

June 2009

# Y696VR Series Vacuum Regulators



## WARNING

Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion, fire and/or chemical contamination causing property damage and personal injury or death.

Fisher® regulators must be installed, operated, and maintained in accordance with federal, state, and local codes, rules and regulations, and Emerson Process Management Regulator Technologies Inc. instructions.

If the regulator vents gas or a leak develops in the system, service to the unit may be required. Failure to correct trouble could result in a hazardous condition.

Installation, operation, and maintenance procedures performed by unqualified personnel may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Use qualified personnel when installing, operating, and maintaining the Y696 Series regulator.

## Introduction

### Scope of Manual

This manual describes and provides instructions and parts lists for the Type Y696VR and the Type Y696VRM vacuum regulators. Instructions and parts lists for other equipment used with these regulators are found in separate manuals.



W7431

Figure 1. Type Y696VR Vacuum Regulator

## Product Description

The Y696VR Series direct-operated vacuum regulators are used for precise control of small capacity, low-pressure service applications where an increase in vacuum must be limited. They are described as follows:

**Type Y696VR**—The Type Y696VR has internal pressure registration requiring no downstream control line.

**Type Y696VRM**—The Type Y696VRM has a control line connection and an O-ring stem seal blocking the throat for external pressure registration.

## Specifications

Some general ratings and specifications for the Y696VR Series vacuum regulators are given on page 2. Individual regulators from the factory are supplied with the specific data stamped on the nameplate.



# Y696VR Series

## 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

### Vacuum Control Pressure Ranges<sup>(2)</sup>

See Table 2

### Wide-Open Flow Coefficients

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

### IEC Sizing Coefficients

$X_T$ : 0.78;  $F_D$ : 0.67;  $F_L$ : 0.89

### Spring Case Connection

3/4 NPT

### Control Line Connection Connection

1/2 NPT

### Gauge Tap Connection

1/4 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 275°F (-29° to 135°C)

**Perfluoroelastomer (FFKM):**

0° to 300°F (-18° to 149°C)

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

### Approximate Weights

**Cast Iron:**

45 pounds (20 kg)

**Steel, Stainless Steel, or Hastelloy® C:**

57 pounds (26 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 instruction manual and any applicable standard or code limitation should not be exceeded.

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

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

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

## Installation



### WARNING

Personal injury, property damage, equipment damage, or leakage due to escaping gas or bursting of pressure-containing parts may result if this equipment is overpressured or is installed where service conditions could exceed the limits given in specifications, or where conditions exceed any ratings of the adjacent piping or piping connections. To avoid such injury or damage, provide pressure-relieving or

pressure-limiting devices (as required by the appropriate code, regulation, or standard) to prevent service conditions from exceeding those limits. Additionally, physical damage to this equipment could cause personal injury or property damage due to escaping gas. To avoid such injury or damage, install the equipment in a safe and well ventilated location.

Equipment operation within ratings does not preclude the possibility of damage from debris in the lines or from external sources. This equipment should be inspected for damage after any overpressure condition.

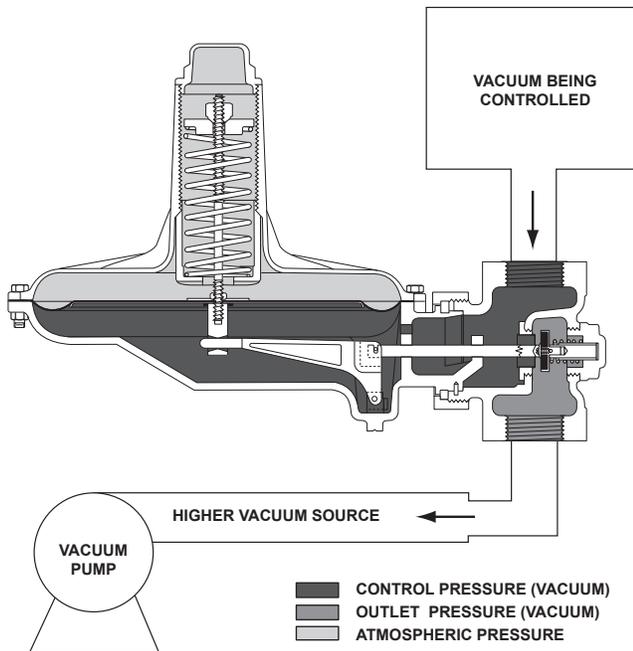


Figure 2. Type Y696VR Operational Schematic

### Note

**If this equipment is shipped mounted on another unit, install the unit according to the appropriate instruction manual.**

1. Only personnel qualified through training and experience should install, operate, and maintain this equipment. For Y696VR Series equipment that is shipped separately, make sure that there is no damage to or foreign material in it. Also ensure that all tubing and piping have been blown free.
2. This equipment may be installed in any position as long as the flow through the body is in the direction indicated by the arrow cast on the body. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the equipment.

