

CSB400 Series Commercial / Industrial Pressure Reducing Regulators

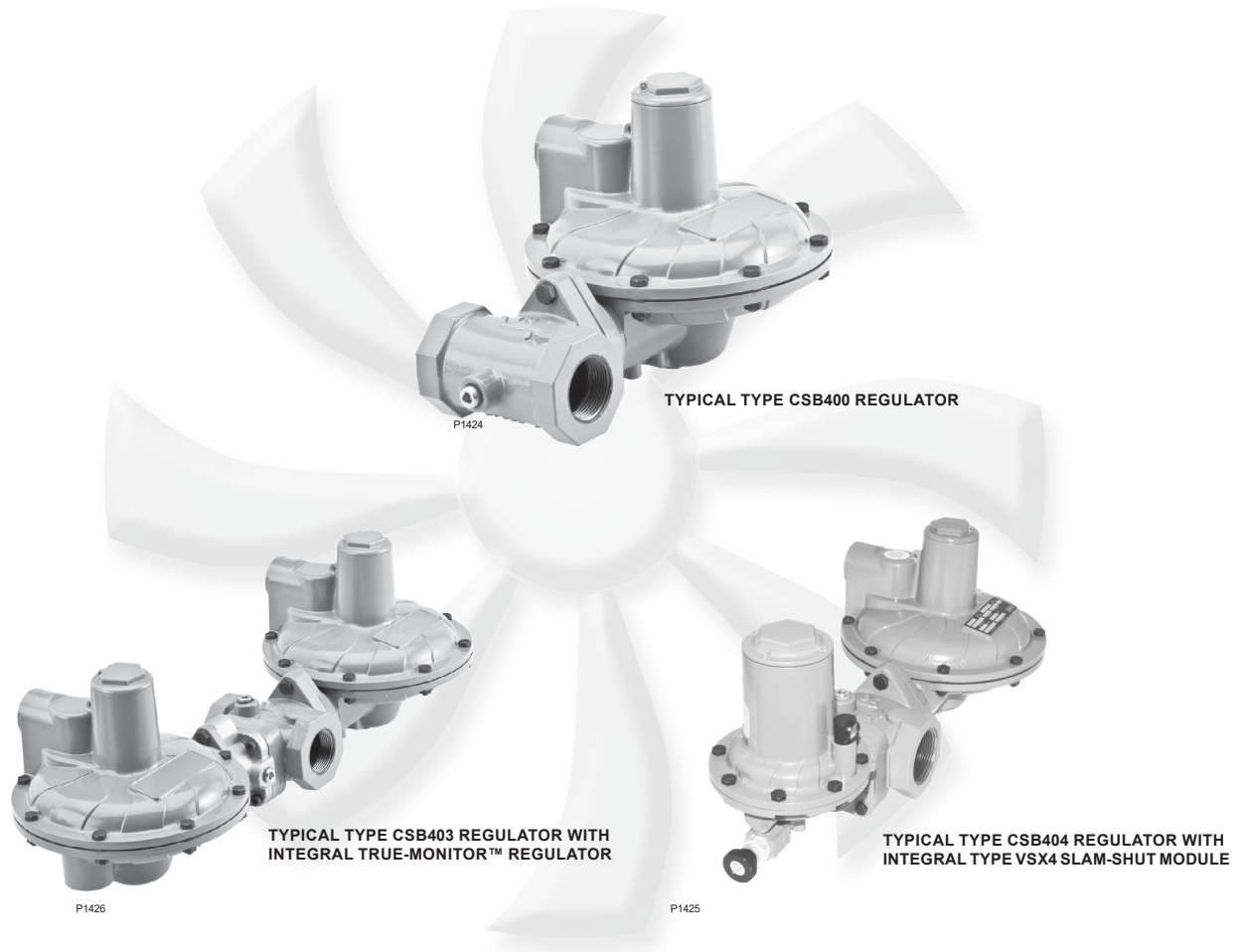


Figure 1. Typical CSB400 Series Pressure Reducing Regulators

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Introduction

Scope of the Manual

This Instruction Manual provides installation, maintenance and parts ordering information for the CSB400 Series regulators. Instructions and parts lists for other equipment mentioned in this instruction manual are found in separate manuals.

CSB400 Series

Specifications

The Specifications section lists the specifications for the CSB400 Series Regulators. The following information is stamped on the nameplate of CSB400 Series: Type and Class, Maximum Outlet Pressure and Spring Range.

Available Configurations

See Table 1

Regulator Type: Differential Strength (DS)⁽⁴⁾

Accuracy Class: Up to AC5

(depending on Outlet Pressure)⁽⁴⁾

Lock-up Class: Up to SG10

(depending on Outlet Pressure)⁽⁴⁾

Failure Mode: Fail Open (FO)

Body Sizes and End Connection Styles

See Table 5

Integral Strength (IS) Pressure Ratings⁽¹⁾⁽⁴⁾

See Table 4

Differential Strength (DS) Pressure Ratings and Flow and Sizing Coefficients⁽¹⁾⁽⁴⁾

See Table 3

Operating Pressure Ranges⁽¹⁾

Regulator: See Table 6

Integral True-Monitor™ Module: See Table 7

Slam-Shut Module: See Tables 8a, 8b, 8c and 8d

Maximum Outlet Pressures⁽¹⁾

Emergency: 4.0 bar / 58 psig

To Avoid Internal Parts Damage:

Type CSB450: 1 bar / 14.5 psig above outlet pressure setting

All other Types: 0.34 bar / 5 psig above outlet pressure setting

Operating: 3.0 bar / 43.5 psig

Spring Case Vent Connection

1 NPT

Orifice Size

17.5 mm / 11/16 in.

Pressure Registration

Internal, External or Dual (Internal and External)

Operating Temperature (TS)⁽¹⁾⁽²⁾

According to Pressure Equipment Directive (PED) Standards:

All Types: -20 to 66°C / -4 to 150°F

Non-PED with Standard Construction:

Types CSB400/CSB404, CSB420/CSB424:

-20 to 66°C / -4 to 150°F

Types CSB450/CSB454⁽³⁾:

-30 to 66°C / -22 to 150°F

Non-PED with Low Temperature Construction:

Types CSB400F/CSB404F⁽³⁾, CSB420F/CSB424F⁽³⁾:

-30 to 66°C / -22 to 150°F

Approximate Weights

with Threaded body

Type CSB400: 4.1 kg / 9 lbs

Type CSB403: 9.1 kg / 20 lbs

Type CSB404: 5.0 kg / 11 lbs

with Flanged Body:

Add 4.1 kg / 9 lbs to threaded weights

listed above

PED Conformity Statement and Information

The CSB400 Product Series is in conformity with the PED 2014/68/EU. Types CSB403 and CSB423 True-Monitor overpressure protection are not covered by PED.

Pressure regulator does not require any supplementary upstream safety accessory for protection against overpressure compared with its design pressure PS, when upstream reducing station is sized for a max downstream incidental $MIP_d \leq 1.1 P_s$.

PED Related Information

See Table 2

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

2. Standard token relief set values listed in Table 8 are based on -20 to 60°C / -4 to 140°F.

3. Product has passed Emerson Process Management Regulator Technologies, Inc. (Emerson) testing for lockup, relief start-to-discharge and reseal down to -40°.

4. EN 334 applicable pressure terms. Not applicable for non-EU countries.

Table 1. Available Configurations

TYPE NUMBER					OPTION
C	S	B	4		
PRESSURE CONSTRUCTION AND UPSTREAM MONITOR APPLICATIONS					
0					Low Pressure Applications (Outlet Pressure: 17 to 100 mbar / 7 to 40 in. w.c.)
1					Low Pressure, Upstream Monitoring Applications ⁽¹⁾⁽³⁾ (Outlet Pressure: 17 to 100 mbar / 7 to 40 in. w.c.)
2					Medium Pressure Applications (Outlet Pressure: 100 to 517 mbar / 40 to 208 in. w.c.)
3					Medium Pressure, Upstream Monitoring Applications ⁽¹⁾⁽³⁾ (Outlet Pressure: 100 to 517 mbar / 40 to 208 in. w.c.)
5					High Pressure Applications ⁽²⁾ (Outlet Pressure: 0.50 to 3.0 bar / 7 to 43.5 psig)
OVERPRESSURE PROTECTION					
0					Without Overpressure Protection Module
0F					Low Temperature Capability, Without Overpressure Protection Module
3					With Integral True-Monitor™ Module ⁽⁴⁾
3F					Low Temperature Capability, With Integral True-Monitor Module ⁽⁴⁾
4					With Type VSX4 Slam-shut Module ⁽⁵⁾
4F					Low Temperature Capability, With Type VSX4 Slam-shut Module ⁽⁵⁾
PRESSURE REGISTRATION					
D					Dual Registration (Best solution for quick changing loads)
E					External Registration
I					Internal Registration
RELIEF					
N					No Relief
T					Internal Token Relief
Example: Type number CSB424DT : Type CSB400 regulator constructed for medium pressure applications, with Type VSX4 slam-shut module, Dual pressure registration and Internal Token relief. 1. Not available with Integral True-Monitor option. 2. Not available with Integral True-Monitor or Token Relief option. 3. Available with External Pressure Registration only. 4. Reference Instruction Manual D103126X012 for information regarding the Type TM600 Integral True-Monitor module. 5. Reference Instruction Manual D103127X012 for information regarding the Type VSX4 Slam-Shut module.					



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 must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson 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

CSB400 Series regulators are typically installed on industrial and commercial applications. See Table 1 for Available Configurations. Low, Medium and High outlet pressure constructions are available via Types CSB400, CSB420 and CSB450, respectively, that provide outlet setpoints ranging from 17 mbar to 3.0 bar / 7 in. w.c. to 43.5 psig. Also available are upstream monitoring configurations such as Types CSB410 and CSB430, which are installed upstream of the primary regulator to provide overpressure protection.

Types that include an “F” refer to the cold temperature construction of the base Type number. For example, the Type CSB404F provides a cold temperature construction of the Type CSB404. Refer to the Operating Temperature section found on the following page for additional information regarding temperature capabilities and refer to Table 7 for inlet pressure limitations. For types that include an “F”, refer to the base type number for general information such as Principles of Operation, Maintenance instructions, Warnings and Cautionary notes.


CSB400 Series

 PATENT PENDING  0062	REGULATOR	SLAM SHUT	SERIAL NO.	
	TS	TEMP CLASS	DOM	
	PS	FLUID GROUP	CAT	LOC
	DN	SEAT	BODY	
	PN	φ	MATL	

Std: EN334 REGULATOR PED mfg: Chartres, France	TYPE	PSD
	Pumax	Pmax
	Wds	Matl Case
	Failure Mode	

REGULATOR NAMEPLATES

Std: EN14382 SLAM SHUT PED mfg: Chartres, France	RELAIS RELAY	Pu Max	
	MATL CASE	P max	
	TYPE	PSD	CLASS
	Wdso	Wdsu	
	OP range	UP range	

 PATENT PENDING	TYPE NO.	SERIAL NO.		
	DOM	RELIEF		
	LOC	MAX IN	ORIFICE	SPG RANGE
	MAX EMER OUT	MAX OP OUT		

SLAM-SHUT NAMEPLATE

INTEGRAL TRUE-MONITOR NAMEPLATE

Figure 2. CSB400 Series Regulator, Slam-shut and Integral True-Monitor™ Nameplates and Labels

Table 2. PED Information

TYPE	DESCRIPTION	PED CATEGORY	FLUID GROUP
CSB400, CSB400F, CSB410, CSB420, CSB420F, CSB430 and CSB450	Base regulator	I	Groups 1 and 2 according to PED 2014/68/EU, 1st and 2nd family gas according to EN 437 or other gases (compressed air, nitrogen). The gas must be non-corrosive, clean (filtration on inlet side necessary) and dry.
CSB404, CSB404F, CSB414, CSB424, CSB424F, CSB434 and CSB454	Regulator with Slam-Shut Module	IV	
European EN Reference Standards		EN 334, EN 14382	

Table 3. Maximum Inlet Pressure Ratings, Flow and Sizing Coefficients⁽¹⁾

TYPE	SPECIFIC MAXIMUM ALLOWABLE PRESSURE / MAXIMUM EMERGENCY OUTLET PRESSURE		MAXIMUM OPERATING INLET PRESSURE		MAXIMUM EMERGENCY INLET PRESSURE ⁽²⁾		ORIFICE SIZE		FLOW COEFFICIENTS WIDE OPEN			IEC SIZING COEFFICIENTS		
	PSD		P _{umax}		P _s		mm	In.	C _g	C _v	C ₁	X _T	F _D	F _L
	bar	psig	bar	psig	bar	psig								
CSB400F and CSB404F	4.0	58	6.0	87	12.0	174	17.5	11/16	428	11	43	1.16	0.84	0.90
CSB403F and CSB423F			6.0	87	10.0	145								
CSB403 and CSB423			10.0	145	10.0	145								
CSB410 and CSB414			10.0	145	12.0	174								
CSB430 and CSB434			10.0	145	12.0	174								
CSB400 and CSB404			10.0	145	20.0	290								
CSB420F and CSB424F			16.0	232	20.0	290								
CSB420 and CSB424			16.0	232	20.0	290								
CSB450 and CSB454														

1. EN 334 Differential Strength (DS) Pressure ratings. Used where DS ratings required by EN334 Code. (Not applicable for non-EU countries).
 2. If ordered with a PN 16 flanged connection, P_s rating is a maximum of 16.0 bar / 232 psig. P_s rating may be lower than 16.0 bar / 232 psig as indicated by this table.

Table 4. EN334 Integral Strength (IS) Pressure Ratings (Applicable only where inlet rating cannot exceed outlet rating per EN334 Code. Not applicable for non-EU countries)

TYPE	MAXIMUM ALLOWABLE PRESSURE ⁽¹⁾ / MAXIMUM EMERGENCY INLET PRESSURE		MAXIMUM OPERATING INLET PRESSURE ⁽¹⁾	
	P _s		P _{umax}	
	bar	psig	bar	psig
CSB400, CSB400F, CSB404 and CSB404F	4.0	58	4.0	58
CSB420, CSB420F, CSB424 and CSB424F				
CSB450 and CSB454				
CSB410 and CSB414				
CSB403, CSB403F, CSB423 and CSB423F				
CSB403 and CSB423				

1. For the Integral Strength (IS) version, the maximum value of P_s and P_{umax} should be similar to the PSD used for the Differential Strength (DS) version.

Table 5. Body Sizes, Materials, End Connections and Maximum Cold Working Pressure Ratings⁽¹⁾

BODY MATERIAL	INLET SIZE, NPS	OUTLET SIZE, NPS	END CONNECTION	FACE-TO-FACE DIMENSION		BODY PRESSURE RATING	
				mm	In.	bar	psig
Ductile Iron	1	1	NPT	100	4	17.2	250
	1-1/4	1-1/4		114	4.5		
	1-1/2	1-1/2		114	4.5		
	2	2		127	5		
	1	1	Rp	100	4		
	1	1-1/4		114	4.5		
	1-1/4	1-1/4		114	4.5		
	1-1/2	1-1/2		114	4.5		
	2	2		127	5		
	DN 50 / 2	DN 50 / 2	CL150 FF	254	10		
		PN 10/16	254	10			
DN 40 / 1-1/2 ⁽²⁾	DN 40 / 1-1/2 ⁽²⁾	PN 16 Slip-On	184	7.24	16.0	232	
1	2-1/4	Rp x GAZ	105	4.1	20.0	290	
1	1	NPT	100	4			
1-1/4	1-1/4		114	4.5			
1-1/2	1-1/2		114	4.5			
1	1	Rp	100	4			
1-1/4	1-1/4		114	4.5			
1-1/2	1-1/2		114	4.5			

1. The pressure/temperature limits in this Instruction Manual or any applicable standard or code limitation should not be exceeded.
 2. Uses Rp 1-1/2 x 1-1/2 threaded body with PN 16 slip-on flanges.

