

Y695A Series Vapor Recovery Regulators

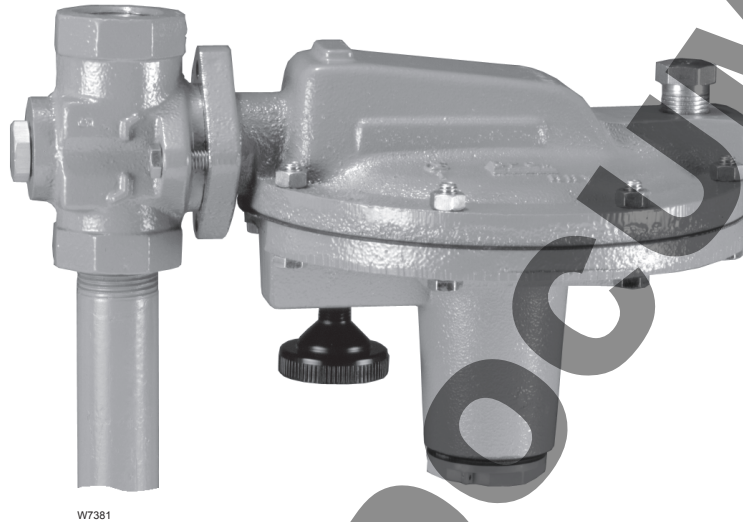


Figure 1. Y695A Series Vapor Recovery Regulators

Introduction

The Y695A Series are direct-operated vapor recovery regulators. These regulators are used to sense an increase in vessel pressure and vent excessive internal tank pressure to an appropriate vapor recovery disposal or reclamation system. They may also be used as backpressure regulators or relief valves.

Features

- **Precision Control**—Large diaphragm area provides very accurate throttling control at low pressure settings.
- **Easy Conversion**—Changes easily from the Type Y695A to the Type Y695AM with two O-rings and a machine screw.
- **Rugged Construction**—Heavy duty casings and internal parts are designed to reduce vibration and shock and give this regulator the ability to withstand 150 psig (10,3 bar) inlet pressure with no internal parts damage.
- **Simplicity**—Direct-operated, straightforward stem and lever design minimizes the number of parts while providing excellent regulation of pressure.

Bulletin 74.2:Y695A

Specifications

Available Configurations

Type Y695A: Direct-operated vapor recovery regulator.

Type Y695AM: Direct-operated vapor recovery regulator equipped with a blocked throat and O-ring stem seal. The lower diaphragm casing is tapped 1/2-inch NPT for control line connection.

Body Sizes

3/4 or 1-inch (DN 20 or 25)

End Connection Styles

See Table 1

Maximum Allowable Inlet (Casing) Pressure⁽¹⁾

150 psig (10,3 bar)

Maximum Outlet Pressure⁽¹⁾

150 psig (10,3 bar)

Maximum Emergency Inlet Pressure to Avoid Internal Parts Damage

150 psig (10,3 bar)

Control Pressure Ranges⁽¹⁾

See Table 2

Flow Coefficients with Fully Open Disk

C_g : 120, C_v : 3.43, C_f : 35

Flow Capacities

See Table 4

Orifice Size

7/16-inch (11,1 mm)

Construction Materials

See Table 3

Material Temperature Capabilities⁽¹⁾

Nitrile:

-20° to 180°F (-29° to 82°C)

Fluoroelastomer (FKM):

40° to 300°F (4° to 149°C)

Perfluoroelastomer (FFKM):

-20° to 300°F (-29° to 149°C)

Ethylenepropylene (EPDM):

-20° to 300°F (-29° to 149°C)

Pressure Setting Adjustment

Adjusting Screw

Spring Case Vent Connection

1/4-inch NPT

Diaphragm Case Connection

1/2-inch NPT

Approximate Weight

19 pounds (8,62 kg)

1. The pressure/temperature limits in this bulletin and any applicable standard or code limitation should not be exceeded.

