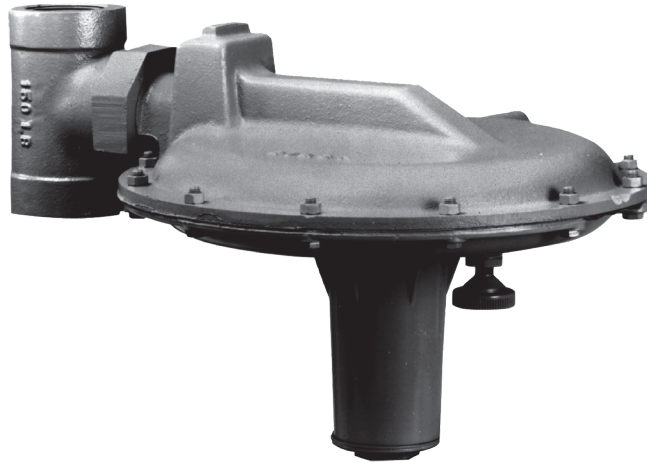


Type Y692 Gas Blanketing Regulator System



W5930-1

Figure 1. Type Y692 Low-Pressure Gas Blanketing Regulator

Introduction

An Accu-Pressure™ Gas Blanketing Regulator System reduces a high-pressure gas, such as Nitrogen, to maintain a protective environment above any liquid stored in a tank or vessel when the liquid is being pumped out. Also when the vessel is suddenly cooled, causing vapors inside the vessel to contract, the regulator system replaces the volume of contracting vapors with a volume of blanketing gas to prevent the internal vessel pressure from decreasing. In both cases, a slight positive vessel pressure prevents outside air, moisture and other contaminants from entering the vessel and the possible collapse of the vessel walls.

The Type Y692 (Figure 1) is a direct-operated regulator used for accurate pressure control on very low-pressure blanketing systems. Downstream pressure is sensed through a pitot tube installed in the lower casing of the regulator for units with internal pressure registration or through a downstream control line for units with external pressure registration. The Type Y692 is available in NPS 1-1/2 and 2 / DN 40 and 50 body sizes.

Features

- **Ease of Inspection and Maintenance**—The union nut connection between the body and actuator permits access to the disk and orifice by only removing the diaphragm casing assembly without removing the body from the line.
- **Accuracy of Control**—Large diaphragm areas provide more precise control even at low-pressure settings and the pitot tube also creates a dynamic boost that helps provide greater capacity.
- **Speed of Response**—The downstream pressure is sensed directly by the diaphragm through the pitot tube providing quick response.
- **Ease of Installation**—The Type Y692 is easy to install in the pipeline because no additional connections are required.



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Bulletin 74.1:Y692

Specifications

This section lists the specifications of the Type Y692 Gas Blanketing Regulator System. Factory specification, such as spring range and orifice size are stamped on the nameplate fastened on the regulator at the factory.

Available Configurations

Direct-operated pressure reducing regulator with external or internal pressure registration with seven outlet (control) pressure ranges from 1 in. w.c. to 7 psig / 2 mbar to 0.48 bar. Available in NPS 1-1/2 and 2 / DN 40 and 50 body sizes.

Body Sizes and End Connection Styles⁽¹⁾

Cast Iron: NPS 1-1/2 / DN 40, NPT, NPS 2 / DN 50, NPT or CL125 FF
Steel: NPS 1-1/2 or 2 / DN 40 or 50, NPT, SWE, CL150 RF, CL300 RF or PN 16/25/40
Stainless steel: NPS 1-1/2 or 2 / DN 40 or 50, NPT, CL150 RF, CL300 RF or PN 16/25/40

Maximum Inlet Pressure⁽²⁾

150 psig / 10.3 bar

Maximum Outlet (Casing) Pressure⁽²⁾

15 psig / 1.0 bar

Maximum Operating Outlet (Control) Pressure to Avoid Internal Part Damage⁽²⁾

3 psig / 0.21 bar above outlet (control) pressure setting

Control Pressure Ranges⁽²⁾

See Table 1

Flow Capacities

See Table 5

Relief Sizing Coefficients

See Table 6

Orifice Size

See Table 6

Pressure Registration

Internal (**standard**) or External

Spring Case Connection

1/4 NPT

Temperature Capabilities⁽²⁾

Nitrile (NBR):

