

T208VR Series Tank Blanketing Vacuum Regulator

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Figure 1. Type T208VR Vacuum Regulator

Introduction

Scope of the Manual

This Instruction Manual provides instruction for installation, startup, maintenance and parts list for the T208VR Series tank blanketing vacuum regulator. Instructions and parts lists for other equipment used with these regulators are found in separate manuals.

Product Description

The T208VR Series vacuum regulators are used for precise control of small capacity, low-pressure service applications where a constant vacuum must be

maintained. These direct-operated vacuum regulators come in 3/4 and 1-inch / DN 20 and 25 body sizes and have a 7/16-inch / 11 mm orifice and a 1/4-inch spring case vent connection with optional umbrella vent assembly. The individual products are described as follows:

Type T208VR

The Type T208VR is a vacuum regulator with internal pressure registration requiring no control line.

Type T208VRM

The Type T208VRM has a control line connection and blocked throat for external pressure registration.

T208VR Series

Specifications

The Specifications section lists the specifications for T208VR Series Tank Blanketing Vacuum Regulator. Factory specifications, such as maximum temperature, maximum inlet and outlet pressures, spring range, orifice size and material and seat material are stamped on the nameplate fastened on the regulator at the factory.

Available Configurations

Type T208VR: Direct-operated vacuum regulator with internal pressure registration

Type T208VRM: Direct-operated vacuum regulator with blocked throat and control line connection for external pressure registration

Body Sizes and End Connection Styles⁽¹⁾

BODY SIZE		END CONNECTION STYLES	
Inch	DN	Gray cast iron	316L/316 Stainless steel
3/4 or 1	20 or 25	NPT	NPT or CL150 RF

Maximum (Casing) Pressure⁽¹⁾

35 psig / 2.41 bar

Maximum (Casing) Vacuum Pressure⁽¹⁾

Full Vacuum

Maximum Allowable Vacuum Pressure⁽¹⁾

See Table 1

Maximum Downstream Vacuum Pressure⁽¹⁾

Full Vacuum

Vacuum Control Pressure Ranges⁽¹⁾

See Table 1

Pressure Registration

Type T208VR: Internal

Type T208VRM: External

Orifice Size

7/16-inch / 11 mm

Control Line Connection

1/2 NPT

Material Temperature Capabilities⁽¹⁾

Nitrile (NBR):

-20 to 180°F / -29 to 82°C

Fluorocarbon (FKM):

40 to 300°F / 4 to 149°C

Spring Case Connection

1/4 NPT

Approximate Weight

19 pounds / 8.6 kg

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



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® vacuum 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. (Regulator Technologies) instructions.

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

Call a qualified service person to service the unit. Installation, operation and maintenance procedures

performed by unqualified person may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Only a qualified person shall install or service the T208VR Series vacuum regulators.

Principle of Operation

The T208VR Series vacuum regulators (Figure 2) are used to maintain a constant vacuum at the regulator inlet. A decrease in this vacuum (increase in absolute pressure) beyond this value registers on the diaphragm and opens the disk. This permits a downstream vacuum of lower absolute pressure than the upstream vacuum to restore the upstream vacuum to its original pressure setting. On the Type T208VR, pressure registers underneath the diaphragm. The Type T208VRM has a control line connecting the diaphragm casing to the vacuum line and an O-ring stem seal blocking the throat causing registration pressure to flow through the control line.

