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Type TM600 Integral True-Monitor™ Regulator

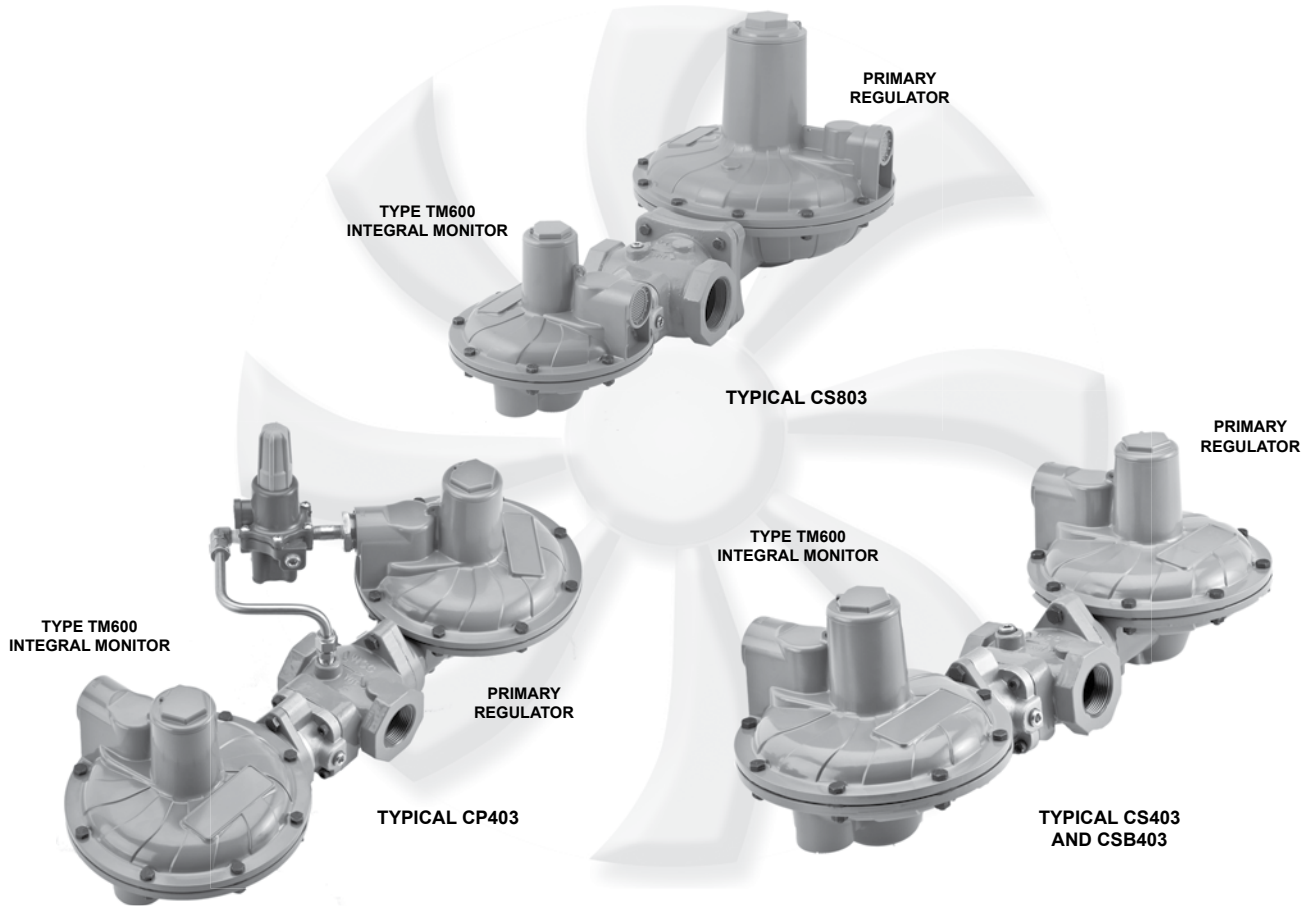


Figure 1. Type TM600 Integral Monitor Installed on Types CS403, CP403, and CS803 Regulators

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Introduction

Scope of the Manual

This manual provides instructions for the Installation, Startup, Adjustment, Maintenance, and Parts Ordering information for the Type TM600 Integral True-Monitor regulator.

The Type TM600 must be installed on service regulators with body connections suitable for the Type TM600.



Type TM600

Specifications

The Specifications section lists the specifications for Type TM600 configurations. The following information is stamped on the nameplate of the Type TM600: Spring Range and Orifice Size. Additional operating information is located on the Primary Regulator nameplate.

Available Configurations

Type TM600I—Integral True-Monitor™ regulator with internal registration

Type TM600E—Integral True-Monitor regulator with external registration

Body Size and End Connection Styles

See the Instruction Manual of the primary regulator for available Body Sizes and End Connections.

PRIMARY REGULATOR SERIES	INSTRUCTION MANUAL
CS400	D103120X012
CP400	D103122X012
CSB400	D103123X012
CS800	D103124X012

Allowable Inlet Pressures⁽¹⁾

See Table 8

Port Size

1 inch / 25 mm

Monitor Set Pressure Range⁽¹⁾

14 inches w.c. to 7.5 psig / 35 to 517 mbar

Maximum Downstream Pressures⁽¹⁾

Casing: 25 psig / 1.7 bar

To Avoid Internal Parts Damage:

5 psig / 345 mbar over set pressure

Operating: 7.5 psig / 517 mbar

Setpoints of Primary Regulator and Integral Monitor

See Tables 1 through 7

Maximum Lockup above True-Monitor Setpoint

Setpoints at or below 1 psig / 69 mbar:

0.3 psi / 21 mbar

Setpoints above 1 psig / 69 mbar:

0.6 psi / 41 mbar

Temperature Capabilities⁽¹⁾⁽²⁾

-20 to 150°F / -30 to 66°C

Pressure Registration

When used with:

CS400, CP400, and CS800 Series: same as primary regulator

CSB400 Series: external only

Approximate Weight

14 pounds / 6.3 kg

1. The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.
2. Product has passed Regulator Technologies testing for lockup down to -40 degrees.



WARNING

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

Fisher® regulators and integral True-Monitor 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 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.

Call a gas service person to service the unit. Only a qualified person must install or service the regulator.

Description

The Type TM600 Integral Monitor provides True-Monitor Protection by taking the place of a separate service regulator on monitor applications. Intended for commercial and light industrial applications, it can be used for pressure reducing service on natural, manufactured, or LP gas. To be functional, Type TM600 must be mounted on primary regulators with orifices up to 1 inch / 25 mm. The Type TM600 is not currently orderable separate from a service regulator.