-20 to 180°F / -29 to 82°C

Fluorocarbon (FKM):

0 to 300°F / -18 to 149°C

Perfluoroelastomer (FFKM):

-20 to 300°F / -29 to 149°C

Ethylene Propylene (EPDM):

-20 to 275°F / -29 to 135°C

IEC Sizing Coefficients

X_T : 0.775

F_D : 0.50

F_L : 0.89

Approximate Weights

Cast Iron Body: 45 lbs / 20 kg

Steel/Stainless steel Body: 57 lbs / 26 kg

Canadian Registration Number (CRN)

Approved

PED (Pressure Equipment Directive) Category

The Type Y692 may be used as a safety accessory with pressure equipment in the PED 97/23/EC Category I.

Construction Materials

Body, Union Nut, Spring Case and Lower Casing Assembly: Cast iron, WCC steel, CF8M Stainless steel

Control Spring, Control Spring Seat, Split Ring and Diaphragm Plate: Plated steel

Diaphragm: Nitrile (NBR) (**standard**), Fluorocarbon (FKM), Ethylenepropylene (EPDM), Silicone (VMQ)

O-rings: Nitrile (NBR), Fluorocarbon (FKM), Perfluoroelastomer (FFKM), Ethylenepropylene (EPDM)

Orifice, Pusher Post, Pusher Post Connector, Lever Assembly, Stem and Pitot Tube: Stainless steel

Gasket: Composition

Disk Assembly: Nitrile (NBR) and Stainless steel, Fluorocarbon (FKM) and Stainless steel, Polytetrafluoroethylene (PTFE) and Stainless steel or Ethylenepropylene (EPDM) and Stainless steel

1. Fabricated by using slip-on flanges and socket welding nipples into body.

2. The pressure/temperature limits in this Bulletin and any applicable standard limitation should not be exceeded.

Table 1. Control Pressure Ranges

CONTROL PRESSURE RANGE WITH CASE BARREL POINTED DOWN		CONTROL SPRING COLOR CODE	CONTROL SPRING PART NUMBER	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
				in.	mm	in.	mm
Light Spring Assembly	1 to 3 in. w.c. / 2 to 7 mbar ⁽²⁾⁽³⁾	Brown	1D892527022	0.109	2.77	6.12	155
	3 to 11 in. w.c. / 7 to 27 mbar ⁽²⁾⁽⁴⁾	Iridite	0B019727052	0.148	3.76	6.00	152
	6.5 in. w.c. to 1.2 psig / 16 mbar to 83 mbar ⁽⁵⁾	Green	0B019427052	0.187	4.75	6.00	152
	0.7 to 2 psig / 48 mbar to 0.14 bar	Blue	0B019627032	0.225	5.71	6.00	152
	1 to 3.2 psig / 69 mbar to 0.22 bar	Orange	0A081127202	0.250	6.35	6.00	152
Heavy spring Assembly	2 to 5.5 psig / 0.14 to 0.38 bar	Silver with green stripe	0Y066427022	0.363	9.22	6.00	152
	4 to 10 psig / 0.28 to 0.69 bar	Silver	1H802427032	0.406	10.3	6.00	152

1. Install with spring case pointing down to achieve low setpoints in these spring ranges.
 2. Do not use Fluorocarbon (FKM) diaphragm with these springs at diaphragm temperature lower than 60°F / 16°C.
 3. Installation with spring case pointing up will change outlet (control) pressure range to 3 to 5 in. w.c. / 7 to 12 mbar.
 4. Installation with spring case pointing up will change outlet (control) pressure range to 5.75 to 14 in. w.c. / 14 to 35 mbar.
 5. Installation with spring case pointing up will change outlet (control) pressure range to 7.5 in. w.c. to 1.3 psig / 19 to 90 mbar.