### WARNING

**This equipment may vent some gas to the atmosphere. In hazardous or flammable gas service, vented gas may accumulate and cause personal injury, death, or property damage due to fire or explosion. Vent equipment in hazardous gas service to a remote, safe location away from air intakes or any hazardous area. Protect vent lines and stack openings from**

**condensation and clogging.**

## 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.

## Startup and Adjustment

To place the vacuum regulator in operation, slowly introduce inlet or vacuum pressure. The unit takes control when vacuum is established. This unit operates within the pressure range stamped on the closing cap.

## Shutdown

To shutdown the unit, close the upstream shutoff valve and then close the downstream shutoff valve to vent the equipment properly. Next, open the vent valve between the equipment and the nearest downstream shutoff valve. All pressure between the shutoff valves is released through the open vent valve.

## Maintenance

Equipment parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement of parts depends on the severity of service conditions and upon applicable codes and government regulations.

### WARNING

**To avoid personal injury, property damage, or equipment damage caused by sudden release of pressure or explosion of accumulated gas, isolate the regulator and release internal pressure before attempting maintenance or disassembly.**

## Body Area

# Y696VR Series

**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> 1-1/2 to 5-inches w.c. (4 to 12 mbar) <sup>(2)</sup> 3 to 8-inches w.c. (7 to 20 mbar) <sup>(2)</sup>	1.5-inches w.c. (4 mbar) 2-inches w.c. (5 mbar) 3-inches w.c. (7 mbar)	1D892527022 1D7654000A2 0B0197000A2	Brown Unpainted Purple	0.109-inch (2,8 mm) 0.120-inch (3,1 mm) 0.148-inch (3,8 mm)
8 to 16-inches w.c. (20 to 40 mbar) 16 to 32-inches w.c. (40 to 80 mbar) 0.25 to 3 psig (17 to 207 mbar)	4-inches w.c. (10 mbar) 7-inches w.c. (17 mbar) 1.2 psig (83 mbar)	1B766627062 1B883327022 1A630627022	Gray Unpainted Black	0.156-inch (4,0 mm) 0.187-inch (4,8 mm) 0.275-inch (7,0 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 mbar).  
(Example: 1 to 3-inches w.c. (2 to 7 mbar) changes to 2.7 to 4.7-inches w.c. (7 to 12 mbar).)  
2. Do not use fluorocarbon (FKM) diaphragm with these springs at diaphragm temperatures lower than 40°F (4°C).

These procedures are for gaining access to the disk assembly, orifice, and body gasket. All pressure must be released from the diaphragm case before the following steps can be performed. Key numbers are referenced in Figure 3.

1. To inspect and replace the disk holder assembly (key 25), remove the body cap assembly (key 38).
2. If it is necessary to replace the disk holder assembly (key 25), remove the machine screw (key 47) and cotter pin (key 14) from the disk stem (key 40).
3. To inspect and replace the orifice (key 27), loosen the union nut (key 19), tip the diaphragm casing (key 20) toward the inlet, and separate the diaphragm casing from the body (key 28).
4. Remove and inspect the body gasket (key 16).
5. Inspect and replace the orifice (key 27) if necessary. Lubricate the threads of the replacement orifice with a good grade of pipe thread sealant and tighten using 29 to 37 foot-pounds (39 to 50 N•m) of torque.
6. If necessary, install the replacement body gasket (key 16) into the body (key 28).
7. Slide the union nut (key 19) as far as it will go onto the diaphragm casing (key 20). Install both halves of the split ring (key 17) into the slots of the diaphragm casing (key 20) and secure them by sliding the union nut down on the split ring.
8. Install the diaphragm casing (key 20) by tightening the union nut (key 19) until the diaphragm case is secure on the body (key 28).
9. The disk holder assembly (key 25) consists of the disk and disk holder, as well as the valve disk washer (key 46) and the machine screw (key 47). Install the disk spring (key 41) and valve holder assembly and secure it to the disk stem (key 40) with the cotter

pin (key 14).