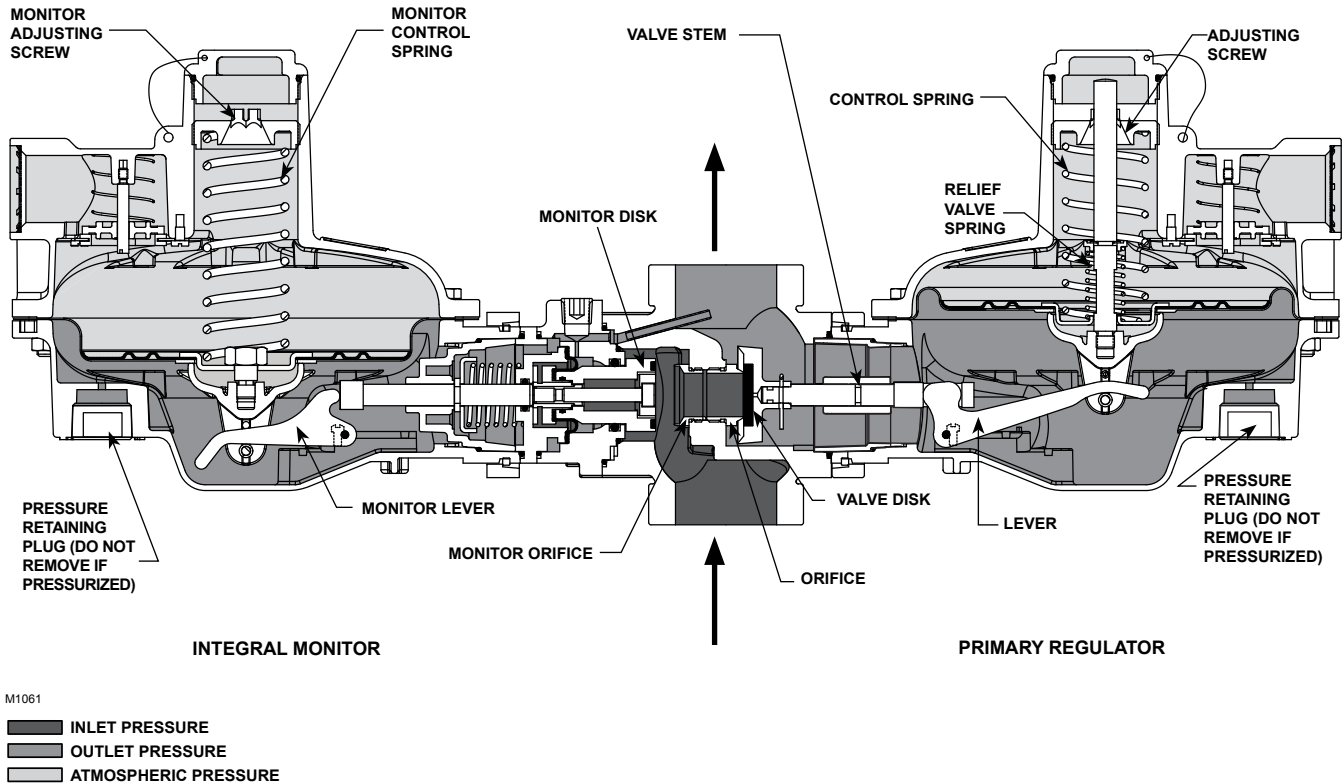


Figure 2. Internally Registered Regulator Operational Schematic

Principle of Operation

As downstream pressure registers under the main diaphragm of the Primary Regulator, it also registers under the diaphragm of the Integral Monitor. If for any reason the Primary Regulator ceases to regulate downstream pressure below the setpoint of the Integral Monitor, the monitor will begin to throttle the flow and maintain a downstream pressure below the maximum pressure indicated in Tables 1 through 7. If the Primary Regulator is equipped with a token internal relief valve, it will begin to relieve to provide an indication via smell that the Integral Monitor is controlling the downstream pressure. As downstream demand decreases, the Integral Monitor closes to maintain a downstream pressure below the maximum value given in Tables 1 through 7. As downstream demand increases, the Integral Monitor opens to supply additional gas flow as needed to maintain downstream pressure.

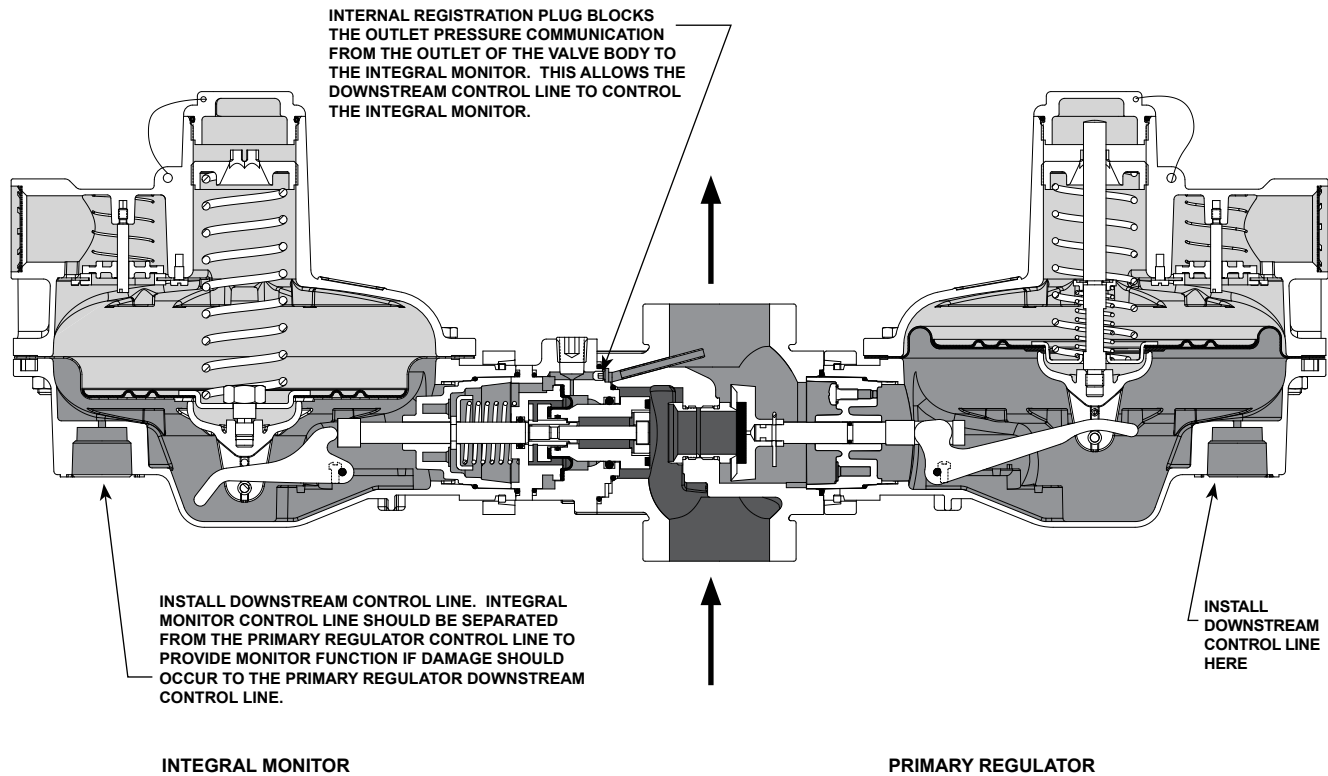
Installation



All vents should be kept open to permit free flow of gas to the atmosphere. Protect openings against entrance of rain, snow, insects or any other foreign material that may plug the vent or vent line. When installing outdoors, point the spring case vent of the Primary regulator and Integral Monitor downward to allow condensate to drain. This minimizes the possibility of freezing and accumulation of water or other foreign materials entering the vent and interfering with proper operation.

Under enclosed conditions or indoors, escaping gas may accumulate and be an explosion hazard. In these cases, the vents should be piped away from the regulator to the outdoors.

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M11062

■ INLET PRESSURE
■ OUTLET PRESSURE
■ ATMOSPHERIC PRESSURE

Figure 3. Externally Registered Regulator Operational Schematic

CAUTION

The Type TM600 Integral Monitor has an outlet pressure rating lower than their inlet pressure rating. Overpressuring any portion of the regulators beyond the limits in Specifications section and Tables 1 through 8 may cause leakage, damage to regulator parts, or personal injury due to bursting of pressure-containing parts.

If the Type TM600 is exposed to an overpressure condition, it should be inspected for any damage that may have occurred. Integral Monitor operation below these limits does not preclude the possibility of damage from external sources or from debris in the pipeline.

General Installation Instructions

Before installing the Type TM600:

- Check for damage, which might have occurred during the shipment.
- Check for and remove any dirt or foreign material, which may have accumulated in the regulator body.
- Blow out any debris, dirt, or copper sulfate in the copper tubing and the pipeline.
- Apply pipe compound to the external threads of the pipe before installing the pipe into the Type TM600 vent or external control line port.
- Make sure gas flow through the primary regulator is in the same direction as the arrow on the body. “Inlet” and “Outlet” connections are clearly marked.

