PRO-50 Instrument Supply Regulator

Technical Sales Bulletin

Figure 1 PRO-50 Regulator

PRO-50 Series regulators are designed to be a compact, lightweight option for providing controlled pressures for instrumentation. Generally used to constantly control supply pressure to pneumatic and electro-pneumatic instrumentation, these direct-operated regulators are rugged enough to be used in most air or gas applications.

Engineered to provide clean supply pressure to meet the accuracy, repeatability and hysteresis demands of digital instrumentation, the PRO-50 is also well suited to supply local pneumatic instrumentation.

Features

CRN Approved
The PRO-50 Regulator has been granted a Canadian Registration Number.

Sour Service Capability
Available in NACE configurations that comply with NACE MR0175/MR0103. Environmental limits may apply.

Versatility
Provides clean air supply to a variety of pneumatic and electro-pneumatic instrumentation. Also, improves accuracy and reduces inlet sensitivity caused by inlet pressure fluctuations.

Field Service Friendly
Although made for easy maintenance with no special tools required for servicing the regulator in-line, the PRO-50 is engineered for long service life with minimal maintenance. These rugged regulators are easily inspected and serviced because of their one-piece valve plug assembly and easy access integral filter.

Reliable Construction
All PRO-50 regulators are factory tested to insure they meet 100% of our published specifications. The PRO-50 is also equipped with an internal relief valve featuring a soft seat for reliable shutoff excellent for conserving supply gas.

Industrial High Quality External Coatings
Our standard industrial high quality external coatings provide long lasting resistance to the harshest environments.

Panel Mounting
Handwheel adjusting screw, mounting nut, and spring case with ¼" NPT are all available to provide a panel mounting option.

Second Outlet
The PRO-50 regulator is equipped with a body side outlet for application of a pressure gauge or for other uses.

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SPECIFICATIONS

Configurations
Standard or NACE MR0175/MR0103. Environmental limits may apply.

Consult your Dyna-Flo sales office for other available configurations.

Outlet Connection Styles and Sizes
1/4 inch NPT.

Maximum Inlet Pressure (Body Rating)
250 Psig (1,724 kPag)

Outlet Pressure Ranges
Refer to Table 1.

Maximum Emergency Outlet Pressure
50 Psi (345 kPa) over outlet pressure setting.

Pressure Registration
Internal.

Flow Capacities
Refer to Table 3.

Wide-Open Flow Coefficients
Main Valve: C_v - 0.36

Internal Relief Valve: C_v - 0.045

IEC Sizing Coefficients
Main Valve: XT - 0.66 / FL - 0.89 / FD - 0.50

Dimensions
Refer to Figures 2 - 4.

Cross-Section
Refer to Figure 5.

Approximate Weights
1 lb. (0.5 Kg)

Construction Materials
Refer to Table 2.

Filter Capabilities
Free Area: 12 times pipe area.

Micron Rating:

Polyethylene Filter(1) (Standard Temp.) - 5 microns.
Glass Filter (High Temp.) - 5 microns.
Stainless Steel Filter (Optional) - 40 microns.

Temperature Capabilities
With Nitrile:

Polyethylene Filter(1): -40 to 180ºF (-40 to 82ºC)
Stainless Steel Filter: -40 to 180ºF (-40 to 82ºC)

With Viton®:

Glass Filter: 0 to 300ºF (-18 to 149ºC)
Stainless Steel Filter: 0 to 300ºF (-18 to 149ºC)

Accuracy
Inlet Sensitivity for Nitrile Elastomers:

Less than 0.20 Psig (1.38 kPag) change in outlet pressure for every 25 Psig (172 kPag) change in inlet pressure.

Inlet Sensitivity for Viton® Elastomers:

Less than 0.40 Psig (2.76 kPag) change in outlet pressure for every 25 Psig (172 kPag) change in inlet pressure.

Repeatability for Nitrile Elastomers:

0.10 Psig (0.69 kPag)(2)

Repeatability for Viton® Elastomers:

0.30 Psig (2.07 kPag)(2)

Air Consumption:

0 SCFH in steady state.

Internal Relief Performance
Low capacity relief for minor seat leakage only, PRO-50 regulators do not provide overpressure protection. Protection for overpressure must be provided if the inlet pressure will exceed the maximum pressure rating for the downstream equipment.

Options
- Handwheel for Adjustment Screw
- Panel Mount
- Tire Valve or Pipe Plug or Gauge in Second Outlet
- Inlet Screen
- Viton® Elastomers (High Temp./Corrosive)
- NACE Construction

NOTES
1 - Do not use for high aromatic hydrocarbon service.

