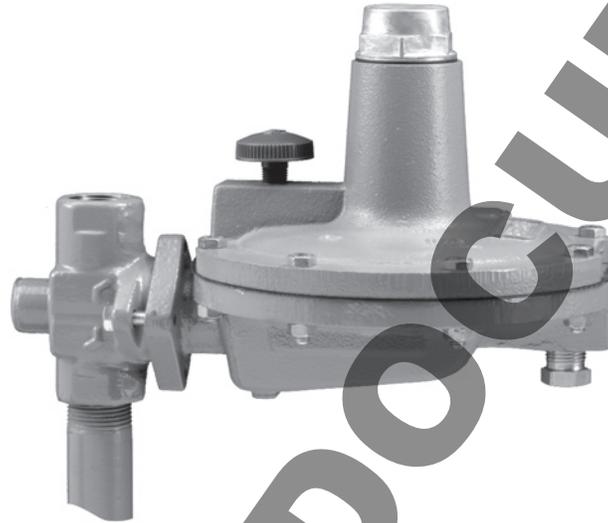


# Y690VB Series Vacuum Breakers



W7292

Figure 1. Type Y690VB Vacuum Breaker

## Introduction

The Y690VB Series direct-operated vacuum breakers are used for precise control of small capacity and low-pressure service applications where an increase in vacuum must be limited. The Type Y690VB has internal pressure registration. The Type Y690VBM has a control line connection and an O-ring stem seal for external pressure registration.

## Features

- **Common Spare Parts:**

The Type Y690VB and the Type Y690VBM have common spare parts with the other Y690A Series products.

- **Tamper-Resistant Adjustment:**

Closing cap and spring case on many types allow installation of sealing wire to discourage or detect unauthorized adjustment of pressure setting.

- **Easy Conversion:**

The Type Y690VB converts easily to the Type Y690VBM.

- **Precision Control of Low-Pressure Settings:**

Large diaphragm areas provide more accurate control at low-pressure settings.

- **Corrosion Resistance:**

Constructions are available in a variety of materials for compatibility with corrosive process gases.

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## Specifications

### Available Configurations

**Type Y690VB:** Direct-operated vacuum breaker with internal registration.

**Type Y690VBM:** Direct-operated vacuum breaker equipped with a blocked throat and control line connection for external pressure registration.

### Body Sizes

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

### End Connection Styles

See table 1

### Maximum Allowable Inlet Pressure<sup>(1)</sup>

150 psig (10,3 bar)

### Maximum Outlet (Casing) Pressure<sup>(1)</sup>

Full Vacuum

### Maximum Emergency Outlet Pressure to Avoid Internal Parts Damage<sup>(1)</sup>

150 psig (10,3 bar)

### Vacuum Control Pressure Ranges<sup>(1)</sup>

See table 4

### Flow Coefficients

See table 2

### Flow Capacities

See table 6

### Construction Materials

See table 3

### Material Temperature Capabilities<sup>(1)</sup>

#### Nitrile (NBR):

-20° to 180°F (-29° to 82°C)

#### Fluoroelastomer (FKM):

40° to 300°F (4° to 149°C)

#### Ethylenepropylene (EPDM):

-20° to 300°F (-29° to 149°C)

#### Perfluoroelastomer (FFKM):

-20° to 300°F (-29° to 149°C)

### Pressure Registration

**Type Y690VB:** Internal

**Type Y690VBM:** External

### Orifice Size

1/4-inch (6,35 mm)

1/2-inch (12,7 mm)

### Pressure Setting Adjustment

Adjusting Nut

### Spring Case Connection

1/4-inch NPT Screwed

### Diaphragm Case Connection

1/2-inch NPT Screwed

### 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 SIZE, INCHES (DN)	END CONNECTION STYLE <sup>(1)</sup>	
	Ductile Iron	Stainless Steel
3/4 (20)	NPT Screwed	NPT Screwed, SWE, or ANSI Class 150 RF
1 (25)		

1. All flange dimensions are 14-inches (356 mm) face-to-face.

**Table 2. Flow Coefficients**

ORIFICE SIZE	FLOW COEFFICIENT		
	C <sub>g</sub>	C <sub>v</sub>	C <sub>1</sub>
1/4-inch (6,35 mm)	50	1.4	35
1/2-inch (12,7 mm)	200	5.7	35