Table 1. Type CS403 Setpoints and Associated True-Monitor™ Setpoints, with Token Relief

PRIMARY REGULATOR						INTEGRAL MONITOR					
Typical Regulator Setpoint		Spring Range		Spring Part Number	Spring Color	Monitor Setpoint ⁽¹⁾		Spring Range		Spring Part Number	Spring Color
Inch w.c.	mbar	Inch w.c.	mbar			Inch w.c.	mbar	Inch w.c.	mbar		
4	10	3.5 to 5	9 to 13	GE30198X012	Red	21	52	18 to 30	45 to 75	GE30196X012	Green
						1 psig	69	26 to 40	65 to 99	GE30225X012	Orange
5	12	4.5 to 6.5	11 to 16	GE30195X01	Purple	21	52	18 to 30	45 to 75	GE30196X012	Green
						1 psig	69	26 to 40	65 to 99	GE30225X012	Orange
7	17	6 to 8	15 to 20	GE30188X012	Gold	21	52	18 to 30	45 to 75	GE30196X012	Green
						1 psig	69	26 to 40	65 to 99	GE30225X012	Orange
11	27	7.5 to 11	19 to 28	GE30189X012	Blue	1 psig	69	26 to 40	65 to 99	GE30225X012	Orange
						1.5 psig	103	1.4 to 2.9 psig	97 to 200	GE30190X012	Black
14	35	10 to 14	25 to 35	GE30224X012	Unpainted	1 psig	69	26 to 40	65 to 99	GE30225X012	Orange
						1.5 psig	103	1.4 to 2.9 psig	97 to 200	GE30190X012	Black
18	45	12 to 19	30 to 48	GE30196X012	Green	1.5 psig	103	1.4 to 2.9 psig	97 to 200	GE30190X012	Black
						2.5 psig	172	1.4 to 2.9 psig	97 to 200	GE30190X012	Black
1 psig	69	18 inches w.c. to 1 psig	45 to 69	GE30225X012	Orange	2.5 psig	172	1.4 to 2.9 psig	97 to 200	GE30190X012	Black
						3.5 psig	241	2.6 to 3.7 psig	179 to 255	GE35081X012	Purple
2 psig	138	1 to 2 psig	69 to 138	GE30190X012	Black	3.5 psig	241	2.6 to 3.7 psig	179 to 255	GE35081X012	Purple
						5 psig	345	3.6 to 6 psig	248 to 414	GE30192X012	Dark Blue
3 psig	207	2 to 5.5 psig	138 to 380	GE30197X012	Yellow	5 psig	345	3.6 to 6 psig	248 to 414	GE30192X012	Dark Blue
						6 psig	414	5.1 to 7.5 psig	352 to 517	GE33121X012	Red
4 psig	276	2 to 5.5 psig	138 to 380	GE30197X012	Yellow	7 psig	483				
5 psig	345	2 to 5.5 psig	138 to 380	GE30197X012	Yellow	7.5 psig	517				

1. Integral Monitor setpoints shown represent the minimum Monitor setpoint for the Primary regulator Type CS400 with a Token Relief. Higher monitor setpoints can be chosen, e.g., for a Primary regulator setpoint of 7 inches w.c. / 17 mbar, the Integral Monitor can also be set at 21 inches w.c. / 52 mbar, 1 psig / 69 mbar, or higher.

Installation Location

- The installed Type TM600 should be adequately protected from vehicular traffic and damage from other external sources.
- Install both Primary and Type TM600 Integral Monitor with both vents pointing vertically down, see Figure 4. If the vents cannot be oriented in a vertically down position, then Type TM600 must be installed under a separate protective cover. Installation with the vents down allows condensation to drain, minimizes the entry of water or other debris from entering the vent, and minimizes vent blockage from freezing precipitation.
- Do not install Type TM600 in a location where there can be excessive water accumulation or ice formation, such as directly beneath a down spout, gutter, or roof line of building. Even a protective hood may not provide adequate protection in these instances.
- Install the Type TM600 so that any gas discharge through the vents or vent assemblies is over 3 feet / 0.91 meters away from any building opening.

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Table 2. Type CS403 Setpoints and Associated True-Monitor™ Setpoints, without Token Relief

PRIMARY REGULATOR						INTEGRAL MONITOR					
Typical Regulator Setpoint		Spring Range		Spring Part Number	Spring Color	Monitor Setpoint ⁽¹⁾		Spring Range		Spring Part Number	Spring Color
Inch w.c.	mbar	Inch w.c.	mbar			Inch w.c.	mbar	Inch w.c.	mbar		
4	10	3.5 to 5	9 to 13	GE30198X012	Red	14	35	12 to 21	30 to 52	GE30189X012	Blue
						21	52	18 to 30	45 to 75	GE30196X012	Green
						1 psig	69	26 to 40	65 to 99	GE30225X012	Orange
5	12	4.5 to 6.5	11 to 16	GE30195X012	Purple	14	35	12 to 21	30 to 52	GE30189X012	Blue
						21	52	18 to 30	45 to 75	GE30196X012	Green
						1 psig	69	26 to 40	65 to 99	GE30225X012	Orange
7	17	6 to 8	15 to 20	GE30188X012	Gold	14	35	12 to 21	30 to 52	GE30189X012	Blue
						21	52	18 to 30	45 to 75	GE30196X012	Green
						1 psig	69	26 to 40	65 to 99	GE30225X012	Orange
11	27	7.5 to 11	19 to 28	GE30189X012	Blue	21	52	18 to 30	45 to 75	GE30196X012	Green
						1 psig	69	26 to 40	65 to 99	GE30225X012	Orange
						1.5 psig	103	1.4 to 2.9 psig	97 to 200	GE30190X012	Black
14	35	10 to 14	25 to 35	GE30224X012	Unpainted	21	52	18 to 30	45 to 75	GE30196X012	Green
						1 psig	69	26 to 40	65 to 99	GE30225X012	Orange
						1.5 psig	103	1.4 to 2.9 psig	97 to 200	GE30190X012	Black
18	45	12 to 19	30 to 48	GE30196X012	Green	1 psig	69	26 to 40	65 to 99	GE30225X012	Orange
						1.5 psig	103	1.4 to 2.9 psig	97 to 200	GE30190X012	Black
						2.5 psig	172	1.4 to 2.9 psig	97 to 200	GE30190X012	Black
1 psig	69	18 inches w.c. to 1 psig	45 to 69	GE30225X012	Orange	1.5 psig	103	1.4 to 2.9 psig	97 to 200	GE30190X012	Black
						2.5 psig	172	1.4 to 2.9 psig	97 to 200	GE30190X012	Black
						3.5 psig	241	2.6 to 3.7 psig	179 to 255	GE35081X012	Purple
2 psig	138	1 to 2 psig	69 to 138	GE30190X012	Black	2.5 psig	172	1.4 to 2.9 psig	97 to 200	GE30190X012	Black
						3.5 psig	241	2.6 to 3.7 psig	179 to 255	GE35081X012	Purple
						5 psig	345	3.6 to 6 psig	248 to 414	GE30192X012	Dark Blue
3 psig	207	2 to 5.5 psig	138 to 380	GE30197X012	Yellow	3.5 psig	241	2.6 to 3.7 psig	179 to 255	GE35081X012	Purple
						5 psig	345	3.6 to 6 psig	248 to 414	GE30192X012	Dark Blue
						6 psig	414	5.1 to 7.5 psig	352 to 517	GE33121X012	Red
4 psig	276	2 to 5.5 psig	138 to 380	GE30197X012	Yellow	5 psig	345	3.6 to 6 psig	248 to 414	GE30192X012	Dark Blue
						6 psig	414	5.1 to 7.5 psig	352 to 517	GE33121X012	Red
5 psig	345	2 to 5.5 psig	138 to 380	GE30197X012	Yellow	7psig	483				
						6 psig	414				
						7.5 psig	517				

1. Integral Monitor setpoints shown represent the minimum Monitor setpoint for the Primary regulator Type CS400. Higher monitor setpoints can be chosen, e.g., for a Primary regulator setpoint of 7 inches w.c. / 17 mbar, the Integral Monitor can also be set at 14 inches w.c. / 35 mbar, 21 inches w.c. / 52 mbar, 1 psig / 69 mbar, or higher.