2 - Repeatability = The regulator's measured ability to return to setpoint consistently when traveling from steady state to transient to steady state.

Table 1

Outlet Pressure Ranges and Spring Information

Outlet Pressure Ranges		Control Spring Data						
		Color	Material	Part Number	Wire Diameter		Free Length	
Psig	kPag				inch	mm	inch	mm
0 to 35	0 to 241	Silver	Music Wire (Standard)	PRO50601X01D	0.156	3.96	1.44	36.5
0 to 60	0 to 414	Blue Stripe		PRO50602X01D	0.170	4.32	1.44	36.5
0 to 125	0 to 862	Red Stripe		PRO50603X01D	0.207	5.26	1.44	36.5
0 to 35	0 to 241	Silver & Gold	Inconel® Alloy X750 (NACE)	PRO50601X02D	0.156	3.96	1.44	36.5
0 to 60	0 to 414	Blue & Gold		PRO50602X02D	0.170	4.32	1.44	36.5
0 to 125	0 to 862	Red & Gold		PRO50603X02D	0.207	5.26	1.44	36.5

PRINCIPLES OF OPERATION (Figures 6 and 7)

Downstream pressure registers internally on the bottom side of the diaphragm. The valve plug will be held against the orifice when the downstream pressure reaches the set pressure, at this point there will be zero flow through the regulator. Once demand increases, downstream pressure drops and the spring extends moving the stem and unseating the valve from the orifice. With the valve unseated there will be flow through the regulator (outlet pressure).

INSTALLATION

PRO-50 regulators may be installed in any position. Considerations must be made to protect the atmospheric pressure vent from filling with foreign material such as rain, snow, and dirt. Standard vent and drain positions are set for properly mounting a PRO-50 to a Siemens PS2 positioner (refer to Figure 8). Both the inlet and outlet are marked "IN" and "OUT" accordingly. If a pressure gauge is not installed in a gauge outlet connection, a pipe plug must be used to seal the connection. For more information on installing the PRO-50 regulator, refer to document P-PRO-50M.

INTERNAL RELIEF

PRO-50 regulators have an elastomer relief valve plug that conserves supply medium by preventing loss of air from downstream (inlet pressure) to atmosphere during normal operation. Should downstream pressure exceed the setpoint of the regulator (an occurrence outside of normal operating conditions), the force created will lift the diaphragm until it is lifted off of the relief seat enabling flow through the relief.

OVERPRESSURE PROTECTION

PRO-50 regulators are equipped with a low capacity internal relief valve for minor seat leak only. Regulators operate with maximum outlet pressure ratings that are lower than their maximum inlet pressure ratings. A pressure-limiting or pressure-relieving device (overpressure protection) is recommended if the inlet pressure will exceed the maximum downstream equipment pressure rating.

Overpressuring may cause leakage, equipment damage, or personal injury from pressurized leakage, bursting parts, fire or explosion from accumulated gas. **WARNING:** using the PRO-50 regulator within the set pressure range and at normal operating conditions does not eliminate the possibility of damage from external sources. Regulators should be inspected for damage regularly, especially after any overpressure situation.

Refer to the regulator Capacity Information section (Page 10) and the Wide-Open Flow Coefficients for Relief Valve Sizing in the Specifications section (Page 2) to determine the required relief valve capacity.

