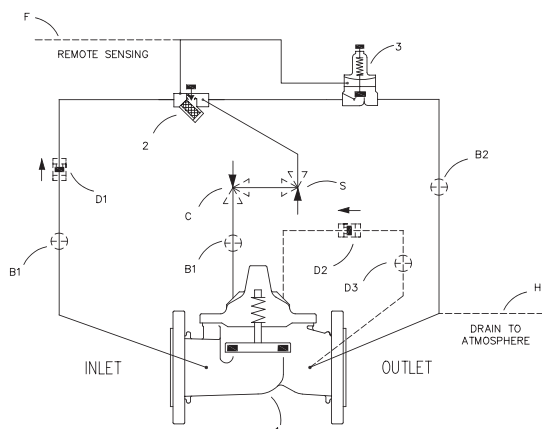
If the optional check feature "D" is added, and a pressure reversal occurs, the valve closes to prevent return flow.

Schematic Diagram

Item	Description
1	Hytrol (100-46 Main Valve - Full Internal Port) Hytrol (100-44 Main Valve - Reduced Internal Port)
2	X42N-2 Strainer & Needle Valve
3	CRL Pressure Relief Control

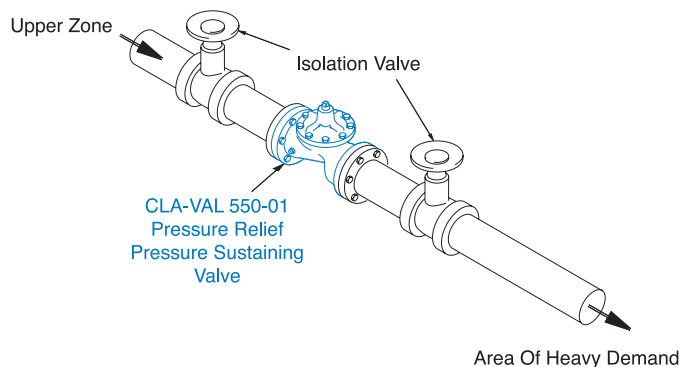
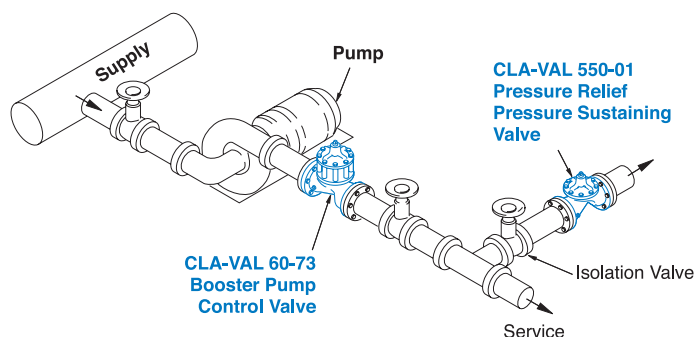
Optional Features

Item	Description
B	CK2 (Isolation Valve)
D	Check Valves with Isolation Valve
F	Remote Pilot Sensing
S	CV Speed Control (Opening)



The "D" feature on a vertically installed 6" and larger valve must be horizontally oriented.

Typical Applications



Pressure Relief Service

To provide protection for the system against high pressure surges when pumps are shut down, this fast opening – slow closing relief valve dissipates the excess pressure.

Pressure Sustaining Service

When installed in a line between an upper zone and a lower area of heavy demand, the valve acts to maintain desired upstream pressure to prevent "robbing" of the upper zone. Water in excess of pressure setting flows to area of heavy demand; control is smooth, and pressure regulation is positive.



Specifications

Sizes

Globe (inch):
1½", 3", 4", 6"

End Detail

Slip-on Two Piece Flange
Dimensions Per ANSI B16.5

Pressure Rating

ANSI Class 150:
Maximum 285 psi
ANSI Class 300:
Maximum 400 psi

Higher Pressure Available
Please Contact Factory

Operating Temperature

Fluids Compatible with Valve
Materials
-40° to 180° F (-40° to 82° C)

Materials

Body, Cover, Trim,
Diaphragm Assembly,
Flanges, and Fasteners
316 Series
Stainless Steel
Electropolished