Table 6. CSB400 Series Primary Regulator Outlet Pressure Ranges

TYPE	OPERATING PRESSURE RANGE, W _g		PART NUMBER	SPRING COLOR	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
	mbar	In. w.c.			mm	In.	mm	In.
CSB400, CSB400F, CSB403, CSB403F, CSB404, CSB404F, CSB410 and CSB414	17 to 24	6.8 to 9.6	GE30191X012	Pink	2.03	0.080	152	6.00
	24 to 35	9.6 to 14	GE43955X012	Orange Stripe	2.19	0.086	110	4.35
	35 to 60	14 to 24.1	GE30201X012	Dark Green	3.23	0.127	110	4.35
	54 to 100	21.7 to 40	GE30202X012	Tan	2.85	0.112	127	5.00
CSB420, CSB420F, CSB423, CSB423F, CSB424, CSB424F, CSB430 and CSB434	100 to 160	1.45 to 2.3 psig	GE35081X012	Purple Stripe	3.86	0.152	124	4.90
	138 to 300	2.0 to 4.4 psig	GE30192X012	Dark Blue	4.27	0.168	118	4.65
	276 to 517	4 to 7.5 psig	GE33121X012	Red	4.93	0.194	118	4.65
CSB450 and CSB454	500 mbar to 1 bar	7.3 to 14.5 psig	GE30203X012	Light Blue	5.59	0.220	102	4.00
	1 to 3 bar	14.5 to 43.5 psig	GE30204X012	Light Green	6.73	0.265	100	3.95

Table 7. Primary Regulator and Integral True-Monitor™ Outlet Pressure Ranges

TYPE	PRIMARY REGULATOR						INTEGRAL TRUE-MONITOR								
	Factory Setpoint		Set Pressure Range		Color	P/N	Factory Token Relief Set ⁽¹⁾			Factory Setpoint ⁽¹⁾		Spring Range		Color	P/N
	mbar	psig	mbar	psig			% of REG. Set	mbar	psig	mbar	psig	mbar	psig		
CSB403 and CSB403F	20	8 in w.c.	17 to 24	6.8 to 9.6 in w.c.	Pink	GE30191X012	No Token Relief			37	15 in w.c.	30 to 52	12 to 21 in w.c.	Blue	GE30189X012
							170%	35	14 in w.c.						
	30	12 in w.c.	24 to 35	9.6 to 14 in w.c.	Orange Stripe	GE43955X012	No Token Relief			52	21 in w.c.	45 to 75	18 to 30 in w.c.	Green	GE30196X012
							150%	45	18 in w.c.						
50	20 in w.c.	35 to 60	14 to 24 in w.c.	Dark Green	GE30201X012	No Token Relief			70	1	65 to 99	26 to 40 in w.c.	Orange	GE30225X012	
						140%	70	1							
69	1	54 to 100	0.78 to 1.45	Tan	GE30202X012	No Token Relief			103	1.5	97 to 200	1.4 to 2.9	Black	GE30190X012	
						130%	90	1.3							
CSB423 and CSB423F	138	2	100 to 160	1.45 to 2.3	Purple Stripe	GE35081X012	No Token Relief			172	2.5	97 to 200	2.6 to 3.7	Purple	GE35081X012
							130%	180	2.6						
	207	3	138 to 300	2.0 to 4.4	Dark Blue	GE30192X012	No Token Relief			276	4	248 to 414	3.6 to 6	Dark Blue	GE30192X012
							125%	260	3.8						
345	5	276 to 517	4 to 7.5	Red	GE33121X012	No Token Relief			414	6	352 to 517	5.1 to 7.5	Red	GE33121X012	
						125%	430	6.25							
483	7	276 to 517	4 to 7.5	Red	GE33121X012	No Token Relief			690	10	500 to 1000	7.3 to 14.5	Light Blue	GE30203X012	
						125%	586	8.5							
CSB453	690	10	500 to 1000	7.3 to 14.5	Light Blue	GE30203X012	No Token Relief			828	12	500 to 1000	7.3 to 14.5	Light Blue	GE30203X012
							125%	793	11.5						

1. Recommended minimum Integral True-Monitor setpoints shown.

CSB400 Series

Table 8a. Type CSB404 Overpressure Shut-off – North American OPSO Ranges

REGULATOR			SLAM SHUT DEVICE								
Type Number	Typical Setpoint	Spring Range	Type Number (Max Operating Inlet)	Token Relief Set	Relief Range Shown as a % of Regulator Setpoint		Minimum Required Difference Between Token Relief and OPSO	Over Pressure Shut-Off (OPSO) Set Range	Factory Set OPSO		
	psig	psig		psig	min ⁽¹⁾	max				psig	
CSB404F	7 in. w.c.	6.8 to 9.6 in. w.c.	VSX4L (125 psi)	0.49	170%	215%	0.12	12 to 24 in. w.c.	22 in. w.c.		
	11 in. w.c.	9.7 to 14 in. w.c.		0.59	150%	160%	0.12	16 in. w.c. to 1.6 psig	25 in. w.c.		
	14 in. w.c.	14 to 24.1 in. w.c.		1	140%	158%	0.23	24 in. w.c. to 2.8 psig	1.1		
CSB424F	1	21.7 in. w.c. to 1.4 psig		1.4	130%	140%	0.29	1.4 to 4.1	2		
	2	1.5 to 2.3		2.8	130%	140%	0.58	2.0 to 7.3	3.5		
	3	2.0 to 4.4		5.4	125%	140%	0.73		5		
CSB404 CSB414	5	4.0 to 7.5		8.9	123%	140%	0.87	3.2 to 11.0	7		
	7 in. w.c.	6.8 to 9.6 in. w.c.		0.49	170%	215%	0.12	12 to 24 in. w.c.	22 in. w.c.		
	11 in. w.c.	9.7 to 14 in. w.c.		0.59	150%	160%	0.12	16 in. w.c. to 1.6 psig	25 in. w.c.		
CSB424 CSB434	14 in. w.c.	14 to 24.1 in. w.c.	VSX4L (232 psi)	1	140%	158%	0.23	24 in. w.c. to 2.8 psig	1.1		
	1	21.7 in. w.c. to 1.4 psig		1.4	130%	140%	0.29	1.4 to 4.1	2		
	2	1.45 to 2.3		2.8	130%	140%	0.58	2.0 to 7.3	3.5		
3	2.0 to 4.4	5.4		125%	140%	0.73	5				
CSB454	5	4.0 to 7.5		8.9	123%	140%	0.87	3.2 to 11.0	7		
	10	7.3 to 14.5							5.8 to 16.3	12	
	15	14.5 to 43.5							VSX4H (232 psi)	13.1 to 43.5	19
	20									25	
	30									35	
40	23.2 to 58.0 ⁽²⁾		45								

Standard factory set shown. Factory set is at the minimum value of the range indicated. Range indicated is a percentage of setpoint. Percentage indicated is based on the set pressure range in which that setpoint resides. If non-standard sets are required, adherence must be made to constrain shown in above table, including token relief set range and OPSO set range and minimum required difference between token relief and OPSO set.

Gray areas indicate that token relief is not available above 5 psig setpoint.

1. Minimum token relief values apply -20°C / -4°F service temperatures and above. For service below -20°C / -4°F, add 8 mbar / 0.12 psig to the minimum token relief value listed.

2. Maximum OPSO set point truncated to reflect maximum outlet pressure for spring range.

Table 8b. Type CSB404 Overpressure Shut-off – European OPSO Ranges

REGULATOR			SLAM SHUT DEVICE								
Type Number	Typical Setpoint	Spring Range	Type Number (Max Operating Inlet)	Token Relief Set	Relief Range Shown as a % of Regulator Setpoint		Minimum Required Difference Between Token Relief and OPSO	Over Pressure Shut-Off (OPSO) Set Range	Factory Set OPSO		
	mbar	mbar		mbar	min ⁽¹⁾	max				mbar	
CSB404F	20	17 to 24	VSX4L (8.6 bar)	34	170%	215%	8	30 to 60	40		
	21			36					45		
	27			41	150%	160%			10	30 to 60	46
	30			45							60
	CSB424F	35		35 to 60	53	140%	158%	16	60 to 193	67	
		50			70					90	
		60			84					104	
		75			98					128	
CSB404 CSB414	100	54 to 100	130	130%	140%	20	60 to 193	170			
	300		138 to 300	375	125%	140%	50	138 to 500	450		
				20	34	170%	215%	8	30 to 60	40	
				21	36					45	
		27		41	150%	160%	10			30 to 60	46
	30	45	60								
	CSB424 CSB434	35	35 to 60	53	140%	158%		16	60 to 193		67
		50		70							90
60		84		105							
75		98		130							
CSB454	100	54 to 100	130	130%	140%	20	60 to 193	170			
	150		100 to 160	195	130%	140%	40	95 to 280	248		
	300		138 to 300	375	125%	140%	50	138 to 500	450		
	500		276 to 517	615	123%	140%	60	221 to 760	700		
CSB454	750	500 to 1000						400 to 1450	1050		
	1000							1320			
	1200							900 to 3000	1600		
	1500								1900		
	2000								2400		
3000	3400										

Standard factory set shown. Factory set is at the minimum value of the range indicated. Range indicated is a percentage of setpoint. Percentage indicated is based on the set pressure range in which that setpoint resides. If non-standard sets are required, adherence must be made to constrain shown in above table, including token relief set range and OPSO set range and minimum required difference between token relief and OPSO set.

Gray areas indicate that token relief is not available above 345 mbar setpoint.

1. Minimum token relief values apply -20°C / -4°F service temperatures and above. For service below -20°C / -4°F, add 8 mbar / 0.12 psig to the minimum token relief value listed.

Table 8c. Type CSB404 Over Pressure and Under Pressure Shut-off – North American OPSO and UPSO Ranges

REGULATOR			SLAM SHUT DEVICE										
Type Number	Typical Setpoint	Spring Range	Type Number (Max Operating Inlet)	Token Relief Set	Relief Range Shown as a % of Regulator Setpoint		Required Difference Between Token Relief and OPSO	Under Pressure Shut-off (UPSO) Set Range	Over Pressure Shut-Off (OPSO) Set Range Over UPSO Setpoint	Factory Set			
					psig	min ⁽¹⁾				max	psig	psig	psig
	psig	psig		psig			psig	psig	psig	psig	psig	psig	
CSB404F	7 in. w.c.	6.8 to 9.6 in. w.c.	VSX4L (125 psi)	0.49	170%	215%	0.12	3 to 12 in. w.c.	16 to 29 in. w.c.	3 in. w.c.	19 in. w.c. to 1.2 psig	22 in. w.c.	
	11 in. w.c.	9.7 to 14 in. w.c.		0.59	150%	160%	0.12	3 to 12 in. w.c.	16 to 29 in. w.c.	6 in. w.c.	22 in. w.c. to 1.3 psig	25 in. w.c.	
	14 in. w.c.	14 to 24.1 in. w.c.		1	140%	158%	0.23	4 in. w.c. to 1.1 psig	20 in. w.c. to 1.8 psig	9 in. w.c.	1.1 to 2.1	1.1	
CSB424F	1	21.7 in. w.c. to 1.4 psig		1.4	130%	140%	0.29	10 in. w.c. to 2.3 psig	1.2 to 3.2	14 in. w.c.	1.7 to 3.7	2	
	2	1.5 to 2.3		2.8	130%	140%	0.58	10 in. w.c. to 2.3 psig	1.2 to 3.2	1	2.2 to 4.2	3.5	
	3	2.0 to 4.4		5.4	125%	140%	0.73	1.5 to 7.3	2.6 to 5.6	2	4.6 to 7.6	5	
5	4.0 to 7.5	8.9		123%	140%	0.87	3			5.6 to 8.6	7		
CSB404	7 in. w.c.	6.8 to 9.6 in. w.c.		VSX4L (232 psi)	0.49	170%	215%	0.12	3 to 12 in. w.c.	18 to 30 in. w.c.	3 in. w.c.	21 in. w.c. to 1.2 psig	22 in. w.c.
	11 in. w.c.	9.7 to 14 in. w.c.			0.59	150%	160%	0.12	3 to 12 in. w.c.	18 to 30 in. w.c.	6 in. w.c.	24 in. w.c. to 1.3 psig	25 in. w.c.
	14 in. w.c.	14 to 24.1 in. w.c.	1		140%	158%	0.23	4 in. w.c. to 1.1 psig	25 in. w.c. to 1.9 psig	9 in. w.c.	1.2 to 2.2	1.1	
CSB424	1	21.7 in. w.c. to 1.4 psig	1.4		130%	140%	0.29	10 in. w.c. to 2.3 psig	1.2 to 3.2	14 in. w.c.	1.7 to 3.7	2	
	2	1.45 to 2.3	2.8		130%	140%	0.58	10 in. w.c. to 2.3 psig	1.2 to 3.2	1	2.2 to 4.2	3.5	
	3	2.0 to 4.4	5.4		125%	140%	0.73	1.5 to 7.3	2.6 to 5.6	2	4.6 to 7.6	5	
5	4.0 to 7.5	8.9	123%		140%	0.87	3			5.6 to 8.6	7		
CSB454	10	7.3 to 14.5	VSX4H (232 psi)						1.5 to 7.3	3.5 to 8.2	5	8.5 to 13.2	12
	15	14.5 to 43.5							1.5 to 10.9	6.7 to 13.5	7	13.7 to 20.5	19
	20			7.3 to 29.0					15.2 to 22.8	10	25.2 to 32.8	25	
	30			15					33.1 to 48.4	35			
	40			20					38.1 to 53.4	45			

Standard factory set shown. Factory set is at the minimum value of the range indicated. Range indicated is a percentage of setpoint. Percentage indicated is based on the set pressure range in which that setpoint resides. If non-standard sets are required, adherence must be made to constrain shown in above table, including token relief set range and OPSO set range and minimum required difference between token relief and OPSO set.

Gray areas indicate that token relief is not available above 5 psig setpoint.

1. Minimum token relief values apply -20°C / -4°F service temperatures and above. For service below -20°C / -4°F, add 8 mbar / 0.12 psig to the minimum token relief value listed.

