

**APACHE CANADA  
LIMITED**

**HAMBURG 2-6  
COMPRESSOR STATION**

**SO# 99404**

LSD: 02-06-097-11 W6M

SEPTEMBER, 2000

OPERATING MANUAL

**VOLUME 3**

**PROPAK COPY  
PLEASE DO NOT REMOVE**

# **APACHE CANADA LIMITED**

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**LSD: 02-06-097-11 W6M**

**2-6 Hamburg 1478 hp Compressor Package**

**Propak Systems Unit #99404**

**Waukesha L7042GL / Dresser-Rand 6HOS-3**

**Operations and Maintenance Manual**



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PROPAK SYSTEMS LTD POSTAL BAG #2, AIRDRIE, ALBERTA, CANADA T4B 2C3				LEVEL INSTRUMENTS (DISPLACER OR FLOAT)				SHEET 1 OF 1	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : LEVEL CONTROLLER				NO	BY	DATE	REVISION	JOB #	99404
				0	PC	12/21/99	FOR PURCHASE	DATE	
								REQ.	
								BY	CHK'D
1	TAG NO.	LC-100	LC-110	LC-120					
2	SERVICE	1ST STAGE SCRUBBER	2ND STAGE SCRUBBER	3RD STAGE SCRUBBER					
3	LINE NO. / VESSEL NO.	V-100	V-110	V-120					
B O D Y	4	BODY OR CAGE MATERIAL	CS	CS	CS				
		RATING	300#	300#	600#				
	5	CONN. SIZE	LOC. UPPER	60 mm	60 mm	60 mm	mm		
		TYPE	NPT	NPT	NPT				
I N S T R U M E N T	6	CONN. SIZE	LOC. LOWER	mm	mm	mm	mm		
		TYPE							
	7	CAGE MOUNTING (RH, LH, TOP)							
		TYPE	INTERNAL	INTERNAL	INTERNAL				
C O N T R O L L E R	8	ROTATABLE HEAD							
	9								
	10	ORIENTATION	VERTICAL	VERTICAL	VERTICAL				
	11	COOLING EXTENSION							
D I M E N S I O N S	12								
	13	DIMENSIONS	48 OD x 305 mm	48 OD x 305 mm	48 OD x 305 mm	mm	mm	mm	
	14	INSERTION DEPTH	STD mm	STD mm	STD mm	mm	mm	mm	
	15	DISPLACER EXTENSION	--- mm	--- mm	--- mm	mm	mm	mm	
M O U N T I N G	16	DISP. OR FLOAT MATERIAL	304SS	304SS	304SS				
	17	DISPLACER SPRING/TUBE MTL	K-MONEL	K-MONEL	K-MONEL				
	18								
	19								
F U N C T I O N	20	FUNCTION	CONTROLLER	CONTROLLER	CONTROLLER				
	21	OUTPUT	35 KPAG	35 KPAG	35 KPAG				
	22	CONTROL MODES	ON-OFF	ON-OFF	ON-OFF				
	23	DIFFERENTIAL							
O U T P U T	24	OUTPUT ACTION: LEVEL RISE	INCREASE	INCREASE	INCREASE				
	25	MOUNTING							
	26	ENCLOSURE CLASS	WEATHER PROOF	WEATHER PROOF	WEATHER PROOF				
	27	ELEC. POWER OR AIR SUPPLY	SWEET GAS	SWEET GAS	SWEET GAS				
S E N S I T I V I T Y	28								
	29	UPPER LIQUID	HC GAS	HC GAS	HC GAS				
	30	LOWER LIQUID	HC LIQUID/WATER	HC LIQUID/WATER	HC LIQUID/WATER				
	31	SP. GR. UPPER	SP. GR. LOWER	1.00	1.00	1.00			
P R E S S U R E	32	PRES. MAX.	PRES. NORMAL	4516 kPa(g) 138 kPa(g)	4516 kPa(g) 961 kPa(g)	9067 kPa(g) 2976 kPa(g)	kPa(g)	kPa(g)	
	33	TEMP. MAX.	TEMP. NORM.	-28/149 °C 15 °C	-28/149 °C 49 °C	-28/149 °C 49 °C	°C	°C	
	34								
	35								
O T H E R	36	AIRSET	SUPPLY GAGE	YES	YES	YES			
	37	GAGE GLASS CONNECTIONS							
	38	GAGE GLASS MODEL NO.							
	39	CONT. NUM	CONT. FORM						
I N S T R U M E N T	40	CONTACT RATING							
	41	ACTION OF CONTACTS							
	42								
	43								
M A N U F A C T U R E R	44								
	45	MANUFACTURER	FISHER	FISHER	FISHER				
	46	MODEL NO.	2680A-268T	2680A-268T	2680A-268T				
47	P. O. NUMBER								

NOTES: 1. NACE REQUIRED.

AREA UNIT #:

PROPAK SYSTEMS LTD POSTAL BAG #2 AIRDRIE, ALBERTA, CANADA T4B 2C3	GAUGES GLASS AND COCKS	SHEET 1 OF 1	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : LEVEL GAUGE	NO BY DATE REVISION 1 PC 99/12/21 FOR PURCHASE	SPEC NO _____ FILE 14.111 JOB # 99404	DATE _____
			REQ. _____
			BY _____ CHK'D _____ APPR. _____

1. GAGE COLUMN _____ COCKS <input checked="" type="checkbox"/> ASSEMB, WITH NIPPLES <input checked="" type="checkbox"/> UNASSEMBLED _____ GAGE GLASSES 2. TYPE: REFLEX <input checked="" type="checkbox"/> TRANSPAR. _____ TUBULAR _____ LARGE CHAMBER _____ WELD PAD _____ 3. CONN ( mm ) : SIZE AND TYPE _____ 21 NPT TOP & BOT. 21 _____ SIDE _____ BACK _____ VENT 21 _____ DRAIN 21 _____ 4. MATERIAL _____ ALLOY STEEL 5. MIN. RATING _____ AS BELOW _____ kPa AT _____ AS BELOW _____ °C 6. OPTIONS: ILLUMINAT. _____ MICA SHIELD _____ INTERNAL TUBE _____ EXT. LENGTH _____ mm NON - FROST _____ EXT. LENGTH _____ mm CALB. SCALE _____ OTHFR _____ 7 MANUFACTURER & MODEL _____ PENBERTHY	GAGE COCKS 8. TYPE : OFFSET <input checked="" type="checkbox"/> STRAIGHT _____ 9. CONN(mm): VESSEL 27 _____ GAGE 21 _____ VENT/DRAIN 21 _____ 10. MATERIAL: BODY CS _____ TRIM SS _____ 11. MIN. RATING _____ 26300 kPa @ _____ 149 °C 12. CONSTRUCTION: _____ 13. TYPE OF CONN: VESSEL MNPT _____ GAGE FNPT _____ 14. BONNET _____ INTEGRAL _____ 15. OPTIONS: BALL CHECKS <input checked="" type="checkbox"/> RENEWABLE SEATS _____ OTHER _____ 16. MANUFACTURER & MODEL _____ PENBERTHY M/N 330-J, NACE
---	---

TAG NO.	REV	QTY	VISIBLE GLASS mm	C LINE TO CONN. mm	MODEL NUMBER	OPERATING		DESIGN		FROST SHIELD	SERVICES	NOTES	ASSEMBLY & UNIT #
						PRESS. kPa(g)	TEMP. ° C	PRESS. kPa(g)	TEMP. ° C				
100	1	1	321	MIN 448	1RL9	138	16	4516	-28 / 149	NO	V-100	NACE TRIM	152
110	1	1	321	MIN 448	1RL9	961	49	4516	-28 / 149	NO	V-110	NACE IRIM	152
120	1	1	321	MIN 448	1RL9	2976	49	9076	-28 / 149	NO	V-120	NACE TRIM	152

MFR: PENBERTHY

MODEL NUMBER: 1RL9

P.O. NUMBER:

NOTES:  
1. NACE REQUIRED



CUSTOMER : APACHE CANADA LIMITED
PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE
SERVICE : LEVEL GAUGE- ENGINE AND COMPRESSOR UTILITIES

Table with columns: NO, BY, DATE, REVISION, JOB #, DATE, REQ, BY, CHK'D, APPR

1. GAGE COLUMN COCKS
ASSFMR WITH NIPPI FS UNASSEMBLED
GAGE GLASSES
2. TYPE : REFLEX TRANSPAR TUBULAR X
LARGE CHAMBER WELD PAD
3. CONN ( mm ) : SIZE AND TYPE
TOP & BOT, X SIDE BACK
VENT DRAIN
4. MATERIAL
5. MIN. RATING kPa AT ° C
6. OPTIONS: ILLUMINAT. MICA SHIELD
INTERNAL TUBE EXTERNAL JKT
NON - FROST EXT. LENGTH mm
CALB. SCALE OTHER
7. MANUFACTURER & MODEL PENBERTHY - TUBULAR

GAGE COCKS
8. TYPE : OFFSET STRAIGHT X
9. CONN(mm): VESSEL 21 GAGE 13 VENT/DRAIN 13
10. MATERIAL: BODY TRIM
11. MIN. RATING kPa @ ° C
12. CONSTRUCTION:
13. TYPE OF CONN: VESSEL MNPT
GAGE FNPT
14. BONNET INTEGRAL
15. OPTIONS: BALL CHECKS RENEWABLE SEATS
OTHER
16. MANUFACTURER & MODEL PENBERTHY N7A

Main table with columns: TAG NO., REV, QTY, VISIBLE GLASS, C LINE TO CONN., MODEL NUMBER, OPERATING PRESS. TEMP., DESIGN PRESS. TEMP., FROST SHIELD, SERVICES, NOTES, ASSEMBLY & UNIT #

MFR: PENBERTHY
MODEL NUMBER: TUBULAR, c/w N7A Valves
P.O. NUMBER:
NOTES: 1. c/w 330J GAUGE COCKS (V-130)

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3				LEVEL INSTRUMENTS (DISPLACER OR FLOAT)				SHEET _____ OF _____ SPEC NO _____ FILE 14.11.L		
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : LEVEL SWITCHES				NO	BY	DATE	REVISION	JOB #	99404	
				1	PC	99/12/13	FOR PURCHASE	DATE		
				2	DP	00/04/01	REVISED TAG 262	REQ.		
								BY	CHK'D	APPR.
1	TAG NO.	LI/LC/LSL-262		LI/LC/LSL-270						
2	SERVICE	ENGINE CRANKCASE		COMPRESSOR LUBE OIL						
3	LINE NO. / VESSEL NO.									
B O D Y	4	BODY OR CAGE MATERIAL		ALUMINUM HOUSING						
		RATING		15 FT HEAD						
	5	CONN. SIZE	LOC. UPPER	1/2 in		mm				
		TYPE		NPT						
	6	CONN. SIZE	LOC. LOWER	3/4 in		mm				
		TYPE		NPT						
	7	CASE MOUNTING (R/L/L/TOP)		BACK						
C A S E	8	TYPE		REPLACES ENGINE DOOR						
	9	ROTATABLE HEAD								
	10	ORIENTATION								
	11	COOLING EXTENSION								
D I S P L A C E R	12	CAGE								
	13	DIMENSIONS		MFR. STANDARD	in	MFR. STANDARD	mm			
	14	INSERTION DEPTH			in		mm			
	15	DISPLACER EXTENSION			in		mm			
	16	DISP. OR FLOAT MATERIAL		POLYURETHANE		MFR. STANDARD				
	17	DISPLACER SPRING/TUBE MTL		NITRILE						
	18			20 MESH BRASS CLOTH						
F L O A T	19			CLEAR POLYCARBONATE						
	20	FUNCTION		LIQUID LEVEL CONTROLLER		LIQUID LEVEL CONTROLLER				
	21	OUTPUT		1-15 FT HEAD						
	22	CONTROL MODES		OPENS UPON LOW LEVEL						
	23	DIFFERENTIAL		SPDT, WIRED N.C.						
	24	OUTPUT ACTION: LEVEL RISE		1/2" NPT		CONTACT CLOSE				
	25	MOUNTING		LOCAL, WIRED TO PANEL		LOCAL				
	26	ENCLOSURE CLASS		CLASS 1, DIV. 1, GROUP C & D		CLASS 1 DIV. 11, XP				
	27	ELEC. POWER OR AIR SUPPLY		0.5A, 125VDC		INSTRUMENT GAS				
	28									
S E N S I T I V E	29	UPPER LIQUID		LUBE OIL, SAE 30						
	30	LOWER LIQUID		LUBE OIL, SAE 30		LUBE OIL				
	31	SP. GR. UPPER	SP. GR. LOWER							
	32	PRES. MAX.	PRES. NORMAL	15 FT	12 FT	kPa(g)	ATM	kPa(g)		
C O N T A C T	33	TEMP. MAX.	TEMP. NORM.	100 ° F	80 ° F	* C	16 * C			
	34									
O P T I O N S	35									
	36	AIRSET	SUPPLY GAGE							
	37	GAGE GLASS CONNECTIONS								
	38	GAGE GLASS MODEL NO.								
	39	CONT: NUM	CONT: FORM							
	40	CONTACT RATING								
	41	ACTION OF CONTACTS								
	42									
	43									
	44									
M A N U F A C T U R E R	45	MANUFACTURER		KENCO		KENCO				
	46	MODEL NO.		LCE-27		LCE-9				
	47	P. O. NUMBER								
NOTES:										

AREA UNIT # : .152

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3				LEVEL INSTRUMENTS (DISPLACER OR FLOAT)				SHEET OF		
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : LEVEL SWITCHES				NO	BY	DATE	REVISION	SPEC NO	FILE 14.11.L	
				1	PC	99/12/21	FOR PURCHASE	JOB #	99404	
								DATE		
								REQ.		
								BY	CHK'D	APPR.
1	TAG NO.	LS-100	LS-110	LS-120						
2	SFRVICF	1ST STAGE SCRUBBER	2ND STAGE SCRUBBER	3RD STAGE SCRUBBER						
3	LINE NO. / VESSEL NO.	V-100	V-110	V-120						
4	BODY OR CAGE MATERIAL									
B O D Y	RATING									
	CONN. SIZE	LOC. UPPER	mm	mm	mm	mm	mm	mm	mm	mm
	TYPE									
6	CONN. SIZE	LOC. LOWER	mm	mm	mm	mm	mm	mm	mm	mm
7	CASE MOUNTING (RH, LH, TOP)									
C A S E	TYPE		48 mm NPT	48 mm NPT	48 mm NPT					
	ROTATABLE HEAD									
	ORIENTATION		HORIZONTAL	HORIZONTAL	HORIZONTAL					
11	COOLING EXTENSION									
12	CAGE									
13	DIMENSIONS		MFR STD	mm	MFR STD	mm	MFR STD	mm	mm	mm
14	INSERTION DEPTH		MFR STD	mm	MFR STD	mm	MFR STD	mm	mm	mm
15	DISPLACER EXTENSION			mm		mm		mm	mm	mm
16	DISP. OR FLOAT MATERIAL		STAINLESS STEEL		STAINLESS STEEL		STAINLESS STEEL			
17	DISPLACER SPRING/TUBE MTL		316SS		316SS		316SS			
18	NACE REQUIRED		YES		YES		YES			
20	FUNCTION		SWITCH		SWITCH		SWITCH			
21	OUTPUT									
22	CONTROL MODES		ON/OFF		ON/OFF		ON/OFF			
23	DIFFERENTIAL									
24	OUTPUT ACTION: LEVEL RISE		CONTACTS OPEN		CONTACT OPEN		CONTACT OPEN			
25	MOUNTING		EXTERNAL		EXTERNAL		EXTERNAL			
26	ENCLOSURE CLASS		CLASS I, DIV II, XP		CLASS I, DIV II, XP		CLASS I, DIV II, XP			
27	ELEC. POWER OR AIR SUPPLY		24V DC		24V DC		24V DC			
29	UPPER LIQUID		SOUR HC VAPOR		SOUR HC VAPOR		SOUR HC VAPOR			
30	LOWER LIQUID		SOUR WATER		SOUR WATER		SOUR WATER			
31	SP. GR. UPPER	SP. GR. LOWER	0.65	1.0	0.65	1.0	0.65	1.0		
32	PRES. MAX.	PRES. NORMAL	4516 kPa(g)	138 kPa(g)	4516 kPa(g)	961 kPa(g)	9067 kPa(g)	2976 kPa(g)	kPa(g)	kPa(g)
33	TEMP. MAX.	TEMP. NORM.	-28/149 ° C	15 ° C	-28/149 ° C	49 ° C	-28/149 ° C	49 ° C	° C	° C
36	AIRSET	SUPPLY GAGE								
37	GAGE GLASS CONNECTIONS									
38	GAGE GLASS MODEL NO.									
39	CONT: NUM	CONT: FORM	ONE - SPDT		ONE - SPDT		ONE - SPDT			
40	CONTACT RATING		2 AMPS @ 30 VDC		2 AMPS @ 30 VDC		2 AMPS @ 30 VDC			
41	ACTION OF CONTACTS		OPEN ON HIGH LEVEL		OPEN ON HIGH LEVEL		OPEN ON HIGH LEVEL			
45	MANUFACTURER		MURPHY		MURPHY		MURPHY			
46	MODEL NO.		L1100-SS		L1100-SS		L1100-SS			
47	P. O. NUMBER									

NOTES:

AREA. UNIT # : 152

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3				LEVEL INSTRUMENTS (DISPLACER OR FLOAT)				SHEET OF	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : LEVEL SWITCHES				NO	BY	DATE	REVISION	SPEC NO	FILE 14,11,L
				1	PC	99/12/13	FOR PURCHASE	JOB #	99404
				2	DP	00/04/01	REVISED TAG 262	DATE	
				3	GWW	00.09.22	ADD LS-130	BY	CHK'D
1	TAG NO.	LSL-235A	LSL-235B	LS-130					
2	SERVICE	JACKET WATER TANK	AUX. WATER SURGE TANK	SEAL POT					
3	LINE NO. / VESSEL NO.	T-235A	T-235B	V-130					
4	BODY OR CAGE MATERIAL								
	RATING								
B	5	CONN. SIZE	LOC. UPPER	mm	mm	mm			
		TYPE							
D	6	CONN. SIZE	LOC. LOWER	mm	mm	mm			
		TYPE							
I	7	CASE MOUNTING (RH, LH, TOP)							
C		TYPE	48 mm NPT	48 mm NPT	48 mm NPT				
A	8	ROTATABLE HEAD							
G	9								
E	10	ORIENTATION	HORIZONTAL	HORIZONTAL	HORIZONTAL				
	11	COOLING EXTENSION							
	12	CAGE	NONE	NONE					
D	13	DIMENSIONS	MFR STD	mm	MFR STD	mm	MFR STD	mm	
I	14	INSERTION DEPTH	MFR STD	mm	MFR STD	mm	MFR STD	mm	
S	15	DISPLACER EXTENSION		mm		mm		mm	
I	16	DISP. OR FLOAT MATERIAL	BUOYGLAS		BUOYGLAS		STAINLESS STEEL		
F	17	DISPLACER SPRING/TUBE MTL	MFR STD		MFR STD		316SS		
L	18						YES		
O	19								
	20	FUNCTION	SWITCH		SWITCH		SWITCH		
X	21	OUTPUT							
M	22	CONTROL MODES	ON/OFF		ON/OFF		ON/OFF		
	23	DIFFERENTIAL							
T	24	OUTPUT ACTION: LEVEL RISE	CONTACTS CLOSE		CONTACTS CLOSE		CONTACT OPEN		
R	25	MOUNTING	EXTERNAL		EXTERNAL		EXTERNAL		
	26	ENCLOSURE CLASS	CLASS I, DIV II, XP		CLASS I, DIV II, XP		CLASS I, DIV II, XP		
	27	ELEC. POWER OR AIR SUPPLY	24V DC		24V DC		24V DC		
	28								
S	29	UPPER LIQUID	AIR		AIR		HC VAPOR		
E	30	LOWER LIQUID	50/50 GLYCOL/WATER		50/50 GLYCOL/WATER		OIL / HC'S		
R	31	SP. GR. UPPER	SP. GR. LOWER	1.0		1.0	0.65	1.0	
V	32	PRES. MAX.	PRES. NORMAL	101 kPa(g)	101 kPa(g)	101 kPa(g)	101 kPa(g)	100 kPa(g)	40 kPa(g)
I	33	TEMP. MAX.	TEMP. NORM.	-28/121 * C	16 * C	-28/121 * C	16 * C	-28/45 * C	21 * C
C	34								
E	35								
	36	AIRSET	SUPPLY GAGE						
O	37	GAGE GLASS CONNECTIONS							
P	38	GAGE GLASS MODEL NO.							
T	39	CONT:NUM	CONT: FORM	ONE - SPST		ONE - SPST		ONE - SPDT	
I	40	CONTACT RATING		2 AMPS @ 30 VDC		2 AMPS @ 30 VDC		2 AMPS @ 30 VDC	
O	41	ACTION OF CONTACTS		OPEN ON LOW LEVEL		OPEN ON LOW LEVEL		OPEN ON HIGH LEVEL	
N	42								
S	43								
	44								
	45	MANUFACTURER		MURPHY		MURPHY		MURPHY	
	46	MODEL NO.		L1111		L1111		L1100-SS	
	47	P. O. NUMBER							

NOTES:

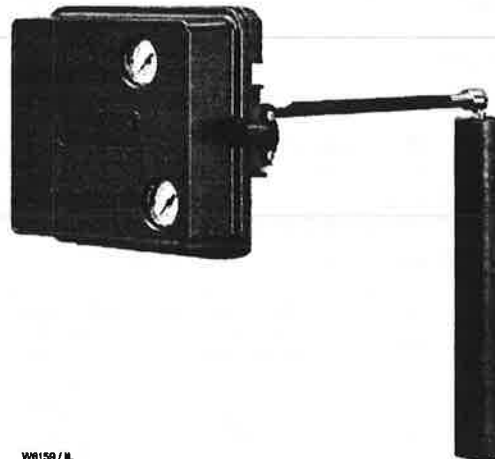
AREA UNIT #: 152

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		DIFFERENTIAL PRESSURE INSTRUMENTS				SHEET	OF
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : LEVEL TRANSMITTER		NO	BY	DATE	REVISION	SPEC NO	FILE 14.11.P
		0	GWW	00.09.26	FOR PURCHASE	JOB #	99404
						DATE	SEPTEMBER 26, 2000
						REQ.	
					BY	CHK'D	APPR.
					GWW		
1	TAG NO. LT-100	SERVICE: V-100 LEVEL TRANSMITTER					
2	FUNCTIONS	RECORD	INDICATE	CONTROL	BLIND	X	TRANS. X
3	CASE	MFR STD	X	NOM SIZE	COLOR: MFR STD	X	OTHER
4	MOUNTING	FLUSH	SURFACE	YOKE	OTHER	60mm PIPE MOUNT	
5	ENCLOSURE CLASS	GENERAL PURPOSE	WEATHER PROOF	EXPLOSION PROOF	X	CLASS I, DIV II, GRP C&D	
6	POWER SUPPLY	117 V 60Hz	OTHER AC	DC	X	VOLTS 24	
7	CHART	STRIP	ROLL	FOLD	CIRCULAR	TIME MARKS	
8	CHART DRIVE	SPEED			POWER		
9	SCALES	TYPE					
		RANGE	1	2	3	4	
X	10 TRANSMITTER OUTPUT	4 - 20 mA	X	10 - 50 mA	21 - 103 kPa(g)	42 - 206 kPa (g)	OTHER
		FOR RECEIVER SEE SPEC. SHEET					
C	11 CONTROL MODES	P = PROP ( GAIN ), I = INTEGRAL ( AUTO RESET ), D = DERIVATIVE ( RATE ), SUB ; S = SLOW F = FAST					
		P	PI	PD	PID	IF	DF IS DS
		OTHER					
12	ACTION	ON MEAS. INCREASE OUTPUT :	INCREASES	DECREASES			
13	AUTO - MAN SWITCH	NONE	MFR STD	OTHER			
14	SET POINT ADJ.	MANUAL	EXTERNAL	REMOTE		OTHER	
15	MANUAL REG.	NONE	MFR STD	OTHER			
16	OUTPUT	4 - 20 mA	10 - 50 mA	21 - 103 kPa(g)	42 - 206 kPa (g)	OTHER	
17	SERVICE	FLOW	LEVEL X	DIFF. PRESS.		OTHER	
18	ELEMENT TYPE	DIAPHRAGM	X	BELLOWS	MERCURY	OTHER	
19	MATERIAL	BODY	316SS	ELEMENT	316SS		
20	RATING	OVERRANGE	BODY RATING		kPa (g)		
21	DIFF. RANGE	FIXED	0-186.4 kPa	CALIB. RANGE	0-125 kPa	SET AT	kPa (g)
22		ELEVATION	SUPPRESSION				
23	PROCESS DATA	FLUID	HC GAS/LIQUID/H2O	MAX TEMP.	-28/149	* C	MAX. PRESS. 4516 kPa (g)
24	PROCESS CONN.	21 mm NPT	OTHER	60mm 600# ANSI FLANGE			
25	ALARM SWITCHES	QUANTITY	FORM	RATING			
26	FUNCTION	MEAS. VAR.	DEVIATION	CONTACTS TO		ON INC. MEAS.	
27	OPTIONS	PRESSURE ELEMENT	RANGE	MATL.			
		TEMP. ELEMENT	RANGE	TYPE			
		FILT REG.	SUP. GAGE	OUTPUT GAGE		CHARTS	
		VALVE MANIFOLD					
		COND. POTS	ADJ. DAMP	INTEGRAL SQ. RT. EXT.			
		INTEGRATOR					
		OTHER					
28	MFR. & MODEL NO.	ROSEMOUNT					
29	MODEL NO.	1151DP5E22B1C6 C/W 1199DAC10 AFFWG4DA000					
30	P. O. NUMBER						
NOTES:							
AREA UNIT # :							

# 2680-268T Series Liquid Level Controllers

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Figure 1. 2680 Series Controller with Type 268T Sensor

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## Introduction

### Scope of Manual

This instruction manual includes installation, adjustment, maintenance, and parts ordering information for 2680 Series liquid level controllers and Type 268T displacer-type sensors.

Only personnel qualified through training or experience should install, operate and maintain this controller. If there are any questions regarding the instructions in this manual, contact your Fisher Controls sales office or sales representative before proceeding.



FISHER-ROSEMOUNT™

**Level Change Required for Full Change in Output Signal in 1.0 Specific Gravity Liquid, with 20 Psig (1.4 Bar) Supply, Direct Action, and Standard 1-7/8 X 12-Inch (48 x 305 mm) Vertical Displacer with Standard Lever Arm Length:**

Type	Control Mode	Maximum Proportional Band Level Change, Inches (mm)	Minimum Proportional Band Level Change, Inches (mm)
2680	Throttling	4 (102)	12 (305)
	On-off	5 (127)	12 (305)
2680A	Snap-acting	0.5 (13)	0.8 (20)

**Minimum Specific Gravity<sup>(2)</sup>**

**Type 2680:** Minimum specific gravity, or specific gravity differential for interface applications, is 0.4

**Type 2680A:** Minimum specific gravity, or specific gravity differential for interface applications, is 0.1

**Type 2680E:** Minimum specific gravity, or specific gravity differential for interface applications, is 0.3

**Output Signal<sup>(1)</sup>**

**Type 2680 and 2680A:** Pneumatic ■ on-off or ■ proportional pressure signal

**Ranges:**

**On-Off:** 0 (off) or full supply pressure (on)

**Throttling:** ■ 3 to 15 psig (0.2 to 1.0 bar) or ■ 6 to 30 psig (0.4 to 2.0 bar)

**Action:** Field-reversible between direct (increasing level increases output signal) and reverse (increasing level decreases output signal)

**Type 2680E:** Same as signal to switch (see electrical rating)

**Electrical Rating**

**Type 2680E:** Single-pole, double-throw (SPDT) or double-pole, double throw (DPDT) switch: 11 amperes, 1/4 horsepower at 125/250 volts ac; 5 amperes resistive, 3 amperes inductive at 28 volts dc; 2 amperes resistive, 1 ampere inductive at 48 volts dc

20 and 35 psig (1.4 bar and 2.4 bar) reverse  
Do not use supply pressure below 20 psig (1.4 bar)

**Steady-State Air Consumption<sup>(4)</sup>**

**Type 2680:** ≤1.0 scfh (0.03 normal m<sup>3</sup>/hr) at 20 psig (1.4 bar) supply pressure

**Type 2680A:** ≤1.0 scfh (0.03 normal m<sup>3</sup>/hr) at 20 psig (1.4 bar) supply pressure or ≤1.5 scfh (0.04 normal m<sup>3</sup>/hr) at 35 psig (2.4 bar) supply pressure in tripped condition; air consumption increases during trip

**Nominal Displacer Sizes**

- 1-7/8 x 12 inches, 33 in<sup>3</sup> (48 x 305 mm, 541 cm<sup>3</sup>)
- 2-3/4 x 8 inches, 47.5 in<sup>3</sup> (70 x 203 mm, 778 cm<sup>3</sup>)

**Maximum Displacer Working Pressure<sup>(3)</sup>**

**Polyvinylchloride (PVC) Displacer:** 3750 psig (258.5 bar)

**Stainless Steel Displacer:** 1440 psig (99 bar) cold working pressure. 1330 psig (92 bar) at 400°F (204°C)

**Maximum Displacer Insertion Length**

**Horizontal Displacers:** 1-7/8 x 12-inch PVC, standard lever arm length plus one 6-inch extension  
1-7/8 x 12-inch SST and all standard 2-3/4 x 8-inch, standard lever arm length

**Vertical Displacers:** All standard 1-7/8 x 12-inch, standard lever arm length plus one 6-inch extension  
All standard 2-3/4 x 8-inch, standard lever arm length

**Maximum Sensor Working Pressure<sup>(3)</sup>**

See table 3

**Operative Ambient Temperature Limits<sup>(1)(3)</sup>**

**Controller:** -20 to 160°F (-29 to 71°C)

-continued-

**2680-268T Series**

Table 1. Specifications

**Available Configurations**

**Controllers:** See table 2

**Type 268T Sensor:** Displacer-type liquid level sensor

**Supply Pressure Requirements**

**Type 2680 Controller**

**On-Off:** Any desired pressure between 20 and 50

Table 1. Specifications (continued)

<p><b>Process Temperature Limits<sup>(1)(3)</sup></b></p> <p><b>PVC Displacer and Highly Saturated Nitrile O-Rings:</b> -20 to 175°F (-29 to 79°C)  <b>Stainless Steel Displacer and Highly Saturated Nitrile O-Rings:</b> -20 to 200°F (-29 to 93°C)  <b>Stainless Steel Displacer and Fluoroelastomer O-Rings:</b> 0 to 400°F (-18 to 204°C)</p> <p><b>Standard Supply, and Output Pressure Gauge Indications</b></p> <p>Triple scale gauges in 0 to 60 psig/0 to 0.4 MPa/0 to 4.0 bar</p> <p><b>Hazardous Area Classification</b></p> <p>The 2680 Series controllers have no hazardous area approvals. For approvals on the electrical</p>	<p>switch component of the Type 2680E, see Hazardous Area Classifications bulletin</p> <p><b>Controller Connections</b></p> <p><b>Supply:</b> 1/4 in. NPT female located on the bottom of the case  <b>Output:</b> 1/4 in. NPT female located on the top of the case  <b>Case Vent:</b> 1/4 in. NPT female with vent screen assembly located on the back of the case</p> <p><b>Type 2680E Electrical Connection Size</b></p> <p>1/2-inch (12.7 mm) NPT male</p>
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1. This term is defined in ISA Standard S51.1.  
 2. Depends on float rod/displacer orientation and length. Contact your Fisher Controls sales office or sales representative for further information.  
 3. The pressure and temperature limits in this document and any applicable code limitations should not be exceeded.  
 4. Scfh—Standard cubic feet per hour (60°F and 14.7 psia). Normal m<sup>3</sup>/hr—Normal cubic meters per hour (0°C and 1.01325 bar, absolute)

Table 2. Available Controller Configurations

TYPE NUMBER	CONTROL MODE	CONTROL ACTION
2680	On-off	Direct
		Reverse
	Throttling	Direct
		Reverse
2680A and 2680E	Snap acting	Direct
		Reverse

Table 3. Sensor Connection Types and Maximum Working Pressure

CONNECTION SIZE	CONNECTION TYPE <sup>(1)</sup>	MAXIMUM WORKING PRESSURE
2-inch	Screwed (NPT)	Consistent with Class 1500 pressure temperature ratings per ASME B16.34 up to maximum pressure of 3750 psig (258.5 bar)
	Slip-on flange	Consistent with pressure temperature ratings of coupling used per ASME B16.34 up to maximum pressure of 3750 psig (258.5 bar)
	Sch X BWE Sch 80 BWE Sch 40 BWE	Consistent with Class 1500 pressure temperature ratings per ASME B16.34 up to a maximum pressure of 3750psig (258.5 bar)

1. All connection types available in NACE materials.

## Description

These rugged 2680 Series liquid level controllers use a Type 268T displacer type sensor (see figure 1) to detect liquid level or the interface of two liquids of different specific gravities.

The Type 2680 and 2680A low-bleed controllers use a single four-mode relay to provide the applicable control and action. The device delivers a pneumatic output signal to a control valve.

The Type 2680E electrical controller is similar except it opens and closes an electrical switch in response to rising or falling levels.

## Specifications

Specifications for these controllers and sensors are listed in table 1.

## Installation

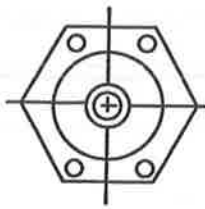
### WARNING

To avoid personal injury or property damage caused by the sudden release of process fluid, be certain the service conditions do not exceed the sensor pressure limits listed in table 3. Use pressure-limiting or pressure-relieving devices to prevent service conditions from exceeding these limits.

### CAUTION

If the Type 2680-268T level controller is installed on a vessel that is to be





**CORRECT CONTROLLER MOUNTING HOLE ORIENTATION WHEN MOUNTED ON VESSEL**

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*Figure 2. Sensor Orientation for Flange Welding*

shipped to a different location (e.g. skid mounted units), remove the displacer and displacer rod extensions before shipment. Failure to do so could result in damage to the displacer rod due to vibration and impact loading during shipment. After the vessel is installed at its final location, reassemble the displacer and displacer rod extension.

1. Be sure there are no obstructions inside the tank that will interfere with displacer installation or operation.
2. Provide the appropriate connection in the tank wall to match the sensor connection. Locate the tank wall connection such that the displacer will be at the desired control level.
3. If necessary, reinforce the tank connection so that it will be capable of supporting the sensor and controller.

## Welding Information

When installed, the controller case must be plumb and level to allow proper operation. To ensure proper positioning, observe the following before welding a flange to the Type 268T sensor. Refer to figure 7 for key number locations.

1. For proper operation, the arms of the sensor pivot base (key 12) and pivot body (key 11), shown in figure 7, must be horizontal when the sensor is mounted on the tank. Mounting the sensor connection on the vessel so that the controller mounting hole pattern is as shown in figure 2 assures that these arms are horizontal.
2. Before welding on the sensor connection (key 4), the pivot base (key 12) (see figure 7) must be removed to prevent subjecting the O-rings and anti-extrusion rings to excessive heat. To remove the pivot base, unscrew the hex nut (key 6) and remove the spacer (key 5) and spring (key 7). After removing the spring, re-

place the spacer (key 5) and hex nut (key 6) on the displacer rod.

From the displacer end, pull the displacer rod away from the sensor connection (key 4) to pull the pivot base (key 12) loose from the sensor connection. Remove the hex nut (key 6) to permit removing the displacer rod, pivot base, pivot body, and spacer from the sensor connection.

3. Place a shield in the bore of the sensor connection (key 4) to prevent weld splatter from getting into the pivot base and O-ring areas.
4. Before welding the welded-on flange to the sensor connection (key 4), be sure that the sensor connection is positioned so that the controller mounting hole pattern will be as shown in figure 2 when the flange is bolted to the vessel.

## Attaching a Vertical Displacer

Refer to figure 7 for part locations.

1. Thread jam nut (key 2) all the way onto the threaded portion of the universal joint assembly (key 8).
2. Thread the displacer (key 1) all the way onto the threaded portion of the universal joint assembly.
3. Tighten the jam nut (key 2) against the displacer (key 1).

## Attaching a Horizontal Displacer

Refer to figure 7 for part locations. Thread the displacer (key 1) all the way onto the displacer rod (key 3) or extension (key 20).

## Screwed Connections

Insert the displacer end of the controller-sensor assembly into the tank connection, and screw the sensor threads into the tank connection. Tighten sufficiently to seal the threads. Make sure that the controller case is level.

## Flanged Connections

Perform the steps listed below. Refer to figure 7 for key number locations.

1. Orient the controller so that the case is level.

## CAUTION

**Do not pick up the controller/sensor by lifting the displacer rod (key 3). This action could place excessive stress on the displacer rod and cause the unit to malfunction.**

Table 4. Type 2680E Wiring Codes

Wire Color	SPDT	DPDT Switch 1	DPDT Switch 2
Red	Normally Closed	Normally Closed	Ground Normally Closed Common Normally Open
Brown	Common	Common	
Blue	Normally Open	Normally Open	
Green	Ground	Ground	
Black			
Yellow			
Purple			

2. Install a suitable flange gasket.
3. Insert the displacer end of the sensor into the tank connection. Position the sensor flange so it can be bolted to the tank flange.
4. Complete the sensor flange to tank flange connection.

## Pressure Connections

### WARNING

Personal injury or property damage may result from an uncontrolled process if the supply medium is not clean, dry, oil-free, or non-corrosive gas. Industry instrument air quality standards describe acceptable dirt, oil, and moisture content. Due to the variability in nature of the problems these influences can have on pneumatic equipment, Fisher Controls has no technical basis to recommend the level of filtration equipment required to prevent performance degradation of pneumatic equipment. A filter or filter regulator capable of removing particles 40 microns in diameter should suffice for most applications. Use of suitable filtration equipment and the establishment of a maintenance cycle to monitor its operation is recommended.

1. Provide a source of clean, dry air that meets the requirements of ISA Standard S7.3 as the operating medium. Refer to table 1 to determine supply pressure.
2. Connect the supply pressure to the 1/4-inch NPT female connection on the bottom of the controller case.
3. Connect the output signal line to the equipment being operated and to the 1/4-inch NPT output connection on the top of the controller case.

## Vent

### WARNING

If a flammable, toxic, corrosive, or reactive gas is to be used as the supply pressure medium, personal injury or property damage could result from fire or explosion of accumulated gas or from contact with toxic, corrosive, or reactive gas. The controller/actuator assembly does not form a gas-tight seal, and when the assembly is enclosed, a remote vent line, adequate ventilation, and necessary safety measures should be used. A remote vent pipe alone cannot be relied upon to remove all hazardous gas. Vent line piping should comply with local and regional codes and should be as short as possible with adequate inside diameter and few bends to reduce case pressure buildup.

The vent opening or the end of the remote vent pipe, if one is required, must be protected against the entrance of all foreign matter that could plug the vent. Use 1/2-inch (13 mm) diameter pipe for the remote vent pipe. Check the vent periodically to be certain it is free of any obstructions.

## Type 2680E Electrical Connection

For standard action, connect electrical wires as shown in table 4. To reverse the action, refer to table 4 and reverse wiring for normally open (NO) switches and normally closed (NC) switches.

## Changing Controller Action or Mode

### WARNING

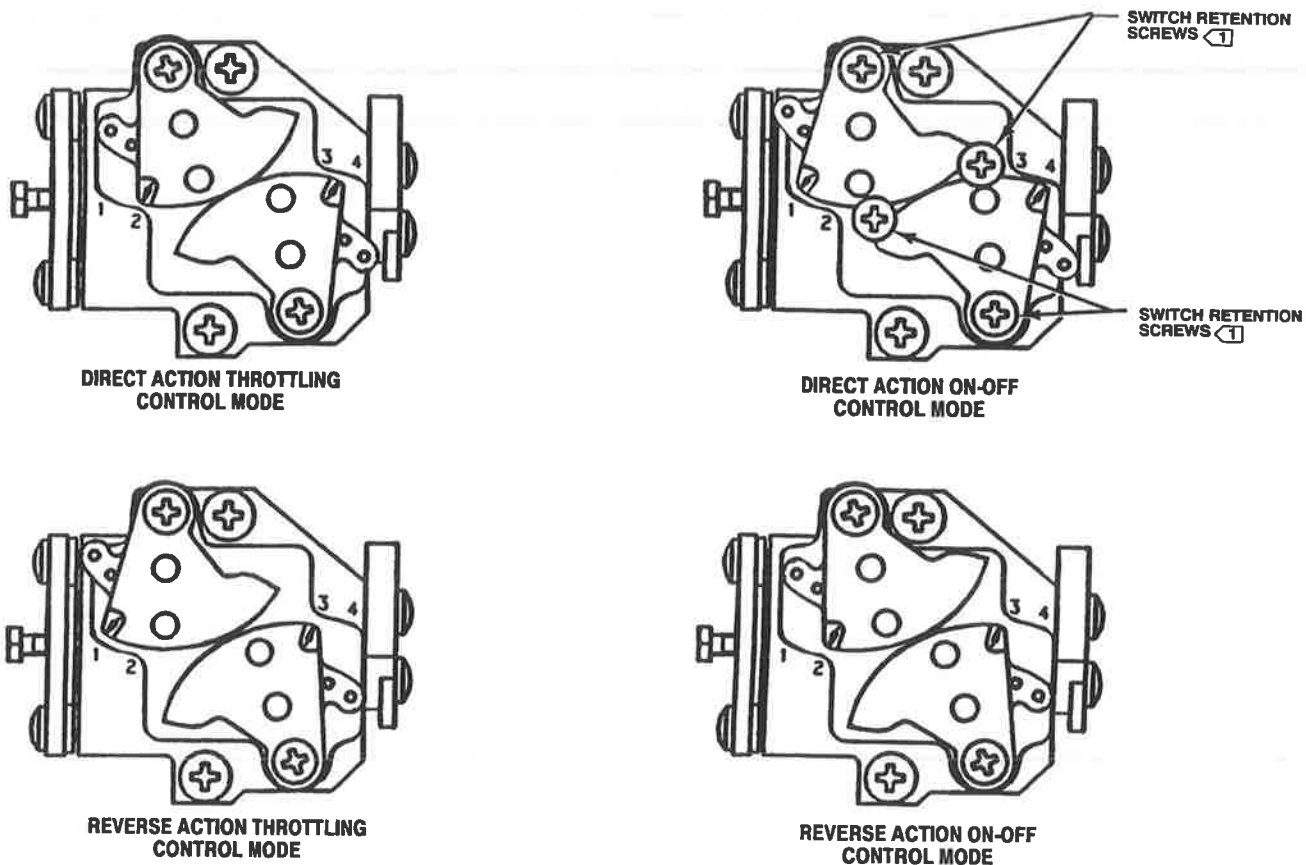
To avoid personal injury caused by a sudden release of pressure, shut off the supply pressure and bleed pressure from the supply lines before performing any procedure in this section.

## Type 2680

The action of a Type 2680 controller may be changed between either direct or reverse, and the control mode may be changed between either on-off or throttling.

Refer to figure 3. Loosen the four switch retention screws on the relay. Move the switches to the control

# 2680-268T Series



**NOTE:**

- ① ALL FOUR SWITCH RETENTION SCREWS SHOWN ONLY ON THIS VIEW. OTHER VIEWS SHOW ONLY TWO SWITCH RETENTION SCREWS IN ORDER TO ILLUSTRATE THE SWITCH CONFIGURATION.

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Figure 3. Type 2680 Controller Switch Positions for Changing Action and Control Mode

action and control mode required by the application. Tighten the four switch retention screws.

## Type 2680A

The action of a Type 2680A controller may be changed between either direct or reverse. The control mode is always snap acting.

Refer to figure 4. Loosen the four switch retention screws on the relay. Move the switches to the control action required by the application. Tighten the four switch retention screws.

## Type 2680E

For standard action, connect electrical wires as shown in table 4.

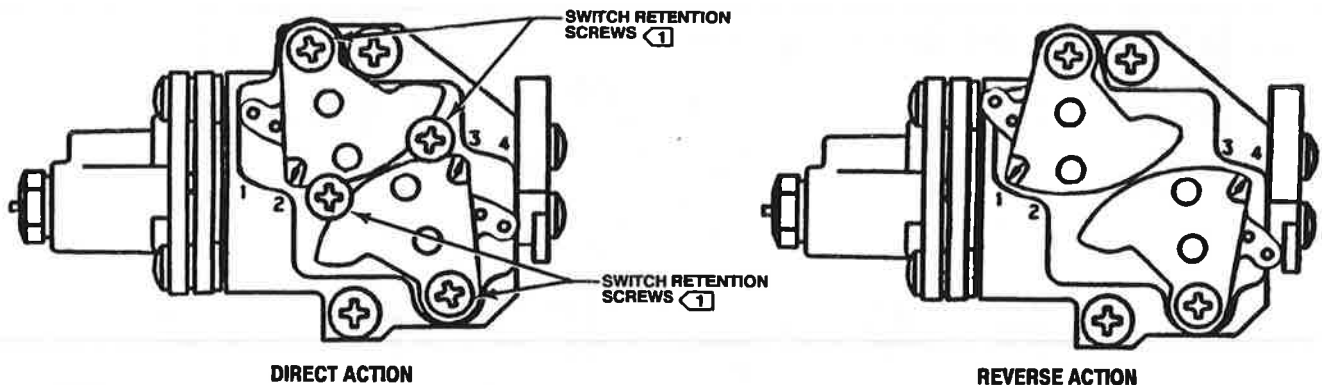
To reverse the action, refer to table 4 and reverse wiring for normally open (NO) switches and normally closed (NC) switches.

## Proportional Band Adjustment

Except where indicated, key numbers referenced in the following procedures are shown in figure 8. The span levers and other proportional band information are shown in figure 5.

## Preliminary Checks

1. Check the supply pressure gauge (key 10) to be certain that the supply pressure is at the desired value. Adjust the supply pressure as required.
2. Adjust the displacer rod to the horizontal position with the spring adjustment (key 4).
3. Bounce the end of the displacer rod (key 3, figure 7) up and down to check that the sensor is operating freely.
4. Place the span adjuster (key 9) at the desired position (see figure 5).
5. Check figures 3 and 4 for correct control action and control mode.



**NOTE:**

- ① ALL FOUR SWITCH RETENTION SCREWS SHOWN ONLY ON THIS VIEW. OTHER VIEWS SHOW ONLY TWO SWITCH RETENTION SCREWS IN ORDER TO ILLUSTRATE THE SWITCH CONFIGURATION.

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Figure 4. Type 2680A Controller Switch Positions for Changing Action

6. Adjust the relay adjustment screw (key 51, Type 2680) or the valve assembly (key 53, Type 2680A) so that the gap between the span levers (see figure 5) is equal when lever A is contacting the displacer rod.

## Type 2680 Direct-Acting Throttling Controllers

1. Make certain the Preliminary Checks procedure at the start of this section has been completed.
2. Lower the liquid level so that it is below the bottom of the displacer or at the lowest desired operating point on the displacer. For interface applications, completely cover the displacer with the lighter fluid. The heavier fluid should be below the bottom of the displacer or at the lowest desired operating point on the displacer.
3. Adjust the spring adjustment (key 4) until the output pressure is 1 to 2 psig for a 3 to 15 psig output range, or 2 to 4 psig for a 6 to 30 psig output range.

## Type 2680 Reverse-Acting Throttling Controllers

1. Make certain the Preliminary Checks procedure at the start of this section has been completed.
2. Lower the liquid level so that it is below the bottom of the displacer or at the lowest desired operating point on the displacer. For interface applications, completely cover the displacer with the lighter fluid. The heavier fluid should be below the bottom of the displacer or at the lowest desired operating point on the displacer.
3. Adjust the spring adjustment (key 4) until the output is 16 to 17 psig for a 3 to 15 psig output range, or 31 to 34 psig for a 6 to 30 psig output range.

## Type 2680 Direct-Acting On-Off and Type 2680A Direct-Acting Snap Acting Controllers

1. Make certain the Preliminary Checks procedure at the start of this section has been completed.
2. Lower the liquid level so that it is below the bottom of the displacer or at the lowest desired operating point on the displacer. For interface applications, completely cover the displacer with the lighter fluid. The heavier fluid should be below the bottom of the displacer or at the lowest desired operating point on the displacer.
3. Adjust the spring adjustment (key 4) until the output pressure is at full supply pressure.
4. Readjust the spring adjustment (key 4) until the output pressure goes to zero psig.

## Type 2680 Reverse-Acting On-Off and Type 2680A Reverse-Acting Snap Acting Controllers

1. Make certain the Preliminary Checks procedure at the start of this section has been completed.
2. Lower the liquid level so that it is below the bottom of the displacer or at the lowest desired operating point on the displacer. For interface applications, completely cover the displacer with the lighter fluid. The heavier fluid should be below the bottom of the displacer or at the lowest desired operating point on the displacer.
3. Adjust the spring adjustment (key 4) until the output pressure goes to zero psig.
4. Readjust the spring adjustment (key 4) until the output pressure goes to full supply pressure.

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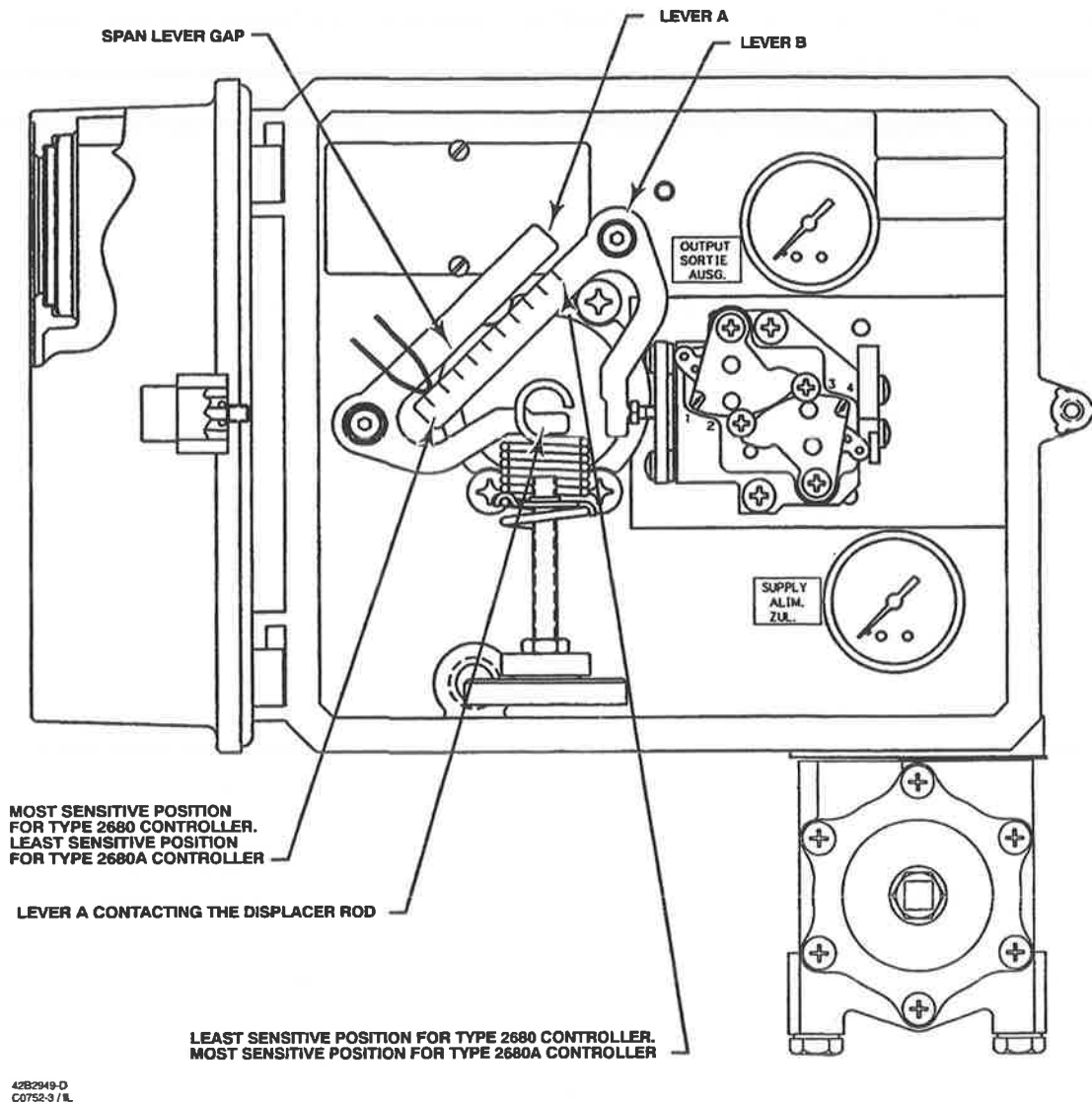


Figure 5. Proportional Band Adjustments

## Principle of Operation

The operation of the Type 2680 and 2680A controllers in combination with the Type 268T sensor is based on Archimedes Principle, which states that a body immersed in a liquid will be buoyed up by a force equal to the weight of the liquid displaced. The buoyant force and resultant movement of the displacer in the liquid is transmitted to the controller which delivers a pneumatic signal to a control valve.

Figure 6 shows a simple schematic of the controller and sensor. In its normal position, the counterclockwise moment due to the weight of the displacer about pivot point O is balanced by the clockwise zero spring moment and the counterclockwise relay zero force mo-

ment applied through lever A to the displacer rod. The weight of the displacer decreases when the liquid level increases and the subsequent buoyant force increases causing a force imbalance between the zero spring, relay, and displacer forces. This force imbalance is transmitted to the relay by levers A and B. The relay compensates for the force imbalance by converting it to a pressure output to a control valve and bringing the forces back into equilibrium.