Table 2. Flow Rate Conversion⁽¹⁾

MULTIPLY MAXIMUM PUMP RATE OUT	BY	TO OBTAIN
U.S. GPM	8.021	SCFH
U.S. GPH	0.1337	SCFH
m ³ /hr	1.01	Nm ³ /H
Barrels/hr	5.615	SCFH
Barrels/day	0.2340	SCFH

1. Gas flow of blanketing gas to replace liquid pumped out.

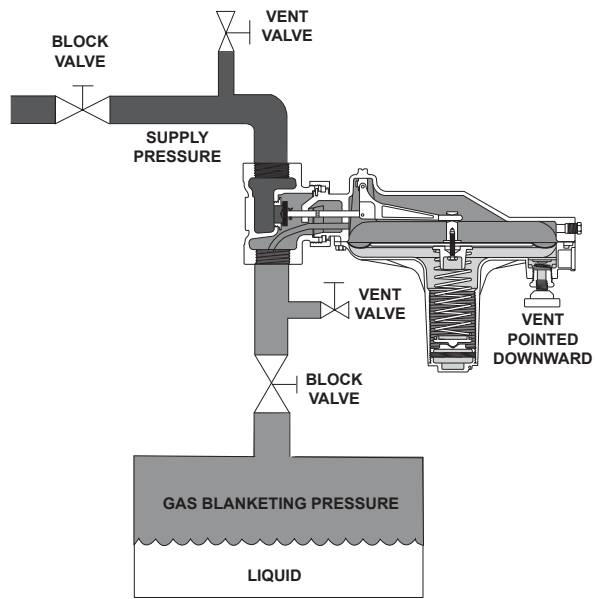
Table 3. Conversion Factors (for converting Nitrogen flow rates to other gas flow rates)

BLANKET GAS	SPECIFIC GRAVITY	CORRECTION FACTOR
Natural Gas	0.60	1.270
Air	1.00	0.985
Dry CO ₂	1.52	0.797

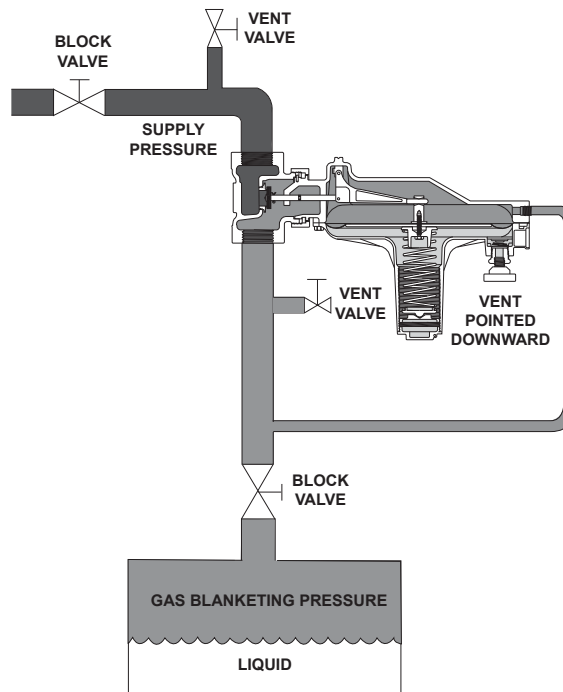
Correction Factor = $\frac{0.985}{\sqrt{SG}}$

Table 4. Gas Flow Required for Thermal Heating (Outbreathing) or Cooling (Inbreathing) per API 2000 (Interpolate for Intermediate size)

VESSEL CAPACITY			AIR FLOW RATE REQUIRED	
Barrel	Gallon	Liter	SCFH	Nm ³ /h
60	2500	9500	60	1.6
100	4200	16,000	100	2.7
500	21,000	79,500	500	1.3
1000	42,000	159,000	1000	26.8
2000	84,000	318,000	2000	53.6
3000	126,000	477,000	3000	80.4
4000	168,000	636,000	4000	107
5000	210,000	795,000	5000	134
10,000	420,000	1,590,000	10,000	268
15,000	630,000	2,385,000	15,000	402
20,000	840,000	3,180,000	20,000	536
25,000	1,050,000	3,975,000	24,000	643
30,000	1,260,000	4,769,000	28,000	750
35,000	1,470,000	5,564,000	31,000	831
40,000	1,680,000	6,359,000	34,000	911
45,000	1,890,000	7,154,000	37,000	992
50,000	2,100,000	7,949,000	40,000	1072
60,000	2,520,000	9,539,000	44,000	1179
70,000	2,940,000	11,129,000	48,000	1286
80,000	3,360,000	12,718,000	52,000	1394
90,000	3,780,000	14,308,000	56,000	1501
100,000	4,200,000	15,898,000	60,000	1608
120,000	5,040,000	19,078,000	68,000	1822
140,000	5,880,000	22,437,000	75,000	2010
160,000	6,720,000	25,437,000	82,000	2198
180,000	7,560,000	28,616,000	90,000	2412