Table 8d. Type CSB404 Over Pressure and Under Pressure Shut-off – European OPSO and UPSO Ranges

REGULATOR			SLAM SHUT DEVICE											
Type Number	Typical Setpoint	Spring Range	Type Number (Max Operating Inlet)	Token Relief Set	Relief Range Shown as a % of Regulator Setpoint		Required Difference Between Token Relief and OPSO	Under Pressure Shut-off (UPSO) Set Range	Over Pressure Shut-Off (OPSO) Set Range Over UPSO Setpoint	Factory Set				
					mbar	min ⁽¹⁾				max	mbar	mbar	mbar	UPSO
	mbar	mbar		mbar			mbar	mbar	mbar	mbar	mbar	mbar		
CSB404F	20	17 to 24	VSX4L (8.6 bar)	34	170%	215%	8	7 to 11	30 to 44	10	40 to 54	40		
	21			36						11	40 to 54	45		
	27			41						14	46 to 58	46		
	30	24 to 35		45	150%	160%	10	7 to 15	32 to 44	15	55 to 87	60		
	35	35 to 60		53	140%	158%	16	7 to 30	40 to 76	18	58 to 90	67		
	50	35 to 60		70						25	73 to 99	90		
	60			84						30	78 to 104	100		
	CSB424F	75		54 to 100	VSX4L (16 bar)	98	130%	140%	20	10 to 75	50 to 122	38	88 to 160	128
		100				130	50	100 to 172	170					
300		138 to 300	375			125%	140%	50	100 to 500	179 to 386	150	329 to 536	450	
CSB404		20	17 to 24	VSX4L (16 bar)		34	170%	215%	8	7 to 30	40 to 55	10	50 to 65	55
		21				36						10	50 to 65	55
		27				41						14	54 to 69	55
		30	24 to 35			45	150%	160%	10	7 to 30	40 to 55	15	60 to 91	60
		35	35 to 60			53	140%	158%	16	7 to 30	45 to 76	18	63 to 94	70
		50	35 to 60			70						25	75 to 105	90
	60	84			30	80 to 110						100		
	CSB424	75	54 to 100		VSX4L (16 bar)	98	130%	140%	20	10 to 75	50 to 80	38	100 to 170	128
		100				130	50	112 to 182	170					
150		100 to 160		195		130%	140%	40	25 to 160	83 to 221	75	158 to 296	248	
CSB434		300	138 to 300	375		125%	140%	50	100 to 500	179 to 386	150	329 to 536	450	
		500	276 to 517	615		123%	140%	60		241 to 565	250	491 to 813	700	
		CSB454	750	500 to 1000		VSX4H (16 bar)					100 to 750	460 to 932	375	959 to 1432
1000			500								960 to 1432	1320		
1200			1000 to 3000	500 to 2000							1050 to 1570	600	1650 to 2170	1650
1500				750							1800 to 2320	1900		
2000	1000			2250 to 3300	2400									
3000	1500	2750 to 3800	3400											

Standard factory set shown. Factory set is at the minimum value of the range indicated. Range indicated is a percentage of setpoint. Percentage indicated is based on the set pressure range in which that setpoint resides. If non-standard sets are required, adherence must be made to constrain shown in above table, including token relief set range and OPSO set range and minimum required difference between token relief and OPSO set.

Gray areas indicate that token relief is not available above 345 mbar setpoint.

1. Minimum token relief values apply -20°C / -4°F service temperatures and above. For service below -20°C / -4°F, add 8 mbar / 0.12 psig to the minimum token relief value listed.

Example: If a non-standard setpoint is needed, see the following example for the proper use of Tables 8a, 8b, 8c and 8d. Non-standard setpoint = 140 mbar / 2 psig, using the value presented above, the factory set of the token relief will be 1.3 x 140 = 182 mbar / 2.6 psig. The factory OPSO and UPSO set pressures are 165% and 50% of the non-standard setpoint, respectively. The resulting settings are: OPSO = 231 mbar / 3.4 psig and UPSO = 70 mbar / 1 psig.

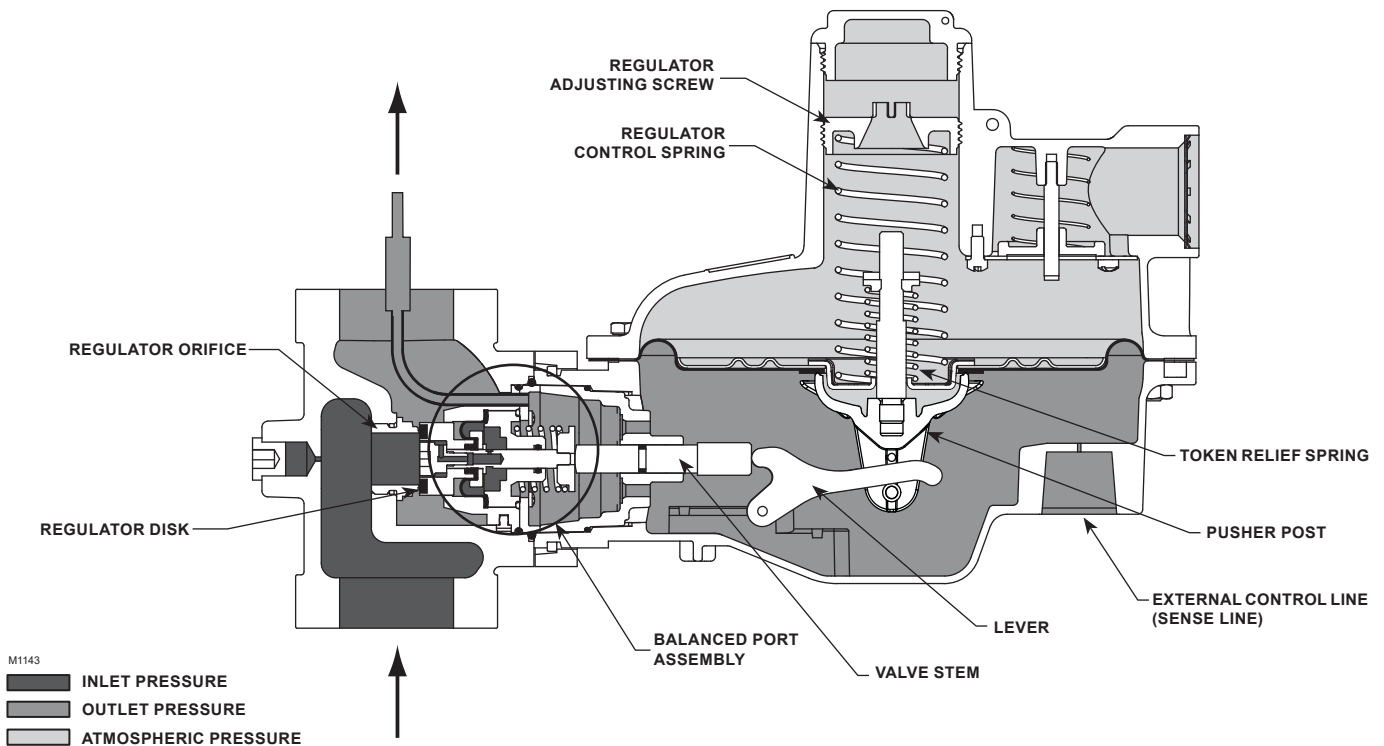


Figure 3. Type CSB400DT Dual Registered Regulator Operational Schematic

Additional overpressure protection options include Types CSB403 and CSB423, which offer True-Monitor™ protection provided by an integral monitor module installed on the inlet side of the valve body. This Integral True-Monitor assumes control of the pressure to the downstream system should the primary regulator fail to regulate. The Types CSB404, CSB424 and CSB454 are examples of CSB400 Series configurations that offer a slam-shut module that shuts off the flow of gas to the downstream system in the event of outlet pressure rising above or falling below the predefined levels due to a failure.

Optional token relief is available, which acts as a low-capacity internal relief valve to relieve minor overpressure situations due to nicks or other minor damage to the orifice or disk, or due to thermal expansion of the downstream system.

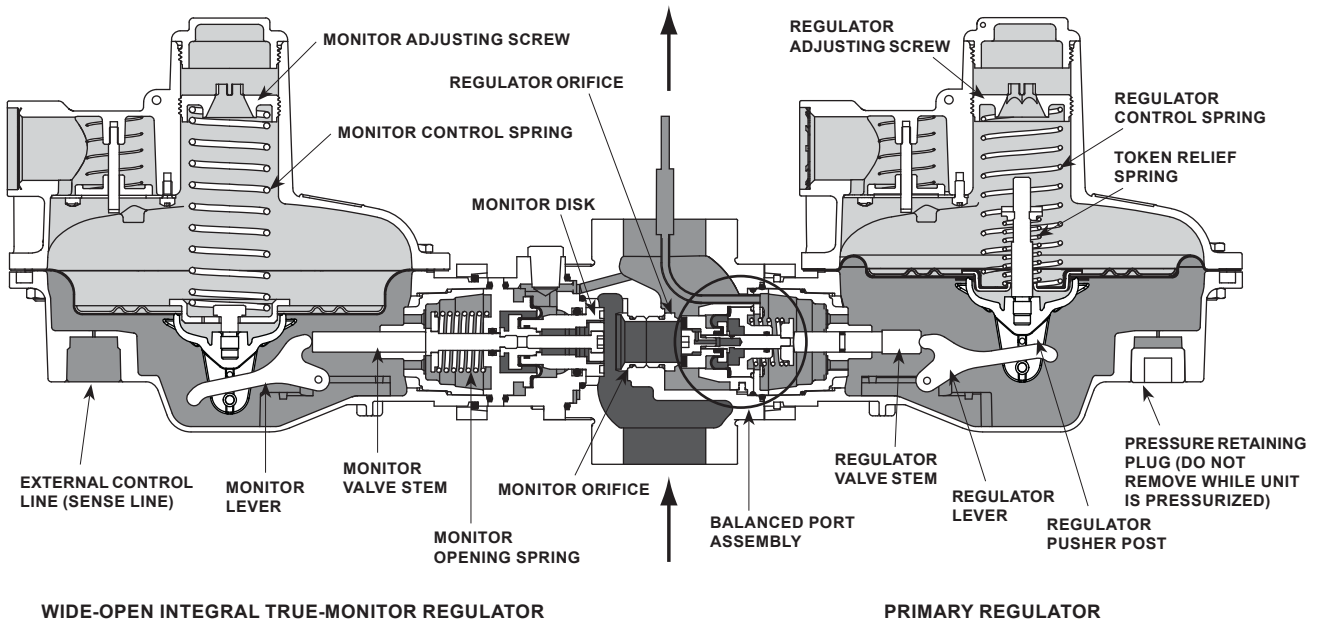
Internal, external or dual outlet pressure registration is available. Constructions with dual or external registration require an external control line / sense line. For quick changing loads, dual sense is recommended as it provides the quickest response time.

Principle of Operation

Type CSB400 Base Regulator Operation

Refer to Figure 3. When downstream demand decreases, the pressure under the regulator diaphragm increases. This pressure overcomes the regulator setting (which is set by the regulator control spring). Through the action of the pusher post assembly, lever and valve stem, the valve disk moves closer to the orifice and reduces gas flow. If demand downstream increases, pressure under the regulator diaphragm decreases. Spring force pushes the pusher post assembly downward, the valve disk moves away from the orifice and the gas flow increases downstream as the regulator opens in response to the decreased pressure underneath the regulator diaphragm.

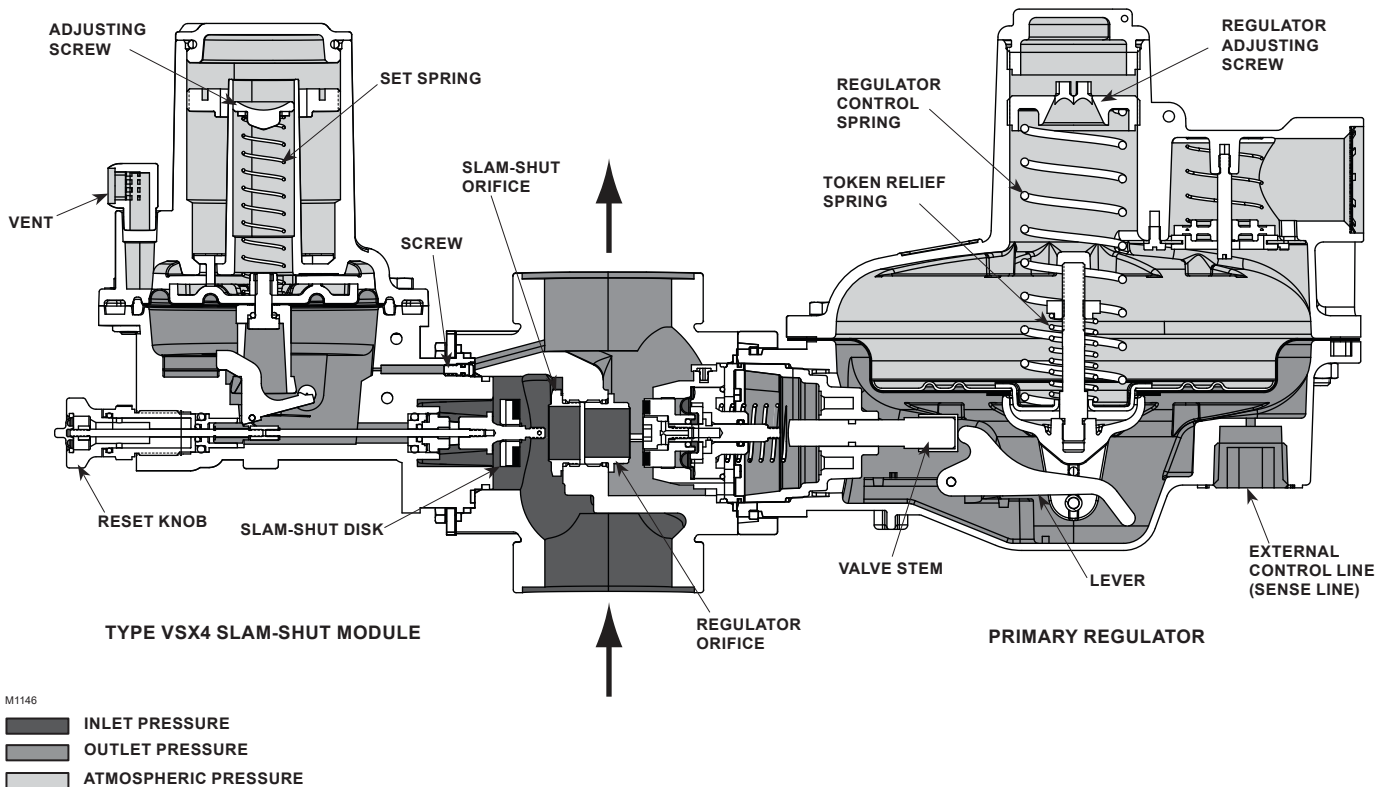
Type numbers with a “T”, for example, Type CSB400IT, provide a token or low-capacity relief. The Token relief provides relief from minor overpressure caused by nicks or dents on the orifice or by thermal expansion of gas in the downstream line. Token relief also provides a token or signal, in the form of odor, that an overpressure situation is occurring.