For throttling control, the relay pressure output will be proportional to the buoyant force. For on-off control, the relay pressure output will be either zero or equal to the supply pressure over the range of liquid level change. The liquid level change required to fully operate the relay is adjusted by sliding the proportional

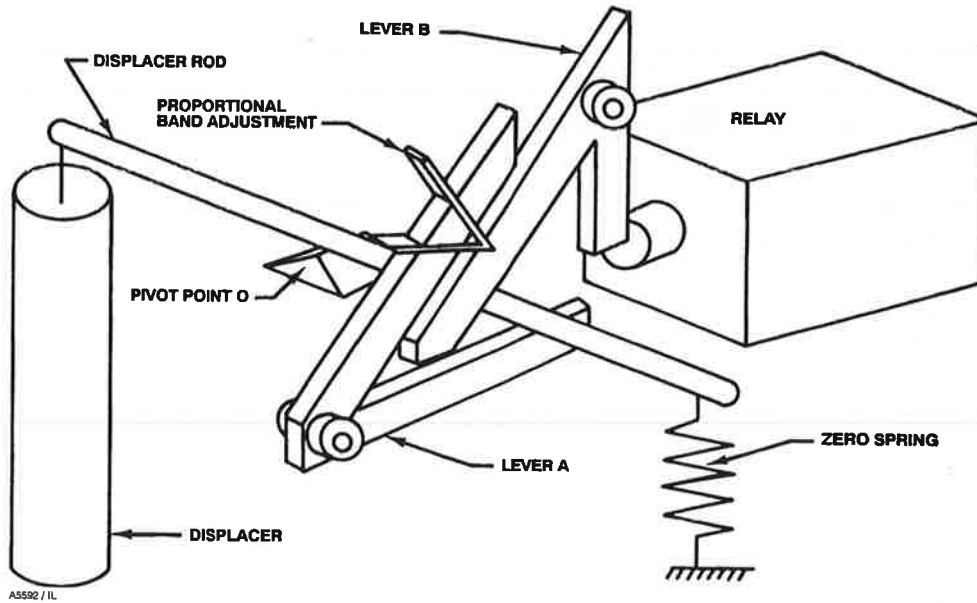


Figure 6. Operational Schematic

band adjustment along lever A to vary the lever ratio between levers A and B.

With reverse-acting proportional control, the principle of operation remains the same as that for direct action; however, the controller delivers an increasing pneumatic signal to the control valve when the liquid level falls.

Operation of the Type 2680E is similar, except rising or falling levels opens or closes the electrical switch.

- Provide some temporary means of control for the process before taking the controller out of service.
- Provide a means of containing the process fluid before removing any measurement devices from the process.
- Vent any trapped process pressure.
- Shut off electrical power to Type 2680E.

## Maintenance

Parts are subject to normal wear and must be inspected periodically and replaced as necessary. The frequency of parts inspection and replacement depends upon the severity of service conditions. When inspection or repairs are required, disassemble only those parts necessary to accomplish the task.

Due to the care Fisher Controls takes in meeting all manufacturing requirements (heat treating, dimensional tolerances, etc.), use only replacement parts manufactured by Fisher.

## WARNING

To avoid personal injury or property damage caused by the release of pressure or process fluid, observe the following before starting maintenance:

## Removing the Controller From the Sensor

Observe the warning given at the start of the Maintenance section.

1. Disconnect the supply and output pressure lines.
2. Slide the hook end of the zero spring (key 5, figure 8) over and off the controller end of the displacer rod (key 3, figure 7).
3. Remove the four controller mounting screws (key 11, figure 8), and pull the controller straight away from the sensor.

## Replacing the Sensor O-Rings

Observe the warning given at the start of the Maintenance section. Refer to figure 7 for key number locations unless otherwise indicated.

## Disassembly

1. Remove the controller from the sensor by following the procedure outlined in the previous section.
2. Remove the sensor from the tank.

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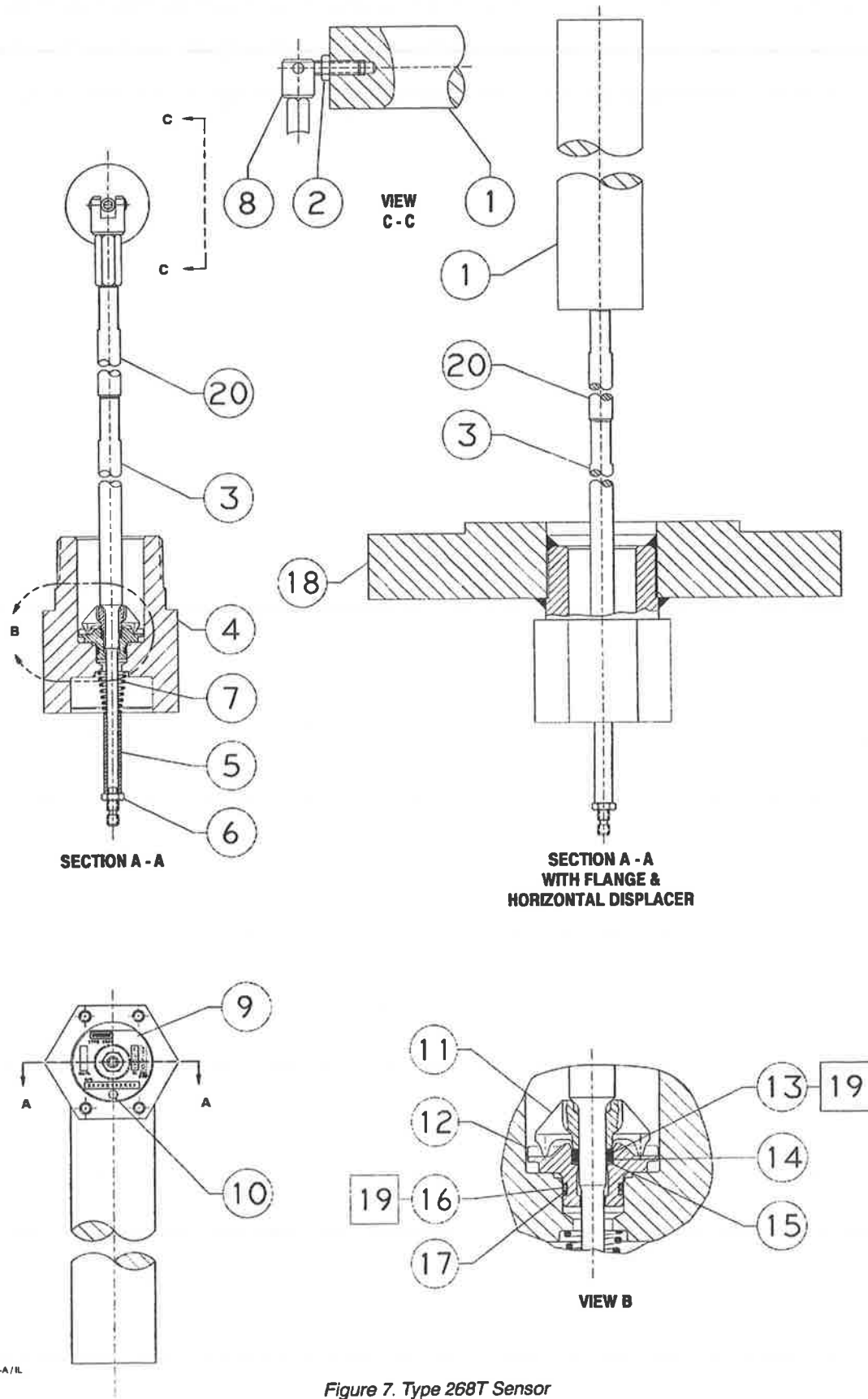


Figure 7. Type 268T Sensor

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3. Unscrew the hex nut (key 6) and remove the spacer (key 5) and spring (key 7). After removing the spring, replace the spacer (key 5) and hex nut (key 6) on the displacer rod.

From the displacer end, pull the displacer rod away from the sensor connection (key 4) to pull the pivot base (key 12) loose from the sensor connection. Remove the hex nut (key 6) to permit removing the displacer rod, pivot base, pivot body, and spacer from the sensor connection.

4. Slide the pivot base (key 12), retaining ring (key 15), anti-extrusion ring (key 14), and O-ring (key 13) off the displacer rod. Remove the O-ring (key 16) and backup ring (key 17) from the pivot base.

## Assembly

### WARNING

**Improper assembly of the O-rings, anti-extrusion ring, and backup ring could result in O-ring extrusion and permit leakage of process fluids. To avoid personal injury or property damage from leaking process fluid, be sure the O-rings, anti-extrusion ring and backup ring are assembled in the order shown in figure 7.**

1. Place the pivot body (key 11) on the displacer rod (key 3) so that it is positioned as shown in figure 7.
2. Slide the O ring (key 13), anti-extrusion ring (key 14) and retaining ring (key 15) onto the displacer rod assembly (key 3). Be sure the O-ring, anti-extrusion ring, and retaining ring are in the order shown in figure 7. Slide the pivot base onto the displacer rod so that the points of the pivot body (key 11) will engage the slots in the pivot base (key 12).
3. Install the O-ring (key 16) and backup ring (key 17) into the groove on the pivot base (key 12). Be sure the backup ring is on the downstream pressure side of the O-ring as shown in figure 7.
4. Insert the displacer rod (key 3) into the vessel side of the sensor connection (key 4).
5. The pivot base must seat in the slots cast in the sensor connection. These slots will be horizontal when the sensor connection (key 4) is oriented as shown in figure 2.
6. To reduce the possibility of nicking the O-ring (key 16) on the pivot base, keep the displacer rod centered in the sensor connection as much as possible while pushing the pivot base into the sensor connection.

tion. Be sure the pivot base seats in the slots cast in the sensor connection.

7. Slide the spring (key 7) and spacer (key 5) onto the displacer rod and secure with the hex nut (key 6). Fully tighten the hex nut (key 6).

8. View the sensor connection from the vessel side. Ensure that the pivot body arms remain aligned with the pivot base arms (the two pivot body points are seated in the pivot base slots).

9. Install the sensor on the tank.

## Replacing the Controller Relay

Observe the warning given at the start of the Maintenance section. Refer to figure 8 for key number locations unless otherwise indicated.

1. Disconnect the supply and output pressure lines.
2. Remove the two relay mounting screws (key 34), and pull the relay away from the controller base (key 1).
3. Install the new relay using two relay mounting screws (key 34). Make certain that the relay mounting O-rings (keys 45 and 46, not shown) are completely in their mounting bosses before installing the relay. Make certain span lever B (see figure 5) is in line with and pushing in on the end of either the relay adjustment screw (key 51, Type 2680) or the pilot valve plug of the valve assembly (key 53, Type 2680A).

## Replacing the Controller Supply Filter

Observe the warning given at the start of the Maintenance section. Refer to figure 8 for key number locations unless otherwise indicated.

1. Disconnect the supply and output pressure lines.
2. Loosen the filter cap screws (key 15), and rotate the filter cap (key 14) to the side to uncover the supply filter (key 16).
3. Remove the old filter (key 16), and remove any debris from the filter boss.
4. Install a new supply filter. Reinstall the filter cap (key 14), and tighten the filter cap screws (key 15).

## Removing Switch from Type 2680E

Observe the warning given at the start of the Maintenance section. Refer to figure 9 for key number locations unless otherwise indicated.

1. Disconnect conduit and wires from the controller.
2. On the back of the controller (outside the switch, key 62) is a set screw. This set screw retains the spacer (key 64). Loosen the set screw.
3. Open the controller, and remove the spacer (key 64).



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4. Push the switch down into the housing far enough to remove two C-rings (key 63).
5. Pull the switch out through the top of the controller.
6. Reverse the steps to install a new switch.

## Parts Ordering

When corresponding with the Fisher Controls sales office or sales representative about this equipment, always mention the serial number of the controller. The serial number can be found on the nameplate (key 56, figure 8). When ordering replacement parts, also specify the complete 11-character part number of each part required as found in the following parts list.

## Parts Kits

Key	Description	Part Number
	<b>Controller</b>	
	Repair kit includes O-rings (keys 13 and 17) and gaskets (keys 19, 22, and 24)	R2680X00012
	<b>Relay</b>	
	Repair kits include relay assembly, relay mounting screws, and O-rings (keys 34, 45, and 46)	
	Type 2680	
	Low temperature	32B2951X012
	High temperature	32B2951X022
	Type 2680A	
	Low temperature	32B2951X032
	High temperature	32B2951X042
	<b>Sensor</b>	
	Repair kit includes keys 13, 14, 16, and 17 (highly saturated nitrile O-rings, retaining ring, anti-extrusion ring, and nitrile backup ring)	R268TX00012

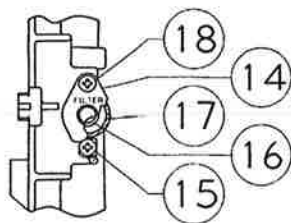
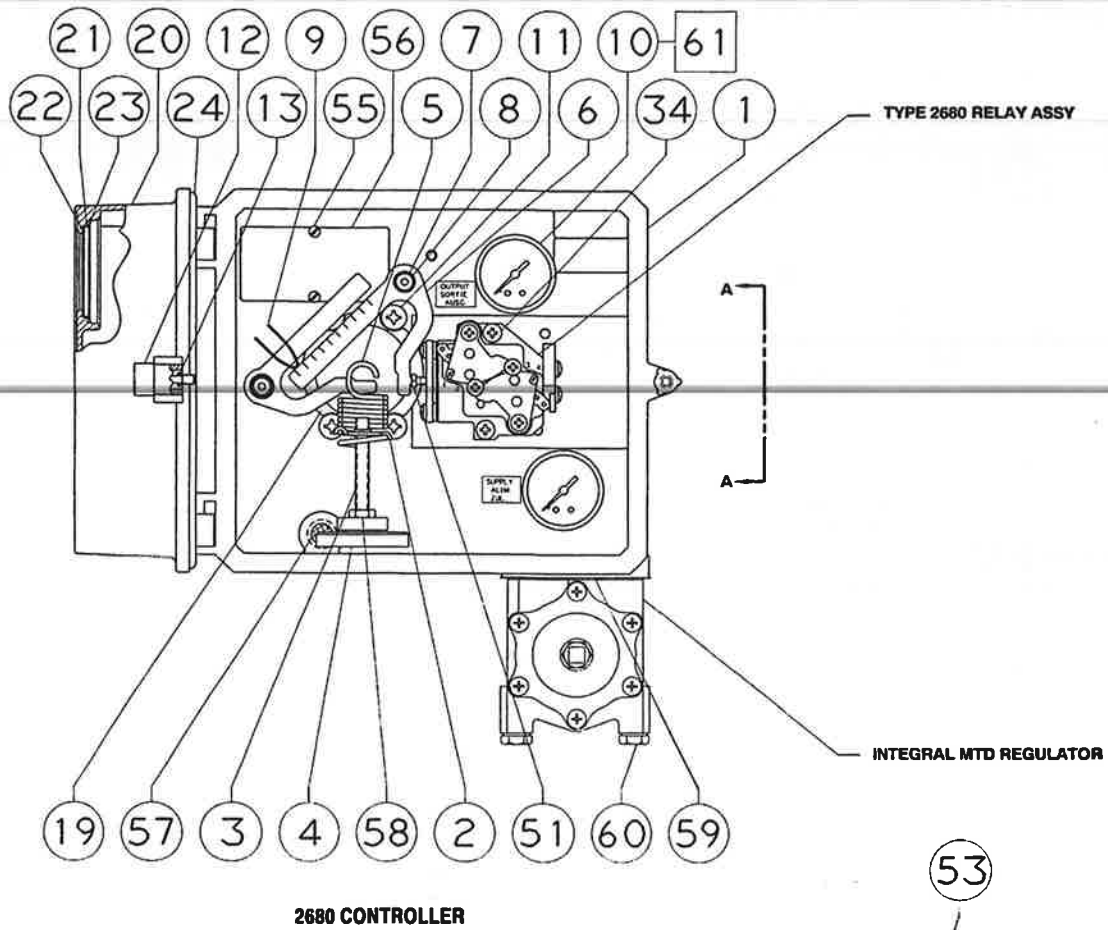
## Parts List

### Controller

1	Controller Base, marine grade aluminum	
	Type 2680/2680A	42B2894 X012
	Type 2680E	33B8086 X012
2	Zero Spring Seat, 316 SST	22B2904 X012
3	Zero Adjustment Bolt, stainless steel	12B2907 X012
4	Spring Adjustment, 316 SST	22B2896 X012

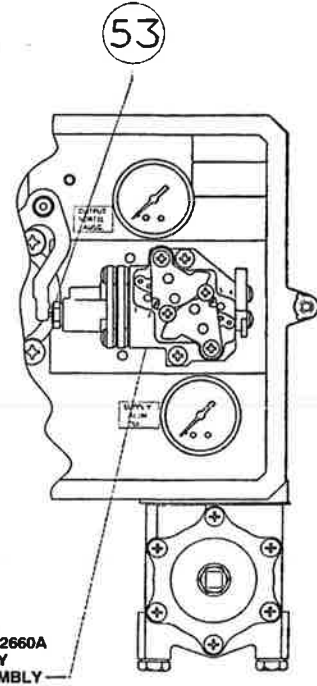
Key	Description	Part Number
5	Zero Spring, 17-7PH SST	
	Type 2680/2680A (25 lb. spring)	12B2893 X012
	Type 2680A (5 lb. spring)	12B2957 X012
	Type 2680E (5 lb. spring)	12B2957 X012
6	Span Lever Assembly, stainless steel	
	(2 req'd for Type 2680 & 2680A) (1 req'd for Type 2680E)	12B2897 X012
6A	Span Lever Assembly, stainless steel	
	Type 2680E	22B8033 X012
7	Shoulder Screw, stainless steel (2 req'd)	12B2900 X012
8	Flanged Bearing, nylon (4 req'd)	12B2901 X012
9	Span Adjustor, stainless steel	22B2902 X012
10*	Pressure Gauge (2 req'd) (Type 2680/2680A)	11B4036 X022
11	Mounting Screw, stainless steel (4 req'd)	12B2903 X012
12	Case Cover Screw, stainless steel	18A1080 X012
13*	O-Ring, nitrile	1D1346 06992
14	Filter Cap, reinforced plexiglass	22B2898 X012
15	Square Nut stainless steel (2 req'd)	16A6711 X022
16*	Filter (Type 2680/2680A)	11B2307 X012
17*	O-Ring, nitrile (Type 2680/2680A)	14A1968 X012
18	Machine Screw, stainless steel (2 req'd)	5908124 0X12
19*	Sensor Gasket, composition	12B2933 X012
20	Cover, marine grade aluminum	42B2895 X012
21	Cover Lens, plexiglass (2 req'd)	
	Type 2680/2680A	1R1922 05032
	Type 2680E	1R1922 X0022
22*	Gasket, neoprene (2 req'd)	1V5521 06992
23	Retaining Ring, steel (2 req'd)	11A6502 X012
24*	Cover Gasket, nitrile	12B2905 X012
34	Relay Mounting Screw, stainless steel	
	(2 req'd) (Type 2680/2680A)	12B2921 X012
45*	Relay Mounting O-Ring, nitrile (not shown)	
	Type 2680/2680A	10A3804 X012
46*	Relay Mounting O-Ring, nitrile (not shown)	
	Type 2680/2680A	10A8217 X042
51	Relay Adjustment Screw	Incl in Parts Kits
53	Valve Assembly	Incl in Parts Kits
54	Valve Assembly O-Ring	Incl in Parts Kits
55	Self-Tapping Screw, stainless steel (2 req'd)	1P4269 28982
56	Nameplate	---
57	Screen, stainless steel	0L0783 43062
58	Hex Nut, stainless steel	1A4117 X0012
59A*	Filter Gasket	
	For Type 2680/2680A w/integral mounted filter/regulator only	
	Neoprene	1C8986 03012
	Silicone	1N8740 04142
59B	Spacer	
	Type 2680/2680A w/integral mounted filter/regulator only	T2104 3T0012
59C	O-ring	
	Type 2680/2680A w/integral mounted filter/regulator only	
	Nitrile	1E5914 06992
	Viton	1E5914 X0062
60	Cap Screw, stainless steel (2 req'd)	
	Type 2680/2680A w/integral mounted filter/regulator only	1C1970 X0012
61	Sealant Zinc-plate No. 770 (Type 2680/2680A) (not furnished with controller)	

# 2680-268T Series



VIEW A-A

□ APPLY LUB/SEALANT  
42B2950-D / IL



2680A CONTROLLER

Figure 8. Type 2680 and 2680A Liquid Level Controllers

# 2680-268T Series

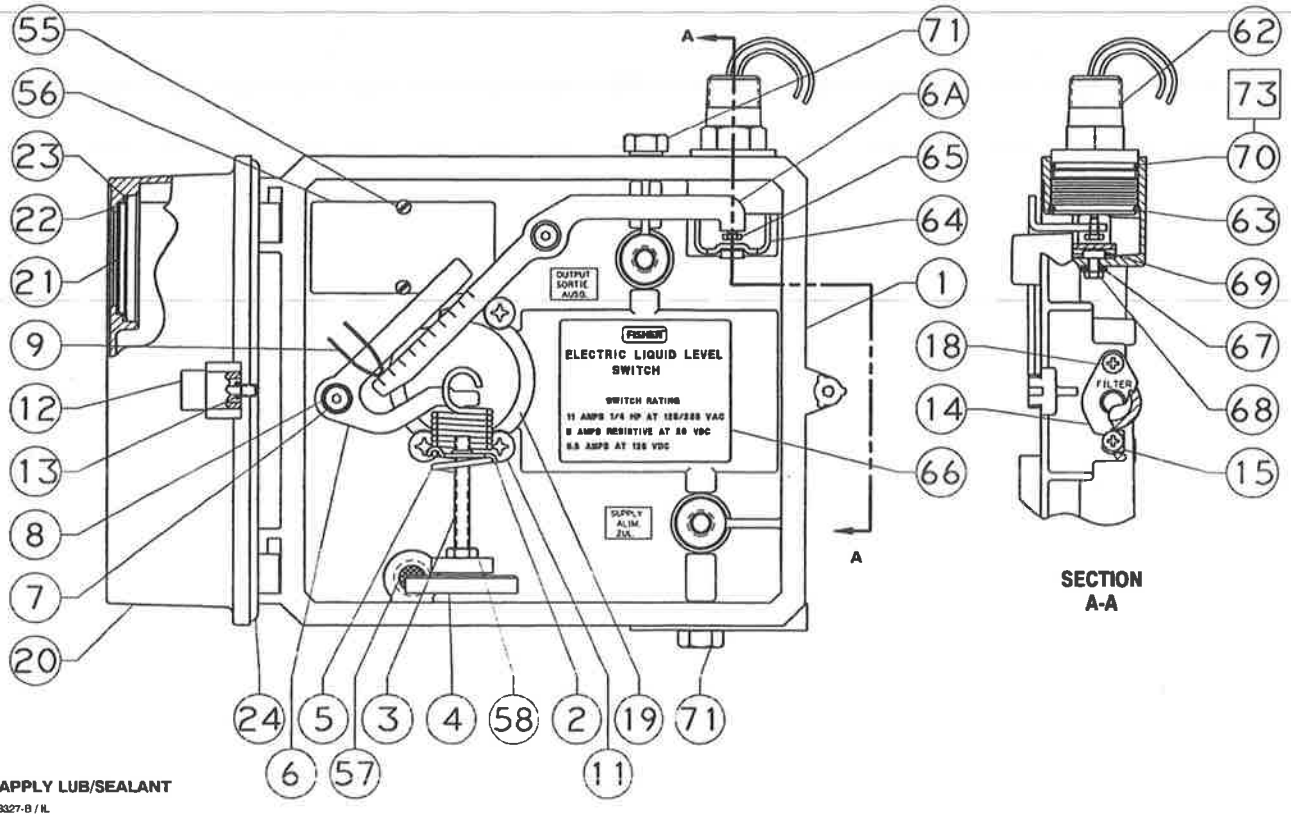


Figure 9. Type 2680E Liquid Level Controller

Key	Description	Part Number	Key	Description	Part Number
<b>Key numbers 62 through 71 are for the Type 2680E only.</b>					
62*	Switch, stainless steel SPDT	20B5075 X012		316 SST	12B2956 X032
	DPDT	20B5076 X012		2-3/4x8-inches PVC	12B2958 X032
63	Split Ring, steel/zn pl (2 req'd)	13B8088 X012		304 SST	12B2959 X042
64	Spacer, 316 SST	23B8089 X012		316 SST	12B2959 X032
65	Self Tap Screw, stainless steel	13B8090 X012	2	Hex Nut, 316 SST (vertical displacer only)	1A3421 X0042
66	Label, alum	13B8091 X012	3	Displacer Rod, 17-4 SST (17-4PH SST)	14B5018 X012
67*	O-Ring, nitrile	13B8326 X012	4	Sensor Connection	
68	Machine Screw, stainless steel	16A6935 X022		2-inch NPT Connection	34B4962 X012
69	Square Nut, stainless steel	16A6711 X022		2-inch slip-on Connection	34B5019 X012
70*	O-Ring, nitrile	1U8790 06562		2-inch Sch 40 BWE	34B5022 X012
71	Pipe Plug, 316 SST (2 req'd)	1A7675 35072		2-inch Sch 80 BWE	34B5023 X012
72	Label, relay action	23B8328 X012		2-inch Sch XX BWE	34B5024 X012
73	Lubricant, Dow Corning 33 (not furnished with controller)				
<b>Sensor</b>			5	Spacer, 304 SST (304 SST)	12B2945 X012
1	Displacer		6	Hex Nut, 316 SST	1A4117 X0022
	1-7/8x12-inches PVC	12B2936 X032	7	Conical Spring, 316 SST	12B2931 X012
	304 SST	12B2956 X042	8	Universal Joint, 316 SST (vert displ only)	13B8749 X012
			9	Nameplate	---
			10	Drive Screw, stainless steel	1A3682 28982
			11	Pivot Body, CB7CU-1 (17-4PH SST)	24B4960 X012
			12	Pivot Base, CF8M (316 SST)	24B4967 X012

# 2680-268T Series

Key	Description	Part Number	Key	Description	Part Number
13*	O-Ring, Highly Saturated Nitrile Fluoroelastomer	17B3305 X012 17B3305 X022	18	Flange Assembly, steel (includes flange and 2-inch slip-on sensor connection, key 4)	
14*	Anti-Extrusion Ring, PTFE	14B4964 X012		W/2x2 Flange (cont'd)	
15	Retaining Ring, 304 SST	14B4965 X012		Class 600 RTJ	34B5013 X042
16*	O-Ring Highly Saturated Nitrile Fluoroelastomer	10A3716 X062 10A3716 X022		Class 1500 RF	34B5013 X052
				Class 1500 RTJ	34B5013 X062
17*	Backup Ring Nitrile Fluoroelastomer	14B4940 X012 14B5017 X012		W/4x2 Flange	
				Class 150 RF	34B5013 X072
18	Flange Assembly, steel (includes flange and 2-inch slip-on sensor connection, key 4)			Class 300 RF	34B5013 X082
	W/2x2 Flange			Class 600 RF	34B5013 X092
	Class 150 RF	34B5013 X012		Class 600 RTJ	34B5013 X102
	Class 300 RF	34B5013 X022		Class 900 RF	34B5013 X112
	Class 600 RF	34B5013 X032		Class 900 RTJ	34B5013 X122
				Class 1500 RF	34B5013 X132
				Class 1500 RTJ	34B5013 X142
			19	Lubricant, Lubriplate Mag-1 (not furnished with sensor)	
			20	Extension, S31600	12B2953 X022
			21	Instruction Label	13B8106 X012
			22	Instruction Tag	17B0397 X012

# 2680-268T Series

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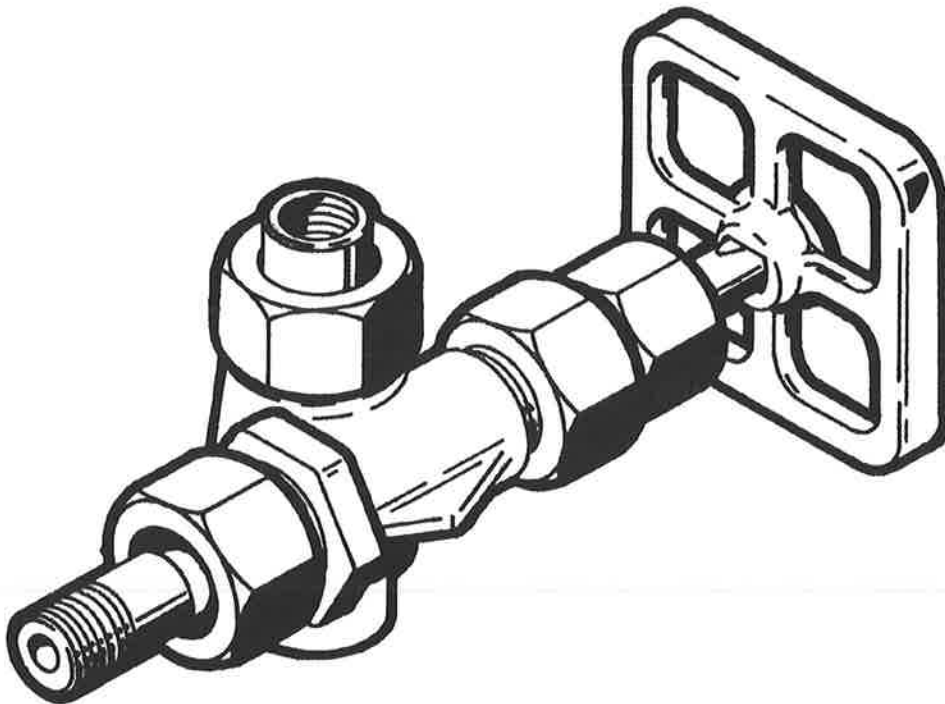
**FISHER-ROSEMOUNT™**

PENBERTHY®

Section 2000  
Instal. Instr. 2960  
Issued 8/96  
Replaces 2/94

# Gage Valves

Series 100, 200, 300 and 400



Installation/Operation/Maintenance Instructions

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## PRODUCT WARRANTY

Penberthy Inc., warrants its products as designed and manufactured by Penberthy to be free of defects in material and workmanship for a period of one year after the date of installation or eighteen months after the date of manufacture, whichever is earliest. Penberthy will, at its option, replace or repair any products which fail during the warranty period due to defective material or workmanship.

Prior to submitting any claim for warranty service, the owner must submit proof of purchase to Penberthy and obtain written authorization to return the product. Thereafter, the product shall be returned to Penberthy in Prophetstown, Illinois, with freight prepaid.

This warranty shall not apply if the product has been disassembled, tampered with, repaired or altered outside of the Penberthy factory, or if it has been subjected to misuse, neglect or accident.

Penberthy's responsibility hereunder is limited to repairing or replacing the product at its expense. Penberthy shall not be liable for loss, damage, or expenses directly or indirectly related to the installation or use of its products, or from any other cause or for consequential damages. It is expressly understood that Penberthy is not responsible for damage or injury caused to other products, building, property or persons, by reason of the installation or use of its product.

**THIS IS PENBERTHY'S SOLE WARRANTY AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED WHICH ARE HEREBY EXCLUDED, INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

This document and the warranty contained herein may not be modified and no other warranty, expressed or implied, shall be made by or on behalf of Penberthy unless modified or made in writing and signed by the President or a Vice President of Penberthy.



## 1.0 About the Manual

This manual has been prepared as an aid and guide for personnel involved in installation or maintenance. All instructions must be read and understood thoroughly before attempting any installation, operation, or maintenance. Failure to follow *any* instruction could possibly result in a malfunction of the valve with resulting sudden release of pressure, property damage or physical injury to personnel.

# SAFETY INSTRUCTION

Penberthy does not have any control over the manner in which its gage valves are handled, installed, or used. Penberthy cannot and will not guarantee that a gage valve is suitable or compatible for the user's specific application.



## CAUTION



Vessel fluids may be pressurized and can unexpectedly exit vessel connections due to apparatus or material failure. Safety glasses should be worn when installing a gage valve. Failure to do so could result in serious physical injury to personnel or property damage.

## 2.0 Introduction

Penberthy armored gage valves are used to isolate gage glass, magnetic gages or other apparatus from the holding or pressure vessel when it becomes necessary to drain and service the gage. Penberthy Series 100, 200, 300, and 400 gage valve are supplied in pairs (upper and lower) and are available with socketweld, flanged and NPT connections.

These valves are equipped, as a standard feature, with a floating shank union vessel connection, which permits up to 3/8" [9.5mm] variation in center to center distance and with ball check shut-offs to prevent leakage of contained fluid in case of accidental gage glass breakage.

Series 100, 200, 300, and 400 valves for process use should include ball check shut-off feature. Valves without the ball check shut-off feature will not automatically stop leakage of contained fluid in the event of accidental gage glass breakage.

### 2.1 System Description

Penberthy armored valves are comprised of six basic components. Each component may vary slightly, depending on the desired physical and mechanical properties for the valve. Use the exploded parts view in Section 11.0 as additional reference material.

Body – a pressure retaining structure through which liquid passes to enter a gage glass or other apparatus. Provides a rigid, union, or spherical union connection to the vessel and seating surfaces for most valve components. Series 100 and 200 are straight pattern bodies; Series 300 and 400 are offset pattern bodies.

Ball Checks – sphere installed loosely within the body of the valve that seats to prevent significant leakage when a differential pressure surge occurs (e.g., mechanical failure). Ball checks for ASME steam service incorporate a vertically rising lower and leaky horizontal upper or omit ball checks completely. “Reverse acting” ball checks are available for vacuum service.

Trim – wetted parts that mechanically control the liquid path from the vessel to the gage glass or other apparatus. The ball and stem act to seal and release the liquid. In the event of mechanical failure, the ball will seat to prevent large quantities of the contained fluid from exiting the vessel. Liquid is allowed to exit the vessel into the gage glass or other apparatus when the stem is screwed away from its seated position. The liquid is sealed when the stem is screwed into its seated position.

The stem packing retainer provides a compression surface between the process liquid and the stem packing. A stem packing gland is used to compress the packing against the retainer and around the stem to prevent leakage.

Stem Packing – under compression the stem packing is forced to mold around the stem and prevent leakage of media during operation.

Gage Connection – provides connection between the valve and the gage glass or other apparatus. A union, spherical union or rigid connection may be used. A union connection can move in a plane parallel to the vessel connection.

Handwheel/Lever – rotated to engage threads and provide screw action of stem.

### 3.0 Available Models

Armored valves standard feature are listed in chart below.

Features	Model No.							
	120	130	220	230	320	330	420	430
Straight Pattern	X	X	X	X				
Offset Pattern					X	X	X	X
Integral Bonnet	X	X			X	X		
Union Bonnet			X	X			X	X
Union Gage Connection	X		X		X		X	
Rigid Gage Connection		X		X		X		X
Screwed in Seat			X	X			X	X

#### 3.1 Design Ratings at Maximum and Minimum Operating Temperatures

To determine the maximum allowable working pressure for a specific temperature within the design limits stated below, the user must refer to Penberthy Dimension Sheets, or when provided, the specifically stated design limits on a Penberthy product proposal.

## DESIGN RATINGS FOR THREADED OR WELDED CONNECTIONS

Valve Series	Material of Construction	Maximum Allowable Working Pressure	
		Teflon® packing	Grafoil® packing
100 200 300 400	Carbon Steel	4000 psig [27579 kPa] @ -20°F to +100°F [-29°C to +38°C] 3525 psig [24304kPa] @ 500°F [260°C]	4000 psig [27579 kPa] @ -20°F to +100°F [-29°C to +38°C] 2620 psig [18064 kPa] @ 750°F [399°C]
	316 STS Construction	4000 psig [27579 kPa] @ -300°F to +100°F [-184°C to +38°C] 3525 psig [24304kPa] @ 500°F [260°C]	4000 psig [27579 kPa] @ -300°F to +100°F [-184°C to +38°C] 2755 psig [18995 kPa] @ 750°F [399°C]
For other materials or connections consult factory			

TABLE 1



**NEVER exceed these design ratings or application data. Exceeding design ratings or application data may result in mechanical failure of valve components resulting in serious personal injury and/or property damage.**

### 3.2 Steam Application

Penberthy series 100, 200, 300 and 400 valves are designed for process conditions. In low pressure steam/water applications ( $\leq 350$  psig [2413 kPa] @ 431°F [221°C]), Penberthy allows the use of 300 and 400 series valves because the potential mechanical stress imposed on the valve assembly by the thermodynamic steam environment is relatively small. Request Penberthy Application Reports for more detailed information.

### **4.0 Inspection**

Upon receipt of a gage valve set, check all components carefully for damage incurred in shipping. If damage is evident or suspected, do not attempt installation. Notify carrier immediately and request damage inspection. Refer to exploded view drawing in Section 11.0 to inventory parts.

#### 4.1 User Rating Inspection

The user should confirm that:

- 1) The gage valve set model number and pressure/temperature rating stamped on nameplate (163) conforms to the description on the user's purchase order
- 2) The operating conditions described in the purchase order agree with the actual operating conditions at the installation site
- 3) The actual operating conditions at the installation site are within the applications data shown on the Penberthy Technical Data Bulletin or product proposal referred to previously.

- 4) The materials of construction of the gage valve set are compatible with both the contained fluid and the surrounding atmosphere in the specific application.

## SAFETY INSTRUCTIONS

**If the size, model or performance data of the gage valve set as received does not conform with any of the criteria above, do not proceed with installation. Contact an authorized Penberthy distributor for assistance. The incorrect valve can result in unacceptable performance and potential damage to the gage.**

### 5.0 Installation

Installation should only be undertaken by qualified personnel who are familiar with this equipment. They should have read and understood all of the instructions in this manual. The user should refer to Penberthy dimension sheets or Penberthy product proposal to obtain dimensional information for specific size and model gage valve.

Penberthy recommendations on gage valve installations are not necessarily related to the installation of flat glass liquid level gages. The number of different types of gage and valve installations is too great to adequately explain in an installation manual. Therefore, it is the user's responsibility to assure that knowledgeable installation personnel plan and carry out the installation in a safe manner. The following procedures are some of the guidelines that should be employed.

#### 5.1 Piping Strain

The gage valve should be mounted and connected so that it can support the gage without binding. Torsional stresses can make it difficult or impossible to seal tailpipes. Although union connections will allow marginal errors in piping alignment, misalignment can still create unusual strain on connectors. Gages not properly supported by brackets may subject the gage valve to stresses that can cause leaks or mechanical failure.

#### 5.2 Differential Thermal Expansion

High mechanical loading may be imposed on a gage valve by expanding and contracting gages due to hot or cold service. Such mechanical loads on the valve must be minimized by controlling process conditions in the system.

#### 5.3 Mounting

- 1) Prior to installation, turn the handwheel of each valve clockwise until the stem closes against the seat
- 2) Remove union vessel connections from valves, where applicable, and apply heavy grease (where allowable) to tailpipe seat. (the grease minimizes galling of the seat surfaces when tightening the coupling nuts.)

- 3) Wrench tighten tailpipes of upper and lower valves to the vessel using Teflon® tape, or equivalent, on all male tapered pipe thread connections as shown in Figure 1. If the valve is flanged or weld mount, use proper industry standard procedures.

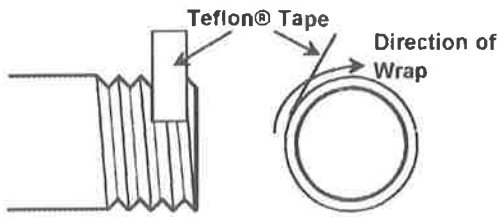


FIGURE 1

- 4) If installing with a flat glass gage, follow all installation instructions for the specific liquid level gage as there are many points to consider on gage installation; among them, piping strain, differential thermal expansion, weight and bolt torque.
- 5) Install gage tailpipes to union gage connections, where applicable, making sure that coupling nuts are in place.

## 6.0 Operation

Before initializing gage valve operation, check that all installation procedures have been completed. Use only qualified, experienced personnel who are familiar with valve equipment and thoroughly understand the implications of the tables and all the instructions. Check to determine that all connections are pressure tight.



## DANGER



Valve installations should be brought into service slowly. Valves should be opened slightly, and the valve assembly temperature and pressure allowed to slowly equalize. If the valves are equipped with ball checks, the valves must be opened all the way after the pressure and temperature have equalized to permit operation of the automatic ball check in the event of failure. Failure to follow the recommended operating procedures can result in severe personal injury and property damage.

### 6.1 Hydrostatic Test

Take all precautions necessary to handle the possibility of leakage during the test. Hydrostatic pressure test all installations to 100 psig [689 kPa] and correct any leakage before proceeding.

## 7.0 Maintenance



## WARNING



Use only qualified, experienced personnel who are familiar with valve equipment and thoroughly understand the implications of the tables and all the instructions. **DO NOT** proceed with any maintenance unless the valve assembly has been relieved of all pressure or vacuum, has been allowed to reach ambient temperature, and has been drained or purged of all fluids. Failure to do so can cause serious personal injury and property damage.

The user must create maintenance schedules, safety manuals, and inspection details for each gage valve. These will be based upon the users own operating experience with their specific application. Realistic maintenance schedules can only be determined with full knowledge of the services and application situations involved.

During system shutdown, the valves should be left open to permit the gage to lose pressure and cool with the rest of the system. Failure to leave the valve open during system shutdown may trap high pressure fluid in the gage.

### 7.1 Preventive Maintenance

On all installations the following items should be regularly evaluated by the user for purposes of maintenance:

- 1) Leakage around stem area
- 2) Internal stem leak
- 3) Leakage around union connections
- 4) Internal or external corrosion

The user must determine upon evaluation of his or her own operating experience an appropriate maintenance schedule necessary for his or her own specific application. Realistic maintenance schedules can only be determined with full knowledge of the services and application situation involved.

### 7.2 Ball Check Shut-Off

## SAFETY INSTRUCTION

**Ball checks, when installed, may fail to seat due to corrosion of the ball or seat, foreign material in ball chamber or viscous material in the ball chamber. A routine operational test of the ball check can prevent significant seepage of liquid in the event of glass breakage.**

An operational check can be performed on the valve ball checks by closing both the upper and lower valve stems completely. Drain contents from and relieve pressure on liquid gage to an appropriate safe container/area. NOTE: some loss of process fluid to the drain line is expected with this test procedure.



## WARNING



**Use only qualified, experienced personnel who are familiar with valve equipment and thoroughly understand the implications of the tables and all the instructions. DO NOT proceed with any maintenance unless the valve assembly has been relieved of all pressure or vacuum, has been allowed to reach ambient temperature, and has been drained or purged of all fluids. Failure to do so can cause serious personal injury and property damage.**

With drain line still in place, open **BOTTOM** valve as rapidly as possible. Listen for "click" sound which will indicate that the ball has seated. If possible, observe the quantity of flow from the drain line. Flow should either stop completely or be no greater than single drips (no solid stream). Close lower valve. Repeat above procedure for **UPPER** valve. There must be a pressure differential of at least 5 psi [34.5 kPa] for the above procedure to work properly.

If the above procedure is not successful, the only alternative is to isolate the gage and valve assembly from the vessel or to shut the process down completely. Disassemble the valve as outlined in Section 8.1 using the exploded parts drawing in Section 11.0 as reference. Visibly inspect ball check and ball seats in the valve body. Remove any foreign matter and/or replace with new ball checks if inspection indicates this is required. If the ball seat is damaged, consider replacing the valve or the seat (if it is removable). Reassemble valves as outlined in Section 8.2

### 7.3 Troubleshooting

**STEM PACKING LEAKAGE** can often be stopped by tightening the stem packing nut. If leak persists, the stem packing should be replaced by following steps 1) through 5) of the Disassembly and 1) through 6) of the Reassembly instructions

**INTERNAL SEAT LEAKAGE** is an indication of a worn or damaged stem or seat. To replace the stem follow steps 1) through 5) of the Disassembly and 1) through 7) of the Reassembly instructions. To renew the seat surface, follow steps 1) and 2) of the Disassembly instructions. Renew the seats by using a fine lapping compound and a mandrel the same size, shape and seat angle as the stem. Flush the valve body clean and reassemble by following steps 4) and 5) of the Reassembly instructions.

Renewable Threaded Seats (Series 200 and 400). Remove the seat by inserting a ¼" [6.4mm] square driver in the seat and turning it counterclockwise. Replace the new seat by turning it clockwise using the square driver, making sure that the ball check, if used, is replaced in the body. Tighten the seat in place. Follow steps 4) and 5) of the Reassembly instructions.

**LEAKAGE AROUND UNION** connections can often be stopped by tightening union coupling nut or remake connection using Teflon® tape, or equivalent, on all male pipe threads as shown in Figure 1

**INTERNAL OR EXTERNAL CORROSION** could be an indication of a misapplication. An investigation should immediately be carried out to determine the cause of the problem. It is the user's responsibility to choose a material of construction compatible with both the contained fluid and the surrounding atmosphere.

### 8.0 Removal – Disassembly – Reassembly



## WARNING



Use only qualified, experienced personnel who are familiar with valve equipment and thoroughly understand the implications of the tables and all the instructions.

**DO NOT proceed with any maintenance unless the valve assembly has been relieved of all pressure or vacuum, has been allowed to reach ambient temperature, and has been drained or purged of all fluids. Failure to do so can cause serious personal injury and property damage.**

### 8.1 Disassembly

Refer to the exploded parts drawing in Section 11.0 for additional reference during disassembly and reassembly of the valves.

- 1) Remove handwheel nut (30), nameplate (163) and handwheel (28) or lever from stem.
- 2) Loosen and remove stem packing nut (26).
- 3) Remove stem by turning counterclockwise, along with stem packing gland, stem packing, and stem packing retainer.
- 4) Slip the stem packing gland, stem packing and stem packing retainer off stem.
- 5) On Series 200 and 400 valves, remove bonnet nut and bonnet.
- 6) To replace seat on Series 200 and 400 valves, follow instructions as described in maintenance procedures.

### 8.2 Reassembly

Refer to the exploded parts drawing in Section 11.0 for additional reference during disassembly and reassembly of the valves.

- 1) Prepare for installation of new packing by cleaning all packing chambers and glands of upper and lower valves.
- 2) On Series 200 and 400 valves, replace bonnet (20), and bonnet nut (21) and tighten securely in place.
- 3) Slip packing retainer (18) on stem (17)
- 4) Install new stem packing (25) and stem packing gland (19)
- 5) Thread stem assembly into valve by turning clockwise until stem seats and then back off one turn (1/8 turn with quick close stem).
- 6) Assemble stem packing nut (26) and tighten in place.
- 7) Assemble handwheel (28) or lever (261), nameplate (163) and handwheel nut (30) on stem and tighten securely in place.
- 8) Close both valves by turning handwheel or lever clockwise until stem seats.

Refer to Section 6.0 for operation of the gage valve when returned to service.

## **9.0 Disposal at End of Useful Life**

Penberthy valves are used in a variety of fluid applications. By following the appropriate governmental and industry regulations, the user must determine the extent of preparation and treatment the valve must incur before its disposal. A Material Safety Data Sheet (MSDS) may be required before disposal services accept certain components.

Metals and polymers should be recycled whenever possible. Refer to order and Penberthy's Material Specification sheets for materials of construction.



- Model #
- Name of the company from whom you purchased your valve
- Invoice # and date
- Process fluid
- Operating pressures
- Operating temperature
- A brief description of the problem
- Troubleshooting procedures that failed

If attempts to solve your problem fail, you may be requested to return your valve to the factory for intensive testing. You must obtain a Return Authorization (RA) number from Penberthy prior to returning anything. Failure to do so will result in the unit being returned to you, without being tested, freight collect. To obtain a R.A. number, the following information (in addition to that above) is needed:

- Reason for return
- Person to contact at your company
- "Ship To" address
- MSDS sheet if in harmful service

We recommend that you return the entire valve set for testing. There is a minimum charge of \$50.00 for evaluation of non-warranty units. You will be contacted before any repairs are initiated should the cost exceed the minimum charge. If you return a unit that is covered by the warranty, but is not defective, the minimum charge will apply.

Grafoil® is a registered trademark of Union Carbide Corporation  
Teflon® is a registered trademark of E.I. duPont de Nemours and Company

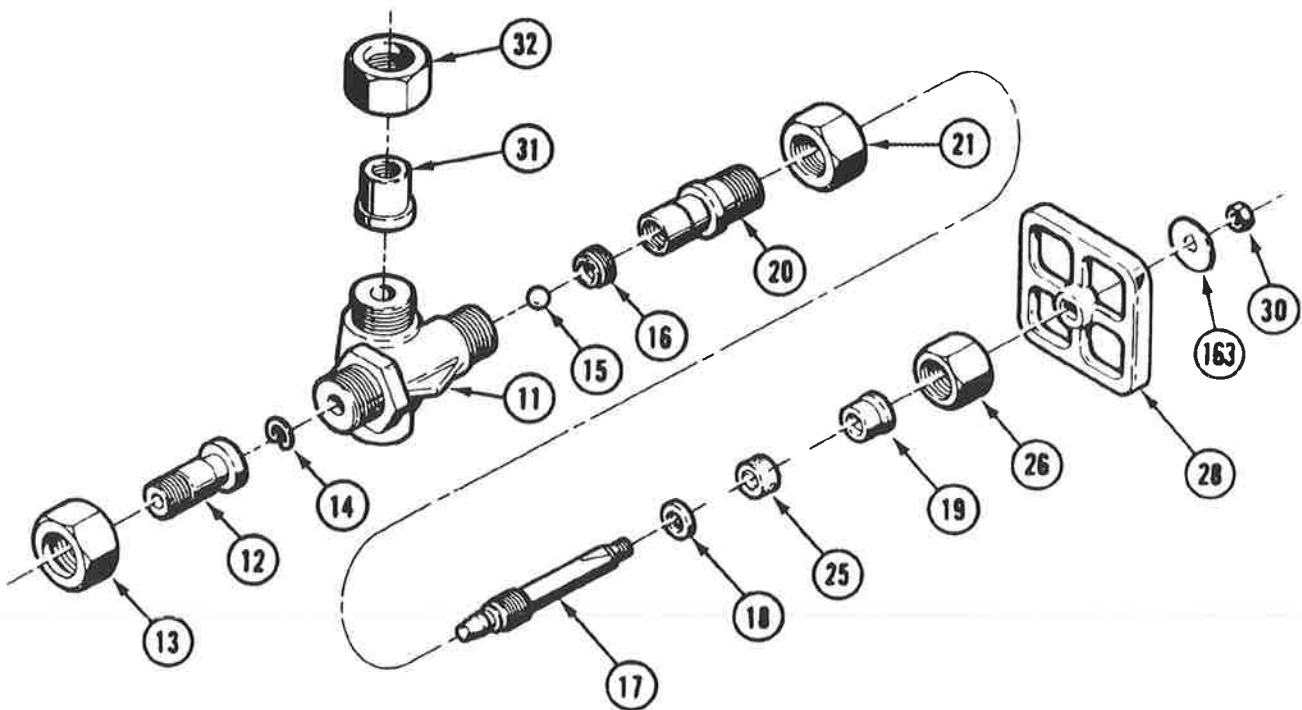
## 11.0 Exploded Parts Drawing

- 11 Body
- 12 Tailpipe, Vessel
- 13 Nut, Vessel Coupling
- 15 Ball
- 16 Seat
- 17 Stem
- 18 Retainer, Stem Packing
- 19 Gland, Stem Packing
- 20 Bonnet
- 21 Nut, Bonnet
- 25 Packing, Stem
- 26 Nut, Stem Packing
- 30 Nut, Handwheel
- 31 Tailpipe, Gage
- 32 Nut, Gage Coupling
- 163 Nameplate
- 261 Lever

### SPARE PARTS

Ref. No.	Item	Min. Qty.
18	Retainer, Stem Packing	1
19	Gland, Stem Packing	1
25	Packing, Stem	1
30	Nut, Handwheel	1

RECOMMENDED MAXIMUM QUANTITIES SHOULD PROVIDE SPARE PARTS FOR 10% OF THE VALVES IN SERVICE



Note: Seat (16), Bonnet (20) and Nut (21) to be used on Series 200 and 400 valves only.

# PENBERTHY

## DECLARATION of CONFORMITY

In conformance with ISO/IEC Guide 22 – 96  
VLV.DC r C


Manufacturer's Name: Penberthy, Incorporated  
Manufacturer's Address: 320 Locust Street  
Prophetstown, IL 61277-1147 U.S.A

Product:  
Type of Equipment: Pressure Vessel – Armored and Tubular Gauge Glass Valves  
Equipment Class: Industrial Instrumentation – Hazardous Area  
Model Designations: 100, 200, 300, 400, 500, 600, 700 series N2, K2, K3, N6, N7, A5

The product described above is in conformity with:

92/59/EEC	General product safety	1992
87/404/EEC	Simple pressure vessels	1987
89/392/EEC	Machinery	1989
EN 10213-1:4	Technical delivery conditions for steel castings	1996
ISO 7 – 1	Pipe threads where pressure-tight joints are made	1994
BS 10	Flanges and bolting for pipes, valves and fittings	1962
BS 21	Pipe threads for tubes and fittings where pressure tight	1985
BS759	Valves, gauges and other safety fittings for application	1984
BS 970 Part 1	Wrought steels for mechanical and allied engineering	1996
BS 970 Part 3	Wrought steel for mechanical and allied engineering	1991
BS 970 Part 4	Wrought steels in the form of blooms, billets, bars	1970
BS 1502	Steels for fired and unfired pressure vessel	1982
BS 1506	Carbon, low alloy and stainless steel bars and billets	1990
BS 1560	Circular flanges for pipes, valves and fittings	1989
BS 1640 Part 1	Steel butt-welding pipe fittings	1962
BS 1640 Part 2	Steel butt-welding pipe fittings	1962
BS 1965	Butt-welding pipe fittings	1963
BS 3076	Nickel and nickel alloys: bar	1989
BS 3463	Observation and gauge glasses for pressure vessels	1975
BS Part 1	Steel pipes and tubes for pressure purposes	1987
BS 3605	Austenitic stainless steel pipes and tubes	1991
BS 3643	ISO metric screw threads	1981
BS 3799	Steel pipe fittings, screwed and socket-welding	1974
BS 4504	Circular flanges for pipes, valves and fittings	1989
ASME B&PV Code, Section VIII	Rules for construction of pressure vessels	1995
ANSI/ASME B1.1	Unified screw inch threads un and unr thread form	1982
ANSI/ASME B1.20.1	Pipe threads, general purpose (inch)	1983
ANSI/ASME B16.5	Pipe flanges and flanged fittings	1988
ANSI/ASME B18.2.1	Square and hex bolts and screw inch series	1981
ANSI/ASME B18.2.2	Square and hex nuts	1972
ANSI/ASME B18.3	Socket cap shoulder and set screws inch series	1982
ANSI/ASME B31.3	Process piping	1996

Date: 30 December 1996  
Prophetstown, IL U.S.A.

Signature:   
Name: David J. Williams, C.Q.E.  
Position: Quality Assurance Manager

Technical Construction File is available at stated address. Signatory is contact person.