TYPE Y692 WITH INTERNAL REGISTRATION



TYPE Y692 WITH EXTERNAL REGISTRATION

A6340

- INLET PRESSURE
- CONTROL PRESSURE (OUTLET PRESSURE)
- ATMOSPHERIC PRESSURE

Figure 2. Type Y692 Operational Schematics

Principle of Operation

The Type Y692 Gas Blanketing Regulator reduces a high-pressure gas to maintain a positive low-pressure of blanket gas over a stored liquid when the liquid is being pumped out of the vessel (see Figure 2). Also when the vessel (or tank) is suddenly cooled, causing vapors to contract, the regulator replaces the volume of contracting vapors with a volume of blanketing gas to prevent the internal vessel pressure from decreasing. In both cases, a positive vessel pressure prevents outside air from entering the vessel and reduces the possibility of atmospheric pressure collapsing the vessel.

Gas blanketing regulators respond to a slight decrease in internal vessel pressure by throttling open to increase the flow rate of gas into the vessel. When the vessel's liquid level has been lowered to the desired point and the vapor pressure re-established, the regulator throttles closed.

When the liquid level drops and vessel pressure decreases below the setting of the control spring, the spring force on the diaphragm opens the disk assembly to supply the required flow of gas to the vessel. When vessel pressure has been satisfied, control pressure tends to increase slightly, acting on the diaphragm. When the control (vessel) pressure exceeds the control spring setting, the diaphragm moves to close the disk assembly.

The Type Y692 Gas Blanketing Regulator provides a constant set pressure for accurate gas blanketing. When vessel pressure decreases below the control spring setpoint, the force of the spring moves the disk away from the orifice allowing gas to flow into the vessel. As the vessel pressure increases, the increase is sensed by the diaphragm through the pitot tube or control line. This movement of the diaphragm causes the disk to move toward the orifice, decreasing the flow of blanketing gas. When the vessel pressure reaches the system setpoint, the disk will seat against the orifice shutting off the flow of gas.

Installation

Install the Type Y692 regulator with the spring case barrel pointed down. This will assure that the lowest set pressure shown in Table 1 is achieved. Flow through the regulator body is indicated by the flow arrow cast on the body. If a block valve is required, install a full flow valve between the regulator and the blanketed vessel.

Sizing Tank Blanketing Systems

When sizing a gas blanketing regulator system for a low pressure blanketing application, you must consider the replacement of blanketing gas required for the liquid loss during pump out of the vessel and also the condensation/contraction of vessel vapors during atmospheric thermal cooling.

Direct Displacement

The direct displacement method should be used with extreme caution. The direct displacement method determines the amount of blanketing gas required to replace liquid pumped out of the tank. Direct displacement does not allow for fluctuating temperature or other factors that may affect pressure in the vapor space. This method is typically applied to tanks operating at constant temperature and containing non-flammable, non-volatile products.

$$Q_{\text{total}} = Q_{\text{pump}}$$

where,

Q_{total} = Required Flow Rate

Q_{pump} = Required Flow Rate to replace pumped out liquid from Table 1

API 2000

The American Petroleum Institute Standard 2000 (API 2000) sizing method accounts for liquid pump-out as well as contraction of tank vapors due to cooling. When using API methods:

$$Q_{\text{total}} = Q_{\text{pump}} + Q_{\text{thermal}}$$

where,

Q_{total} = Required Flow Rate

Q_{pump} = Required Flow Rate to replace pumped out liquid from Table 1

Q_{thermal} = Required Flow Rate due to thermal cooling. See Thermal Equations 1 to 4 below or Table 2.