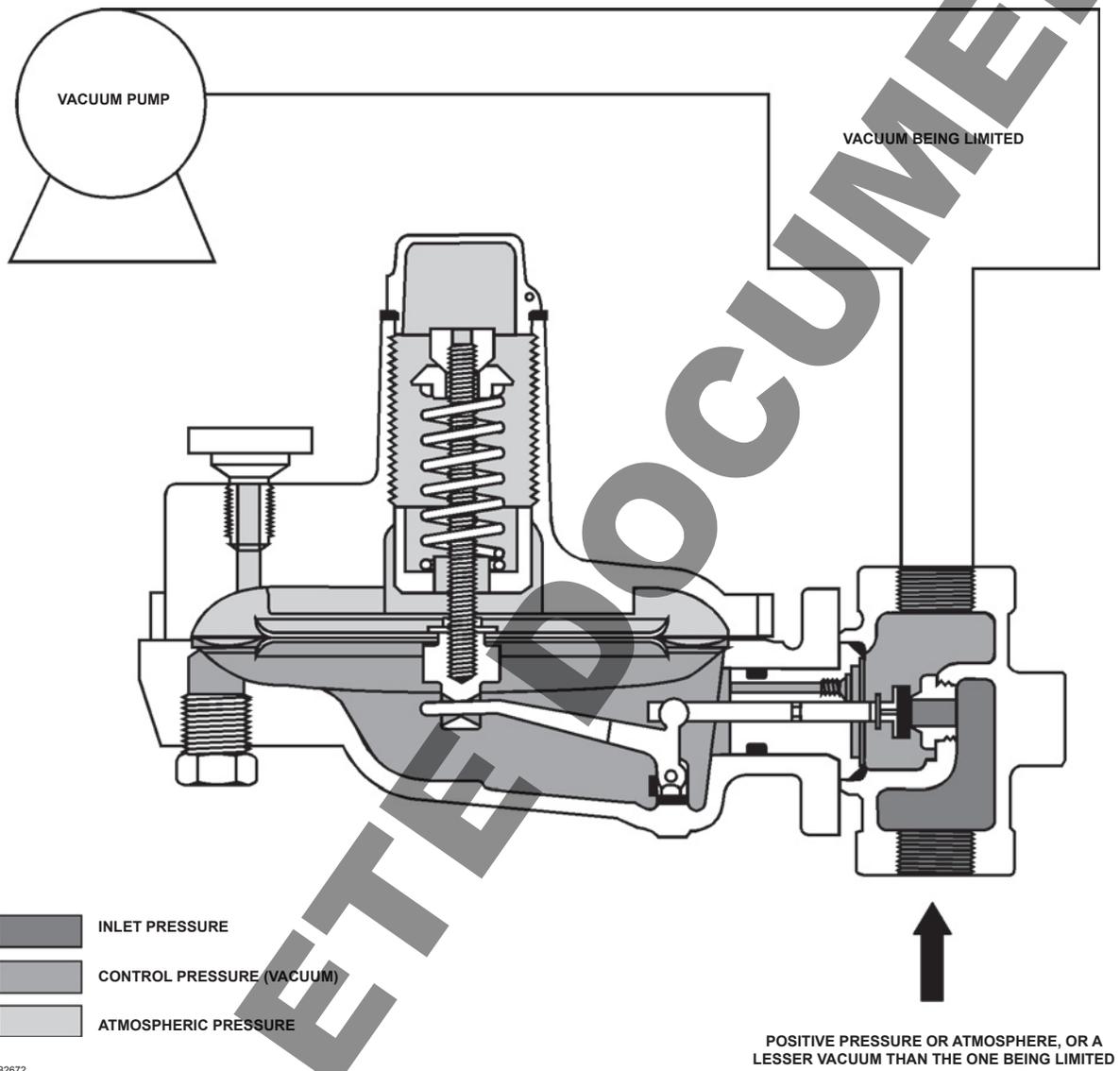


Figure 2. Y690VB Operational Schematic

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**Table 3. Construction Materials**

BODY	SPRING CASE	DIAPHRAGM CASE	TRIM	DIAPHRAGM	DISK
Ductile iron or CF8M Stainless steel	Ductile iron or CF8M Stainless steel	Ductile iron or CF8M Stainless steel	S30300 Stainless steel	Nitrile (NBR) or Fluoroelastomer (FKM)	Nitrile (NBR) or Fluoroelastomer (FKM)