M1145

- INLET PRESSURE
- OUTLET PRESSURE
- ATMOSPHERIC PRESSURE

Figure 4. Type CSB403IT Internally Registered Primary Regulator with Externally Registered Integral True-Monitor™ Operational Schematic



M1146

- INLET PRESSURE
- OUTLET PRESSURE
- ATMOSPHERIC PRESSURE

Figure 5. Type CSB404ET Externally Registered Regulator and Slam-shut Operational Schematic

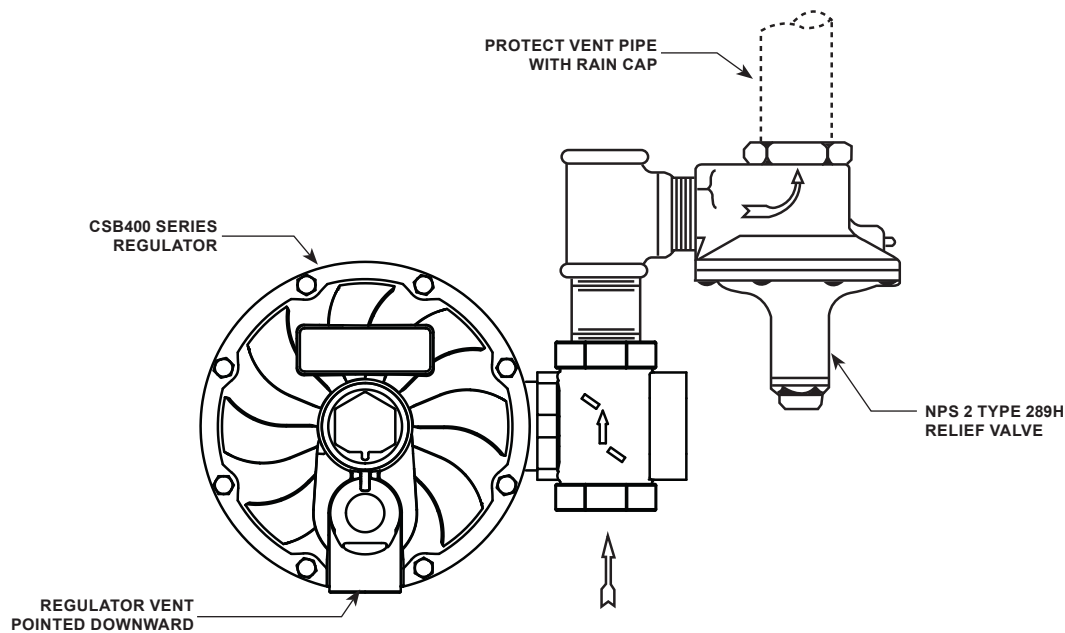


Figure 6. CSB400 Series Regulator Installed with the Vent Pointed Downward and with a Type 289H Relief Valve for High Capacity Relief

Type CSB403 Integral True-Monitor™ Operation

Type CSB403 combines the operation of a conventional two-regulator wide-open monitor set into one body, see Figure 4. The Integral True-Monitor is installed on the inlet side of the body and serves to throttle flow and maintain an acceptable downstream pressure in the case where the primary regulator ceases to regulate downstream pressure. During normal operation the Integral True-Monitor is in a wide-open state as its setpoint is set higher than the primary regulator. See Table 7 for guidance regarding the setpoints of the regulator and associated Integral True-Monitor sets. If the downstream pressure should rise to the setpoint of the Internal Monitor due to a loss of pressure control by the primary regulator, the Integral True-Monitor will assume control and regulate the flow to the downstream system. If token relief is present, it will relieve a small amount of gas to the atmosphere as an indication that the Integral True-Monitor is controlling the downstream pressure.

The Type CSB403 provides the option of internal or external downstream pressure registration. External registration requires a downstream sensing line. See Figure 8 for guidance regarding installation of the downstream control line. Refer to the Type TM600 Instruction Manual for additional details of Integral True-Monitor operation.

Type CSB404 Slam-shut Operation

The Type VSX4 slam-shut module on the Type CSB404 regulator is a fast acting shut-off device that provides overpressure (OPSO) or over and underpressure (OPSO / UPSO) protection by completely shutting off the flow of gas to the downstream system. See Table 8 for guidance regarding the typical setpoints of the regulator and associated slam-shut OPSO and also the combined OPSO and UPSO setpoints. The Type VSX4's actions are independent of the Type CSB404 regulator and of variations to the inlet pressure. The Type VSX4 comes standard with external downstream pressure registration, with the option for internal registration only on the Rp 1 x 2-1/4 GAZ body. External registration requires a downstream sensing line. See Figure 9 for guidance regarding installation of the downstream control line.

The Type VSX4 shut-off disk is normally in the open (reset) position, see Figure 5. If the downstream pressure below the slam-shut diaphragm increases (or decreases) until it reaches the slam-shut setpoint, this diaphragm moves upward (or downward) to release the trip mechanism which allows the spring force on the stem to push the disk against the seat, shutting off all gas flow. To reset the slam shut after gas has been shut off, refer to the Types VSX4 and VSX8 Instruction Manual (D103127X012) for additional details.

**WARNING**

In order for the Underpressure Shutoff (UPS) of any slam shut to be triggered, the downstream pipe pressure must drop below the UPS setpoint. In the case of a downstream line break, numerous factors can prevent the downstream pipe pressure from decreasing below the slam-shut UPS setpoint. These factors include the distance of pipe to the break, the diameter of the pipe, size of the break and the number of restrictions, such as valves, elbows and bends, downstream of the regulator and/or slam-shut device. Due to these factors additional protections should be installed to stop flow in the event of a line break.

Installation and Overpressure Protection

Install in accordance with provisions of EN 12186 / EN 12279.

**WARNING**

Personal injury or system damage may result if this regulator is installed, without appropriate overpressure protection, where service conditions could exceed the limits given in the Specifications section and/or regulator nameplate. Regulator and equipment installation should be adequately protected from physical damage.

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. On outdoor installations, point the spring case vent downward to allow condensate to drain, see Figures 6 through 9. This minimizes the possibility of freezing and of water or other foreign materials entering the vent and interfering with proper operation.

For the Type CSB403 with Integral True-Monitor™ or the Type CSB404 with Slam shut, point the vents of both the primary regulator and Integral

True-Monitor or slam shut downward to allow condensate to drain. From the factory, the Integral True-Monitor or slam shut will always point in the same direction as that of the primary regulator.

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

In case of complete disassembly of the equipment (body included) from the pipeline, care must be taken not to bend, hit or otherwise damage the pitot tube (key 83, Figure 13) that protrudes beyond the body outlet. Damage to the pitot tube could result in inaccurate internal pressure registration and loss of regulation quality.

**CAUTION**

CSB400 Series regulators have an outlet pressure rating lower than their inlet pressure rating. If actual inlet pressure can exceed the outlet pressure rating, outlet overpressure protection is necessary. However, overpressuring any portion of the regulators beyond the limits in the Specifications section may cause leakage, damage to regulator parts or personal injury due to bursting of pressure-containing parts.

Some type of external overpressure protection should be provided to the CSB400 Series if inlet pressure will be high enough to damage downstream equipment. Common methods of external overpressure protection include relief valves, monitoring regulators, shut-off devices and series regulation.

If the regulator is exposed to an overpressure condition, it should be inspected for any damage that may have occurred. Regulator operation below the limits specified in the Specifications section and regulator nameplate does not preclude the possibility of damage from external sources or from debris in the pipeline.

CSB400 Series

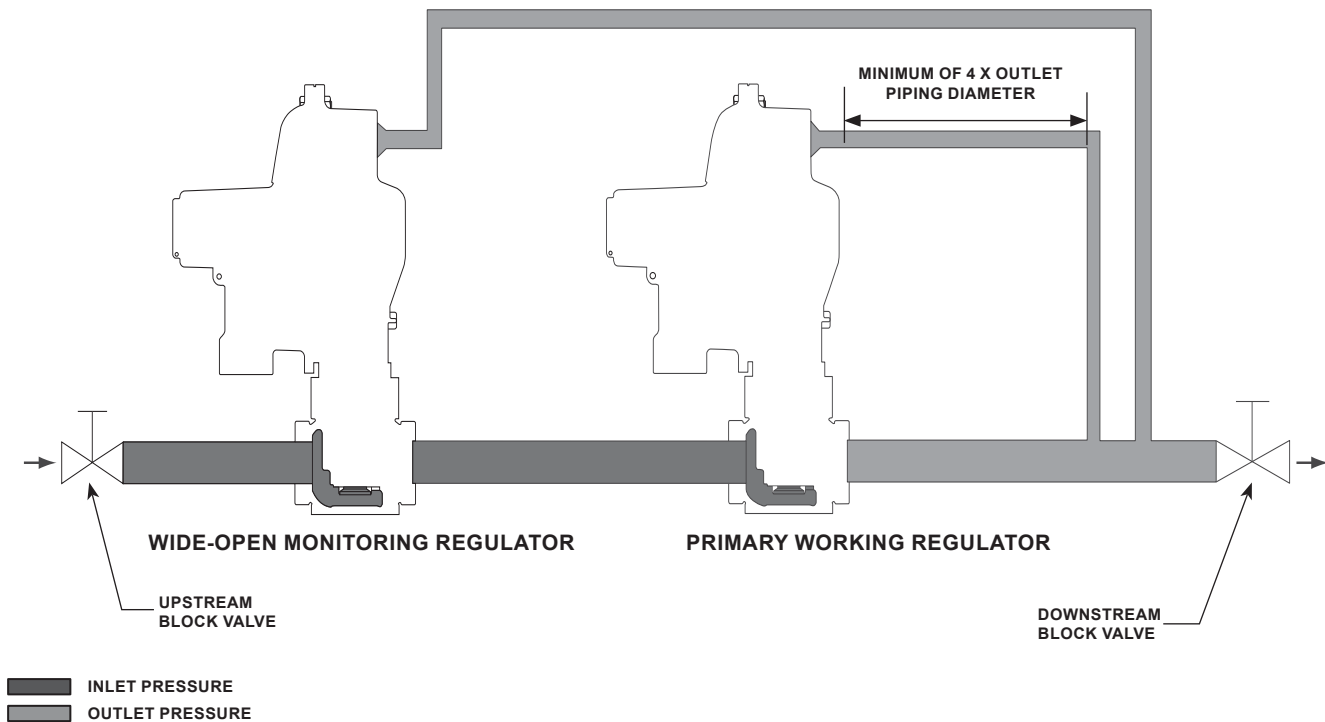


Figure 7. Type CSB400 “Series Monitor” Regulator Downstream Control Line Installation

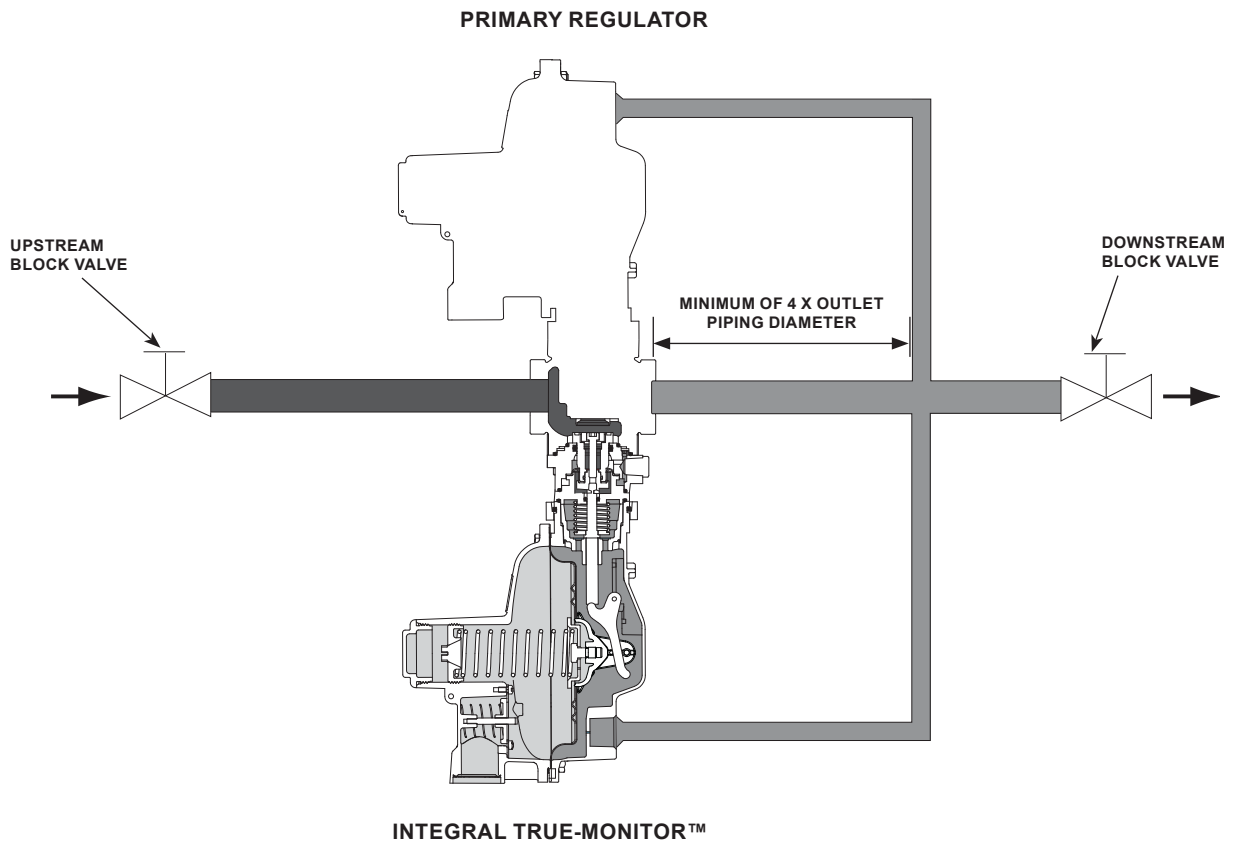
Before installing the regulator, check for damage which might have occurred in shipment. Also check for dirt or foreign matter which may have accumulated in the regulator body or in the pipeline. Apply pipe compound to the external threads of the pipeline and install the regulator so that flow is in the direction of the arrow cast on the body. The diaphragm casing assembly can be rotated to any position relative to the body. Loosen the two cap screws (key 71, Figure 10) in order to rotate the diaphragm casing assembly.

General Installation Instructions

Before installing the regulator,

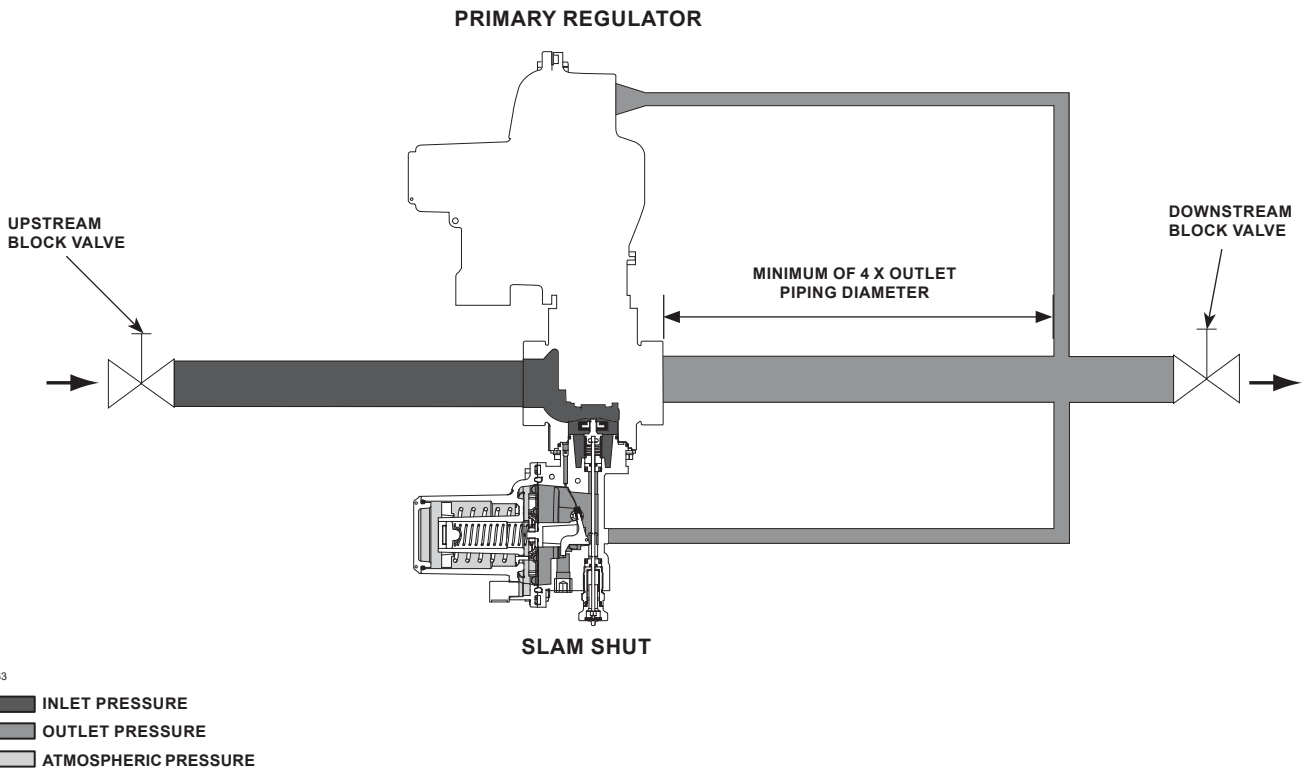
- Check for damage, which might have occurred during shipment.
- Check for and remove any dirt or foreign material, which may have accumulated in the regulator body.