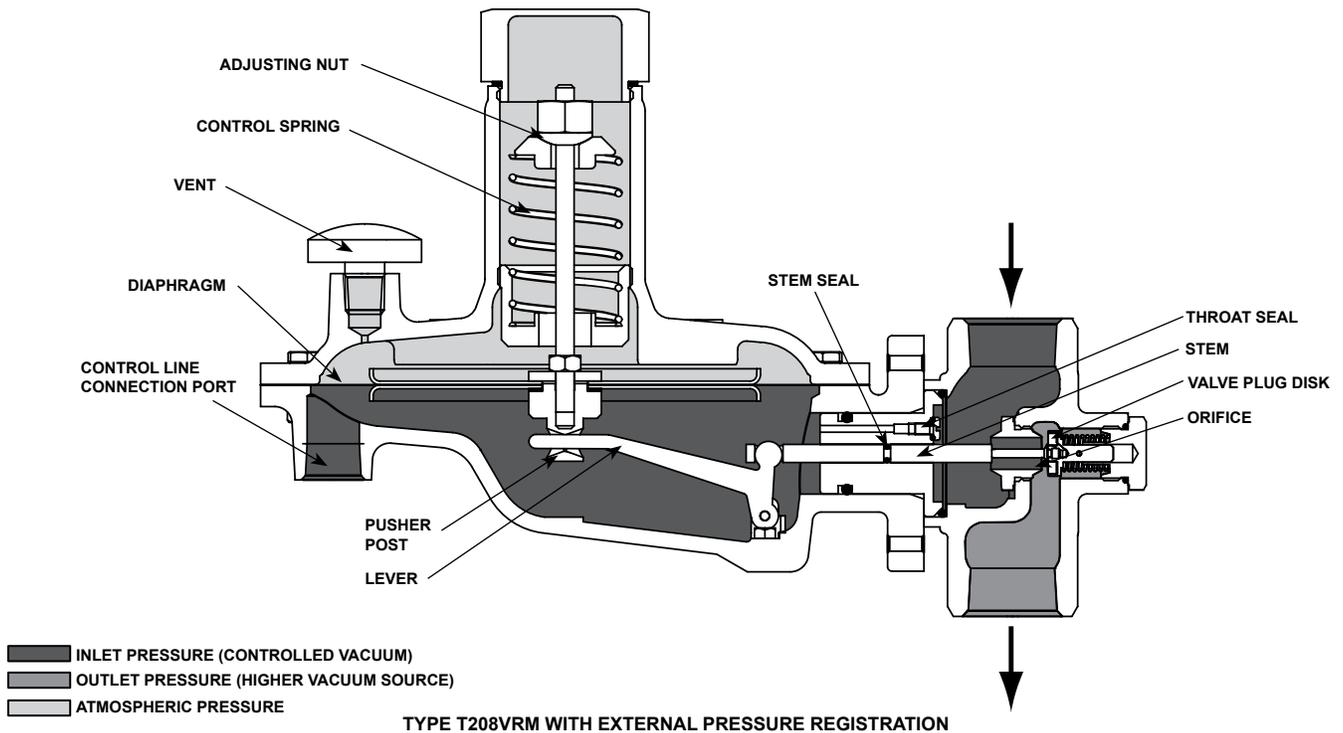
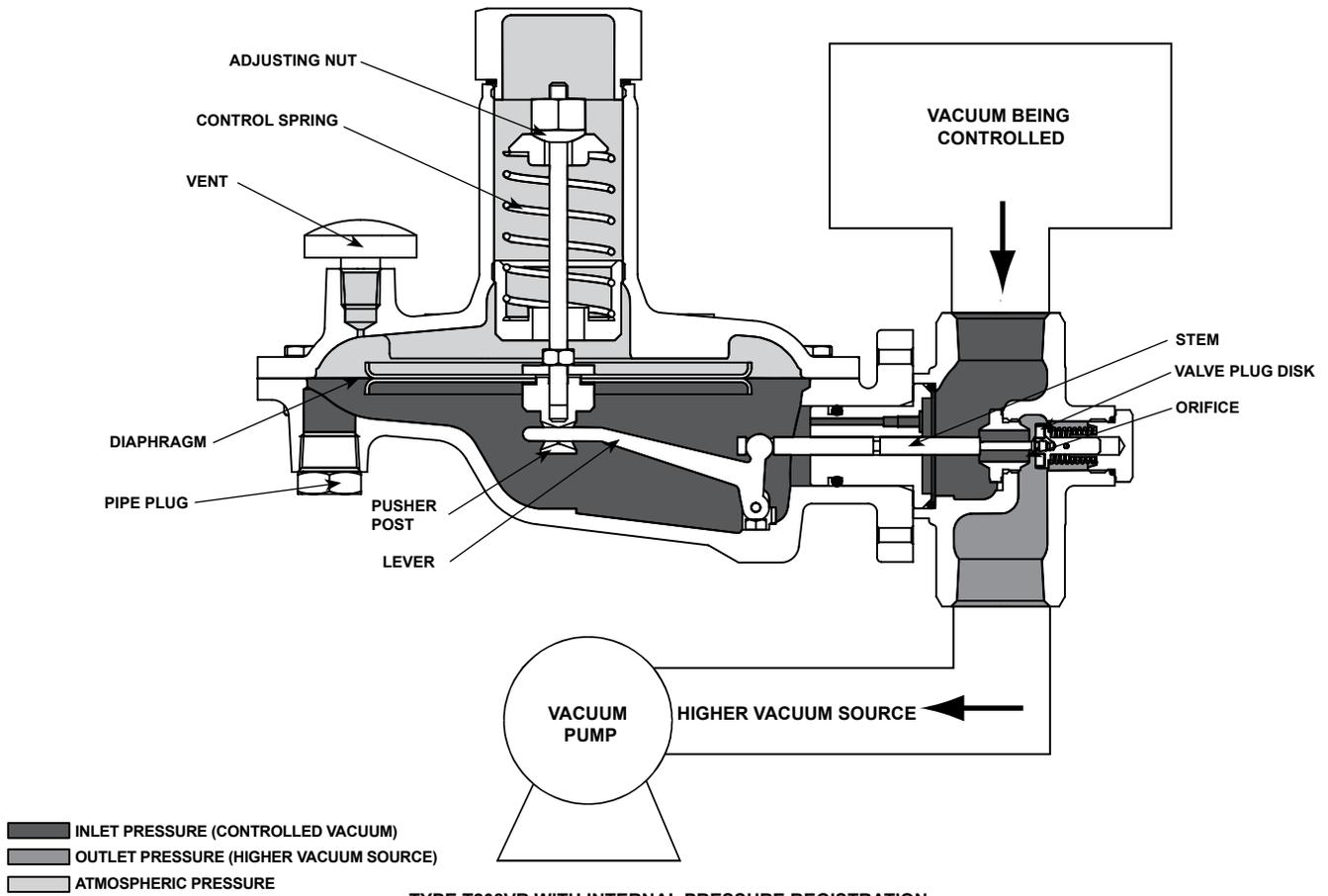


Figure 2. Type T208VR Operational Schematic

T208VR Series

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 the 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.