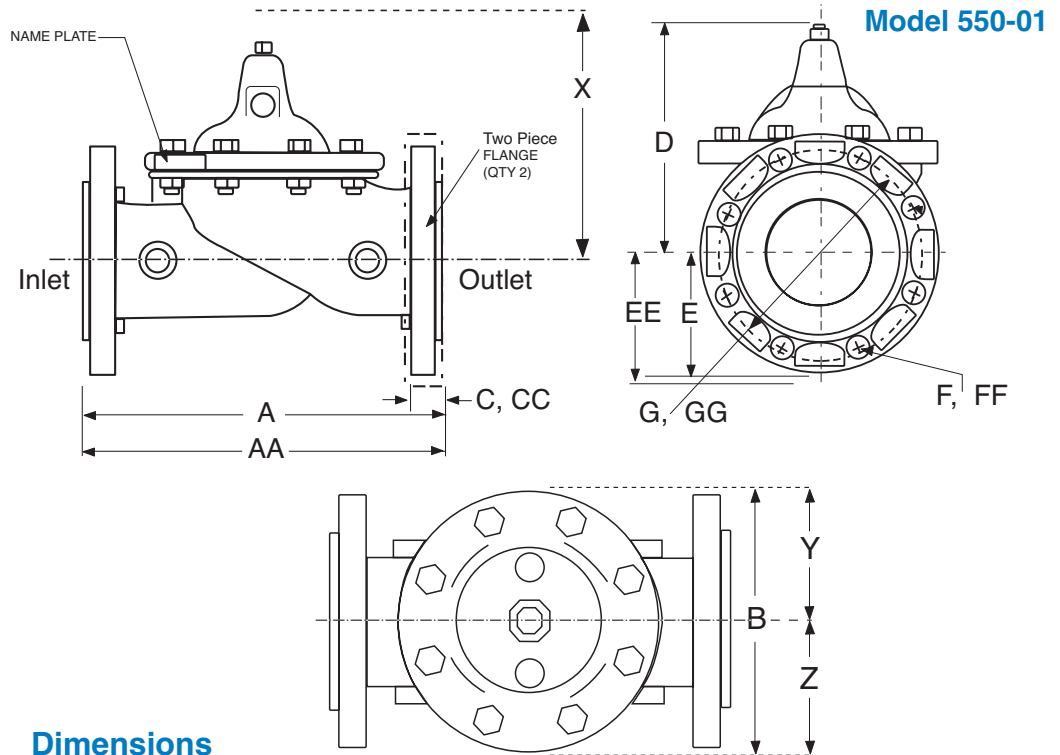
Disc:

Buna-N® Rubber*

Diaphragm:

Nylon Fabric Reinforced
Synthetic Buna-N® Rubber*

*Contact Factory for Other
Disc or Diaphragm Materials



Dimensions

Size (In)	1½	3	4	6
(mm)	40	80	100	150
A 150 ANSI	7.87	12.01	15.00	20.00
AA 300 ANSI	7.87	12.01	15.00	20.00
B	5.70	9.25	11.61	15.75
C	.89	.93	.93	1.02
CC 300 ANSI	.88	1.00	1.00	1.10
D	5.90	8.20	10.12	13.32
E	2.56	3.74	4.53	5.61
EE 300 ANSI	3.05	4.13	5.02	6.30
F	.63	.71	.71	.91
FF 300 ANSI	.87	.87	.87	.87
G	3.88	6.00	7.50	9.50
GG 300 ANSI	4.50	6.62	7.88	10.62
Flange Bolts (150 Class)	4	4	8	8
Flange Bolts (300 Class)	4	8	8	12
Approx. Ship Wt. Lbs.	25	75	160	290
Approx. Ship Wt. Kgs.	11.4	35	73	132
X Pilot System	13.00	15.00	17.00	29.00
Y Pilot System	9.00	11.00	12.00	20.00
Z Pilot System	9.00	11.00	12.00	20.00

100-46 Full Port Functional Data

Size (Inches)	Cv (gpm)*	Cv (l/s)**
1½	32	8
3	115	27
4	200	48
6	440	105

*Cv = gpm flow at 1 psi drop

**Cv = l/s flow at 1 bar drop



Specifications

Sizes

Globe (inch):
2", 2½", 3", 4", 6", 8", 10", 12"

End Detail

Slip-on Two Piece Flange
Dimensions Per ANSI B16.5

Pressure Rating

ANSI Class 150:
Maximum 285 psi
ANSI Class 300:
Maximum 400 psi

Higher Pressure Available
Please Contact Factory

Operating Temperature

Fluids Compatible with Valve
Materials
-40° to 180° F (-40° to 82° C)

