

# Y696VR Series Vacuum Regulator

## Introduction

The Y696VR Series are direct-operated vacuum regulators used where a decrease in vacuum (increase in absolute pressure) must be limited, such as between a tank and vacuum source to control vacuum in the tank. The Type Y696VR has internal pressure registration. The Type Y696VRM has a control line connection port and blocked throat for external pressure registration.

## Features

- **Precision Control of Low Pressure Settings**—Large diaphragm areas provide more accurate control at low pressure settings.
- **Installation Adaptability**—Four-position vent mounting and 360° adjustability of the union nut connection permit flexibility in vent positioning and installation in awkward positions or limited spaces.
- **Corrosion Resistance**—Constructions are available in a variety of materials for compatibility with corrosive process gases.

## Principle of Operation

A vacuum regulator maintains a constant vacuum at the regulator inlet. A decrease in vacuum (increase in absolute pressure) below the setpoint registers on the diaphragm and opens the disk. This allows the pressure from the higher vacuum source to pass through the regulator and restore the vacuum to its original setting. On the Type Y696VR, the controlled pressure registers directly into the diaphragm casing. The Type Y696VRM has a control line connecting the diaphragm casing to the vacuum being controlled and an O-ring stem seal blocking the throat allowing for registration only through the control line connection.



W7431

**Figure 1.** Type Y696VR Vacuum Regulator

## Installation

The versatility of the Y696VR Series devices permits a wide variety of installations. The body may be mounted in any position (360° rotation possible) relative to the spring and diaphragm cases just by loosening the union nut and rotating the diaphragm case. Spring case can be rotated to fit the application required. Any mounting position provides excellent performance. When exposed to the weather, spring case port should be protected by an optional umbrella vent or pointed downward to allow drainage. When indoors, pipe this port outside if used in hazardous gas service.

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



# Bulletin 71.3:Y696VR

## Specifications

### Body Sizes and End Connection Styles<sup>(1)</sup>

See Table 1

### Maximum Allowable Emergency Inlet (Casing) Pressure<sup>(2)</sup>

±15 psig (±1,03 bar)

### Maximum Allowable Pressure without Internal Parts Damage<sup>(2)</sup>

±8 psig (±0,55 bar)

### Maximum Downstream Pressure<sup>(2)</sup>

Full Vacuum

### Wide-Open Flow Coefficients

$C_g$ : 515;  $C_v$ : 14.7;  $C_1$ : 35

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

See Table 2

### Capacities

See Table 3

### Spring Case Connection

3/4-inch NPT

### Control Line Connection

1/2-inch NPT

### Gauge Tap Connection

1/4-inch NPT

### Pressure Registration

Type Y696VR: Internal

Type Y696VRM: External

### Material Temperature Capabilities<sup>(2)</sup>

**Nitrile (NBR):** -40° to 180°F (-40° to 82°C)

**Fluorocarbon (FKM):** 40° to 300°F (4° to 149°C)

**Ethylenepropylene (EPR):**

-20° to 200°F (-29° to 93°C)

**Perfluoroelastomer (FFKM):**

0° to 300°F (-18° to 149°C)

**Silicone (VMQ):** -40° to 400°F (-40° to 204°C)

### Construction Materials

**Body:** Cast iron, WCC steel (NACE), CF8M

Stainless steel (NACE), or Hastelloy C (optional)

**Diaphragm Casing:** Cast iron, WCC steel (NACE), CF8M Stainless steel, or Hastelloy C (optional)

**Spring Case:** Cast iron, WCC steel, aluminum, or CF8M Stainless steel

**Disk Holder:** 302 Stainless steel (**standard**) or 316 Stainless steel (NACE)

**Disk:** Nitrile (NBR) or Fluorocarbon (FKM) (**standard**); Neoprene (CR), Polytetrafluoroethylene (PTFE), Fluorocarbon (FKM), Perfluoroelastomer (FFKM), or Ethylenepropylene (EPR) (NACE)

**Diaphragm:** Nitrile (NBR), Fluorocarbon (FKM), Ethylenepropylene (EPR), or Silicone

**Trim:** 302 stainless steel (**standard**), 316 Stainless steel (NACE), or Hastelloy C (optional)

**O-rings:** Nitrile (NBR), Fluorocarbon (FKM), Perfluoroelastomer (FFKM), or Ethylenepropylene (EPR)

### Approximate Weights

**Cast Iron:** 45 pounds (20,4 kg)

**Steel, Stainless Steel, or Hastelloy C:** 57 pounds (25,9 kg)

1. End connections for other than U.S. standards can usually be provided; consult the local Sales Office.
2. The pressure/temperature limits in this bulletin and any applicable standard or code limitation should not be exceeded.