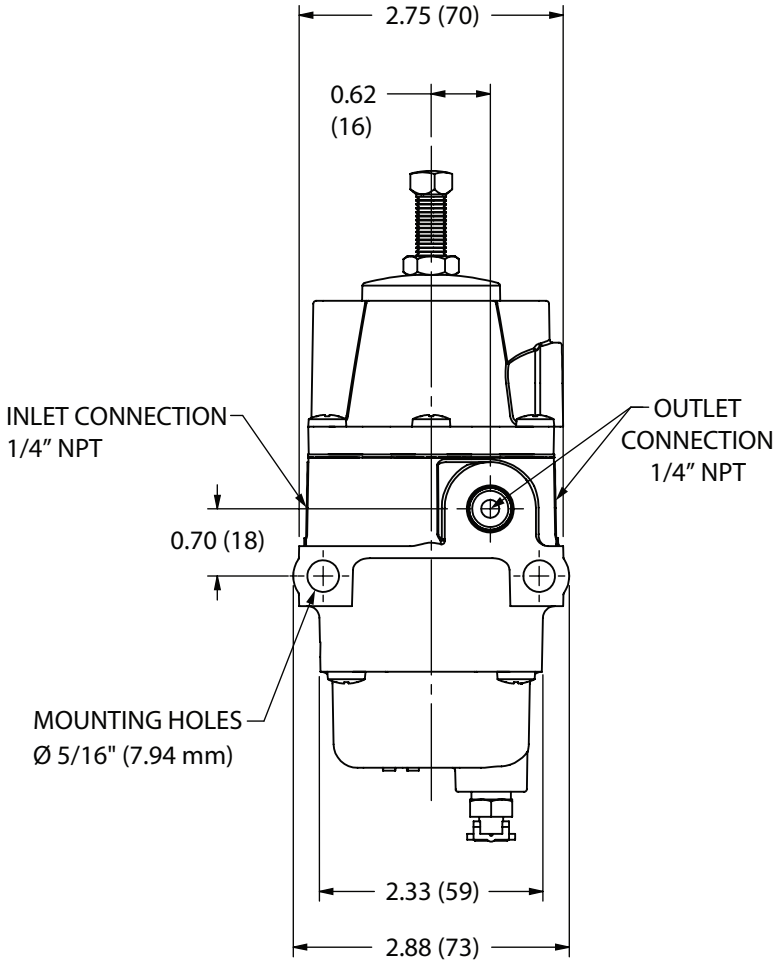

Figure 2 *PRO-50 Standard Dimensions*

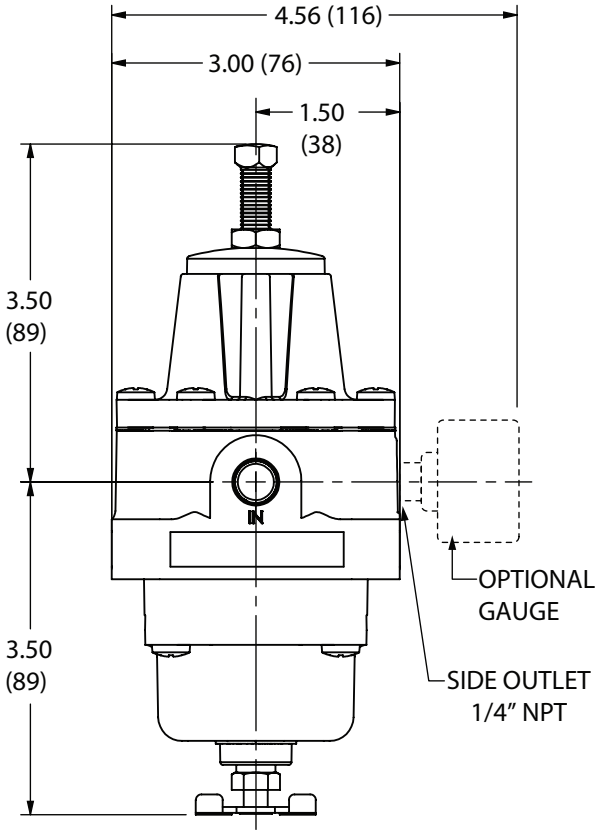

Figure 3 *PRO-50 Dimensions with Gauge Option*

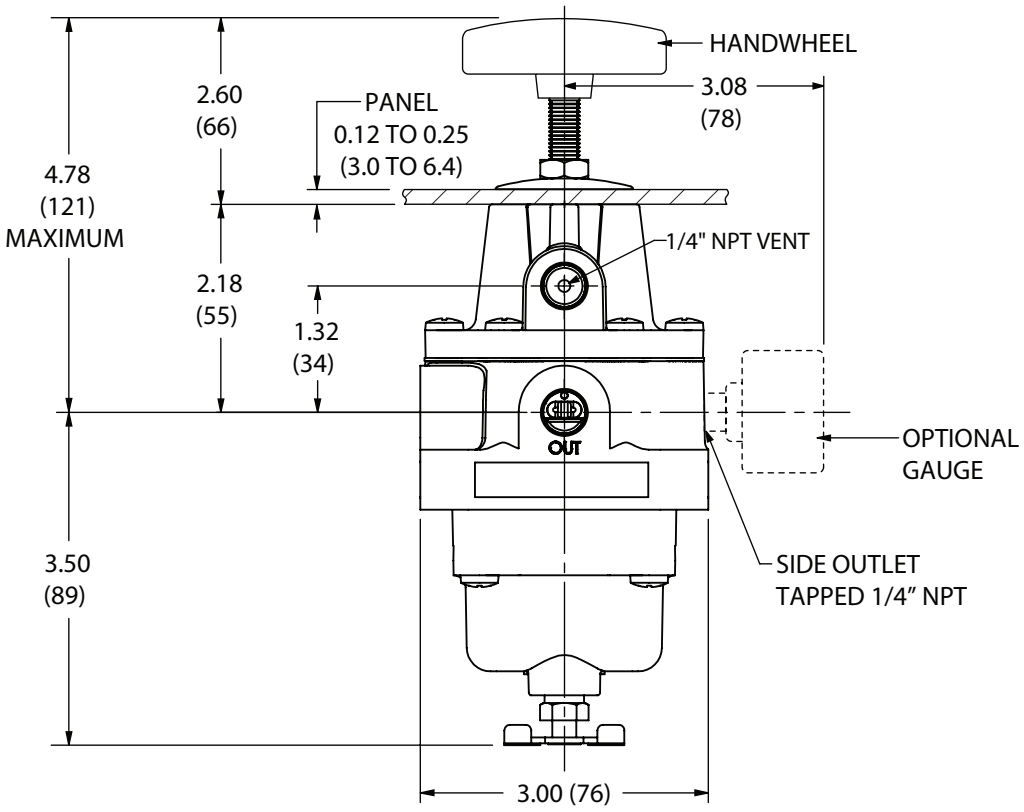

Figure 4 *PRO-50 Dimensions for Panel Mount and Handwheel*

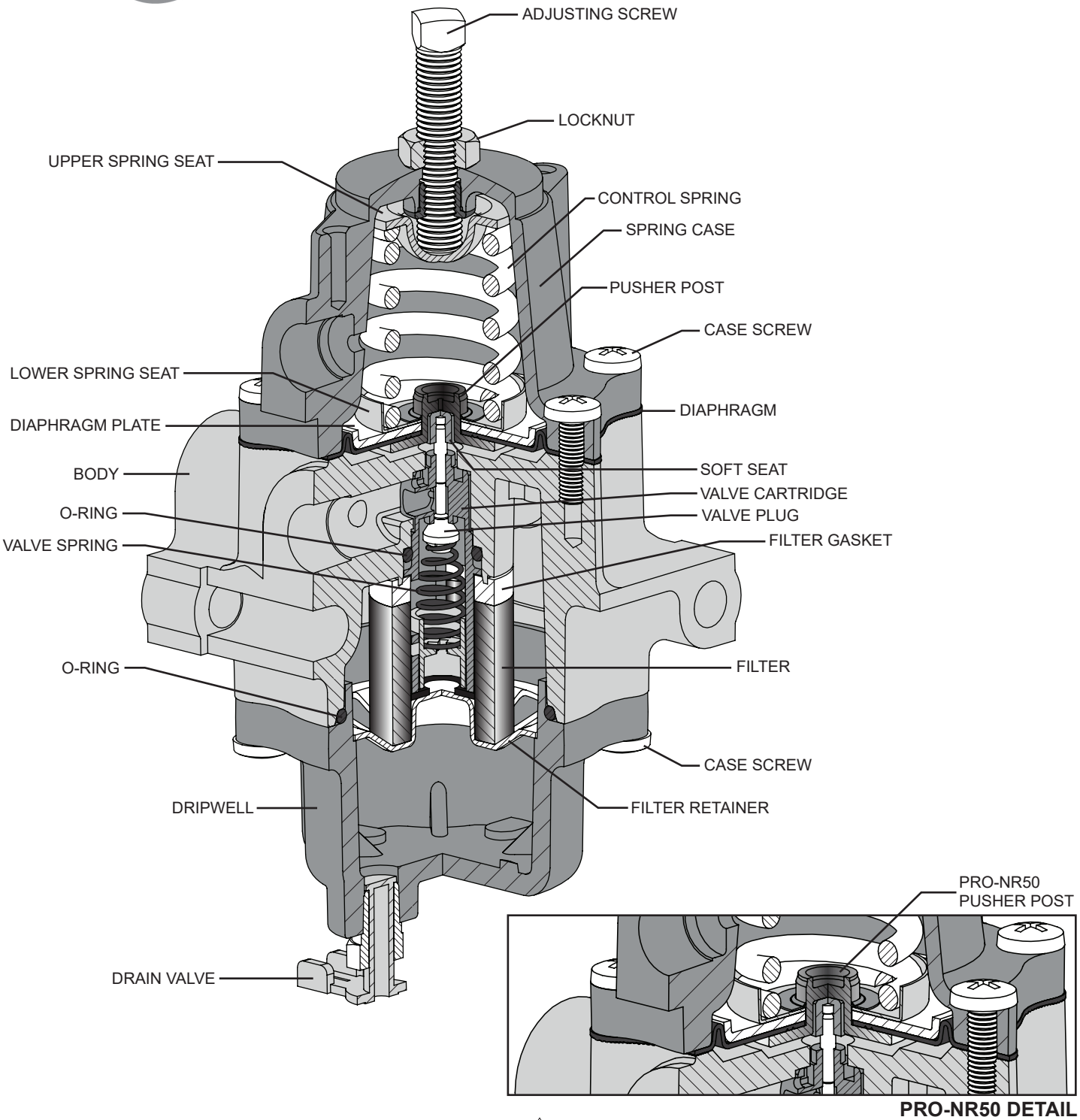

Figure 5 *Typical PRO-50 and PRO-NR50 Regulator Assembly Diagram*

Table 2

Common Regulator Parts Typical Construction Materials

Part	Material
Body and Spring Case	Aluminum A380 (ASTM B85)
Adjusting Screw / Locknut	Zinc-Plated Steel
Case Screw	18-8
Control Spring	Music Wire - Zinc-Plated Steel (Standard)
	Inconel® Alloy X750 (NACE)
Diaphragm and O-Rings	Nitrile (Standard Temp.)
	Viton® (High Temp.)
Drain Valve	Brass
	S31600
Dripwell	Aluminum A380 (ASTM B85)
Filter	5 Micron Polyethylene (Standard Temp.)
	5 Micron Glass (High Temp.)
	40 Micron Stainless Steel (Option - Standard and High Temp.)
Filter Retainer	Zinc-Plated Steel
Handwheel	Plastic
Lower Spring Seat / Diaphragm Plate	Aluminum
Pusher Post	Acetal
Soft Seat and Gaskets	Nitrile (Standard Temp.)
	Viton® (High Temp.)
Upper Spring Seat	Zinc-Plated Steel
Valve Cartridge	Polyester
Valve Plug	Nitrile (Standard)
	Viton®
Valve Spring	Stainless Steel (Standard)
	Inconel® Alloy X750 (NACE)