10. Use a good quality thread sealer when replacing the body cap assembly (key 38).

## Diaphragm and Spring Case Area

These procedures are for gaining access to the control spring, diaphragm assembly, valve stem, and stem O-ring. All pressure must be released from the diaphragm case before these steps can be performed. Key numbers are referenced in Figure 3.

### Type Y696VR Vacuum Regulator

1. Remove the closing cap (key 3) and turn the adjusting nut (key 2) counterclockwise until all compression is removed from the control spring (key 1). If the only further maintenance is to change the control spring (key 1), skip to step 10.
2. Remove the screws (key 21) and hex nuts (key 22) and lift off the spring case assembly (key 23).
3. Remove the diaphragm (key 5) and attached parts by tilting it so that the pusher post (key 8) slips off the lever assembly (key 9). To separate the diaphragm (key 5) from the attached parts, unscrew the diaphragm hex nut (key 37). If the only further maintenance is to replace the diaphragm parts, skip to step 8.
4. To replace the lever assembly (key 9), remove the machine screws (key 11).
5. To replace the valve stem (key 13) pull it out of the diaphragm casing (key 20) and install a new valve stem by pushing it into the diaphragm casing.
6. Install the lever assembly (key 9) on the valve stem (key 13) and secure the lever assembly (key 9) with the machine screws (key 11).
7. Install the diaphragm head gasket (key 7), lower

diaphragm head (key 24), diaphragm (key 5), and upper diaphragm head (key 6) on the pusher post (key 8) and attach with the hex nut (key 37). Tighten using 30 to 45 foot-pounds (41 to 61 N•m) of torque.

8. Install the pusher post (key 8) plus attached diaphragm parts onto the lever assembly (key 9).
  9. Install the spring case assembly (key 23) and control spring (key 1) on the diaphragm casing (key 20) so that the vent assembly is correctly oriented, and secure them with the spring case cap screws (key 21) and hex nuts (key 22), finger tight only.
  10. Install the upper spring seat and the adjusting nut (key 2) turning clockwise until there is enough control spring force to provide proper slack to the diaphragm (key 5) and attached parts. Using a crisscross pattern, finish tightening the spring case cap screws (key 21) and hex nuts (key 22) using 55 to 75 inch-pounds (6 to 8 N•m) of torque. Then finish turning the adjusting nut (key 2) to the desired outlet pressure setting.
  11. Install a replacement closing cap gasket (key 35) if necessary, and then install the closing cap (key 3).
5. To replace the valve stem (key 13) or stem seal O-ring (key 15) remove the valve stem from the diaphragm casing.
  6. Lightly grease the new stem seal O-ring (key 15) and install on the valve stem (key 13). Install the valve stem by pushing it into the diaphragm casing (key 20).
  7. Install the lever assembly (key 9) on the valve stem (key 13) and secure the lever assembly (key 9) with the machine screws (key 11).
  8. Install the diaphragm head gasket (key 7), lower diaphragm head (key 24), diaphragm (key 5), and upper diaphragm head (key 6) on the pusher post (key 8) and attach with the hex nut (key 37). Tighten using 30 to 45 foot-pounds (41 to 61 N•m) of torque.
  9. Install the pusher post (key 8) plus attached diaphragm parts onto the lever assembly (key 9).
  10. Install the spring case assembly (key 23) and control spring (key 1) on the diaphragm casing (key 20) so that the vent assembly is correctly oriented, and secure them with the spring case cap screws (key 21) and hex nuts (key 22), finger tight only.
  11. Turn the adjusting nut (key 2) clockwise until there is enough control spring (key 1) force to provide proper slack to the diaphragm (key 5) and attached parts. Using a crisscross pattern, finish tightening the spring case cap screws (key 21) and hex nuts (key 22) using 55 to 75 inch-pounds (6 to 8 N•m) of torque. Then finish turning the adjusting nut (key 2) to the desired outlet pressure setting.
  12. Install a replacement closing cap gasket (key 35) if necessary, and then install the closing cap (key 3).