## NOTES

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**PENBERTHY**

320 Locust St., Prophetstown, Illinois 61277

Telephone: (815) 537-2311

Fax No: (815) 537-5764

e-mail: [www.pcc-penberthy.com](http://www.pcc-penberthy.com)

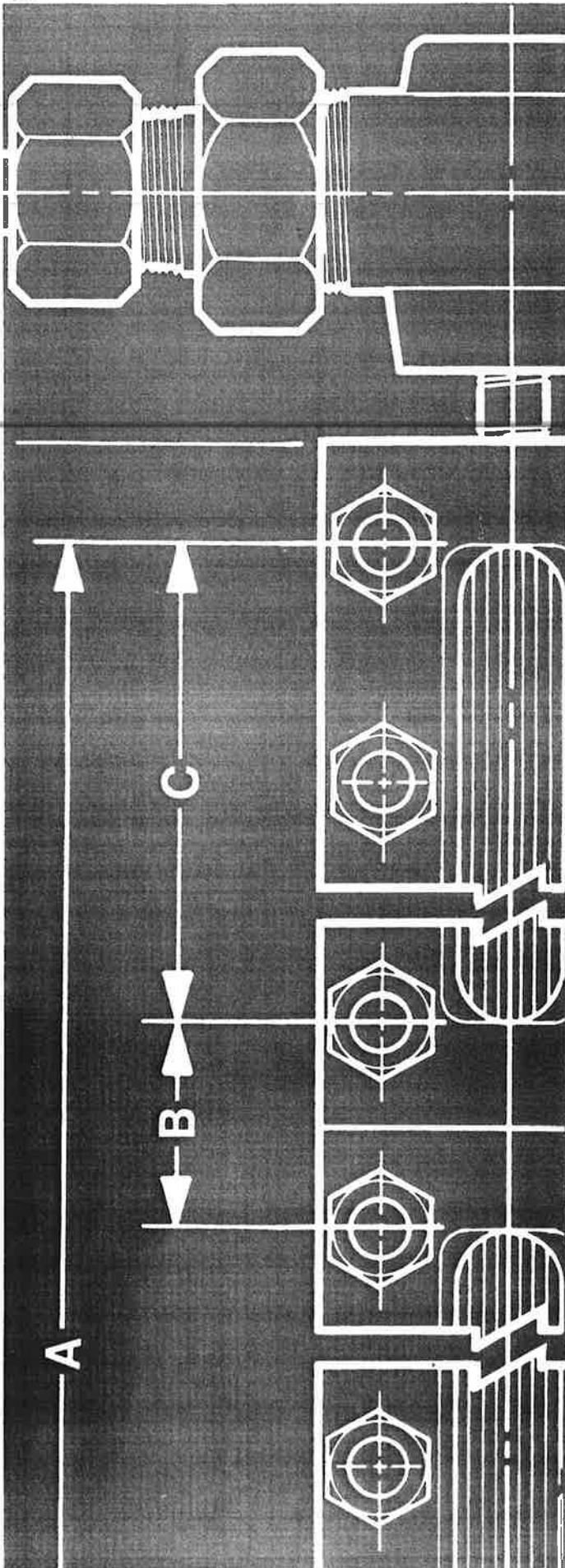
Printed in U.S.A

Part No. 14912-009

**PENBERTHY**

# direct reading liquid level gages & valves

This bulletin contains general information about Penberthy Direct Reading Liquid Level Gages and Valves. Details for selecting specific units for various applications and operating conditions are given in separate technical bulletins.



# (TUBULAR GLASS GAGES) valves

Offset and straight pattern designs for use with tubular glass in a variety of materials and configurations for most needs

Penberthy tubular glass gage valves are for use in lower pressure applications. They are available with many combinations of features for a range of uses.

Valves are available with union or solid shank vessel connections, and with a choice of stuffing box sizes for various glass diameters. All stuffing box connections are designed for positive seal with minimum compression.






These valves can be used with flat glass gages by using special tubular adapters.

Both straight and offset pattern valves are offered. Offset pattern valves permit easy cleaning of gage glass since they provide a passage straight through the vent connection, glass, and drain connection.

All standard Penberthy tubular glass valves have corrosion resistant steel ball checks for instant shutoff should the glass break.

Upper valves in a valve set have horizontal ball checks, while lower valves have either horizontal or vertical acting balls, depending on the model.

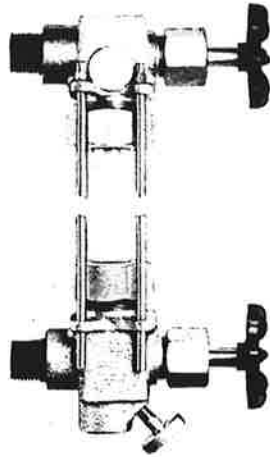
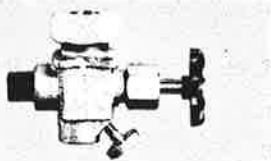
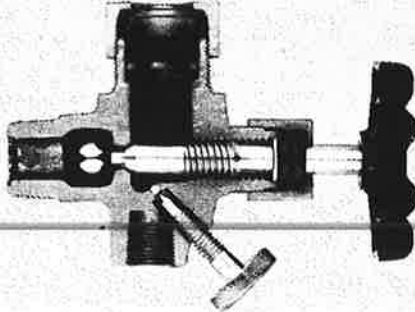
Horizontal ball check valves have extensions on the stems to unseat the ball when the valve is closed.

series design type	Standard Features	Connection Size Combinations		Model	Vessel Connection Type Standard <i>Optional</i>	Maximum Pressure subject to limitations of glass	Temperature Range	
		vessel (NPTM)	glass dia.				min	max
 <p><b>N2</b> offset pattern Bulletin 2250</p>	Ball Check Shut-off Integral Bonnet Integral Seat Handwheel	1/2" 3/4" 1"	3/8" 1/2" 3/4"	N2AJ N2BJ N2CJ	Union <i>Socketweld</i> <i>Flanged</i> <i>Spherical Union</i>	600 psi @ +100F 4100 kPa @ +38C	-300F -184C	+750F +399C
 <p><b>K2</b> offset pattern Bulletin 2250</p>	Ball Check Shut-off Union Bonnet Threaded Seat Handwheel	1/2" 3/4" 1"	3/8" 1/2" 3/4"	K2AJ K2BJ K2CJ	Union <i>Socketweld</i> <i>Flanged</i> <i>Spherical Union</i>	600 psi @ +100F 4100 kPa @ +38C	-300F -30C	+750F +400C
 <p><b>K3</b> offset pattern Bulletin 2251</p>	Ball Check Shut-off Union Bonnet Backseating Stem Drain Cock Furnished Handwheel Quick Closing Stem	1/2" 3/4"	3/8" 1/2"	K3A K3B	Solid Shank <i>Socketweld</i> <i>Flanged</i>	500 psi @ +100F 3500 kPa @ +38C Max. steam pressure 360 psi 2500 kPa	-20F -29C	+550F +288C
 <p><b>N6</b> straight pattern Bulletin 2252</p>	Ball Check Shut-off Integral Bonnet Drain Cock Furnished Handwheel	1/2"	3/8"	N6A	Solid Shank <i>Socketweld</i> <i>Flanged</i>	200 psi @ +100F 1400 kPa @ +38C Max. steam pressure 125 psi 900 kPa	-20F -29C	+400F +204C
 <p><b>N7</b> straight pattern Bulletin 2255</p>	Ball Check Shut-off Integral Bonnet Integral Drain Cock Handwheel	1/2" 3/4"	3/8" 1/2"	N7A N7B	Solid Shank <i>Socketweld</i> <i>Flanged</i>	500 psi @ +500F 3500 kPa @ +260C Max. steam pressure 500 psi 3500 kPa	-20F -29C	+500F +260C

# TECHNICAL DATA valves for tubular glass gages series N7 [STRAIGHT PATTERN]

Section 2000  
Bulletin 2255  
Issued 5/87  
Replaces 4/86

Pressures to 500 psi @ +100F (3400 kPa @ +38C)  
Temperature range -20F to +500F (-29C to +260C)



### Design features

The N7 series includes models N7A and N7B with these design features —

- Straight pattern
- Integral bonnet
- Stuffing box gage connection
- Rigid vessel connection
- Ball check shutoff
- Integral drain cock

Combinations of optional features and materials are available. Each combination is designated by a model number as shown in the table of Features.

Optional materials can be specified for the valve body and trim. (Trim consists of the stem, stem packing retainer, glass packing gland and ball check.) Standard and optional materials are available for service as described by AISI or ASTM Specifications.

### Pressure temperature ranges

The pressure/temperature ranges in the following table are subject to the limitations of the tubular glass.

### ASME Boiler Code

Series N7 valve sets that are acceptable for ASME Boiler Code are available as an option. These valve sets have vertical rising ball check in lower valve, horizontal ball in upper valve and ball inspection plug.

### STANDARD/OPTIONAL FEATURES

		Model N7A	Model N7B	Optional	Optional
		Standard	Optional	Standard	Optional
<b>STRAIGHT PATTERN</b>			X		X
<b>INTEGRAL BONNET</b>			X		X
<b>GAGE CONNECTION</b>					
Stuffing Box	1/8" Glass Dia.		X		
	1/4" Glass Dia.				X
<b>VESSEL CONNECTION</b>					
Solid Shank	1/2" NPTM		X		
	3/4" NPTM				X
Socketweld	1/2" Male			X	
	3/4" Male				X
Flanged			X		X
<b>DRAIN CONNECTION</b>					
	1/4" NPTF		X		X
<b>BALL CHECK SHUTOFF</b>					
Horizontal Lower and Upper (Iron, STS Valves)			X		X
Vertical Lower/Horizontal Upper (Bronze Valves)			X		X
Vertical Lower/Horizontal Upper (Acceptable for ASME Service)				X	X
Omitted (Acceptable for ASME Service)				X	X
<b>BALL INSPECTION PLUG (Required for ASME Service)</b>					
Furnished				X	X
Omitted			X		X
<b>SEAT — Integral</b>			X		X
<b>HANDWHEEL w/STANDARD PITCH THREAD (Iron, STS Valves)</b>			X		X
<b>HANDWHEEL w/QUICK CLOSING THREAD (Bronze valves)</b>			X		X
<b>INTEGRAL DRAIN COCK</b>			X		X
POLISHED BODY (bronze valves)				X	X
GUARD RODS (4 per valve set)				X	X
					1/16" (4.8 mm) Dia.

### DIMENSIONS

Model	Dimension X inches (cm)	Dimension Y inches (cm)
All models	2 (5.1)	1/4 (1.9)

### Dimensions

To obtain length of glass tubing needed to make up gage set for given vessel center-to-center dimension —

$$\text{Glass Tubing Length} = \left( \frac{\text{Vessel Center-to-Center Dimension}}{\text{Dimension X}} \right) - \text{Dimension X}$$

To obtain length of guard rods for given valve center-to-center dimension —

$$\text{Guard Rod Length} = \left( \frac{\text{Valve Center-to-Center Dimension}}{\text{Dimension Y}} \right) - \text{Dimension Y}$$

### PRESSURE/TEMPERATURE RANGES

Model	Maximum working pressure, psi (kPa) at temperatures to —							Maximum Steam Pressure psi (kPa)
	with standard neoprene glass packing				with optional teflon glass packing			
	-20F (-29C)	+100F (+38C)	+200F (+93C)	+300F (+149C)	+400F (+204C)	+450F (+232C)	+500F (+260C)	
	psi (kPa)	psi (kPa)	psi (kPa)	psi (kPa)	psi (kPa)	psi (kPa)	psi (kPa)	
N7A	200	200	190	165	125	—	—	125
Bronze	(1400)	(1400)	(1300)	(1100)	(900)	—	—	(900)
N7B	400	400	385	335	250	—	—	250
Bronze	(2800)	(2800)	(2700)	(2300)	(1700)	—	—	(1700)
N7A	185	185	170	165	165	160	—	165
Iron	(1300)	(1300)	(1200)	(1100)	(1100)	(1100)	—	(1100)
N7B	490	490	445	435	425	415	—	415
Iron	(3400)	(3400)	(3100)	(3000)	(2900)	(2900)	—	(2900)
N7A, N7B	500	500	500	500	500	500	500	500
STL, STS	(3500)	(3500)	(3500)	(3500)	(3500)	(3500)	(3500)	(3500)

Pressure/temperature ranges in above table subject to limitations of tubular glass.



LI/LC/LSL-262/270

YOU'RE

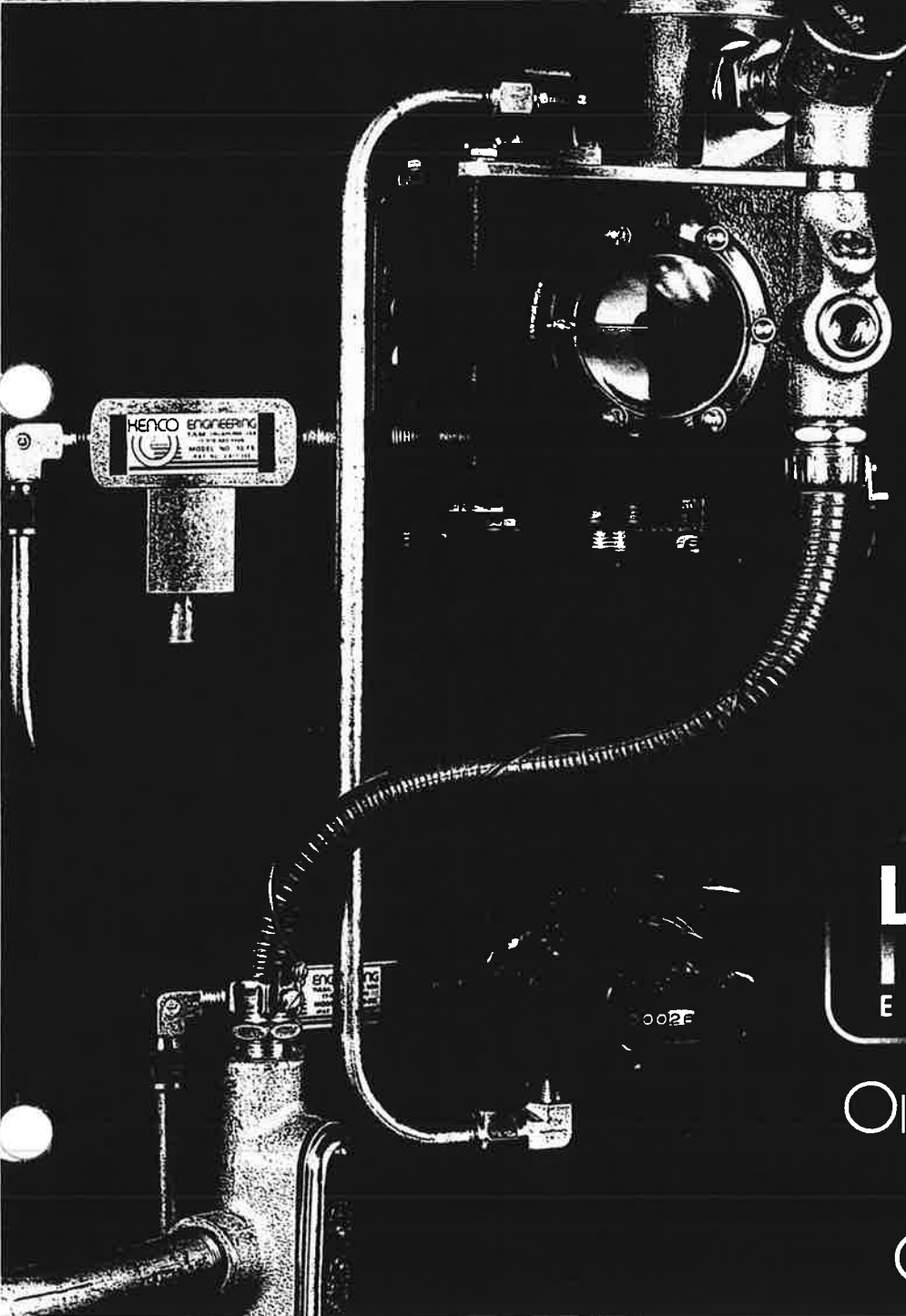
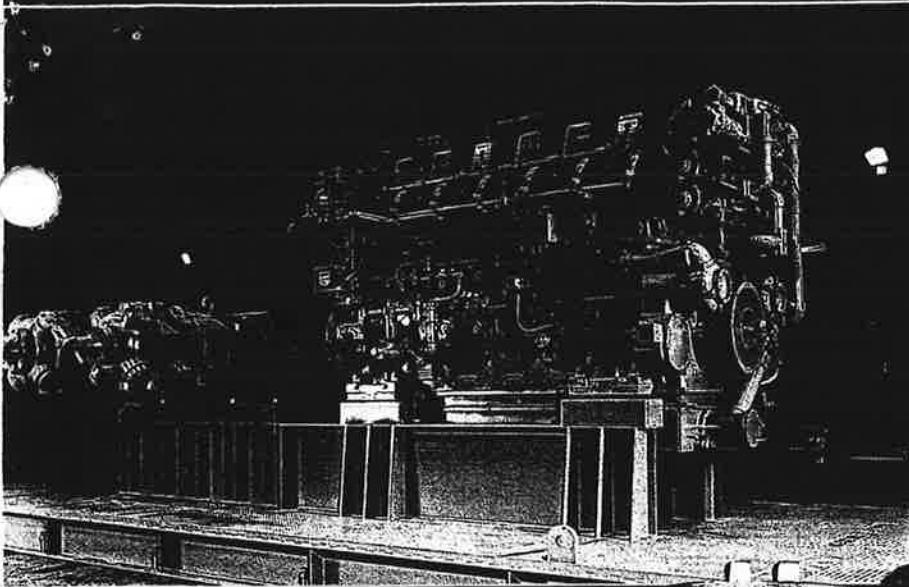
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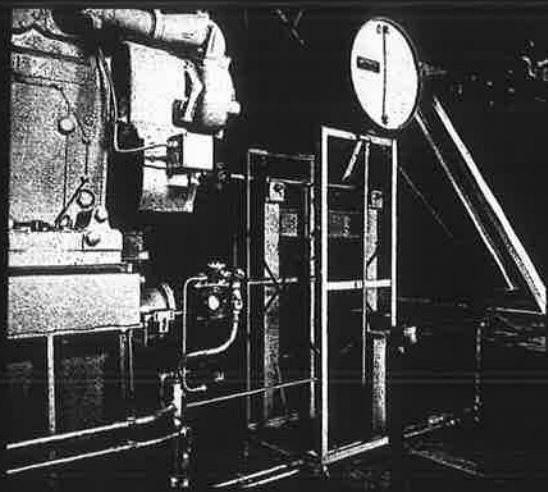
WITH

**HENCO**  
ENGINEERING

OIL LEVEL CONTROLLERS  
AND  
OIL LEVEL SWITCHES



# OIL LEVEL CONTROLLERS AND OIL LEVEL SWITCHES



## Operating Principle for Oil Level Controllers

The Kenco Oil Level Controllers are designed to control a constant oil level in the crankcase of stationary engines, compressors, and mechanical lubricator boxes. The Kenco oil controller works in conjunction with an overhead oil supply system which feeds the oil level controller.

As the oil is consumed, the oil controller supplies the required oil. The oil controller controls the amount of oil in the crankcase by a float controlled valve. The valve opens and closes as oil is needed in the crankcase to provide a constant oil level.

## Operating Principle for Oil Level Switches

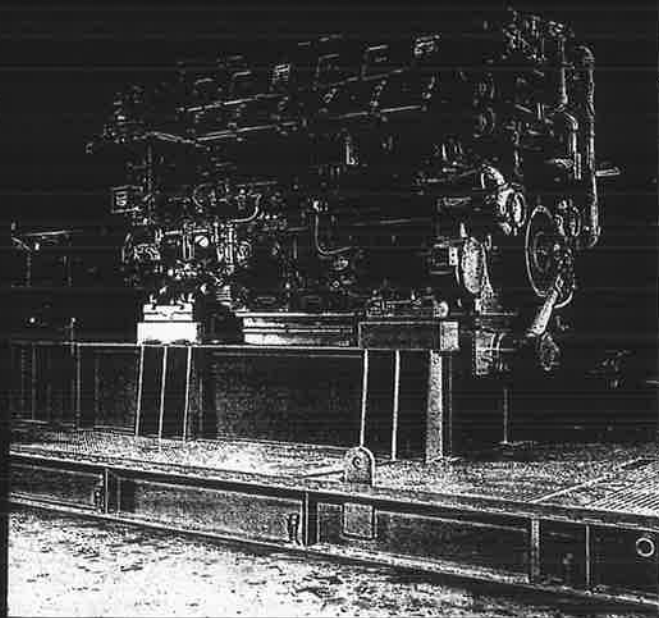
Oil level switches are designed as a safety device for the stationary engine or compressor. The oil level switch monitors the oil level in the crankcase. The level within the crankcase directly corresponds with the oil level in the oil level switch housing. The engine or compressor constantly consumes the oil from the crankcase. If the oil level in the crankcase drops past the designated level, the switch will trip sending an alarm.

## Features

- Reduces maintenance by controlling a constant lube oil level.
- Protects against lubrication failure.
- Controller mechanism fully removable without draining oil.
- Oil inlet can be rotated 360 degrees.
- Easy view convex sight window.
- Many direct mount adapters which reduce installation cost.
- Explosion proof and intrinsically safe models available.
- Low to high pressure applications.
- Many options available to meet customer specifications.

## Applications

- Stationary engines
- Stationary compressors
- Mechanical lubricators
- Pumps



# MODEL SPECIFICATIONS

## Model LC Oil Level Controller

### Purpose of Model LC:

To supply and control the amount of oil in the crankcase

### Standard Materials of Construction:

Valve Seat - Nitrile  
Optional Valve Seat Material - Fluorocarbon  
Valve Orifice - Aluminum  
Housing - Aluminum  
Float Material - Closed Cell Polyurethane  
Oil Inlet Screen - 20 Mesh Brass Cloth  
Sight Window - Clear Polycarbonate (UV stabilized)

### Oil Inlet Specifications:

Oil Inlet Connection - 1/2" FNPT  
Static Head Pressure Range - 1-15 ft.  
Max. Temp. 180° F / 82° C

### High Pressure Models -

A - 5-35 psi  
B - 36-70 psi

### Flow Rate Test Results:

(Low pressure tested at 32° F, with SAE 30)  
2" Head - 1.141 GPH  
4" Head - 2.122 GPH  
7" Head - 2.853 GPH  
12" Head - 3.043 GPH  
(High Pressure tested at 20° F, with SAE 30)  
5 psi - 0.163 GPH  
20 psi - 0.266 GPH

### Shipping Weight:

5 lbs.

## Model ES - Explosion Proof Electric Oil Level Switch

### Purpose of Model ES:

To monitor the oil level in the crankcase and to signal or shut down in case of low oil level.

### Standard Materials of Construction

Housing - Aluminum  
Float Material - Closed Cell Polyurethane  
Sight Window - Clear Polycarbonate (UV stabilized)

### Electric Switch Specifications:

Switch trip point, 3/4" drop  
Switch Rating -  
15 amp, 125, 250/480 VAC  
0.5 amp, 125 VDC  
0.25 amp, 250 VDC  
1/8 hp, 125 VAC  
1/4 hp, 250 VAC

Max. Temp. 180° F / 82° C

Electrical connection, 1/2" FNPT

CSA approved for Class 1, Div. 1, Div. 2, Group C and D Hazardous locations  
SPDT standard, DPDT available  
High Level Switch also available

### Shipping Weight:

7 lbs.

## Model PS - Pneumatic Oil Level Switch

### Purpose of Model PS:

To monitor the oil level in the crankcase and to signal or shut down in case of low oil level.

Remote or offshore locations with no electric power.

### Standard Materials of Construction

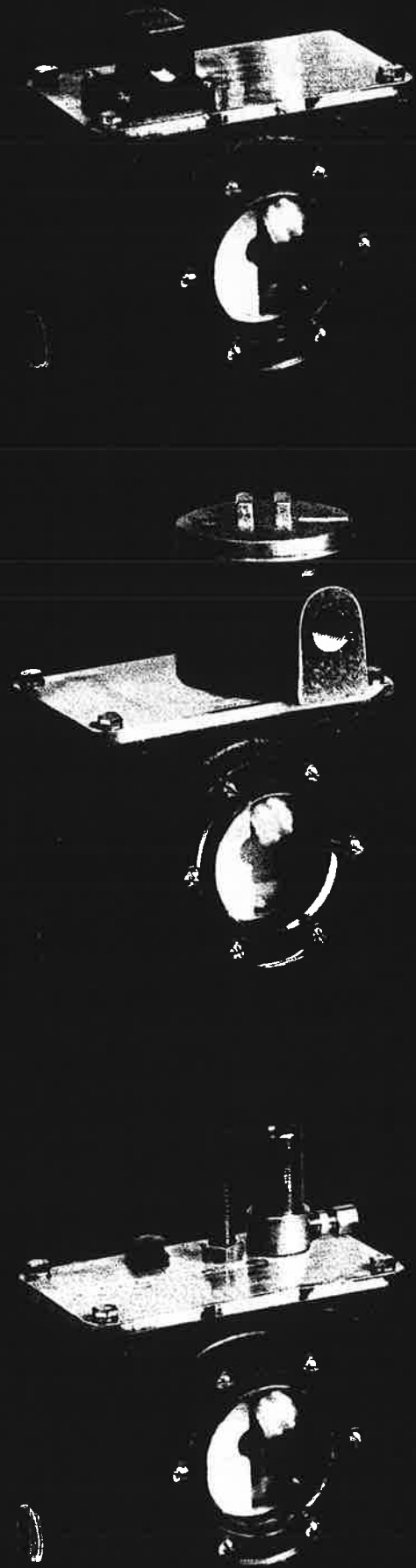
Housing - Aluminum  
Float Material - Closed Cell Polyurethane  
Sight Window - Clear Polycarbonate (UV stabilized)  
Valve - Stainless Steel

### Pneumatic Switch Specifications:

Switch Trip point, 3/4" drop  
Maximum Air Valve Inlet pressure - 100psi  
Switch Test Button Standard  
Air Inlet Connection, 1/4" FNPT  
Max. Temp. 180° F / 82° C

### Shipping Weight:

6 lbs.



**NEW**  
From  
**Kenco**

## MODEL SPECIFICATIONS

### Model LCM Oil Level Controller With Switch for Intrinsically Safe Applications

#### Purpose of Model LCM:

The Kenco LCM utilizes the operating principles of both the oil level controller and the electric switch. The LCM is intrinsically safe when used with an approved safety barrier.

#### Applications:

Intrinsically safe applications with an approved safety barrier.

#### Standard Materials of Construction

Valve Seat: Nitrile

Optional Valve Seat Material: Fluorocarbon

Valve Orifice: Aluminum

Housing: Aluminum

Float Material: Closed Cell Polyurethane

Oil Inlet Screen: 20 mesh brass cloth

Sight Window: Clear Polycarbonate  
(UV stabilized)

Switch Test Button: Standard

#### Oil Inlet Specifications:

Static Head Pressure Range: 1-15 ft

High Pressure Models -

A- 5-35 psi

B- 36-70 psi

Electrical Connection: 1/2" FNPT

#### Flow Rate Test Results

(Low pressure tested at 32° F, with SAE 30)

2' Head - 1.141 GPH

4' Head - 2.122 GPH

7' Head - 2.853 GPH

12' Head - 3.043 GPH

(High Pressure tested at 20° F, with SAE 30)

5 psi - 0.163 GPH

20 psi - 0.266 GPH

#### Electric Switch Specifications:

Switch trip point: 3/4" drop

Switch Rating:

10 amp, 125, 250 VAC or VDC

Circuitry: SPDT

Max. Temp: 180° F / 82° C

Electrical Connection: 1/2" FNPT

Wire Leads: 18 AWG x 24" long

#### Wire Color Code:

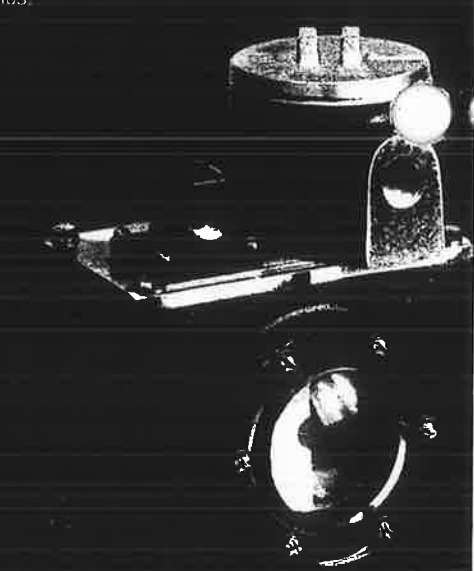
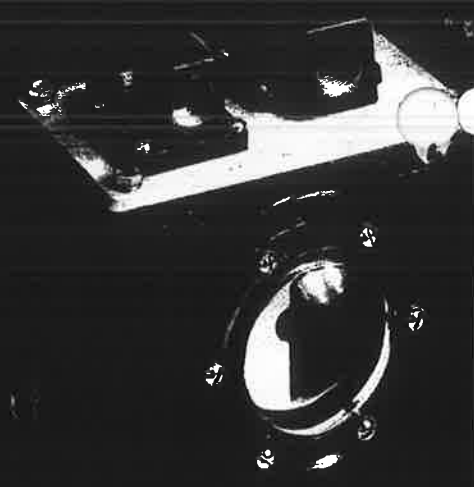
Red: Normally closed

Blue: Normally open

White: common

#### Shipping Weight:

7 lbs.



### Model LCE Oil Level Controller With Explosion Proof Electric Switch

#### Purpose of Model LCE:

The Kenco LCE utilizes the operating principles of both the oil level controller and the electric switch.

#### Applications:

Hazardous locations where flammable or combustible elements are present.

#### Standard Materials of Construction:

Valve Seat: Nitrile

Optional Valve Seat Material: Fluorocarbon

Valve Orifice: Aluminum

Housing: Aluminum

Float Material: Closed Cell Polyurethane

Oil Inlet Screen: 20 mesh brass cloth

Sight Window: Clear Polycarbonate  
(UV stabilized)

#### Oil Inlet Specifications:

Static Head Pressure Range: 1-15 ft

High Pressure Models -

A- 5-35 psi

B- 36-70 psi

Electrical Connection: 1/2" FNPT

#### Flow Rate Test Results:

(Low pressure tested at 32° F, with SAE 30)

2' Head - 1.141 GPH

4' Head - 2.122 GPH

7' Head - 2.853 GPH

12' Head - 3.043 GPH

(High Pressure tested at 20° F, with SAE 30)

5 psi - 0.163 GPH

20 psi - 0.266 GPH

#### Electric Switch Specifications:

Switch trip point: 3/4" drop

Switch Rating -

15 amp, 125/250/480 VAC

0.5 amp, 125 VDC

0.25 amp, 250 VDC

1.5 hp, 125 VDC

1.4 hp, 250 VDC

Max. Temp: 180° F / 82° C

Electrical Connection: 1/2" FNPT

CSA approved for Class I, Div. 1, Div. 2

Group C and D Hazardous locations

SPDT standard, DPDT available

High Level Switch: available

**Shipping Weight:** 7.5 lbs.

# MODEL SPECIFICATIONS

## Model 512 Oil Level Controller with Case to Ground Electric Switch

### Purpose of Model 512:

The Kenco 512 utilizes the operating principles of both the oil level controller and the electric switch.

### Applications:

Locations where space is limited and non-hazardous locations.

### Standard Materials of Construction:

Valve Seat - Nitrile

Optional Valve Seat Material - Fluorocarbon

Valve Orifice - Aluminum

Housing - Aluminum

Floating Material - Closed Cell Polyurethane

Oil Inlet Screen - 20 mesh brass cloth

Sight Window - Clear Polycarbonate  
(UV stabilized)

Electrical Connection - 1/2" FNPT

### Oil Inlet Specifications:

Static Head Pressure Range - 1-12 ft.

No high pressure models available.

### Flow Rate Test Results:

(Tested at 30° F with SAE 40)

2' Head - 10 GPD

### Electric Switch Specifications:

Switch Rating - 2 amp, 30VAC or VDC

Switch Trip Point Range - 3/16" to 1/2"

(Factory set 1/2")

Circuitry - Case to Ground

Electrical Connection - 1/2" FNPT

Max. Temp. 180° F / 82° C

### Shipping Weight:

3 lbs.



## Model LCP Oil Level Controller with Pneumatic Switch

### Purpose of Model LCP:

The Kenco LCP utilizes the operating principles of both the oil level controller and the pneumatic switch.

### Applications:

Remote or Offshore locations with no electric power.

### Standard Materials of Construction:

Valve Seat - Nitrile

Optional Valve Seat Material - Fluorocarbon

Valve Orifice - Aluminum

Housing - Aluminum

Floating Material - Closed Cell Polyurethane

Oil Inlet Screen - 20 mesh brass cloth

Sight Window - Clear Polycarbonate  
(UV stabilized)

### Oil Inlet Specifications:

Static Head Pressure Range - 1-15 ft.

High Pressure Models:

A - 300 psi

B - 3670 psi

### Flow Rate Test Results:

(Low pressure tested at 32° F with SAE 30)

2' Head - 1.141 GPH

4' Head - 2.122 GPH

7' Head - 2.853 GPH

12' Head - 3.043 GPH

(High Pressure tested at 20° F with SAE 30)

5 psi - 0.163 GPH

20 psi - 0.265 GPH

### Pneumatic Switch Specifications:

Switch Trip point - 3/4" drop

Maximum Air Valve Inlet pressure - 100psi

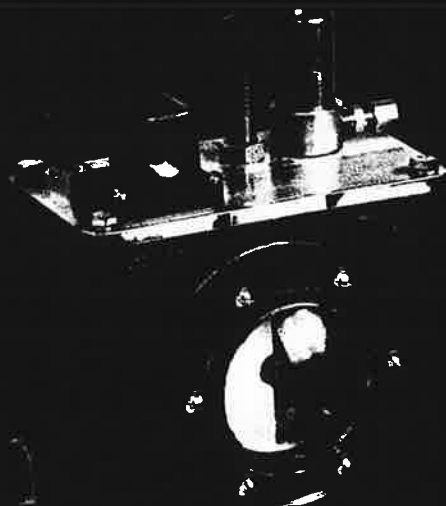
Switch Test Button Standard

Air Inlet Connection - 1/4" FNPT

Max. Temp. 180° F / 82° C

### Shipping Weight:

6.5 lbs.



# MODEL DIMENSIONS

Model LC Oil Level Controller

Model ES Electric Oil Level Switch

Model PS Pneumatic Oil Level Switch

# MODEL DIMENSIONS

Model LCM Oil Level Controller for Intrinsically Safe Applications

Model LCE Oil Level Controller with Explosion Proof Electric Switch

Model 512 Oil Level Controller with Case to Ground Electric Switch

Model LCP Oil Level Controller with Pneumatic Switch

# IN-LUBRICATOR OIL LEVEL CONTROLLER WITH SAFETY SWITCH

**NEW**  
From  
**Kenco**

## Model 507M

The standard valve seat material is Nitrite, but may be ordered as Fluorocarbon for other types of lubrication. A 1/2" FNPT conduit connection is standard. A basic two wire SPDT switch with form C contacts is standard. The enclosure meets NEMA type 4 classification.

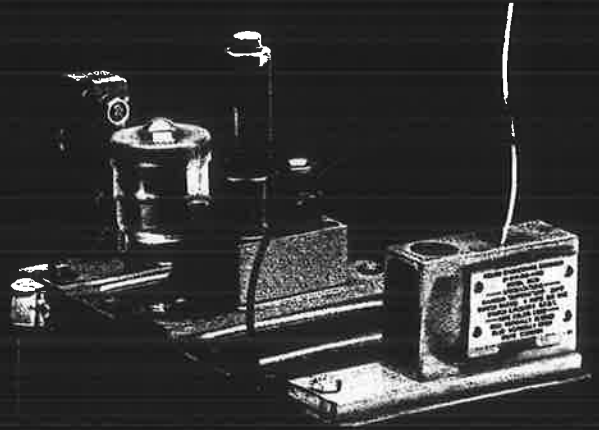
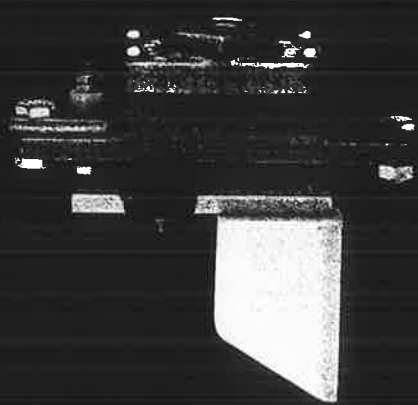
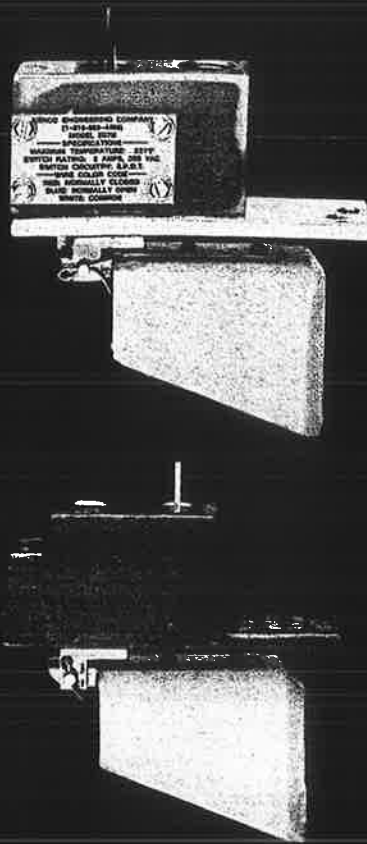
## Model 507L

The standard valve seat material is Nitrite. A 1/2" FNPT conduit connection is standard. The switch is case to ground, the circuit will remain open until the switch is activated.

## Model 507K

The 507K has a stainless steel valve seat for handling the oil safely. The switch is case to ground, the circuit will remain open until the switch is activated.

## Model 507M Shown Mounted



## APPLICATION

SERIES 507 OIL LEVEL CONTROLLERS are designed for use in Lincoln, Premier, and Mega Lubricators.

## OPERATING PRINCIPLE

Series 507 Oil Level Controllers automatically monitor and control the amount of oil in the lubricator housing. This keeps all of the working parts including the pump plungers submerged in oil to reduce wear and corrosion. When the level falls below the operational requirement, the low level safety switch will be activated.

## FEATURES

- Valve design eliminates lubricator box overfill due to contaminants in the oil.
- Controls oil level in lubricator.
- Low level safety switch protects against engine and pump repairs due to lubrication failure.
- Non-mercury switch will not react to vibration.



## Model 507M



### MATERIALS OF CONSTRUCTION

Controller Housing — Aluminum  
Valve Seat — Nitrile  
Oil Inlet Valve Seat — Fluorocarbon ball seat for  
synthetic oil  
Valve Orifice — Aluminum  
Float Material — Closed Cell Polyurethane  
Oil Inlet Screen — 60 mesh brass cloth

### SPECIFICATIONS

Switch Trip Point — 3/4" drop in oil level  
Switch Rating — 2 Amps, 30 VAC or VDC  
Electrical Connection — 1/2" FNPT  
Conduit Connection  
18 Gauge wire X 36" long  
Wire Color Code — Red-Normally Closed  
Blue-Normally Open  
White-Common  
Enclosure — NEMA type 4  
Maximum Temperature — 211°F  
Inlet Oil Connection — 1/2" FNPT  
Circuitry — SPDT  
Inlet Pressure — 1 to 14" head of oil  
Flow Rate — 2" head at 32°F, SAE 30;  
1141.3 gallons per hour  
Shipping Weight — 15 oz

## Model 507L



### MATERIALS OF CONSTRUCTION

Controller Housing — Aluminum  
Valve Seat — Nitrile  
Oil Inlet Valve Seat — Fluorocarbon ball seat for  
synthetic oil  
Valve Orifice — Aluminum  
Float Material — Closed Cell Polyurethane  
Oil Inlet Screen — 60 mesh brass cloth

### SPECIFICATIONS

Switch Trip Point — 3/4" drop in oil level  
Switch Rating — 2 Amps, 30 VAC or VDC  
Electrical Connection — 1/2" FNPT Conduit Connection  
18 Gauge wire X 36" long  
Maximum Temperature — 211 degree, Fahrenheit  
Inlet Oil Connection — 1/2" FNPT  
Circuitry — Close to Ground  
Inlet Pressure — 1 to 14" head of oil  
Flow Rate — 2" head at 32°F, SAE 30;  
1141.3 gallons per hour  
Shipping Weight — 15 oz

## Model 507K



### MATERIALS OF CONSTRUCTION

Controller Housing — Aluminum  
Valve Seat — Aluminum  
Ball Shut-off — Stainless Steel  
Float Material — Closed Cell Polyurethane  
Oil Inlet Screen — 60 mesh brass cloth

### SPECIFICATIONS

Switch Trip Point — 3/4" drop in oil level  
Switch Rating — 2 Amps, 30 VAC or VDC  
Electrical Connection — 1/2" FNPT Conduit Connection  
18 Gauge wire X 36" long  
Maximum Temperature — 211 degrees Fahrenheit  
Inlet Oil Connection — 1/2" FNPT  
Circuitry — Close to Ground  
Inlet Pressure — 2" head of oil  
Flow Rate — 2" head at 32°F, SAE 30;  
1141.3 gallons per hour  
Shipping Weight — 15 oz

## High-Pressure Models 507M-HP and 507L-HP

Inlet Pressure — 0 psi to 60 psi  
Flow Rate — 5 psi at 32°F, SAE 30; 0.6425 gallons per hour

# KENCO ADAPTERS

## CONTROLLER TO CRANKCASE MOUNTING ADAPTERS

Universal Mounting Bracket for Any Engine  
**Type 10**

Universal Mounting Bracket for Any Engine  
**Type 9**

For Mechanical Location  
(Part 29/32) Holes in Lubricator Housing to mount  
**Type 11**

For Type 17  
**Type 12**

**Type 17**

White Superior Compressor  
**Type 14**

Standard Type 17 Adapter with 27mm diameter holes having  
1mm diameter with 1/16" mounting holes  
**Type 27**

# KENCO ADAPTER MODEL NUMBERS

## ENGINE

## NUMBER

Clark RA & CFA

-2

Clark HMB & TMP Compressor

-3

Clark RA, HRA, HBA, HCA, HLA, TLA

-4

Ingersoll-Rand SVG & KVS

-5

Ingersoll-Rand XVG

-6

Cooper-Bessemer GMW

-7

Cooper-Bessemer GMV

-8

Cooper-Bessemer GMX

-9

Universal Mount Bracket\*

-10

Slotted Adapter Universal Mount\*

-11

Mechanical Lubricator Mounting

-12

Post Mount For 1/2" Pipe\*

-13

White Compressor

-14

Ingersoll-Rand XVG & PVG

-15

Cooper-Bessemer BMV & 275 (Available With Varied Oil Level)

-16

Waukesha VHP Engines F 2895, F3251, F5108, L5790 & L7042 (Replaces Inspection Door)

-17

Waukesha VHP Engines F 2895, F3251, F5108, L5790 & L7042 Door With Low Flow Meter (Replaces Inspection Door)

-18

Ingersoll-Rand Rotary

-19

Cooper-Bessemer 2400 SERIES 6

-20

Ariel JGJ, JGK & JGR Compressor

-21

Waukesha VHP Engines F 2895, F3251, F5108, L5790 & L7042 (New Style Inspection Door)

-22

Waukesha Inspection Door P 9390

-23

Waukesha Inspection Door P 9390 WITH OIL METER

-24

Fairbanks Morse ZC, 118, 208, 346, 503, 739

512-FM

For Side Mounting On Mechanical Lubricator When There Is No Extra Pump Pocket

512-SM

Mounts On The End Of The McCord Mechanical Lubricator Next To The Filler Cap

512-SML

With B.C.S. F28, F42 & F42

512-W

With 98 WITH OIL GAUGE BOLTED TO ENGINE

512-W98

Alex C48, C66, C106 AND C245

512-A

Alex Lufkin Made Before 1-1-63, Superior And Other Crosshead Type Engines, And Tri-Plex Pumps With 1/2" Drains

512-AJAX

Also L7045

512-AJAX

\*Indirect mounted controllers, switches require an equalizing line for proper operation

# PRODUCT SPECIFICATION SHEET

## CONTROLLER DESIGNATIONS

LCE	Oil level controller with explosion proof switch
LCM	Oil level controller with switch for intrinsically safe applications
3318	Oil level controller with an independent high level/low level switch
3358	Oil level controller with two trip points for low level 3/4" drop and 1" drop
512	Oil level controller with case to ground electric switch
LCP	Oil level controller with a pneumatic switch
LC	Oil level controller only
ES	Explosion proof switch only - no level control
PS	Pneumatic switch only - no level control

## OPTIONS

FS	Fire Safe Valve
HP-A	High Pressure Oil Inlet, 5-35 psi
HP-B	High Pressure Oil Inlet, 36-70 psi
HL	High/Low Switch
DPDT	Double Pole, Double Throw Switch

## ORDERING SYSTEM

**LCE****24****HP-A****HL****FS**

### Oil Level Controller

LC	ES
LCE	PS
LCM	3318
LCP	3358
512	

### Mounting Adapters

(See chart on page 2109)

### Inlet Oil Pressure

HP-A	5-35psi	(Leave blank for Static Head Pressure)
HP-B	36-70psi	

### Electric Switch Options

(Leave blank for SPDT)

DPDT

### Fire Safe Valves

### Additional Options

V	Fluorocarbon Valve Seat
K	Hose Kit

Example shown above: LCE - 24 - HP-A - HL - FS - VK is an oil level controller with an explosion-proof switch with a bracket for an Ariel JGJ compressor, a high pressure inlet valve good for inlet pressure from 5 to 35 psi, a high or low level switch, fire safe valves, a fluorocarbon valve seat, and a hose kit.

# PRODUCT SPECIFICATION SHEET

	LCE	LCM	3318	3358	512	LCP	LC	ES	PS
FIRE SAFE OPTION	X	X	X	X	X	X	X	X	X
STATIC HEAD PRESSURE 1-15 FT	X	X	X	X	—	X	X	—	—
STATIC HEAD PRESSURE 1-12 FT	—	—	—	—	X	—	—	—	—
HIGH PRESSURE INLET OIL 54-55 PSI	X	X	X	X	—	X	X	—	—
HIGH PRESSURE INLET OIL 50-70 PSI	X	X	X	X	—	X	X	—	—
HIGH AND/OR LOW LEVEL SWITCH	X <sup>***</sup>	—	—	—	—	—	—	X <sup>***</sup>	—
CONTROLLER WITH HIGH AND LOW LEVEL SWITCH	—	—	X <sup>*</sup>	—	—	—	—	—	—
CONTROLLER WITH LOW AND LOW LOW LEVEL SWITCH	—	—	—	X <sup>**</sup>	—	—	—	—	—
CONTROLLER WITH DPDT SWITCH	X	—	—	—	—	—	—	X	—
CSA CERTIFIED CLASS 1, DIV. 1, DIV. 2, GROUP C & D	X	—	—	—	—	—	—	X	—
FOR INTRINSICALLY SAFE APPLICATION	X	X	X	X	—	—	—	X	—

X = is available on this model

— = is not available on this model

\* Unit constructed with two independent switches, one for high level and the second for low level alarm

\*\* Unit Constructed with two trip points for low level 3/4" drop and 1" drop

\*\*\* Unit Constructed with single switch, which will trip at 3/4" above and/or 3/4" below

# OTHER LUBRICATION PRODUCTS FROM KENCO



No-Flow Switch



Low Flow Meter



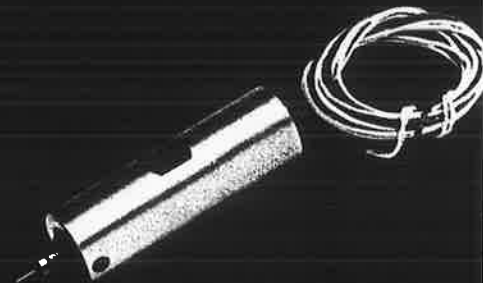
Oil Supply Tanks  
and Stands



Pneumatic Float  
Switch



Electronic Lube  
Guard



Proximity Switch  
for Drivler Block

Represented by:

KENCO Sales Offices

Tulsa

15855 E. 21st  
Tulsa, OK 74116  
phone 918 663 4400  
fax 918 663 4400  
http://www.kencoeng.com  
email: info@kencoeng.com

Baton Rouge

1000 N. 10th St.  
Baton Rouge, LA 70802  
phone 225 775 2200  
http://www.kencoeng.com  
email: kenco@kencoeng.com

**KENCO**  
ENGINEERING

# Installation for L1100, L1200, L1200N Serie Liquid Level Switches and DV850, DV875, DV2100 Series Dump Valves

LSL-235A/B



Dump Valve models are patent pending

Please read the following instructions before installing. A visual inspection for damage during shipping is recommended before mounting.

## GENERAL INFORMATION

### WARNING

BEFORE BEGINNING INSTALLATION OF THIS MURPHY PRODUCT

- ✓ Disconnect all electrical power to the machine.
- ✓ Make sure the machine cannot operate during installation.
- ✓ Follow all safety warnings of the machine manufacturer.
- ✓ Read and follow all installation instructions.
- ✓ OBSERVE all pressure and electrical ratings and requirements for the devices and the operating environment.
- ✓ BE SURE all pressure HAS BEEN REMOVED from the vessel before opening any pressure connections.

### Description

Series L1100 and L1200 Liquid Level Switches are float activated to operate an electrical SPDT snap switch (optional DPDT on some models) for alarm or shutdown of an engine or electric motor. They screw directly into the wall of the vessel. Series L1200 can also be used with a weld collar or external float chamber.

Series L1200N is a float-activated, pneumatic-vent level device used to operate dump valves or similar devices. This model screws directly into the vessel or can be mounted via an external float chamber. It **cannot** be used with weld collar 15050375. Model variations include a dump valve operator with or without a filter/pressure regulator and indicating pressure gauge.

All stainless steel versions of L1200 and L1200N series: Canadian Registration Number OF1476.2.

Series DV850, DV875 & DV2100 Dump Valves receive a pneumatic input signal to cause an orifice to open or close allowing liquid condensate to be drained from a pressure vessel. A pop up button indicates valve open/closed. Stainless steel versions available.



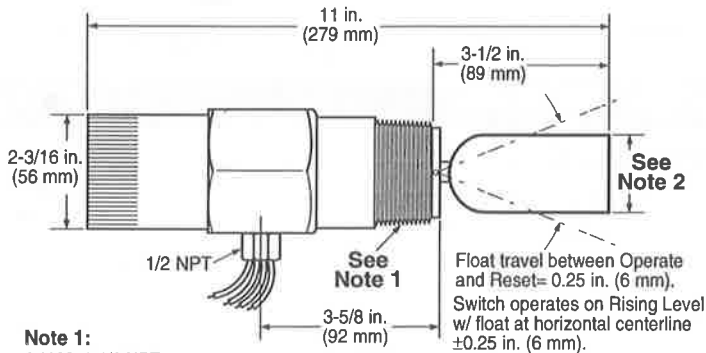
Specifications	L1100	L1111	L1150	L1200	L1250	L1200N	L1200NDVO	L1200NDVOR
<b>Body</b>								
• Standard: Electroless Nickel plated steel	X <sup>A</sup>	X <sup>A</sup>	X <sup>A</sup>	X <sup>B</sup>	X <sup>B</sup>	X <sup>B</sup>	X <sup>B</sup>	X <sup>B</sup>
• Optional: 316 Stainless Steel†	X <sup>A</sup>	X <sup>A</sup>	X <sup>A</sup>	X <sup>B</sup>	X <sup>B</sup>	X <sup>B</sup>	X <sup>B</sup>	X <sup>B</sup>
<b>Pressure Rating</b>								
• 15 psi (103 kPa) [1.03 bar] Polyethylene Float			X		X			
• 1500 psi (10.3 MPa) [103.42 bar] Stainless Float	X	X		X		X	X	X
• 2000 psi (13.8 MPa) [138 bar] BUOYGLAS™ Float	X	X		X		X	X	X
<b>Temperature Rating</b>								
• Standard: -20/175°F (-29/79°C)			X		X			
• Standard: -20/300°F (-29/149°C)	X	X		X		X	X	X
• Optional: -20/400°F (-29/204°C)*	X	X		X		X	X	X
<b>Specific Gravity</b>								
• Standard: 0.5 with BUOYGLAS™ float	X	X		X		X	X	X
• Optional: 0.65 with 304 Stainless Steel†	X	X		X		X	X	X
• Standard 0.73 Polyethylene Float			X		X			
<b>Electrical</b>								
• Standard SPDT: 5 A @ 125/480 VAC (see p. 3 for full ratings)	X	X	X	X	X			
• Optional DPDT: 10 A @ 250 VAC (see p. 3 for full ratings)	X	X	X	X	X			
<b>Wire:</b> 18 AWG x 36 in. (1.0 mm <sup>2</sup> x 914 mm)	X	X	X	X	X			
<b>O-Rings:</b> Viton	X	X	X	X	X	X	X	X
<b>Valve:</b> Two-way snap-action vent type • 1/8 in. (3 mm) orifice w/Viton "A" seat • 1/8 NPT inlet; 1/4 NPT outlet • 30-70 psi (207-483 kPa) [2.07-4.83 bar] operating pressure						X	X	X
<b>Dump Valve Operator:</b> Operates Murphy DV Series dump valves or similar.							X	X
<b>Pressure Regulator/Filter and Murphy 20BPG:</b> 0-75 psi (0-51 / kPa) [0-5.17 bar] pressure gauge. Maximum input 300 psi (2.07 MPa) [20.68 bar].								X
<b>Operation:</b> H=For high level, L=For low level	H	L	H	H	H	H	H	H

A=1-1/2 NPT B=2 NPT †Meets NACE standard MR-01-75 for direct exposure to H<sub>2</sub>S service. \*Not available with DPDT snap-switch.

\*\*Products covered by this literature comply with EMC Council directive 89/336/EEC regarding electromagnetic compatibility.