Thermal Equations

For tanks up to 840,000 gallons / 3179 m³ capacity, use one of the following equations:

Equation 1:

$$Q_{\text{thermal}} [\text{SCFH Air}] = V_{\text{tank}} \times 0.0238$$

Equation 2:

$$Q_{\text{thermal}} [\text{SCFH Nitrogen}] = V_{\text{tank}} \times 0.0238 \times 1.015$$

Equation 3:

$$Q_{\text{thermal}} [\text{Nm}^3/\text{h Air}] = V_{\text{tank}} \times 0.169$$

Equation 1:

$$Q_{\text{thermal}} [\text{Nm}^3/\text{h Nitrogen}] = V_{\text{tank}} \times 0.169 \times 1.015$$

where,

For Equations 1 and 2: V_{tank} = tank volume, gallons

For Equations 3 and 4: V_{tank} = tank volume, m³

For tanks greater than 840,000 gallons / 3179 m³ capacity: See Table 2.

Depending on the method, there can be a significant difference in the calculated required capacity. **No matter which method is used, the tank must be equipped with supplemental venting to protect the**

tank, product and personnel in cases of equipment failure, fire exposure or other conditions that could cause the tank pressure or vacuum to exceed operating limits.

Sizing can be done by following these steps:

1. Determine the gas flow rate required to replace the liquid being pumped out (see Table 2).
2. Using the established procedures from the American Petroleum Institute Standard 2000 (API 2000), determine the gas flow rate due to "inbreathing" caused by atmospheric thermal cooling (see Table 4).
3. Add the requirements of 1 and 2 and select the regulator size, based on total capacity required from Table 6.

Sample sizing problem for blanketing applications:

Service Conditions:

Vessel Capacity 42,000 gallons / 159,000 L
 Pump In/Out Capacity . . . 150 gallons/minute / 570 L/m
 Inlet Pressure Source 20 psig / 1.4 bar Nitrogen
 Desired Blanket Setpoint 1 in. w.c. / 2 mbar

Sizing and Selection Methodology:

1. From Table 2 the desired air flow rate due to pump out equals 150 GPM x 8.021 = 1203 SCFH / 32.2 Nm³/h air.
2. From Table 4, the required air flow due to thermal cooling = 1000 SCFH / 26.8 Nm³/h air.
3. Total flow required for pump out and thermal cooling is 1203 + 1000 = 2203 SCFH / 59.0 Nm³/h air.
4. Convert to nitrogen by dividing the total air flow by the square root of the specific gravity of nitrogen: 2203 ÷ 0.97 = 2248 SCFH / 60.2 Nm³/h nitrogen (See Table 3 for the conversion).
5. From Table 5, a Type Y692 in either an NPS 1-1/2 and 2 / DN 40 and 50 body sizes and a 3/8 in. / 9.5 mm orifice will flow 3620 SCFH / 97.0 Nm³/h nitrogen at 20 psig / 1.4 bar inlet pressure. This satisfies the required flow of 2248 SCFH / 60.2 Nm³/h nitrogen.

Capacity Information

Table 5 gives the typical regulating capacities at selected inlet pressures and outlet (control) pressure settings. Flows are in SCFH (60°F and 14.7 psia) of 0.97 specific gravity nitrogen. For gases of other specific gravities, multiply the given capacity of nitrogen by 0.985 and divide the given capacity by the square root of the appropriate specific gravity of the gas required. Then, if capacity is desired in normal cubic meters per hour at 0°C and 1.01325 bar, multiply SCFH by 0.0268.