Table 3. Type CP403 Setpoints and Associated True-Monitor™ Setpoints, with Token Relief

PRIMARY REGULATOR						INTEGRAL MONITOR					
Typical Regulator Setpoint		Spring Range		Spring Part Number	Spring Color	Monitor Setpoint		Spring Range		Spring Part Number	Spring Color
psig	mbar	psig	mbar			psig	mbar	psig	mbar		
1	69	1 to 2	69 to 138	GE30199X012	Yellow Stripe	5	345	3.6 to 6	248 to 414	GE30192X012	Dark Blue
2	138					5.5	379	5.1 to 7.5	352 to 517	GE33121X012	Red

Table 4. Type CP403 Setpoints and Associated True-Monitor Setpoints, without Token Relief

PRIMARY REGULATOR						INTEGRAL MONITOR					
Typical Regulator Setpoint		Spring Range		Spring Part Number	Spring Color	Monitor Setpoint		Spring Range		Spring Part Number	Spring Color
psig	mbar	psig	mbar			psig	mbar	psig	mbar		
1	69	1 to 2	69 to 138	GE30199X012	Yellow Stripe	2	138	1.4 to 2.9	97 to 200	GE30190X012	Black
						2.5	172	1.4 to 2.9	97 to 200	GE30190X012	Black
						3.5	241	2.6 to 3.7	179 to 255	GE35081X012	Purple
2	138	1 to 2	69 to 138	GE30199X012	Yellow Stripe	3	207	2.6 to 3.7	179 to 255	GE35081X012	Purple
						4	276	3.6 to 6	248 to 414	GE30192X012	Dark Blue
						5	345	3.6 to 6	248 to 414	GE30192X012	Dark Blue
3	207	2 to 5	345 to 689	GE27213X012	Orange Stripe	5	345	3.6 to 6	248 to 414	GE30192X012	Dark Blue
						6	414	5.1 to 7.5	352 to 517	GE33121X012	Red
4	276	2 to 5	345 to 689	GE27213X012	Orange Stripe	6	414				
						7	483				
5	345	2 to 5	345 to 689	GE27213X012	Orange Stripe	7	483				

Table 5. Types CSB403 and CSB423 with and without Token Relief Setpoints and Maximum Downstream Pressures

TYPE	PRIMARY REGULATOR							INTEGRAL TRUE-MONITOR							
	Factory Setpoint		Set Pressure Range		Color	Part Number	Factory Token Relief Set ⁽¹⁾			Factory Setpoint		Spring Range		Color	Part Number
	Inch w.c.	mbar	Inch w.c.	mbar			% of REG. Set	Inch w.c.	mbar	Inch w.c.	mbar	Inch w.c.	mbar		
CSB403 and CSB403F	8	20	7 to 10	17 to 24	Pink	GE30191X012	No Token Relief			15	37	12 to 21	30 to 52	Blue	GE30189X012
							170%	14	35	21	52	18 to 30	45 to 75	Green	GE30196X012
	12	30	10 to 14	24 to 35	Orange Stripe	GE43955X012	No Token Relief			1 psig	70	26 to 40	65 to 99	Orange	GE30225X012
							150%	18	45						
	20	50	14 to 24	35 to 60	Dark Green	GE30201X012	No Token Relief			1.5 psig	103	1.4 to 2.9 psig	97 to 200	Black	GE30190X012
							140%	1 psig	70						
1 psig	70	0.87 to 1.5 psig	60 to 100	Tan	GE30202X012	No Token Relief			2 psig	138	1.4 to 2.9 psig	97 to 200	Black	GE30190X012	
						130%	1.3 psig	90							
CSB423 and CSB423F	2 psig	138	1.5 to 2.3 psig	100 to 160	Purple Stripe	GE35081X012	No Token Relief			2.5 psig	172	1.4 to 2.9 psig	97 to 200	Black	GE30190X012
							130%	2.6 psig	180	3.5 psig	241	2.6 to 3.7 psig	179 to 255	Purple	GE35081X012
	3 psig	207	2.3 to 4.4 psig	160 to 300	Dark Blue	GE30192X012	No Token Relief			4 psig	276	3.6 to 6 psig	248 to 414	Dark Blue	GE30192X012
							125%	3.8 psig	260	5 psig	345	3.6 to 6 psig	248 to 414	Dark Blue	GE30192X012
	5 psig	345	4.4 to 7.3 psig	300 to 500	Red	GE33121X012	No Token Relief			6 psig	414	5.1 to 7.5 psig	352 to 517	Red	GE33121X012
							125%	6.25 psig	430	6.5 psig	448				

1. Integral Monitor setpoints shown represent the minimum Monitor setpoint for the Primary regulator Type CSB400 without Token Relief. Higher monitor setpoints can be chosen, e.g., for a Primary regulator setpoint of 8 inches w.c. / 20 mbar, the Integral Monitor can also be set at 14 inches w.c. / 35 mbar, 21 inches w.c. / 52 mbar, or higher.

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Table 6. Types CS803 and CS823 Setpoints and Associated True-Monitor™ Setpoints, without Token Relief

Type	PRIMARY REGULATOR						INTEGRAL MONITOR					
	Factory Setpoint		Spring Part Number	Spring Range		Spring Color	Factory Setpoint		Spring Part Number	Spring Range		Spring Color
	Inch w.c.	mbar		Inch w.c.	mbar		Inch w.c.	mbar		Inch w.c.	mbar	
CS803IN and CS803EN	4	10	GE30337X012	3.5 to 6	9 to 15	Red	14	35	GE30189X012	12 to 21	30 to 52	Blue
							21	52	GE30196X012	18 to 30	45 to 75	Green
							1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
	7	17	GE30338X012	5.5 to 8.5	13 to 21	Black	14	35	GE30189X012	12 to 21	30 to 52	Blue
							21	52	GE30196X012	18 to 30	45 to 75	Green
							1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
	11	27	GE30339X012	8 to 12	20 to 30	Purple	21	52	GE30196X012	18 to 30	45 to 75	Green
							1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
							1.5 psig	103	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
	14	35	GE30340X012	10 to 16	25 to 40	White Stripe	21	52	GE30196X012	18 to 30	45 to 75	Green
							1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
							1.5 psig	103	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
	1 psig	69	GE30341X012	14 to 30	35 to 75	Dark Green	1.5 psig	103	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
							2 psig	138	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
							3.5 psig	241	GE35081X012	2.6 to 3.7 psig	179 to 255	Purple
CS823IN and CS823EN	2 psig	138	GE30342X012	1 to 2.5 psig	69 to 170	Dark Blue	2.5 psig	172	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
							3 psig	207	GE35081X012	2.6 to 3.7 psig	179 to 255	Purple
							5 psig	345	GE30192X012	3.6 to 6 psig	248 to 414	Dark Blue
	3 psig	207	GE46922X012	1.5 to 3.5 psig	100 to 240	Orange	3.5 psig	241	GE35081X012	2.6 to 3.7 psig	179 to 255	Purple
							4 psig	276	GE30192X012	3.6 to 6 psig	248 to 414	Dark Blue
							6 psig	414	GE33121X012	5.1 to 7.5 psig	352 to 517	Red
	5 psig	345	GE30343X012	2.5 to 5.5 psig	170 to 380	Yellow	6 psig	414	GE33121X012	5.1 to 7.5 psig	352 to 517	Red
							7 psig	483	GE33121X012	5.1 to 7.5 psig	352 to 517	Red
							7.5 psig	517	GE33121X012	5.1 to 7.5 psig	352 to 517	Red

Table 7. Types CS803 and CS823 Setpoints and Associated True-Monitor™ Setpoints, with Token Relief