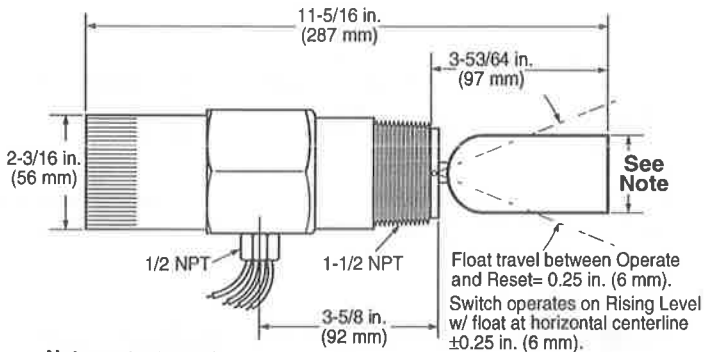
# DIMENSIONS

## L1100 and L1200



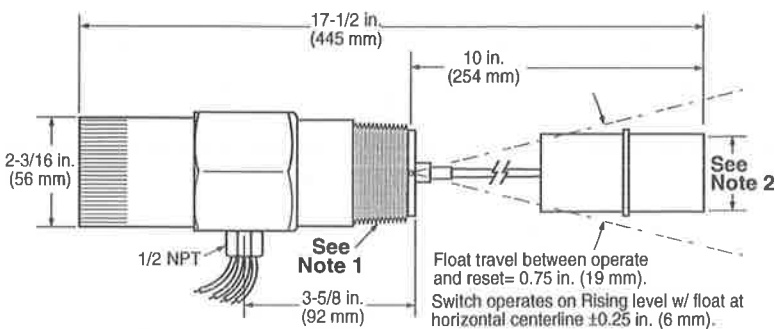
**Note 1:**  
**L1100:** 1-1/2 NPT  
**L1200:** 2 NPT  
**Note 2:** 1-9/16 (40 mm)  
**SF option:**  
**L1100:** 1-1/2 (38 mm)  
**L1200:** 1-3/4 (44 mm)

## L1111



**Note:** 1-9/16 (40 mm)  
**SF option:** 1-1/2 (38 mm)

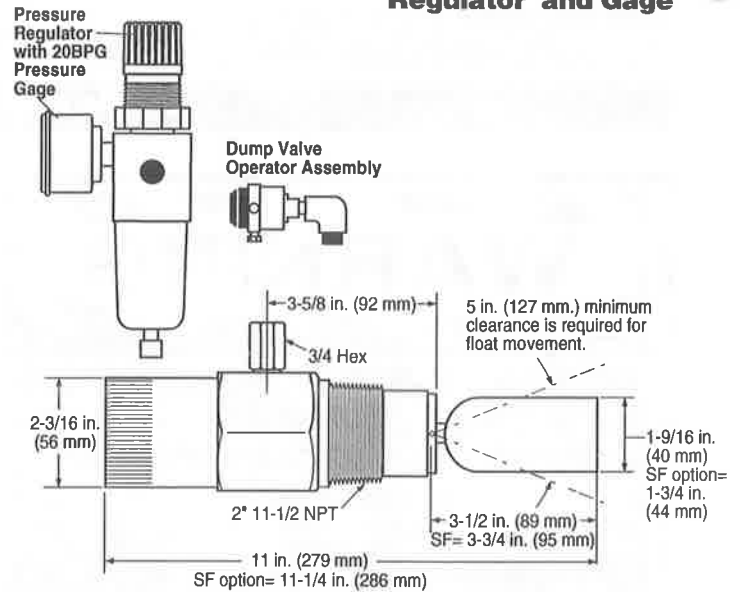
## L1150 and L1250



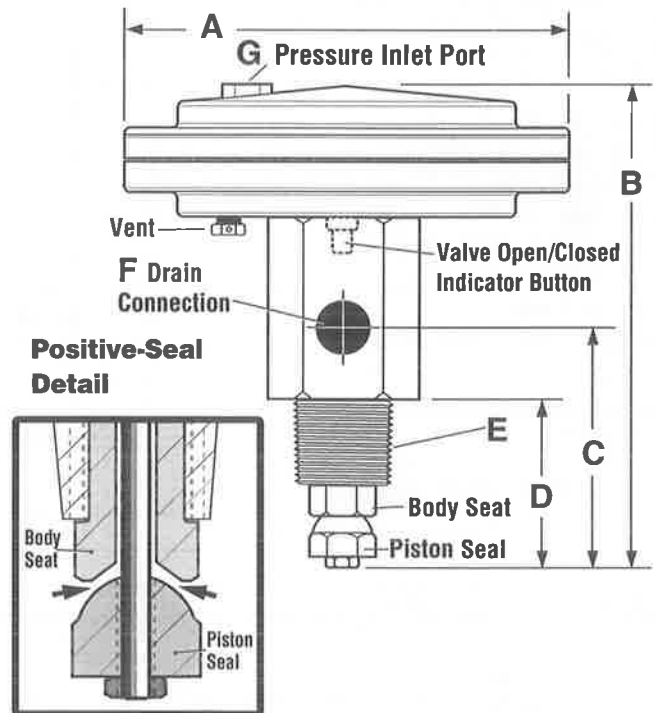
**Note 1:**  
**L1150:** 1-1/2 NPT  
**L1250:** 2 NPT

**Note 2:**  
**L1150:** 1-1/2 in. (38 mm)  
**L1250:** 2 in. (51 mm)

## L1200N, L1200NDVO and L1200NDVOR with Dump Valve Operator, Pressure Regulator and Gage



## DV850, DV875, and DV2100 Series Dump Valves



	DV850/SS	DV875/SS	DV2100/SS
A	6-3/4 (171)	6-3/4 (171)	6-3/4 (171)
B	7-9/64 (181)	7-9/64 (181)	7-59/64 (201)
C	3-9/32 (83)	3-9/32 (83)	3-63/64 (101)
D	2-19/64 (58)	2-19/64 (58)	2-5/32 (55)
E	1 NPT	1 NPT	2 NPT
F	1/2 NPT	3/4 NPT	1 NPT
G	1/8 NPT	1/8 NPT	1/8 NPT

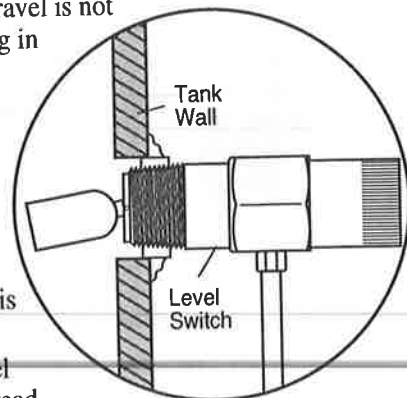
NOTE: Dimensions are in inches and (millimeters)



## PRESSURE VESSEL INSTALLATION: L1100, L1200, and L1200N

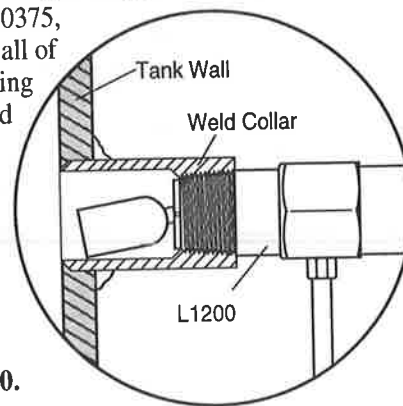
### Direct Installation into the Wall of the Pressure Vessel

- Determine that the float travel is not obstructed by the coupling in the vessel wall, internal baffles, etc. Do NOT use more than one arm extension P/N 15050395.
- BE SURE that the float and extension are tight and that the lock washer is in place.
- Before installing the level switch a suitable pipe thread sealant is recommended. Screw the unit directly into the threaded connection in the wall of the pressure vessel.
- Be sure that the electrical connection is positioned at the bottom. For L1200N the 1/8 NPT pneumatic connection should be on top (the 1/4 NPT vent connection should be on the bottom). See "Pneumatic models" section for further instructions for the L1200N.
- Make the electrical wiring connections according to appropriate wiring diagrams for the alarm or shutdown system to be used. The electrical connection is 1/2-14 NPT.
- BE SURE all electrical connections are insulated and the cover is fully installed before reconnecting electrical power.
- BE SURE all pressure connections are tight before pressurizing the system.



### Installation with a Weld Collar

- The weld collar, P/N 15050375, must be welded into the wall of the pressure vessel according to code standards and good welding practices.
- Follow above instructions for installation directly into the wall of the pressure vessel.
- NOTE:** Weld collar 15050375 can be used ONLY with model L1200.



### Installation Using External Float Chamber 15050697

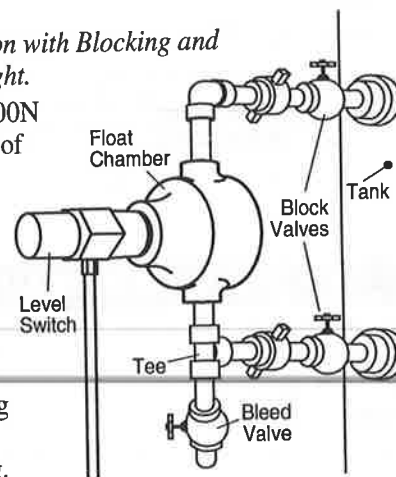
**CAUTION: USE "NON SPARKING TOOLING".**

- Install the float chamber 15050697 on the outside wall of the pressure vessel using 1 NPT piping. Position the 2 NPT threaded connection at the height where you want the level switch to operate. The 2 NPT threaded connection must be positioned away from the tank wall.

- A tee is typically installed at the bottom of the lower 1 inch pipe riser to allow draining of the float chamber for servicing or replacement.

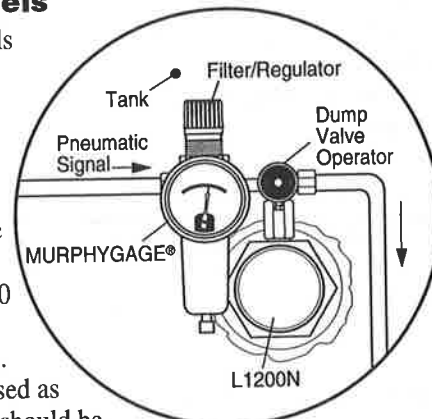
**NOTE:** A typical installation with Blocking and Bleed valves is shown at right.

- Install the L1200 or L1200N in the 2 NPT connection of the float chamber. BE SURE float travel is not restricted and that the float is tight onto the float shaft.
- To complete installation and wiring, follow the instructions for mounting directly into wall of the vessel and for wiring.



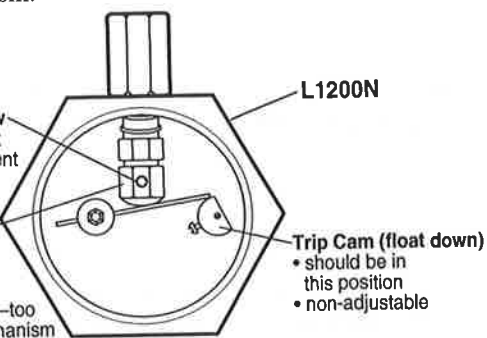
### Pneumatic Models

- All pneumatic models operate on the vent principle. The pneumatic signal source MUST BE CLEAN AND DRY. The input pneumatic signal must be regulated between 30 and 70 psi (207-483 kPa) [2.07-4.83 bar]. If produced gas is used as the signal source, it should be taken after gas passes through the final scrubber. A suitable filter must be positioned before the L1200NDVO to prevent liquids and/or particulates from entering the dump valve operator. **NOTE:** Check filter periodically for wear and tear and elements that hamper the flow of the pneumatic signal.
- All pressure connections must be tight and maintained tight so as not to leak air/gas.
- Valve seat adjustment can be made if air/gas begins to leak. Care should be taken when adjusting as only slight movement is necessary to stop the leakage; excessive force will bind the seating mechanism.



Hex Socket Set Screw  
• loosen for adjustment  
• tighten after adjustment

Hex Adjustment Nut  
• turn left until air seepage stops  
• Caution: only slight adjustment is needed—too much will lock up mechanism



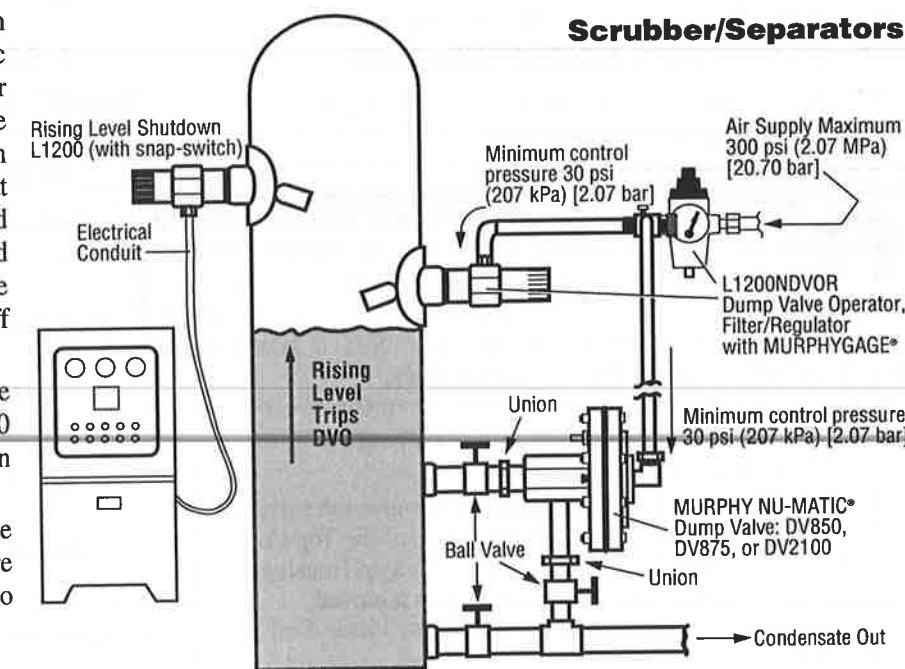
L1200N

Trip Cam (float down)  
• should be in this position  
• non-adjustable

## TYPICAL INSTALLATION ON GAS COMPRESSORS

### Basic Operation

As condensate rises in the scrubber, the float on the L1200NDVOR rises and trips its pneumatic valve. The valve opens allowing pressure to enter the dump valve pilot chamber. Once the pressure enters the pilot chamber it forces the diaphragm and valve stem forward thus opening the valve seat (valve open/closed indicator button pops out) and releasing condensate through the valve stem and out the drain. As the condensate level drops, the L1200NDVOR pneumatic valve closes to shut off the pressure to the dump valve causing it to close. If for any reason the condensate continues to rise beyond normal dump levels, model L1200 operates the alarm and/or shuts down the equipment. The L1200NDVOR Filter/Regulator and the MURPHYGAGE® help keep the control pressure clean and dry. They also allow the operator to adjust pressure to recommended levels.



## DUMP VALVE INSTALLATION

### DV850 - DV875 - DV2100

**CAUTION: USE "NON SPARKING TOOLING".**

The following steps describe the "Block and Bleed" method for installing the dump valve. The "Direct Mounting" method to the tank wall is also accepted.

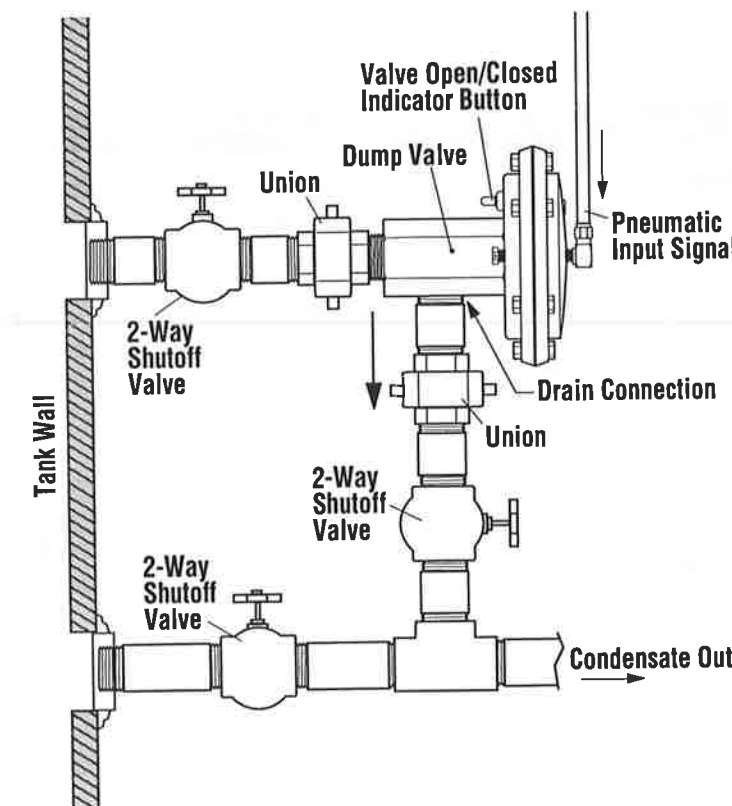
- Install a manual shutoff (2-way) valve and a union between the DV valve and the vessel to facilitate valve repair or replacement.
- Position the DV valve drain connection so it is on the bottom.
- Install a 2-way valve to the drain line between the lower vessel entry and the condensate out line.
- Be sure the unit is screwed tight and does not leak liquid.
- Install the piping for the pneumatic input signal into the 1/8 NPT threaded connection of the pressure inlet port (on top of the DV valve).
- Install a 2-way valve and union between the DV drain connection and the condensate out line.

**NOTE:** The typical procedure to remove the valve should be:  

- Close the shutoff valve between the scrubber and the DV valve.
- Operate the dump valve to equalize pressure to the drain (condensate out) line.
- Close the shutoff valve downstream of the drain.

**Be Careful,** pressure will still be in the system at the drain pressure when the unions are loosened.

### Typical Dump Valve installation



## REPLACING THE DUMP VALVE SEAT KIT

### Replacing the Seat Kit on the Dump Valves

**Tools needed:** 7/8" hex wrench, 7/16" hex wrench, 1-1/8" hex wrench, and thread sealer; optional pressure source.

**NOTE:** Relieve pressure from scrubber or use the block valves before removing the DV dump valve.

1. Remove the valve from the Scrubber.

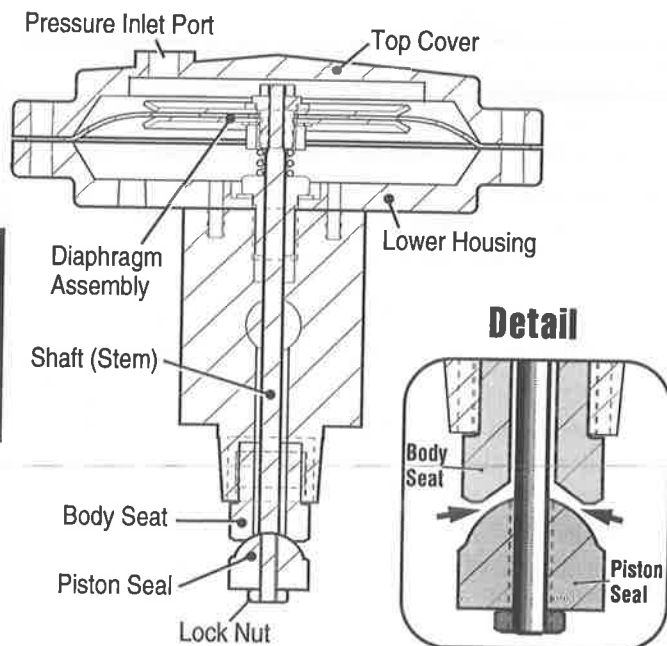
**CAUTION:** THE BODY SEAT AND PISTON SEAL WILL BE DAMAGED IF ALLOWED TO TURN AGAINST EACH OTHER. THE PREFERRED METHOD IS TO USE AIR TO KEEP THE VALVE OPEN. IF AIR IS NOT AVAILABLE, CAREFULLY FOLLOW THE ALTERNATE INSTRUCTIONS (STEPS 2A & 8A). ALSO, DO NOT GRIP THE OPERATING STEM WITH ANY TOOLS. IF STEM NEEDS TO BE HELD, USE THE NUT ON THE BACK OF THE DIAPHRAGM.

2. Apply 30 psi to the pressure inlet port (top of valve). The Shaft and Piston Seal will extend.

2A. **IF AIR IS NOT AVAILABLE DO THE FOLLOWING:** Remove the valve Top Cover (bolts/nuts). Note the orientation of the Top Cover to the bottom. Mark both sides of the Diaphragm Housing before dis-assembly. Once the Top Cover is removed, carefully turn the valve upside down with the Piston Seal pointing up. Clamp the bottom housing down, or secure it against a flat surface to compress the spring and open the Piston Seal and Body Seat. Be careful not to damage the diaphragm. The valve must be kept in this fashion, with this much clearance throughout the following operations.

3. Hold the Piston Seal with the 7/8" hex wrench, and remove the Locknut with 7/16" hex wrench.

4. Unscrew the Piston Seal with the 7/8" hex wrench. Now, unscrew the Body Seat (use 7/8" hex wrench for DV850 and DV875 models). Use the 1-1/8" hex wrench for the DV2100 Series models.



5. Apply thread sealer to new Body Seat, and screw it in place tightening with the wrench until it stops. **NOTE:** Clean the female threads in the body before inserting the new Body Seat to facilitate threading.
6. Apply thread sealer to the shaft (stem), and screw the new Piston Seal on to the shaft (stem).
7. Hold the Piston Seal with the 7/8" hex wrench and screw the Locknut in place.
8. Remove the 30 psi pressure to the pressure inlet port, and re-install the valve into the scrubber.
- 8A. Re-install the Top Cover, paying attention to the alignment marks made in step 2A. Re-install the DV into the scrubber.

## REPLACING THE DUMP VALVE DIAPHRAGM ASSEMBLY

### Replacing the Diaphragm Assembly for all DV models (Refer to the illustration above)

**Tools needed:** 7/8" hex wrench, 7/16" hex wrench, 5/8" hex wrench or socket, and thread sealer.

**NOTE:** Relieve pressure from scrubber or use the block valves before removing the DV dump valve.

1. Remove the valve from the Scrubber.

2. Remove the valve Top Cover (bolts/nuts). Note the orientation of the Top Cover to the bottom. Mark both sides of the Diaphragm Housing before dis-assembly.

**CAUTION:** MAKE SURE TO USE A 7/8" HEX WRENCH TO HOLD THE PISTON SEAL WHILE REMOVING THE DIAPHRAGM ASSEMBLY. DO NOT GRIP THE DIAPHRAGM (BLACK RUBBER) WITH ANY TOOLS.

3. Hold the Piston Seal with a 7/8" hex wrench making sure to keep the shaft (stem) from turning, and remove the nut on the back of the diaphragm assembly with the 7/16" wrench.

4. While holding the piston seal with the 7/8" wrench, proceed to remove the diaphragm assembly by hand.

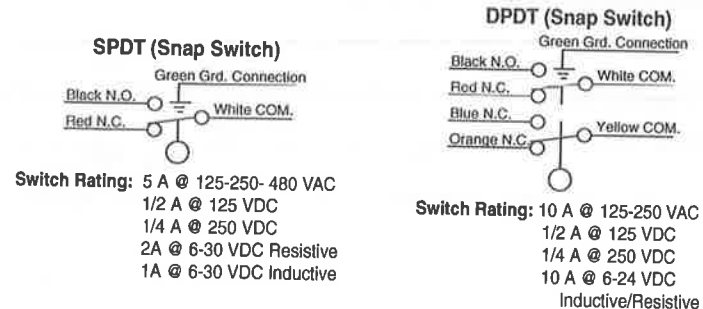
**NOTE:** You will be turning the assembly against the spring when unscrewing the diaphragm assembly.

5. To re-assemble the assembly, apply thread sealer to the shaft/stem threads and hold the Piston Seal with a 7/8" hex wrench.
6. Keep holding the Piston Seal with 7/8" hex wrench. Make sure the 3/4" nut side of the new diaphragm assembly is toward the shaft. Press the diaphragm assembly into the shaft threads and tighten it on to the shaft threads by hand.
7. Keep holding the Piston Seal with 7/8" hex wrench. Apply thread sealer to 7/16" nut, and screw it on to the shaft threads to lock the diaphragm assembly in place, tighten the nut with the 7/16" wrench.
8. Press down the diaphragm assembly with your hands to open the valve, and *very carefully* turn to align the diaphragm holes with the lower housing bolt holes.

**CAUTION:** THE BODY SEAT AND PISTON SEAL WILL BE DAMAGED IF ALLOWED TO TURN AGAINST EACH OTHER.

9. Re-install the Top Cover, paying attention to the alignment marks made in step 2. Be sure to tighten the bolts and nuts evenly. Re-install the DV into the scrubber.

## ELECTRICAL INFORMATION



## REPLACEMENT PARTS

Order by part number designation.

### L1100/L1200\*

- 15000893: BUOYGLAS™ float  
 15000894: Stainless Steel float for L1200  
 15000937: Stainless Steel float for L1100  
 15000124: SPDT snap switch assembly  
 15010213: L1100 counter balance assembly  
 15010214: L1200 counter balance assembly

### L1200N

- 15050420: Cam spring return  
 15050421: Cam  
 15000893: BUOYGLAS™ float  
 15000894: Stainless Steel float for L1200N  
 15050453: Valve stem  
 15010189: Counter balance assembly

### L1200NDVO and L1200NDVOR

- 55050621: Regulator only  
 05703160: 20BPG Pressure MURPHYGAGE® 0-75 psi (517 kPa) [5.17 bar]  
 15010216: DVO assembly  
 00003341: Filter for regulator  
 00003340: Regulator Diaphragm Kit

### DV850, DV850SS, DV875, DV875SS, DV2100 and DV2100SS

- 55000219: Diaphragm Assembly (all models)  
 55000224: Seat Kit (DV850, DV850SS, DV875 and DV875SS)  
 55000225: Seat Kit (DV2100 and DV2100SS)  
 55050617: Optional Adapter Bushing 2 NPT to 1 NPT

\*To maintain hazardous location listings, all other repairs must be made by the factory.

### Warranty

A two-year limited warranty on materials and workmanship is given with this Murphy product. Details are available on request and are packed with each unit.

In order to consistently bring you the highest quality, full featured products, we reserve the right to change our specifications and designs at any time.

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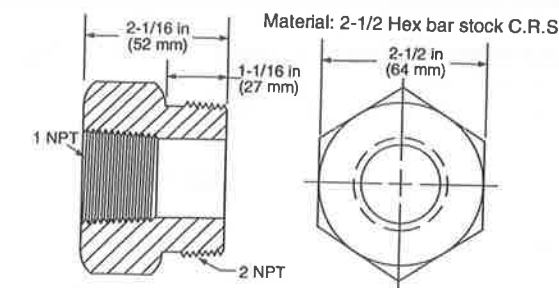
USA-ISO 9001 FM 28221  
 UK-ISO 9002 FM 29422

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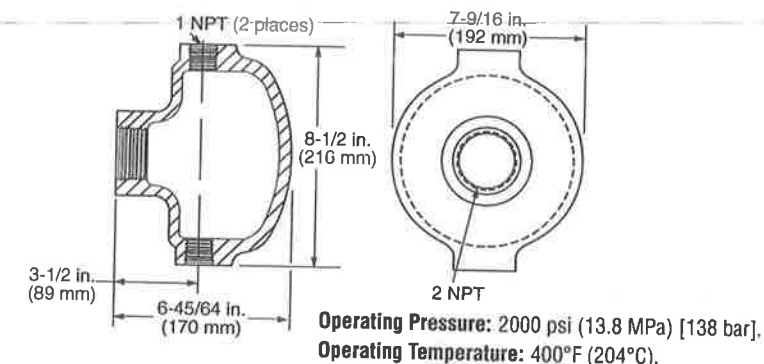
## ACCESSORIES

Order by part number designation.

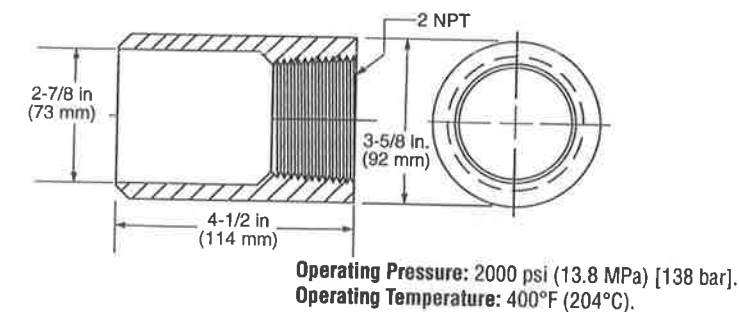
### 55050617: DV850/DV875 Adapter Bushing



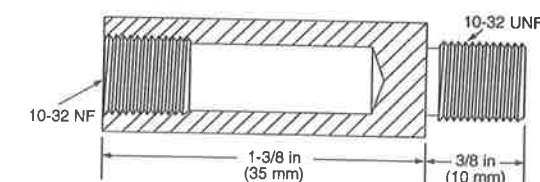
### 15050697: External Float Chamber



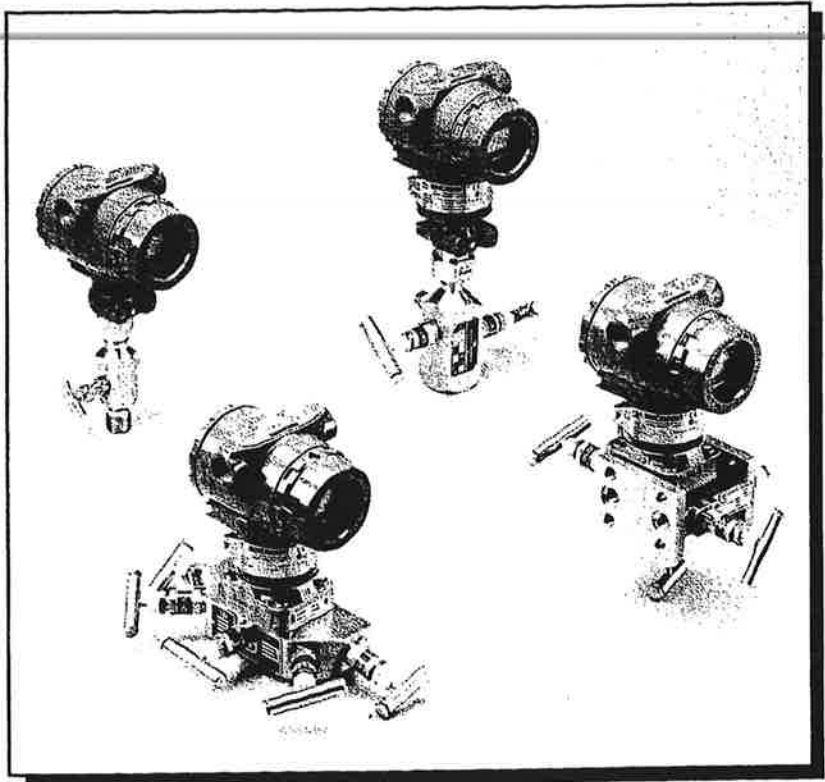
### 15050375: Weld Collar



### 15000892: Float Shaft Extension



# Model 3051 Smart Pressure Transmitter Family



**ROSEMOUNT®**

**FISHER-ROSEMOUNT™ Managing The Process Better.™**



# Model 3051 Smart Pressure Transmitter Family

Model 3051 Smart Software Revision 5.2.x

## NOTICE

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.

Within the United States, Rosemount Inc. has two toll-free assistance numbers:

### Customer Central

Technical support, quoting, and order-related questions.

1-800-999-9307 (7:00 am to 7:00 pm CST)

### North American Response Center

Equipment service needs.

1-800-654-7768 (24 hours—includes Canada)

Outside of the United States, contact your local Rosemount representative.

## ⚠ CAUTION

The products described in this document are NOT designed for nuclear-qualified applications. Using non-nuclear qualified products in applications that require nuclear-qualified hardware or products may cause inaccurate readings.

For information on Rosemount nuclear-qualified products, contact your local Rosemount Sales Representative.

*Rosemount Model 3051 Smart Pressure Transmitters may be protected by one or more of the following U.S. Patent Nos. 4,370,890; 4,466,290; 4,612,812; 4,791,352; 4,798,089; 4,818,994; 4,833,922; 4,866,435; 4,926,340; 4,988,990; and 5,028,746. Mexico Patentado No. 154,961. May depend on model. Other foreign patents issued and pending.*

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## USING THIS MANUAL

The sections in this manual provide information on installing, operating, and maintaining devices from the Rosemount Model 3051 Smart Pressure Transmitter Family. The sections are organized as follows:

### **Section 2: Transmitter Functions**

Section 2 provides instruction on commissioning and operating Model 3051 Pressure Transmitters. Information on software functions, configuration parameters, and on-line variables is also included.

### **Section 3: Installation**

Section 3 contains mechanical and electrical installation instructions.

### **Section 4: Troubleshooting**

Section 4 provides troubleshooting techniques for the most common Model 3051 transmitter operating problems.

### **Section 5: Specifications and Reference Data**

Section 5 supplies reference and specification data for the Model 3051 Smart Pressure Transmitter Family.

### **Section 6: Options**

Section 6 describes the mounting and configuration options available for Model 3051 transmitters.

### **Appendix A: HART Communicator**

Appendix A gives an overview of the Model 275 HART Communicator, defines its command menu tree for the Model 3051 family, and provides a table of its fast key sequences. A table of diagnostic messages is also included.

### **Appendix B: Model 268 Communicator**

Appendix B gives an overview of the Model 268 Communicator, defines its command menu tree for the Model 3051 family, and provides a table of its fast key sequences. A table of diagnostic messages is also included.

### **Appendix C: Approval Drawings**

Appendix C contains intrinsic safety approval drawings.

### **Appendix D: European ATEX Directive Information**

Appendix D contains European ATEX Directive information.

## MODELS COVERED

The following Rosemount Model 3051 Pressure Transmitters are covered by this manual:

### **Model 3051CD Differential Pressure Transmitter**

The Model 3051CD measures pressures from 0.1 inH<sub>2</sub>O to 2000 psi (0,02 to 13 800 kPa) with superior performance including 0.075% accuracy and 100:1 rangeability.

### **Model 3051CG Gage Pressure Transmitter**

The Model 3051CG measures gage pressures from 2.5 inH<sub>2</sub>O to 2000 psig (0,62 to 13 800 kPa) using proven Rosemount capacitance cell technology.

### **Model 3051CA Absolute Pressure Transmitter**

The Model 3051CA measures absolute pressures from 0.167 to 4000 psia (8,6 mmHg<sub>a</sub> to 27 580 kPa) using a Rosemount patented piezoresistive silicon sensor.

### **Model 3051L Liquid Level Transmitter**

The Model 3051L provides precise level and specific gravity measurements from 2.5 to 8310 inH<sub>2</sub>O (0,62 to 2 070 kPa) for a wide variety of tank configurations.

### **Model 3051H High Process Temperature Pressure Transmitter**

The Model 3051H provides high process temperature capability to 375 °F (191 °C) without the use of remote diaphragm seals or capillaries. Model 3051H transmitters are available for differential and gage configurations (3051HD and 3051HG).

### **Model 3051P Reference Class Pressure Transmitter**

The Model 3051P, at 0.05% accuracy, is the most accurate pressure transmitter available. The Model 3051P is ideal for fiscal and allocation metering.

### **Model 3051T Gage and Absolute Pressure Transmitter**

The Model 3051T measures absolute and gage pressures from 0.3 to 10000 psig/a (2,07 to 68 900 kPa). The Model 3051T uses a single isolator design and microprocessor-based electronics.

### **New Model 3051CD0 Draft Range Transmitter**

See page 1-4 for the details of the Model 3051CD0 transmitter.

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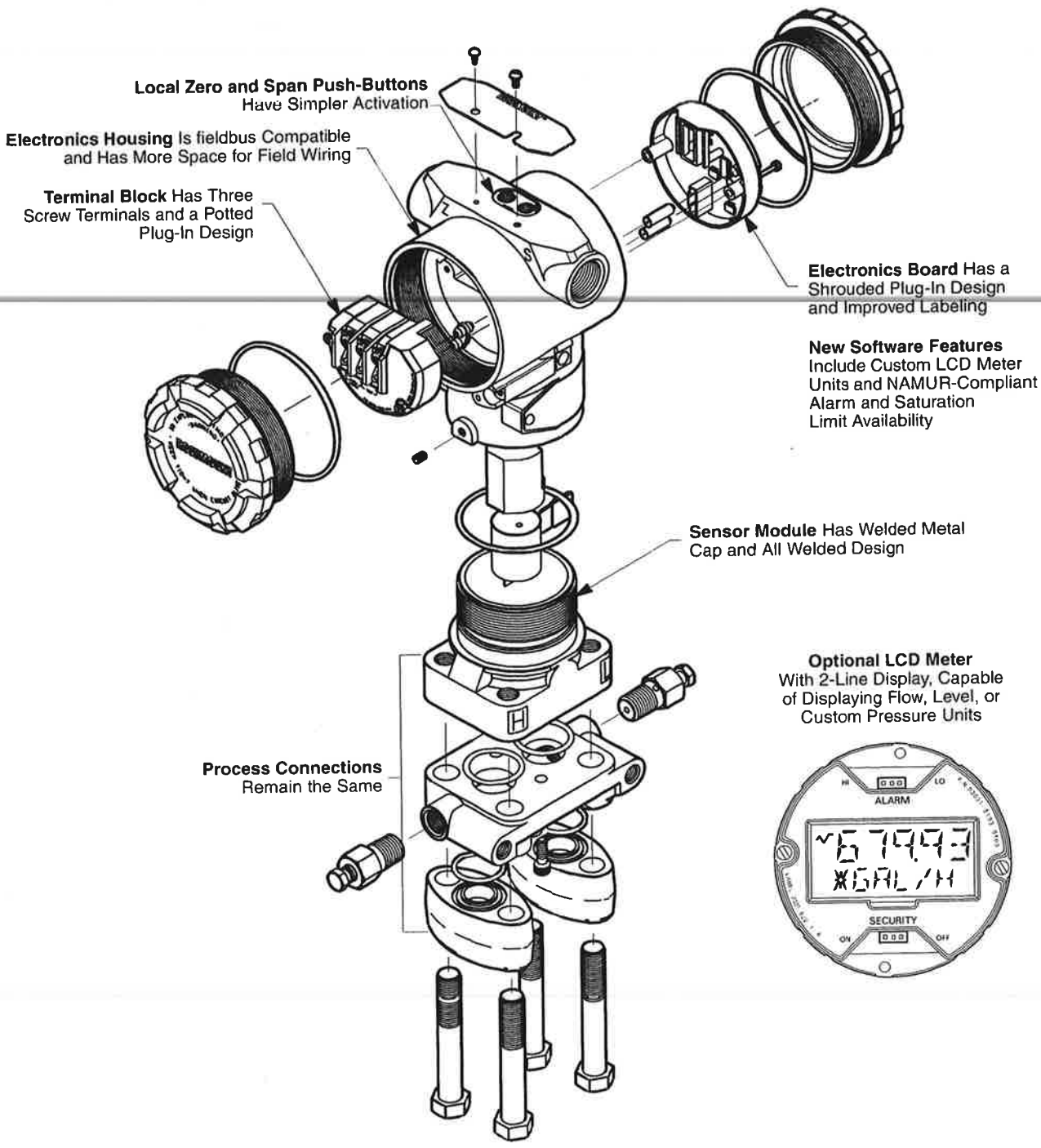
#### **NOTE**

For Model 3051 with FOUNDATION™ fieldbus, see Rosemount Product Manual 00809-0100-4774.

---

# NEW FEATURES OF THE MODEL 3051 PRESSURE TRANSMITTER

The latest line of Rosemount Model 3051 Pressure Transmitters feature physical and software enhancements for additional functionality and increased ease of use.



3051-3031A08B; 3C51LCD

## MODEL 3051CD0 DRAFT RANGE PRESSURE TRANSMITTER

The Model 3051CD0 Draft Range Pressure Transmitter is a true draft range offering that features a pressure range from  $-3.0$  to  $3.0$  inH<sub>2</sub>O ( $-750$  to  $750$  Pa) with spans as small as  $0.1$  inH<sub>2</sub>O ( $25$  Pa). The transmitter has an accuracy of  $\pm 0.10\%$  of range and has a redesigned capacitance sensor optimized for draft measurements. Because the Model 3051CD0 Draft Range Transmitter is based on the standard Model 3051 Transmitter design, the requirement for spare parts is reduced.

The Model 3051CD0 Draft Range Transmitter is the perfect choice for applications including:

- Furnace and boiler draft
- HVAC duct flow and clogging filter detection
- Room and chamber pressurization
- Clean room pressurization control systems
- Flow measurements with low differential pressures

### Special Draft Range Considerations

#### Installation

It is best to mount the transmitter with the isolators parallel to the ground. Installing the transmitter in this way reduces oil head effect and provides for optimal temperature performance.

Be sure the transmitter is securely mounted. Tilting of the transmitter may cause a zero shift in the transmitter output.

#### Reducing Process Noise

It is often difficult to isolate the actual process variable from process noise in draft range applications. Pressure fluctuations and air currents can make accurate draft range measurements difficult to obtain.

There are two recommended methods of reducing process noise: output damping and, in gage applications, reference side filtering.

#### Output Damping

The output damping for the Model 3051CD0 is factory set to 3.2 seconds as a default. If the transmitter output is still noisy, increase the damping time. If faster response is needed, decrease the damping time. Damping adjustment information is available in Section 2: Transmitter Functions.

#### Reference Side Filtering

In gage applications it is important to minimize fluctuations in atmospheric pressure to which the low side isolator is exposed. One method of reducing fluctuations in atmospheric pressure is to attach a length of tubing to the reference side of the transmitter to act as a pressure buffer. Another method is to plumb the reference side to a chamber that has a small vent to atmosphere. If multiple draft transmitters are being used in an application, the reference side of each device can be plumbed to a chamber to achieve a common gage reference.

# Transmitter Functions

## OVERVIEW

This section contains information on commissioning and operating Model 3051 Smart Pressure Transmitters. Tasks that should be performed on the bench prior to installation are explained in this section.

For your convenience, HART communicator fast key sequences are listed for each software function. If you are unfamiliar with the communicator or how to follow fast key sequences, please refer to Appendices A and B for communicator operations.

## SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

### Warnings (⚠)

#### ⚠ WARNING

##### **Explosions can result in death or serious injury.**

- Do not remove the transmitter covers in explosive environments when the circuit is alive.
- Transmitter covers must be fully engaged to meet explosionproof requirements.
- Before connecting a communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or nonincendive field wiring practices.

#### ⚠ WARNING

##### **Electrical shock can result in death or serious injury.**

- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

## FAILURE MODE ALARM

Model 3051 transmitters automatically and continuously perform self-diagnostic routines. If the self-diagnostic routines detect a failure, the transmitter drives its output outside of the normal saturation values. The transmitter will drive its output low or high based on the position of the failure mode alarm jumper. See Table 2-1, Table 2-2, and Table 2-3 for failure mode and saturation output levels. To select alarm position, see "Configuring Transmitter Alarm and Security Jumper Procedure" on page 2-5.

TABLE 2-1. Standard Alarm and Saturation Values.

Level	4–20 mA Saturation	4–20 mA Alarm
Low	3.9 mA	≤ 3.75 mA
High	20.8 mA	≥ 21.75 mA

TABLE 2-2. NAMUR-Compliant Alarm and Saturation Values.

Level	4–20 mA Saturation	4–20 mA Alarm
Low	3.8 mA	≤ 3.6 mA
High	20.5 mA	≥ 22.5 mA

TABLE 2-3. Low-Power Alarm and Saturation Values.

Level	1–5 V Saturation	1–5 V Alarm	0.8–3.2 V Saturation	0.8–3.2 V Alarm
Low	0.97 V	≤ 0.95 V	0.78 V	≤ 0.75 V
High	5.20 V	≥ 5.4 V	4.04 V	≥ 4.2 V

### NOTE

You can alter the actual transmitter mA output values by performing an analog output trim.

### NOTE

When a transmitter is in an alarm condition, the hand-held HART communicator indicates the analog output the transmitter would drive if the alarm condition did not exist. The transmitter will alarm high in the event of failure if the alarm jumper is removed.



  
**Alarm and Saturation Values for Transmitters Set to Burst Mode**

Transmitters set to burst mode handle saturation and alarm conditions differently.

**Alarm Conditions:**

- Analog output switches to alarm value.
- Primary variable (pressure) is burst with a status bit set.
- Percent of range follows primary variable (pressure).
- Temperature is burst with a status bit set.

**Saturation:**

- Analog output switches to saturation value.
- Primary variable (pressure) is burst normally.
- Temperature is burst normally.

  
**Alarm and Saturation Values for Transmitters Set to Multidrop Mode**

Transmitters set to multidrop mode handle saturation and alarm conditions differently.

**Alarm Conditions:**

- Primary variable (pressure) is sent with a status bit set.
- Percent of range follows primary variable (pressure).
- Temperature is sent with a status bit set.

**Saturation:**

- Primary variable (pressure) is sent normally.
- Temperature is sent normally.

  
**Alarm Level Verification**

Transmitters with shrouded design electronics boards (board version 5.3 or later) have increased functionality that allows verification testing of alarm current levels. If you repair or replace the transmitter electronics board, sensor module, or LCD meter, verify the transmitter alarm level before you return the transmitter to service. This feature is also useful in testing the reaction of your control system to a transmitter in an alarm state. To verify the transmitter alarm values, perform a loop test and set the transmitter output to the alarm value (see Tables 2-1 and 2-2 on page 2-2, and "Loop Test" on page 2-18).

## TRANSMITTER SECURITY

There are three security methods with the Model 3051 transmitter:

1. **Security Jumper:** prevents all writes to transmitter configuration.
2. **Local Keys (Local Zero and Span) Software Lock Out:** prevents changes to transmitter range points via local zero and span adjustment keys. With local keys security enabled, changes to configuration are possible via HART.
3. **Physical Removal of Local Keys (Local Zero and Span) Magnetic Buttons:** removes ability to use local keys to make transmitter range point adjustments. With local keys security enabled, changes to configuration are possible via HART.

---

### NOTE

If the security jumper is not installed, the transmitter will continue to operate in the security OFF configuration.

---

### Security Jumper (Write Protect)

You can prevent changes to the transmitter configuration data with the write protection jumper. Security is controlled by the security (write protect) jumper located on the electronics board or meter face. Position the jumper on the transmitter circuit board in the "ON" (WP on previous electronics board) position to prevent accidental or deliberate change of configuration data.

If the transmitter write protection jumper is in the "ON" position, the transmitter will not accept any "writes" to its memory. Configuration changes, such as digital trim and reranging, cannot take place when the transmitter security is on.

### Local Zero and Span (Local Keys) Software Lock Out

To enable this feature, see "Local Span and Zero Control (Local Keys)" on page 2-17.

### Physical Removal of Local Zero and Span (Local Keys)

To remove the magnetic buttons used to activate the local zero and span, use a small slotted head screwdriver and pry off the small, plastic cap located under the approval tag. Remove button assemblies and discard.

---

### NOTE

On previous versions of Model 3051, remove the magnetic screws.

---

## CONFIGURING TRANSMITTER ALARM AND SECURITY JUMPER PROCEDURE

To reposition the jumpers, follow the procedure described below.

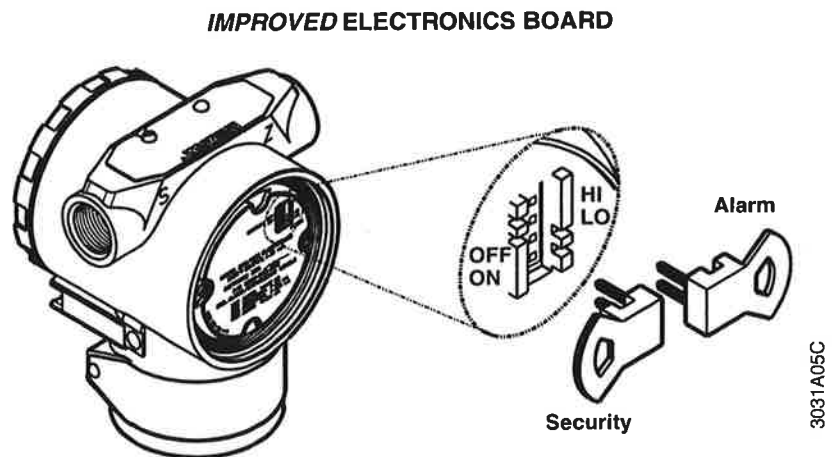


1. If the transmitter is installed, secure the loop and remove power.
2. Remove the housing cover opposite the field terminal side. Do not remove the transmitter covers in explosive atmospheres when the circuit is alive.
3. Reposition the jumpers as desired.
  - Figure 2-1 shows the jumper positions for *Improved Electronics Boards*.
  - Figure 2-2 shows *Previous Electronics Board* jumper positions.
  - Figure 2-3 shows transmitters with an optional LCD meter.
  - Figure 2-5 shows the jumper positions for low-power transmitters.



4. Reattach the transmitter cover. Transmitter covers must be fully engaged to meet explosionproof requirements.

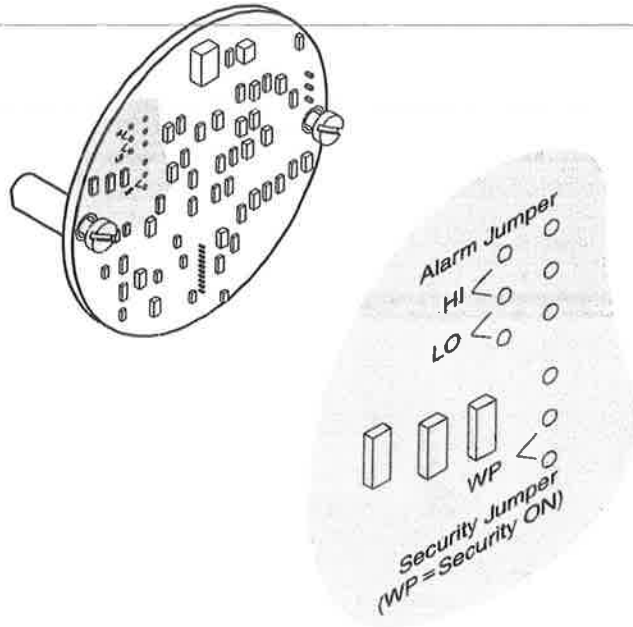
FIGURE 2-1. *Improved Electronics Board.*



### NOTE

Security jumper not installed = Not Write Protected.  
Alarm jumper not installed = High Alarm.

FIGURE 2-2. Previous Electronics Board.



On one version of the previous electronics board, the security jumper is located on the back side of the board. Contact Rosemount Customer Central at 1-800-999-9307 for more information.

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**NOTE**

Security jumper not installed = Not Write Protected.  
Alarm jumper not installed = High Alarm.

FIGURE 2-3. Improved Model 3051 with Optional LCD Meter.

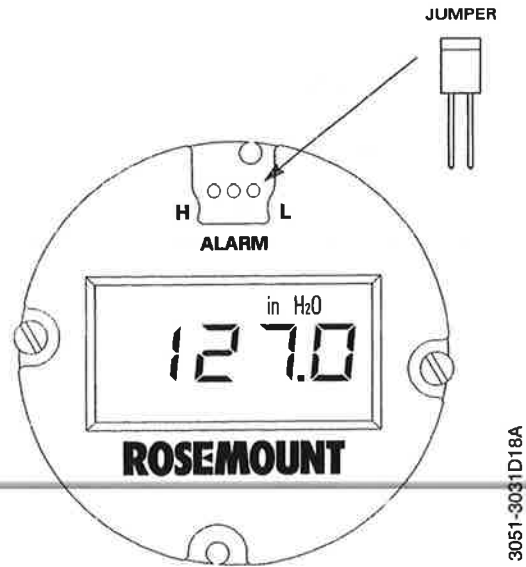


3051LCD

**NOTE**

Security jumper not installed = Not Write Protected.  
Alarm jumper not installed = High Alarm.

FIGURE 2-4. Previous Model 3051 with  
Optional LCD Meter.



**NOTE**

Alarm jumper not installed = High Alarm.

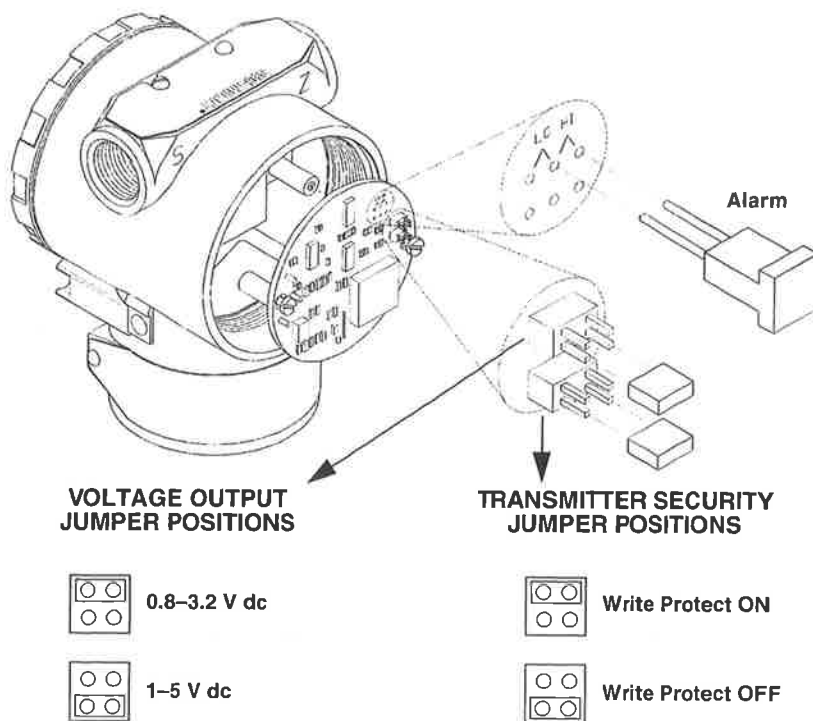
## SELECTING OUTPUT RANGE FOR LOW-POWER OUTPUT TRANSMITTERS

Low power transmitters output either 1–5 V dc or 0.8–3.2 V dc depending on the position of the voltage output jumper. To reposition the voltage output jumper, follow the procedure described on page 2-5.

### NOTE

Default low power output is 1–5 V dc. After changing output between 1–5 V and 0.8–3.2 V, perform a low power output trim.

FIGURE 2-5. Low Power Transmitter Electronics Boards.




3051-3031B05D

### NOTE

Security jumper not installed = Not Write Protected.  
 Alarm jumper not installed = High Alarm.  
 Voltage output jumper not installed = 1–5 V

## COMMISSIONING THE MODEL 3051 ON THE BENCH WITH A HART-BASED COMMUNICATOR

Commissioning consists of testing the transmitter and verifying transmitter configuration data. You may commission Model 3051 transmitters either before or after installation. Commissioning the transmitter on the bench before installation using a HART-based communicator ensures that all transmitter components are in good working order and acquaints you with the operation of the device.

 To commission on the bench, connect the transmitter and the communicator as shown in Figure 2-6 and 2-7. Make sure the instruments in the loop are installed in accordance with intrinsically safe or nonincendive field wiring practices before connecting a communicator in an explosive atmosphere. Connect the communicator leads at any termination point in the signal loop. It is most convenient to connect them to the terminals labeled "COMM" on the terminal block. Connecting across the "TEST" terminals will prevent successful communication. To avoid exposing the transmitter electronics to the plant environment after installation, set all transmitter jumpers during the commissioning stage on the bench.

For 4–20 mA transmitters, you will need a power supply capable of providing 10.5 to 55 V dc at the transmitter, and a meter to measure output current. To enable communication, a resistance of at least 250 ohms must be present between the communicator loop connection and the power supply. Do not use inductive-based transient protectors with the Model 3051.