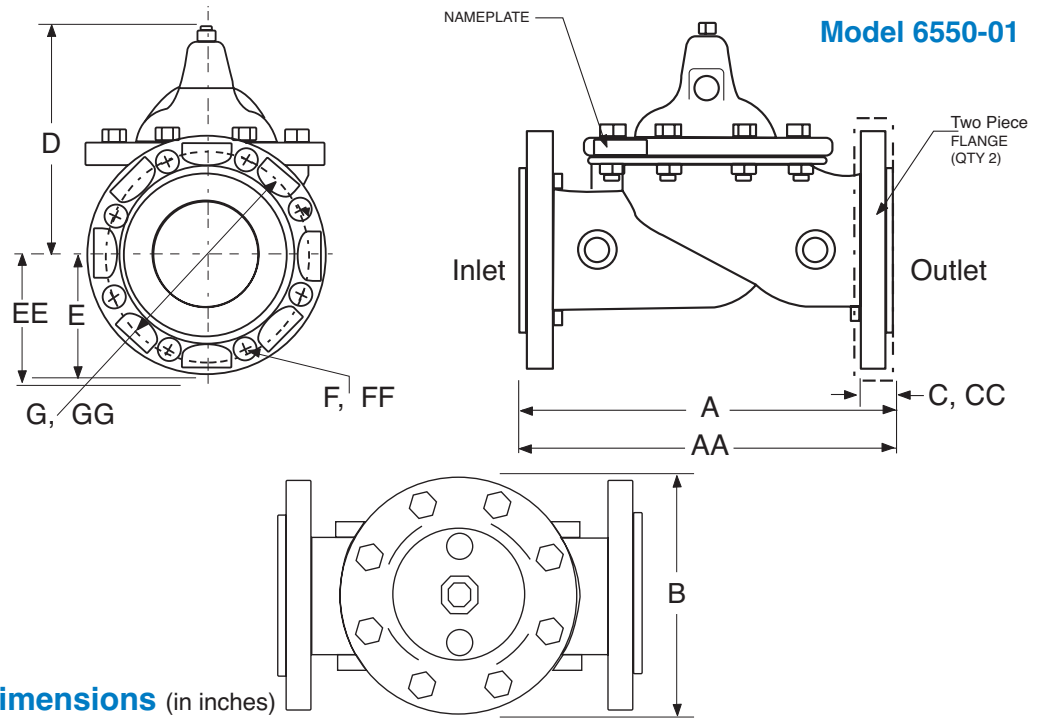
Materials

Body, Cover, Trim,
Diaphragm Assembly,
Flanges, and Fasteners
316 Series
Stainless Steel
Electropolished

Disc:
Buna-N® Rubber*

Diaphragm:
Nylon Fabric Reinforced
Synthetic Buna-N® Rubber*

*Contact Factory for Other
Disc or Diaphragm Materials

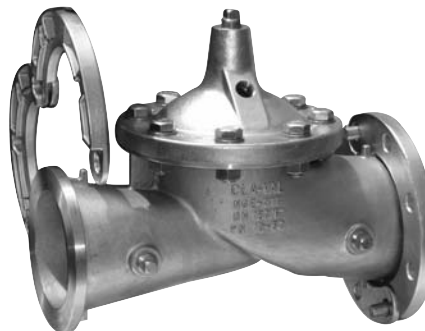


Dimensions (in inches)