**Table 4. Vacuum Control Pressure Ranges**

VACUUM CONTROL PRESSURE RANGE <sup>(1)(2)</sup>	CHANGE IN VACUUM TO WIDE-OPEN		SPRING PART NUMBER	SPRING COLOR	SPRING WIRE DIAMETER
	1/4-inch (6,35 mm) Orifice	1/2-inch (12,7 mm) Orifice			
0 to 4-inches w.c. (0 to 10 mbar)	0.6-inches w.c. (1,5 mbar)	1.3-inches w.c. (3 mbar)	0N039427222	Unpainted	0.062-inches (1,58 mm)
0 to 1.0 psig (0 to 0,07 bar)	10-inches w.c. (25 mbar)	0.7 psig (0,05 bar)	0N086127022	Unpainted	0.125-inches (3,18 mm)
0 to 2.1 psig (0 to 0,15 bar)	1.2 psig (0,08 bar)	2.4 psig (0,17 bar)	0N004327022	Yellow	0.172-inches (4,37 mm)
0 to 5 psig (0 to 0,35 bar)	3.2 psig (0,22 bar)	6.3 psig (0,43 bar)	1D1418227012	Dark blue	0.207-inches (5,26 mm)

1. Spring ranges based on atmospheric inlet pressure.  
2. To convert to inches Hg, multiply psig value by 2.04.

**Table 5. Maximum Setpoints for Achieving Wide-Open Flow**

SPRING RANGE, PART NUMBER, AND COLOR <sup>(1)(2)</sup>	ORIFICE SIZE	MAXIMUM ALLOWED VACUUM	MAXIMUM SETPOINTS FOR ACHIEVING WIDE-OPEN FLOW AT SPECIFIC INLET PRESSURES					
			0 Psi (0 bar)	25 Psi (1,72 bar)	50 Psi (3,45 bar)	75 Psi (5,17 bar)	100 Psi (6,90 bar)	125 Psi (8,62 bar)
0 to 4-inches w.c. (0 to 10 mbar) 0N039427222 Unpainted	1/4-inch (6,35 mm)	5.1 psig (0,35 bar)	4-inches w.c. (10 mbar)	4-inches w.c. (10 mbar)	3.5-inches w.c. (8,7 mbar)	3-inches w.c. (7,5 mbar)	2.5-inches w.c. (6,2 mbar)	2-inches w.c. (5 mbar)
	1/2-inch (12,7 mm)		4-inches w.c. (10 mbar)	3-inches w.c. (7,5 mbar)	1.5-inches w.c. (3,7 mbar)	0-inches w.c. (0 mbar)	0-inches w.c. (0 mbar)	0-inches w.c. (0 mbar)
0 to 1.0 psig (0 to 0,069 bar) 0N086127022 Unpainted	1/4-inch (6,35 mm)	6.0 psig (0,41 bar)	1 psig (0,069 bar)	1 psig (0,069 bar)	1 psig (0,069 bar)	1 psig (0,069 bar)	0.96 psig (0,066 bar)	0.92 psig (0,063 bar)
	1/2-inch (12,7 mm)		1 psig (0,069 bar)	0.95 psig (0,066 bar)	0.9 psig (0,062 bar)	0.85 psig (0,059 bar)	0.8 psig (0,055 bar)	0.75 psig (0,052 bar)
0 to 2.1 psig (0 to 0,145 bar) 0N004327022 Yellow	1/4-inch (6,35 mm)	7.1 psig (0,49 bar)	2.1 psig (0,145 bar)	2.1 psig (0,145 bar)	2.1 psig (0,145 bar)	2.1 psig (0,145 bar)	2.05 psig (0,141 bar)	2.0 psig (0,138 bar)
	1/2-inch (12,7 mm)		2.1 psig (0,145 bar)	2.1 psig (0,145 bar)	2.05 psig (0,141 bar)	1.98 psig (0,137 bar)	1.92 psig (0,132 bar)	1.86 psig (0,128 bar)
0 to 5 psig (0 to 0,34 bar) 1D1418227012 Dark blue	1/4-inch (6,35 mm)	12.0 psig (0,83 bar)	5.0 psig (0,34 bar)	5.0 psig (0,34 bar)	5.0 psig (0,34 bar)	5.0 psig (0,34 bar)	5.0 psig (0,34 bar)	5.0 psig (0,34 bar)
	1/2-inch (12,7 mm)		5.0 psig (0,34 bar)	5.0 psig (0,34 bar)	5.0 psig (0,34 bar)	5.0 psig (0,34 bar)	5.0 psig (0,34 bar)	5.0 psig (0,34 bar)