Note

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

1. Only personnel qualified through training and experience shall install, operate and maintain this equipment. For T208VR 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.



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. The vent line or stack opening must be protected against condensation or clogging.

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 attached to the body. If continuous operation is required during inspection or maintenance, install a three-way bypass valve around the equipment.
3. To keep the vent assembly (key 26) from being plugged or the spring case (key 3) from collecting moisture, corrosive chemicals or other foreign material, point the vent down or otherwise protect it. The diaphragm casing (key 4, Figure 6) may be rotated in order to obtain desired positioning.
4. To remotely vent the regulator, remove the vent assembly (key 26) and install obstruction-free tubing or piping into the 1/4 NPT vent tapping. Provide protection on a remote vent by installing a screened vent cap into the remote end of the vent pipe. If continuous operation of the system is required during inspection or maintenance, install a three-way bypass valve around the regulator.
5. The Type T208VRM requires a control line. Be sure to install the control line before putting the regulator into operation. Make the control line as short and straight as possible and do not install it in a location where flow may be turbulent. Significant restrictions in the control line can prevent proper pressure registration. When using a hand valve, it should be a full flow valve, such as a full port ball valve. Install the control line sloping downward toward the tank to prevent condensation buildup and avoid low points (or traps) that could catch liquid. The sensing line must enter the tank above the liquid level at a point that senses the vapor space pressure and is free from turbulence associated with tank nozzles or vents. The control line pipe should be at least 1/2-inch / 13 mm in diameter and increase 1 pipe size for every 10 feet / 3.05 m of control line, with setpoint less than 5-inches w.c. / 12 mbar.

Table 1. Vacuum Control Pressure Ranges

VACUUM CONTROL PRESSURE RANGE	SPRING PART NUMBER	SPRING COLOR	BACK DISK SPRING PART NUMBER	CHANGE IN CONTROL PRESSURE TO WIDE-OPEN	SPRING WIRE DIAMETER	SPRING FREE LENGTH	MAXIMUM INLET VACUUM	MAXIMUM OUTLET VACUUM
psig / bar				psig / bar	Inch / mm	Inch / mm	psig / bar	psig / bar
0 to 4 inches w.c. / 0 to 10 mbar ⁽¹⁾	0N039427222	Unpainted	1E984637022	1 inch w.c. / 2 mbar	0.062 / 1.57	3.063 / 77.80	5.1 psig / 0.35 bar	7.5 psig / 0.52 bar
0.05 to 0.75 / 3.5 to 52 mbar	0N086027022	Unpainted	18B0911X012	5.5 inches w.c. / 14 mbar	0.105 / 2.67	2.500 / 63.50	5.7 psig / 0.39 bar	7.5 psig / 0.52 bar
0.15 to 1.75 / 10 to 121 mbar	0N086127022	Unpainted		0.44 / 0.03	0.125 / 3.17	2.500 / 63.50	6.5 psig / 0.45 bar	7.5 psig / 0.52 bar
0.25 to 2.75 / 17 to 190 mbar	0N022027022	Dark green		0.63 / 0.043	0.135 / 3.43	2.500 / 63.50	7.4 psig / 0.51 bar	7.5 psig / 0.52 bar
1.5 to 4.75 / 0.10 to 0.33	0N004327022	Yellow		1.44 / 0.10	0.162 / 4.12	2.500 / 63.50	9.2 psig / 0.63 bar	7.5 psig / 0.52 bar
3 to 12.8 / 0.21 to 0.88	1D141827012	Blue		3.88 / 0.27	0.207 / 5.26	2.500 / 63.50	12.0 psig / 0.83 bar	12.0 psig / 0.83 bar

1. Do not use fluorocarbon (FKM) diaphragm with this spring at diaphragm temperatures lower than 60°F / 16°C.

Startup, Adjustment and Shutdown

Note

The Specifications section and Table 1 provide the maximum pressure capabilities for each vacuum regulator construction. Use pressure gauges to monitor inlet pressure and outlet pressure during startup and adjustment procedures.

Startup

1. Slowly open the downstream (outlet) shutoff valve, if used, to vacuum regulator and leave it fully open.
2. Slowly open the upstream (inlet) shutoff valve (for Type T208VRM, open the control line shutoff valve first followed by the upstream shutoff valve) between the tank and vacuum regulator.
3. Use gauges to monitor pressure.

Adjustment

1. Remove the closing cap (key 22) and turn the adjusting nut (key 20) clockwise to increase the pressure setting or counterclockwise to decrease the setting. Use gauges to monitor pressure.