## *Type Y696VRM Vacuum Regulator*

1. Remove the closing cap (key 3) and turn the adjusting nut (key 2) counterclockwise until all compression is removed from the control spring (key 1). If the only further maintenance is to change the control spring (key 1), skip to step 10.
2. Remove the spring case cap screws (key 21) and hex nuts (key 22) and remove the spring case (key 23).
3. Remove the diaphragm (key 5) and attached parts by tilting it so the pusher post (key 8) slips off the lever assembly (key 9). To separate the diaphragm (key 5) from the attached parts, unscrew the diaphragm hex nut (key 37). If the only further maintenance is to replace the diaphragm parts or change the control spring (key 1), skip to step 8.
4. To replace the lever assembly (key 9), remove the machine screws (key 11) and lever pin.

## **Parts Ordering**

When corresponding with the local Sales Office or about this regulator, include the type number and all other pertinent information stamped on the closing cap or nameplate. Specify the eleven-character part number when ordering new parts from the following parts list.

# Y696VR Series

## Parts List

Key	Description	Part Number	Key	Description	Part Number	
1	Spring		13	Valve Stem		
	1 to 3-inches w.c. (2 to 7 mbar)	1D892527022		Stainless steel (NACE)	1A630935032	
	1-1/2 to 5-inches w.c. (4 to 12 mbar)	1D7654000A2	Hastelloy® C	1A6309X0022		
	3 to 8-inches w.c. (7 to 20 mbar)	0B0197000A2	14	Cotter Pin		
	8 to 16-inches w.c. (20 to 40 mbar)	1B766627062		Stainless steel (Standard)	1A866537022	
16 to 32-inches w.c. (40 to 80 mbar)	1B883327022	Stainless steel (NACE)		1A8665X0032		
2	Adjusting Nut	0.25 to 3 psig (17 to 207 mbar)	1A630627022	Hastelloy® C	14B7990X012	
			1A201914012	15*	O-Ring (Stem Seal for Type Y696VRM only)	
3	Closing Cap	1L928308012	Nitrile (NBR)		1E472706992	
4	Lower Spring Seat	1U226019012	Fluorocarbon (FKM)		1N430406382	
5*	Diaphragm		Ethylenepropylene (EPR)		1D6875X0032	
		Nitrile (NBR)	0R032502052		Perfluoroelastomer (FFKM)	1D6875X0082
		Fluorocarbon (FKM)	0R0325X0032	Body Gasket	1A348004032	
		Ethylenepropylene (EPR)	0R0325X0062	Split Ring	0Y095828982	
6	Upper Diaphragm Head	Silicone	0R0325X0082	19	Union Nut	
			0B006628982		Cast iron body	0Z017619062
7*	Diaphragm Head Gasket	1L143403022			WCC steel body	0Z017624092
8	Pusher Post				CF8M Stainless steel body	0Z0176X0012
		Stainless steel	0Y096435072	Hastelloy® C		0Z0176X0012
9	Lever Assembly	Hastelloy® C	0Y0964X0012	20	Diaphragm Casing	
		Stainless steel	1E3409X0052		Type Y696VR	
11	Machine Screw (2 Required)	Hastelloy® C	1E3409X0022		Cast iron	3B973519012
		Stainless steel (Standard)	1A866935032		WCC Steel	
		Stainless steel (NACE)	1A8669X0012		Standard	3F191622012
		Hastelloy® C	1A8669X0022		NACE	3F1916X0022
					CF8M Stainless steel	3F191633092
					Hastelloy® C	3F1916X0102