To determine wide-open flow capacities for relief sizing, use the following formula:

$$Q = \sqrt{\frac{520}{GT}} C_g P_1 \text{SIN} \left(\frac{3417}{C_1} \sqrt{\frac{\Delta P}{P_1}} \right) \text{DEG}$$

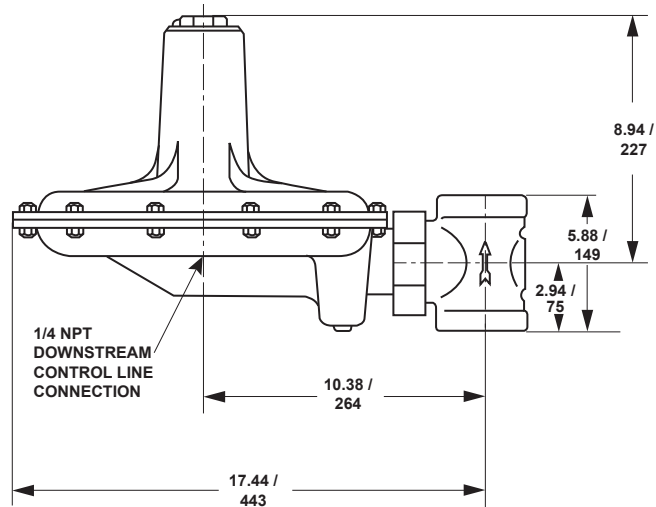
where,

- C_g = gas sizing coefficient from Table 6
- C_1 = C_g/C_v or 35 from Table 6
- G = gas specific gravity (air = 1.0)
- $P_{1\text{abs}}$ = inlet pressure, psia (add 14.7 psi to gauge inlet pressure to obtain absolute inlet pressure)
- Q = flow rate, SCFH
- T = absolute temperature in °Rankine of gas at inlet

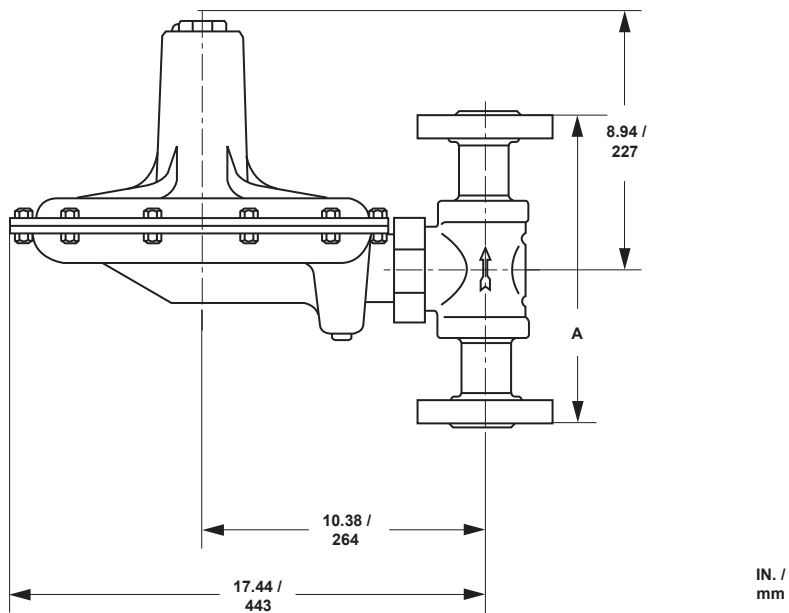
Ordering Information

When ordering, specify:

1. Type of gas being controlled (nitrogen fuel gas, etc.); list any factors such as impurities in the gas that may affect compatibility of the gas with the regulator trim parts.
2. Specific gravity of the gas
3. Temperature of the gas
4. Range of flowing inlet pressures to regulator
5. Flow rates
 - a) Minimum controlled flow
 - b) Normal flow
 - c) Maximum flow
6. Line size and end connection size of adjacent piping. Adjacent downstream piping must be the same size as the regulator body or longer.
7. Vessel size



NPT DIMENSIONS



A - CAST IRON FLANGES ARE 10 IN. / 254 mm FACE-TO-FACE; STEEL, STAINLESS STEEL AND HASTELLOY® C FLANGES ARE 14 IN. / 356 mm FACE-TO-FACE.