Type	PRIMARY REGULATOR						INTEGRAL MONITOR					
	Factory Setpoint		Spring Part Number	Spring Range		Spring Color	Factory Setpoint		Spring Part Number	Spring Range		Spring Color
	Inch w.c.	mbar		Inch w.c.	mbar		Inch w.c.	mbar		Inch w.c.	mbar	
CS803IT and CS803ET	4	10	GE30337X012	3.5 to 6	9 to 15	Red	21	52	GE30196X012	18 to 30	45 to 75	Green
							1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
	7	17	GE30338X012	5.5 to 8.5	13 to 21	Black	21	52	GE30196X012	18 to 30	45 to 75	Green
							1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
	11	27	GE30339X012	8 to 12	20 to 30	Purple	1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
							1.5 psig	103	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
	14	35	GE30340X012	10 to 16	25 to 40	White Stripe	1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
							1.5 psig	103	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
	1 psig	69	GE30341X012	14 to 30	35 to 75	Dark Green	2 psig	138	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
							3 psig	207	GE35081X012	2.6 to 3.7 psig	179 to 255	Purple
CS823IT and CS823ET	2 psig	138	GE30342X012	1 to 2.5 psig	69 to 170	Dark Blue	3 psig	207	GE35081X012	2.6 to 3.7 psig	179 to 255	Purple
							4 psig	276	GE30192X012	3.6 to 6 psig	248 to 414	Dark Blue
	3 psig	207	GE46922X012	1.5 to 3.5 psig	100 to 240	Orange	5 psig	345	GE30192X012	3.6 to 6 psig	248 to 414	Dark Blue
							6 psig	414	GE33121X012	5.1 to 7.5 psig	352 to 517	Red
	5 psig	345	GE30343X012	2.5 to 5.5 psig	170 to 380	Yellow	7 psig	483	GE33121X012	5.1 to 7.5 psig	352 to 517	Red
							7.5 psig	517	GE33121X012	5.1 to 7.5 psig	352 to 517	Red

Table 8. Inlet Pressure Ratings

INTEGRAL MONITOR ORIFICE SIZE		MAXIMUM OPERATING INLET PRESSURE ⁽¹⁾		MAXIMUM EMERGENCY INLET PRESSURE	
Inch	mm	psig	bar	psig	bar
1	25	125	8.6	175	12.1

1. The maximum allowable inlet pressure for the Primary regulator per orifice may be lower than that of the Integral Monitor. Refer to the Primary Regulator Instruction manual for Inlet pressure capabilities of the Primary regulator.

Regulators Subjected to Heavy Snow Conditions

Some installations, such as in areas with heavy snowfall, may require a hood or enclosure to protect the regulator from snow load and vent freeze over.

Downstream Control Line Installation



WARNING

Integral Monitor external registration via the downstream control line is used when it is desired to control the Integral Monitor and primary regulator

from points other than the outlet of the valve body. The Integral Monitor may not be used as an upstream monitor for a regulator installed downstream since the intermediate pressure may be greater than the maximum outlet of the Integral Monitor.

If using a control line, use two separate control lines, one for the primary regulator and one for the Integral Monitor, see Figure 3. In this way, damage to the primary regulator control line will not affect operation of the Integral Monitor. Attach the control line from the primary regulator a minimum of 6 pipe diameters downstream of the regulator in a straight run of pipe. Attach the control line from the Integral Monitor a minimum of 6 pipe diameters downstream of the

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regulator in a straight run of pipe. If it is impossible to comply with this recommendation due to the pipe arrangement, it may be better to make the control line taps nearer the regulator outlet rather than downstream of a block valve. Do not make the tap near any elbow, swage, or nipple which might cause turbulence. For optimal performance, use as large of a control line as practical.

In many instances, it will be necessary to enlarge the downstream piping to keep flow velocities within good engineering practices. Expand the piping as close to the regulator outlet as possible.

Startup



Pressure gauges should always be used to monitor downstream pressure during Startup.

With the downstream system depressurized, use the following procedure to start up the regulator.

1. Slowly open the upstream shutoff valve.
2. Slowly open the downstream shutoff valve.
3. Check all connections for leaks.

Adjustment

For adjustment of the Primary Regulator, refer to the appropriate Instruction Manual of the Primary Regulator (see Specifications section for details). If adjustment of the Integral Monitor is required, then the Primary Regulator will need to be adjusted above the intended lockup of the Integral Monitor, typically 0.25 psig / 0.17 mbar above setpoint of the Integral Monitor in order for the Integral Monitor to take control of the system and throttle the flow. This can be done by temporarily installing a set spring into the Primary Regulator with a higher setpoint than the Integral Monitor or by some other means of maintaining the Primary Regulator in a wide-open position. Once the Primary Regulator has been adjusted above that lockup pressure of the Integral Monitoring, adjustment can then be made to the Integral Monitor.

Refer to Figure 4. To increase the outlet pressure setting, the adjusting screw (key 65) must be turned clockwise. This requires removal of the closing cap (key 60). To reduce the outlet pressure setting, turn the adjusting screw counterclockwise. A pressure gauge should always be used to monitor downstream

pressure while adjustments are being made. If the required pressure is not within the range of the spring being used, substitute with the correct spring as shown in Tables 1 through 7. When changing the spring, also alter the nameplate or affix an additional label, so that the actual pressure range of the spring in use is indicated. After the spring adjustment has been completed, replace the closing cap.

Shutdown

Installation arrangements may vary, but in any installation it is important that the valves be opened or closed slowly and that the outlet pressure be vented before venting inlet pressure to prevent damage caused by reverse pressurization of the Integral Monitor. The steps below apply to the typical installation as indicated.

1. Open valves downstream of the Integral Monitor.
2. Slowly close the upstream shutoff valve.
3. Inlet pressure will automatically be released downstream as the Integral Monitor opens in response to the lowered pressure on the diaphragm.

Maintenance and Testing



To avoid personal injury or equipment damage, do not attempt any maintenance or disassembly without first isolating the regulator from system pressure and relieving all internal pressure as described in “Shutdown”.

Failure to test for/of Integral True-Monitor™ regulation can result in a hazardous condition. Test the Integral Monitor for operation per applicable federal, state and local codes, rules and regulations, and Regulator Technologies instructions.

Gas controlling devices such as the Primary Regulator and Integral Monitor 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® regulators.

Restart gas utilization equipment according to normal startup procedures. Due to normal wear or damage that may occur from external sources, this Integral Monitor should be inspected and maintained periodically.

The frequency of inspection and replacement of parts depends upon the severity of service conditions or the requirements of local, state, and federal rules and regulations.

Recommended Test Frequency

True-Monitor™ devices should be tested periodically to confirm operation at the desired regulation pressure. Repair and/or replace the True-Monitor regulator if it does not regulate at the desired pressure or leaks gas after closure.

Parts are subject to normal wear and must be inspected periodically and replaced as necessary.

The frequency of inspection and replacement depends on the severity of service conditions, test results found during testing, and on applicable codes and regulations.

Note

For adjusting setpoints above 1 psig / 69 mbar, use a 1/2-inch / 13 mm hex driver, a 1/2-inch / 13 mm socket, or a 1-1/16-inch / 27 mm socket to turn the adjusting screw (key 65).

Disassembly to Replace Type TM600 Main Diaphragm

For disassembly of the Integral Monitor, refer to Figures 4 and 6.

1. Remove closing cap (key 60) and turn the adjusting screw (key 65) out of the spring case.
2. Remove the spring (key 38).
3. Remove the cap screws (key 15) holding the spring case (key 1) to the lower casing (key 9). Remove the spring case.
4. The diaphragm and diaphragm head assembly (keys 55A and 55B) can be removed by sliding the diaphragm assembly off of the lever (key 10).
5. Unscrew the diaphragm retainer (key 45) from the diaphragm assembly and remove the lower spring seat (key 43) to expose the diaphragm plate

(key 55B) and diaphragm (key 55A). Remove the diaphragm plate (key 55B) and replace the diaphragm (key 55A).

6. Reassemble in reverse order of the above procedures. Before tightening the diaphragm retainer (key 45) into the lower spring seat (key 43) to secure the new diaphragm, place the loosely assembled diaphragm assembly into position in the lower casing (key 9), being sure the diaphragm assembly is properly hooked on the lever (key 10). Rotate the diaphragm so that the diaphragm and lower casing holes align. Tighten the diaphragm retainer (key 45) and proceed with Reassembly.