Table 1. End Connection Styles

BODY SIZES, INCHES (DN)	END CONNECTION STYLES ⁽¹⁾		
	Ductile Iron	CF8M Stainless Steel	Hastelloy C
3/4 or 1 (20 or 25)	NPT	NPT, ANSI Class 150 RF, ANSI Class 300 RF, or PN 16/25/40	ANSI Class 150 RF

1. All flanges have 14-inches (356 mm) face-to-face.

Table 2. Control Pressure Ranges

RELIEF SET PRESSURE RANGE	SPRING PART NUMBER	SPRING COLOR	SPRING WIRE DIAMETER	FREE LENGTH
2 to 7-inches w.c. (5 to 17 mbar) ⁽¹⁾⁽²⁾	1B653827052	Red	0.085-inch (2,16 mm)	3.625-inches (92,1 mm)
3 to 13-inches w.c. (7 to 32 mbar) ⁽¹⁾⁽²⁾	1B653927022	Olive drab	0.105-inch (2,67 mm)	3.75-inches (95,2 mm)
10 to 26-inches w.c. (25 to 65 mbar)	1B537027052	Yellow	0.114-inch (2,90 mm)	4.188-inches (106 mm)
0.9 to 2.5 psig (0,062 to 0,17 bar)	1B537127022	Light green	0.156-inch (3,96 mm)	4.060-inches (103 mm)
1.3 to 4.5 psig (0,09 to 0,31 bar)	1B537227022	Light blue	0.187-inch (4,75 mm)	3.938-inches (100 mm)
3.8 to 7 psig (0,26 to 0,48 bar)	1B537327052	Black	0.218-inch (5,54 mm)	3.980-inches (101 mm)

1. Spring ranges based on spring case installed pointed down. When installed pointing up, the spring ranges increase by 2-inches w.c. (5 mbar).
2. Do not use fluoroelastomer (FKM) diaphragm with these springs at diaphragm temperatures lower than 60°F (16°C).

Table 3. Construction Materials

BODY	SPRING CASE	DIAPHRAGM CASE	DISK HOLDER	DIAPHRAGM	DISK
Ductile iron, CF8M Stainless steel, or Hastelloy C	Ductile iron or CF8M Stainless steel	Ductile iron, CF8M Stainless steel, or Hastelloy C	S31600 Stainless steel or Hastelloy C	Nitrile (NBR), Fluoroelastomer (FKM), or Nitrile (NBR) with bonded Teflon (PTFE)	Nitrile (NBR), Fluoroelastomer (FKM), Perfluoroelastomer (FFKM), Teflon (PTFE), or Ethylenepropylene (EPDM)

Table 4. Y695A Series Capacities

SPRING RANGE, PART NUMBER, AND COLOR	SET PRESSURE	MINIMUM BUILDUP TO WIDE-OPEN	VACUUM OUTLET PRESSURE	CAPACITIES IN SCFH (Nm ³ /h) OF 0.97 SPECIFIC GRAVITY NITROGEN
2 to 7-inches w.c. (5 to 17 mbar) 1B653827052 Red	2-inches w.c. (5 mbar)	1.5-inches w.c. (3,7 mbar)	0 psig (0 bar) 2.5 psig (0,17 bar) 5 psig (0,34 bar)	280 (7,50) 1180 (31,6) 1520 (40,7)
	4-inches w.c. (10 mbar)	1.5-inches w.c. (3,7 mbar)	0 psig (0 bar) 2.5 psig (0,17 bar) 5 psig (0,34 bar)	350 (9,38) 1200 (32,2) 1530 (41,0)
3 to 13-inches w.c. (7 to 32 mbar) 1B653927022 Olive drab	10-inches w.c. (25 mbar)	2.3-inches w.c. (5,7 mbar)	0 psig (0 bar) 2.5 psig (0,17 bar) 5 psig (0,34 bar)	520 (13,9) 1250 (33,5) 1570 (42,1)
10 to 26-inches w.c. (25 to 65 mbar) 1B537027052 Yellow	15-inches w.c. (37 mbar)	3.4-inches w.c. (8,5 mbar)	0 psig (0 bar) 2.5 psig (0,17 bar) 5 psig (0,34 bar)	640 (17,2) 1300 (34,8) 1600 (42,9)
0.9 to 2.5 psig (0,06 to 0,17 bar) 1B537127022 Light green	1 psig (0,07 bar)	0.40 psig (0,03 bar)	0 psig (0 bar) 2.5 psig (0,17 bar) 5 psig (0,34 bar)	940 (25,2) 1450 (38,9) 1720 (46,1)
1.3 to 4.5 psig (0,09 to 0,31 bar) 1B537227022 Light blue	2 psig (0,14 bar)	0.88 psig (0,06 bar)	0 psig (0 bar) 2.5 psig (0,17 bar) 5 psig (0,34 bar)	1360 (36,4) 1730 (46,4) 1940 (52,0)
3.8 to 7 psig (0,26 to 0,48 bar) 1B537327052 Black	5 psig (0,34 bar)	1.66 psig (0,11 bar)	0 psig (0 bar) 2.5 psig (0,17 bar) 5 psig (0,34 bar)	2110 (56,5) 2330 (62,4) 2470 (66,2)