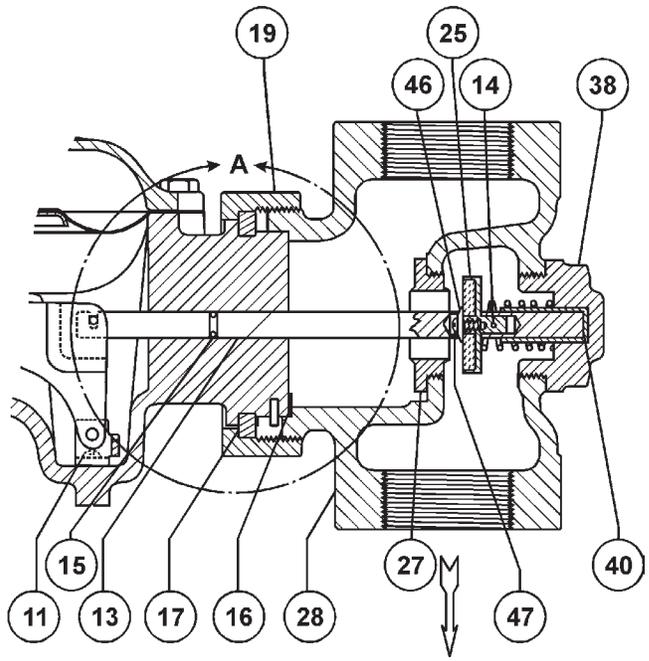
\*Recommended Spare Parts.

**Table 3. Disk Holder Assembly Materials and Part Numbers (key 25)**

TRIM MATERIAL	DISK MATERIAL	DISK ASSEMBLY
303 Stainless steel (standard)	Nitrile (NBR)	1D6405000D2
316 Stainless steel	Perfluoroelastomer (FFKM)	Disk: 1D6404X0022, Disk Holder: 1D6403X0032
N10276 Hastelloy C	Polytetrafluoroethylene (PTFE)	1D6405X0152
316 Stainless steel (NACE)	Nitrile (NBR)	1D6405X0202
	Fluorocarbon (FKM)	1D6405X0212
	Perfluoroelastomer (FFKM)	Disk: 1D6404X0022, Disk Holder: 1D6403X0012
	PTFE	1D6405X0162
	Ethylenepropylene (EPR)	1D6405X0122

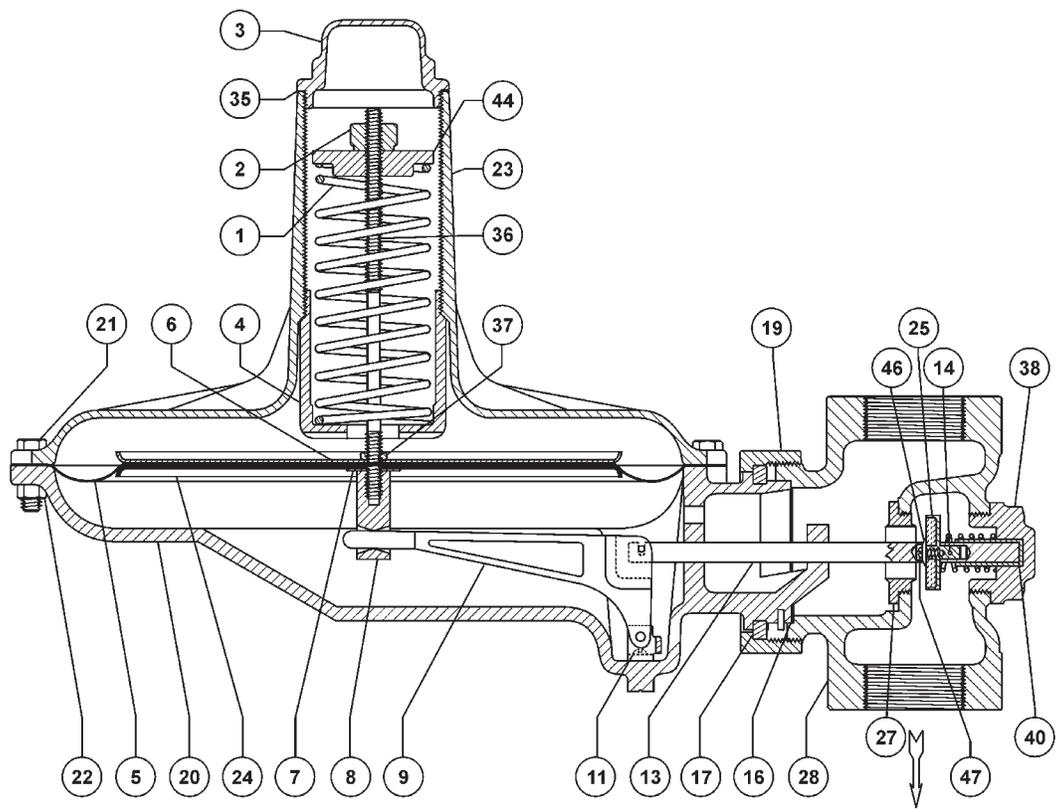
**Table 4. Body Materials and Part Numbers (key 28)**