**Table 1. Body Sizes and End Connection Styles**

BODY SIZE, INCHES (DN)	CONSTRUCTION MATERIAL AND END CONNECTION STYLE <sup>(1)</sup>		
	Cast Iron	Steel or Stainless Steel	Hastelloy C
1-1/2 (40) 2 (50)	NPT	NPT, SWE, CL150 RF, CL300 RF, or PN 16/25/40	CL150 RF

1. All flanges are welded on to the body and have a face-to-face dimension of 14-inches (356 mm).

**Table 2. Vacuum Control Pressure Ranges and Spring Part Numbers**

VACUUM CONTROL PRESSURE RANGE <sup>(1)</sup>	CHANGE IN VACUUM CONTROL PRESSURE TO REACH WIDE-OPEN	SPRING PART NUMBER	SPRING COLOR	SPRING WIRE DIAMETER
1 to 3-inches w.c. (2 to 7 mbar) <sup>(2)</sup>	1.5-inches w.c. (4 mbar)	1D892527022	Brown	0.109-inch (2,77 mm)
1-1/2 to 5-inches w.c. (4 to 12 mbar) <sup>(2)</sup>	2-inches w.c. (5 mbar)	1D7654000A2	Unpainted	0.120-inch (3,05 mm)
3 to 8-inches w.c. (7 to 20 mbar) <sup>(2)</sup>	3-inches w.c. (7 mbar)	0B019727052	Purple	0.148-inch (3,76 mm)
8 to 16-inches w.c. (20 to 40 mbar)	4-inches w.c. (10 mbar)	1B766627062	Gray	0.156-inch (3,96 mm)
16 to 32-inches w.c. (40 to 80 mbar)	7-inches w.c. (17 mbar)	1B883327022	Unpainted	0.187-inch (4,75 mm)
0.25 to 3 psig (17 to 207 mbar)	1.2 psig (83 mbar)	1A630627022	Black	0.275-inch (6,99 mm)

1. Pressure ranges are based on the spring case pointing up. Pointing the spring case down increases the pressure range 1.7-inches w.c. (4,2 mbar). (Example: 1 to 3-inches w.c. (2,5 to 7,5 mbar) changes to 2.7 to 4.7-inches w.c. (6,7 to 11,7 mbar).)
2. Do not use Fluorocarbon (FKM) diaphragm with these springs at diaphragm temperatures lower than 40°F (4°C).

## Capacity Information

To determine flow capacities for the Y696VR Series vacuum regulators, use the following formula:

$$Q = P_{1abs} C_g \text{ SIN} \left[ \frac{3415}{C_1} \sqrt{\frac{\Delta P}{P_{1abs}}} \right] \text{ DEG}$$

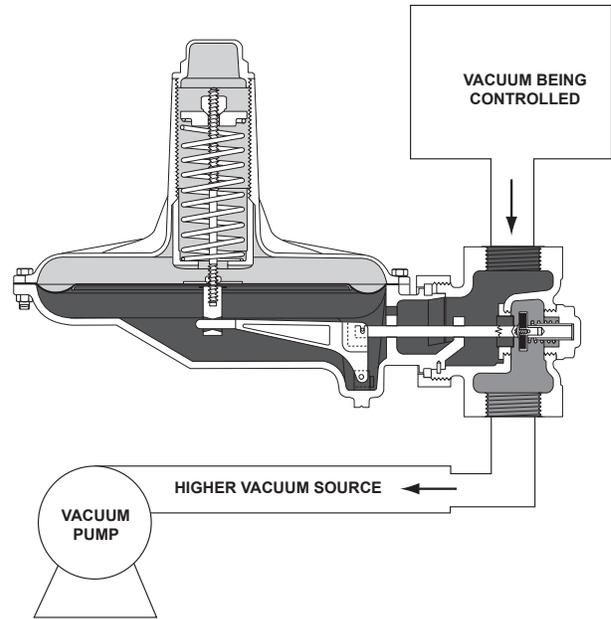
where,

- Q = flow capacity in SCFH (60°F, 14.7 psia) of air
- P<sub>1abs</sub> = absolute inlet pressure, psia (P<sub>1</sub> psig + 14.7)
- C<sub>g</sub> = flow coefficient
- C<sub>1</sub> = 35
- ΔP = pressure drop across the vacuum breaker

If the actual change in control pressure (from the service conditions) is less than the change in vacuum control pressure required to reach wide-open (Table 2), the C<sub>g</sub> in the formula must be reduced accordingly. To reduce C<sub>g</sub>, multiply C<sub>g</sub> (515) by the ratio of the actual change in control pressure to the change in vacuum control pressure required to reach wide-open.

## Conversion Factors

To determine equivalent capacities of other common gases, multiply the calculated capacity by the following appropriate conversion factor: natural gas–1.29, propane–0.810, butane–0.707, or nitrogen–1.018. For gases of other specific gravities, divide by the square root of the appropriate specific gravity.