Size (Inches)	2	2 1/2	3	4	6	8	10	12
Size (mm)	50	65	80	100	150	200	250	300
A 150 ANSI	9.06	11.42	12.20	13.78	18.90	23.62	28.74	33.46
AA 300 ANSI	9.06	11.42	12.20	13.78	18.90	23.62	28.74	33.46
B	5.70	8.06	6.69	9.25	11.61	15.75	20.08	23.62
C	.89	.89	.93	.93	1.02	1.15	1.15	1.25
CC 300 ANSI	.96	.96	1.00	1.00	1.10	1.15	1.46	1.50
D	6.50	7.95	8.20	10.12	13.32	16.39	19.12	20.95
E	3.05	3.54	3.74	4.53	5.61	6.79	7.97	9.55
EE 300 ANSI	3.25	3.75	4.13	5.01	6.30	7.48	8.76	10.24
F	.71	.71	.71	.71	.91	.87	1.02	1.02
FF 300 ANSI	.71	.75	.87	.87	.87	1.03	1.16	1.34
G	4.75	5.50	6.00	7.50	9.50	11.75	14.25	17.00
GG 300 ANSI	5.00	5.88	6.62	7.88	10.62	13.00	15.25	17.72
Flange Bolts (150 Class)	4	4	4	8	8	8	12	12
Flange Bolts (300 Class)	8	8	8	8	12	12	16	16
Approx. Ship Wt. Lbs.	25	40	40	75	160	290	419	728
Approx. Ship Wt. Kgs.	11.4	19	19	35	73	132	190	330
X Pilot System	13.00	14.00	15.00	17.00	29.00	31.00	33.00	36.00
Y Pilot System	9.00	10.00	11.00	12.00	20.00	22.00	24.00	26.00
Z Pilot System	9.00	10.00	11.00	12.00	20.00	22.00	24.00	26.00















100-44 Reduced Port Functional Data

Size (Inches)	Cv (gpm)*	Cv (l/s)**
2	38	9
2½	50	12
3	67	16
4	138	33
6	242	58
8	555	133
10	923	222
12	1492	359
*Cv = gpm flow at 1 psi drop		
**Cv = l/s flow at 1 bar drop		



When Ordering Please Specify:

1. Catalog No. 100-44
2. Valve Size
3. Fluid Being Handled
4. Fluid Temperature
5. Inlet Pressure Range
6. Outlet Pressure Range
7. Maximum and Minimum Differential Pressure
8. Flow Rate Range

Valve Selection		These Symbols  and  Indicate Available Sizes									
		Inches	1 ½	2	2 1/2	3	4	6	8	10	12
		mm	40	50	65	80	100	150	200	250	300
		End Detail	Flanged								
Model 550-01	Basic Valve 100-46 Full Port	Globe									
		Angle									
	Suggested Flow (gpm)	Max. Continuous	125			460	800	1800			
		Max. Surge	280			1000	1800	4000			
	Suggested Flow (Liters/Sec)	Max. Continuous	8			29	50	113			
		Max. Surge	18			63	113	252			
Model 6550-01	Basic Valve 100-44 Reduced Port	Globe									
		Angle									
	Suggested Flow (gpm)	Max. Continuous		200	300	460	580	1025	2300	4100	6400
		Max. Surge		420	600	900	990	1760	3970	7050	11000
	Suggested Flow (Liters/Sec)	Max. Continuous		12.5	18	32	37	65	145	258	403
		Max. Surge		26	38	55	62	111	250	444	693

6550-01 is the reduced internal port size version of the 550-01.

For 100-46 basic valves, suggested flow calculations were based on flow through Schedule 40 Pipe. Maximum continuous flow is approx. 20 ft/sec (6.1 meters/sec) & maximum intermittent is approx. 25 ft/sec (7.6 meters/sec) and minimum continuous flow is approx. 1 ft/sec (.3 meters/sec). For 100-44 basic valves, suggested flow calculations were based on flow through the valve seat. Approx. 26 ft/sec (7.9 meters/sec) was used for maximum continuous flow & 1 ft/sec (.3 meters/sec) is used for minimum continuous flow.

Many factors should be considered in sizing pressure reducing valves including inlet pressure, outlet pressure and flow rates. For sizing questions or cavitation analysis, consult Cla-Val with system details.

Pilot System Specifications

Adjustment Ranges

0 to 75 psi Max.
20 to 200 psi *
100 to 300 psi

*Supplied unless otherwise specified
Other ranges available, please consult factory

Temperature Range

Water: to 180°F

Materials

Standard Pilot System Materials

Pilot Control: Stainless Steel Type 303
Trim: Stainless Steel Type 303
Rubber: Buna-N® Synthetic Rubber

Optional Pilot System Materials

Pilot Systems are available with optional 316 Stainless Steel or Monel materials at additional cost.

Note: Available with remote sensing control.

When ordering Please Specify:

1. Catalog No. 550-01/6550-01
2. Valve Size
3. Pilot System Materials
4. End Detail (150/300)
5. Fluid to be Handled
6. Fluid Temperature
7. Inlet Pressure
8. Outlet Pressure
9. Adjustment Range
10. Desired Options



E-550-01/6550-01

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