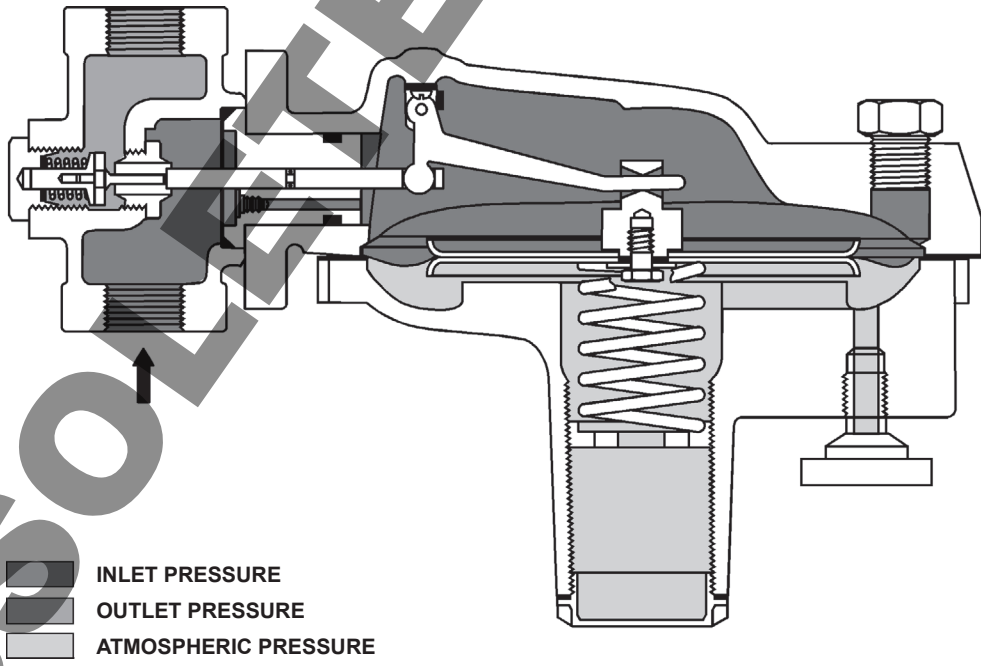


Figure 2. Y695A Series Operational Schematic

Bulletin 74.2:Y695A

Table 5. Materials Compatibility

CORROSION INFORMATION															
Fluid	Material							Fluid	Material						
	Carbon Steel	Cast or Ductile Iron	S30200 or S30400 Stainless Steel	CF8M or S31600 Stainless Steel	S41600 Stainless Steel	Monel ⁽¹⁾	Hastelloy C ⁽²⁾		Carbon Steel	Cast or Ductile Iron	S30200 or S30400 Stainless Steel	CF8M or S31600 Stainless Steel	S41600 Stainless Steel	Monel ⁽¹⁾	Hastelloy C ⁽²⁾
Acetic Acid (Air Free)	C	C	B	B	C	B	A	Hydrochloric Acid (Air free)	C	C	C	C	C	C	B
Acetic Acid Vapors	C	C	A	A	C	A	A	Hydrogen	A	A	A	A	A	A	A
Acetone	A	A	A	A	A	A	A	Hydrogen Peroxide	I.L.	A	A	A	B	A	B
Acetylene	A	A	A	A	A	A	A	Hydrogen Sulfide (Liquid)	C	C	A	A	C	C	A
Alcohols	A	A	A	A	A	A	A	Magnesium Hydroxide	A	A	A	A	A	A	A
Aluminum Sulfate	C	C	A	A	C	B	A	Methanol	A	A	A	A	A	A	A
Ammonia	A	A	A	A	A	A	A	Methyl Ethyl Ketone	A	A	A	A	A	A	A
Ammonium Chloride	C	C	B	B	C	B	A	Natural Gas	A	A	A	A	A	A	A
Ammonium Nitrate	A	C	A	A	C	C	A	Nitric Acid	C	C	A	B	C	C	B
Ammonium Sulfate	C	C	B	A	C	A	A	Petroleum Oils, (Refined)	A	A	A	A	A	A	A
Ammonium Sulfite	C	C	A	A	B	C	A	Phosphoric Acid (Air Free)	C	C	A	A	C	B	A
Beer	B	B	A	A	B	A	A	Phosphoric Acid Vapors	C	C	B	A	C	C	I.L.
Benzene (Benzol)	A	A	A	A	A	A	A	Potassium Chloride	B	B	A	A	C	B	A
Benzoic Acid	C	C	A	A	A	A	A	Potassium Hydroxide	B	B	A	B	B	A	A
Boric Acid	C	C	A	A	B	A	A	Propane	A	A	A	A	A	A	A
Butane	A	A	A	A	A	A	A	Silver Nitrate	C	C	A	A	B	C	A
Calcium Chloride (Alkaline)	B	B	C	B	C	A	A	Sodium Acetate	A	A	B	A	A	A	A
Carbon Dioxide (Dry)	A	A	A	A	A	A	A	Sodium Carbonate	A	A	A	A	B	A	A
Carbon Dioxide (Wet)	C	C	A	A	A	A	A	Sodium Chloride	C	C	B	B	B	A	A