## Setting the Loop to Manual

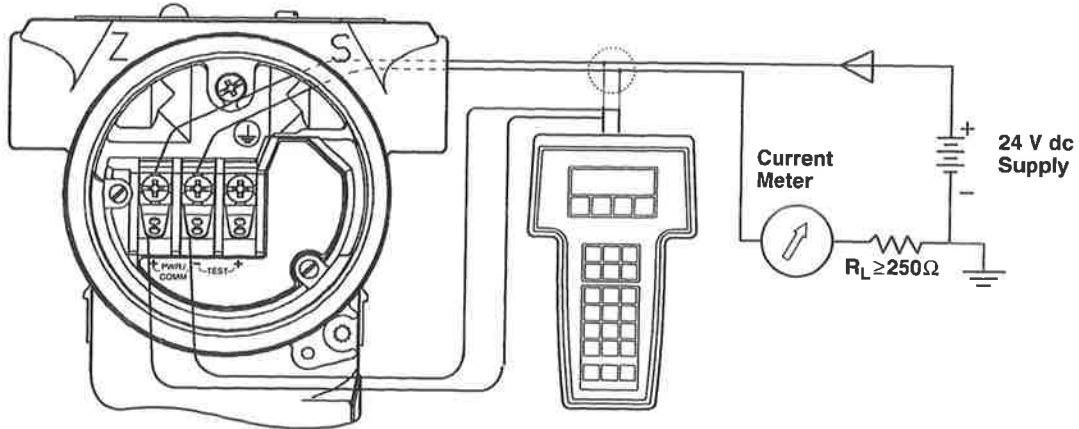
Whenever you are preparing to send or request data that would disrupt the loop or change the output of the transmitter, you must set your process application loop to manual. Both the HART Communicator Model 275 and the Rosemount Model 268 will prompt you to set the loop to manual when necessary. Keep in mind that acknowledging this prompt does not set the loop to manual. The prompt is only a reminder; you have to set the loop to manual yourself as a separate operation.

 See "Safety Messages" on page 2-1 for complete warning information.

**Wiring Diagrams**  
**(Bench Hook-up)**

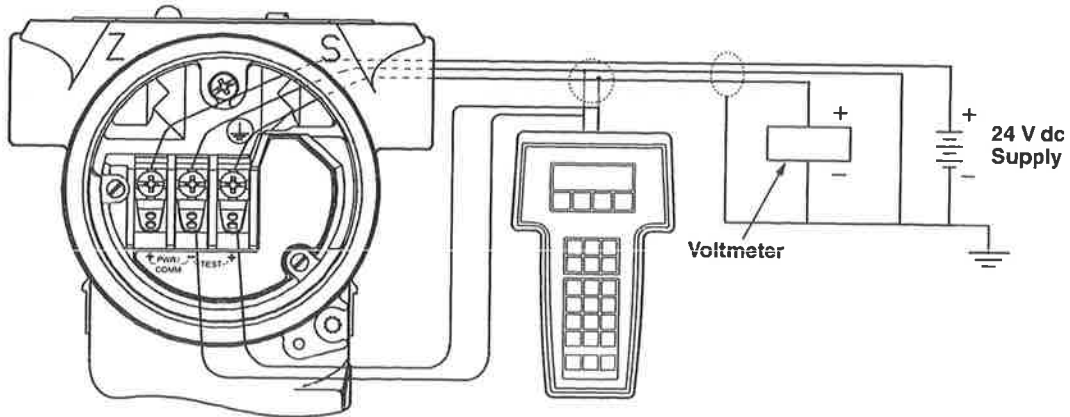
Connect the bench equipment as shown in Figure 2-6 and 2-7, and turn on the HART-based communicator by pressing the ON/OFF key. The communicator will search for a HART-compatible device and will indicate when the connection is made. If the communicator fails to connect, it will indicate that no device was found. If this occurs, refer to **Section 4: Troubleshooting**.

FIGURE 2-6. Bench Hook-up  
 (4–20 mA Transmitters).



3051-3031G02B

FIGURE 2-7. Bench Hook-up  
 (Low-Power Transmitters).



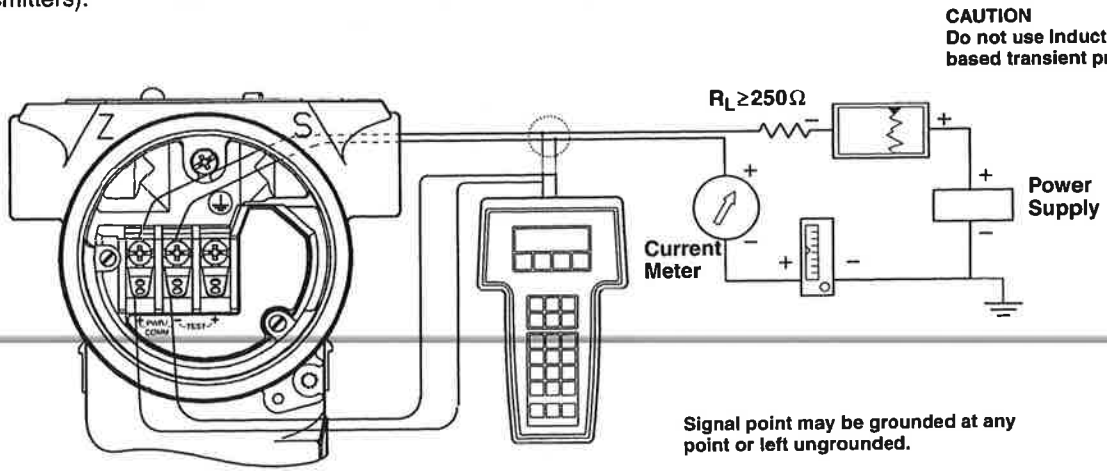
3051-3031I02B



**Wiring Diagrams  
(Field Hook-up)**

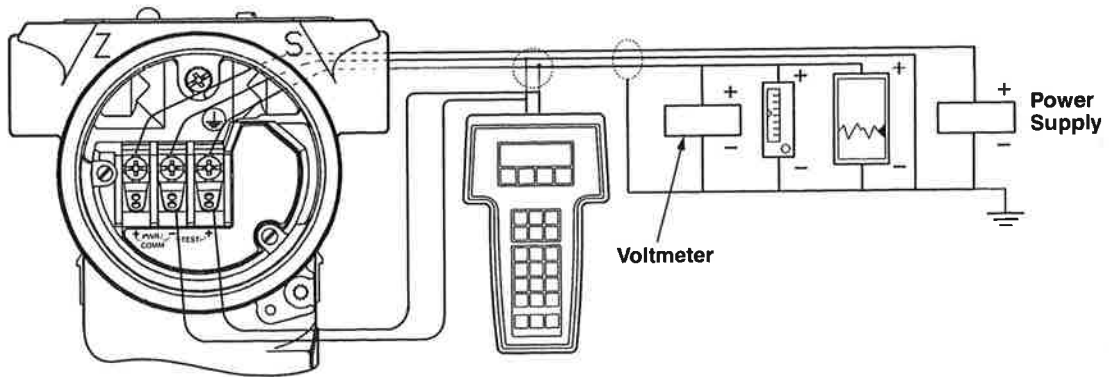
The following diagrams illustrate wiring loops for a field hook-up with a HART-based communicator.

FIGURE 2-8. Field Hook-up  
(4–20 mA Transmitters).



3051-3031H02B

FIGURE 2-9. Field Hook-up  
(Low-Power Transmitters).



3051-3031E02B

**REVIEW CONFIGURATION DATA**

HART Comm	1, 5
Model 268	Review Key

**NOTE**

Information and procedures in this section that make use of HART Communicator fast key sequences assume that the transmitter and communicator are connected, powered, and operating correctly. If you are not familiar with the HART Communicator or fast-key sequences, refer to Appendix A: HART Communicator.

Before you place the transmitter into operation, it is recommended that you review the transmitter configuration data that was set at the factory. You should review the following configuration data:

Transmitter Model	Type
Tag	Range
Date	Descriptor
Message	Minimum and Maximum Sensor Limits
Minimum Span	Units
4 and 20 mA points	Output (linear or sq. root)
Damping	Alarm Setting (high, low)
Security Setting (on, off)	Local Zero/Span Keys (enabled, disabled)
Integral Meter	Sensor Fill
Isolator Material	Flange (type, material)
O-Ring Material	Drain/Vent
Remote Seal (type, fill fluid, isolator material, number)	Transmitter S/N
Address	Sensor S/N

**CHECK OUTPUT**

Before performing other transmitter on-line operations, review the digital output parameters to ensure that the transmitter is operating properly and is configured to the appropriate process variables.

**Process Variables**

HART Comm.	2
Model 268	PV

The process variables for the Model 3051 provide the transmitter output, and are continuously updated. The process variable menu displays the following process variables:

- Pressure
- Percent of Range
- Analog Output

The pressure reading in both Engineering Units and Percent of Range will continue to track with pressures outside of the defined range from the lower to the upper range limit of the sensor module. (Previous versions of the software will track with pressure up to 105% of span and remain there as pressure increases.)

**NOTE**

Regardless of the range points, the Model 3051 will measure and report all readings within the digital limits of the sensor. For example, if the 4 and 20 mA points are set to 0 and 10 inH<sub>2</sub>O, and the transmitter detects a pressure of 25 inH<sub>2</sub>O, it digitally outputs the 25 inH<sub>2</sub>O reading and a 250% of span reading. However, there may be up to  $\pm 5.0\%$  error associated with output outside of the range points.

**Sensor Temperature**

HART Comm.	1, 1, 4
Model 268	PV, F3

The Model 3051 contains a temperature sensor just above its pressure sensor in the sensor module. When reading this temperature, keep in mind that this is not a process temperature reading.

**BASIC SETUP****Set Process Variable Units**

HART Comm.	1, 3
Model 268	F3, F2

The *PV Unit* command sets the process variable units to allow you to monitor your process using the appropriate units of measure. Select from the following engineering units:

- inH<sub>2</sub>O
- inHg
- ftH<sub>2</sub>O
- mmH<sub>2</sub>O
- mmHg
- psi
- torr
- inH<sub>2</sub>O at 4 °C<sup>(1)</sup>
- bar
- mbar
- g/cm<sup>2</sup>
- kg/cm<sup>2</sup>
- Pa
- kPa
- atm
- mmH<sub>2</sub>O at 4 °C<sup>(1)</sup>

(1) Not available with low power or previous Model 3051 transmitters.

**Set Output**

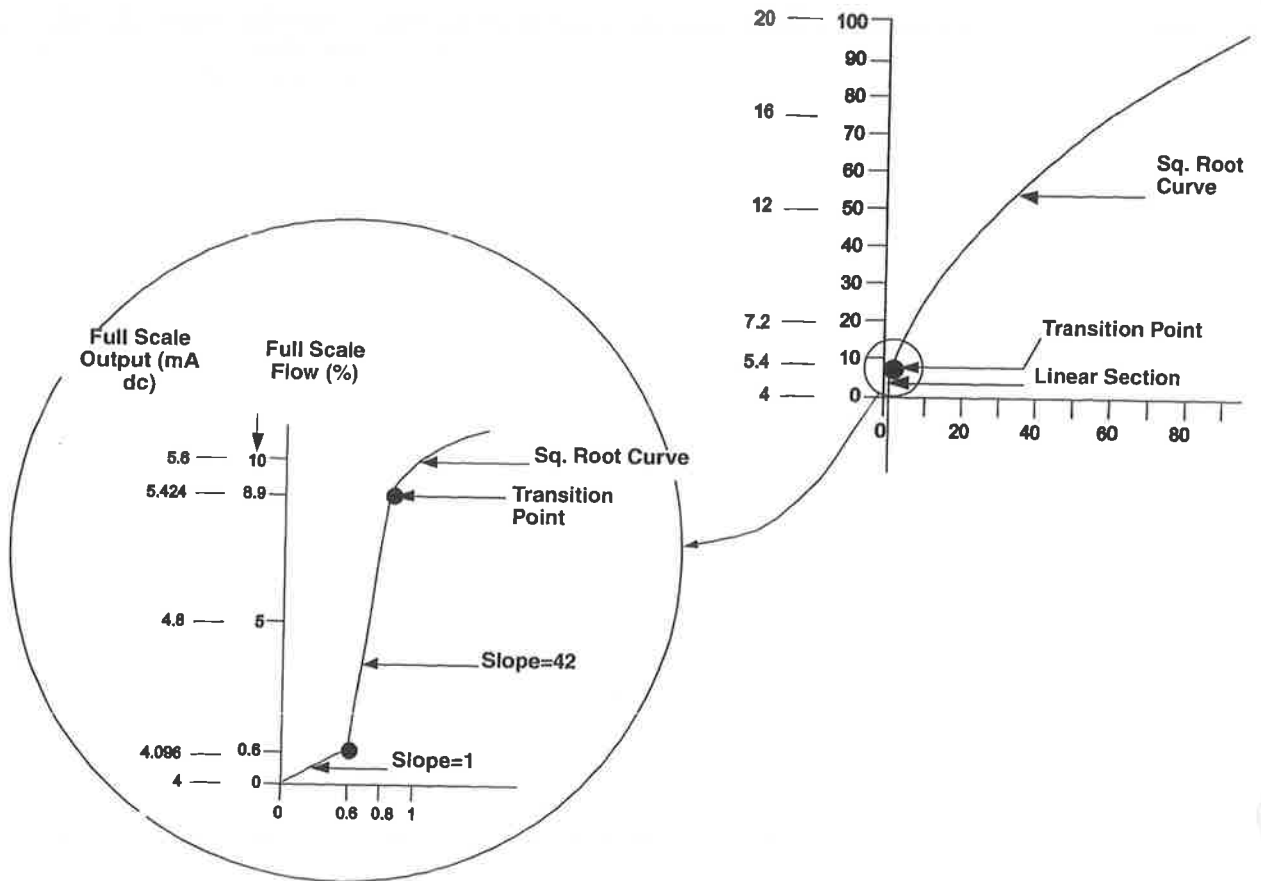
HART Comm.	1, 3, 5
Model 268	F3, F2, F1, F1

Activate the transmitter square root output option to make the analog output proportional to flow. As the input approaches zero, the Model 3051 automatically switches to a linear output in order to ensure a more smooth, stable output near zero. See Figure 2-10.

The transition from linear to square root is not adjustable. It occurs at 0.8% of ranged pressure input or 9% of full-scale flow output in transmitters with Revision 5.2 or higher software. In earlier software, the transition point occurred at 4% of ranged pressure input, or 20% of full scale flow output.

From 0 percent to 0.6 percent of the ranged pressure input, the slope of the curve is unity ( $y = x$ ). This allows accurate calibration near zero. Greater slopes would cause large changes in output for small changes at input. From 0.6 percent to 0.8 percent, the slope of the curve equals 42 ( $y = 42x$ ) to achieve continuous transition from linear to square root at the transition point.

FIGURE 2-10. Square Root Output Transition Point.



## Rerange

The *Range Values* command sets the 4 and 20 mA points (lower and upper range values). Setting the range values to the limits of expected readings maximizes transmitter performance. In practice, you may reset the transmitter range values as often as necessary to reflect changing process conditions.

### NOTE

Regardless of the range points, the Model 3051 will measure and report all readings within the digital limits of the sensor. For example, if the 4 and 20 mA points are set to 0 and 10 inH<sub>2</sub>O, and the transmitter detects a pressure of 25 inH<sub>2</sub>O, it digitally outputs the 25 inH<sub>2</sub>O reading and a 250% percent of span reading. However, there may be up to ±5.0% error associated with output outside of the range points.

You may use one of three methods to rerange the transmitter. Each method is unique; examine all three closely before deciding which method to use.

**Rerange with a Communicator Only**

HART Comm.	1, 2, 3, 1, 1
Model 268	F3, F2, F1, F3, F1

Reranging using only the communicator is the easiest and most popular way to rerange the transmitter. This method changes the values of the analog 4 and 20 mA points independently without a pressure input.

**NOTE**

Changing the lower or upper range point results in similar changes to the span.

To rerange using only the communicator, enter the fast-key sequence above, select *1 Keypad input*, and follow the on-line instructions. Or enter the values directly from the **HOME** screen.

**NOTE**

If the transmitter security jumper is in the **ON** position, you will not be able to make adjustments to the zero and span. Refer to Figure 2-1 on page 2-5 for the appropriate placement of the transmitter security jumper.

**Rerange with a Pressure Input Source and a Communicator**

HART Comm.	1, 2, 3, 1, 2
Model 268	F3, F2, F1, F3, F2

Reranging using the communicator and a pressure source or process pressure is a way of reranging the transmitter when specific 4 and 20 mA points are not known. This method changes the values of the analog 4 and 20 mA points.

**NOTE**

When you set the 4 mA point the span is maintained; when you set the 20 mA point the span changes. If you set the lower range point to a value that causes the upper range point to exceed the sensor limit, the upper range point is automatically set to the sensor limit, and the span is adjusted accordingly.

To rerange using the communicator and a pressure source or process pressure, enter the fast-key sequence above, select *2 Apply values*, and follow the on-line instructions.

**NOTE**

If the transmitter security jumper is in the **ON** position, you will not be able to make adjustments to the zero and span. Refer to Figure 2-1 on page 2-5 for the appropriate placement of the transmitter security jumper.

**Rerange with a Pressure Input Source and the Local Zero and Span Buttons**

Reranging using the local zero and span adjustments (see Figure 2-11 on page 2-16) and a pressure source is a way of reranging the transmitter when specific 4 and 20 mA points are not known and a communicator is not available.

**NOTE**

When you set the 4 mA point the span is maintained; when you set the 20 mA point the span changes. If you set the lower range point to a value that causes the upper range point to exceed the sensor limit, the upper range point is automatically set to the sensor limit, and the span is adjusted accordingly.

To rerange the transmitter using the span and zero buttons, perform the following procedure:

1. Loosen the screw holding the certifications label on top of the transmitter housing, and rotate the label to expose the zero and span buttons (see Figure 2-11 on page 2-16).
2. Using a pressure source with an accuracy three to ten times the desired calibrated accuracy, apply a pressure equivalent to the lower range value to the high side of the transmitter.
3. To set the 4 mA point, press and hold the zero button for at least two seconds, then verify that the output is 4 mA. If a meter is installed, it will display ZERO PASS.

**NOTE**

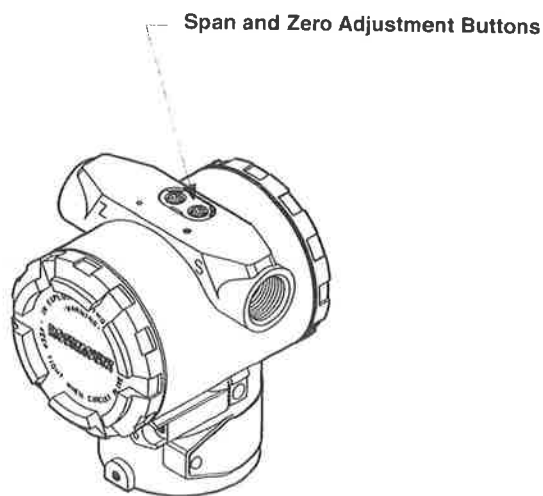
The zero and span adjustments on previous versions of the transmitter are screws instead of buttons. To activate the zero and span adjustments loosen the screws until they pop up.

4. Apply a pressure equivalent to the upper range value to the high side of the transmitter.
5. To set the 20 mA point, press and hold the span button for at least two seconds, then verify that the output is 20 mA. If a meter is installed, it will display SPAN PASS.

**NOTE**

If the transmitter security jumper is in the **ON** position, or if the local zero and span adjustments are disabled through the software, you will not be able to make adjustments to the zero and span using the local buttons. Refer to Figure 2-1 on page 2-5 for the proper placement of the transmitter security jumper. Or refer to “Local Span and Zero Control (Local Keys)” on page 2-17 for instructions on how to enable the span and zero buttons.

FIGURE 2-11. Local Zero and Span Adjustments.



3051-3031D02A

After you rerange the transmitter using the span and zero adjustments, it is possible to disable the adjustments to prevent further reranging. Refer to “Local Span and Zero Control (Local Keys)” below for more information.

## Damping

HART Comm.	1, 3, 6
Model 268	F3, F2, (F1 × 3)

The PV damp command changes the response time of the transmitter to smooth variations in output readings caused by rapid changes in input. Determine the appropriate damping setting based on the necessary response time, signal stability, and other requirements of the of loop dynamics of your system. The default damping value is 0.4 seconds,<sup>(1)</sup> and can be reset to any of ten pre-configured damping values between 0 and 25.6 seconds.

## LCD Meter Options

HART Comm.	1, 4, 3, 4
Model 268	not available

The Meter Options command allows you to customize the LCD meter for use in your application. You can configure the meter to display the following information:

- Engineering Units
- Percent of Range
- User-Configurable LCD Scale
- Alternating between any two of the above

### NOTE

The user-configurable LCD scale is a feature specific to the new 4–20 mA output transmitters. If you have a previous Model 3051 transmitter, upgrade the transmitter electronics board and LCD display to attain this new functionality.

The user-configurable scale is a new feature that enables you to configure the LCD meter to a custom scale using a Model 275 HART communicator. With this feature you can define the decimal point position, the upper range value, the lower range value, the engineering units, and the transfer function. Refer to “Custom Meter Configuration” on page 6-3 for complete configuration information.

## DETAILED SETUP

### Local Span and Zero Control (Local Keys)

HART Comm.	1, 4, 4, 1, 7
Model 268	F4, F4, F2, F1

The *Local keys* command allows software control over the use of the local span and zero adjustments. To enable or disable the span and zero adjustment buttons on your transmitter, perform the fast key sequence at left.

### NOTE

Disabling the local keys does not disable all transmitter configuration changes. With the local keys disabled, you can still make changes to the transmitter configuration—including range values—using a HART communicator.

### Sensor Temperature Output Unit Selection

HART Comm.	1, 4, 1, 2, 2
Model 268	F4, F4, F2, F1

The *Sensor Temperature Output Unit Selection* command selects between Celsius and Fahrenheit units for output of the sensor temperature. The sensor temperature output is accessible via HART only. (The Sensor Temperature Output Units command is not available on previous design transmitters.)

(1) Model 3051CD0 default damping is 3.2 seconds. Model 3051CD1, with calibrations below 2.5 inH<sub>2</sub>O (0.62 kPa), have damping set at 3.2 seconds.

## DIAGNOSTICS AND SERVICE

The diagnostics and service functions listed here are primarily for use after you install the transmitter in the field. The transmitter test feature is designed to verify that the transmitter is operating properly, and can be performed either on the bench or in the field. The loop test feature is designed to verify proper loop wiring and transmitter output, and should only be performed after you install the transmitter.

### Transmitter Test

<b>HART Comm.</b>	1, 2, 1, 1
<b>Model 268</b>	F2, F2

The transmitter test command initiates a more extensive diagnostics routine than that performed continuously by the transmitter. The transmitter test routine can quickly identify potential electronics problems. If the transmitter test detects a problem, messages to indicate the source of the problem are displayed on the communicator screen.

### Loop Test

<b>HART Comm.</b>	1, 2, 2
<b>Model 268</b>	F2, F3

The *Loop Test* command verifies the output of the transmitter, the integrity of the loop, and the operations of any recorders or similar devices installed in the loop. To initiate a loop test, perform the following procedure:

1. Connect a reference meter to the transmitter. To do so, either connect the meter to the test terminals on the transmitter terminal block, or shunt the power to the transmitter through the meter at some point in the loop.
2. From the **HOME** screen, select *1 Device Setup, 2 Diagnostics and Service, 2 Loop Test*, to prepare to perform a loop test.
3. Select **OK** after you set the control loop to manual (see "Setting the Loop to Manual" on page 2-9). The communicator displays the loop test menu.
4. Select a discreet milliamp level for the transmitter to output. At the **CHOOSE ANALOG OUTPUT** prompt, select *1 4mA, 2 20mA*, or select *3 other* to manually input a value. IF you are performing a loop test to verify the output of a transmitter, THEN enter a value between 4 and 20 mA. IF you are performing a loop test to verify the transmitter alarm levels, THEN enter the milliamp value representing an alarm state (see Tables 2-1, 2-3, and 2-2 on page 2-2).
5. Check the electrical current meter installed in the test loop to verify that it reads the value you commanded the transmitter to output. IF the readings match, THEN the transmitter and the loop are configured and functioning properly. IF the readings do not match, THEN you may have the current meter attached to the wrong loop, there may be a fault in the wiring, the transmitter may require an output trim, or the electrical current meter may be malfunctioning.

After completing the test procedure, the display returns to the loop test screen and allows you to choose another output value or to exit loop testing.



## CALIBRATION

Calibrating a smart transmitter is different from calibrating an analog transmitter. The one-step calibration process of an analog transmitter is done in three steps with a smart transmitter:

- **Rerange**—sets the 4 and 20 mA points at the desired pressures;
- **Sensor Trim**—Adjusts the position of the factory characterization curve to optimize the transmitter performance over a specified pressure range or to adjust for mounting effects
- **Analog Output Trim**—Adjusts the analog output to match the plant standard or the control loop.

Smart transmitters operate differently than analog transmitters. A smart transmitter uses a microprocessor that contains information about the sensor's specific characteristics in response to pressure and temperature inputs. A smart transmitter compensates for these sensor variations. The process of generating the sensor performance profile is called factory characterization. Factory characterization also provides the ability to readjust the 4 and 20 mA points without applying pressure to the transmitter.

The trim and rerange functions also differ. Reranging sets the transmitter analog output to the selected upper and lower range points and can be done with or without an applied pressure. Reranging does not change the factory characterization curve stored in the microprocessor. Sensor trimming requires an accurate pressure input and adds additional compensation that adjusts the position of the factory characterization curve to optimize transmitter performance over a specific pressure range.

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### NOTE

Sensor trimming adjusts the position of the factory characterization curve. It is possible to degrade the performance of the transmitter if the sensor trim is done improperly or with inaccurate equipment. Contact your local Rosemount representative or call Rosemount Customer Central at 800-999-9307 if you have questions.

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TABLE 2-4. Recommended Calibration Tasks.

Transmitter	Bench Calibration Tasks	Field Calibration Tasks
3051CD 3051CG 3051L 3051HD 3051HG	<ol style="list-style-type: none"> <li>1. Set output configuration parameters:                             <ol style="list-style-type: none"> <li>a. Set the range points.</li> <li>b. Set the output units.</li> <li>c. Set the output type.</li> <li>d. Set the damping value.</li> </ol> </li> <li>2. <i>Optional:</i> Perform a full sensor trim. (Accurate multimeter required.)</li> <li>3. <i>Optional:</i> Perform an analog output trim. (Accurate multimeter required.)</li> </ol>	<ol style="list-style-type: none"> <li>1. Reconfigure parameters if necessary.</li> <li>2. Zero trim the transmitter to compensate for mounting effects or static pressure effects.</li> </ol>
3051CA 3051TA 3051TG	<ol style="list-style-type: none"> <li>1. Set output configuration parameters:                             <ol style="list-style-type: none"> <li>a. Set the range points.</li> <li>b. Set the output units.</li> <li>c. Set the output type.</li> <li>d. Set the damping value.</li> </ol> </li> <li>2. <i>Optional:</i> Perform a full sensor trim if equipment available (accurate absolute pressure source required), otherwise perform the low trim value section of the full sensor trim procedure.</li> <li>3. <i>Optional:</i> Perform an analog output trim (multimeter required).</li> </ol>	<ol style="list-style-type: none"> <li>1. Reconfigure parameters if necessary.</li> <li>2. Perform low trim value section of the full sensor trim procedure to correct for mounting position effects.</li> </ol>

**Notes:**

- A HART communicator is required for all sensor and output trim procedures.
- Model 3051C Range 4 and Range 5 transmitters require a special calibration procedure when used in differential pressure applications under high static line pressure (see "Compensating Model 3051 Range 4 and 5 Differential Transmitters for Line Pressure" on page 2-28).
- Model 3051TG Range 5 transmitters use an absolute sensor that requires an accurate absolute pressure source to perform the optional full sensor trim.

**Calibration Overview**

Complete calibration of the Model 3051 Pressure Transmitter involves the following tasks:

**Configure the Analog Output Parameters**

- Set Process Variable Units (page 2-13)
- Set Output Type (page 2-13)
- Rerange (page 2-14)
- Set Damping (page 2-17)

**Calibrate the Sensor**

- Full Trim (page 2-25)
- Zero Trim (page 2-25)

**Calibrate the 4–20 mA Output**

- 4–20 mA Output Trim (page 2-27) or
- 4–20 mA Output Trim Using Other Scale (page 2-27) or
- Low-Power 1–5 V dc or Low-Power 0.8–3.2 V dc (page 2-27)

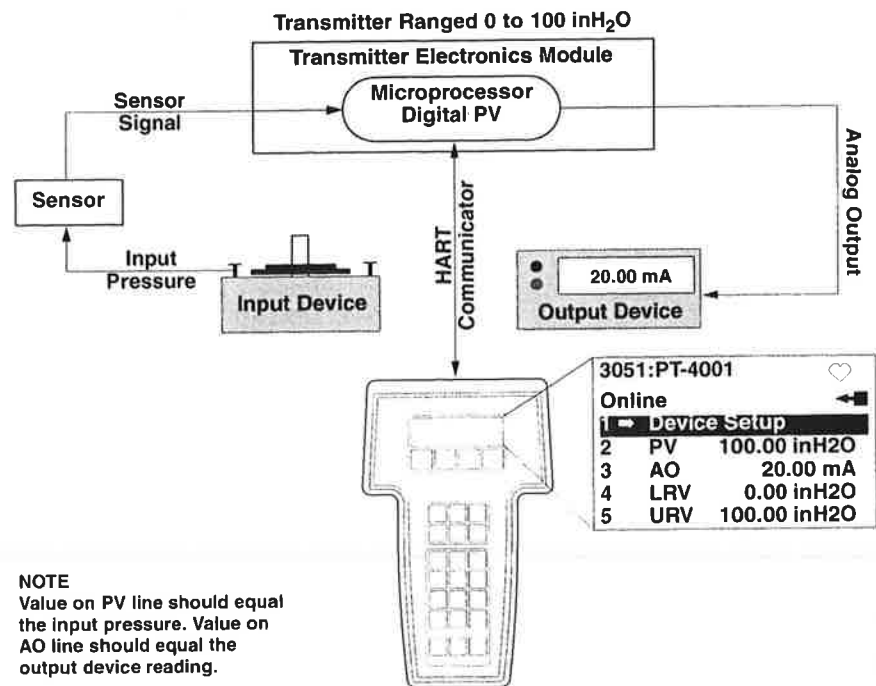
Figure 2-12 on page 2-21 illustrates the Model 3051 transmitter data flow. This data flow can be summarized in four major steps:

1. A change in pressure is measured by a change in the sensor output (Sensor Signal).
1. The sensor signal is converted to a digital format that can be understood by the microprocessor (Analog-to-Digital Signal Conversion).
2. Corrections are performed in the microprocessor to obtain a digital representation of the process input (Digital PV).
3. The Digital PV is converted to an analog value (Digital-to-Analog Signal Conversion).

Figure 2-12 also identifies the approximate transmitter location for each calibration task. Note that the data flows from left to right, and a parameter change affects all values to the right of the changed parameter.

Not all calibration procedures should be performed for each Model 3051 transmitter. In addition, some procedures are appropriate for bench calibration but should not be performed during field calibration. Table 2-4 identifies the recommended calibration procedures for each type of Model 3051 transmitter for both bench and field calibration.

FIGURE 2-12. Transmitter Data Flow with Calibration Options.



1151-1151F0EB

### Deciding Which Trim Procedure to Use

To decide which trim procedure to use, you must first determine whether the analog-to-digital section or the digital-to-analog section of the transmitter electronics is in need of calibration. To do so, refer to Figure 2-12 and perform the following procedure:

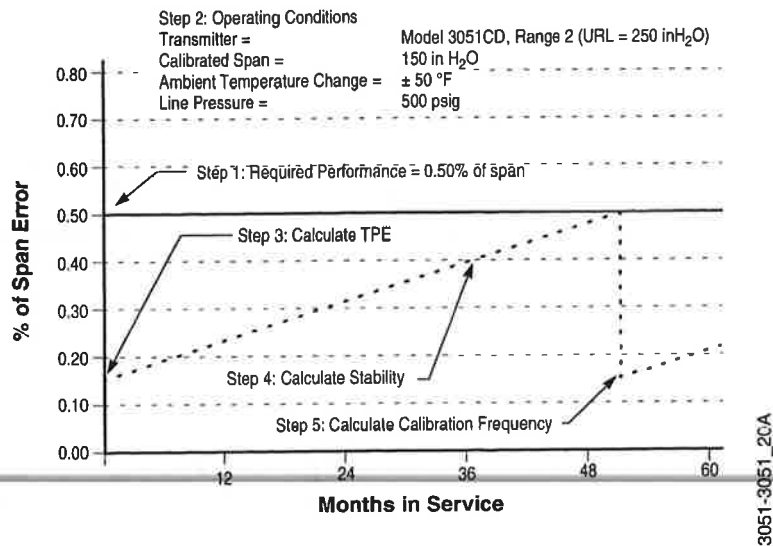
1. Connect a pressure source, a HART communicator, and a digital readout device to the transmitter.
2. Establish communication between the transmitter and the communicator.
3. Apply pressure equal to the upper range point pressure (100 inH<sub>2</sub>O, for example).
4. Compare the applied pressure to the Process Variable (PV) line on the Communicator On-line Menu. **IF** the PV reading on the communicator does not match the applied pressure, and you are confident that your test equipment is accurate, **THEN** perform a sensor trim.
5. Compare the Analog Output (AO) line on the communicator on-line menu to the digital readout device. **IF** the AO reading on the communicator does not match the digital readout device, and you are confident that your test equipment is accurate, **THEN** perform an output trim.

### Determining Calibration Frequency

Calibration frequency can vary greatly depending on the application, performance requirements, and process conditions. Use the following procedure to determine the calibration frequency that meets the needs of your application.

1. Determine the performance required for your application.
2. Determine the operating conditions.
3. Calculate the Total Probable Error (TPE).
4. Calculate the stability per month.
5. Calculate the calibration frequency.

FIGURE 2-13. Calculating Calibration Frequency.



**Sample Calculation**

**Step 1: Determine the performance required for your application.**

Required Performance: 0.30% of span

**Step 2: Determine the operating conditions.**

Transmitter: Model 3051CD, Range 2 (URL=250 inH<sub>2</sub>O)  
 Calibrated Span: 150 inH<sub>2</sub>O  
 Ambient Temperature Change: ± 50 °F  
 Line Pressure: 500 psig

**Step 3: Calculate total probable error (TPE).**

$$TPE = \sqrt{(\text{Reference Accuracy})^2 + (\text{Temperature Effect})^2 + (\text{Static Pressure Effect})^2} = 0.150\% \text{ of span}$$

Where:

Reference Accuracy = ± 0.075% of span

Ambient Temperature Effect =

$$\pm \left( \frac{0.0125 \times \text{URL}}{\text{Span}} + 0.0625 \right) \text{ per } 50 \text{ }^\circ\text{F} = \pm 0.0833\% \text{ of span}$$

Span Static Pressure Effect<sup>(1)</sup> =

0.1% reading per 1000 psi = ±0.05 of span at maximum span

(1) Zero static pressure effect removed by zero trimming at line pressure.

**Step 4: Calculate the stability per month.**

$$\text{Stability} = \pm \left[ \frac{0.0125 \times \text{URL}}{\text{Span}} \right] \% \text{ of span for 5 years} = \pm 0.05\% \text{ of span per month}$$

**Step 5: Calculate calibration frequency.**

$$\text{Cal. Freq.} = \frac{(\text{Req. Performance} - \text{TPE})}{\text{Stability per Month}} = \frac{(0.3\% - 0.123\%)}{0.0035\%} = 51 \text{ months}$$

## Sensor Trim

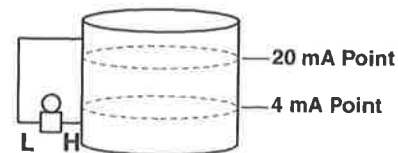
You can trim the sensor using either the full trim or the zero trim function. The trim functions vary in complexity, and their use is application-dependent. Both trim functions alter the transmitter's interpretation of the input signal.

A **zero trim** is a single-point adjustment. It is useful for compensating for mounting position effects and is most effective when performed with the transmitter installed in its final mounting position. Since this correction maintains the slope of the characterization curve, it should not be used in place of a full trim over the full sensor range.

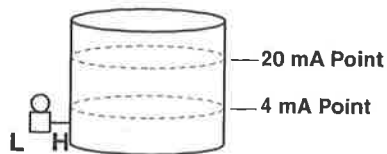
When performing a zero trim, ensure that the equalizing valve is open and all wet legs are filled to the correct levels.

### NOTE

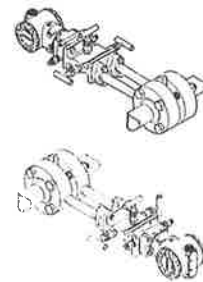
**Do not perform a zero trim on Model 3051 Absolute pressure transmitters.** A zero trim is zero based, and absolute pressure transmitters reference absolute zero. To correct mounting position effects on a Model 3051 Absolute Pressure Transmitter, perform a low trim within the full sensor trim function. The low trim function provides a "zero" correction similar to the zero trim function but it does not require the input to be zero based.



**NONZERO-BASED  
LEVEL APPLICATION**



**ZERO-BASED LEVEL  
APPLICATION**



**ZERO-BASED FLOW  
APPLICATION**

3051-3031B03A, B03B, 3051\_18A, 19A

A **full trim** is a two-point sensor calibration where two end-point pressures are applied, and all output is linearized between them. You should always adjust the low trim value first to establish the correct offset. Adjustment of the high trim value provides a slope correction to the characterization curve based on the low trim value. The factory-established characterization curve is not changed by this procedure. The trim values allow you to optimize performance over your specified measuring range at the calibration temperature.

**Zero Trim**

<b>HART Comm.</b>	1, 2, 3, 3, 1
<b>Model 268</b>	F3, F2, F1, F3, F2

To calibrate the sensor with a HART Communicator using the zero trim function, perform the following procedure.

1. Vent the transmitter and attach a communicator to the measurement loop.
2. From the communicator main menu select *1 Device setup, 2 Diagnostics and service, 3 Calibration, 3 Sensor trim, 1 Zero trim* to prepare to adjust the zero trim.

**NOTE**

The transmitter must be within 3% of true zero (zero based) in order to calibrate it using the zero trim function.

3. Follow the commands provided by the communicator to complete the adjustment of the zero trim.

**Full Trim**

<b>HART Comm.</b>	1, 2, 3, 3
<b>Model 268</b>	F4, F4, F3, F2, F1

To calibrate the sensor with a HART communicator using the full trim function, perform the following procedure:

1. Assemble and power the entire calibration system including a transmitter, HART communicator, power supply, pressure input source, and readout device (see Figure 2-14).

**NOTE**

Use a pressure input source that is at least three times more accurate than the transmitter, and allow the input pressure to stabilize for 10 seconds before entering any values.

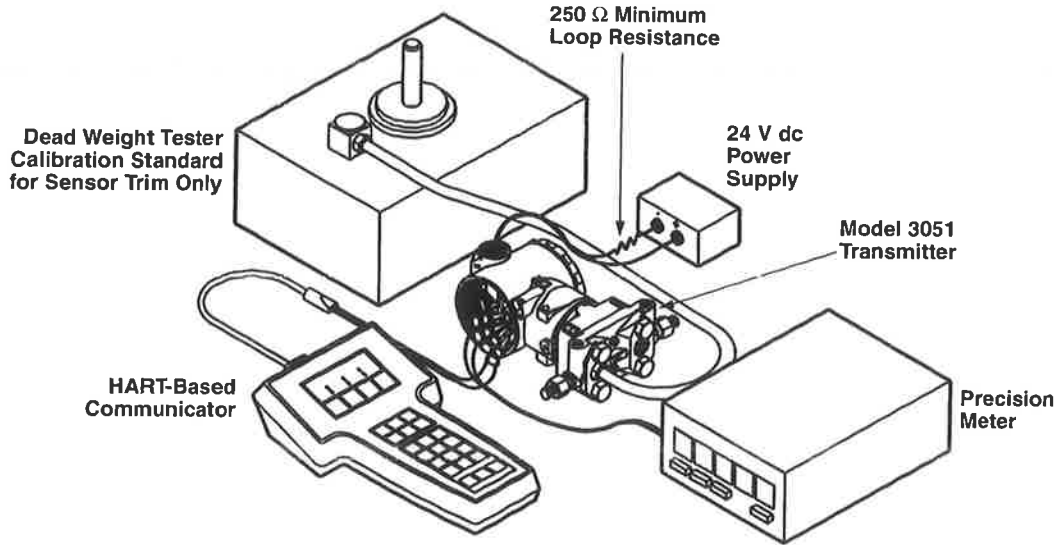
2. From the communicator **MAIN** menu select *1 Device setup, 2 Diagnostics and service, 3 Calibration, 3 Sensor trim, 2 Lower sensor trim* to prepare to adjust the lower trim point.

**NOTE**

Select pressure input values so that the low and high values are equal to or outside the 4 and 20 mA points. Do not attempt to obtain reverse output by reversing the high and low points. The transmitter allows approximately a 5% URL deviation from the characterized curve established at the factory.

3. Follow the commands provided by the communicator to complete the adjustment of the lower value.
4. Repeat the procedure for the upper value, replacing *2 Lower sensor trim* with *3 Upper sensor trim* in Step 2.

FIGURE 2-14. Digital Trim Connection Drawing (4–20 mA Transmitters).



3051-3031A01A

### Recall Factory Trim

The *Recall Factory Trim* commands allow the restoration of the as-shipped factory settings of the sensor trim and analog output trim.

#### NOTE

The Recall Factory Trim commands are not available on previous design transmitters.

#### Recall Factory Trim— Sensor Trim

HART Comm.	1, 2, 3, 4, 1
Model 268	Not available

Resets the transmitter sensor trim to the as-shipped factory settings. The *Recall Factory Trim—Sensor Trim* command can be useful for recovering from an inadvertent zero trim of an absolute pressure unit.

#### Recall Factory Trim— Analog Output

HART Comm.	1, 2, 3, 4, 2
Model 268	Not available

Resets the transmitter analog output trim to the as-shipped factory settings. The *Recall Factory Trim—Analog Output* command can be useful for recovering from an inadvertent zero trim on an absolute pressure transmitter.



## Analog Output Trim

The *Analog Output Trim* commands allow you to adjust the transmitter's current output at the 4 and 20 mA points to match the plant standards. This command adjusts the digital to analog signal conversion (see Figure 2-12 on page 2-21).

### Digital-to-Analog Trim

HART Comm.	1, 2, 3, 2, 1
Model 268	F4, F4, F3, F1, F1

To perform a digital-to-analog trim with a HART communicator, perform the following procedure.

1. From the **HOME** screen, select *1 Device setup, 2 Diag/Service, 3 Calibration, 4 D/A trim*. Select **OK** after you set the control loop to manual (see "Setting the Loop to Manual" on page 2-9).
2. Connect an accurate reference ammeter to the transmitter at the **CONNECT REFERENCE METER** prompt. To do so, connect the positive lead to the positive terminal and the negative lead to the test terminal in the transmitter terminal compartment, or shunt the transmitter power through the reference meter at some point.
3. Select **OK** after connecting the reference meter.
4. Select **OK** at the **SETTING FLD DEV OUTPUT TO 4 MA** prompt. The transmitter outputs 4,00 mA.
5. Record the actual value from the reference meter, and enter it at the **ENTER METER VALUE** prompt. The communicator prompts you to verify whether or not the output value equals the value on the reference meter.
6. Select *1 Yes* if the reference meter value equals the transmitter output value, or *2 No* if it does not.  
IF you select *1 Yes*, THEN proceed to Step 7.  
IF you select *2 No*, THEN repeat Step 5.
7. Select **OK** at the **SETTING FLD DEV OUTPUT TO 20 MA** prompt, and repeat Steps 5 and 6 until the reference meter value equals the transmitter output value.
8. Select **OK** after you return the control loop to automatic control.

### Digital-to-Analog Trim Using Other Scale

HART Comm.	1, 2, 3, 2, 2
Model 268	F4, F4, F3, F1, F2

The *Scaled D/A Trim* command matches the 4 and 20 mA points to a user-selectable reference scale other than 4 and 20 mA (1 to 5 volts if measuring across a 250 ohm load, or 0 to 100 percent if measuring from a DCS, for example). To perform a scaled D/A trim, connect an accurate reference meter to the transmitter and trim the output signal to scale as outlined in the Output Trim procedure.

### NOTE

Use a precision resistor for optimum accuracy. If you add a resistor to the loop, ensure that the power supply is sufficient to power the transmitter to a 20 mA output with the additional loop resistance.

### Analog Output Trim (Low Power)

HART Comm.	1, 2, 3, 2, 1
Model 268	F4, F4, F3, F1, F1

The Model 3051 Low-Power Transmitter has two jumper-selectable output ranges: 1–5 V dc and 0.8–3.2 V dc. Positioning this jumper for the desired output range selects the proper coefficients for temperature corrections. The jumper position also sets the output values (1–5 or 0.8–3.2) which are communicated through HART protocol and accessed by a hand held communicator.

### Compensating Model 3051 Range 4 and 5 Differential Transmitters for Line Pressure

However, switching this jumper does not by itself select the new outputs; you must perform the "Digital-to-Analog Trim" procedure above to match the transmitter's output voltages to the new jumper selection.

Model 3051 Range 4 and Range 5 pressure transmitters require a special calibration procedure when used in differential pressure applications. The purpose of this procedure is to optimize transmitter performance by reducing the effect of static line pressure in these applications. Model 3051 differential pressure transmitters (Ranges 1, 2, and 3) do not require this procedure because the optimization occurs in the sensor.

Applying high static pressure to Model 3051 Range 4 and Range 5 pressure transmitters causes a systematic shift in the output. This shift is linear with static pressure; correct it by performing the Full Trim procedure on page 2-18.

The following specifications show the static pressure effect for Model 3051 Range 4 and Range 5 transmitters used in differential pressure applications:

**Zero Effect:**

±0.1% of the upper range limit per 1000 psi (6,9 MPa) for line pressures from 0 to 2000 psi (0 to 13,8 MPa)

±0.2% of the upper range limit per 1000 psi (6,9 MPa) for line pressures above 2000 psi (13,8 MPa)

**Span Effect:**

Correctable to ±0.2% of reading per 1000 psi for line pressures from 0 to 3626 psi.

The systematic span shift caused by the application of static line pressure is -1.00% of reading per 1000 psi for 3051C Range 4 transmitters, and -1.25% of reading per 1000 psi for Range 5 transmitters.

Use the following example to compute corrected input values.

**Example**

A transmitter with model number 3051CD4 will be used in a differential pressure application where the static line pressure is 1200 psi. The transmitter is ranged so that the output is 4 mA at 500 inH<sub>2</sub>O and 20 mA at 1500 inH<sub>2</sub>O.

To correct for systematic error caused by high static line pressure, first use the following formulas to determine corrected values for the low trim and high trim.

$$LT = LRV + S (LRV) P$$

Where:	LT =	Corrected Low Trim Value
	LRV =	Lower Range Value
	S =	-(Span shift per specification)
	P =	Static Line Pressure

$$HT = URV + S (URV) P$$

Where: HT = Corrected High Trim Value  
 URV = Upper Range Value  
 S = -(Span shift per specification)  
 P = Static Line Pressure

In this example:

URV = 1500 inH<sub>2</sub>O  
 LRV = 500 inH<sub>2</sub>O  
 P = 1200 psi  
 S = ± 0.01/1000

To calculate the low trim (LT) value:

LT =  $500 + (0.01/1000)(500)(1200)$   
 LT = 506 inH<sub>2</sub>O

To calculate the high trim (HT) value:

HT =  $1500 + (0.01/1000)(1500)(1200)$   
 HT = 1518 inH<sub>2</sub>O

To complete a Model 3051 full trim and enter the corrected values for low trim (LT) and high trim (HT), refer to "Full Trim" on page 2-25.

Enter the corrected input values for low trim and high trim through the communicator keypad after you apply the nominal value of pressure as the transmitter input.

**NOTE**

After calibrating Model 3051 Range 4 and Range 5 transmitters for high differential pressure applications, rerange the 4 and 20 mA points using the communicator to maintain the systematic static line pressure correction. You may re-zero the 4 mA point at line pressure after installation using the local zero button without affecting the completed calibration.

**ADVANCED FUNCTIONS**

**Saving, Recalling, and Cloning Configuration Data**

HART Comm.	left arrow, 1, 2
Model 268	F4, F3, F1

Use the cloning feature of the Model 275 HART Communicator if you need to configure several Model 3051 transmitters similarly. The cloning process involves configuring a transmitter, saving the configuration data, then sending a copy of the data to a separate transmitter. There are a number of possible procedures to use when saving, recalling, and cloning configuration data. For complete instructions refer to the HART Communicator manual, publication no. 00809-0100-4275. One common method is as follows:

1. Completely configure the first transmitter.
  2. Save the configuration data:
    - a. Select **F2 SAVE** from the communicator **HOME/ONLINE** screen.
    - b. Ensure that the location to which the data will be saved is set to **MODULE**. If it is not, select *1 Location* to set the save location to **MODULE**.
    - c. Select *2 Name* to name the configuration data. The default is the transmitter tag number.
    - d. Ensure that the data type is set to **STANDARD**. IF the data type is **NOT STANDARD**, THEN select *3 Data Type* to set the data type to **STANDARD**.
    - e. Select **F2 SAVE**.
  3. Connect and power the receiving transmitter and communicator.
  4. Select the back arrow from the **HOME/ONLINE** screen. The HART Communicator menu appears.
  5. Select *1 Offline*, *2 Saved Configuration*, *1 Module Contents* to reach the **MODULE CONTENTS** menu.
  6. Use the **DOWN ARROW** to scroll through the list of configurations in the memory module, and use the **RIGHT ARROW** to select the configuration you wish to retrieve.
  7. Select *1 Edit*.
  8. Select *1 Mark All*.
  9. Select **F2 SAVE**.
  10. Use the **DOWN ARROW** to scroll through the list of configurations in the memory module, and use the **RIGHT ARROW** to select the configuration again.
  11. Select *3 Send* to download the configuration to the transmitter.
- When finished, the communicator informs you of the status. To configure another transmitter, repeat Steps 3 through 10.

**NOTE**

The transmitter receiving the cloned data must have the same software version (or later) as the original transmitter.

**Burst Mode**

<b>HART Comm.</b>	1, 4, 3, 3, 3
<b>Model 268</b>	F4, F4, F4, F1

When configured for burst mode, the Model 3051 provides faster digital communication from the transmitter to the control system by eliminating the time required for the control system to request information from the transmitter. Burst mode is compatible with use of the analog signal. Because the HART protocol features simultaneous digital and analog data transmission, the analog value can drive other equipment in the loop while the control system is receiving the digital information. Burst mode applies only to the transmission of dynamic data (pressure and temperature in engineering units, pressure in percent of range, and/or analog output), and does not affect the way other transmitter data is accessed.

Access to information other than dynamic transmitter data is obtained through the normal poll/response method of HART communication. A HART-based communicator or the control system may request any of the information that is normally available while the transmitter is in burst mode. Between each message sent by the transmitter, a short pause allows the HART-based communicator or a control system to initiate a request. The transmitter will receive the request, process the response message, and then continue "bursting" the data approximately three times per second.

## Multidrop Communication

Multidropping transmitters refers to the connection of several transmitters to a single communications transmission line. Communication between the host and the transmitters takes place digitally with the analog output of the transmitters deactivated. Many of the Rosemount SMART FAMILY<sup>®</sup> transmitters can be multidropped. With the HART smart communications protocol, up to 15 transmitters can be connected on a single twisted pair of wires or over leased phone lines. This feature can greatly reduce wiring costs.

The application of a multidrop installation requires consideration of the update rate necessary from each transmitter, the combination of transmitter models, and the length of the transmission line. Communication with the transmitters can be accomplished with commercially available Bell 202 modems and a host implementing the HART protocol. Each transmitter is identified by a unique address (1-15) and responds to the commands defined in the HART protocol. HART-based communicators can test, configure, and format a multidropped transmitter the same way as a transmitter in a standard point-to-point installation.

Figure 2-15 shows a typical multidrop network. This figure is not intended as an installation diagram. Contact Rosemount product support with specific requirements for multidrop applications.

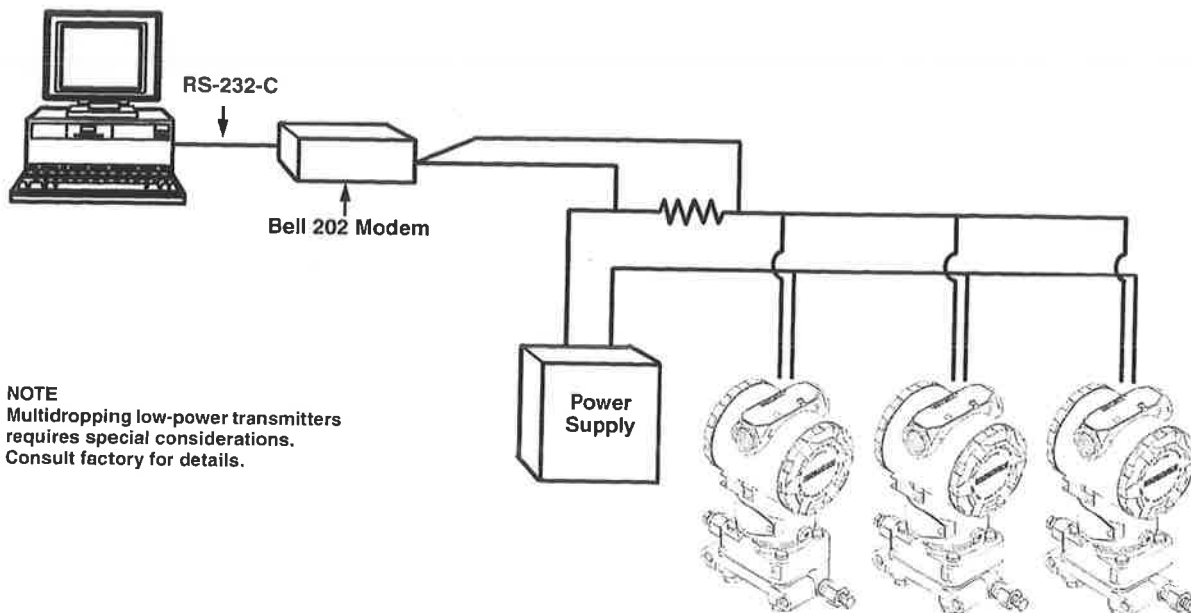
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### NOTE

A transmitter in multidrop mode has the analog output fixed at 4 mA. If a meter is installed to a transmitter in multidrop mode, it will alternate the display between "current fixed" and the specified meter output(s).