2. Replace the closing cap (key 22) after making this adjustment.
3. If desired, the closing cap (key 22) may be wired to the hole provided in the spring case (key 3) to discourage tampering.

Shutdown

1. Close the nearest upstream shutoff valve.
2. Close the nearest downstream shutoff valve.
3. Open the vent valve between the equipment and the downstream shutoff valve nearest to it. All pressure between these 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 upon the severity of service conditions or the requirements of local, state and federal regulations. Due to the care Regulator Technologies takes in meeting all manufacturing requirements (heat treating, dimensional tolerances, etc.), use only replacement parts manufactured or furnished by Regulator Technologies.

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WARNING

To avoid personal injury, property damage or equipment damage caused by sudden release of pressure or explosion of accumulated gas, do not attempt any maintenance or disassembly without first isolating the regulator from system pressure and relieving all internal pressure from the equipment.

Vacuum regulators that have been disassembled for repair must be tested for proper operation before being returned to service. Only parts manufactured by Regulator Technologies should be used for repairing Fisher® vacuum regulator. Restart gas utilization equipment according to normal startup procedures.

General Maintenance

1. Visually inspect the vacuum regulators and its parts for any damage.
2. Ensure tight connections, tight seals and safe operation. If there is an evidence of leakage or unstable internal motion, a rebuild with seal replacement and relubrication may be necessary.
3. Observe the controlled upstream vacuum pressure and downstream vacuum source pressure.

Body Area

To gain access to the disk assembly and body gasket, follow this procedure. Before the following steps can be performed, release all pressure from the diaphragm case.

Key numbers are referenced in Figures 3 and 4.

1. To inspect and replace the disk holder assembly (key 13), remove the body cap assembly (key 43).
2. If it is necessary to replace the disk holder assembly (key 13), remove it from the disk spacer (key 44).

3. To inspect the orifice (key 5) on Types T208VR and T208VRM or throat seal O-ring (key 31) and machine screw (key 34) on the Type T208VRM, remove the cap screws (key 2) and separate the lower casing (key 4) from the body (key 1).
4. Remove and inspect the body seal O-ring (key 11). For Type T208VRM, also inspect the throat seal O-ring (key 31) by removing the machine screw (key 34). Replace if necessary. To install a throat seal, place the O-ring on the machine screw and thread into guide insert (key 18) to seal.
5. Inspect the orifice (key 5) by carefully running your finger along the edges to check for nicks or dents; replace if necessary. Lightly lubricate the threads of the replacement orifice with a good grade of light grease and tighten using 340 to 470 inch-pounds / 38.5 to 53.1 N•m.
6. If necessary, install the replacement backup ring (key 49) and body seal O-ring (key 11) into the body (key 1).
7. Replace the body (key 1) on the diaphragm casing (key 4) and secure with the cap screws (key 2) using 90 to 126 inch-pounds / 10.2 to 14.2 N•m of torque.

Note

The disk holder assembly (key 13) is comprised of the disk and disk holder.

8. Install the disk holder assembly (key 13) and secure it to the disk spacer (key 44).
9. Place the back disk spring (key 41) and a new back body seal O-ring (key 11) on the back body cap (key 43).
10. Lightly lubricate the threads when replacing the body cap assembly. Use 340 to 470 inch-pounds / 38.5 to 53.1 N•m of torque.

Diaphragm and Spring Case Area

To gain access to the control spring, diaphragm assembly, valve stem and stem O-ring, follow this procedure. All pressure must be released from the diaphragm case before performing the following steps.

Type T208VR Vacuum Regulator

Key numbers are referenced in Figure 3.

1. Remove the closing cap (key 22) and turn the adjusting nut (key 20) counterclockwise until all compression is removed from the control spring (key 6). If the only further maintenance is to change the control spring, skip to step 11.
2. Remove the spring case cap screws (key 24) and hex nuts (key 23) and lift off the spring case assembly (key 3).
3. Remove the diaphragm (key 10) and attached parts by tilting it so that the pusher post (key 8) slips off the lever assembly (key 16). To separate the diaphragm from the attached parts, unscrew the hex nut (key 21). If the only further maintenance is to replace the diaphragm parts, skip to step 8.
4. To replace the lever assembly (key 16), remove the machine screws (key 17).
5. To replace the valve stem (key 14), perform steps 1 through 3 of Body Area Maintenance then pull valve stem (key 14) out of the guide insert (key 18).
6. Install the stem (key 14) into the guide insert (key 18) and perform Body Area Maintenance procedure steps 6 through 10 as necessary.
7. Install the lever assembly (key 16) into the valve stem (key 14) and secure the lever assembly (key 16) with the machine screws (key 17) using 14 to 19 inch-pounds / 1.6 to 2.1 N•m of torque.
8. Reassemble the diaphragm assembly in the following order:
 - Pusher post (key 8)
 - Diaphragm head gasket (key 45)
 - Lower Diaphragm head (key 7)
 - Diaphragm (key 10)
 - Upper Diaphragm head (key 7)
 - Washer (key 36)Secure the parts with hex nut (key 21) using 60 to 72 inch-pounds / 6.8 to 8.1 N•m of torque.
9. Install the pusher post (key 8) plus attached diaphragm parts onto the lever assembly (key 16).
10. Install the spring case assembly (key 3) and control spring (key 6) on the lower casing (key 4) so that the vent assembly (key 26) is correctly oriented and secure them with the spring case cap screws (key 24) and hex nuts (key 23) to fingertightness only.