Carbon Disulfide	A	A	A	A	B	B	A	Sodium Chromate	A	A	A	A	A	A	A
Carbon Tetrachloride	B	B	B	B	C	A	A	Sodium Hydroxide	A	A	A	A	B	A	A
Carbonic Acid	C	C	B	B	A	A	A	Stearic Acid	A	C	A	A	B	B	A
Chlorine Gas (Dry)	A	A	B	B	C	A	A	Sulfur	A	A	A	A	A	A	A
Chlorine Gas (Wet)	C	C	C	C	C	C	B	Sulfur Dioxide (Dry)	A	A	A	A	B	A	A
Chlorine (Liquid)	C	C	C	C	C	C	A	Sulfur Trioxide (Dry)	A	A	A	A	B	A	A
Chromic Acid	C	C	C	B	C	A	A	Sulfuric Acid (Aerated)	C	C	C	C	C	C	A
Citric Acid	I.L.	C	B	A	B	B	A	Sulfuric Acid (Air Free)	C	C	C	C	C	B	A
Coke Oven Gas	A	A	A	A	A	B	A	Sulfurous Acid	C	C	B	B	C	C	A
Copper Sulfate	C	C	B	B	A	C	A	Trichloroethylene	B	B	B	A	B	A	A
Ether	B	B	A	A	A	A	A	Water (Boiler Feed)	B	C	A	A	B	A	A
Ethyl Chloride	C	C	A	A	B	A	A	Water (Distilled)	A	A	A	A	B	A	A
Ethylene	A	A	A	A	A	A	A	Water (Sea)	B	B	B	B	C	A	A
Ethylene Glycol	A	A	A	A	A	A	I.L.	Zinc Chloride	C	C	C	C	C	C	A
Formaldehyde	B	B	A	A	A	A	A	Zinc Sulfate	C	C	A	A	B	A	A
Formic Acid	I.L.	C	B	B	C	A	A								
Freon (Wet)	B	B	B	A	I.L.	A	A								
Freon (Dry)	B	B	A	A	I.L.	A	A								
Gasoline (Refined)	A	A	A	A	A	A	A								
Glucose	A	A	A	A	A	A	A								
Hydrochloric Acid (Aerated)	C	C	C	C	C	C	B								

1. Monel is a trademark of International Nickel Co.
 2. Hastelloy is a trademark of Stellite Div., Cabot Corp.

A+--Best possible selection
 A--Recommended
 B--Minor to moderate effect. Proceed with caution.
 C--Unsatisfactory
 I.L.--Information lacking

- continued -

Principle of Operation

Y695A Series vapor recovery regulators are used to maintain a constant blanket (inlet) pressure or vessel pressure with the outlet flowing to a system whose pressure is lower than the inlet (see Figure 2).