FLANGED DIMENSIONS

Figure 3. Dimensions

Table 6. Orifice Sizes and Coefficients for Relief Valve Sizing

BODY SIZE		ORIFICE SIZE		WIDE-OPEN C _v	WIDE-OPEN C _g	C ₁
NPS	DN	In.	mm			
1-1/2 and 2	40 and 50	1/4	6.4	1.51	53.0	35
		3/8	9.5	3.14	111	
		1/2	13	5.43	190	
		3/4	19	11.9	415	
		1	25	20	700	
		1-3/16	30	26	910	

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Ordering Information

Carefully review the Specifications section, then specify the desired selection on the Ordering Guide. If a pilot

setpoint is not requested, the regulator will be factory set at the approximate midrange.

Ordering Guide

Body Size (Select One)

- NPS 1-1/2 / DN 40
- NPS 2 / DN 50

Body Material and End Connection Style (Select One)

Cast Iron

- NPT***
- CL125 FF (NPS 2 / DN 50 body only)*

WCC Steel

- NPT***
- SWE**
- CL150 RF**
- CL300 RF**
- PN 16/25/40*

CF8M Stainless Steel

- NPT***
- CL150 RF**
- CL300 RF**
- PN 16/25/40 RF*

Spring Case Material (Select One)

- Cast iron***
- WCC steel***
- CF8M Stainless steel**

Diaphragm Case Material (Select One)

- Cast iron***
- WCC steel***
- CF8M Stainless steel**

Trim Material (Select One)

- 304 Stainless steel***
- 316 Stainless steel**

Diaphragm Material (Select One)

- Nitrile (NBR) (**standard**)***
- Fluorocarbon (FKM)***
- Ethylenepropylene (EPDM)***
- Silicone (VMQ)***

Disk Material (Select One)

- Nitrile (NBR) (**standard**)***
- Fluorocarbon (FKM)***
- Polytetrafluoroethylene (PTFE)***
- Ethylenepropylene (EPDM)***

Orifice Size (Select One)

- 1/4 in. / 6.4 mm***
- 3/8 in. / 9.5 mm***
- 1/2 in. / 13 mm***
- 3/4 in. / 19 mm***
- 1 in. / 25 mm***
- 1-3/16 in. / 30 mm***

Outlet Pressure Range (Select One)

- 1 to 3 in. w.c. / 2 to 7 mbar, Brown***
- 3 to 11 in. w.c. / 7 to 27 mbar, Iridite***
- 6.5 in. w.c. to 1.2 psig / 16 to 83 mbar, Green***
- 0.7 to 2 psig / 48 mbar to 0.14 bar, Blue***
- 1 to 3.2 psig / 69 mbar to 0.22 bar, Orange***
- 2 to 5.5 psig / 0.14 to 0.38 bar, Silver with Green stripe***
- 4 to 10 psig / 0.28 to 0.69 bar, Silver***

Pressure Registration (Select One)

- Internal***
- External**

PTFE Diaphragm Protector (Optional)

- Yes

CRN (Canadian Registration Number) Required (Optional)

- Yes

PED (Pressure Equipment Directive) Conformity (Optional)

- Yes

Replacement Parts Kit (Optional)

- Yes, send one replacement parts kit to match this order.

Ordering Guide (continued)

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Tank Blanketing Specification Worksheet	
Application Specifications:	
Tank Size	_____
Pump In Rate	_____
Pump Out Rate	_____
Blanketing Gas (Type and Specific Gravity)	_____
Pressure Requirements:	
Maximum Inlet Pressure (P_{1max})	_____
Minimum Inlet Pressure (P_{1min})	_____
Control Pressure Setting (P_2)	_____
Maximum Flow (Q_{max})	_____
Accuracy Requirements:	
<input type="checkbox"/> 0.25 in. w.c. / 0.6 mbar	<input type="checkbox"/> 0.5 in. w.c. / 1 mbar
<input type="checkbox"/> 1 in. w.c. / 2 mbar	<input type="checkbox"/> 2 in. w.c. / 5 mbar
<input type="checkbox"/> Other _____	
Other Specifications:	
Is a vapor recovery regulator required? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Special Material Requirements: <input type="checkbox"/> Ductile Iron <input type="checkbox"/> Steel	
<input type="checkbox"/> Stainless steel <input type="checkbox"/> Other _____	
Other Requirements: _____	

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