11. Install the upper spring seat (key 19) and the adjusting nut (key 20). Turn the adjusting nut clockwise until there is enough control spring (key 6) force to provide proper slack to the diaphragm (key 10) and attached parts. Using a crisscross pattern, finish tightening the spring case cap screws (key 24) and hex nuts (key 23) to 90 to 126 inch-pounds / 10.2 to 14.2 N•m of torque. Adjust the control pressure to the desired pressure setting, refer to Adjustment section.
12. Install a replacement closing cap gasket (key 25) if necessary and then install the closing cap (key 22).

Type T208VRM Vacuum Regulator

Key numbers are referenced in Figure 4.

1. Remove the closing cap (key 22) and turn the adjusting nut (key 20) counterclockwise until all compression is removed from the control spring (key 6). If the only further maintenance is to change the control spring, skip to step 10.
2. Remove the spring case cap screws (key 24) and hex nuts (key 23) and lift off the spring case assembly (key 3).
3. Remove the diaphragm (key 10) and attached parts by tilting it so that the pusher post (key 8) slips off the lever assembly (key 16). To separate the diaphragm from the attached parts, unscrew the hex nut (key 21). If the only further maintenance is to replace the diaphragm parts or change the control spring (key 6), skip to step 8.
4. To replace the lever assembly (key 16), remove the machine screws (key 17).
5. To replace the valve stem (key 14) and stem seal O-ring (key 30), perform steps 1 through 3 of Body Area Maintenance and then pull the valve stem out of the guide insert (key 18).
6. Lightly grease the replacement stem seal O-ring (key 30) and install on the valve stem (key 14). Install the valve stem by pushing it into the guide insert (key 18). Perform Body Area Maintenance procedure steps 6 through 10 as necessary.
7. Install the lever assembly (key 16) into the valve stem (key 14) and secure the lever assembly with the machine screws (key 17) using 14 to 19 inch-pounds / 1.6 to 2.1 N•m of torque.

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Table 2. Body Part Numbers (Key 1)

BODY MATERIAL	END CONNECTION STYLE ⁽¹⁾	PART NUMBER	
		3/4-Inch / DN 20 Body	1-Inch / DN 25 Body
Gray cast iron	NPT	ERSA03695A0	ERSA03697A0
316L/316 Stainless steel	NPT (standard)	ERSA00231A0	ERSA00764A0
	CL150 RF	ERSA01470A6	ERSA01470A7

1. All flanges are welded on. All flange dimensions are 14-inches / 356 mm face-to-face.

8. Reassemble the diaphragm assembly in the following order:
 - Pusher post (key 8)
 - Diaphragm head gasket (key 45)
 - Lower Diaphragm head (key 7)
 - Diaphragm (key 10)
 - Upper Diaphragm head (key 7)
 - Washer (key 36)

Secure the parts with hex nut (key 21) using 60 to 72 inch-pounds / 6.8 to 8.1 N•m of torque.
9. Install the pusher post (key 8) plus attached diaphragm parts onto the lever assembly (key 16).
10. Install the spring case (key 3) and control spring (key 6) on the lower casing (key 4) so that the vent assembly (key 26) is correctly oriented and secure them with the spring case cap screws (key 24) and hex nuts (key 23) to fingertightness only. Install upper spring seat (key 19) and adjusting nut (key 20).
11. Turn the adjusting nut (key 20) clockwise until there is enough control spring (key 6) force to provide proper slack to the diaphragm (key 10) and attached parts. Using a crisscross pattern, finish tightening the spring case cap screws (key 24) and hex nuts (key 23) to 90 to 126 inch-pounds / 10.2 to 14.2 N•m of torque. Adjust the control pressure to the desired pressure setting, refer to Adjustment section.
12. Install a replacement closing cap gasket (key 25) if necessary and then install the closing cap (key 22).

To Convert Constructions

The Type T208VR to the Type T208VRM:

New parts required: keys 30, 31 and 34

1. Remove pipe plug (key 27, Figure 3) from the diaphragm casing (key 4).
2. Refer to steps 1 and 3 in the Body Area Maintenance section.
3. Insert the throat seal O-ring (key 31, Figure 4) and one machine screw (key 34).
4. Insert the stem seal O-ring (key 30) by following steps 1 through 7 and 9 through 12 in the Diaphragm and Spring Case Area Maintenance (Type T208VRM Vacuum Regulator) section.