1. Spring ranges based on atmospheric inlet pressure.  
2. To convert to inches Hg, multiply psig value by 2.04.

**Table 6. Type Y690VB Capacities**

SPRING RANGE, PART NUMBER, AND COLOR <sup>(1)</sup>	VACUUM CONTROL SETTING <sup>(2)</sup>	ORIFICE SIZE	CHANGE IN VACUUM TO WIDE-OPEN	CAPACITIES IN SCFH (Nm <sup>3</sup> /h) OF 1.0 SPECIFIC GRAVITY AIR
0 to 4-inches w.c. (0 to 10 mbar) 0N039427222 Unpainted	2-inches w.c. (5 mbar)	1/4-inch (6,35 mm)	0.6-inches w.c. (1,5 mbar)	110 (2,95)
		1/2-inch (12,7 mm)	1.3-inches w.c. (3 mbar)	486 (13,0)
0 to 1.0 psig (0 to 0,069 bar) 0N086127022 Unpainted	0.5 psig (0,034 bar)	1/4-inch (6,35 mm)	10-inches w.c. (25 mbar)	293 (7,85)
		1/2-inch (12,7 mm)	0.7 psig (0,048 bar)	1382 (37,0)
0 to 2.1 psig (0 to 0,145 bar) 0N004327022 Yellow	2 psig (0,14 bar)	1/4-inch (6,35 mm)	1.2 psig (0,08 bar)	524 (14,0)
		1/2-inch (12,7 mm)	2.4 psig (0,17 bar)	2353 (63,1)
0 to 5 psig (0 to 0,34 mbar) 1D141827012 Dark blue	4 psig (0,28 bar)	1/4-inch (6,35 mm)	3.2 psig (0,22 bar)	682 (18,3)
		1/2-inch (12,7 mm)	6.3 psig (0,43 bar)	2910 (78,0)

1. Spring ranges based on atmospheric inlet pressure.  
2. To convert to inches Hg, multiply psig value by 2.04.

## Principle of Operation

An increase in vacuum (decrease in absolute pressure) beyond a set point registers on the diaphragm, opening the disk. This permits atmosphere, positive, or an upstream vacuum that has higher absolute pressure than the downstream vacuum, to enter the system and restore the controlled vacuum to the setpoint. On the Type Y690VB, the pressure registers internally underneath the diaphragm. The Type Y690VBM has a control line connecting the diaphragm casing to the vacuum line and a throat seal allowing for registration only through the control line connection.

## Note

**If the actual change in (control) pressure (from the service conditions) is less than the minimum change in (control) pressure required to fully open the vacuum breaker (table 6), the  $C_g$  in the formula must be reduced accordingly. To obtain the correct reduced  $C_g$ , multiply the  $C_g$  from table 2 by the ratio of the actual change in (control) pressure to the minimum change in (control) pressure required to fully open the vacuum breaker.**

## Capacity Information

To determine flow capacities for the Y690VB Series vacuum breakers, use the following formula:

$$Q = P_{1abs} C_g \text{ SIN} \left( \frac{3415}{C_1} \sqrt{\frac{\Delta P}{P_{1abs}}} \right)^{\text{deg}}$$

where,

- Q = flow capacity in SCFH (60°F and 14.7 psia) of air
- $P_{1abs}$  = absolute inlet pressure in psia ( $P_1$  gauge + 14.7)
- $C_g$  = flow coefficient (from table 3)
- $C_1$  = 35
- $\Delta P$  = pressure drop across vacuum breaker

## Conversion Factors

To determine equivalent capacities for natural gas, propane, butane, or nitrogen, multiply the calculated capacity by the following appropriate conversion factor: 1.29 for natural gas, 0.810 for propane, 0.707 for butane, or 1.018 for nitrogen. For gases of other specific gravities, divide by the square root of the appropriate specific gravity. Then, if capacity is desired in normal cubic meters per hour at 0°C and 1.01325 bar, multiply SCFH by 0.0268.

## Example Problem Using Formula

This example involves a Type Y690VB vacuum breaker with its outlet connected to a vessel in which the vacuum must be limited. This breaker has a 1/4-inch (6,35 mm)

orifice and a control spring set to start opening and admit atmospheric pressure whenever the vacuum pump downstream from the vessel increases the vessel vacuum to more than 4-inches w.c. (10 mbar). It is desirable to find the air flow by the time the pump has increased the vessel vacuum to 9-inches w.c. (22 mbar) and the breaker has opened more. To find the air flow through the breaker under these conditions:

1. Check whether the change in outlet (controlled) pressure of 5-inches w.c. (12 mbar) is less than the minimum change in outlet (controlled) pressure required to fully open the vacuum breaker. Since the minimum change in outlet (controlled) pressure required to fully open the vacuum breaker with a 1/4-inch (6,35 mm) orifice and control spring is 0.6-inches w.c. (1,5 mbar) from table 4, no reduction in the regulating  $C_g$  of 50 (table 2) need be made.