- 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 regulator.
- Make sure gas flow through the regulator is in the same direction as the arrow on the body. “Inlet” and “Outlet” connections are clearly marked.
- Verify that:
 - Equipment limits of utilization (PS, TS) corresponds to the desired operating conditions.
 - The inlet is protected by an appropriate device(s) to avoid exceeding the allowable limits (PS, TS).
- When designing a pressure reducing station using a Type CSB regulator, make an analysis if it is necessary to take into account the effects of wind, snow and temperature to avoid unnecessary load and movement to the flanges of the equipment.
- If needed, a support may be used under the piping and regulator/slam-shut body to avoid excessive pressure force on the regulator/slam shut.



M1062

Figure 8. Type CSB403 Downstream Control Line Installation



M1063

Figure 9. Type CSB404 Downstream Control Line Installation

CSB400 Series

Installation Location

- The installed regulator should be adequately protected from vehicular traffic and damage from other external sources.
- Install the regulator with the vent pointed vertically down, see Figures 6 through 9. If the vent cannot be installed in a vertically down position, the regulator must be installed under a separate protective cover. Installing the regulator with the vent 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 the regulator in a location where there can be excessive water accumulation or ice formation, such as directly beneath a downspout, gutter or roof line of building. Even a protective hood may not provide adequate protection in these instances.
- Install the regulator so that any gas discharge through the vent or vent assembly is over 0.91 m / 3 ft. away from any building opening.

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

Failure to install a downstream control line could result in a hazardous condition. Install downstream control line(s) to the slam-shut device when construction uses external pressure registration.

The regulator and slam-shut device will not control pressure or shutoff if a downstream control line is not installed on those constructions where external pressure registration is required.

CSB400 Series regulators with an “ET” or “EN” in the type number use external pressure registration. To communicate the downstream pressure to the regulator, connect a downstream control line tubing to the 3/4 NPT control line tapping in the lower diaphragm casing and connect the other end of the tubing downstream of the regulator outlet with a minimum distance of 4 times the outlet pipe diameter.

For Types CSB400 and CSB404 with external control lines, use tubing with an outer diameter of 9.5 mm / 0.375 in. or larger. For Types CSB420, CSB424, CSB450 and CSB454 with external control lines, use tubing with an outer diameter of 13 mm / 0.5 in. or larger.

The Types CSB410, CSB414, CSB430 and CSB434 are dedicated wide-open monitoring regulators and are installed upstream of a primary working regulator. Refer to Figure 7 for installation of the downstream control line. To communicate the downstream pressure to the wide-open monitor regulator, connect a downstream control line tubing to the 3/4 NPT control line tapping in the lower diaphragm casing of the monitor regulator and connect the other end of the tubing downstream of the regulator outlet with a minimum distance of 4 times the outlet pipe diameter.

For Types CSB410 and CSB414, use tubing with an outer diameter of 9.5 mm / 0.375 in. or larger.

For Types CSB430 and CSB434, use tubing with an outer diameter of 13 mm / 0.5 in. or larger.

Downstream Control Line Installation with Integral True-Monitor™

Refer to Figure 8. When installing the Types CSB403 and CSB423 regulators, connect downstream control line tubing to the lower casing of the primary regulator, and run the tubing downstream of the regulator outlet with a minimum distance of 4 times the outlet pipe diameter. Connect a second, separate downstream control line tubing to the lower casing of the Integral True-Monitor and run the tubing downstream of the regulator outlet with a minimum distance of 4 times the outlet pipe diameter.

For Type CSB403 with external control lines, use tubing with an outer diameter of 9.5 mm / 0.375 in. or larger for both the primary regulator and Integral True-Monitor.

For Type CSB423 with external control lines, use tubing with an outer diameter of 13 mm / 0.5 in. or larger for both the primary regulator and Integral True-Monitor™.

Downstream Control Line Installation with Slam shut

Refer to Figure 9. When installing the Types CS404ET, CS404EN, CSB424ET, CSB424EN and CSB454EN regulators, connect downstream control line tubing to the lower casing of the regulator and run the tubing downstream of the regulator outlet with a minimum distance of 4 times the outlet pipe diameter. Connect a second, separate downstream control line tubing to the lower casing of the slam shut and run the tubing downstream of the regulator outlet a minimum distance of 4 times the outlet pipe diameter.

For Type CSB404 with external control lines, use tubing with an outer diameter of 9.5 mm / 0.375 in. or larger for the primary regulator and 6.4 mm / 0.25 in. or larger for the slam shut.

For Types CSB424 and CSB454 with external control lines, use tubing with an outer diameter of 13 mm / 0.5 in. or larger for the primary regulator and 6.4 mm / 0.25 in. or larger for the slam shut.

Installation with External Overpressure Protection

If the regulator is used in conjunction with a Type 289H relief valve, it should be installed as shown in Figure 6. The outside end of the vent line should be protected with a rainproof assembly. The Type 289H is typically set 25 mbar / 10 in. w.c. higher than the outlet pressure setting of the regulator, up to 75 mbar / 30 in. w.c. outlet pressure. For pressure greater than this, set the Type 289H 0.05 bar / 0.75 psi higher than the outlet pressure setting of the regulator.

Vent Line Installation

The CSB400 Series regulators have a 1 NPT screened vent opening in the spring case. If necessary to vent escaping gas away from the regulator, install a remote vent line in the spring case tapping. Vent piping should be as short and direct as possible with a minimum number of bends and elbows. The remote vent line should have the largest practical diameter. Vent piping on regulators with token relief must be large enough to vent all relief valve discharge to atmosphere without excessive backpressure and resulting excessive pressure in the regulator.

For types with optional Token relief, this low capacity relief is located in the spring case of the primary regulator. If necessary to vent escaping gas away, install a remote vent line in the spring case tapping of the primary regulator as described above. Periodically check all vent openings to be sure that they are not plugged or obstructed.

CSB400 Series outlet pressure ranges are shown in Table 6. Outlet pressure higher than 0.34 bar / 5 psig above the setpoint may damage internal parts such as the diaphragm head and valve disk. **The maximum emergency (casing) outlet pressure is 4.0 bar / 58 psig.**

Commissioning



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

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

1. Check to see that all appliances are turned off.
2. Slowly open the upstream shut-off valve.
3. Check inlet and outlet pressure for correct values.
4. Check all connections for leaks.
5. Turn on utilization equipment and recheck the pressures.

Adjustment

Note

For types that include the Integral True-Monitor module, refer to the Instruction Manual for Type TM600 Integral True-Monitor for adjustment and maintenance of the Integral True-Monitor. For the types that include the slam-shut module, refer to the Instruction Manual for Type VSX4 slam shut for adjustment and maintenance of the slam shut.

The range of allowable pressure settings for the primary regulator is stamped on the nameplate. If the required setting is not within this range, substitute the correct spring (as shown in Table 6). If the spring is changed, re-stamp the nameplate to indicate the new pressure range.

A pressure gauge must always be used to monitor downstream pressure while adjustments are being made.

CSB400 Series

For Types CSB400 and CSB420

1. Remove the closing cap (key 60, Figure 14).
2. To increase the outlet setting, turn the adjusting screw (key 65) clockwise. To decrease the outlet setting, turn the adjusting screw counterclockwise.
3. Replace the closing cap.

For Type CSB450

1. Loosen the hex nut (key 58, Figure 14).
2. To increase the outlet setting, turn the adjusting screw (key 65, Figure 14) clockwise. To decrease the outlet setting, turn the adjusting screw counterclockwise.
3. Tighten the hex nut.

CSB400 Series with Integral True-Monitor™

When adjusting the primary regulator and Integral True-Monitor for operation, ensure that the pressure differences between the primary regulator and the integral monitor shown in Table 7 are observed. For example, if the primary regulator setpoint is set at 20 mbar / 8 in. w.c., then the Integral True-Monitor should be set at a minimum of 35 mbar / 14 in. w.c. or higher.

To test the Integral True-Monitor operation, the primary regulator setpoint must be adjusted above the Integral True-Monitor's setpoint to simulate a failure of the primary regulator. If the spring range of the primary regulator is sufficiently high, it can simply be adjusted above the Integral True-Monitor's setpoint by following step 2 above. Otherwise, a different spring with a setpoint higher than the Integral True-Monitor's setpoint must be installed to check the operation of the Integral True-Monitor.

CSB400 Series with Slam shut

When adjusting the primary regulator and slam shut for operation, refer to Table 8 for the OPSO setpoints and also the combined OPSO and UPSO setpoints of the slam shut for a given regulator spring ranges. Reference Type VSX4/VSX8 Instruction Manual (D103127X012) for steps to properly maintain the Slam-shut module.

CAUTION

Equipment installed downstream the Type VSX slam shut device can be damaged if the following procedure for resetting the Type VSX slam shut device is not followed. This equipment includes the integral Type VSX or regulator configurations.

Step 1:

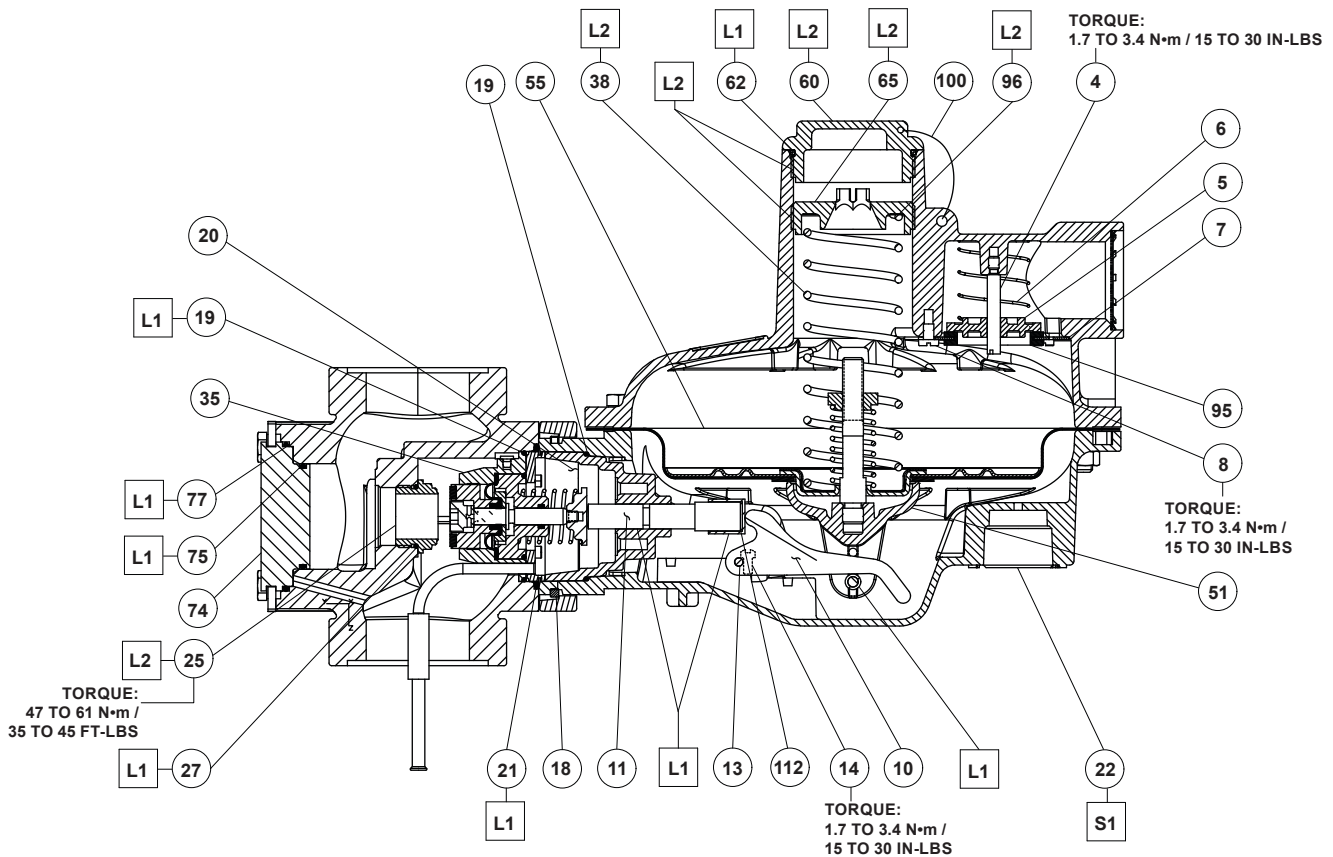
- Slowly pull the reset button (refer to Type VSX4 Instruction Manual, key 30) away from the Type VSX device. This slow movement allows for a slow bleed of the pressure across the Type VSX slam shut's disk and seat area. The operator should be able to hear the pressure bleeding through the system.

Step 2:

- When the pressure has equalized and the air bleeding sound has dissipated, the reset button (refer to Type VSX4 Instruction Manual, key 30) should be pulled completely away from the Type VSX slam shut device by hand until the internal shut-off mechanism has been re-latched.

Step 3:

- Once the operator feels the click of the re-latch occurring, the reset button (refer to Type VSX4 Instruction Manual, key 30) should be pushed completely back into its original position.