---

FIGURE 2-15. Typical Multidrop Network.



**NOTE**  
Multidropping low-power transmitters requires special considerations. Consult factory for details.

3051-0087A, 3031A07B

**NOTE**

The Model 3051 is set to address 0 at the factory, allowing it to operate in the standard point-to-point manner with a 4–20 mA output signal. To activate multidrop communication, the transmitter address must be changed to a number from 1 to 15. This change deactivates the 4–20 mA analog output, sending it to 4 mA. It also disables the failure mode alarm signal, which is controlled by the upscale/downscale jumper position. Failure signals in multidropped transmitters are communicated through HART messages.

**Changing a Transmitter Address**

<b>HART Comm.</b>	1, 4, 3, 3, 1
<b>Model 268</b>	F1, F4, F4, F2, F3

To change the address of a multidropped transmitter, follow these fast key sequences. To activate multidrop communication, the transmitter address must be changed to a number from 1 to 15, and each transmitter in a multidropped loop must have a unique address.

**Communicating with a Multidropped Transmitter**

<b>HART Comm.</b>	1, 4, 3, 3, 2
<b>Model 268</b>	F1, F4, F4, F2, F2

To communicate with a multidropped transmitter for the purpose of testing, configuring, or formatting, follow the fast key sequence at left.

**Polling a Multidropped Transmitter**

<b>HART Comm.</b>	Left arrow, 4, 1
<b>Model 268</b>	F1, F4, F4, F2, F3

Polling a multidropped loop determines the model, address, and number of transmitters on the given loop.

**NOTE**

The HART Communicator Model 275 requires you to use the **UTILITY** menu to perform and autopoll. This menu is available from the **MAIN** menu of the HART Communicator. Press the **LEFT ARROW** to move from the **ONLINE MENU** to the **MAIN** menu. Press **4** from the **MAIN** menu to access the **UTILITY** menu.

## OVERVIEW

The information in this section covers installation considerations. Dimensional drawings for each Model 3051 variation and mounting configuration are included in this section.

## SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operation. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

## Warnings (⚠)

**⚠ WARNING**

**Explosions can result in death or serious injury.**

- Do not remove the transmitter covers in explosive environments when the circuit is alive.
- Both transmitter covers must be fully engaged to meet explosionproof requirements.
- Before connecting a communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.

**⚠ WARNING**

**Electrical shock can result in death or serious injury.**

- Avoid contact with the leads and terminals.

**⚠ WARNING**

**Process leaks could result in death or serious injury.**

- Install and tighten all four flange bolts before applying pressure.
- Do not attempt to loosen or remove flange bolts while the transmitter is in service.

**⚠ WARNING**

**Replacement equipment or spare parts not approved by Rosemount Inc. for use as spare parts could reduce the pressure retaining capabilities of the transmitter and may render the instrument dangerous.**

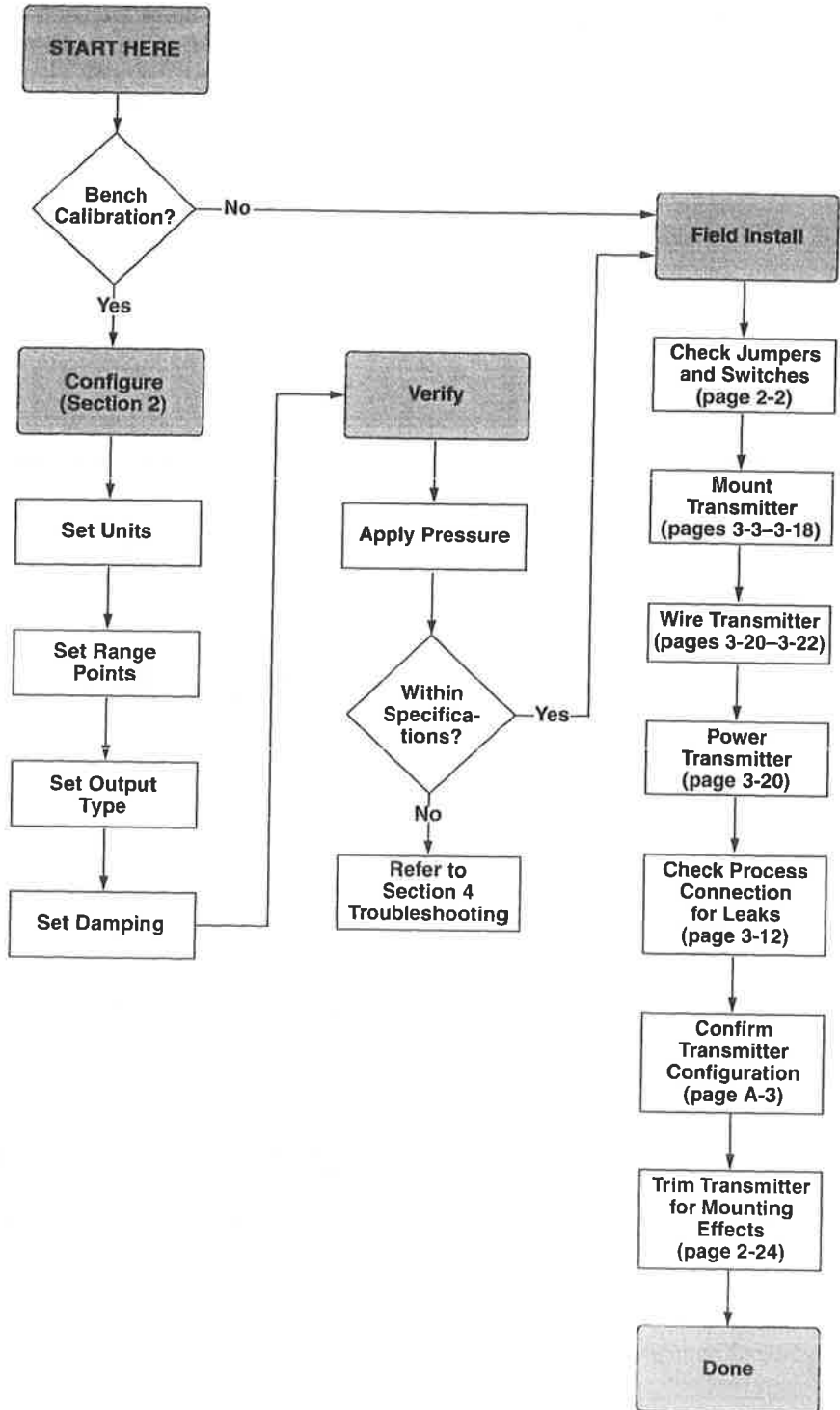
- Use only bolts supplied with the Model 3051 or sold by Rosemount Inc. as spare parts for the Model 3051.

**⚠ WARNING**

**Improper assembly of manifolds to traditional housing can damage sensor module.**

- For safe assembly of manifold to traditional flange, bolts must break back plane of flange web (i.e., bolt hold) but must not contact module housing.

FIGURE 3-1. Installation Flowchart.





## GENERAL CONSIDERATIONS

Measurement accuracy depends upon proper installation of the transmitter and impulse piping. Mount the transmitter close to the process and use a minimum of piping to achieve best accuracy. Keep in mind the need for easy access, personnel safety, practical field calibration, and a suitable transmitter environment. Install the transmitter to minimize vibration, shock, and temperature fluctuation.

### IMPORTANT

Install the enclosed pipe plug in unused conduit openings with a minimum of five threads engaged to comply with explosionproof requirements. The transmitter is shipped with the plug installed on transmitters ordered with CSA explosionproof approval.

## MECHANICAL CONSIDERATIONS

Figures 3-2 through 3-7 on pages 3-4 through 3-8 show dimensional drawings of Model 3051 transmitters. Figure 3-9 on page 3-11 shows installation examples. Figures 3-12 through 3-14 on pages 3-16 through 3-17 show dimensional drawings of mounting brackets.

### NOTE

For Model 3051CD0 and 3051CD1, mount the transmitter solidly to prevent tilting. A tilt in the physical transmitter may cause a zero shift in the transmitter output.

### NOTE

For steam service, do not blow down impulse piping through the transmitter. Flush the lines with the blocking valves closed and refill the lines with water before resuming measurement.

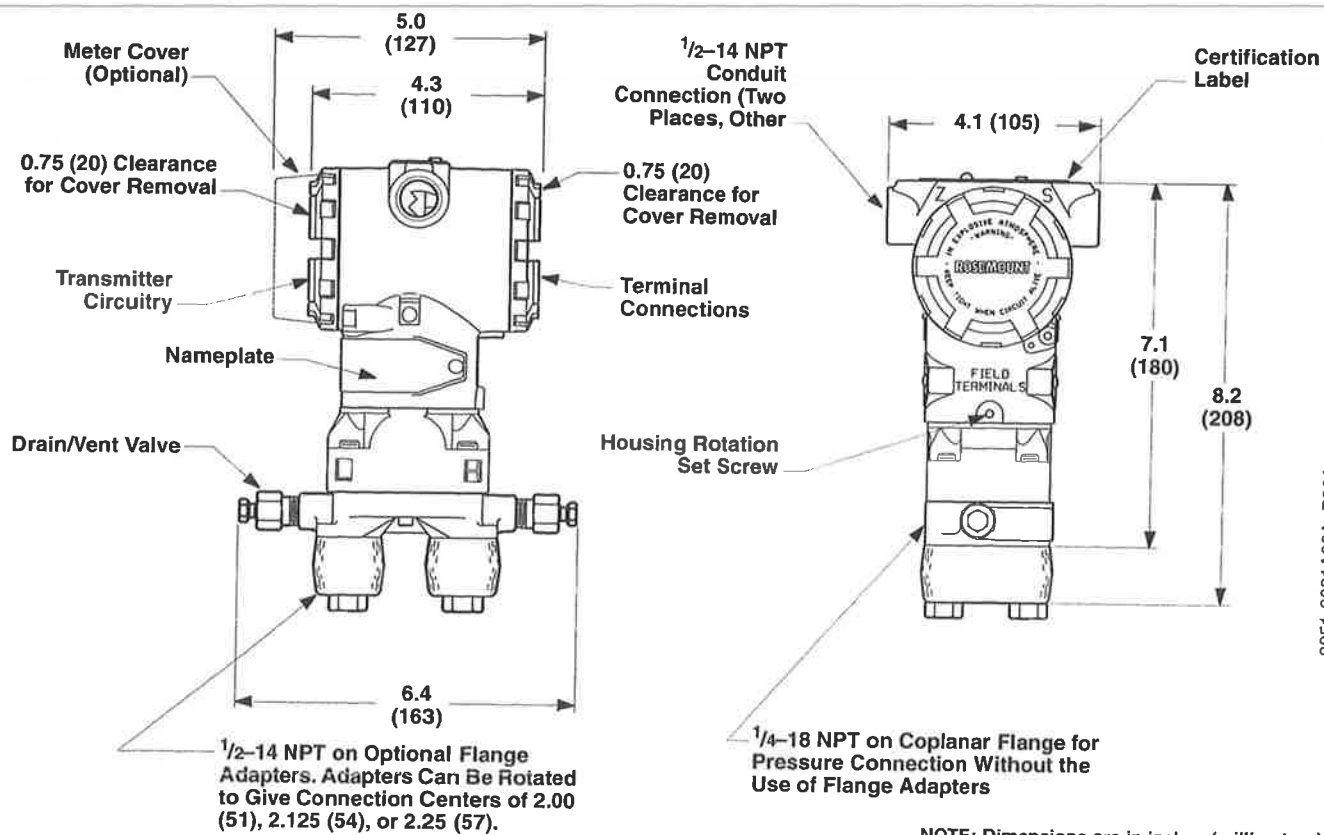
### NOTE

When the transmitter is mounted on its side, position the Coplanar flange to ensure proper venting or draining. Mount the flange as shown in Figure 3-10 on page 3-14, keeping drain/vent connections on the bottom for gas service and on the top for liquid service.

### NOTE

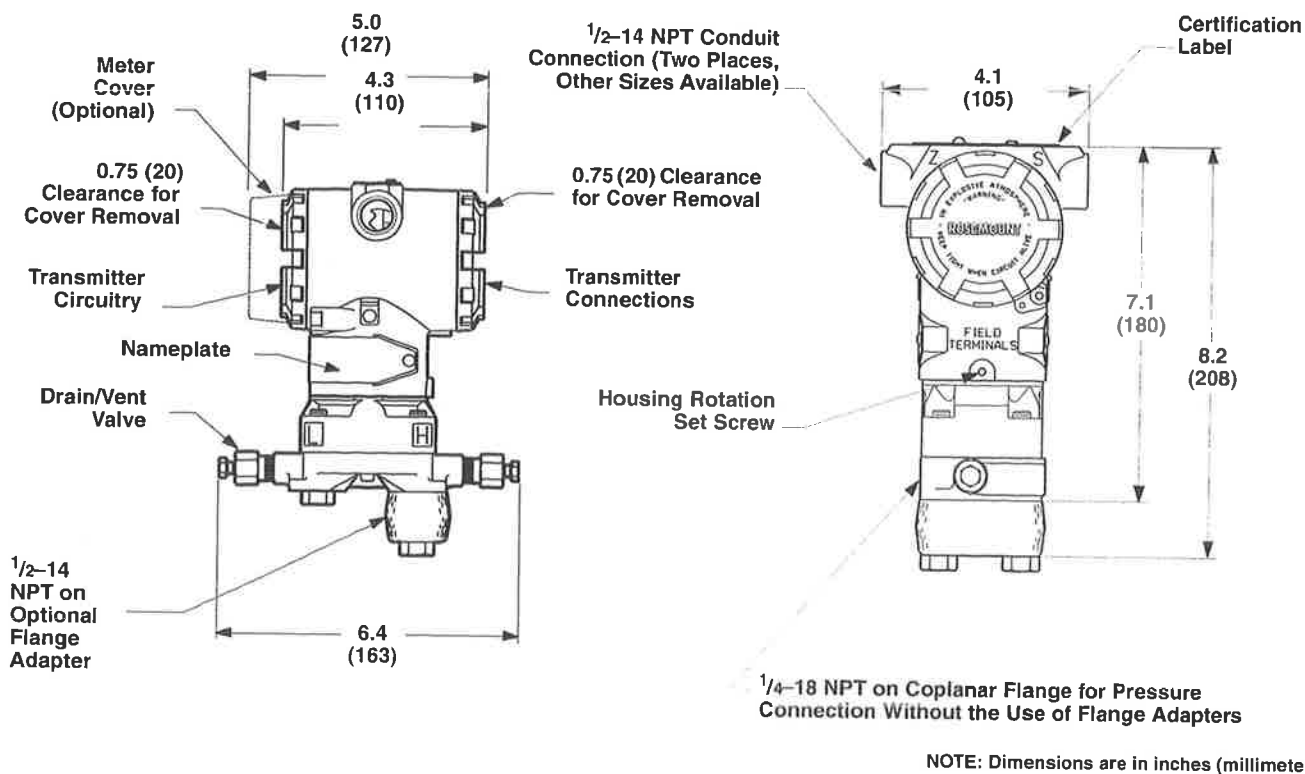
The Model 3051 transmitter incorporates two independent seals between the process connection and the conduit connection.

FIGURE 3-2. Model 3051CD Dimensional Drawings.



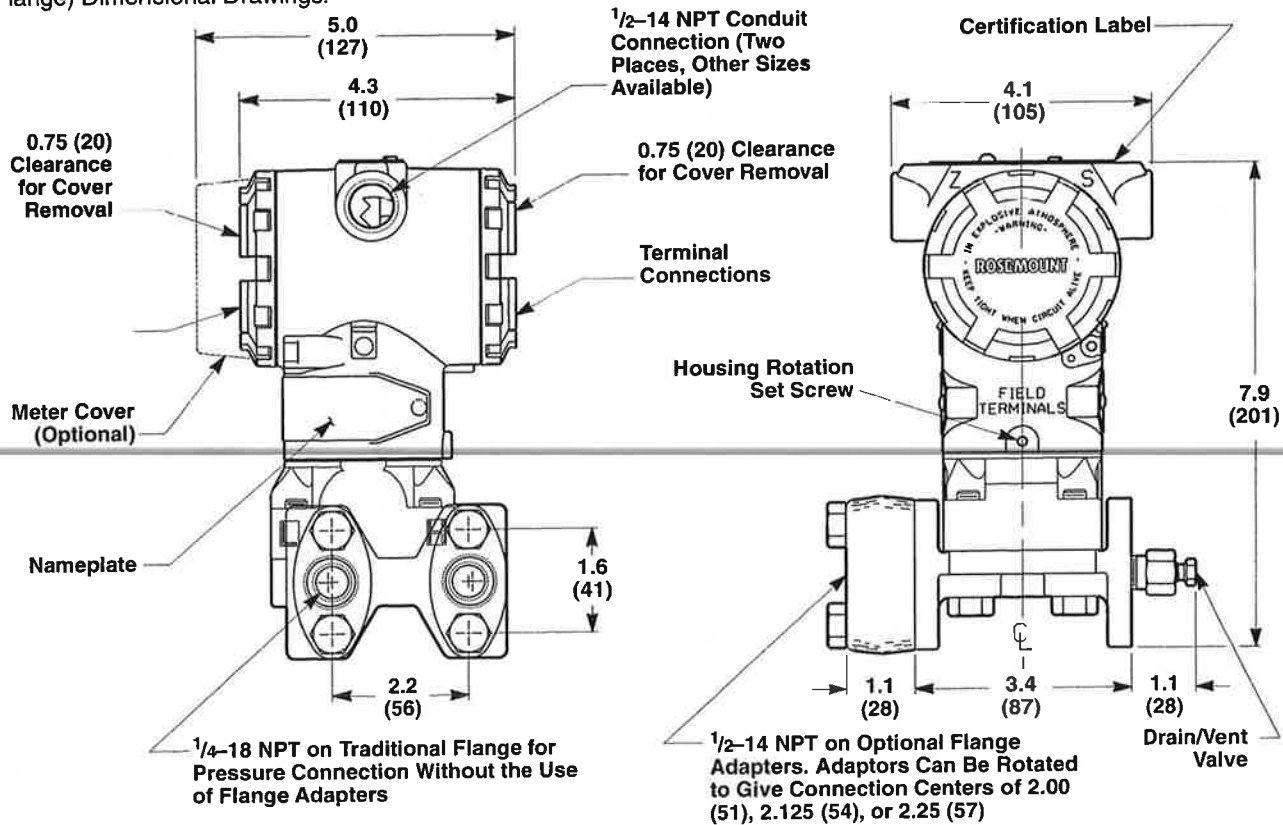
3051-3031A06A, B06A

FIGURE 3-3. Model 3051CG and 3051CA Dimensional Drawings.



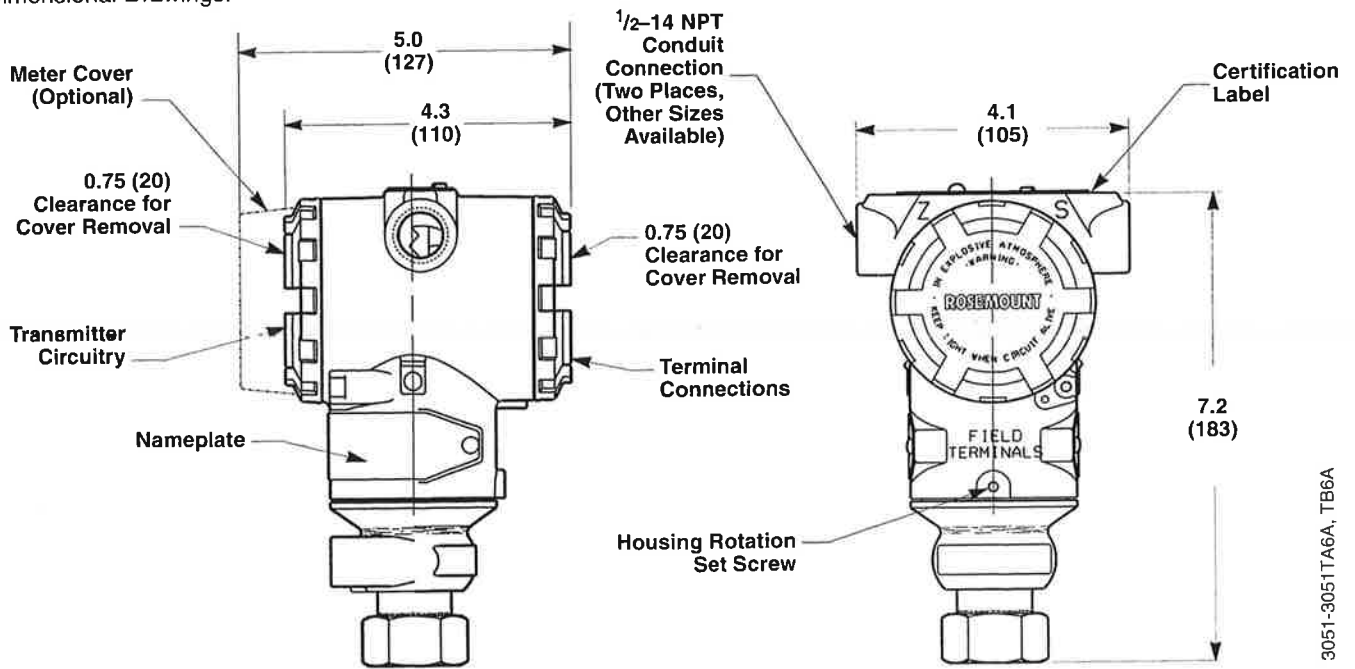
3051-3031A06C, B06A

FIGURE 3-4. Model 3051C (Traditional Flange) Dimensional Drawings.



NOTE: Dimensions are in inches (millimeters).

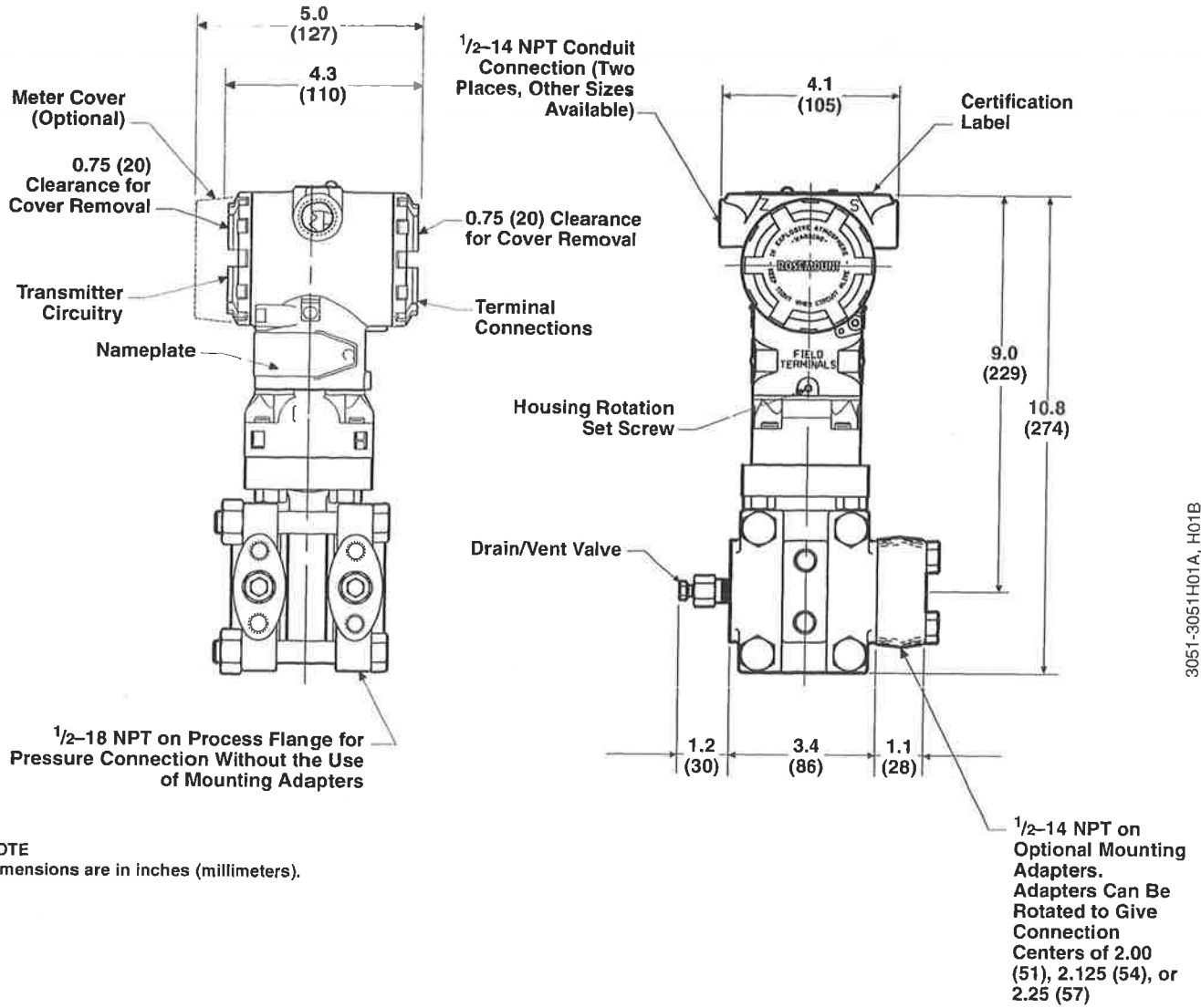
FIGURE 3-5. Model 3051T Dimensional Drawings.



NOTE: Dimensions are in inches (millimeters).

**Rosemount Model 3051 Smart Pressure Transmitters**

**FIGURE 3-6. Model 3051H  
Dimensional Drawings.**



3051-3051H01A, H01B

**NOTE**  
Dimensions are in inches (millimeters).

TABLE 3-1. Model 3051L Dimensional Specifications—*Except Where Noted, Dimensions Are in Inches (Millimeters).*

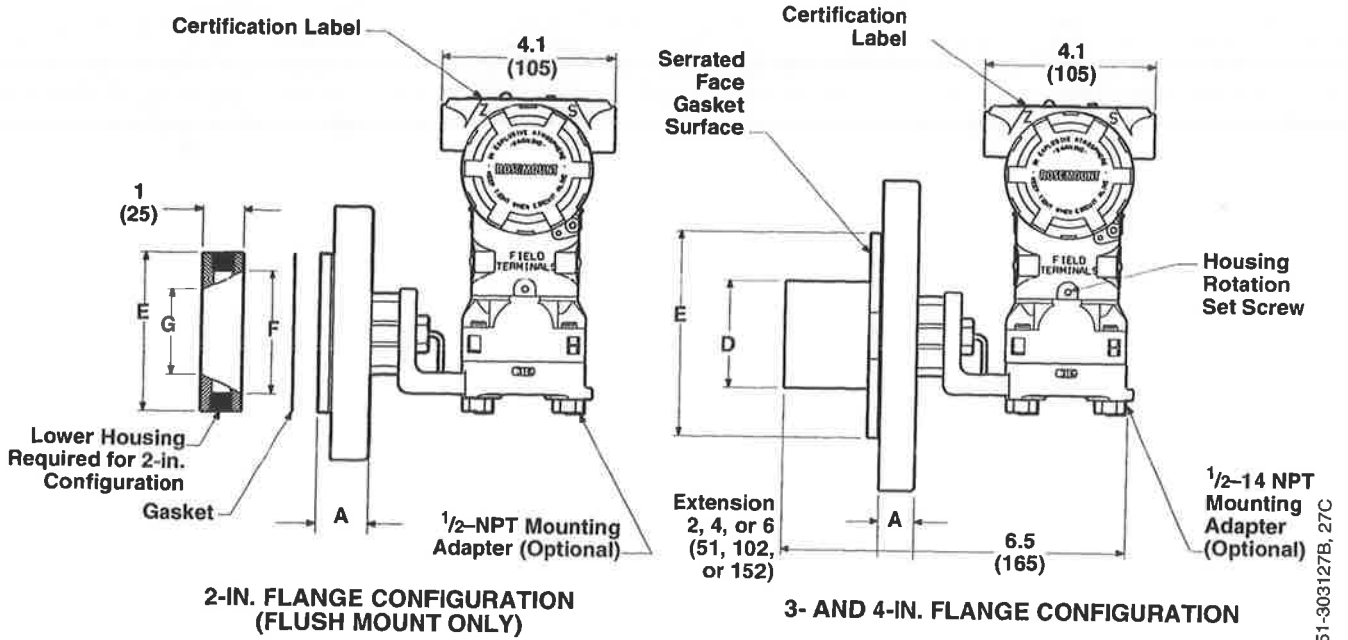
Class	Pipe Size	Flange Thickness A	Bolt Diameter B	Outside Diameter C	No. of Bolts	Bolt Hole Diameter	Exten. Diam. (1) D	O.D. Gask. Surf. E	Lower Housing	
									Xmtr Side F	Proc. Side G
ASME B 16.5 (ANSI) 150	2 (51)	1.12 (28)	4.75 (121)	6.0 (152)	4	0.75 (19)	NA	3.75 (95)	2.9 (74)	2.16 (55)
	3 (76)	1.31 (33)	6.0 (152)	7.5 (190)	4	0.75 (19)	2.58 (65)	5.0 (127)	3.11 (79)	3.11 (79)
	4 (102)	1.31 (33)	7.5 (190)	9.0 (228)	8	0.75 (19)	3.5 (89)	6.81 (173)	4.06 (103)	4.06 (103)
ASME B 16.5 (ANSI) 300	2 (51)	1.25 (32)	5.0 (127)	6.5 (165)	8	0.75 (19)	NA	3.75 (95)	2.9 (74)	2.16 (55)
	3 (76)	1.50 (38)	6.62 (168)	8.25 (209)	8	0.88 (22)	2.58 (65)	5.0 (127)	3.11 (79)	3.11 (79)
	4 (102)	1.62 (41)	7.88 (200)	10.0 (254)	8	0.88 (22)	3.5 (89)	6.81 (173)	4.06 (103)	4.06 (103)
ASME B 16.5 (ANSI) 600	2 (51)	1.12 (28)	5.0 (127)	6.5 (165)	8	0.75 (19)	NA	3.75 (95)	2.9 (74)	2.16 (55)
	3 (76)	1.37 (35)	6.62 (168)	6.62 (168)	8	0.88 (22)	2.58 (65)	5.0 (127)	3.11 (79)	3.11 (79)
DIN PN 10-40	DN 50	26 mm	125 mm	165 mm	4	18 mm	NA	95 mm	74 mm	55 mm
DIN PN 25/40	DN 80	30 mm	160 mm	200 mm	8	18 mm	65 mm	127 mm	79 mm	79 mm
	DN 100	30 mm	190 mm	235 mm	8	22 mm	89 mm	173 mm	103 mm	103 mm
DIN PN 10/16	DN 100	26 mm	180 mm	220 mm	8	18 mm	89 mm	173 mm	103 mm	103 mm

(1) Tolerances are 0.040 (1,02), -0.020 (0,51).

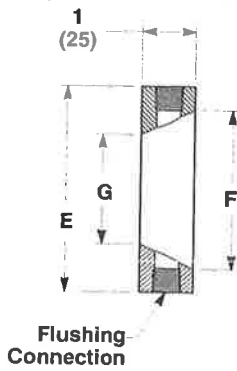
#### NOTE

Use this table in conjunction with Figure 3-7.

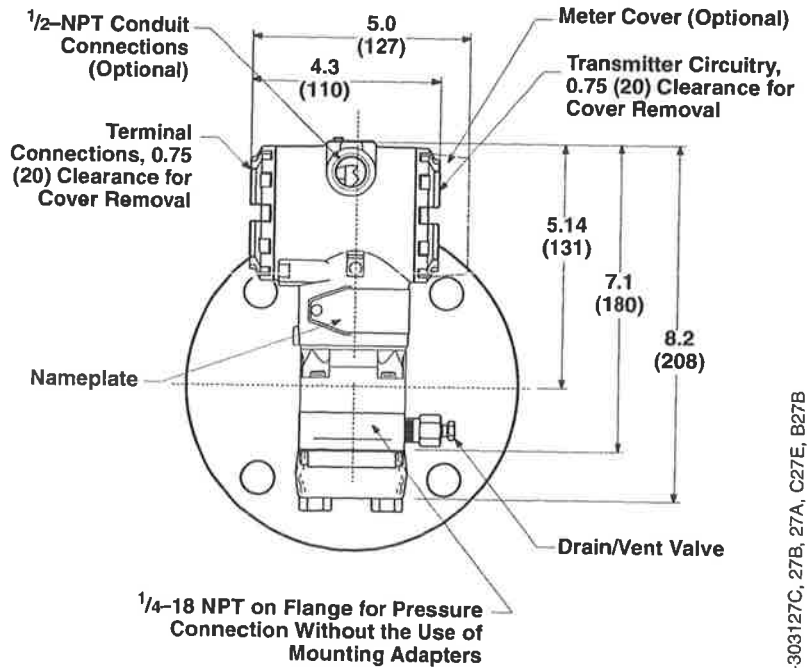
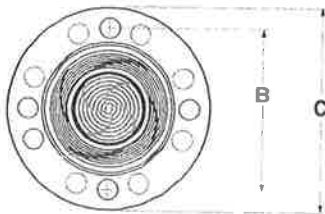
FIGURE 3-7. Model 3051L  
Dimensional Drawings.



**OPTIONAL FLUSHING CONNECTION RING (LOWER HOUSING)**



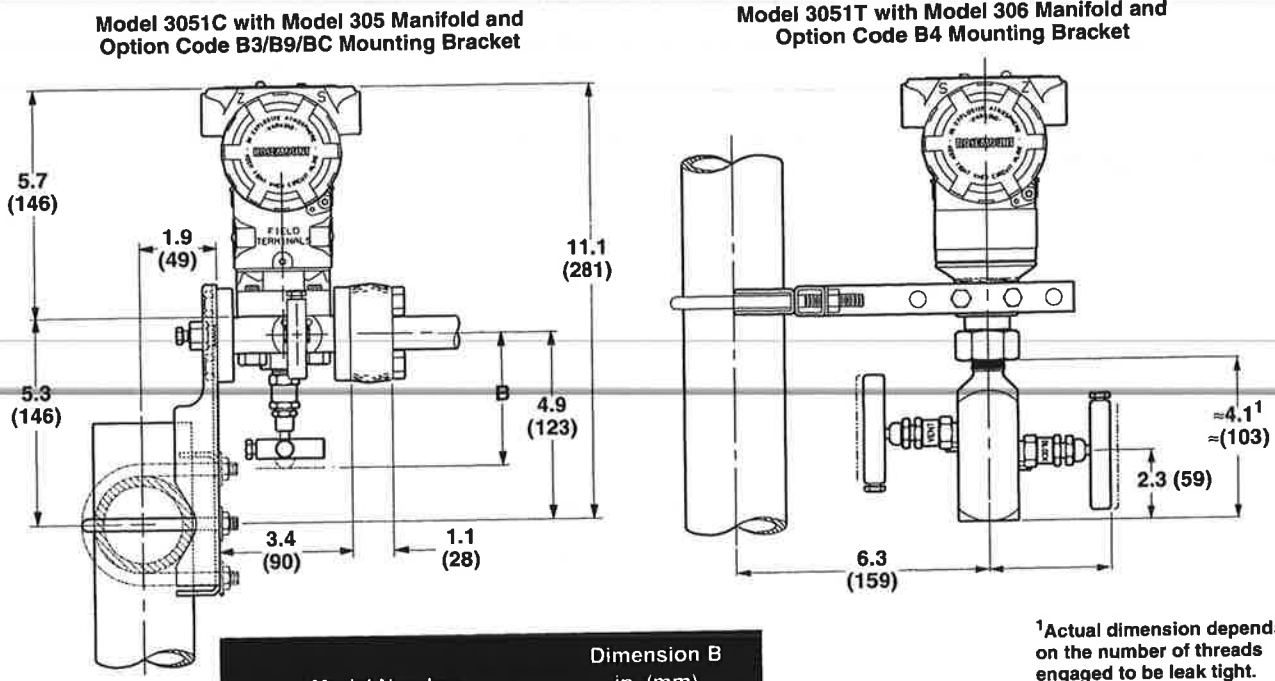
**DIAPHRAGM ASSEMBLY AND MOUNTING FLANGE**



NOTE: Dimensions are in inches (millimeters).

3051-303127B, 27C  
3051-303127B, 27C  
3051-303127B, 27C, B27B

FIGURE 3-8. Typical Mounting Configurations for Model 3051 Transmitters with Model 305 and 305 Manifolds.



Model Number	Dimension B in. (mm)
0305AT2, Teflon Packing	3.6 (90)
0305AT2, Grafoil Packing	4.2 (107)
0305AT3, Teflon Packing	3.6 (90)
0305AT3, Grafoil Packing	4.2 (107)
0305AT7, ASME B 31.1 (ANSI)	4.2 (107)
0305AT8, ASME B 31.1 (ANSI)	4.2 (107)

NOTE: Dimensions are in inches (millimeters).

### Mounting

The Model 3051C Pressure Transmitter weighs 5.7 lbs (2,6 kg) without additional options. Optional mounting brackets available with the Model 3051 allow mounting to a panel, wall, or 2-inch pipe. The B4 Bracket Option for use with the Coplanar flange and the Model 3051T is 316 SST with 316 SST bolts. Figures 3-10 and 3-11 on pages 3-14 and 3-15 show bracket dimensions and mounting configurations for the B4 Option.

Bracket options B1, B2, B3, B7, B8, and B9 are sturdy polyurethane painted carbon steel brackets designed for use in pipe or panel mounting the traditional flange (H2, H3, H4, or H7 option). The B1–B3 brackets have carbon steel bolts, while the B7–B9 brackets have stainless steel bolts. Bracket options BA and BC are stainless steel with stainless steel bolts. Dimensionally, these brackets are identical to the B1–B3 brackets used with the Rosemount Model 1151 Pressure Transmitter except for the length of the bolts used to mount the transmitter to the bracket. Bracket options B5/B6 are used for Model 3051H transmitters. These bracket styles facilitate multiple mounting configurations (see Figures 3-12 and 3-13 on page 3-16). When installing the transmitter to one of the mounting brackets, torque the bolts to 125 inch-pounds.

**NOTE**

The transmitter is calibrated in an upright position at the factory. If you mount the transmitter in any other position, the zero point will shift by an amount equivalent to the liquid head caused by the varied mounting position. To reset the zero point, refer to "Sensor Trim" on page 2-24.

---

**Mounting Requirements**

Refer to Figure 3-9 for examples of the following mounting configurations:

**Liquid Flow Measurement**

- Place taps to the side of the line to prevent sediment deposits on the transmitter's process isolators.
- Mount the transmitter beside or below the taps so gases can vent into the process line.
- Mount drain/vent valve upward to allow gases to vent.

**Gas Flow Measurement**

- Place taps in the top or side of the line.
- Mount the transmitter beside or above the taps so liquid will drain into the process line.

**Steam Flow Measurement**

- Place taps to the side of the line.
- Mount the transmitter below the taps to ensure that the impulse piping will stay filled with condensate.
- Fill impulse lines with water to prevent the steam from contacting the transmitter directly and to ensure accurate measurement start-up.

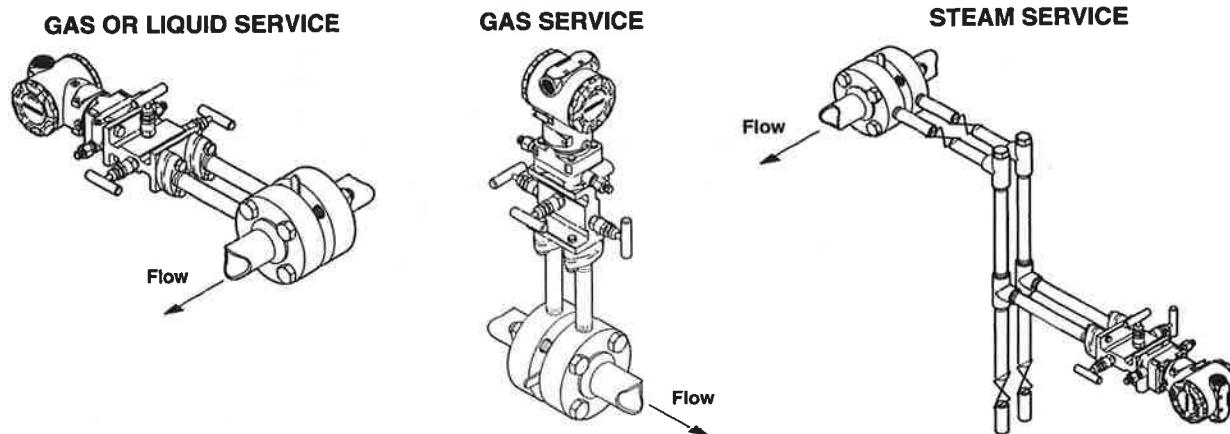
**NOTE**

In steam or other elevated temperature services, it is important that temperatures at the coplanar process flanges not exceed 250 °F (121 °C) for transmitters with silicone fill or 185 °F (85 °C) for inert fill. In vacuum service, these temperature limits are reduced to 220 °F (104 °C) for silicone fill and 160 °F (71 °C) for inert fill. Models 3051L, 3051H, and the traditional flange allow higher temperatures.

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FIGURE 3-9. Installation Examples.



## Impulse Piping

The piping between the process and the transmitter must accurately transfer the pressure to obtain accurate measurements. There are five possible sources of error: pressure transfer, leaks, friction loss (particularly if purging is used), trapped gas in a liquid line, liquid in a gas line, and density variations between the legs.

The best location for the transmitter in relation to the process pipe depends on the process itself. Use the following guidelines to determine transmitter location and placement of impulse piping:

- Keep impulse piping as short as possible.
- For liquid service, slope the impulse piping at least 1 inch per foot (8 cm per m) upward from the transmitter toward the process connection.
- For gas service, slope the impulse piping at least 1 inch per foot (8 cm per m) downward from the transmitter toward the process connection.
- Avoid high points in liquid lines and low points in gas lines.
- Make sure both impulse legs are the same temperature.
- Use impulse piping large enough to avoid friction effects and blockage.
- Vent all gas from liquid piping legs.
- When using a sealing fluid, fill both piping legs to the same level.
- When purging, make the purge connection close to the process taps and purge through equal lengths of the same size pipe. Avoid purging through the transmitter.
- Keep corrosive or hot (above 250 °F [121 °C]) process material out of direct contact with the sensor module and flanges.
- Prevent sediment deposits in the impulse piping.
- Keep the liquid head balanced on both legs of the impulse piping.
- Avoid conditions that might allow process fluid to freeze within the process flange.

## Process Connections

Model 3051 process connections on the transmitter flange are 1/4-18 NPT. Flange adapter unions with 1/2-14 NPT connections are supplied as standard. The threads are Class 2; use your plant-approved lubricant or sealant when making the process connections. The process connections on the transmitter flange are on 2 1/8-inch (54 mm) centers to allow direct mounting to a three-valve or five-valve manifold. Rotate one or both of the flange adapters to attain connection centers of 2 inches (51 mm), 2 1/8 inches (54 mm), or 2 1/4 inches (57 mm). See page 3-12 for information on the Model 3051T process connection.

- ⚠** Install and tighten all four flange bolts before applying pressure, or process leakage will result. When properly installed, the flange bolts will protrude through the top of the module housing. Do not attempt to loosen or remove the flange bolts while the transmitter is in service.

To install adapters to a Coplanar flange, perform the following procedure:

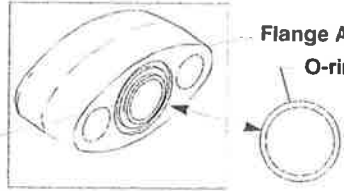
1. Remove the flange bolts.
2. Leaving the flange in place, move the adapters into position with the O-ring installed.
3. Clamp the adapters and the Coplanar flange to the transmitter module using the larger of the bolts supplied.
4. Tighten the bolts. Refer to "Mounting Bolts" on page 3-18 for torque specifications.

**⚠ WARNING**

Failure to install proper flange adapter O-rings can cause process leaks, which can result in death or serious injury.

Each style of Rosemount flange adapters requires a unique O-ring, as shown below. Flange adapters are distinguished by their unique grooves.

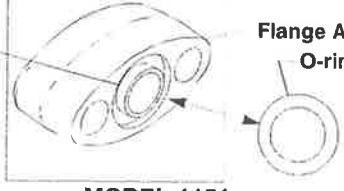
**MODEL 3001/3051/2024/3095**



Flange Adapter O-ring

Unique O-ring Grooves

**MODEL 1151**



Flange Adapter O-ring

3051-0569A01A

Use only the O-ring designed to seal with an adapter. Refer to the Spare Parts list in Section 5: Specifications and Reference Data for the correct part numbers of the flange adapters and O-rings designed for Model 3051 transmitters.

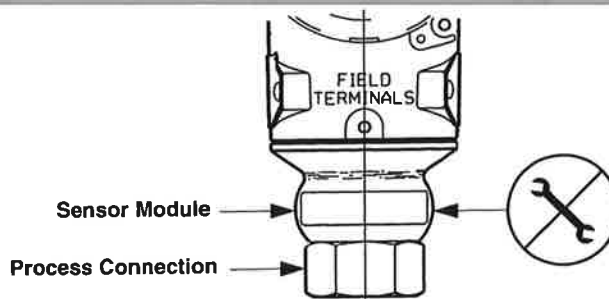
**⚠** See "Safety Messages" on page 3-1 for complete warning information.

When compressed, Teflon® O-rings tend to cold flow, which aids in their sealing capabilities. Whenever you remove flanges or adapters, visually inspect the Teflon O-rings. Replace them if there are any signs of damage, such as nicks or cuts. If they are undamaged, you may reuse them. If you replace the O-rings, retorque the flange bolts after installation to compensate for cold flow. Refer to the process sensor body reassembly procedure in **Section 4: Troubleshooting**.

### Model 3051T Process Connection

#### ⚠ WARNING

Do not apply torque directly to the sensor module. Rotation between the sensor module and the process connection can damage the electronics. To avoid damage, apply torque only to the hex-shaped process connection.

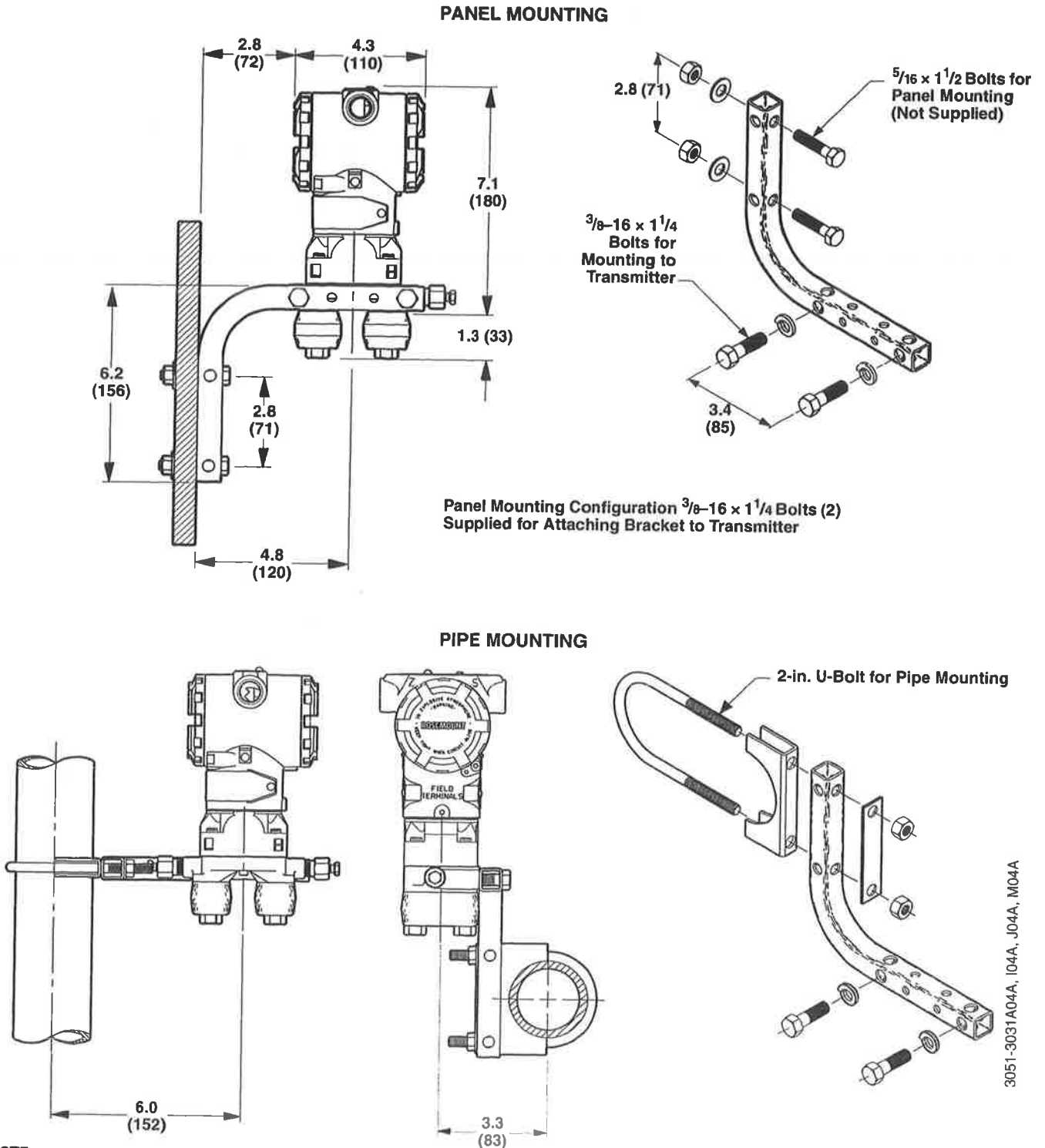


### Housing Rotation

The electronics housing can be rotated up to 180 degrees (left or right) to improve field access or to better view the optional LCD meter. To rotate the housing, perform the following procedure:

1. Loosen the housing rotation set screw using a  $\frac{9}{64}$ -in. hex wrench.
2. Turn the housing up to 180 degrees to the left or right of its original (as shipped) position. **Do not rotate the housing more than 180 degrees without first performing a disassembly procedure (see "Disassembly Procedures" on page 4-3). Over-rotation will sever the electrical connection between the sensor module and the electronics module.**
3. Retighten the housing rotation set screw.

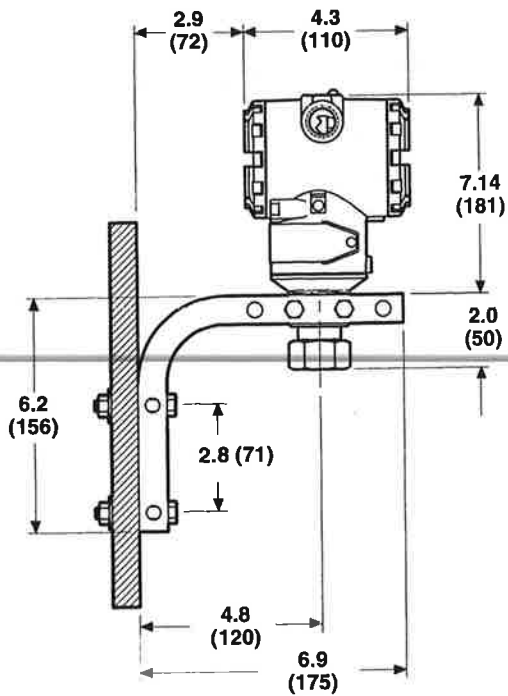
FIGURE 3-10. Coplanar Flange Mounting Configurations with Optional Bracket (B4) for 2-in. Pipe or Panel Mounting.



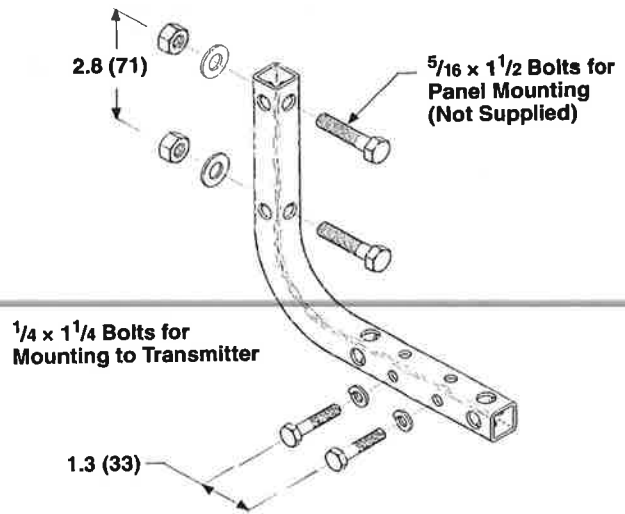
**NOTE**  
Dimensions are in inches (millimeters).

FIGURE 3-11. Model 3051T Mounting Configurations with Optional Bracket (B4) for 2-in. Pipe or Panel Mounting.