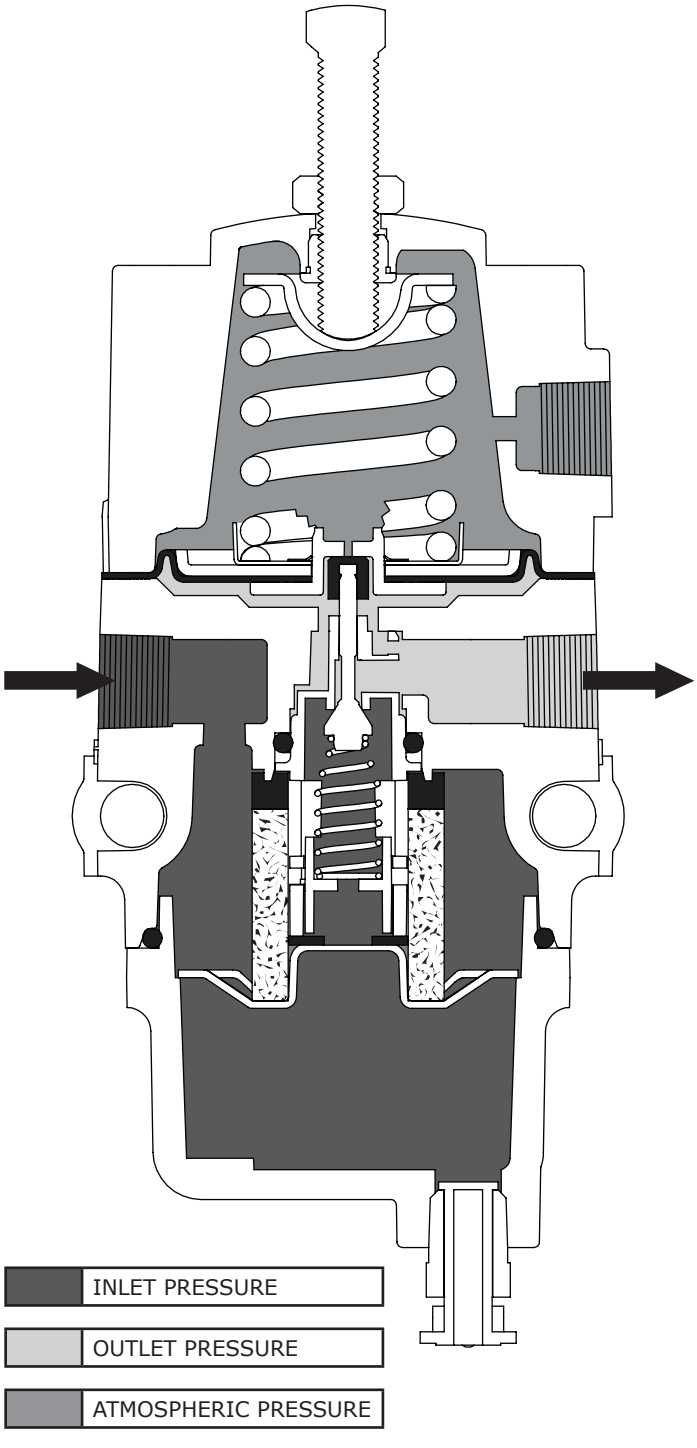

Figure 6 *PRO-50 Operation Schematic*

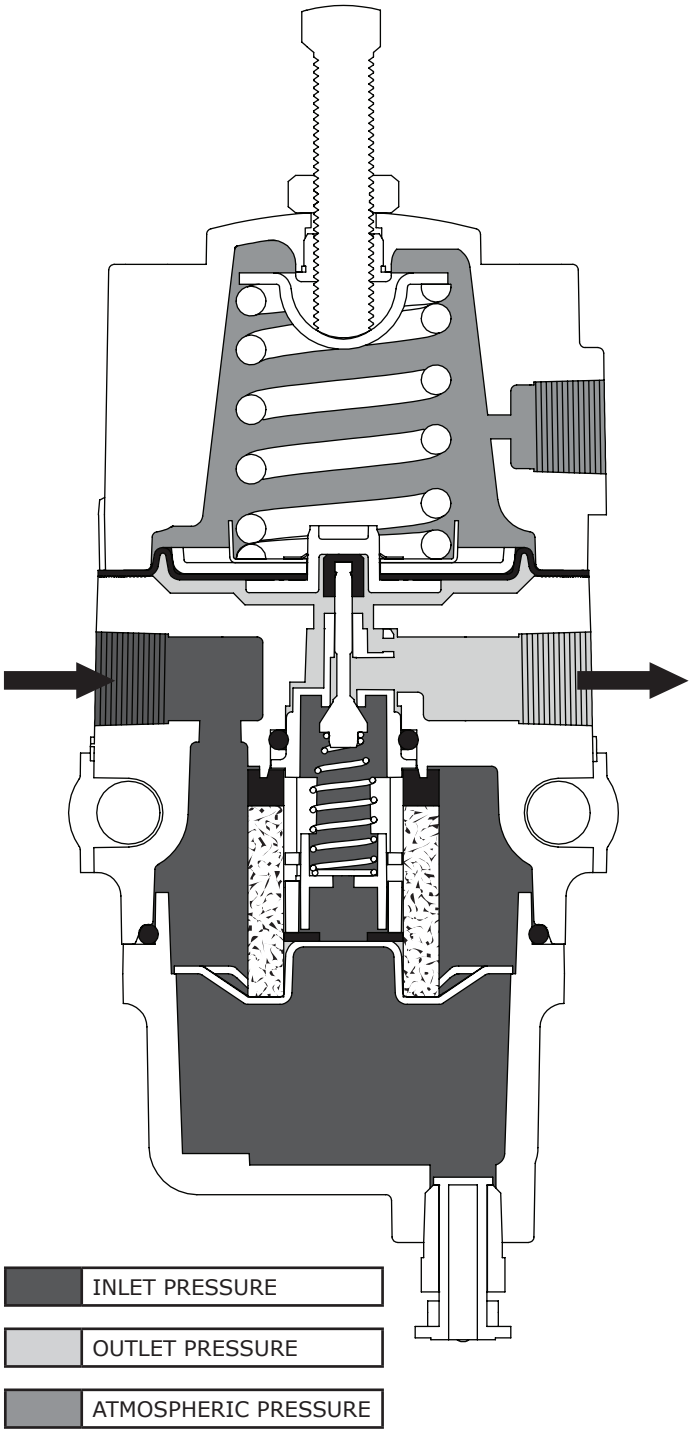

Figure 7 *PRO-NR50 Operation Schematic*

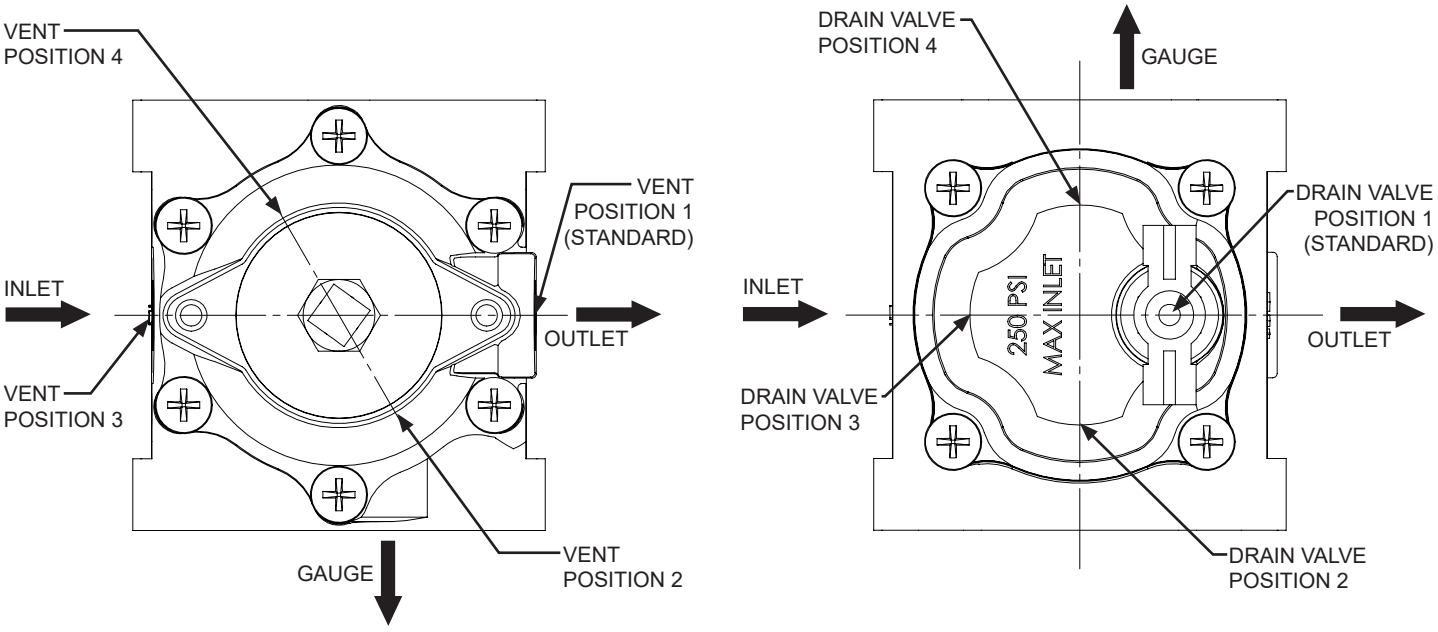

Figure 8 *PRO-50 Vent and Drain Positions*

Table 3

PRO-50 FLOW CAPACITIES (FOR AIR)

OUTLET PRESSURE RANGE SPRING PART NUMBER AND COLOR CODE	OUTLET PRESSURE		INLET PRESSURE		CAPACITIES			
					10% Droop		20% Droop	
	Psig	kPag	Psig	kPag	SCFH	Nm³/h	SCFH	Nm³/h
0 to 35 Psig (0 to 241 kPag) Refer to Table 1 for Spring Colors and Part Numbers.	15	103	50	345	250	6.7	430	11.5
			75	517	300	8.0	690	18.5
			100	689	330	8.8	1,000	26.8
			150	1,034	400	10.7	1,600	42.9
			250	1,724	450	12.1	1,800	48.2
	20	138	50	345	350	9.4	500	13.4
			75	517	530	14.2	820	22.0
			100	689	750	20.1	1,100	29.5
			150	1,034	1,400	37.5	1,600	42.9