ERAA04154

APPLY LUBRICANTS (L) / SEALANT (S)⁽¹⁾:

- L1 = DOW CORNING® 33 OR COMPARABLE EXTREME LOW TEMPERATURE LUBRICANT
- L2 = ANTI-SEIZE LUBRICANT
- S1 = MULTI-PURPOSE POLYTETRAFLUOROETHYLENE (PTFE) THREAD SEALANT

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

Figure 10. CSB400 Series Regulator Assembly

WARNING

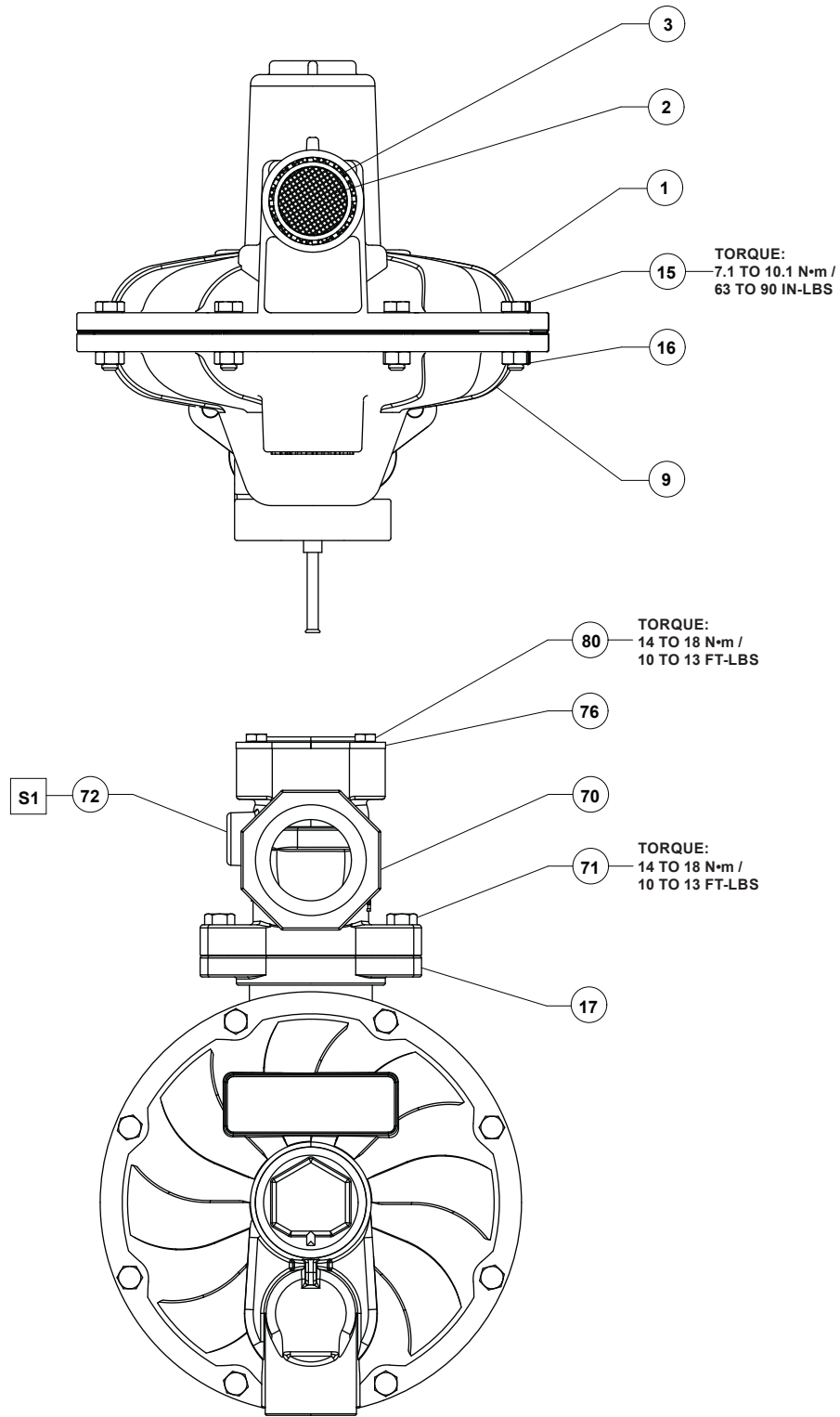
In the case of a downstream line break, numerous factors affect the capability to evacuate gas from the pipeline. These factors include the distance of pipe to the break, the diameter of the pipe, size of the break and the number of restrictions, such as valves, elbows and bends, downstream of the regulator and/or slam-shut device. Due to these factors additional protections should be installed to stop flow in the event of a line break.

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 regulator. The following steps apply to the typical installation as indicated.

1. Open valves downstream of the regulator.
2. Slowly close the upstream shut-off valve.
3. Inlet pressure should automatically be released downstream as the regulator opens in response to the lowered pressure underside of the diaphragm.
4. Close outlet shut-off valve.

CSB400 Series



ERAA04154

APPLY SEALANT (S)⁽¹⁾:

S1 = MULTI-PURPOSE PTFE THREAD SEALANT

1. Sealant must be selected such that it meets the temperature requirements.

2. The torque range as specified is initial assembly torque. Due to elastomeric compression, the torque values indicated may decrease. Minimum inspection torque is 4 N·m / 35 in-lbs.

Figure 10. CSB400 Series Regulator Assembly (continued)

Maintenance and Inspection



WARNING

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”.

Regulators that have been disassembled for repair must be tested for proper operation before being returned to service. Only parts manufactured by Emerson 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 regulator should be inspected and maintained periodically. The frequency of inspection and replacement depends on the severity of service conditions, test results found during the annual test and on applicable codes and regulations. In accordance with applicable National or Industry codes, standards and regulations/recommendations, all hazards covered by specific tests after final assembly, before applying the CE marking, shall also be covered after every subsequent reassembly at installation site in order to ensure that the equipment will be safe throughout its intended life.

Periodic inspection must be performed on the CSB400 Series that include the Integral True-Monitor™ or slam-shut overpressure protection modules to ensure that they protect the downstream system in the event the primary regulator loses pressure control. This inspection must test that the Integral True-Monitor or slam-shut functions as intended.



WARNING

Only parts manufactured by Emerson should be used for repairing and/or replacement purposes.

Note

For adjusting setpoints above 100 mbar / 1.5 psig, use a 13 mm / 1/2 in. hex driver, a 13 mm / 1/2 in. socket or a 27 mm / 1-1/16 in. socket to turn the adjusting screw (key 65).

Disassembly to Replace the Regulator Main Diaphragm

1. Remove the closing cap (key 60, Figure 10) or loosen hex locknut (key 58, Figure 14). Turn the adjusting screw (key 65) or nut (key 58) counterclockwise to ease spring (key 38) compression.
2. Remove the adjusting screw (key 65) and spring (key 38).
3. Remove hex nuts (key 16, Figure 10) and cap screws (key 15, Figure 10). Separate the upper spring case (key 1) from the lower casing assembly (key 9).

Note

When disassembling a CSB400 Series regulator, lift the upper spring case (key 1) straight up in order to avoid hitting the stem (key 44).

4. Slide the diaphragm assembly (key 55) away from the body (key 70) to unhook the pusher post (key 51) from the lever (key 10). Lift off the diaphragm assembly (key 55).
5.
 - a. For none relieving units such as the Types CSB400IN and CSB400EN, unscrew the cap (key 45), see Figure 11, high-pressure Non-Relief and low-pressure Non-Relief assemblies. The cap fastens the R.V. spring seat (key 43) to the pusher post (key 51). Unscrew the cap to separate the R.V. spring seat (key 43), diaphragm assembly (key 55) and pusher post (key 51).
 - b. For units with internal token relief such as Type CSB400IT, refer to Figure 11, unscrew the adjusting upper seat (key 47). This will allow for removal of the relief spring (key 41), R.V. spring seat (key 43), diaphragm assembly (key 55) and pusher post (key 51).

6. Reassemble the spring case (key 1) unit in the reverse order of the above steps. Before tightening the cap screws (key 15) or stem (key 44) into the pusher post (key 51), place the loosely-assembled diaphragm assembly (key 55) into position in the lower casing (key 9), being sure that the pusher post (key 51) is hooked on the lever (key 10). Rotate the diaphragm (key 55A) so that the diaphragm and lower casing (key 9) holes are aligned. Tighten the stem (key 44) or diaphragm retainer (key 45) for HP and LP non-relief assemblies.

Disassembly to Replace Valve Disk, Balanced Port Assembly Diaphragm and Regulator Orifice

1. Remove the bolts (key 71, Figure 10) which hold the lower spring casing (key 9) to the body (key 70). Separate the lower spring casing (key 9) from the body (key 70).
2. Check the body O-ring (key 21) for wear.
3. Remove the balanced port assembly (key 35, Figures 10 and 12) from the body, make sure to rotate the assembly toward the outlet of the body as it is being removed to clear the sense tube from the body.
4. Examine the valve disk (key 35K) for nicks, cuts and other damage. If damage is present, it is recommended to replace both the disk and also the balanced port diaphragm (key 35F) and associated diaphragm O-ring (key 35M), that comes into direct contact with the inner flange of the balanced port diaphragm. Start the process of replacing the disk by disassembling the balanced port assembly. Remove the four cap screws (key 35R) and then the cap (key 35G).
5. Grasp the spring retainer (key 35C) and slide the brazed housing (key 35A) away to expose the diaphragm (key 35F) and disk (key 35K). Still grasping the spring retainer (key 35C) insert a 5 mm / 0.2 in. Allen wrench into the disk screw (key 35E) and unscrew.
6. Remove the disk (key 35K) and discard if damaged. Slide the diaphragm O-ring (key 35M) off the stem (key 35B) along with the diaphragm (key 35F). Slide the new diaphragm over the stem in the same manner that it was removed, make sure that it completely contacts the surface of the inner retainer (key 35J).
7. Reassemble the Balanced Port assembly in reverse order of the above. Ensure Dow Corning® 33 or comparable extreme low temperature lubricant completely coats the O-ring (key 35M), stem (key 35B) and the center bore of the outer retainer (key 35H).
8. Examine the seating edge of the orifice (key 25). If it is nicked or rough, replace the orifice and O-ring (key 27). If a slam shut or monitor is installed on the backside of the body, refer to the applicable Instruction Manual for inspection and removal of the overpressure protection orifice (key 26) and O-ring (key 27).
9. Reassemble the regulator in reverse order of the above steps.

Regulator Reassembly

As indicated by the square callouts in Figures 10 to 15, it is recommended that a good quality pipe thread sealant be applied to pressure connections and fittings and a good quality extreme low temperature lubricant, such as Dow Corning® 33, be applied to O-rings. Also apply an anti-seize compound to the adjusting screw threads orifice threads and other noted areas as needed.

Parts Ordering

The type number, orifice size, spring range and date of manufacture are stamped on the nameplate. Always provide this information in any correspondence with your local Sales Office regarding replacement parts or technical assistance.

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

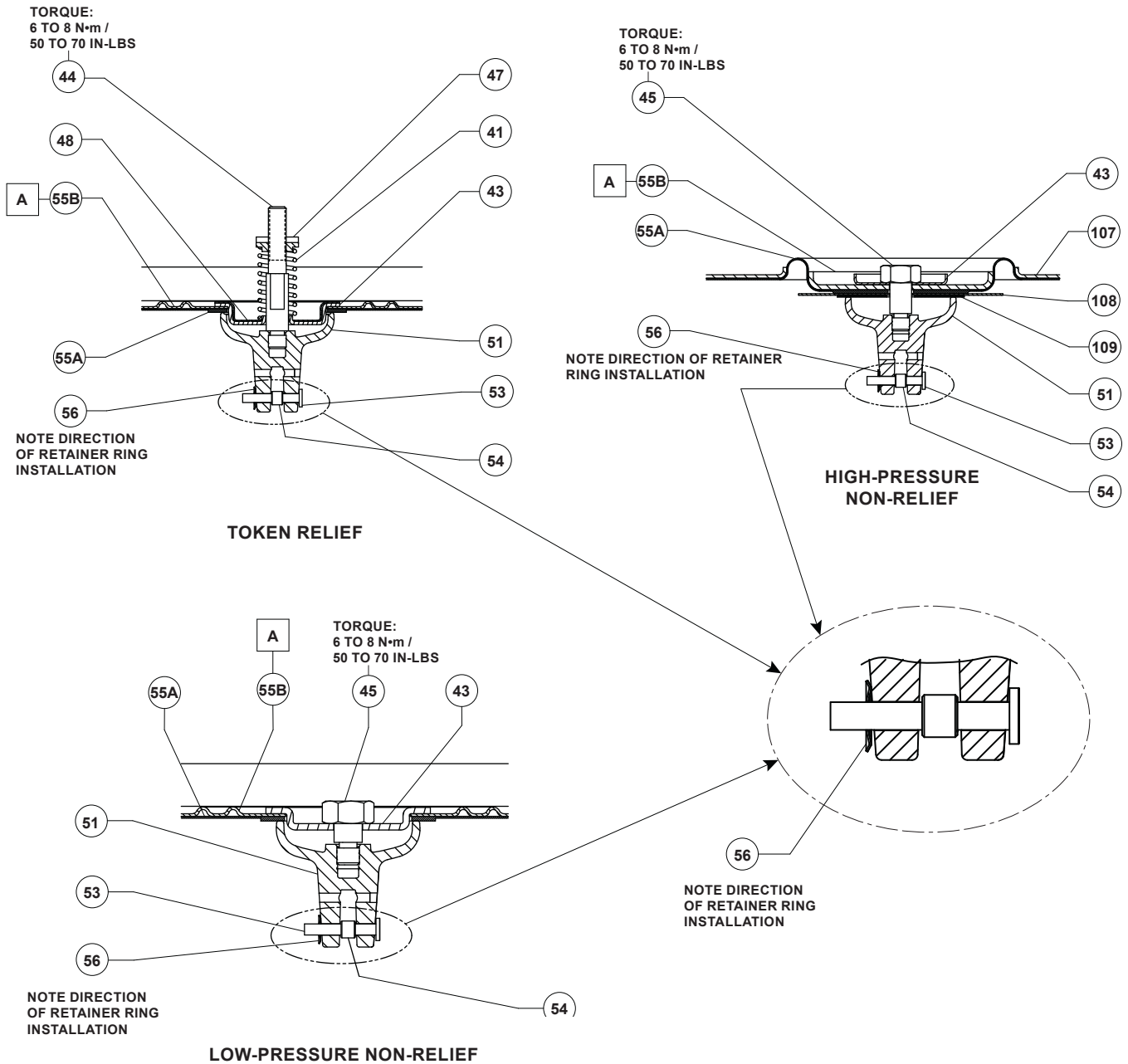
Key	Description	Part Number	Key	Description	Part Number
	Spare Parts (Repair Parts Kit includes keys 12, 19, 21, 27, 35K, 55, 62, 75 and 77)				
	Type CSB400	RCSB400X012			
	Type CSB403	RCSB403X012			
	Type CSB404	RCSB404X012			
	Spare Parts (Repair Parts Kit includes keys 19, 21, 36E, 36I, 36K, 36N, 36O, 36P, 36Q, 36R and 62) ⁽¹⁾				
	Type TM600	RTM600X0012			
	Spare Parts (Repair Parts Kit includes keys 6, 14, 24, 31, 33, 46 and 47)				
	VXS4 Series	RVSX4MCX012			
	Spare Parts (Repair Parts Kit includes keys 6, 14, 24, 31, 33, 46, 47 and 53)				
	VXS8 Series	RVSX8X00012			
1	Spring Case, Aluminum	GE24555X012			
2	Vent Screen, 18-8 Stainless steel	T1121338982			
3	Retaining Ring, Steel	T1120925072			
4	Stabilizer Guide, 304 Stainless steel	GE27061X012			
5	Stabilizer, Acrylonitrile Butadiene Styrene (ABS)	GE27063X012			
6	Stabilizer Spring, Stainless steel	GE35010X012			
7	Retainer Ring, Zinc-plated steel	GE27024X012			
8	Stabilizer Screw, Zinc-plated steel (3 required)	GE29724X012			
9	Lower Casing, Aluminum	GE24289X012			
10	Lever, Steel				
	Types CSB400, CSB403, CSB404, CSB410 and CSB414	GE28773X012			
	Types CSB420, CSB423, CSB424, CSB430, CSB434, CSB450 and CSB454	GE28772X012			
11	Valve Stem, Aluminum	GE27812X012			
12*	O-ring, Nitrile (NBR)				
	External Registration Only	1E472706992			
13	Lever Pin, 18-8 Stainless steel				
	Types CSB400, CSB403, CSB404, CSB410 and CSB414	T14397T0012			
	Types CSB420, CSB423, CSB424, CSB430, CSB434, CSB450 and CSB454 (2 required)	T14397T0012			
14	Lever Screw, Steel				
	Types CSB400, CSB403, CSB404, CSB410 and CSB414 (2 required)	GE34243X012			
	Types CSB420, CSB423, CSB424, CSB430, CSB434, CSB450 and CSB454 (4 required)	GE34243X012			
15	Cap Screw, Steel (8 required)	GE32059X012			
16	Nut, Steel (8 required)	GE32060X012			
17	Union Ring, Aluminum	GE26590X012			
18	Snap Ring, 302 Stainless steel	T1120637022			
19*	O-ring, Nitrile (NBR) (2 required)	1K594906562			
20	Stem Guide, Aluminum	GE26027X012			
21*	O-ring, Nitrile (NBR)	GE45216X012			
22	Pipe plug, 3/4 NPT, Steel				
	Internal Registration Only	GE34199X012			
23	Screw (For external registration only), Steel (2 required)	1E175828982			
24*	O-ring (For external registration only), Nitrile (NBR) (2 required)	17A0960X012			
25	Orifice				
	Types CSB400F and CSB404F, Aluminum	GG08494X012			
	All other types, Brass	GE31321X012			
26	OPP Orifice 18 mm / 0.69 in.				
	With Integral True-Monitor™ Orifice, Aluminum	GE30003X012			
	With Slam-shut Orifice, Brass	GE28684X012			
27*	O-ring, Nitrile (NBR)				
	Type CSB400 (1 required)	10A3802X022			
	Type CSB403 (2 required)	10A3802X022			
	Type CSB404 (2 required)	10A3802X022			
35	Balanced Port Assembly for All Internal and Dual Registration Bodies				
	Standard, -20 to 66°C / -4 to 150°F				GE31196X012
	Low temperature, -30 to 66°C / -22 to 150°F				
	"F" version				GE31196X022
35A	Brazed Housing, Zinc-plated steel				GE31261X012
35B	Stem, Stainless steel				ERAA15222A0
35C	Spring Retainer, Zinc-plated steel				GE31189X012
35D	Spring, Stainless steel				ERAA15508A0
35E	Disk Screw, Zinc-plated steel				GE31190X012
35F*	Diaphragm, Nitrile (NBR) / Fabric				ERRA15224A0
35G	Cap, Brass				GE31195X012
35H	Outer Retainer, Brass				GE31187X012
35J	Inner Retainer, Zinc-plated steel				ERAA16571A0
35K*	Disk Assembly, Brass / Nitrile (NBR)				
	Standard version				ERSA00457A0
	Low Temperature "F" version				GE31185X012
35M	O-ring, Nitrile (NBR) (2 required)				ERAA17405A0
35N*	O-ring, Nitrile (NBR)				1U879006562
35R	Screw, Steel (4 required)				GE25968X012
35S	Pin, Zinc-plated steel				GE31232X012
35U	Thrust Washer, Stainless steel				ERAA16573A0
35	Balanced Port Assembly for Rp 1 x 2-1/4 in.				
	GAZ in Internal or Dual Registration				
	Standard temperature, -20 to 66°C / -4 to 150°F				GE33822X012
	Low temperature, -30 to 66°C / -22 to 150°F				
	"F" version				GE33822X022
35A	Brazed Housing, Zinc-plated steel				GE32505X012
35B	Stem, Stainless steel				ERAA15222A0
35C	Spring Retainer, Zinc-plated steel				GE31189X012
35D	Spring, Stainless steel				ERAA15508A0
35E	Disk Screw, Zinc-plated steel				GE31190X012
35F*	Diaphragm, Nitrile (NBR) / Fabric				ERRA15224A0
35G	Cap, Brass				GE31195X012
35H	Outer Retainer, Brass				GE31187X012
35J	Inner Retainer, Zinc-plated steel				ERAA16571A0
35K*	Disk Assembly, Brass / Nitrile (NBR)				
	Standard version				ERSA00457A0
	Low-temperature "F" version				GE31185X012
35M	O-ring, Nitrile (NBR) (2 required)				ERAA17405A0
35N*	O-ring, Nitrile (NBR)				1U879006562
35R	Screw, Cap, Hex Socket, Steel (4 required)				GE25968X012
35U	Thrust Washer, Stainless steel				ERAA16573A0
35	Balanced Port Assembly for All External Registration Bodies except GAZ body				
	Standard, -20 to 66°C / -4 to 150°F				ERAA14234A0
	Low Temperature, -30 to 66°C / -22 to 150°F				
	"F" version				ERAA14234A1
35A	Brazed Housing, Zinc-plated steel				ERAA14098A0
35B	Stem, Stainless steel				ERAA15222A0
35C	Spring Retainer, Zinc-plated steel				GE31189X012
35D	Spring, Stainless steel				ERAA15508A0
35E	Disk Screw, Zinc-plated steel				GE31190X012
35F	Diaphragm				ERRA15224A0
35G	Cap, Brass				GE31195X012
35H	Outer Retainer, Brass				GE31187X012
35J	Inner Retainer, Carbon steel				ERAA16571A0
35K	Disk Assembly, Brass / Nitrile (NBR)				
	Standard				ERSA00457A0
	Low Temperature "F" version				GE31185X012
35M	O-ring, Nitrile (NBR) (2 required)				ERAA17405A0
35N	O-ring, Nitrile (NBR)				1U879006562
35R	Screw, Steel (4 required)				GE25968X012
35S	Pin, Carbon steel				GE31232X012
35U	Thrust Washer, Stainless steel				ERAA16573A0