CAUTION

Before tightening cap screws on spring case, replace spring and adjusting screw. Tighten adjusting screw slightly. This will align the diaphragm to ensure a smooth seal.

Disassembly to Replace Integral Monitor Disk, Diaphragm, and O-rings

For replacement of the Primary Regulator valve disk, refer to the appropriate Instruction Manual of the Primary Regulator (see Specifications for details). Refer to Figures 4 through 6.

1. Remove the two cap screws (key 36T) in the union ring (key 17).
2. The actuator assembly can be removed from the monitor housing assembly. Inspect the actuator/monitor housing assembly O-ring (key 21) and replace if necessary.
3. Remove the four monitor housing screws (key 36S) using an M6 Allen wrench. Inspect monitor housing/body O-rings (key 36P and 36O) and replace if necessary. Inspect Integral Monitor orifice (key 26) and replace it as well as Integral Monitor orifice O-ring (key 27) if necessary.
4. Unscrew monitor stem (key 36A). This is done by inserting or holding the disk retaining screw (key 36D) fixed. Care must be taken as monitor spring (key 36C) is in a compressed state and unscrewing monitor stem (key 36A) will release it. Inspect upper retainer/stem O-ring (key 36K) and replace if necessary.
5. Remove upper diaphragm retainer (key 36G). Inspect upper retainer/monitor housing O-ring and

Type TM600

replace if necessary. Unscrew disk retaining screw (key 36D) while holding the middle diaphragm retainer (key 36H) fixed.

6. Remove disk retaining screw and disk retainer (keys 36D and 36J). Remove disk (key 36I) and inspect and replace monitor housing/disk O-ring (key 36Q) if necessary. Inspect monitor diaphragm (key 36E) and replace if necessary. Inspect disk/middle retainer O-ring (key 36R) and replace if necessary.
7. To reassemble monitor housing, re-insert disk into monitor housing and reverse previous steps taking care to apply the appropriate lube to O-rings and appropriate torque to fasteners as noted in Figures 4 through 6.

Changing from Internal to External Registration



If the Primary Regulator uses an external control line pressure registration, then the Integral Monitor must also use an external control line for pressure registration. Failure to change both devices will result in improper pressure control and could result in an overpressure condition.

1. Unscrew the four monitor housing screws (key 36S) and remove Integral Monitor from body. Thread the sense blocking screw (key 36U) into the internal sense port located in the monitor housing (key 36F). Reinstall the Integral Monitor into the body and reinstall the four housing screws (key 36S).
2. Remove the 3/4 NPT external pipe plug (key 22) from the Integral Monitor lower casing (key 9) and install a downstream sense line.

Changing from External to Internal Registration

1. Thread the 3/4 NPT external pipe plug (key 22) into the Integral Monitor lower casing (key 9).
2. Unscrew the four monitor housing screws (key 36S) and remove Integral Monitor from body. Remove the sense blocking screw (key 36U) from the internal sense port located in the monitor housing (key 36F). Reinstall the Integral Monitor into the body and reinstall the four housing screws (key 36S).

Regulator Reassembly

It is recommended that a good quality pipe thread sealant be applied to pressure connections and fittings and a good quality lubricant be applied to all O-rings. Also apply an anti-seize compound to the adjusting screw threads and other areas as needed.

Parts Ordering

The type number, orifice (port) size, and date of manufacture are stamped on the closing cap. Always provide this information in any correspondence with your local Sales Office regarding replacement parts or technical assistance. If construction changes are made in the field, be sure that the closing cap is also changed to reflect the most recent construction.

When ordering replacement parts, reference the key number of each needed part as found in the following parts list. Separate kit containing all recommended spare parts is available.

Parts List

Key	Description	Part Number
	Parts Kit	RTM600X0012
	Repair Parts kit includes key numbers 19, 21, 36E, 36I, 36K, 36N, 36O, 36P, 36Q, 36R, and 62. [True-Monitor™ Orifice is not included in repair kit. If Orifice replacement is required, select both True-Monitor Orifice (key 26) and Orifice O-ring (key 27).]	
1	Spring Case, 1-inch / 25 mm with vent, Aluminum	GE24555X012
2	Vent Screen, 18-8 Stainless steel	T1121338982
3	Retaining Ring, 1-3/16-inch / 30 mm ID, Cast Zinc-plated steel	T1120925072
4	Stabilizer Guide, 1-inch / 25 mm vent, stainless steel	GE27061X012
5	Stabilizer, 1-inch / 25 mm vent	GE27063X012
6	Upper Stabilizer Spring, stainless steel	GE35010X012
7	Retaining Ring, 1-inch / 25 mm vent, stainless steel	GE27024X012
8	Stabilizer Screw, steel (3 required)	GE29724X012
9	Lower Casing, Aluminum	GE24289X012
10	Lever 2.5:1 Ratio, steel	GE28773X012
11	Guided Monitor Stem, Aluminum	GE27723X012
13	Pin, 18-8 Stainless steel	T14397T0012
14	Machine Screw, steel (2 required)	GE34243X012
15	Bolt, Zinc-plated steel (8 required)	GE32059X012
16	Nut, Zinc-plated steel (8 required)	GE32060X012
17	Union Ring, Aluminum	GE27724X012
18	Snap Ring, stainless steel	T1120637022
19*	O-ring, Nitrile (NBR)	1K594906562
20	Stem Guide, Aluminum	GE26027X01
21*	O-ring, Nitrile (NBR)	GE45216X012
22	Pipe plug, 3/4 NPT, steel (For Internal Port Balanced Assembly only)	GE34199X012

*Recommended spare parts.