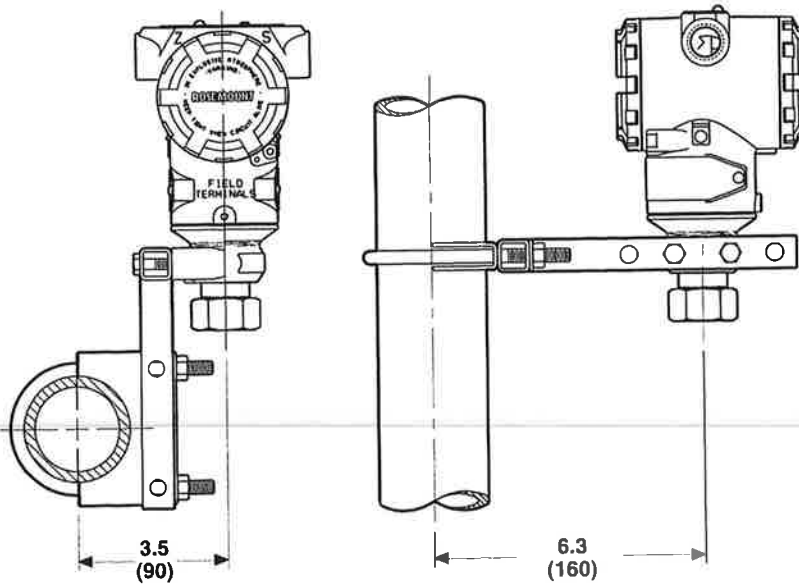
PANEL MOUNTING



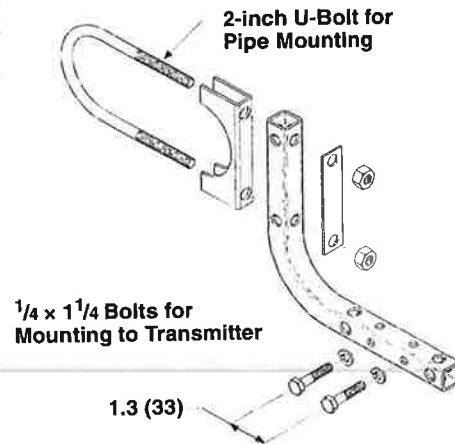
PANEL MOUNTING BRACKET



PIPE MOUNTING



PIPE MOUNTING BRACKET

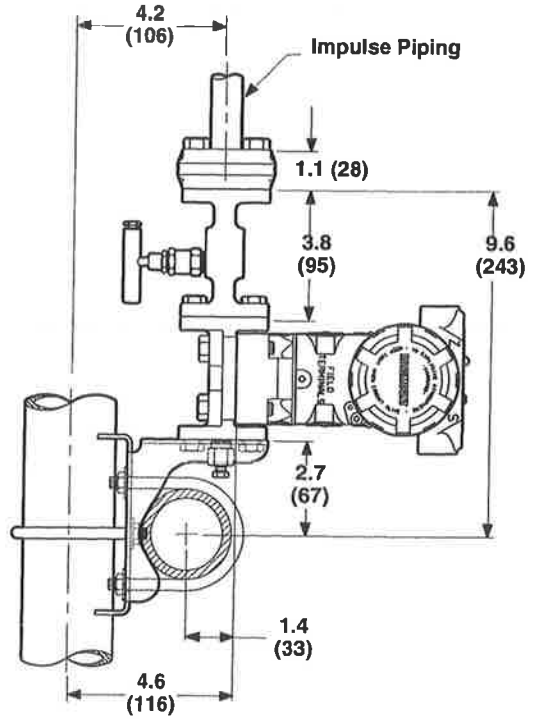
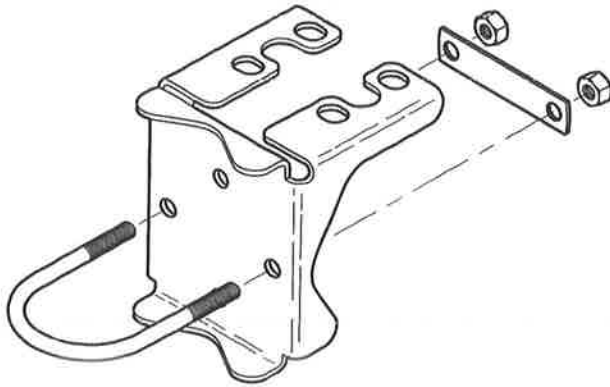


NOTE  
Dimensions are in inches (millimeters).

3051-3051TA4A, TB4A, TC4A, TD4A, TE4A

FIGURE 3-12. Optional Mounting Bracket for Traditional Flange Options B1/B7/BA.

OPTION B1/B7/BA: TRADITIONAL FLANGE 2-IN. PIPE MOUNTING BRACKET

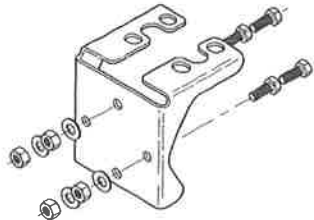
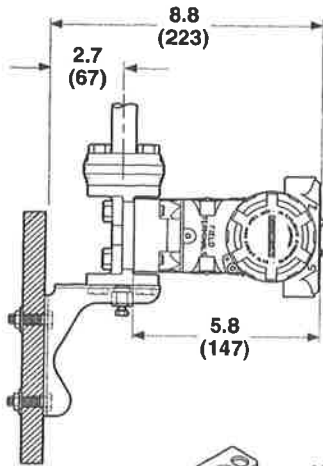


NOTE  
Dimensions are in inches (millimeters).

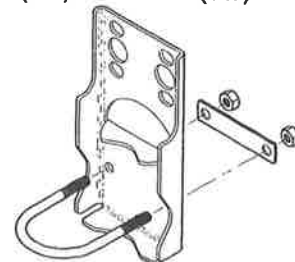
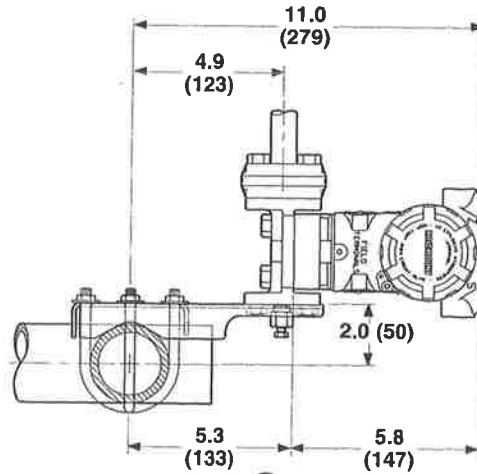
3051-3031C19A, I19A

FIGURE 3-13. Optional Mounting Brackets for Traditional Flange Options B2/B8, B3/B9/BC.

OPTION B2/B8: TRADITIONAL FLANGE PANEL MOUNTING BRACKET



OPTION B3/B9/BC: TRADITIONAL FLANGE

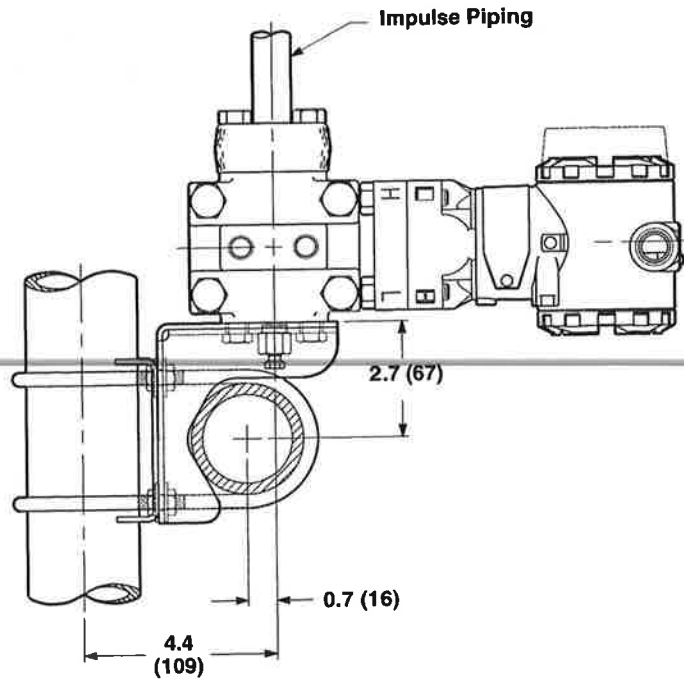
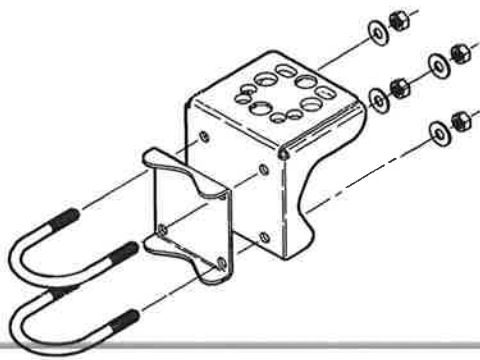


NOTE  
Dimensions are in inches (millimeters).

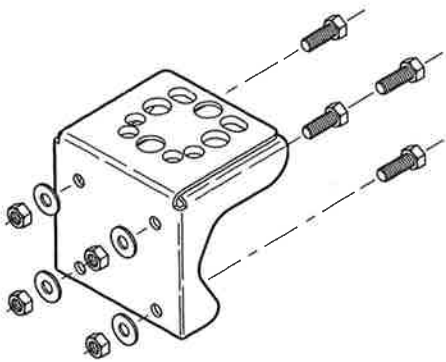
3051-3031E19B, H19A, J19D, J19E

FIGURE 3-14. Optional Mounting Bracket for 3051H Option Codes B5/B6.

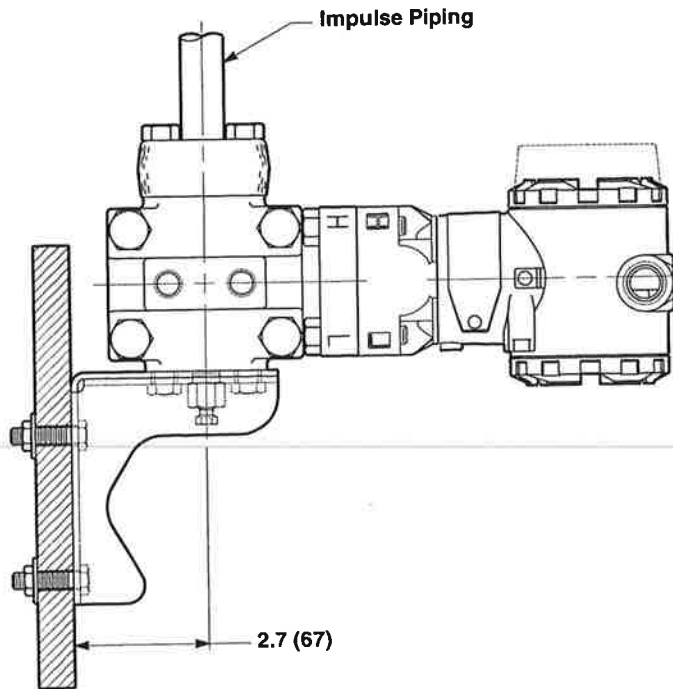
2-IN. PIPE MOUNTING CONFIGURATION



PANEL MOUNTING CONFIGURATION



7/16-20 x 3/4 Bolts Supplied for Attaching Bracket to Transmitter



NOTE  
Dimensions are in inches (millimeters).

3051-3031F19B, G19A; 3051HA3A, HA3B

## Mounting Bolts

The following guidelines have been established to ensure a tight flange, adapter, or manifold seal. The Model 3051 is shipped with the Coplanar flange installed with four 1.75-inch flange bolts. The following bolts also are supplied to facilitate other mounting configurations:

### Differential Pressure

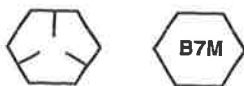
- Four 2.88-inch flange/adapter bolts for mounting the flange adapters to the Coplanar flange.
- Four 2.25-inch manifold/flange bolts for mounting the Coplanar flange on a three-valve manifold. In this configuration, the 1.75-inch bolts may be used to mount the flange adapters to the process connection side of the manifold.

### Gage/Absolute Pressure

- Two 2.88-inch flange/adapter bolts for mounting the flange adapters to the Coplanar flange.

Figures 3-15 and 3-16 on pages 3-19 and 3-20 show mounting bolts and bolting configurations. See page 6-11 for bolting requirements for alternate mounting configurations. Stainless steel bolts supplied by Rosemount Inc. are coated with a lubricant to ease installation. Carbon steel bolts do not require lubrication. No additional lubricant should be applied when installing either type of bolt. Bolts supplied by Rosemount Inc. are identified by their head markings:

#### Carbon Steel (CS) Head Markings



#### Stainless Steel (SST) Head Markings



\* The last digit in the F593\_ head marking may be any letter between A and M.

## Bolt Installation

**⚠** Only use bolts supplied with the Model 3051 or sold by Rosemount Inc. as spare parts for the Model 3051 transmitter. Use the following bolt installation procedure:

1. Finger-tighten the bolts.
2. Torque the bolts to the initial torque value using a crossing pattern (see Table 3-2 for torque values).
3. Torque the bolts to the final torque value using the same crossing pattern.

TABLE 3-2. Bolt Installation Torque Values.

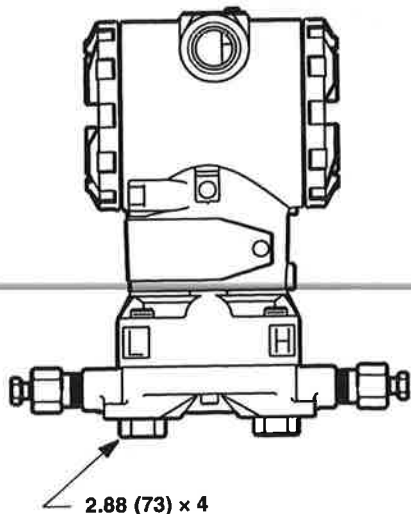
Bolt Material	Initial Torque Value	Final Torque Value
CS-ASTM-A445 Standard	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)
316 SST—Option L4	150 in.-lb (17 N-m)	300 in.-lb (34 N-m)
ASTM-A-193-B7M—Option L5	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)
<i>Monel</i> —Option L6	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)

**⚠** See "Safety Messages" on page 3-1 for complete warning information.

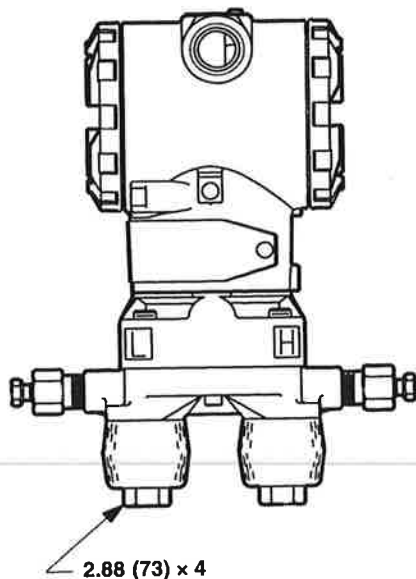


FIGURE 3-15. Mounting Bolts and Bolt Configurations for Coplanar Flange.

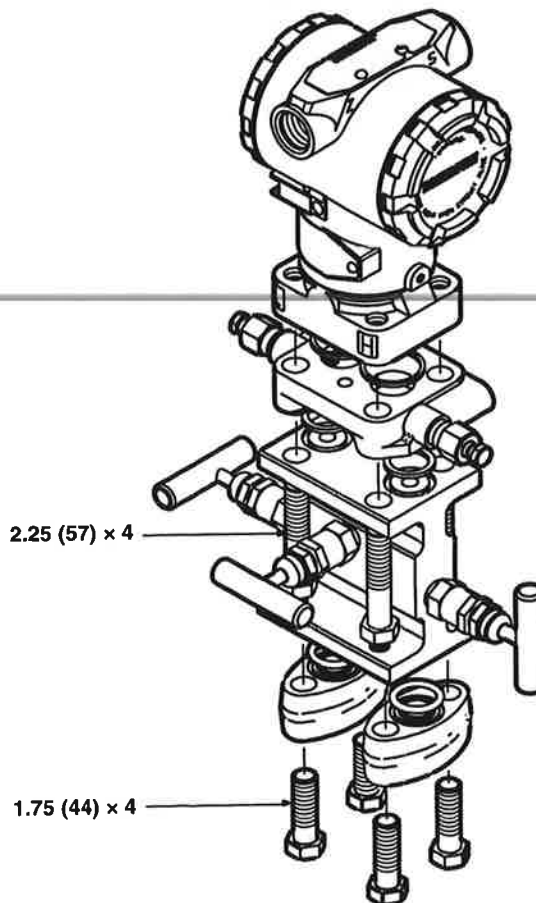
**TRANSMITTER WITH FLANGE BOLTS**



**TRANSMITTER WITH FLANGE ADAPTERS AND FLANGE/ADAPTER BOLTS**



**TRANSMITTER WITH 3-VALVE MANIFOLD MANIFOLD/FLANGE BOLTS FLANGE ADAPTERS AND FLANGE/ADAPTER BOLTS**  
(Differential Configuration Shown)



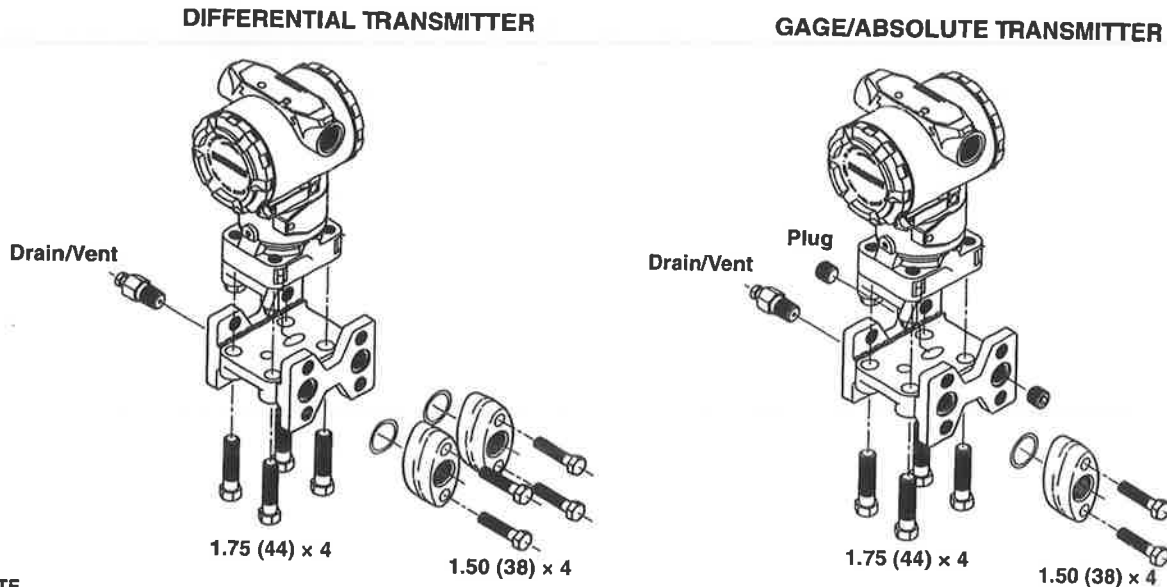
Description	Qty	Size in. (mm)
<b>Differential Pressure</b>		
Flange Bolts	4	1.75 (44)
Flange/Adapter Bolts	4	2.88 (73)
Manifold/Flange Bolts	4	2.25 (57)
<b>Gage/Absolute Pressure <sup>(1)</sup></b>		
Flange Bolts	4	1.74 (44)
Flange/Adapter Bolts	2	2.88 (73)

(1) Model 3051T transmitters are direct mount and do not require bolts for process connection.

**NOTE**  
Dimensions are in inches (millimeters).

3051-3031E06FD E06F: 305-3031A29P

FIGURE 3-16. Traditional Flange Bolt Configurations.



**NOTE**  
Dimensions are in inches (millimeters).

3051-3031B07G, B07I

## ELECTRICAL CONSIDERATIONS

The transmitter terminal block is in the compartment of the electronics housing labeled "FIELD TERMINALS." The other compartment contains the transmitter electronics module. Connections for the HART-based communicator are attached beneath the terminal screws on the terminal block. You can connect the Rosemount Model 272 Field Calibrator at the signal terminals to provide power to the transmitter temporarily for calibration or diagnostic purposes. Or you can attach it to the test connections on the terminal block of the transmitter for indication purposes. Figure 3-17 shows power supply load limitations for the transmitter.

### Power Supply

#### 4–20 mA Transmitters

The dc power supply should provide power with less than 2 percent ripple. The total resistance load is the sum of the resistance of the signal leads and the load resistance of the controller, indicator, and related pieces. Note that the resistance of intrinsic safety barriers, if used, must be included.

#### NOTE

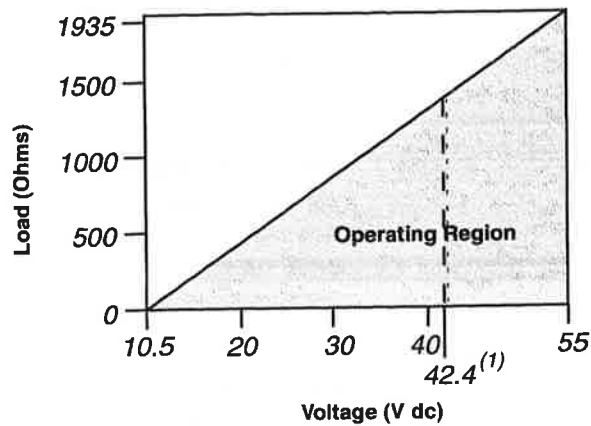
A minimum loop resistance of 250 ohms is required to communicate with a HART-based communicator. With 250 ohms of loop resistance, the transmitter will require a minimum of 16 volts to output 20 mA. If a single power supply is used to power more than one Model 3051 transmitter, the power supply used, and circuitry common to the transmitters, should not have more than 20 ohms of impedance at 1200 Hz.

#### Low Power Transmitters

Low-power transmitters require a 6–12 V dc external power supply.

FIGURE 3-17. Power Supply Load Limitations, 4–20 mA Transmitters.

$$\text{Max. Loop Resistance} = 43.5 \times (\text{Power Supply Voltage} - 10.5)$$



3051-0103A

Communication requires a minimum loop resistance of 250 ohms.

(1) For CSA approval, power supply must not exceed 42.4 V.

## Wiring

To make connections, perform the following procedure:

- ⚠ 1. Remove the housing cover on the side marked "FIELD TERMINALS." Do not remove the cover in explosive atmospheres when the circuit is alive. All power to the transmitter is supplied over the signal wiring.
- ⚠ 2. Connect the lead that originates at the positive side of the power supply to the terminal marked "+" and the lead that originates from the negative side of the power supply to the terminal marked "-". Avoid contact with the leads and terminals. Do not connect the powered signal wiring to the test terminals. Power could damage the test diode in the test connection.
3. Plug and seal unused conduit connections on the transmitter housing to avoid moisture accumulation in the terminal side of the housing. If you do not seal the unused connections, mount the transmitter with the electrical housing positioned downward for drainage. Install wiring with a drip loop. Arrange the drip loop so the bottom is lower than the conduit connections and the transmitter housing.

### NOTE

Signal wiring needs to be shielded, but use twisted pairs for best results. In order to ensure proper communication, use 24 AWG or larger wire, and do not exceed 5000 feet (1 500 meters).

Inductive-based transient protectors, including the Rosemount Model 470, can adversely affect the output of Model 3051 4–20 mA transmitters. Do not use the Model 470 for transient protection with the Model 3051. If your application requires transient protection, install the Transient Protection Terminal Block (see "Transient Protection Terminal Block (T1)" on page 6-12).

⚠ See "Safety Messages" on page 3-1 for complete warning information.

### Signal Wiring Grounding

Do not run signal wiring in conduit or open trays with power wiring, or near heavy electrical equipment. You may ground the signal wiring at any one point on the signal loop, or leave it ungrounded. The negative terminal of the power supply is a recommended grounding point.

### HAZARDOUS LOCATIONS

The Model 3051 has an explosion-proof housing and circuitry suitable for intrinsically safe and non-incendive operation. Individual transmitters are clearly marked with a tag indicating the certifications they carry. See Section 5 Specifications and Reference Data for specific approval categories, and see Appendix C Approval Drawings for installation drawings.

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#### IMPORTANT NOTE

Once a device labeled with multiple approval types is installed, it should not be reinstalled using any other approval types. Permanently mark the approval label to distinguish it from unused approval types.

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### Grounding the Transmitter Case

The transmitter case should always be grounded in accordance with national and local electrical codes. The most effective transmitter case grounding method is direct connection to earth ground with minimal impedance. Methods for grounding the transmitter case include:

- **Internal Ground Connection:** The Internal Ground Connection screw is inside the FIELD TERMINALS side of the electronics housing. This screw is identified by a ground symbol ( $\oplus$ ), and is standard on all Model 3051 transmitters.
- **External Ground Assembly:** This assembly is included with the optional transient protection terminal block (Option Code T1), and it is included with CESI/CENELEC Flameproof Certification (Option Code E8), BASEEFA/CENELEC Intrinsic Safety Certification (Option Code I1), and BASEEFA Type N Certification (Option Code N1). The External Ground Assembly can also be ordered with the transmitter (Option Code V5), or as a spare part (03031-0398-0001).

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#### NOTE

Grounding the transmitter case using the threaded conduit connection may not provide a sufficient ground. The transient protection terminal block (Option Code T1) does not provide transient protection unless the transmitter case is properly grounded. Use the above guidelines to ground the transmitter case. Do not run the transient protection ground wire with signal wiring as the ground wire may carry excessive current if a lightning strike occurs.

---

## ENVIRONMENTAL CONSIDERATIONS

The following guidelines can help optimize transmitter performance. Mount the transmitter to minimize ambient temperature changes, vibration, mechanical shock, and to avoid external contact with corrosive materials. **Section 5: Specifications and Reference Data** lists the transmitter temperature operating limits.

### Access Requirements

When choosing an installation location and position, take into account the need for access to the transmitter.

### Process Flange Orientation

Mount the process flanges with sufficient clearance for process connections. For safety reasons, place the drain/vent valves so the process fluid is directed away from technicians when the vents are used. In addition, consider the possible need for a testing or calibration input.

### Housing Rotation

See "Housing Rotation" on page 3-13.

### Terminal Side of Electronics Housing

Mount the transmitter so that the terminal side is accessible. A 0.75-inch (19 mm) clearance is required for cover removal. Use a conduit plug on the unused side of the conduit opening.

### Circuit Side of Electronics Housing

Provide 0.75 inches (19 mm) clearance if possible for cover removal. Three inches of clearance is required for cover removal if a meter is installed.

### Exterior of Electronics Housing

The integral span and zero adjustments are located under the certifications plate on the top of the transmitter. Allow a minimum of 1.0 inch of clearance above the transmitter if you intend to use the integral zero and span adjustments.

### Cover Installation

Always install the electronics housing covers metal-to-metal to ensure a proper seal.

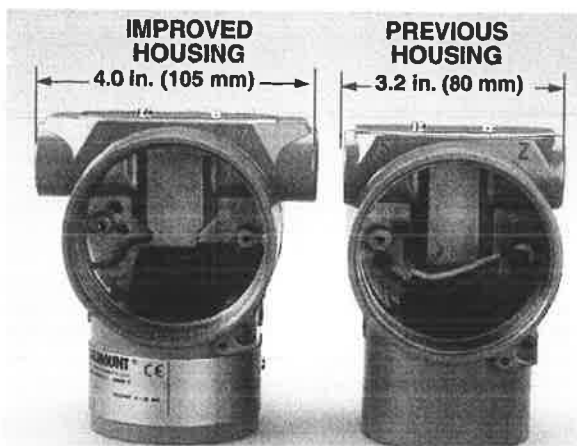
TABLE 4-1. Model 3051 Troubleshooting Chart.

Symptom	Corrective Actions
Milliamp Reading Is Zero	<ul style="list-style-type: none"> <li>• Check if power polarity is reversed.</li> <li>• Verify voltage across terminals (should be 10 to 55 V dc).</li> <li>• Check for bad diode in terminal block.</li> <li>• Replace transmitter terminal block.</li> </ul>
Transmitter Not Communicating with HART Communicator	<ul style="list-style-type: none"> <li>• Check power supply voltage at transmitter (minimum 10.5 V).</li> <li>• Verify calibration settings (4 and 20 mA points)</li> <li>• Check load resistance (250 Ω minimum).</li> <li>• Check if unit is addressed properly.</li> <li>• Replace electronics board.</li> </ul>
Milliamp Reading Is Low or High	<ul style="list-style-type: none"> <li>• Check pressure variable reading for saturation.</li> <li>• Check if output in alarm condition.</li> <li>• Verify 4 and 20 mA range points.</li> <li>• Perform 4–20 mA output trim.</li> <li>• Replace electronics board.</li> </ul>
No Response to Changes in Applied Pressure	<ul style="list-style-type: none"> <li>• Check test equipment.</li> <li>• Check impulse piping for blockage.</li> <li>• Check disabled span adjustment.</li> <li>• Check if output in alarm condition.</li> <li>• Replace sensor module.</li> </ul>
Pressure Variable Reading Is Low or High	<ul style="list-style-type: none"> <li>• Check impulse piping for blockage.</li> <li>• Check test equipment.</li> <li>• Perform full sensor trim.</li> <li>• Replace sensor module.</li> </ul>
Pressure Variable Reading Is Erratic	<ul style="list-style-type: none"> <li>• Check impulse piping for blockage.</li> <li>• Check damping.</li> <li>• Check for EMF interference.</li> <li>• Replace sensor module.</li> </ul>

**BEFORE DISASSEMBLING THE TRANSMITTER**

Maintenance procedures differ for improved and previous style transmitter housings. Verify the specific physical characteristics of your transmitter before you begin any maintenance procedures. The width of the conduit entries is the most noticeable physical difference between the improved and the previous style housing (see Figure 4-1).

FIGURE 4-1. Improved and Previous Styles of the Model 3051 Transmitter Housing.



3051\_063AB

## DISASSEMBLY PROCEDURES

### Remove the Transmitter from Service



3051-052AB

PAUL

**⚠** Do not remove the instrument cover in explosive atmospheres when the circuit is alive.

#### NOTE

Once you have determined a transmitter to be inoperable, remove it from service.

Be aware of the following:

- Isolate and vent the process from the transmitter before removing the transmitter from service.
- Remove all electrical leads and conduit.
- Detach the process flange by removing the four flange bolts and the two alignment screws that secure it.
- Do not scratch, puncture, or depress the isolating diaphragms.
- Clean isolating diaphragms with a soft rag and a mild cleaning solution, and rinse with clear water.
- Whenever you remove the process flange or flange adapters, visually inspect the Teflon O-rings. Replace the O-rings if they show any signs of damage, such as nicks or cuts. If they are undamaged, you may reuse them.

The Model 3051C transmitter is attached to the process connection by four bolts and two cap screws. Remove the four bolts and separate the transmitter from the process connection manifold or flange. You can leave the process connection in place and ready for re-installation.

The Model 3051T is attached to the process by a single hex nut process connection. Loosen the hex nut to separate the transmitter from the process.

### Remove the Terminal Block

Electrical connections are located on the terminal block in the compartment labelled "FIELD TERMINALS."

Loosen the two small screws located at the 9 o'clock and 4 o'clock positions, and pull the entire terminal block out to remove it.

#### NOTE

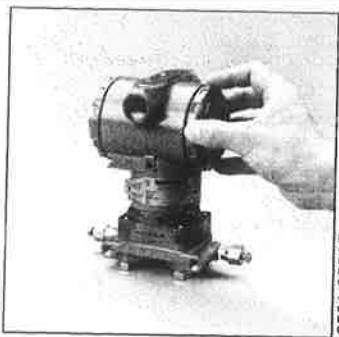
If removing the terminal block from the housing of a previous version of the transmitter, you will have to manually disconnect the power leads from the rear of the terminal block before completely separating it from the housing.

**⚠** See "Safety Messages" on page 4-1 for complete warning information.

## Remove the Electronics Board

The transmitter electronics board is located in the compartment opposite the terminal side. To remove the electronics board perform the following procedure:

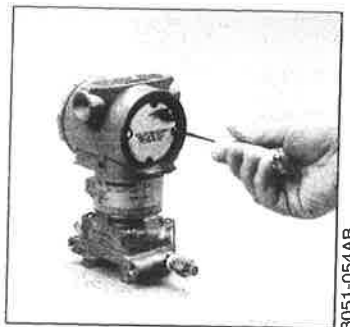
1. Remove the housing cover opposite the field terminal side.



2. Loosen the two captive screws that anchor the board to the housing. The electronics board is electrostatically sensitive; observe handling precautions for static-sensitive components.

### NOTE

If you are disassembling a transmitter with a LCD meter, loosen the two captive screws that are visible on the right and left side of the meter display. The two screws anchor the LCD meter to the electronics board and the electronics board to the housing.



3. Slowly pull the electronics board out of the housing. With the two captive screws free of the transmitter housing, only the sensor module ribbon cable holds the board to the housing.

### NOTE

Previous versions of the electronics board utilize a snap-in power plug and receptacle. Carefully unplug the power plug from the receptacle to free the board from the power cord.



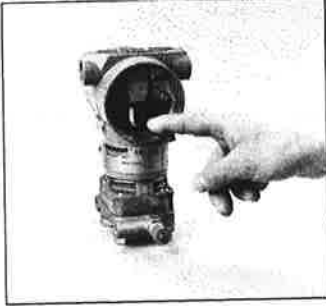
4. Disconnect the sensor module ribbon cable to release the electronics board from the transmitter.



See "Safety Messages" on page 4-1 for complete warning information.



## Remove the Sensor Module from the Electronics Housing

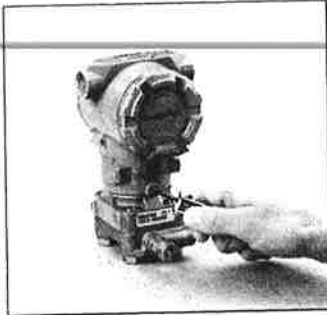


3051-057AB

1. Carefully tuck the cable connector completely inside of the internal shroud.

### NOTE

Do not remove the housing until after you tuck the cable connector completely inside of the internal shroud. The shroud protects the cable from damage that can occur when you rotate the housing.

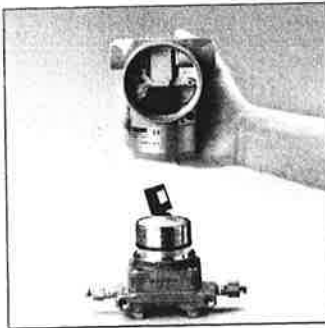


3051-059AB

2. Loosen the housing rotation set screw with a  $\frac{9}{64}$ -inch hex wrench, and back off one full turn.

### IMPORTANT

To prevent damage to the sensor module ribbon cable, disconnect it from the electronics board before you remove the sensor module from the electrical housing.



3051-060AB

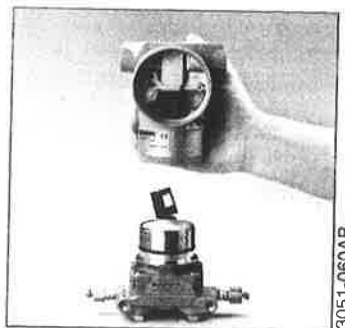
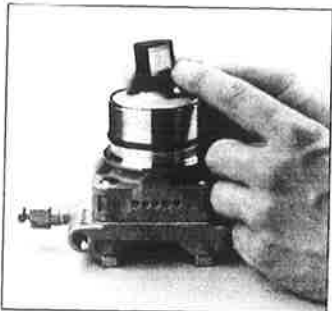
3. Unscrew the housing from the module, making sure the shroud and sensor cable do not catch on the housing.

### IMPORTANT

Make sure the sensor ribbon cable and internal shroud remain completely free of the housing as you rotate it. Damage can occur to the cable if the internal shroud and sensor cable become hung up and rotate with the housing.

## REASSEMBLY PROCEDURES

### Attach the Sensor Module to the Electronics Housing




1. Inspect all cover and housing (non-process wetted) O-rings and replace if necessary. Lightly grease with silicone lubricant to ensure a good seal.
2. Carefully tuck the cable connector completely inside the internal shroud. To do so, turn the shroud and cable counterclockwise one rotation to tighten the cable.

3. Lower the electronics housing onto the module. Guide the internal shroud and cable through the housing and into the external shroud.

4. Turn the housing clockwise to fasten it to the module.

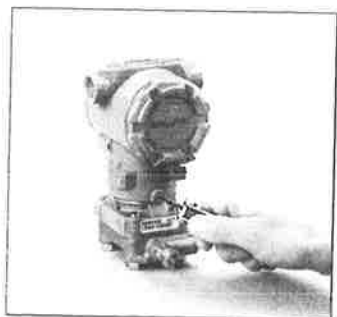
#### IMPORTANT

To prevent damage to the cable connector, watch the cable and shroud as you attach the housing to the module. Make sure the cable connector does not slip out of the internal shroud and begin to rotate with the housing. Reinsert the cable connector into the shroud if it escapes before the housing is fully fastened.

5.  Thread the housing completely onto the sensor module. The housing must be no more than one full turn from flush with the sensor module to comply with explosionproof requirements.
6. Tighten the housing rotation set screw using a  $\frac{9}{64}$ -inch hex wrench.

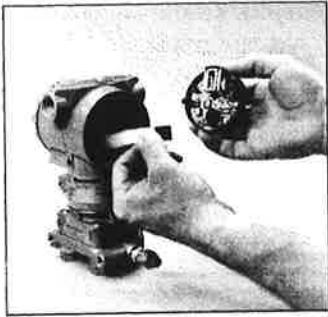
#### NOTE

Electronics board revision 5.3.163 or later (all shrouded designs) are able to verify alarm current levels. After replacing the transmitter electronics board, sensor module, or LCD meter, an alarm level test is recommended before returning the transmitter to service (see "Alarm Level Verification" on page 2-3).



 See "Safety Messages" on page 4-1 for complete warning information.

## Attach the Electronics Board



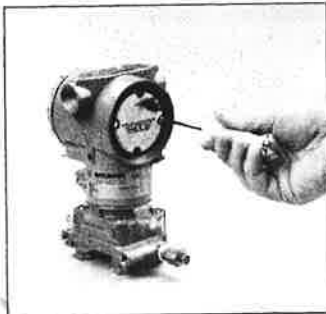
3051-056AB

1. Remove the cable connector from its position inside of the internal shroud and attach it to the electronics board.

2. Insert the electronics board into the housing, making sure that the posts from the electronics housing properly engage the receptacles on the electronics board.

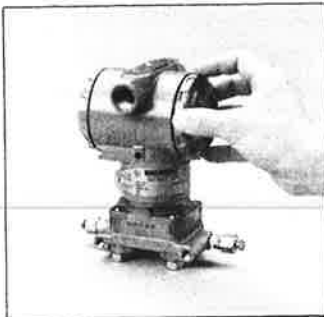
### NOTE

If you are reassembling a previous version of the electronics board (or placing a new version of the electronics board in a previous version of the housing), attach the snap-in power connection to the receptacle on the board with the black and red wires routed toward the center of the board and below the white reed switch holder.



3051-054AB

3. Tighten the captive mounting screws.



3051-053AB



4. Replace the electronics housing cover. The transmitter covers must be engaged metal-to-metal to ensure a proper seal and to meet explosionproof requirements.

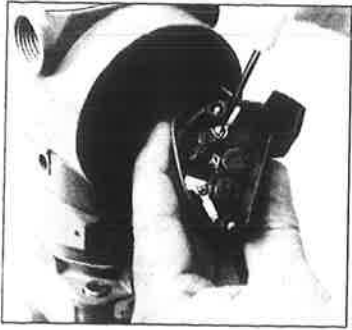
### NOTE

Electronics board revision 5.3.163 or later (all shrouded designs) are able to verify alarm current levels. After replacing the transmitter electronics board, sensor module, or LCD meter, an alarm level test is recommended before returning the transmitter to service (see "Alarm Level Verification" on page 2-3).



See "Safety Messages" on page 4-1 for complete warning information.

## Install the Terminal Block



3051-068AB

## Reassemble the Process Sensor Body

Gently slide the terminal block into place, making sure the posts from the electronics housing properly engage the receptacles on the terminal block. Tighten the captive screws and replace the electronics housing cover. The transmitter covers must be fully engaged to meet explosionproof requirements.

### NOTE

If you are reassembling a previous version of the terminal block, attach the black and red wires to the back side of the block before you insert it into the electronics housing.

1. Visually inspect the Teflon sensor module O-rings. If the O-rings are undamaged, you may reuse them. If the O-rings show signs of damage, such as nicks or cuts, or if there is any doubt about their ability to seal properly, replace them with new O-rings.

### NOTE

If you are replacing the O-rings, be careful not to scratch the O-ring grooves or the surface of the isolating diaphragm when removing the damaged O-rings.

2. Install the process flange on the sensor module. To hold the process flange in place, install the two hex head alignment screws. These screws are not pressure retaining and need only be finger tight. Do not overtighten; this will affect the module/flange alignment.
3. Install the appropriate flange bolts.
  - a. **IF** the installation requires a 1/4-18 NPT mounting, **THEN** use four 1.75-inch flange bolts. Go to **step f**.
  - b. **IF** the installation requires a 1/2-14 NPT mounting, **THEN** use four 2.88-inch process flange/adaptor bolts. **EXCEPTION:** For gage pressure configurations, use two 2.88-inch bolts and two 1.75-inch bolts. Go to **step d**.
  - c. **IF** the installation uses a three-valve manifold (differential pressure applications only), **THEN** use four 2.25-inch manifold flange bolts. Go to **step e**.
  - d. Hold the flange adapters and adapter O-rings in place while finger-tightening the bolts. Go to **step g**.
  - e. Align the process flange with the three-valve manifold.
  - f. Finger tighten the bolts.
  - g. Tighten the bolts to the initial torque value using a crossed pattern. See Table 4-2 for appropriate torque values.
  - h. Tighten the bolts to the final torque value using a crossed pattern. See Table 4-2 for appropriate torque values. When fully tightened, the bolts should extend through the top of the module housing.
  - i. If the installation uses a three-valve manifold, then install flange adapters on the process end of the manifold using the 1.75-inch flange bolts supplied with the transmitter.

TABLE 4-2. Bolt Installation Torque Values.

Bolt Material	Initial Torque Value	Final Torque Value
CS-ASTM-A445 Standard	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)
316 SST—Option L4	150 in.-lb (17 N-m)	300 in.-lb (34 N-m)
ASTM-A-193-B7M—Option L5	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)
Monel—Option L6	300 in.-lb (34 N-m)	650 in.-lb (73 N-m)

4. **IF** you replaced the Teflon sensor module O-rings, **THEN** re-torque the flange bolts after installation to compensate for cold flow.
5. Install the drain/vent valve.
  - a. Apply sealing tape to the threads on the seat. Starting at the base of the valve with the threaded end pointing toward the installer, apply two clockwise turns of the sealing tape.
  - b. Take care to place the opening on the valve so that process fluid will drain toward the ground and away from personnel when the valve is opened.
  - c. Tighten the drain/vent valve to 250 in.-lb (28.25 N-m).

**NOTE**

After replacing O-rings on Range 1 transmitters and re-installing the process flange, expose the transmitter to a temperature of 185 °F (85 °C) for two hours. Then re-tighten the flange bolts in a cross pattern, and again expose the transmitter to a temperature of 185 °F (85 °C) for two hours before calibration.

**Returning Rosemount Products and Materials**

To expedite the return process outside of the United States, contact the nearest Rosemount representative.

Within the United States, call the Rosemount National Response Center using the 1-800-654-RSMT (7768) toll-free number. This center, available 24 hours a day, will assist you with any needed information or materials.

The center will ask for product model and serial numbers, and will provide a Return Material Authorization (RMA) number. The center will also ask for the process material to which the product was last exposed.

**⚠ CAUTION**

Individuals who handle products exposed to a hazardous substance can avoid injury if they are informed of and understand the hazard. If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

Rosemount National Response Center representatives will explain the additional information and procedures necessary to return goods exposed to hazardous substances.

# Specifications and Reference Data

## PERFORMANCE SPECIFICATIONS

*Total Performance is based on combined errors of reference accuracy, ambient temperature effect, and static pressure effect.*

*For detailed performance specifications, see page 5-2.*

### Model 3051C (Ranges 2–5), Model 3051T

#### Reference Accuracy

±0.075% of span.

#### Total Performance

±0.15% of span for ±50 °F (28 °C) temperature changes, up to 1000 psi (6,9 MPa) line pressure (CD only), from 1:1 to 5:1 rangedown.

#### Stability

±0.125% of URL for 5 years for ±50 °F (28 °C) temperature changes, and up to 1000 psi (6,9 MPa) line pressure.

#### Dynamic Performance

##### Total Response Time ( $T_d + T_c$ )

100 ms

### Model 3051CD, Low/Draft Range (Ranges 0–1)

#### Reference Accuracy

±0.10% of span.

#### Stability

±0.20% of URL for 1 year.

### Model 3051P—Reference Class

#### Reference Accuracy

±0.05% of span.

#### Total Performance

±0.10% of span for ±50 °F (28 °C) temperature changes, up to 1000 psi (6,9 MPa) line pressure, from 1:1 to 5:1 rangedown.

#### Stability

±0.125% of URL for 5 years for ±50 °F (28 °C) temperature changes, and up to 1000 psi (6,9 MPa) line pressure.

#### Dynamic Performance

##### Total Response Time ( $T_d + T_c$ )

100 ms

**Model 3051L—Liquid Level**

**Reference Accuracy**

±0.075% of span.

**Model 3051H—High Process Temperature**

**Reference Accuracy**

±0.075% of span.

**Stability**

±0.1% of URL for 12 months for Ranges 2 and 3.

±0.2% of URL for 12 months for Ranges 4 and 5.

**DETAILED  
PERFORMANCE  
SPECIFICATIONS**

**Reference Accuracy**

*Zero-based spans, reference conditions, silicone oil fill, 316 SST isolating diaphragms, 4–20 mA analog output, and digital trim values equal to the span set points.*

Stated reference accuracy includes hysteresis, terminal-based linearity, setability, and repeatability.

**3051CD Ranges 2–5 and 3051CG**

±0.075% of span.

For spans less than 10:1, accuracy =

$$\pm \left[ 0.025 + 0.005 \left( \frac{URL}{Span} \right) \right] \% \text{ of Span}$$

**3051CD Range 1**

±0.10% of span.

For spans less than 15:1, accuracy =

$$\pm \left[ 0.025 + 0.005 \left( \frac{URL}{Span} \right) \right] \% \text{ of Span}$$

**3051CD Range 0**

±0.10% of span.

For spans less than 2:1, accuracy =

±0.05% of URL.

**3051T/CA Ranges 1–5**

±0.075% of span.

For spans less than 10:1, accuracy =

$$\pm \left[ 0.0075 \left( \frac{URL}{Span} \right) \right] \% \text{ of Span}$$

**3051CA Range 0**

±0.075% of span.

For spans less than 5:1, accuracy =

$$\pm \left[ 0.025 + 0.01 \left( \frac{URL}{Span} \right) \right] \% \text{ of Span}$$

**3051H/3051L**

±0.075% of span. For spans less than 10:1, accuracy =

$$\pm \left[ 0.025 + 0.005 \left( \frac{URL}{Span} \right) \right] \% \text{ of Span}$$

**3051P**

±0.05% of span.

**3051CD/CG**

±(0.0125% URL + 0.0625% span) from 1:1 to 5:1

±(0.025% URL + 0.125% span) from 5:1 to 100:1

Range 0: ±(0.25% URL + 0.05% span)

Range 1: ±(0.1% URL + 0.25% span)

**3051P**

±(0.006% URL + 0.03% span)

**3051H**

±(0.025% URL + 0.125% span + 0.35 inH<sub>2</sub>O)

For spans below 30:1 rangedown:

±(0.035% URL + 0.125% span + 0.35 inH<sub>2</sub>O)

**3051L**

See the Rosemount Instrument Toolkit™ or SOAP 2000 software.

**3051T and 3051CA**

±(0.025% URL + 0.125% span) from 1:1 to 30:1

±(0.035% URL + 0.125% span) from 30:1 to 100:1

Range 0: ±(0.1% URL + 0.25% span)

Range 5: ±(0.1% URL + 0.15% span)

Model 3051T Range 1:

±(0.025% URL + 0.125% span) from 1:1 to 10:1

±(0.05% URL + 0.125% span) from 10:1 to 100:1

**Ambient Temperature Effect per 50 °F (28 °C)**

**Static Pressure Effect per 1000 psi (6,9 MPa)**

**Zero Error (can be calibrated out at line pressure)**

Zero line pressure effect per 1000 psi (6,9 MPa).

Model	Range	Zero Effect with Static Pressure	
		≤ 2000 psi (13.7 MPa)	Pressure > 2000 psi (13.7 MPa)
3051CD	0 <sup>(1)</sup>	±0.125% URL	N/A
	1	±0.25% URL	N/A
	2,3	±0.05% URL	[0.20 + 0.20 (Pressure - 2)]%
	4,5	±0.10% URL	[0.10 + 0.10 (Pressure - 2)]%
3051PD	2,3	±0.04% URL	N/A
3051HD	2-5	±0.10% URL	[0.20 + 0.20 (Pressure - 2)]%

(1) Specification expressed in Percent/100 psi (0,69 MPa) up to 750 psi (5,17 MPa).



**Span Error**

Span line pressure effect per 1000 psi (6,9 MPa).

Model	Range	Span Effect
3051CD	0 <sup>(1)</sup>	±0.15% of reading
	1	±0.40% of reading
	2,3	±0.10% of reading
	4,5 <sup>(2)</sup>	±0.20% of reading
3051PD	2,3	±0.10% of reading
3051HD	2,3	±0.10% of reading
	4,5 <sup>(2)</sup>	±0.20% of reading

(1) Specification expressed in Percent/100 psi (0,69 MPa) up to 750 psi (5,17 MPa).

(2) Accuracy listed is after correction of systematic span effect. Refer to page 2-28 for line pressure compensation procedure.

**Dynamic Performance**

Dead Time and Update Rate applies to all models and ranges, analog output only.

**Dead Time ( $T_d$ ):**45 milliseconds (nominal)

**Update Rate:**22 times per second

**Total Response Time ( $T_d + T_c$ ):**

**3051C/P**

100 milliseconds for ranges 2-5

255 milliseconds for range 1

700 milliseconds for range 0

**3051T**

100 milliseconds for ranges 1-5

**3051H/3051L**

Consult factory

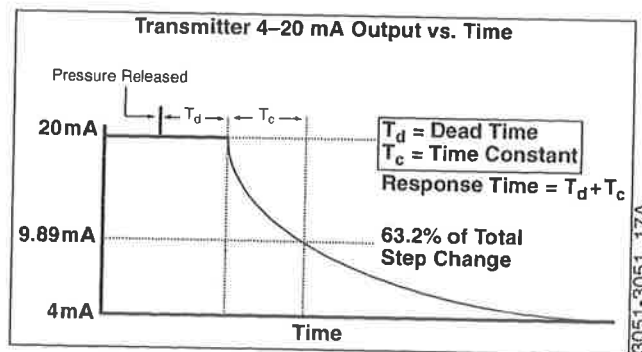


Figure 5-1. Typical Smart Transmitter Response Time

**Mounting Position Effects**

**3051C/P**

Zero shifts up to ±1.25 inH<sub>2</sub>O (0,31 kPa), which can be calibrated out. No span effect.

**3051H**

Zero shifts up to ±5 inH<sub>2</sub>O (127 mmH<sub>2</sub>O), which can be calibrated out. No span effect.

**3051L**

With liquid level diaphragm in vertical plane, zero shift of up to 1 inH<sub>2</sub>O (25,4 mmH<sub>2</sub>O).

With diaphragm in horizontal plane, zero shift of up to 5 inH<sub>2</sub>O (127 mmH<sub>2</sub>O) plus extension length on extended units. All zero shifts can be calibrated out. No span effect.

**3051T/CA**

Zero shifts up to 2.5 inH<sub>2</sub>O (63,5 mmH<sub>2</sub>O), which can be calibrated out. No span effect.

**Vibration Effect**

**All Models**

Measurement effect due to vibrations is negligible except at resonance frequencies. When at resonance frequencies, vibration effect is less than ±0.1% of URL per g when tested between 15 and 2000 Hz in any axis relative to pipe-mounted process conditions.

**Power Supply Effect**

**All Models**

Less than ±0.005% of calibrated span per volt.

**RFI Effects**

**All Models**

±0.1% of span from 20 to 1000 MHz and for field strength up to 30 V/m.

**Transient Protection  
(Option Code T1)**

**All Models**

**Meets IEEE Standard 587, Category B**

1 kV crest (10 × 1000 microseconds)

3 kV crest (8 × 20 microseconds)

6 kV crest (1,2 × 50 microseconds)

**Meets IEEE Standard 472,  
Surge Withstand Capability**

SWC 2,5 kV crest, 1 MHz wave form

**General Specifications:**

<b>Response Time:</b>	< 1 nanosecond
<b>Peak Surge Current:</b>	5000 amps to housing
<b>Peak Transient Voltage:</b>	100 V dc
<b>Loop Impedance:</b>	< 25 ohms
<b>Applicable Standards:</b>	IEC 801-4, IEC 801-5

**NOTE:**

Calibrations at 68 °F (20 °C) per ASME Z210.1 (ANSI).

## FUNCTIONAL SPECIFICATIONS

### Range and Sensor Limits

TABLE 5-1. Model 3051CD, 3051CG, 3051P, 3051L, and 3051H Range and Sensor Limits

Range	Minimum Span			Range and Sensor Limits							
	Model 3051 CD, CG, L, H	Model 3051P	Upper (URL)	Lower (LRL)							
				3051C Differential	3051C/P Gage	3051P Differential	3051L Differential	3051L Gage	3051H Differential	3051H Gage	
0	0.1 inH <sub>2</sub> O (25 Pa)	NA	3.0 inH <sub>2</sub> O (750 Pa)	-3.0 inH <sub>2</sub> O (-750 Pa)	NA	NA	NA	NA	NA	NA	NA
1	0.5 inH <sub>2</sub> O (0,12 kPa)	NA	25 inH <sub>2</sub> O (6,22 kPa)	-25 inH <sub>2</sub> O (-6,22 kPa)	NA	NA	NA	NA	NA	NA	NA
2	2.5 inH <sub>2</sub> O (0,62 kPa)	25 inH <sub>2</sub> O (6,22 kPa)	250 inH <sub>2</sub> O (62,2 kPa)	-250 inH <sub>2</sub> O (-62,2 kPa)	-250 inH <sub>2</sub> O (-62,2 kPa)	-250 inH <sub>2</sub> O (-62,2 kPa)	-250 inH <sub>2</sub> O (-62,2 kPa)	-250 inH <sub>2</sub> O (-62,2 kPa)	-250 inH <sub>2</sub> O (-62,2 kPa)	-250 inH <sub>2</sub> O (-62,2 kPa)	-250 inH <sub>2</sub> O (-62,2 kPa)
3	10 inH <sub>2</sub> O (2,48 kPa)	100 inH <sub>2</sub> O (24,8 kPa)	1000 inH <sub>2</sub> O (248 kPa)	-1000 inH <sub>2</sub> O (-248 kPa)	0.5 psia (3,5 kPa abs)	-1000 inH <sub>2</sub> O (-248 kPa)	-1000 inH <sub>2</sub> O (-248 kPa)	0.5 psia (3,5 kPa abs)	-1000 inH <sub>2</sub> O (-248 kPa)	0.5 psia (3,5 kPa abs)	
4	3 psi (20,7 kPa)	30 psi (207 kPa)	300 psi (2 070 kPa)	-300 psi (-2 070 kPa)	0.5 psia (3,5 kPa abs)	-300 psi (-2 070 kPa)	-300 psi (-2 070 kPa)	0.5 psia (3,5 kPa abs)	-300 psi (-2 070 kPa)	0.5 psia (3,5 kPa abs)	
5	20 psi (138 kPa)	200 psi (1 380 kPa)	2000 psi (13 800 kPa)	-2000 psi (-13 800 kPa)	0.5 psia (3,5 kPa abs)	-2000 psi (-13 800 kPa)	NA	NA	-2000 psi (-13 800 kPa)	0.5 psia (3,5 kPa abs)	

TABLE 5-2. Model 3051CA Range and Sensor Limits

Range	Minimum Span	Range and Sensor Limits	
		Upper (URL)	Lower (LRL)
0	0.167 psia (8,6 mmHg <sub>a</sub> )	5 psia (260 mmHg <sub>a</sub> )	0 psia (0 mmHg <sub>a</sub> )
1	0.3 psia (2,07 kPa)	30 psia (206,8 kPa)	0 psia (0 kPa)
2	1.5 psia (10,34 kPa)	150 psia (1 034,2 kPa)	0 psia (0 kPa)
3	8 psia (55,16 kPa)	800 psia (5 515,8 kPa)	0 psia (0 kPa)
4	40 psia (275,8 kPa)	4000 psia (27 580 kPa)	0 psia (0 kPa)

TABLE 5-3. Model 3051T Range and Sensor Limits

Range	Minimum Span	Range and Sensor Limits		
		Upper (URL)	Lower (LRL) (Abs.)	Lower <sup>(1)</sup> (LRL) (Gage)
1	0.3 psi (2 kPa)	30 psi (207 kPa)	0 psia (0 kPa)	-14.7 psig (-101 kPa)
2	1.5 psi (10 kPa)	150 psi (1 034 kPa)	0 psia (0 kPa)	-14.7 psig (-101 kPa)
3	8 psi (55 kPa)	800 psi (5 516 kPa)	0 psia (0 kPa)	-14.7 psig (-101 kPa)
4	40 psi (276 kPa)	4000 psi (27 579 kPa)	0 psia (0 kPa)	-14.7 psig (-101 kPa)
5	2000 psi (13 790 kPa)	10000 psi (68 948 kPa)	0 psia (0 kPa)	-14.7 psig (-101 kPa)

(1) Assumes atmospheric pressure of 14.7 psig.