The Type T208VRM to the Type T208VR:

New parts required: key 27

1. Insert pipe plug (key 27, Figure 3) in the diaphragm casing (key 4).
2. Follow steps 1 through 7 in the Diaphragm and Spring Case Area maintenance procedure under Type T208VR section. Make sure to remove the stem seal O-ring (key 30, Figure 4) right after step 5. After removing the stem seal O-ring, continue steps 9 through 12.
3. Follow steps 1 through 10 of Body Area maintenance section making sure to remove the throat seal (key 31, Figure 4) and machine screw (key 34, Figure 4) in step 4.

Parts Ordering

When corresponding with the local Sales Office or Sales Representative about this regulator, include the type number and all other pertinent information

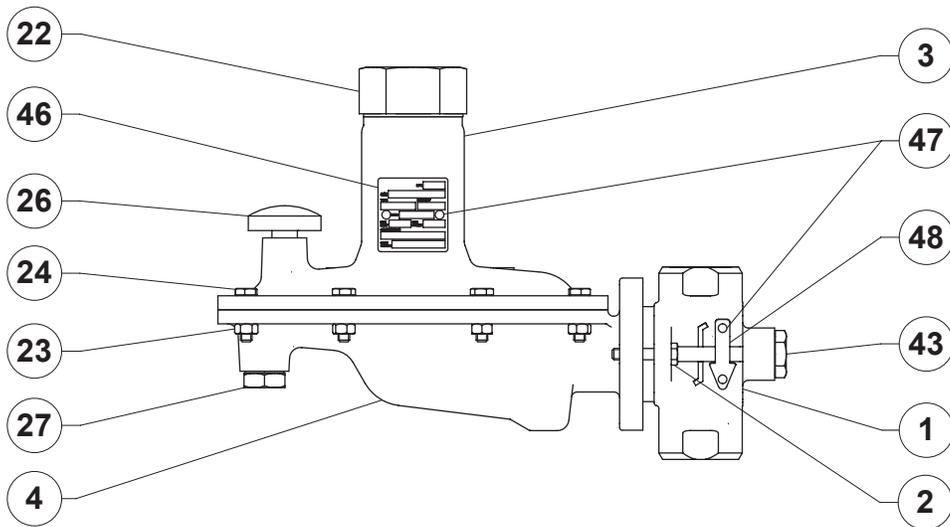
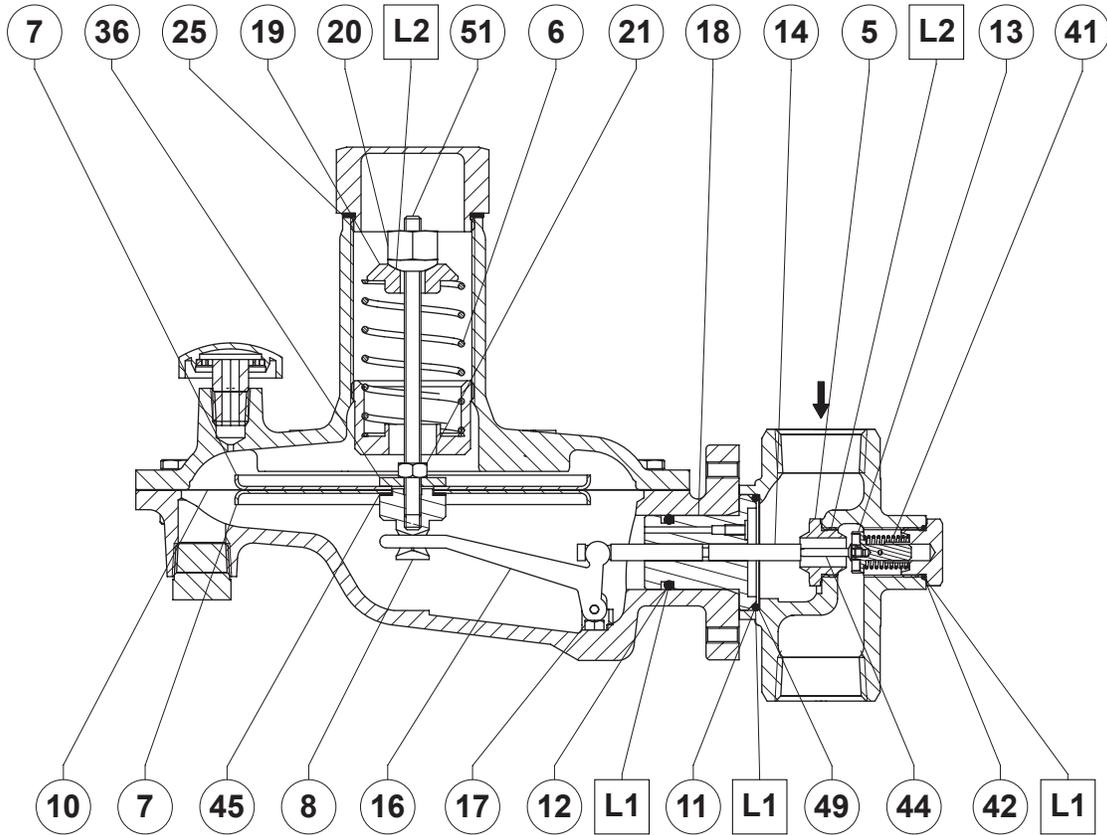
stamped on the nameplate. Specify the eleven-character part number when ordering new parts from the following parts list.