CS400 SERIES ASSEMBLY REFERENCE

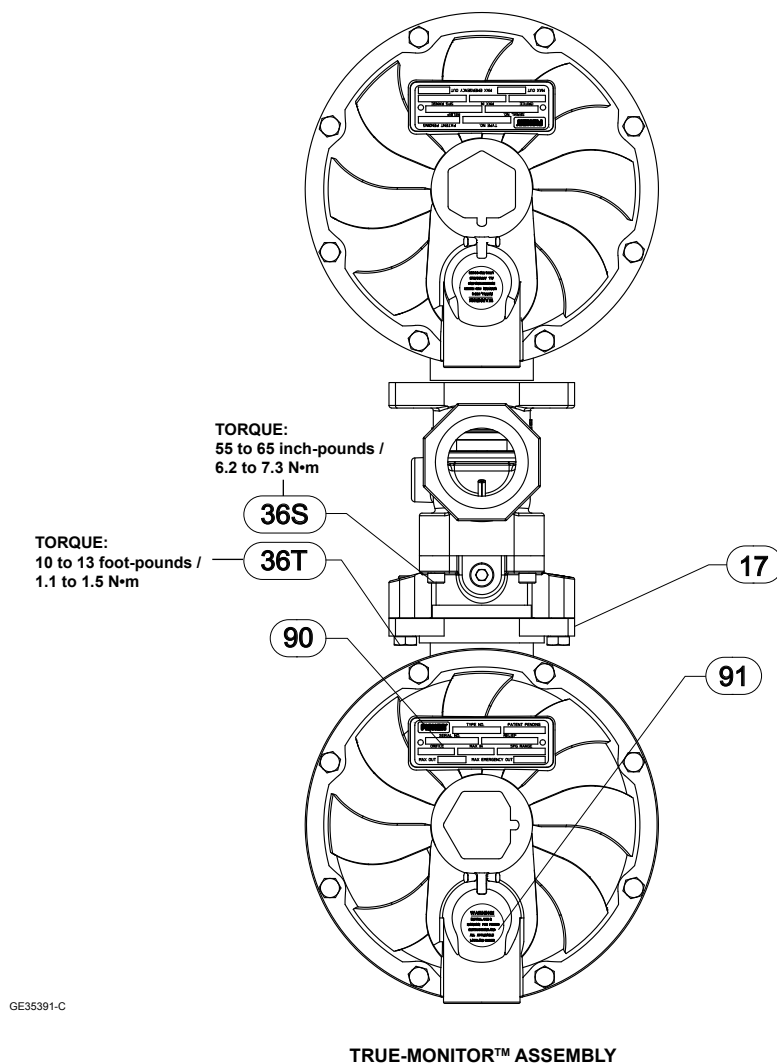
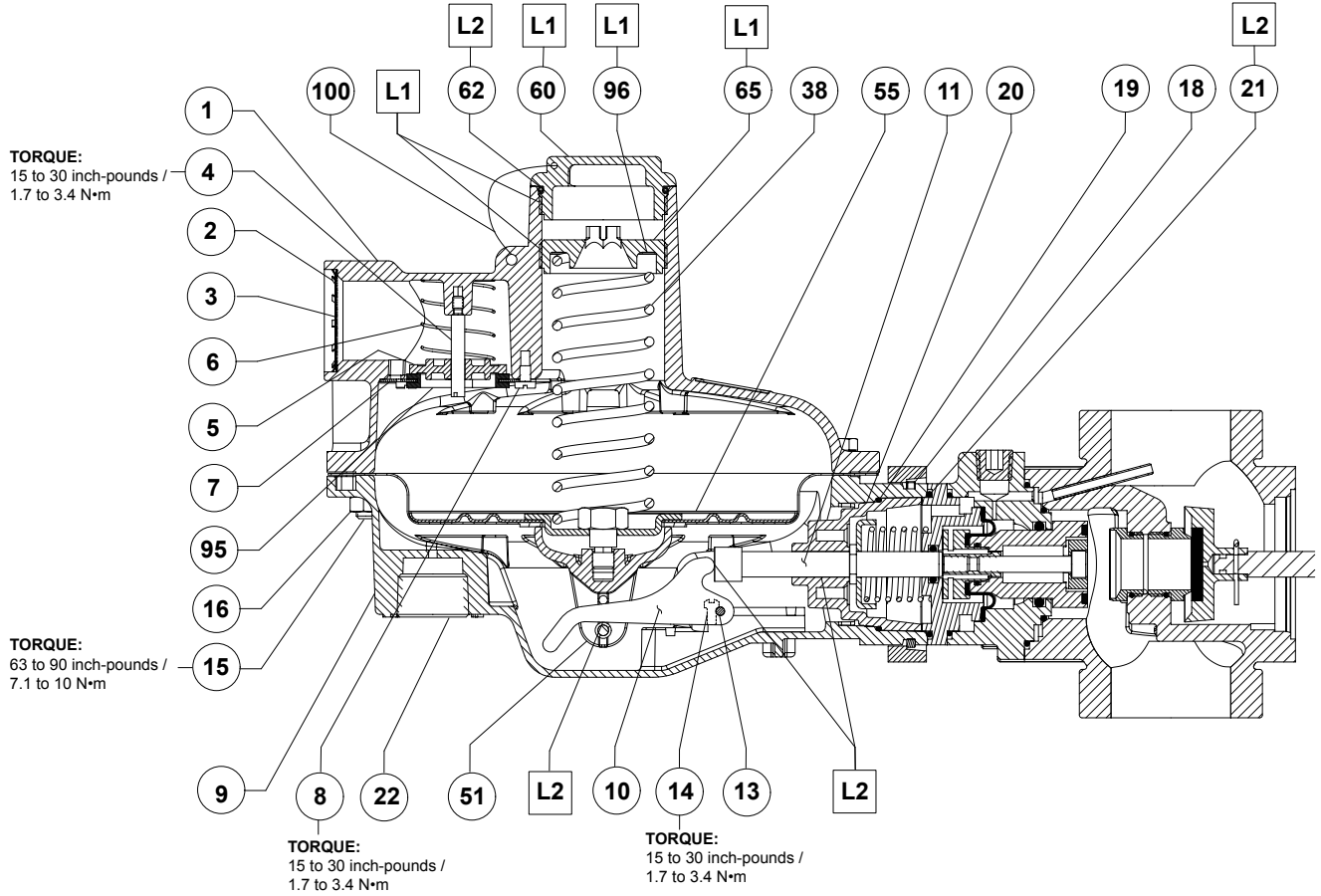


Figure 4. Type TM600 Integral Monitor Assembly Attached to a CS400 Series Primary Regulator

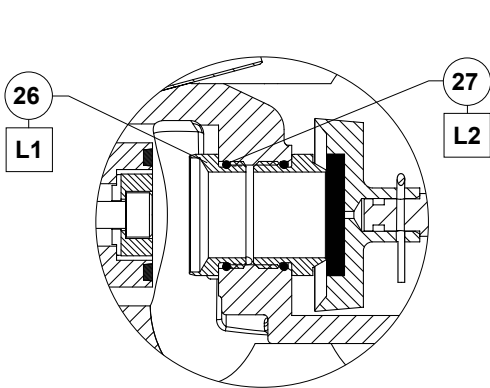
Key	Description	Part Number	Key	Description	Part Number
26	Integral Monitor Orifice Medium Capacity Body High Capacity Body	GE30003X012 GE30327X012	36C	Spring	GE32715X012
27*	Integral Monitor Orifice O-ring Medium Capacity Body High Capacity Body	10A3802X022 GE32723X012	36D	Retaining Screw	GE27726X012
36	Balanced Port Assembly Internal Port Balanced Assembly, 1 inch / 25 mm External Port Balanced Assembly, 1 inch / 25 mm	GE33118X012 GE34989X012	36E*	Diaphragm, Nitrile (NBR), Nylon (PA)	GE30441X012
36A	Stem	GE27727X012	36F	Housing, Aluminum	GE29110X012
36B	Upper Spring Retainer	GE27013X012	36G	Upper Diaphragm Retainer	GE29122X012
			36H	Middle Diaphragm Retainer	GE27087X012
			36I*	Disk, Brass/Nitrile (NBR)	GE32951X012
			36J	Disk Retainer	GE27089X012
			36K*	Stem/Upper O-ring	GE32716X012
			36N*	Upper Retainer/Housing O-ring, Nitrile (NBR)	GE45216X012
			36O*	Lower Body/Housing O-ring, Nitrile (NBR)	GE32717X012
			36P*	Upper Body/Housing O-ring, Nitrile (NBR)	GE32718X012
			36Q*	Disk Holder/Housing O-ring, Nitrile (NBR)	GE32719X012

*Recommended spare parts.