When vessel pressure increases above the setpoint of the regulator due to pumping in or thermal heating, the force of the control spring is overcome by pressure acting on the diaphragm. This moves the disk away from the orifice, allowing gas to flow from the vessel to the vapor recovery system. As vessel pressure is

Table 5. Materials Compatibility (continued)

Fluid	FLUID INFORMATION				
	Material				
	Neoprene (CR)	Nitrile (NBR)	Fluoroelastomer (FKM)	Perfluoroelastomer (FFKM)	Ethylene propylene (EPDM)
Acetic Acid (30%)	C	B	B	A	A
Acetone	B	C	C	A	A
Alcohol (Ethyl)	A	A	B	A	A
Alcohol (Methyl)	A+	A	C	A	A
Ammonia (Anhydrous)	A	C	C	A	A
Ammonia (Gas, Hot)	B	C	C	A	B
Benzene	C	C	A	A	C
Brine (Calcium Chloride)	A	A	B	A	A
Butadiene Gas	B	C	B	A	C
Butane (Gas)	A	A+	A	A	C
Butane (Liquid)	B	A	A	A	C
Carbon Tetrachloride	C	C	A	A	C
Chlorine (Dry)	C	C	A	A	C
Chlorine (Wet)	C	C	A	A	C
Coke Oven Gas	C	B	A+	A	C
Ethyl Acetate	C	C	C	A	B
Ethylene Glycol	A	A	A	A	A
Freon 11	B	A	A+	A	C
Freon 12	A+	A	B	A	B
Freon 22	A+	C	C	A	A
Freon 114	A	A	B	A	A
Gasoline	B	A+	A	A	C
Hydrogen Gas	A	A	A	A	A
Hydrogen Sulfide (Dry)	A	C	C	A	A
Hydrogen Sulfide (Wet)	B	C	C	A	A
Jet Fuel (JP-4)	C	A	A	A	I.L.
Natural Gas	A	A+	A	A	C
Natural Gas + H ₂ S (Sour Gas)	A	B	C	A	C
Nitric Acid (20%)	B	C	A	A	C
Nitric Acid (50 to 100%)	C	C	A	A	C
Nitrogen	A	A	A	A	A
Oil (Fuel)	B	A+	A	A	C
Propane	A	A	A	A	C
Sulfur Dioxide	B	A	A	A	A
Sulfuric Acid (to 50%)	A	C	A	A	A
Sulfuric Acid (50 to 100%)	B	C	A	A	B
Water (Ambient)	C	C	A	A	B
Water [at 200°F (93°C)]	A	A	A	A	A
Water (Sea)	C	B	B	A	A

A+--Best possible selection
A--Recommended
B--Minor to moderate effect. Proceed with caution.
C--Unsatisfactory
I.L.--Information lacking

reduced, the force of the back disk spring causes the disk to move toward the orifice, decreasing the flow of gas out of the vessel. As vessel pressure drops below the setpoint of the regulator, the disk will seat against the orifice, shutting off the flow of gas.

Sizing Vapor Recovery Systems

To determine the capacity required, you must consider the amount of blanketing gas that must be displaced from the tank when either filling the vessel with liquid

(pump-in) or the expansion of tank vapors during atmospheric thermal heating.

Using the established procedures from American Petroleum Institute Standard 2000 (API 2000), determine the required flow rate for outbreathing.

For liquids with a flash point below 100°F (38°C) or a normal boiling point below 300°F (149°C), multiply the calculated outbreathing requirements in Table 6 by 2.0 as indicated in footnote 1 from Table 6.

Bulletin 74.2:Y695A

Table 6. Flow Rate Conversions (Gas flow required to displace blanketing gas with pump-in of liquid.)

MULTIPLY MAXIMUM PUMP RATE IN	BY	TO OBTAIN
U.S. GPM	8.021	SCFH air required ⁽¹⁾⁽²⁾
U.S. GPH	0.1337	
Barrels/hour	5.615	
Barrels/day	0.2340	

1. For liquids with a flash point below 100°F (38°C) or normal boiling point below 300°F (149°C), multiply the above calculated outbreathing requirement by 2.0.
2. To convert to Nm³/h multiply SCFH by 0.0268.

- Determine the flow rate of blanketing gas displaced when liquid is being pumped in (see Table 6).
- Determine the gas flow rate due to "outbreathing" caused by atmospheric thermal heating (see Table 7).
- Add the requirements of steps 1 and 2 and select a vapor recovery regulator size based on total capacity required from Table 4.