*Recommended spare part.

1. 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).

CSB400 Series

Key	Description	Part Number	Key	Description	Part Number
38	Spring		70	Body	
	17 to 24 mbar / 6.8 to 9.6 in. w.c., Pink	GE30191X012		Ductile Cast Iron	
	24 to 35 mbar / 9.6 to 14 in. w.c., Orange Stripe	GE43955X012		NPT:	
	35 to 60 mbar / 14 to 24 in. w.c., Dark Green	GE30201X012		1	GE26463X012
	54 to 100 mbar / 0.78 to 1.5 psig, Tan	GE30202X012		1-1/4	GE26465X012
	100 to 160 mbar / 1.45 to 2.3 psig, Purple Stripe	GE35081X012		1-1/2	GE26466X012
	138 to 300 mbar / 2.0 to 4.4 psig, Dark Blue	GE30192X012		2	GE26467X012
	276 to 517 mbar / 4 to 7.5 psig, Red	GE33121X012		Rp:	
	500 mbar to 1 bar / 7.3 to 14.5 psig, Light Blue	GE30203X012		Rp 1	GE26468X012
	1 to 3 bar / 14.5 to 43.5 psig, Light Green	GE30204X012		Rp 1-1/4	GE26469X012
40	Upper Spring Seat, Steel			Rp 1-1/2	GE26470X012
	High Pressure, Zinc-plated steel	GE32501X012		Rp 1 x 1-1/4	GE42505X012
41	Relief Valve Spring, 302 Stainless steel			Rp 1 x 2-1/4, GAZ	GE26482X012
	Types CSB400, CSB403 and CSB404, Token	GE30194X012		Rp 2	GE26471X012
	Types CSB420, CSB423 and CSB424, Token	GE42225X012		Flange:	
43	Relief Valve Spring Seat, Zinc-plated steel			DN 50 / NPS 2, CL150 FF	GE26480X012
	Types CSB400 and CSB420, Non-Relief	GE27327X012		DN 40 / NPS 1-1/2, PN 10/16 Slip-Flange	GE44902X012
	Type CSB450, Non-Relief	GE31677X012		DN 50 / NPS 2, PN 10/16	GE26481X012
	Types CSB400 and CSB420, Token	GE28947X012		WCC Steel	
44	Stem, Aluminum			NPT:	
	Types CSB400 and CSB420, Token	GE30895X012		1	GE26463X022
45	Diaphragm Retainer, Zinc-plated steel			1-1/4	GE26465X022
	Types CSB400 and CSB420, Non-Relief	GE30887X012		1-1/2	GE26466X022
	Type CSB450, Non-Relief	GE33850X012		Rp:	
47	Upper Spring Seat, Aluminum			Rp 1	GE26468X022
	Types CSB400 and CSB420, Token	GE33332X012		Rp 1-1/4	GE26469X022
48	Restrictor Plate, Zinc-plated steel			Rp 1-1/2	GE26470X022
	Token	GE28948X012	71	Bolt, Steel (2 required)	GE32061X012
51	Pusher Post, Aluminum		72	Pipe Plug, 1/4 NPT	
	Token	ERAA00876A0		Steel	1C333528992
	Non-Relief	ERAA00875A0		316 Stainless steel	1C3335X0012
53	Solid Rivet, 18-8 Stainless steel	GE29761X012	74	Blanking Plug, Aluminum	GE31255X012
54	Roller Pin, Brass	GE27060X012	75*	O-ring, Metric, Nitrile (NBR)	GF03442X012
55*	Diaphragm Assembly, Steel / Nitrile (NBR)		76	Half Flange, Steel (2 required)	GF01942X012
	Without Diaphragm Head Limiter	GE31248X012	77*	Metric O-ring, Nitrile (NBR)	GF03443X012
	With Diaphragm Head Limiter	GE32140X012	80	Cap Screw, Steel (4 required)	GE38176X012
55A	Diaphragm	-----	81	Slotted Spring Pin	GE32503X012
55B	Diaphragm Head	-----	82	Tube Gasket, Nitrile (NBR)	GE32502X012
56	Retaining Ring, Pusher Post Pin	GE33772X012	83	Pitot Tube, Aluminum	GE31988X012
57	Bearing ball	GE33131X012	90	Nameplate	-----
58	Hex Nut, High-Pressure,		91	Warning Label	-----
	(CSB450 Series only) Steel	GE33132X012	93	Information Label	-----
60	Closing Cap, Low-Pressure, Aluminum	GE29244X012	94	Overlay Label	-----
61	Bonnet, High-Pressure,		95	Grommet, Nitrile (NBR)	GE35358X012
	(CSB450 Series only) Zinc-plated steel	GE32499X012	96	Slip Disk, Stainless steel	GG05787X012
62*	O-ring, Nitrile (NBR)	T10275X0012	100	Wire and Seal	T14088T0012
65	Adjust Screw		101	Spring Pin, Steel	GE32724X012
	Low-Pressure, Aluminum	GE27828X012	104	Hub, Zinc-plated steel (2 required) not shown	GG02505X012
	High-Pressure, Steel	GE32500X012	105	Flange Slip, Zinc-plated steel	
				(2 required) not shown	GG02508X012
			106	O-ring, Nitrile (NBR) (2 required) not shown	GE41121X012
			107	Diaphragm Head Limiter, Zinc-plated steel	GE28761X012
			108	Diaphragm Protector, Zinc-plated steel	GE42747X012
			109	Pad, (CSB450 Series only)	T13830T0012
			112	Stem Cap	ERAA16569A0



ERAA04154

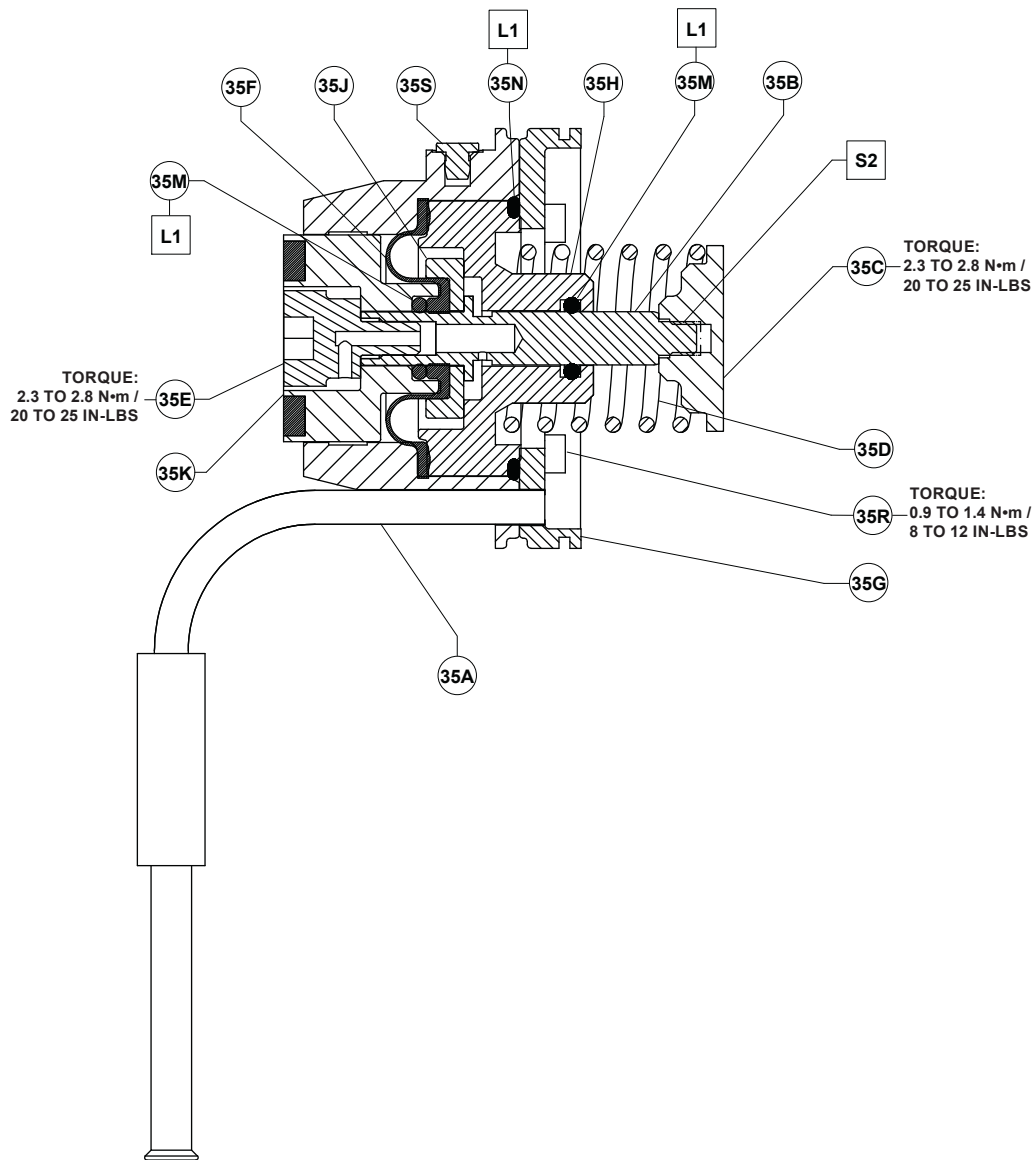
APPLY ADHESIVE (A)⁽¹⁾:
A = ADHESIVE

NOTE: APPLY ADHESIVE ON THE FLAT SURFACE OF THE DIAPHRAGM PLATE THAT CONTACTS THE DIAPHRAGM, TOWARD THE OUTER PERIMETER, AND AWAY FROM THE CENTER HOLE.