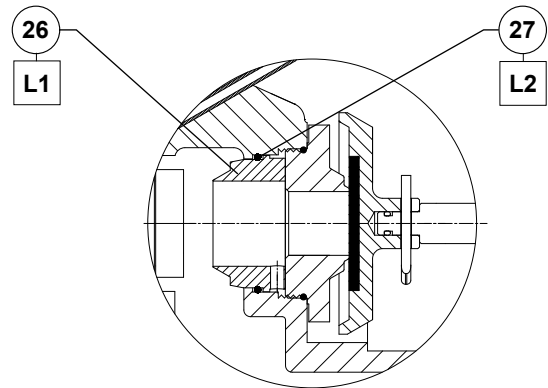
Type TM600



MEDIUM CAPACITY BODY ON CS400,
CP400, AND CSB400 SERIES



MEDIUM CAPACITY BODY ORIFICE CONFIGURATION



HIGH CAPACITY BODY ORIFICE CONFIGURATION

GE35391-G

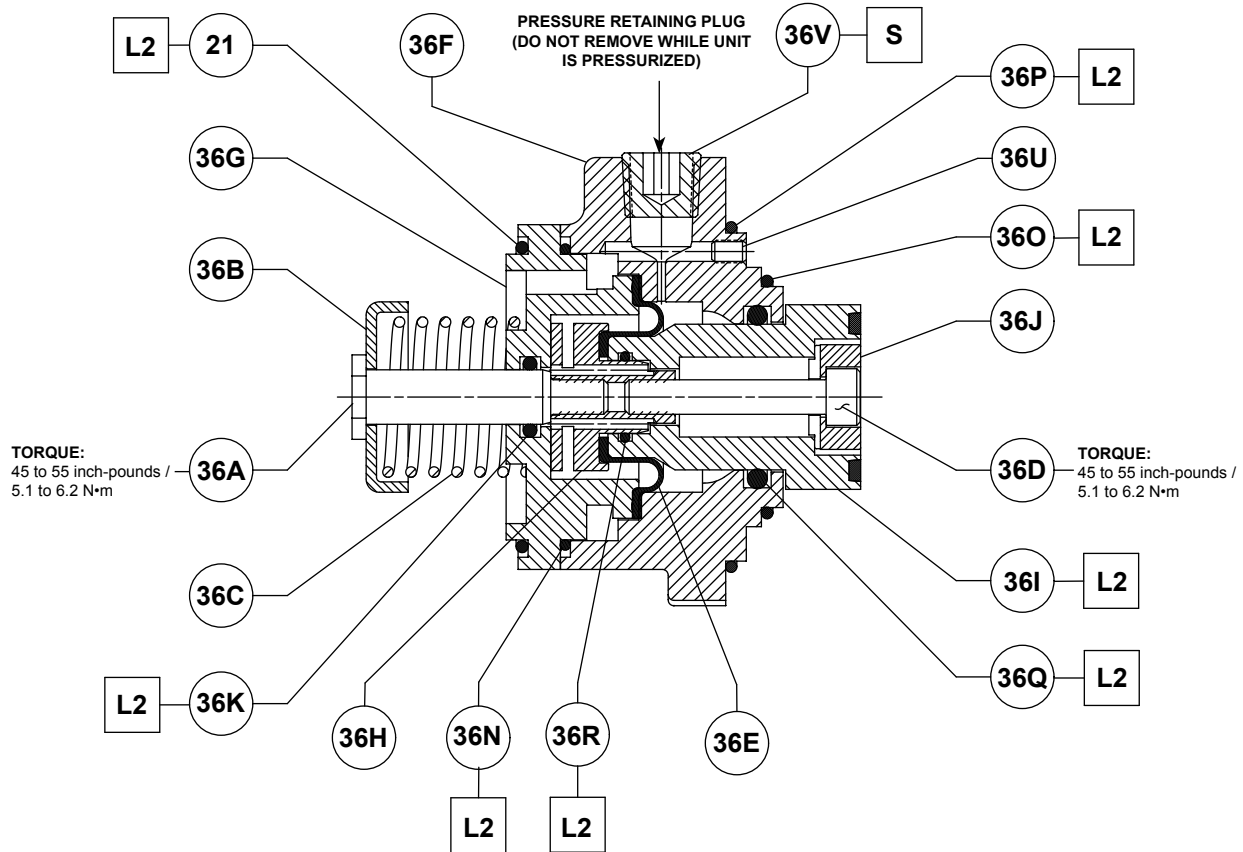
- APPLY LUBRICANT (L)⁽¹⁾:
- L1 = ANTI-SEIZE LUBRICANT
- L2 = EXTREME LOW TEMPERATURE BEARING GREASE

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

TRUE-MONITOR™ ASSEMBLY

Figure 4. Integral Monitor Assembly (continued)

Type TM600



GE35391-E

- APPLY SEALANT (S) OR LUBRICANT (L)⁽¹⁾:
 L2 = EXTREME LOW TEMPERATURE BEARING GREASE
 S = MEDIUM STRENGTH PIPE SEALANT WITH PTFE

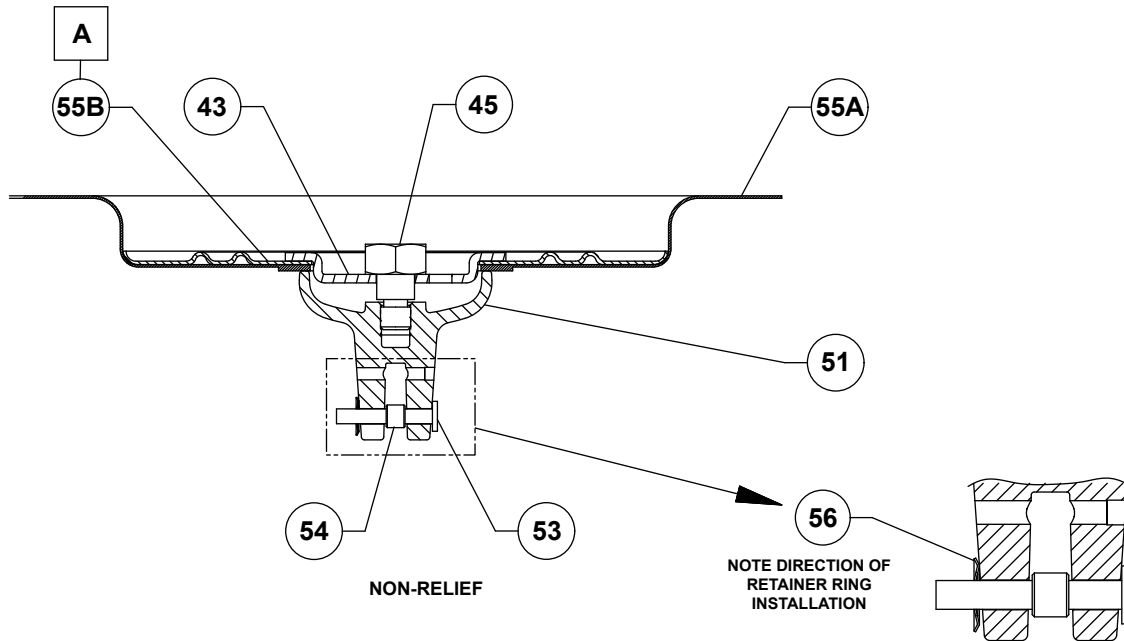
1. Lubricant and sealant must be selected such that they meet the temperature requirements.

Figure 5. Type TM600 Balanced Port Assembly

Key	Description	Part Number	Key	Description	Part Number
36R*	Disk/Middle Retainer O-ring, Nitrile (NBR)	GE32720X012	51	Pusher Post, Aluminum	ERAA00875A0
36S	Screw, Body/Housing (4 required)	GE30266X012	53	Pin, stainless steel	GE29761X012
36T	Cap Screw (2 required)	GE29973X012	54	Roller Pin, Brass	GE27060X012
36U	Plug, Sense Blocking (for External Port Balanced Assembly Only)	GE30382X012	55*	Diaphragm Head Assembly, Nitrile (NBR)	GE31248X012
36V	Sense Plug, 1/4 NPT	1C333528992	55A	Diaphragm	GE31197X012
38	Spring		55B	Diaphragm head	GE28755X012
	12 to 21-inches of w.c. / 30 to 52 mbar, Blue	GE30189X012	56	Pusher Post Pin Retaining Ring, steel	GE33772X012
	18 to 30-inches of w.c. / 45 to 75 mbar, Green	GE30196X012	60	Closing Cap, Aluminum	GE29244X012
	26 to 40-inches of w.c. / 65 to 99 mbar, Orange	GE30225X012	62*	O-ring, Nitrile (NBR)	T10275X0012
	1.4 to 2.9 psig / 97 to 200 mbar, Black	GE30190X012	65	Adjusting Screw, Aluminum	GE27828X012
	2.6 to 3.7 psig / 179 to 255 mbar, Purple	GE35081X012	90	Nameplate	-----
	3.6 to 6 psig / 248 to 517 mbar, Dark Blue	GE30192X012	91	Warning Label	-----
	5.1 to 7.5 psig / 352 to 517 mbar, Red	GE33121X012	95	Grommet, Nitrile (NBR)	GE35358X012
43	Lower Spring Seat, Zinc-plated steel	GE27327X012	96	Slip Disk	GG05787X012
45	Diaphragm Retainer, Zinc-plated steel	GE30887X012	100	Lockwire, stainless steel	T14088T0012

*Recommended spare parts.

Type TM600



GE35391-B

APPLY ADHESIVE (A)⁽¹⁾
A = ADHESIVE

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

Figure 6. Main Diaphragm Assembly

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