			250	1,724	2,550	68.3	2,700	72.4
	35	241	50	345	390	10.4	500	13.4
			75	517	640	17.2	820	22.0
			100	689	840	22.5	1,100	29.5
			150	1,034	1,450	38.9	1,650	42.9
			250	1,724	2,450	65.7	2,700	72.4
0 to 60 Psig (0 to 414 kPag) Refer to Table 1 for Spring Colors and Part Numbers.	35	241	50	345	330	8.8	470	12.6
			75	517	500	13.4	730	19.6
			100	689	700	18.8	1,000	26.8
			150	1,034	1,050	28.1	1,550	41.5
			250	1,724	2,000	53.6	2,600	69.7
	60	414	75	517	520	13.9	720	19.3
			100	689	770	20.6	1,000	26.8
			150	1,034	1,100	29.5	1,600	42.9
			250	1,724	2,450	65.7	2,750	73.7
0 to 125 Psig (0 to 862 kPag) Refer to Table 1 for Spring Colors and Part Numbers.	80	556	100	689	530	14.2	780	20.9
			150	1,034	780	20.9	1,200	32.2
			250	1,724	1,250	33.5	2,200	59.0
	125	862	150	1,034	900	24.1	1,150	30.8
			250	1,724	1,650	44.2	2,450	65.7