1. Adhesive must be selected such that it meets the temperature requirements.

Figure 11. CSB400 Series Diaphragm and Relief Assemblies

CSB400 Series



STANDARD BALANCED PORT ASSEMBLY - INTERNAL REGISTRATION

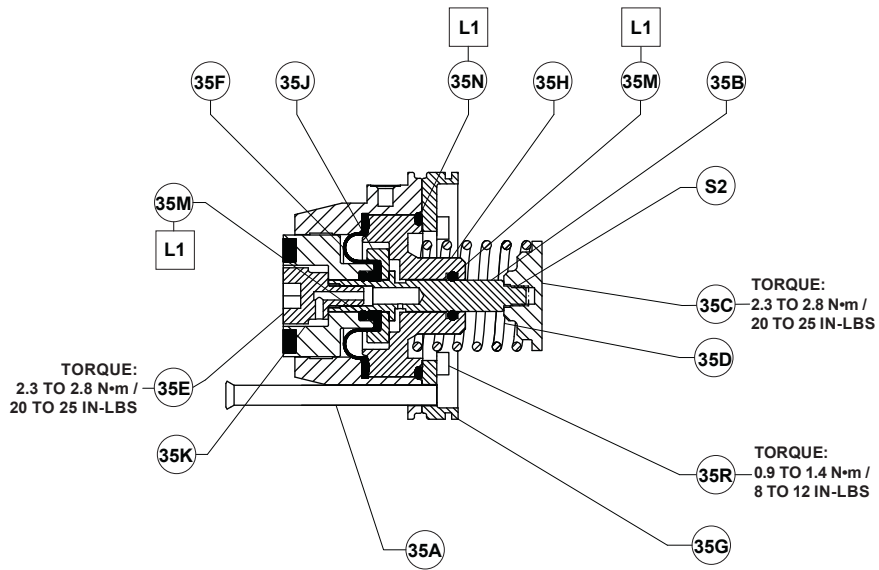
ERAA04154

APPLY LUBRICANT (L) / SEALANT (S)⁽¹⁾:
 L1 = DOW CORNING® 33 OR COMPARABLE EXTREME LOW TEMPERATURE LUBRICANT
 S2 = PERMANENT THREAD SEALANT

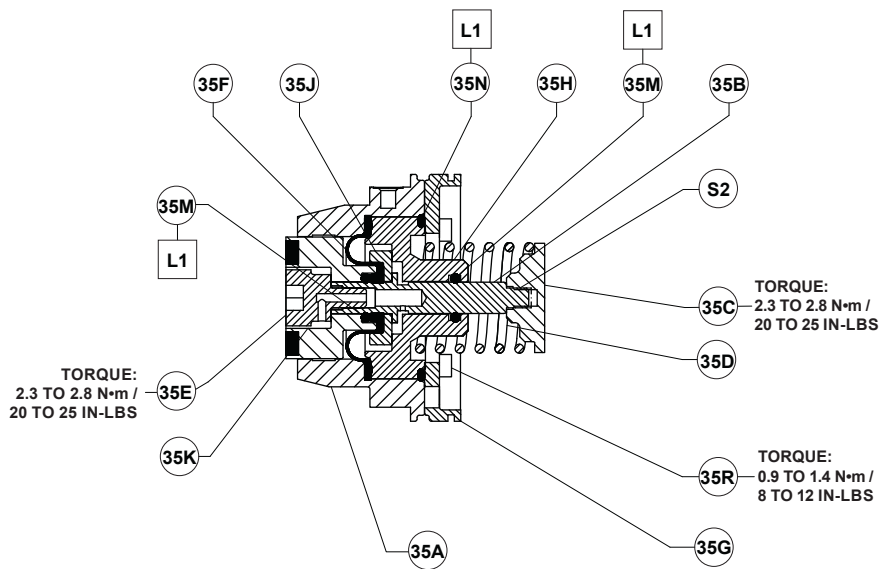
1. Lubricant and sealant must be selected such that they meet the temperature requirements.

Figure 12. Balance Trim Assemblies

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BALANCED PORT ASSEMBLY FOR Rp 1 X 2-1/4 GAZ BODY - INTERNAL REGISTRATION



BALANCED PORT ASSEMBLY FOR RP 1 X 2-1/4 GAZ BODY - EXTERNAL REGISTRATION

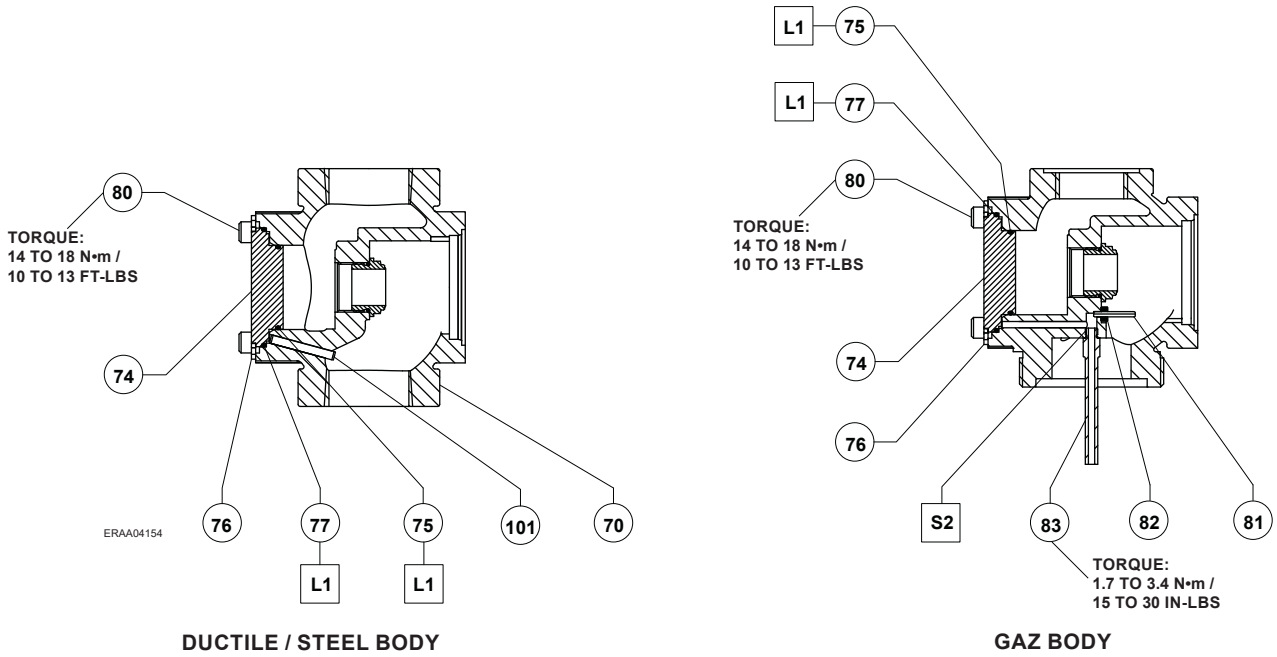
ERAA04154

- APPLY LUBRICANT (L) / SEALANT (S)⁽¹⁾:
- L1 = DOW CORNING® 33 OR COMPARABLE EXTREME LOW TEMPERATURE LUBRICANT
- S2 = PERMANENT THREAD SEALANT

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

Figure 12. Balance Trim Assemblies (continued)

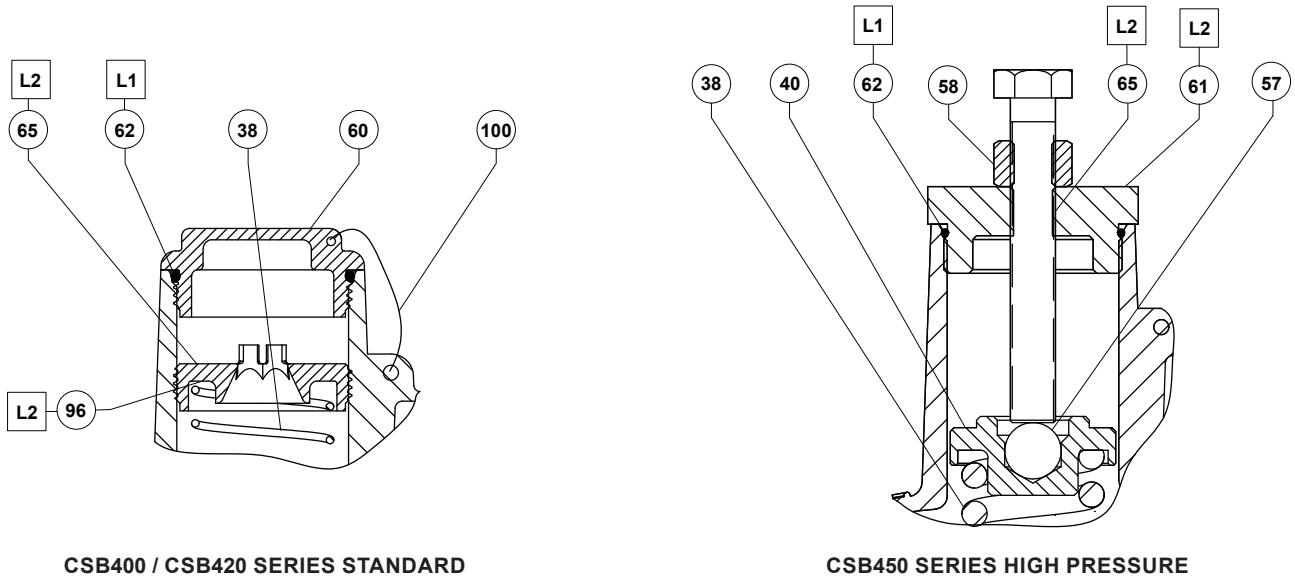
CSB400 Series



APPLY LUBRICANT (L) / SEALANT (S)⁽¹⁾:
L1 = DOW CORNING® 33 OR COMPARABLE EXTREME LOW TEMPERATURE LUBRICANT
S2 = PERMANENT THREAD SEALANT

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

Figure 13. Standard Body Assembly and Rp 1 x 2-1/4 GAZ Body Assembly



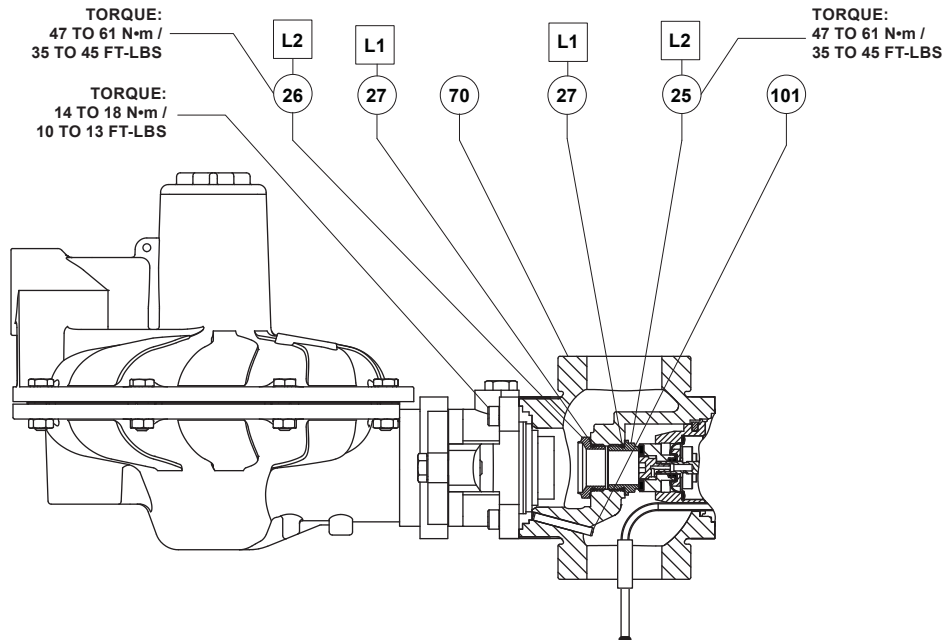
ERAA04154

APPLY LUBRICANT (L)⁽¹⁾:
L1 = DOW CORNING® 33 OR COMPARABLE EXTREME LOW TEMPERATURE LUBRICANT
L2 = ANTI-SEIZE LUBRICANT

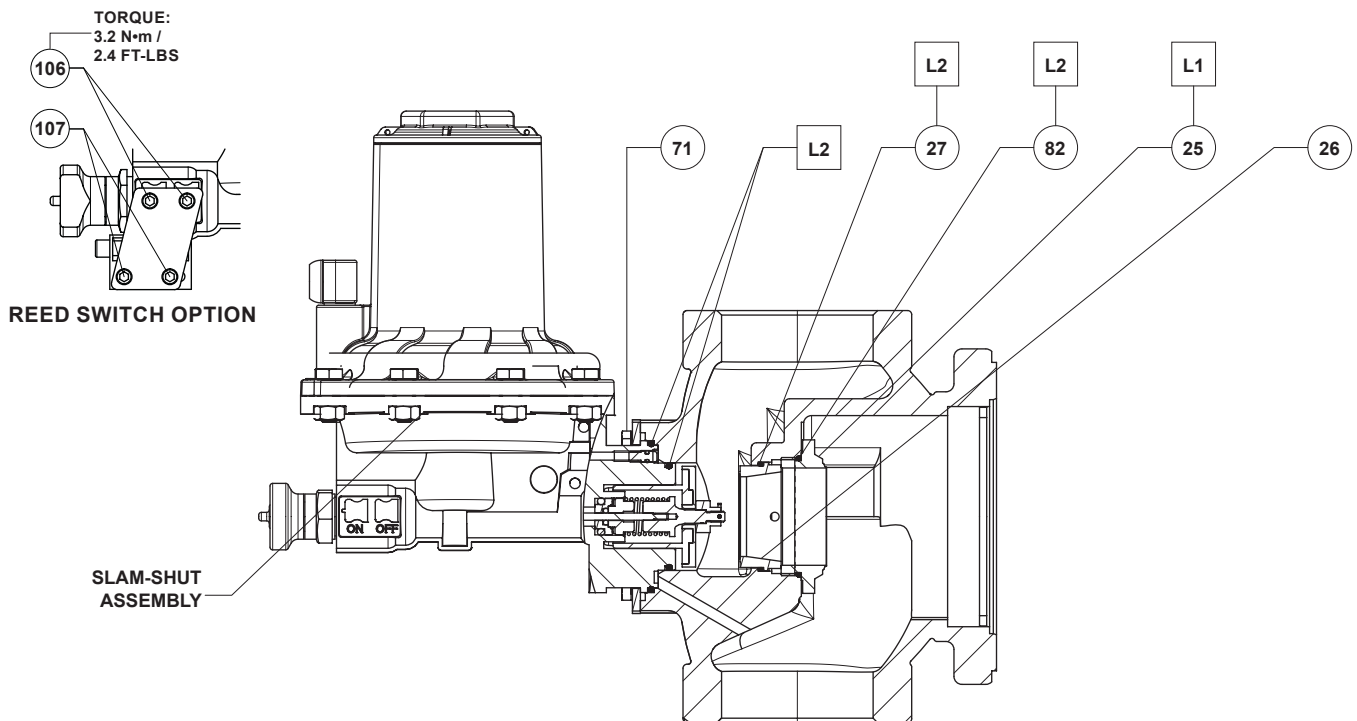
1. Lubricant and sealant must be selected such that they meet the temperature requirements.

Figure 14. CSB400 Series Control Spring Adjustment Assemblies

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INTEGRAL TRUE-MONITOR™ ASSEMBLY



ORIFICE AND SLAM-SHUT ASSEMBLY

GE32407_AE

APPLY LUBRICANT⁽¹⁾:

L2 = EXTREME LOW-TEMPERATURE BEARING GREASE

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

Figure 15. CSB400 Series Slam-shut and Integral True-Monitor Modules

CSB400 Series

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