Sample sizing problem for vapor recovery applications:

Vessel capacity 1000 barrels (42,000 gal)(159 000 liters)
Pump in capacity 20 GPM (75,7 l/min)
Inlet pressure source 60 psig (4,14 bar) nitrogen
Desired blanket setpoint 0.5-inches w.c. (1 mbar)
Desired vapor recovery setpoint . . . 2-inches w.c. (5 mbar)
Vapor recovery vacuum source . . . 5-inches Hg (169 mbar)
Fluid Hexane
Boiling point 155°F (68°C)

- From Table 6 the desired air flow rate due to pump in equals 20 GPM (75,7 l/min) x 8.021 x 2 = 321 SCFH (8,60 Nm³/h) air.
- From Table 7 the desired air flow rate = 1000 SCFH (26,8 Nm³/h) air due to thermal heating.
- Total required flow rate = 1000 SCFH (26,8 Nm³/h) air + 320 SCFH (8,58 Nm³/h) = 1320 SCFH (35,4 Nm³/h) air. This converts to nitrogen requirements of 1340 SCFH (35,9 Nm³/h).

Capacity Information

Table 4 gives typical nitrogen regulating capacities at selected inlet pressures and outlet pressure settings. Flows are in SCFH at 60°F and 14.7 psia and Nm³/h at 0°C and 1,01325 bar of 0.97 specific gravity nitrogen. For gases of other specific gravities, multiply the given capacity of nitrogen by 0.985, and divide by the

Table 7. Gas Flow Required for Thermal Heating (Outbreathing) per API 2000 (Interpolate for intermediate sizes.)

VESSEL CAPACITY			SCFH (Nm ³ /h) AIR FLOW RATE REQUIRED	
Barrels	Gallons	Liters	Flash point is equal to or above 100°F (38°C) or normal boiling point is equal to or above 300°F (149°C)	
			Flash point is below 100°F (38°C) or normal boiling point is below 300°F (149°C)	
60	2500	9500	40 (1,07)	60 (1,61)
100	4200	15 000	60 (1,61)	100 (2,68)
500	21,000	79 500	300 (8,04)	500 (13,4)
1000	42,000	159 000	600 (16,1)	1000 (26,8)
2000	84,000	318 000	1200 (32,2)	2000 (53,6)
3000	126,000	477 000	1800 (48,2)	3000 (80,4)
4000	168,000	636 000	2400 (64,3)	4000 (107)
5000	210,000	795 000	3000 (80,4)	5000 (134)
10,000	420,000	1 590 000	6000 (161)	10,000 (268)
15,000	630,000	2 385 000	9000 (241)	15,000 (402)
20,000	840,000	3 180 000	12,000 (322)	20,000 (536)
25,000	1,050,000	3 975 000	15,000 (402)	24,000 (643)
30,000	1,260,000	4 769 000	17,000 (456)	28,000 (750)
35,000	1,470,000	5 564 000	19,000 (509)	31,000 (831)
40,000	1,680,000	6 359 000	21,000 (563)	34,000 (911)
45,000	1,890,000	7 154 000	23,000 (616)	37,000 (992)
50,000	2,100,000	7 949 000	24,000 (643)	40,000 (1072)
60,000	2,520,000	9 539 000	27,000 (724)	44,000 (1179)
70,000	2,940,000	11 129 000	29,000 (777)	48,000 (1286)
80,000	3,360,000	12 718 000	31,000 (831)	52,000 (1394)
90,000	3,780,000	14 308 000	34,000 (911)	56,000 (1501)
100,000	4,200,000	15 898 000	36,000 (965)	60,000 (1608)
120,000	5,040,000	19 078 000	41,000 (1099)	68,000 (1822)
140,000	5,880,000	22 257 000	45,000 (1206)	75,000 (2010)
160,000	6,720,000	25 437 000	50,000 (1340)	82,000 (2198)
180,000	7,560,000	28 616 000	54,000 (1447)	90,000 (2412)

square root of the appropriate specific gravity of the gas required. To determine regulating capacities at pressure settings not given or to determine wide-open flow capacities, 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 Specifications
- C_1 = C_g/C_v or 35 from Specifications
- G = gas specific gravity (air = 1.0)
- P_{1abs} = 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 (°Rankine = °F + 460)
- ΔP = Pressure differential across the valve, psig ($P_1 - P_2$)

Installation

Install the regulator using a straight run of pipe the same size or larger as the regulator body. Flow through the regulator body is indicated by the flow arrow on the body. If a block valve is required, install a full flow valve between the regulator and the blanketed vessel. For proper operation at low setpoint ranges, the regulators should be installed with the spring case pointed down.