CAPACITY INFORMATION

Refer to Table 3 for PRO-50 air regulating capacities at set inlet and outlet pressures. Flow rates are displayed in SCFH (at 60ºF and 14.7 Psia) and Nm3/h (at 0ºC and 101.325 kPa) of air. Regulators may be sized for 100% flow using these capabilities.

To convert capacities for other gases, multiply the capacities in Table 4 by the following:

Butane – 0.707

Natural Gas @ 0.6 specific gravity – 1.29

Nitrogen – 1.018

Propane – 0.810

For gases of other specific gravities, divide the chart capacities by the square root of the appropriate specific gravity.

$$\frac{\text{chart capacity}}{\sqrt{Sg}} = \frac{\text{chart capacity}}{\sqrt{\frac{MW}{28.97}}}$$

Wide-open flow capacities for relief sizing at any inlet pressure can be determined by performing one of the following formulas. If necessary, covert the wide-open capacity using the factors described above.

For Wide Open Flow:

$$q = C_v N P_1 Y \sqrt{\frac{x}{MTZ}}$$

$$Y = \text{Expansion Factor}$$

$$= 1 - \frac{x}{3F_k X_T}$$

$$F_k = \frac{k}{1.4} \qquad x = \frac{\Delta P}{P_1(\text{Abs})}$$

For Critical Pressure Drops (Absolute Outlet Pressure equal to or less than one-half of the Absolute Inlet Pressure):

$$Q = P_1 C_v 39.76 X_T^{1/2}$$

If the capacity is required in normal cubic meters per hour (at 0ºC and 101.325 kPa) , multiply SCFH by 0.0268.

FORMULA NOMENCLATURE

Q = gas flow rate, SCFH

P_1 = absolute inlet pressure, Psia (P_1 gauge + 14.7)

G = specific gravity of the gas

T = absolute temperature of gas at inlet, ºRankine

ΔP = pressure drop across the regulator, Psi

RELATIONSHIPS OF NOTE:

$$X_T = \left(\frac{C_1}{39.76}\right)^2$$

$$C_v = \frac{C_g}{C_1}$$

$$Q = (P_1)(C_g)$$

PRO-50 Instrument Supply Regulator

MODEL NUMBERING SYSTEM

SAMPLE PART NUMBER: PRO-50-03AFL-NSBD

MODEL							
PRO-50	STANDARD			**PRO-50N**	NACE		
PRO-NR50	NON-RELIEVING						
OUTPUT RANGE							**03**
03	0-35 PSIG	**06**	0-60 PSIG	**12**	0-125 PSIG		
BODY MATERIAL							**A**
A	ALUMINUM A380 (ASTM B85)						
FILTER MATERIAL							**F**
F	5 MICRON POLYETHYLENE (STANDARD TEMP.)						
G	5 MICRON GLASS FIBER (HIGH TEMP. - STANDARD AND NACE MODEL)						
S	40 MICRON STAINLESS STEEL (OPTION - STANDARD AND HIGH TEMP.)						
TEMPERATURE RANGE							**L**
L	STANDARD TEMP. -40 TO 180ºF (-40 TO 82ºC)			**H**	HIGH TEMP. 0 TO 300ºF (-18 TO 149ºC)		
ELASTOMERS (DIAPHRAGM / PLUG SEAT / SEALS)							**N**
N	NITRILE (STANDARD TEMP.)			**V**	VITON® (HIGH TEMP.)		
ADJUSTING SCREW							**S**
S	SQUARE ZINC PLATED			**N**	SLOTTED STAINLESS STEEL		
H	HANDWHEEL						
DRAIN VALVE							**B**
B	BRASS (STANDARD)			**S**	STAINLESS STEEL		
PACKAGING							**D**
D	BOXED FOR INDIVIDUAL SALE				NOT BOXED		

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