BODY SIZE AND END CONNECTION STYLE		MATERIAL				
		Cast Iron	WCC Steel	CF8M Stainless Steel	WCC Steel (NACE)	Hastelloy C
1-1/2-inch (DN 40)	NPT	1B403419012	2P2573X0022	2P2573X0012	----	----
	SWE	----	2P9004X0022	----	----	----
	CL150 RF	----	22B4316X022	22B4316X012	22B4316X032	----
	CL150 Integral RF	----	----	44B9592X022	----	44B9592X012
	CL300 RF	----	23B0825X012	23B0825X022	23B0825X042	----
	PN 16/25/40	----	14B3341X032	14B3341X052	14B3341X112	----
2-inch (DN 50)	NPT	1B403519012	2R140522012	2R1405X00A2	----	----
	SWE	----	22A2572X032	----	----	----
	CL150 RF	----	22B9226X022	22B9226X012	14B3341X092	----
	CL150 Integral RF	----	----	44B9593X022	----	44B9593X012
	CL300 RF	----	14B3341X012	14B3341X022	14B3341X102	----
	PN 16/25/40	----	14B3341X042	14B3341X062	14B3341X122	----



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TYPE Y696VRM BODY AND STEM ASSEMBLY DETAIL



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TYPE Y696VR ASSEMBLY

Figure 3. Types Y696VR and Y696VRM Vacuum Regulator Assemblies

# Y696VR Series

Key	Description	Part Number	Key	Description	Part Number
20	Diaphragm Casing (continued) Type Y696VRM WCC Steel CF8M Stainless steel Hastelloy® C	39A7502X022 39A7502X012 39A7502X032	38	Body Cap Assembly Stainless steel ( <b>standard</b> ) Stainless steel (NACE) Hastelloy® C	15A2185X022 15A2185X012 15A2185X042
21	Cap Screw (12 required) Standard NACE	1B136324052 1B136338992	40	Disk Stem Stainless steel ( <b>standard</b> ) Stainless steel (NACE) Hastelloy® C	0L025135032 0L0251X0022 0L0251X0012
22	Hex Nut (12 required) Standard NACE	1A309324122 1A309338992	41	Valve Spring 303 Stainless Steel ( <b>standard</b> ) 316 Stainless Steel (NACE) or Hastelloy® C	0D002827022 10B6027X012
23	Spring Case Cast iron WCC Steel CF8M Stainless steel Aluminum	2B155719042 34B2157X012 34B2157X042 AE6180X0012	44	Upper Spring Seat 1 to 3-inches w.c. (2 to 7 mbar) 1-1/2 to 5-inches w.c. (4 to 12 mbar) 3 to 8-inches w.c. (7 to 20 mbar) 8 to 16-inches w.c. (20 to 40 mbar) 16 to 32-inches w.c. (40 to 80 mbar) 0.25 to 3 psig (17 to 207 mbar)	1A869524092 1A869524092 1A869524092 1A869524092 1A626424092 1A626424092
24	Lower Diaphragm Head	1A3478X0022	46	Valve Disk Washer Standard Trim NACE Trim Hastelloy® C	0X014635032 0X0146X0012 0X0146X0022 1A866435042
25	Disk Holder Assembly	See Table 3	50	Nameplate (not shown)	-----
27	Orifice 303 Stainless steel ( <b>standard</b> ) S316 Stainless steel (NACE) Hastelloy® C	0L025335032 0L0253X0042 0L025335032	51	Drive Screw (not shown)	1A368228982
28	Body	See Table 4	56	Vent Assembly (not shown), Y602-11	17A5515X012
29	Pipe Plug (not shown), use with Y696VR Cast iron and WCC spring cases CF8M Stainless steel spring case	1C333528992 1C3335X0022	71	Pipe Bushing (not shown)	1A3424X0042
35*	Closing Cap Gasket	1N446206992	95	NACE Tag (not shown)	19A6034X012
36	Adjusting Stem	1A626314012	96	Tag Wire (not shown)	1U7581X0022
37	Diaphragm Hex Nut	1A499724122			

\*Recommended Spare Parts.

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