Parts List

Key	Description	Part Number	Key	Description	Part Number
	Spare Parts Kit, included are keys 10, 11, 12, 25, 42 and 45)		22	Closing Cap	
	Nitrile (NBR) (standard)	RT208XXDD12		Zinc (standard)	1B541644012
	Fluorocarbon (FKM)	RT208XXVV12		Steel	1K797024092
1	Body	See Table 2	23	Hex Nut (8 required)	
2	Cap Screw (2 required)			For gray cast iron body, Steel	1A345724122
	For gray cast iron body	1C856228992		For stainless steel body, Stainless steel	1A3457K0012
	For stainless steel body	18B3456X012	24	Spring Case Cap Screw (8 required)	
3	Spring Case Assembly			For gray cast iron body, Steel	1A579724052
	Gray cast iron	ERSA01074A1		For stainless steel body, Stainless steel	1A5797T0012
	Stainless steel	ERSA01074A0	25*	Closing Cap Gasket, Neoprene (CR)	1P753306992
4	Lower Casing		26	Vent Assembly	
	Gray cast iron	47B2271X012		Spring Case Up (Type Y602-11) (standard)	17A5515X012
	316L/316 Stainless steel	ERSA00196A0		Spring Case Down (Type Y602-2)	17A6571X012
5	Orifice, 316 Stainless steel		27	Pipe Plug (Type T208VR only)	
	7/16-inch / 11 mm	0L0832X0012		For stainless steel body	
6	Control Spring	See Table 1		316 Stainless steel	1A369235072
7	Diaphragm Head (2 required)			For gray cast iron body, Steel	1A369224492
	304 Stainless steel	17B9723X032	30*	Stem Seal O-ring (Type T208VRM only)	
8	Pusher Post, 316 Stainless steel	18B3462X012		Nitrile (NBR) (standard)	1H2926G0012
10*	Diaphragm			Fluorocarbon (FKM)	1H2926X0022
	Nitrile (NBR) (standard)	17B9726X012	31*	Throat Seal O-ring (Type T208VRM only)	
	Fluorocarbon (FKM)	23B0101X052		Nitrile (NBR) (standard)	1D682506992
11*	Body Seal O-ring			Fluorocarbon (FKM)	1D6825X0012
	Nitrile (NBR) (standard)	1H993806992	34	Machine Screw	
	Fluorocarbon (FKM)	1H9938X0012		(Type T208VRM only)	
12*	Insert Seal O-ring			18-8 Stainless steel	18A0703X022
	Nitrile (NBR) (standard)	1B885506992	36	Washer, Steel	18B3440X012
	Fluorocarbon (FKM)	1B8855X0012	41	Back Disk Spring	See Table 1
13	Disk Holder Assembly		42*	Back Body Seal O-ring	
	316 Stainless steel with			Nitrile (NBR) (standard)	13A1584X012
	Nitrile (NBR) (standard)	ERSA01112A0		Fluorocarbon (FKM)	13A1584X022
	Fluorocarbon (FKM)	ERSA01112A1	43	Back Body Cap	
14	Stem, 316 Stainless steel	ERSA00200A0		316 Stainless steel	1F2737X0012
16	Lever Assembly, 302 Stainless steel	1B5375000B2	44	Disk Spacer	
17	Machine Screw (2 required)			316 Stainless steel	ERSA00198A0
	18-8 Stainless steel	19A7151X022	45*	Diaphragm Head Gasket, Composition	18B3450X012
18	Guide Insert, 316 Stainless steel	27B4028X022	46	Nameplate	-----
19	Upper Spring Seat, Steel	1A201824092	47	Drive Screw (4 required)	
20	Adjusting Nut, Brass	17B9740X012		18-8 Stainless steel	1A368228982
21	Hex Nut, Steel	1A345724122	48	Flow Arrow	-----
			49	Backup Ring, 302 Stainless steel	18B3446X012
			51	Connector Thread Stud, Steel	17B9741X012