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.

Ordering information

When ordering, specify:

Application

1. Type of gas being controlled (natural gas, air, etc.); list any factors such as impurities in the gas that may affect compatibility of gas with the regulator trim parts.

Regulator

Refer to the Specifications table on page 2. Carefully review the description of each specification and make the desired selection wherever there is a choice. Always specify the type number.

BODY SIZE, INCHES (DN)	DIMENSIONS, INCHES (mm)									
	A		B		D		F		G	
	Iron	Stainless Steel or Hastelloy C	Ductile Iron	Stainless Steel or Hastelloy C	Ductile Iron	Stainless Steel or Hastelloy C	Ductile Iron	Stainless Steel or Hastelloy C	Ductile Iron	Stainless Steel or Hastelloy C
3/4, 1 (20, 25)	4.0 (102)	4.12 (105)	2.12 (53,8)	2.25 (57,1)	6.19 (157)	6.19 (157)	10.38 (264)	10.38 (264)	1.69 (42,9)	1.69 (42,9)

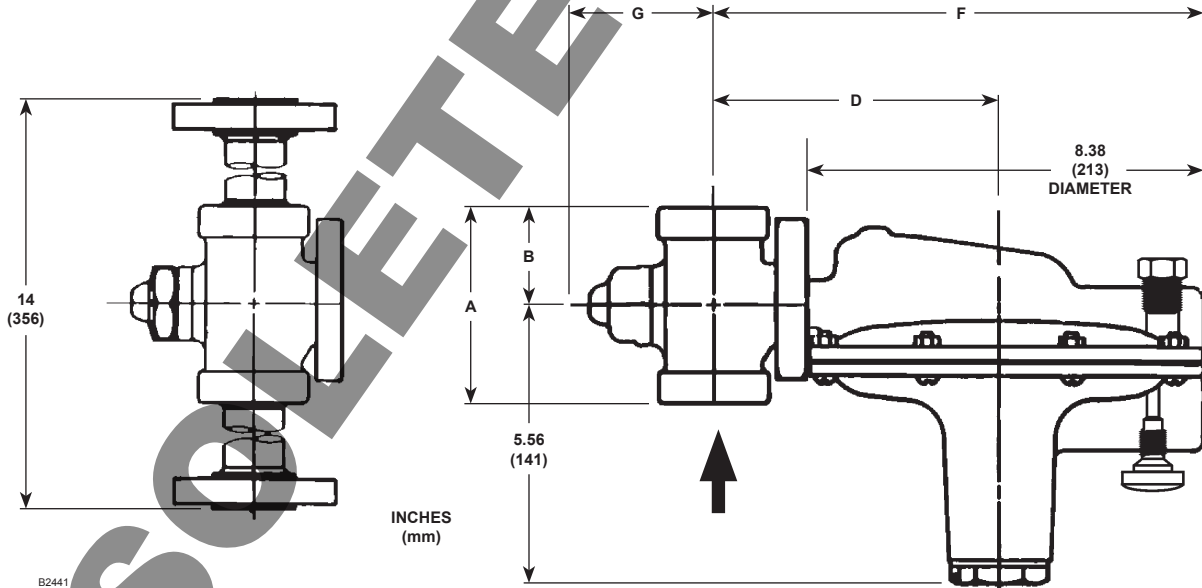


Figure 3. Dimensions

OBsolete DOCUMENT

Industrial

USA - Headquarters
McKinney, Texas 75070 USA
Tel: 1-800-558-5856
Outside U.S. 1-469-293-4201

Asia-Pacific
Shanghai, China 201206
Tel: 86-21-5899 7887

Europe
Bologna, Italy 40013
Tel: 39 051 4190611

Natural Gas Technologies

USA - Headquarters
McKinney, Texas 75070
Tel: 1-800-558-5856
Outside U.S. 1-469-293-4201

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Industrial/High Purity

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