- INLET PRESSURE
- OUTLET PRESSURE
- ATMOSPHERIC PRESSURE

Figure 2. Type Y696VR Operational Schematic

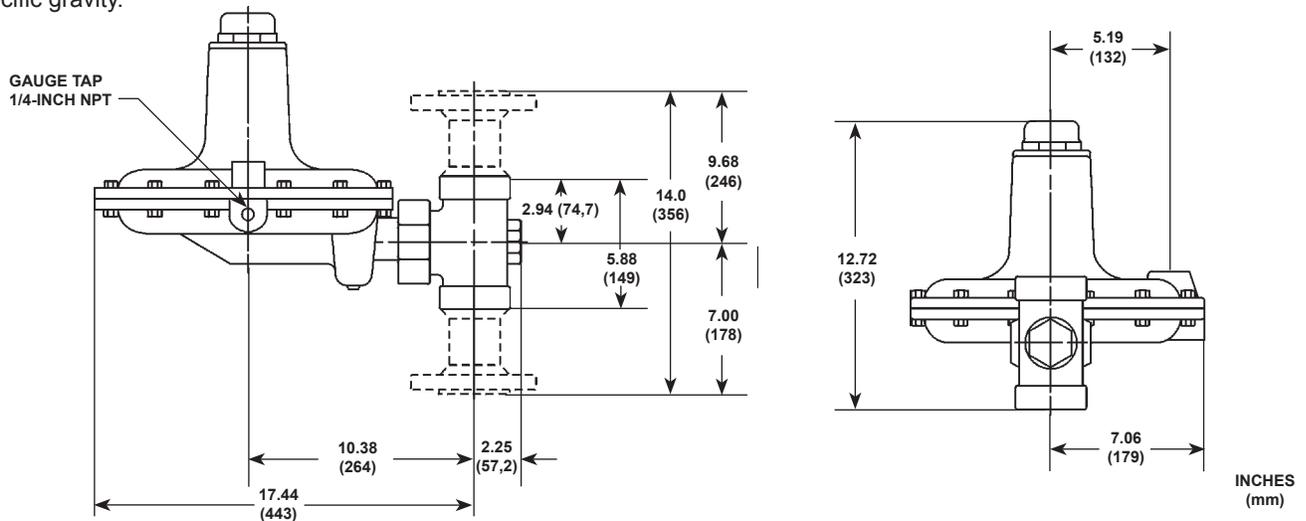


Figure 3. Y696VR Series Dimensions

Table 3. Y696VR Series Capacities

VACUUM CONTROL PRESSURE RANGE	VACUUM CONTROL PRESSURE SETTING	CHANGE IN VACUUM CONTROL PRESSURE TO REACH WIDE-OPEN	CAPACITIES IN SCFH (Nm <sup>3</sup> /h) OF AIR	DOWNSTREAM VACUUM
1 to 3-inches w.c. (2 to 7 mbar)	3-inches w.c. (7 mbar)	1.5-inches w.c. (4 mbar)	6953 (186)	7 psig (0.48 bar) vacuum
1-1/2 to 5-inches w.c. (4 to 12 mbar)	5-inches w.c. (12 mbar)	2-inches w.c. (5 mbar)	6920 (185)	
3 to 8-inches w.c. (7 to 20 mbar)	8-inches w.c. (20 mbar)	3-inches w.c. (7 mbar)	6876 (184)	
8 to 16-inches w.c. (20 to 40 mbar)	16-inches w.c. (40 mbar)	4-inches w.c. (10 mbar)	6722 (180)	7 psig (0.48 bar) vacuum
16 to 32-inches w.c. (40 to 80 mbar)	24-inches w.c. (60 mbar)	7-inches w.c. (17 mbar)	6612 (177)	
0.25 to 3 psig (17 to 207 mbar)	2 psig (138 mbar)	1.2 psig (83 mbar)	6496 (174)	

## Ordering Information

When ordering, specify:

### Application

1. Composition and specific gravity of gas (including chemical analysis if possible)
2. Temperature range
3. Inlet pressures (maximum, minimum, nominal)
4. Pressure drops
5. Desired pressure setting or range
6. Flow rates (minimum, maximum, normal)
7. 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. Be sure to specify spring case port location from Figure 4.

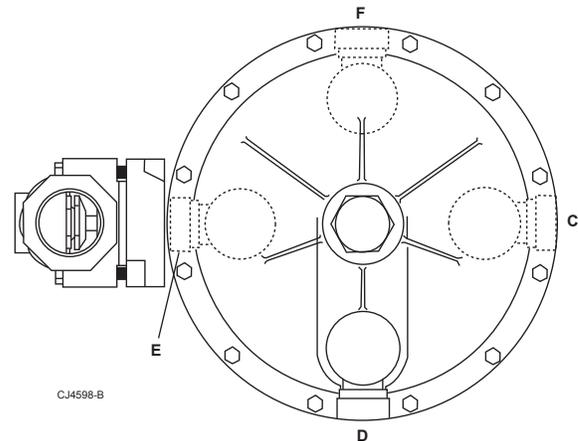


Figure 4. Spring Case Port Location

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