*Recommended spare part

T208VR Series

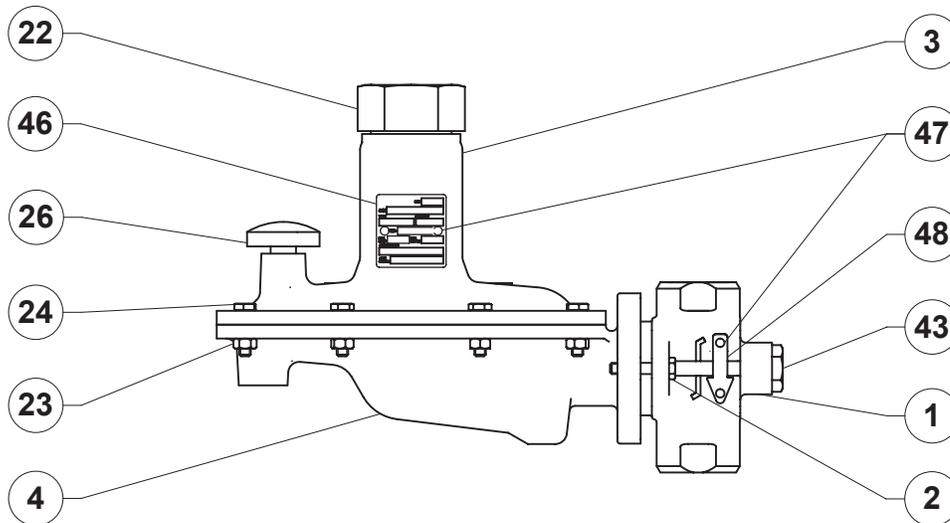
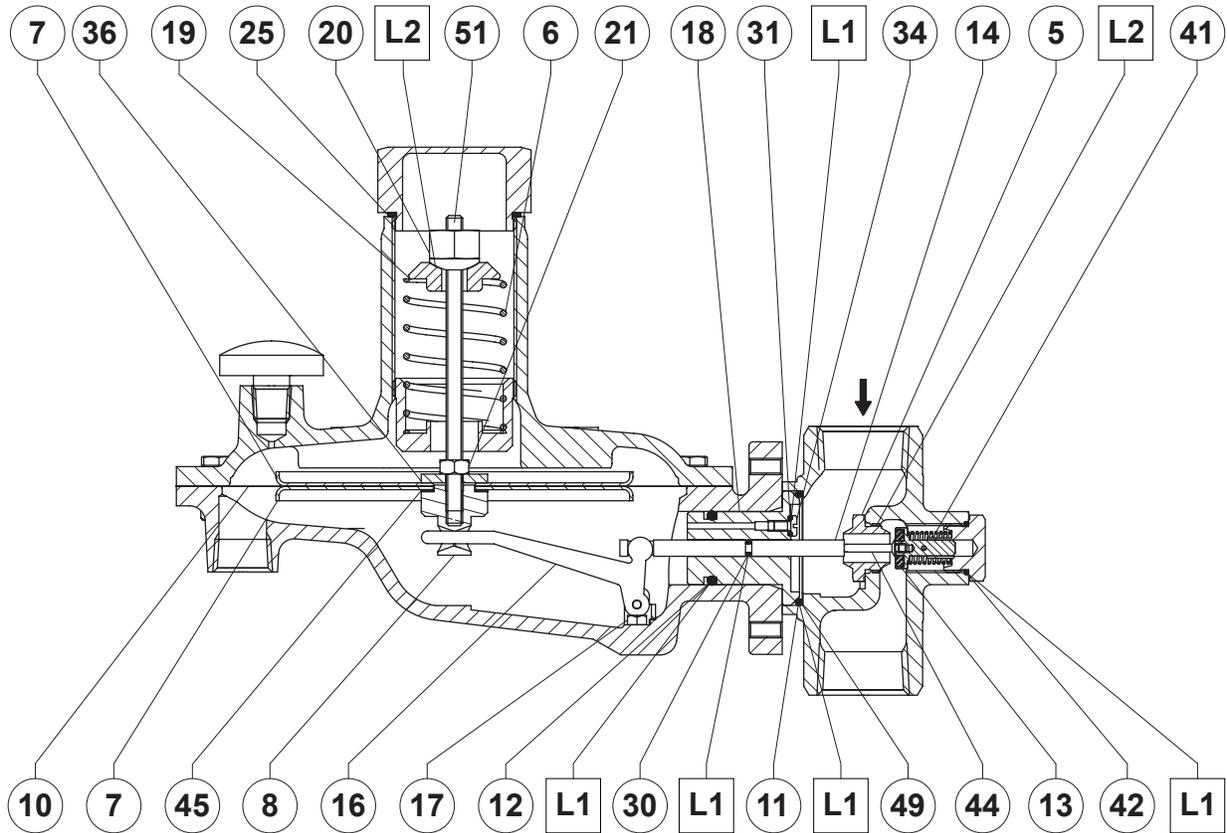


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□ APPLY LUBRICANT⁽¹⁾:
 L1 = SILICONE GREASE
 L2 = ANTI-SEIZE COMPOUND

1. Lubricants must be selected such that they meet the temperature requirements.

Figure 3. Type T208VR (Internal Registration) Assembly



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□ APPLY LUBRICANT⁽¹⁾:
 L1 = SILICONE GREASE
 L2 = ANTI-SEIZE COMPOUND

1. Lubricants must be selected such that they meet the temperature requirements.

Figure 4. Type T208VRM (External Registration) Assembly

T208VR Series

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The distinctive diamond shape cast into every spring case uniquely identifies the regulator as part of the Fisher® brand and assures you of the highest-quality engineering, durability, performance, and support.

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