2. Solve the problem by using the appropriate values in the formula as follows, remembering that the  $\Delta P$  across the vacuum breaker is 9-inches w.c. (0.325 psig) (22 mbar):

$$Q = 14.7(50) \sin \left[ \frac{3415}{35} \sqrt{\frac{0.325}{14.7}} \right]_{\text{deg}}$$
$$= 184 \text{ SCFH (4,93 Nm}^3\text{/h) of Air}$$

## Installation

A Y690VB Series regulator may be installed in any orientation as long as flow through it matches the direction of the arrow on the body. Normal installation is with the spring case vertical above or below the diaphragm case. When exposed to the weather, the

vent should be protected by the optional umbrella vent or pointed down to allow condensate to drain. If used in hazardous gas service on indoor installations, this connection should be piped outdoors. External dimensions and connections are shown in figure 3.

### Note

**Downstream piping will vary with the installation, but to obtain the calculated characteristics, the pipe should be the same size as the outlet and should be straight for the first 18 inches (457 mm).**

## Ordering Information

When ordering, specify:

### Application

1. Composition and specific gravity of gas (including chemical analysis if possible)
2. Range of temperatures, flowing inlet pressures (maximum, minimum, nominal), and pressure drops
3. Desired pressure setting or range
4. Range of flow rates (minimum controlled, maximum, normal)
5. Piping size(s)

### Construction

Refer to the Specifications section and to each referenced table; specify the desired selection whenever there is a choice to be made. Always be sure to specify the type number and the spring case orientation.

BODY SIZE, INCHES (DN)	A		B		D		F		G	
	Ductile Iron NPT	Stainless Steel NPT	Ductile Iron	Stainless Steel	Ductile Iron	Stainless Steel	Ductile Iron	Stainless Steel	Ductile Iron	Stainless Steel
3/4 (20), 1 (25)	4.00 (102)	4.12 (105)	2.12 (53,8)	2.25 (57,2)	6.18 (157)	6.18 (157)	10.37 (263)	10.37 (263)	1.53 (38,9)	1.53 (38,9)

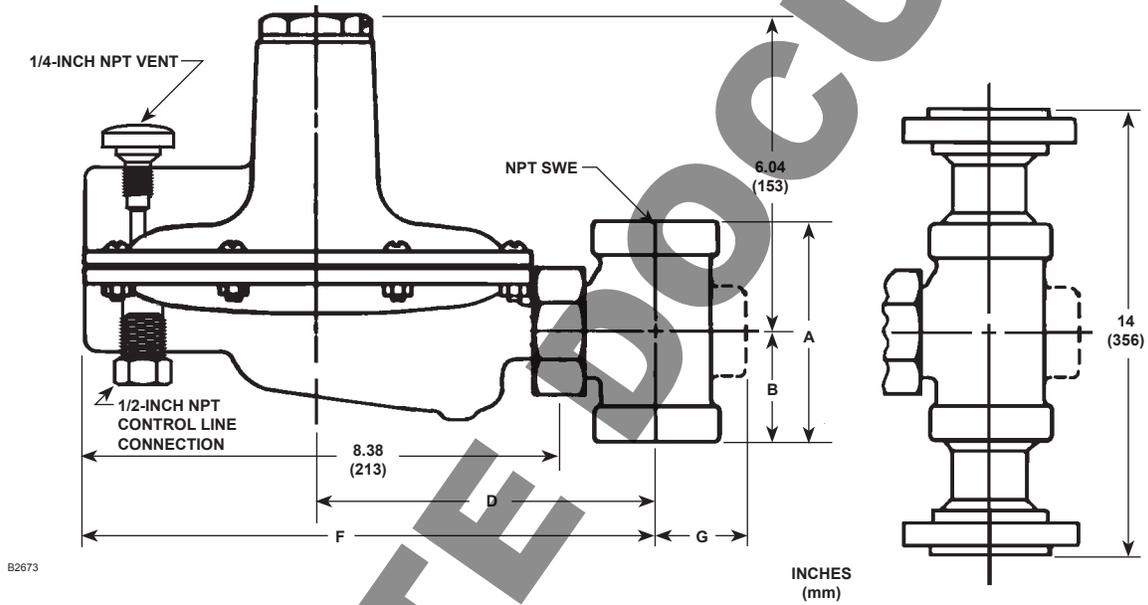


Figure 3. Dimensions

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