### Zero and Span Adjustment Requirements

- Zero and span values can be set anywhere within the range limits stated in Table 5-1 through 5-3.
- Span must be greater than or equal to the minimum span stated in Table 5-1 through 5-3.

### Service

Liquid, gas, and vapor applications.

### 4–20 mA (Output Code A)

#### Output

Two-wire 4–20 mA, user-selectable for linear or square root output. Digital process variable superimposed on 4–20 mA signal, available to any host that conforms to the HART protocol.

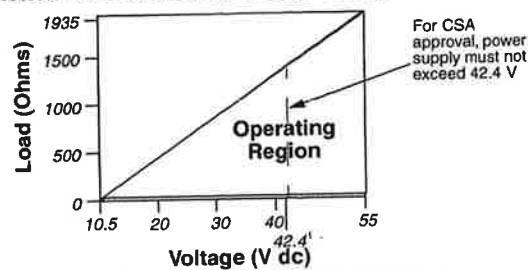
#### Power Supply

External power supply required. Standard transmitter (4–20 mA) operates on 10.5 to 55 V dc with no load.

#### Load Limitations

Maximum loop resistance is determined by the voltage level of the external power supply, as described by:

$$\text{Max. Loop Resistance} = 43.5(\text{Power Supply Voltage} - 10.5)$$



Communication requires a minimum loop resistance of 250 ohms.

### Low Power (Output Code M)

#### Output

Three wire 1–5 V dc or 0.8–3.2 V dc (Option Code C2) user-selectable output. Also user selectable for linear or square root output configuration. Digital process variable superimposed on voltage signal, available to any host conforming to the HART protocol. Low-power transmitter operates on 6–12 V dc with no load.

#### Power Consumption

3.0 mA, 18–36 mW

#### Minimum Load Impedance

100 k $\Omega$  ( $V_{out}$  wiring)

#### Indication

Optional 5-digit LCD meter

**Overpressure Limits**

Transmitters withstand the following limits without damage:

**Model 3051CD/CG**

- Range 0: 750 psi (5 171 kPa)
- Range 1: 2000 psig (13,8 MPa)
- Ranges 2–5: 3626 psig (25 MPa)

**Model 3051CA**

- Range 0: 60 psia (413,7 kPa)
- Range 1: 120 psia (827,4 kPa)
- Range 2: 300 psia (2 070 kPa)
- Range 3: 1600 psia (11 030 kPa)
- Range 4: 6000 psia (41 370 kPa)

**Model 3051H**

All Ranges: 3626 psig (25 MPa)

**Model 3051TG/TA**

- Range 1: 750 psi (5,2 MPa)
- Range 2: 1500 psi (10,3 MPa)
- Range 3: 1600 psi (11,0 MPa)
- Range 4: 6000 psi (41,4 MPa)
- Range 5: 15000 psi (103,4 MPa)

**Model 3051PG**

Ranges 2-5: 3626 psig (25 MPa)

**Model 3051 PD**

Ranges 2 and 3: 2000 psig (13,8 MPa)

For Model 3051L or Level Flange Option Codes FA, FB, FC, and FD, limit is 0 psia to the flange rating or sensor rating, whichever is lower.

TABLE 5-4. Model 3051L and Level Flange Rating Limits

Standard	Type	CS Rating	SST Rating
ANSI/ASME	Class 150	285 psig	275 psig
ANSI/ASME	Class 300	740 psig	720 psig
ANSI/ASME	Class 600	1480 psig	1440 psig
<i>At 100 °F (38 °C), rating decreases with increasing temperature.</i>			
DIN	PN 10-40	40 bar	40 bar
DIN	PN 10/16	16 bar	16 bar
DIN	PN 25/40	40 bar	40 bar
<i>At 248 °F (120 °C), rating decreases with increasing temperature.</i>			

**Static Pressure Limit**

**Model 3051CD Only**

Operates within specifications between static line pressures of 0.5 psia and 3626 psig (4500 psig for Option Code P9).

- Range 0: 0.5 psia and 750 psig
- Range 1: 0.5 psia and 2000 psig

**Model 3051PD Only**

Operates within specifications between static line pressures of 0.5 psia and 2000 psig.

**Burst Pressure Limits**

Burst pressure on Coplanar, traditional, or Model 3051H process flange is 10000 psig (69 MPa).

Burst pressure for the Model 3051T is

Ranges 1-4: 11000 psi (75,8 MPa)

Range 5: 26000 psig (179 MPa)

**Failure Mode Alarm**

**Output Code A**

If self-diagnostics detect a gross transmitter failure, the analog signal will be driven  $\leq 3.75$  mA or  $\geq 21.75$  mA to alert the user. Also, NAMUR-Compliant alarm limits are installed through the C4 or CN option. NAMUR-Compliant limits are  $\leq 3.6$  mA for low alarm, and  $\geq 22.5$  mA for high alarm. High or low alarm signal is user-selectable by internal jumper.

**Output Code M**

If self-diagnostics detect a gross transmitter failure, the analog signal will be driven either below 0.94 V or above 5.4 V to alert the user (below 0.75 V or above 4.4 V for Option C2). High or low alarm signal is user-selectable by internal jumper.

**Temperature Limits**

**Ambient**

-40 to 185 °F (-40 to 85 °C).

With integral meter: -4 to 175 °F (-20 to 80 °C)

**Storage**

-50 to 230 °F (-46 to 110 °C)

With integral meter: -40 to 185 °F (-40 to 85 °C)

**Process**

At atmospheric pressures and above. See Table 5-5.

TABLE 5-5. Model 3051 Process Temperature Limits

Model 3051CD, 3051CG, 3051CA, 3051P	
Silicone Fill Sensor <sup>(1)</sup>	
with Coplanar Flange	-40 to 250 °F (-40 to 121 °C) <sup>(2)</sup>
with Traditional Flange	-40 to 300 °F (-40 to 149 °C) <sup>(2)</sup>
with Level Flange	-40 to 300 °F (-40 to 149 °C) <sup>(2)</sup>
with Model 305 Integral Manifold	-40 to 300 °F (-40 to 149 °C) <sup>(2)</sup>
Inert Fill Sensor <sup>(1)</sup>	0 to 185 °F (-18 to 85 °C) <sup>(3)(4)</sup>
Model 3051H (Process Fill Fluid)	
D.C. Silicone 200 <sup>(1)</sup>	-40 to 375 °F (-40 to 191 °C)
Inert <sup>(1)</sup>	-50 to 350 °F (-45 to 177 °C)
Neobee M-20 <sup>(1)</sup>	0 to 375 °F (-18 to 191 °C)
Model 3051T (Process Fill Fluid)	
Silicone Fill Sensor <sup>(1)</sup>	-40 to 250 °F (-40 to 121 °C) <sup>(2)</sup>
Inert Fill Sensor <sup>(1)</sup>	-22 to 250 °F (-30 to 121 °C) <sup>(2)</sup>
Model 3051L Low-Side Temperature Limits	
Silicone Fill Sensor <sup>(1)</sup>	-40 to 250 °F (-40 to 121 °C) <sup>(2)</sup>
Inert Fill Sensor <sup>(1)</sup>	0 to 185 °F (-18 to 85 °C) <sup>(2)</sup>

TABLE 5-5. Model 3051 Process Temperature Limits

Model 3051L High-Side Temperature Limits (Process Fill Fluid)	
Syltherm® XLT	-100 to 300 °F (-73 to 149 °C)
D.C. Silicone 704 <sup>(5)</sup>	60 to 600 °F (15 to 315 °C)
D.C. Silicone 200	-40 to 400 °F (-40 to 205 °C)
Inert	-50 to 350 °F (-45 to 177 °C)
Glycerin and Water	0 to 200 °F (-18 to 93 °C)
Neobee M-20	0 to 400 °F (-18 to 205 °C)
Propylene Glycol and Water	0 to 200 °F (-18 to 93 °C)
Syltherm 800	-50 to 400 °F (-45 to 205 °C)

- (1) Process temperatures above 185 °F (85 °C) require derating the ambient limits by a 1.5:1 ratio (0.6:1 ratio for the Model 3051H).  
 (2) 220 °F (104 °C) limit in vacuum service; 130 °F (54 °C) for pressures below 0.5 psia.  
 (3) 160 °F (71 °C) limit in vacuum service.  
 (4) Not available for Model 3051CA.  
 (5) Upper limit is for seal assemblies mounted away from the transmitter with the use of capillaries.

**Humidity Limits**

0–100% relative humidity

**Turn-On Time**

Performance within specifications less than 2.0 seconds after power is applied to the transmitter

**Volumetric Displacement**

Less than 0.005 in<sup>3</sup> (0,08 cm<sup>3</sup>)

**Damping**

Analog output response to a step input change is user-selectable from 0 to 36 seconds for one time constant. This software damping is in addition to sensor module response time.

**PHYSICAL SPECIFICATIONS**

**Electrical Connections**

1/2–14 NPT, PG 13.5, G1/2, and M20 × 1.5 (CM20) conduit. HART interface connections fixed to terminal block.

**Process Connections**

**All Models except 3051L and 3051T**

1/4–18 NPT on 2 1/8-in. centers

1/2–14 NPT on 2-, 2 1/8-, or 2 1/4-in. centers

**Model 3051L**

High pressure side: 2-, 3-, or 4-in., ASME B 16.5 (ANSI) Class 150, 300 or 600 flange; 50, 80 or 100 mm, PN 40 or 10/16 flange

Low pressure side: 1/4–18 NPT on flange

1/2–14 NPT on adapter

**Model 3051T**

1/4–18 NPT, 1/2–14 NPT female, G1/2 A DIN 16288 Male (available in SST for Range 1–4 transmitters only), or Autoclave type F-250-C (Pressure relieved 9/16–18 gland thread; 1/4 OD high pressure tube 60° cone; available in SST for Range 5 transmitters only).

**Process-Wetted Parts**

**Process Isolating Diaphragms**

Isolating Diaphragm Material	3051CD/CG	3051T	3051CA	3051P	3051H	3051L
316L SST	•	•	•	•	•	See Below
Hastelloy C-276	•	•	•		•	
Monel	•		•		•	
Tantalum	•				•	
Gold-plated Monel	•		•			
Gold-plated SST	•		•			

**Drain/Vent Valves**

316 SST, Hastelloy C, or Monel material (Monel not available with Model 3051L or 3051H)

**Process Flanges and Adapters**

Plated carbon steel, CF-8M (Cast version of 316 SST, material per ASTM-A743), Hastelloy C, or Monel

**Wetted O-rings**

Glass-filled TFE (Graphite-filled TFE with isolating diaphragm Option Code C6)

**Model 3051L Process Wetted Parts**

**Flanged Process Connection (Transmitter High Side)**

**Process Diaphragms, Including Process Gasket Surface:**

316L SST, Hastelloy C-276, or Tantalum

**Extension**

CF-3M (Cast version of 316L SST, material per ASTM-A743), or Hastelloy C. Fits schedule 40 and 80 pipe.

**Mounting Flange**

Zinc-cobalt plated CS or SST

**Reference Process Connection (Transmitter Low Side)**

**Isolating Diaphragms**

316L SST or Hastelloy C-276

**Reference Flange and Adapter**

CF-3M (Cast version of 316L SST, material per ASTM-A743)

**Non-Wetted Parts**

**Electronics Housing**

Low-copper aluminum or CF-8M (Cast version of 316 SST, material per ASTM-A743). NEMA 4X, IP 65, IP 66

**Coplanar Sensor Module Housing**

CF-3M (Cast version of 316L SST, material per ASTM-A743)



**Bolts**

Plated carbon steel per ASTM A449, Type 1: Austenitic 316 SST, ASME B 16.5 (ANSI)/ASTM-A-193-B7M, or Monel

**Sensor Module Fill Fluid**

Silicone or inert halocarbon (inert not available with Model 3051CA or Model 3051H). Model 3051T uses Fluorinert® FC-43

**Process Fill Fluid (Model 3051L and 3051H only)**

3051L: Syltherm XLT, D.C. Silicone 704, D.C. Silicone 200, inert, glycerin and water, Neobee M-20, propylene glycol and water, or Syltherm 800  
 3051H: inert, Neobee M-20, or D.C. Silicone 200

**Paint**

Polyurethane

**Cover O-rings**

Buna-N

**Shipping Weights**

“Shipping Weights” on page 5-28.

**CERTIFICATIONS**

Stainless steel certification tag provided when optional approval is specified.

**Factory Mutual (FM) Approvals**

- E5** Explosion proof for Class I, Division 1, Groups B, C, and D. Dust-Ignition Proof for Class II and Class III, Division 1, Groups E, F, and G. Suitable for indoor and outdoor (NEMA 4X) hazardous locations. Factory Sealed.
- I5** Intrinsically Safe for use in Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1 when connected in accordance with Rosemount drawings 03031-1019 and 00275-0081 (when used with HART Communicator Model 275), or 00268-0031 (when used with Rosemount Model 268 Communicator). Temperature Code T4. Non-incendive for Class I, Division 2, Groups A, B, C, and D. NEMA 4X. Factory Sealed.

FM Approved Entity Parameters for Model 3051C	FM Approved for Class I, II, III, Division 1 and 2, Groups:
$V_{max} = 40 \text{ V dc}$	A-G
$I_{max} = 165 \text{ mA}$	A-G
$I_{max} = 225 \text{ mA}$	C-G
$I_{max} = 160 \text{ mA (Option Code T1)}$	A-G
$P_{max} = 1 \text{ W}$	A-G
$C_i = 0.01 \mu\text{F (Output Code A)}$	A-G
$C_i = 0.042 \mu\text{F (Output Code M)}$	A-G
$L_i = 10 \mu\text{H}$	A-G
$L_i = 1,05 \text{ mH (Output Code A with T1)}$	A-G
$L_i = 0,75 \text{ mH (Output Code M with T1)}$	A-G

**BASEEFA/CENELEC Intrinsic Safety Certification**

- I1** EEx ia IIC T5 ( $T_{amb} = -60$  to  $+40$  °C)
- EEx ia IIC T4 ( $T_{amb} = -60$  to  $+70$  °C)

**CENELEC Approved Entity Parameters**

$U_{Max:in} = 30$  V  
 $I_{Max:in} = 200$  mA  
 $W_{Max:in} = 0.9$  W  
 $C_{eq} = 0.012$   $\mu$ F

**BASEEFA Non-incendive/Type N Certification**

- N1** Ex N IIC T5 ( $T_{amb} = -40$  to  $+70$  °C)

**Special Conditions for Safe Use:**

When the optional transient protection terminal block is installed, the apparatus is not capable of withstanding a 500 V rms test to case. This must be taken into account in installations in which the transient protection terminal block is used. One method of taking this into account is to ensure that the supply to the apparatus is galvanically isolated.

**CESI/CENELEC Flameproof Certification**

- E8** EEx d IIC T6 ( $T_{amb} = 40$  °C)
- EEx d IIC T5 ( $T_{amb} = 70$  °C)

**Japanese Industrial Standard (JIS) Flameproof Certification**

- E4** (3051C/H/L/P) Ex d IIC T5 + G5
- (3051T) Ex d IIC T5

**Canadian Standards Association (CSA) Approvals**

- C6** Explosion Proof for Class I, Division 1, Groups B, C, and D.  
 Dust-Ignition Proof for Class II and Class III, Division 1, Groups E, F, and G. Suitable for indoor and outdoor hazardous locations, CSA Enclosure Type 4X. Factory Sealed.

Intrinsically Safe for Class I, Division 1, Groups A, B, C, and D when connected in accordance with Rosemount drawings 03031-1024 and 00275-0082 (when used with the Model 275 HART Communicator). Temperature Code T3C.

	CSA Approved Barriers for Model 3051C	CSA Approved for Class I, Division 1 and 2, Groups:
Output Code A	$\leq 30$ V, $\geq 330$ $\Omega$	A-D
	$\leq 28$ V, $\geq 300$ $\Omega$	
Output Code M	$\leq 25$ V, $\geq 200$ $\Omega$	C-D
	$\leq 22$ V, $\geq 180$ $\Omega$	
	$\leq 30$ V, $\geq 150$ $\Omega$	A-D
	Supply $\leq 28$ V, $\geq 300$ $\Omega$ Return $\leq 10$ V, $\geq 47$ $\Omega$	
	Supply $\leq 30$ V, $\geq 150$ $\Omega$ Return $\leq 10$ V, $\geq 47$ $\Omega$	C-D

**Standards Association of Australia (SAA)**

**Intrinsic Safety Certification**

- I7** Ex ia IIC T4 ( $T_{amb} = 70\text{ }^{\circ}\text{C}$ )
- Ex ia IIC T5 ( $T_{amb} = 40\text{ }^{\circ}\text{C}$ )

**Special Conditions for Safe Use**

Observe barriers/entity parameters during installation. Connect per Rosemount drawing 03031 1026.

**SAA Approved Entity Parameters**

$$U_{Max} = 30\text{ V}$$

$$I_{Max} = 200\text{ mA}$$

$$I_{Max} = 160\text{ mA (Option Code T1)}$$

$$P_{Max} = 0.9\text{ W}$$

$$C_i = 0.01\text{ }\mu\text{F (Output Code A)}$$

$$C_i = 0.042\text{ }\mu\text{F (Output Code M)}$$

$$L_i = 10\text{ }\mu\text{H}$$

$$L_i = 1,05\text{ mH (Output Code A with T1)}$$

$$L_i = 0,75\text{ mH (Output Code M with T1)}$$

**Explosion Proof (Flameproof) Certification**

- E7** Ex d IIC T6 ( $T_{amb} = 40\text{ }^{\circ}\text{C}$ )
- Ex d IIC T5 ( $T_{amb} = 80\text{ }^{\circ}\text{C}$ )
- DIP T6 ( $T_{amb} = 40\text{ }^{\circ}\text{C}$ )
- DIP T5 ( $T_{amb} = 80\text{ }^{\circ}\text{C}$ )

**Type N (Non-sparking) Certification**

- N7** Ex n IIC T4 ( $T_{amb} = 70\text{ }^{\circ}\text{C}$ )
- Ex n IIC T5 ( $T_{amb} = 40\text{ }^{\circ}\text{C}$ )

**Combinations of Approvals**

**K5** Combination of **E5** and **I5**

**KB** Combination of **K5** and **C6**

FM and CSA Explosionproof and Intrinsic Safety.

**K6** Combination **C6**, **I1**, and **E8**

**ORDERING INFORMATION**

TABLE 5-6. Model 3051C Differential, Gage, and Absolute Pressure Transmitters  
 — = Not Applicable • = Applicable

Model	Transmitter Type (Select One)						CD	CG	CA
3051CD	Differential Pressure Transmitter						•	—	—
3051CG	Gage Pressure Transmitter						—	•	•
3051CA	Absolute Pressure Transmitter						—	—	•
Pressure Ranges and Minimum Spans—English Units (SI Units)									
Model 3051CD			Model 3051CG		Model 3051CA		CD	CG	CA
Code	Range	Min. Span	Range	Min. Span	Range	Min. Span			
0 <sup>(1)</sup>	-3 to 3 inH <sub>2</sub> O (-747 to 747 Pa)	0.1 inH <sub>2</sub> O (25 Pa)	Not Applicable		0 to 5 psia (0 to 259 mmHg)	0.167 psia (8,6 mmHg)	•		•
1	-25 to 25 inH <sub>2</sub> O (-6,22 to 6,22 kPa)	0.5 inH <sub>2</sub> O (0,12 kPa)	Not Applicable		0 to 30 psia (0 to 207 kPa)	0.3 psia (2,1 kPa)	•		•
2	-250 to 250 inH <sub>2</sub> O (-62,2 to 62,2 kPa)	2.5 inH <sub>2</sub> O (0,6 kPa)	-250 to 250 inH <sub>2</sub> O (-62,2 to 62,2 kPa)	2.5 inH <sub>2</sub> O (0,6 kPa)	0 to 150 psia (0 to 1 034 kPa)	1.5 psia (10,34 kPa)	•	•	•
3	-1000 to 1000 inH <sub>2</sub> O (-248 to 248 kPa)	10 inH <sub>2</sub> O (2,5 kPa)	-407 to 1000 inH <sub>2</sub> O (-101 to 249 kPa)	10 inH <sub>2</sub> O (2,5 kPa)	0 to 800 psia (0 to 5 516 kPa)	8 psia (55,16 kPa)	•	•	•
4	-300 to 300 psi (-2070 to 2070 kPa)	3 psi (20,7 kPa)	-14.7 to 300 psi (-101 to 2 070 kPa)	3 psi (20,7 kPa)	0 to 4000 psia (0 to 27 580 kPa)	40 psia (276 kPa)	•	•	•
5	-2000 to 2000 psi (- 13800 to 13800 kPa)	20 psi (138 kPa)	-14.7 to 2000 psig (-101 to 13800 kPa)	20 psi (138 kPa)	Not Applicable		•	•	
NOTE: 3051CG lower range limit varies with atmospheric pressure.									
Code	Output						CD	CG	CA
A	4-20 mA with Digital Signal Based on HART Protocol						•	•	•
M	Low-Power, 1-5 V dc with Digital Signal Based on HART Protocol (See Option C2 for 0.8-3.2 V dc)						•	•	•
NOTE: Not available with hazardous locations certification Options Codes I1, N1, E4, and K6.									
Materials of Construction									
Code	Process Flange Type	Flange Material	Drain/Vent	Flange Adapters	CD	CG	CA		
2	Coplanar	SST	SST	SST	•	•	•		
3	Coplanar	Hastelloy C	Hastelloy C	Hastelloy C	•	•	•		
4	Coplanar	Monel	Monel	Monel	•	•	•		
5	Coplanar	Plated CS	SST	Plated CS	•	•	•		
7	Coplanar	SST	Hastelloy C	SST	•	•	•		
8	Coplanar	Plated CS	Hastelloy C	Plated CS	•	•	•		
0	Alternate Flange—See Options H2, H3, H4, H7, F1, G1, G2, FA, FB, FC, FD, or S5								
NOTE: Materials of Construction Codes 3, 7, and 8 meet NACE material recommendations per MR 01-75.									
Code	Isolating Diaphragm						CD	CG	CA
2	316L SST						•	•	•
3	Hastelloy C-276 (Meets NACE material recommendations per MR 01-75)						•	•	•
4	Monel						•	•	•
5	Tantalum (Available on Model 3051CD and CG, Ranges 2-5 only. Not available on Model 3051CA)						•	•	•
6	Gold-plated Monel (Use in combination with O-ring Option Code B.)						•	•	•
7	Gold-plated SST						•	•	•
Code	O-ring						CD	CG	CA
A	Glass-filled TFE						•	•	•
B	Graphite-filled TFE						•	•	•
Code	Fill Fluid						CD	CG	CA
1	Silicone						•	•	•
2	Inert fill (Halocarbon)						•	•	•
Code	Housing Material			Conduit Entry Size			CD	CG	CA
A	Polyurethane-covered Aluminum			½-14 NPT			•	•	•
B	Polyurethane-covered Aluminum			M20 x 1.5 (CM20)			•	•	•
C	Polyurethane-covered Aluminum			PG 13.5			•	•	•
D	Polyurethane-covered Aluminum			G½			•	•	•
J	SST			½-14 NPT			•	•	•
K	SST			M20 x 1.5 (CM20)			•	•	•
L	SST			PG 13.5			•	•	•

# Rosemount Model 3051 Transmitter for Flow, Level, and Pressure Measurement

TABLE 5-6. Model 3051C Differential, Gage, and Absolute Pressure Transmitters (continued)  
 — = Not Applicable \* = Applicable

Code	Alternate Flange Options (Requires Materials of Construction Code 0)	CD	CG	CA
H2	Traditional Flange, 316 SST, SST Drain/Vent, SST Flange Adapter	.	.	.
H3	Traditional Flange, Hastelloy C, Hastelloy C Drain/Vent, Hastelloy C Flange Adapter	.	.	.
H4	Traditional Flange, Monel, Monel Drain/Vent, Monel Flange Adapter	.	.	.
H7	Traditional Flange, 316 SST, Hastelloy C Drain/Vent, 316 SST Flange Adapter	.	.	.
HJ	DIN Compliant Traditional Flange, SST, 7/16 in. Adapter/Manifold Bolting	.	.	.
HK	DIN Compliant Traditional Flange, SST, 10 mm Adapter/Manifold Bolting	.	.	.
HL	DIN Compliant Traditional Flange, SST, 12mm Adapter/Manifold Bolting	.	.	.
FA	Level Flange, SST, 2 in., ANSI Class 150, Vertical Mount	.	.	.
FB	Level Flange, SST, 2 in., ANSI Class 300, Vertical Mount	.	.	.
FC	Level Flange, SST, 3 in., ANSI Class 150, Vertical Mount	.	.	.
FD	Level Flange, SST, 3 in., ANSI Class 300, Vertical Mount	.	.	.
FP	DIN Level Flange, SST, DN 50, PN 40, Vertical Mount	.	.	.
FQ	DIN Level Flange, SST, DN 80, PN 40, Vertical Mount	.	.	.
<i>NOTE: Option Codes H3 and H7 meet NACE material recommendations per MR 01-75.</i>				
<b>Code Integral Mount Manifold Options</b>				
S5	Assemble to Model 305 Integral Manifold	CD	CG	CA
<b>Code Integral Mount Primary Elements (Optional)</b>				
S4	Factory Assembly to Rosemount Primary Element (Annubar or Model 1195 Integral Orifice) <i>NOTE: With the primary element installed, the maximum operating pressure will equal the lesser of either the transmitter or the primary element. Option is available for factory assembly to range 1-4 transmitters only.</i>	CD	CG	CA
<b>Diaphragm Seal Assemblies (Optional)</b> <i>NOTE: Standard flange and adapter bolts are austenitic 316 SST.</i>				
S1	One Diaphragm Seal (Direct Mount or Capillary Connection Type)	CD	CG	CA
S2	Two Diaphragm Seals (Direct Mount or Capillary Connection Type)	.	.	.
<b>Optional All Welded Diaphragm Seal Systems (for high vacuum applications)</b> <i>NOTE: Standard flange and adapter bolts are austenitic 316 SST.</i>				
S7	One Diaphragm Seal, All-Welded System (Capillary Connection Type)	CD	CG	CA
S8	Two Diaphragm Seals, All-Welded System (Capillary Connection Type)	.	.	.
S0	One Diaphragm Seal, All-Welded System (Direct Mount Connection Type)	.	.	.
S9	Two Diaphragm Seals, All-Welded System (One Direct Mount and One Capillary Connection Type)	.	.	.
<b>Code Mounting Bracket Options</b>				
B4	Coplanar Flange Bracket for 2-in. Pipe or Panel Mounting, all SST	CD	CG	CA
B1	Traditional Flange Bracket for 2-in. Pipe Mounting, CS Bolts	.	.	.
B2	Traditional Flange Bracket for Panel Mounting, CS Bolts	.	.	.
B3	Traditional Flange Flat Bracket for 2-in. Pipe Mounting, CS Bolts	.	.	.
B7	B1 Bracket with Series 300 SST Bolts	.	.	.
B8	B2 Bracket with Series 300 SST Bolts	.	.	.
B9	B3 Bracket with Series 300 SST Bolts	.	.	.
BA	SST B1 Bracket with Series 300 SST Bolts	.	.	.
BC	SST B3 Bracket with Series 300 SST Bolts	.	.	.
<b>Code Hazardous Locations Certification Options</b>				
E5	FM Explosionproof Approval	CD	CG	CA
I5	FM Non-incendive and Intrinsic Safety Approval	.	.	.
K5	FM Explosionproof and Intrinsic Safety Approval	.	.	.
I1	BASEEFA/CENELEC Intrinsic Safety Certification <i>NOTE: Not available with low-power Option Code M.</i>	.	.	.
N1	BASEEFA Type N Certification <i>NOTE: Not available with low-power Option Code M.</i>	.	.	.
E8	CESI/CENELEC Flameproof Certification	.	.	.
E4	JIS Flameproof Certification <i>NOTE: Not available with low-power Option Code M.</i>	.	.	.
C6	Canadian Standards Association (CSA) Explosionproof and Intrinsic Safety Approval (Requires 42.4 V dc maximum power supply)	.	.	.
K6	Combination of CSA and CENELEC Explosionproof and Intrinsic Safety Approval <i>NOTE: Not available with low-power Option Code M.</i>	.	.	.
KB	Combination of FM and CSA Explosionproof and Intrinsic Safety Approvals <i>NOTE: Not available with low-power Option Code M.</i>	.	.	.
I7	SAA Intrinsic Safety Certification	.	.	.
E7	SAA Flameproof Certification	.	.	.
N7	SAA Type N Certification	.	.	.

TABLE 5-6. Model 3051C Differential, Gage, and Absolute Pressure Transmitters (continued)  
 — = Not Applicable • = Applicable

Code	Bolting Options	CD	CG	CA
L4	Austenitic 316 SST Bolts	•	•	•
L5	ANSI/ASTM-A-193-B7M Bolts	•	•	•
L6	Monel Bolts	•	•	•
Code	Meters (Optional)	CD	CG	CA
M5	LCD Meter for Aluminum Housing (Housing Codes A, B, C, and D only)	•	•	•
M6	LCD Meter for SST Housing (Housing Codes J, K, and L only)	•	•	•
Code	Other Options	CD	CG	CA
Q4	Calibration Data Sheet	•	•	•
Q8	Material Traceability Certification per EN 10204 3.1B <i>NOTE: This option is available for the sensor module housing and Coplanar or traditional flanges and adapters (Model 3051C), and for the sensor module housing and low-volume Coplanar flange and adapter (Model 3051C with Option Code S1).</i>	•	•	•
J1	Local Zero Adjustment Only <i>NOTE: Local zero and span adjustments are standard unless Option Code J1 or J3 is specified.</i>	•	•	•
J3	No Local Zero or Span Adjustment <i>NOTE: Local zero and span adjustments are standard unless Option Code J1 or J3 is specified.</i>	•	•	•
T1	Transient Protection Terminal Block <i>NOTE: Not available with hazardous locations certification Option Code I1 or K6.</i>	•	•	•
C1	Custom Software Configuration (Completed CDS 00806-0100-4001 required with order)	•	•	•
C2	0.8–3.2 V dc Output with Digital Signal Based on HART Protocol (Output Code M only)	•	•	•
C3	Gage Calibration (Model 3051CA4 only)	•	•	•
C4	Analog Output Levels Compliant with NAMUR Recommendation NE43, 27-June-1996 <i>NOTE: NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.</i>	•	•	•
CN	Analog Output Levels Compliant with NAMUR Recommendation NE43, 27-June-1996: Alarm Configuration—Low <i>NOTE: NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.</i>	•	•	•
P1	Hydrostatic Testing	•	•	•
P2	Cleaning for Special Service	•	•	•
P3	Cleaning for <1 PPM Chlorine/Fluorine	•	•	•
D3	¼–18 NPT Process Connections (No flange adapters)	•	•	•
D7	Coplanar Flange Without Drain/Vent Ports	•	•	•
D8	Ceramic Ball Drain/Vents	•	•	•
D9	JIS Process Connection—RC ¼ Flange with RC ½ Flange Adapter	•	•	•
P9	4500 psig Static Pressure Limit (Model 3051CD Ranges 2–5 only)	•	•	•
V5	External Ground Screw Assembly	•	•	•
<b>Typical Model Number: 3051CD 2 A 2 2 A 1 A B4</b>				

(1) *NOTE: Model 3051CD0 is available only with Output Code A, Process Flange Code 0 (Alternate Flange H2), Isolating Diaphragm Code 2, O-ring Code A, and Bolting Option L4. For Multiple Options selections, contact your Rosemount representative or see Rosemount PDS 00813-0600-4001.*

TABLE 5-7. Model 3051T Gage and Absolute Pressure Transmitter

Model	Transmitter Type		Available
3051T	Pressure Transmitter		•
Code	Pressure Type		Available
G	Gage		•
A	Absolute		•
PRESSURE RANGES (RANGE/MIN. SPAN)			
Code	3051TG	3051TA	Available
1	-14.7 to 30 psi/0.3 psi (-101 to 207 kPa/2,1 kPa)	0 to 30 psia/0.3 psia (0 to 207 kPa/2,1 kPa)	•
2	-14.7 to 150 psi/1.5 psi (-101 to 1 034 kPa/10,3 kPa)	0 to 150 psia/1.5 psia (0 to 1 034 kPa/10,3 kPa)	•
3	-14.7 to 800 psi/8 psi (-101 to 5 516 kPa/55 kPa)	0 to 800 psia/8 psia (0 to 5 516 kPa/55 kPa)	•
4	-14.7 to 4000 psi/40 psi (-101 to 27 580 kPa/276 kPa)	0 to 4000 psia/40 psia (0 to 27 580 kPa/276 kPa)	•
5	-14.7 to 10000 psi/2000 psi (-101 to 68 900 kPa/13 800 kPa)	0 to 10000 psia/2000 psia (0 to 68 900 kPa/13 790 kPa)	•
<i>NOTE: 3051TG lower range limit varies with atmospheric pressure.</i>			
Code	Output		Available
A	4-20 mA with Digital Signal Based on HART Protocol		•
M	Low-Power 1-5 V dc with Digital Signal Based on HART Protocol (See Option Code C2 for 0.8-3.2 V dc Output)		•
<i>NOTE: Not available with hazardous certification Option Codes I1 or N1.</i>			
Code	Process Connection Style		Available
2A	¼-18 NPT Female		•
2B	½-14 NPT Female		•
2C	G½ A DIN 16288 Male (Available in SST for Range 1-4 only)		•
2F	Coned and Threaded, Compatible with Autoclave Type F-250-C		•
<i>(Includes Gland and Collar, Available in SST for Range 5 only)</i>			
Code	Isolating Diaphragm	Process Connection Wetted Parts Material	Available
2	316L SST	316L SST	•
3	Hastelloy	Hastelloy	•
<i>NOTE: Meets NACE requirements per MR 01-75.</i>			
Code	Fill Fluid		Available
1	Silicone		•
2	Inert		•
Code	Housing Material	Conduit Entry Size	Available
A	Polyurethane-covered Aluminum	½-14 NPT	•
B	Polyurethane-covered Aluminum	M20 x 1.5 (CM20)	•
C	Polyurethane-covered Aluminum	PG 13.5	•
D	Polyurethane-covered Aluminum	G½	•
J	SST	½-14 NPT	•
K	SST	M20 x 1.5 (CM20)	•
L	SST	PG 13.5	•
Code	Integral Mount Manifold (Optional)		Available
S5	Assemble to Model 306 Integral Manifold (Requires ½ in. process connection code 2B—Refer to PPL 00814-0100-4733)		•
Code	Remote Diaphragm Seal Assemblies (Optional)		Available
S1	One Remote Diaphragm Seal (Direct Mount or Capillary Connection Type)		•
Code	Mounting Brackets (Optional)		Available
B4	Bracket for 2-in. Pipe or Panel Mounting, All SST		•

TABLE 5-7. (continued) Model 3051T Gage and Absolute Pressure Transmitter

Code	Hazardous Locations Certifications (Optional)	Available
E5	FM Explosionproof Approval	•
I5	FM Non-incendive and Intrinsic Safety Approval	•
K5	FM Explosionproof and Intrinsic Safety Approval	•
C6	CSA Explosionproof and Intrinsic Safety Approval (Requires 42.4 V dc maximum power supply)	•
K6	Combination of CSA and CENELEC Explosionproof and Intrinsic Safety Approval <i>NOTE: Not available with low-power Option Code M.</i>	•
KB	Combination of FM and CSA Explosionproof and Intrinsic Safety Approvals <i>NOTE: Not available with low-power Option Code M.</i>	•
I7	SAA Intrinsic Safety Certification	•
E7	SAA Flameproof Certification	•
N7	SAA Type N Certification	•
I1	BASEEFA/CENELEC Intrinsic Safety Certification <i>NOTE: Not available with low-power Option Code M.</i>	•
N1	BASEEFA Type N Certification <i>NOTE: Not available with low-power Option Code M.</i>	•
E8	CESI/CENELEC Flameproof Certification	•
Code	Other Options	Available
Q4	Calibration Data Sheet	•
Q8	Material Traceability Certification per EN 10204 3.1B <i>NOTE: This option applies to the threaded process connection only.</i>	•
J1	Local Zero Adjustment Only <i>NOTE: Local zero and span adjustments are standard unless Option Code J1 or J3 is specified.</i>	•
J3	No Local Zero or Span Adjustment <i>NOTE: Local zero and span adjustments are standard unless Option Code J1 or J3 is specified.</i>	•
M5	LCD Meter for Aluminum Housing (Housing Codes A, B, C, and D only)	•
M6	LCD Meter for SST Housing (Housing Codes J, K, and L only)	•
T1	Transient Protection Terminal Block <i>NOTE: Not available with hazardous locations certification Option Code I1 or K6.</i>	•
C1	Custom Software Configuration (Completed CDS 00806-0100-4001 required with order)	•
C2	0.8–3.2 V dc Output with Digital Signal Based on HART Protocol (Output Code M only)	•
C4	Analog Output Levels Compliant with NAMUR Recommendation NE43, 27-June-1996 <i>NOTE: NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.</i>	•
CN	Analog Output Levels Compliant with NAMUR Recommendation NE43, 27-June-1996: Low Alarm Configuration <i>NOTE: NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.</i>	•
P1	Hydrostatic Testing	•
P2	Cleaning for Special Service	•
P3	Cleaning for <1 PPM Chlorine/Fluorine	•
V5	External Ground Screw Assembly	•
Typical Model Number: 3051T G 5 F 2A 2 1 A B4		



TABLE 5-8. Model 3051L Flange-Mounted Liquid Level Transmitter

Model	Transmitter Type			Available	
3051L	Flange-Mounted Liquid Level Transmitter			•	
Code	PRESSURE RANGES (RANGE/MIN, SPAN)			Available	
2	-250 to 250 inH <sub>2</sub> O/2.5 inH <sub>2</sub> O (-62,2 to 62,2 kPa/0,62 kPa)			•	
3	-1000 to 1000 inH <sub>2</sub> O/10 inH <sub>2</sub> O (-248 to 248 kPa/2,5 kPa)			•	
4	-8310 to 8310 inH <sub>2</sub> O/83.1 inH <sub>2</sub> O (-2 070 to 2 070 Pa/20,7 kPa)			•	
Code	Output			Available	
A	4-20 mA with Digital Signal Based on HART Protocol			•	
M	Low-Power 1-5 V dc with Digital Signal Based on HART Protocol (See Option Code C2 for 0.8-3.2 V dc Output) <i>NOTE: Not available with hazardous certification Option Codes I1, N1, E4, and K6.</i>			•	
HIGH PRESSURE SIDE					
Code	Diaphragm Size	Material	Extension Length	Available	
G0	2 in./DN 50	316L SST	Flush Mount Only	When specifying this option code, a lower housing must be selected from the flushing connection options table.  <b>NOTE</b> Extension diameters are sized to fit Schedule 80 pipe.	
H0	2 in./DN 50	Hastelloy	Flush Mount Only		
J0	2 in./DN 50	Tantalum	Flush Mount Only		
A0	3 in./DN 80	316L SST	Flush Mount		
A2	3 in./DN 80	316L SST	2 in./50 mm		
A4	3 in./DN 80	316L SST	4 in./100 mm		
A6	3 in./DN 80	316L SST	6 in./150 mm		
B0	4 in./DN 100	316L SST	Flush Mount		
B2	4 in./DN 100	316L SST	2 in./50 mm		
B4	4 in./DN 100	316L SST	4 in./100 mm		
B6	4 in./DN 100	316L SST	6 in./150 mm		
C0	3 in./DN 80	Hastelloy	Flush Mount		
C2	3 in./DN 80	Hastelloy	2 in./50 mm		
C4	3 in./DN 80	Hastelloy	4 in./100 mm		
C6	3 in./DN 80	Hastelloy	6 in./150 mm		
D0	4 in./DN 100	Hastelloy	Flush Mount		
D2	4 in./DN 100	Hastelloy	2 in./50 mm		
D4	4 in./DN 100	Hastelloy	4 in./100 mm		
D6	4 in./DN 100	Hastelloy	6 in./150 mm		
E0	3 in./DN 80	Tantalum	Flush Mount Only		
F0	4 in./DN 100	Tantalum	Flush Mount Only		
MOUNTING FLANGE					
Code	Size	ASME B 16.5 (ANSI) or DIN Flange Rating	Material	Applicable With These High Pressure Side Diaphragm Sizes	Available
M	2 in.	Class 150	CS	2 in./DN 50	•
A	3 in.	Class 150	CS	3 in./DN 80	•
B	4 in.	Class 150	CS	4 in./DN 100	•
N	2 in.	Class 300	CS	2 in./DN 50	•
C	3 in.	Class 300	CS	3 in./DN 80	•
D	4 in.	Class 300	CS	4 in./DN 100	•
P	2 in.	Class 600	CS	2 in./DN 50	•
E	3 in.	Class 600	CS	3 in./DN 80	•
X	2 in.	Class 150	SST	2 in./DN 50	•
F	3 in.	Class 150	SST	3 in./DN 80	•
G	4 in.	Class 150	SST	4 in./DN 100	•
Y	2 in.	Class 300	SST	2 in./DN 50	•
H	3 in.	Class 300	SST	3 in./DN 80	•
J	4 in.	Class 300	SST	4 in./DN 100	•
Z	2 in.	Class 600	SST	2 in./DN 50	•
L	3 in.	Class 600	SST	3 in./DN 80	•
Q	DIN DN 50	PN 10-40	CS	2 in./DN 50	•
R	DIN DN 80	PN 40	CS	3 in./DN 80	•
S	DIN DN 100	PN 40	CS	4 in./DN 100	•
V	DIN DN 100	PN 10/16	CS	4 in./DN 100	•
K	DIN DN 50	PN 10-40	CS	2 in./DN 50	•
T	DIN DN 80	PN 40	SST	3 in./DN 80	•
U	DIN DN 100	PN 40	SST	4 in./DN 100	•
W	DIN DN 100	PN 10/16	SST	4 in./DN 100	•

TABLE 5-8. (continued) Model 3051L Flange-Mounted Liquid Level Transmitter

Code	Process Fill-High Pressure Side	Temperature Limits		Available
A	Syltherm XLT	-100 to 300 °F (-73 to 135 °C)		•
C	D. C. Silicone 704	60 to 600 °F (15 to 316 °C)		•
D	D. C. Silicone 200	-40 to 400 °F (-40 to 205 °C)		•
H	Inert (Halocarbon)	-50 to 350 °F (-45 to 177 °C)		•
G	Glycerine and Water	0 to 200 °F (-17 to 93 °C)		•
N	Neobee M-20	0 to 400 °F (-17 to 205 °C)		•
P	Propylene Glycol and Water	0 to 200 °F (-17 to 93 °C)		•
LOW PRESSURE SIDE				
Code	Configuration	Flange Adapter	Diaphragm Material Sensor Fill Fluid	Available
11	Gage	SST	316L SST Silicone	•
21	Differential	SST	316L SST Silicone	•
22	Differential	SST	Hastelloy C-276 Silicone	•
2A	Differential	SST	316L SST Inert (Halocarbon)	•
2B	Differential	SST	Hastelloy C-276 Inert (Halocarbon)	•
31	Remote Seal	SST	316L SST Silicone (Requires Option Code S1)	•
O-ring Material				
A	Glass-filled TFE			•
Code	Housing Material	Conduit Entry Size		Available
A	Polyurethane-covered Aluminum	½-14 NPT		•
B	Polyurethane-covered Aluminum	M20 x 1.5 (CM20)		•
C	Polyurethane-covered Aluminum	PG 13.5		•
D	Polyurethane-covered Aluminum	G½		•
J	SST	½-14 NPT		•
K	SST	M20 x 1.5 (CM20)		•
L	SST	PG 13.5		•
Diaphragm Seal Assemblies (Optional)				
S1	One Diaphragm Seal (requires low pressure side Option Code 31 capillary connection type)			•
Hazardous Locations Certification Options				
E5	FM Explosionproof Approval			•
I5	FM Non-incendive and Intrinsic Safety Approval			•
K5	FM Explosionproof and Intrinsic Safety Approval			•
I1	BASEEFA/CENELEC Intrinsic Safety Certification (NOTE: Not available with low-power Option Code M.)			•
N1	BASEEFA Type N Certification (NOTE: Not available with low-power Option Code M.)			•
E8	CESI/CENELEC Flameproof Certification			•
E4	JIS Flameproof Certification (NOTE: Not available with low-power Option Code M.)			•
C6	CSA Explosionproof and Intrinsic Safety Approval (Requires 42.4 V dc maximum power supply)			•
K6	Combination of CSA and CENELEC Explosionproof and Intrinsic Safety Approval NOTE: Not available with low-power Option Code M.)			•
KB	Combination of FM and CSA Explosionproof and Intrinsic Safety Approvals NOTE: Not available with low-power Option Code M.			•
I7	SAA Intrinsic Safety Certification			•
E7	SAA Flameproof Certification			•
N7	SAA Type N Certification			•
Bolt for Flange and Adapters (Optional)				
L4	Austenitic 316 SST Bolts			•
L5	ASME B 16.5 (ANSI)/ASTM-A-193-B7M Bolts			•
Meter Options				
M5	LCD Meter for Aluminum Housing (Housing Codes A, B, C, and D only)			•
M6	LCD Meter for SST Housing (Housing Codes J, K, and L only)			•

**Rosemount Model 3051 Transmitter for Flow, Level, and Pressure Measurement**

**TABLE 5-8. (continued) Model 3051L Flange-Mounted Liquid Level Transmitter**

Code	Other Options	Available				
Q4	Calibration Data Sheet	•				
Q8	Material Traceability Certification per EN 10204 3.1B <i>NOTE: This options is available with the diaphragm, upper housing, Coplanar flange, adapter, sensor module housing, lower housing/flushing connection, and extension.</i>	•				
J1	Local Zero Adjustment Only <i>NOTE: Local zero and span adjustments are standard unless Option Code J1 or J3 is specified.</i>	•				
J3	No Local Zero or Span Adjustment <i>NOTE: Local zero and span adjustments are standard unless Option Code J1 or J3 is specified.</i>	•				
T1	Transient Protection Terminal Block <i>NOTE: Not available with hazardous locations certification Option Code I1 or K6.</i>	•				
C1	Custom Software Configuration (Completed CDS 00806-0100-4001 required with order)	•				
C2	0.8–3.2 V dc Output with Digital Signal Based on HART Protocol (Output Code M only)	•				
C4	Analog Output Levels Compliant with NAMUR Recommendation NE43, 27-June-1996 <i>NOTE: NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.</i>	•				
CN	Analog Output Levels Compliant with NAMUR Recommendation NE43, 27-June-1996: Alarm Configuration—Low <i>NOTE: NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.</i>	•				
D8	Ceramic Ball Drain/Vents	•				
V5	External Ground Screw Assembly	•				
<b>Lower Housing Flushing Connections</b>						
Code	Ring Material	Number	Size	Diaphragm Size		
				2 in.	3 in.	4 in.
F1	SST	1	¼	•	•	•
F2	SST	2	¼	•	•	•
F3	Hastelloy	1	¼	•	•	•
F4	Hastelloy	2	¼	•	•	•
FA	SST	0	—	•	•	•
FC	Hastelloy	0	—	•	•	•
F7	SST	1	½	•	•	•
F8	SST	2	½	•	•	•
F9	Hastelloy	1	½	•	•	•
F0	Hastelloy	2	½	•	•	•
<i>NOTE: Flushing Codes F3 and F4 are not available with Option Codes A0, B0, and G0.</i>						
<i>NOTE: Flushing Code FC is not available with Option Code G0.</i>						

TABLE 5-9. Model 3051H Pressure Transmitter for High-Temperature Processes

Model	Transmitter Type (Select One)	Available	
		HD	HG
3051HD	Differential Pressure Transmitter for High-Temperature Processes	•	•
3051HG	Gage Pressure Transmitter for High-Temperature Processes	•	•
<b>PRESSURE RANGES (RANGE/MIN. SPAN)</b>			
<b>Code</b>	<b>3051HD</b>	<b>3051HG</b>	
2	-250 to 250 inH <sub>2</sub> O/2.5 inH <sub>2</sub> O (-62,2 to 62,2 kPa/0,62 kPa)	-250 to 250 inH <sub>2</sub> O/2.5 inH <sub>2</sub> O (-62,2 to 62,2 kPa/0,6 kPa)	•
3	-1000 to 1000 inH <sub>2</sub> O/10 inH <sub>2</sub> O (-248 to 248 kPa/2,5 kPa)	-407 to 1000 inH <sub>2</sub> O/10 in H <sub>2</sub> O (-101 to 249 kPa/2,5 kPa)	•
4	-300 to 300 inH <sub>2</sub> O/3 psi (-13 800 to 13 800 kPa/20,1 kPa)	-14.7 to 300 psi/3 psi (-101 to 2 070 kPa/20,7 kPa)	•
5	-2000 to 2000 psi/20 psi (-207 to 207 kPa/2,5 kPa)	-14.7 to 2000 psig/20 psi (-101 to 13 800 kPa/138 kPa)	•
<i>NOTE: 3051HG lower range limit varies with atmospheric pressure.</i>			
<b>Code</b>	<b>Output</b>		
A	4-20 mA with Digital Signal Based on HART Protocol	•	•
M	Low-Power 1-5 V dc with Digital Signal Based on HART Protocol (See Option Code C2 for 0.8-3.2 V dc Output) <i>NOTE: Not available with hazardous certification Option Codes I1, N1, E4, and K6.</i>	•	•
<b>PROCESS CONNECTION</b>			
<b>Code</b>	<b>Process Flange Material</b>	<b>Drain/Vent</b>	<b>Flange Adapters</b>
2	SST	SST	SST
7	SST	Hastelloy	SST
<i>NOTE: Process Connection Code 7 meets NACE material recommendations per MR 01-75.</i>			
<b>Code</b>	<b>Process Isolating Diaphragm</b>		
2	316L SST	•	•
3	Hastelloy C-276 (Meets NACE material recommendations per MR 01-75)	•	•
5	Tantalum	•	•
<b>Code</b>	<b>O-ring Material</b>		
A	Glass-Filled TFE	•	•
<b>Code</b>	<b>Process Fill Fluid</b>		
D	D.C. 200 Silicone	•	•
H	Inert	•	•
N	Neobee M-20	•	•
<b>Code</b>	<b>Sensor Module Isolator Material</b>		
2	SST	•	•
<b>Code</b>	<b>Sensor Module Fill Fluid</b>		
1	Silicone	•	•
2	Inert (Halocarbon)	•	•
<b>Code</b>	<b>Housing Material</b>	<b>Conduit Entry Size</b>	
A	Polyurethane-covered Aluminum	½-14 NPT	•
B	Polyurethane-covered Aluminum	M20 x 1.5 (CM20)	•
C	Polyurethane-covered Aluminum	PG 13.5	•
D	Polyurethane-covered Aluminum	G½	•
J	SST	½-14 NPT	•
K	SST	M20 x 1.5 (CM20)	•
L	SST	PG 13.5	•
<b>Code</b>	<b>Integral Mount Manifold Options</b>		
S4	Factory Assembly to Rosemount Primary Element (Diamond II+Annubar/Model 1195 Integral Orifice) <i>NOTE: With the primary element installed, the maximum operating pressure will equal the lesser of either the transmitter or the primary element. Option is available for factory assembly to range 1-4 transmitters only.</i>	•	•
<b>Code</b>	<b>Mounting Bracket Options</b>		
B5	Universal Mounting Bracket for 2-in. Pipe or Panel Mount, CS Bolts	•	•
B6	Universal Mounting Bracket for 2-in. Pipe or Panel Mount, SST Bolts	•	•

# Rosemount Model 3051 Transmitter for Flow, Level, and Pressure Measurement

TABLE 5-9. (continued) Model 3051H Pressure Transmitter for High-Temperature Processes

Code		Hazardous Locations Certification Options	HD	HG
E5		FM Explosionproof Approval		
I5		FM Non-incendive and Intrinsic Safety Approval	•	•
K5		FM Explosionproof and Intrinsic Safety Approval	•	•
I1		BASEEFA/CENELEC Intrinsic Safety Certification (NOTE: Not available with low-power Option Code M.)	•	•
N1		BASEEFA Type N Certification (NOTE: Not available with low-power Option Code M.)	•	•
E8		CESI/CENELEC Flameproof Certification	•	•
E4		JIS Flameproof Certification (NOTE: Not available with low-power Option Code M.)	•	•
C6		CSA Explosionproof and Intrinsic Safety Approval (Requires 42.4 V dc maximum power supply)	•	•
K6		Combination of CSA and CENELEC Explosionproof and Intrinsic Safety Approval	•	•
		NOTE: Not available with low-power Option Code M.		
KB		Combination of FM and CSA Explosionproof and Intrinsic Safety Approvals	•	•
		NOTE: Not available with low-power Option Code M.		
I7		SAA Intrinsic Safety Certification	•	•
E7		SAA Flameproof Certification	•	•
N7		SAA Type N Certification	•	•
Code		Bolt for Flange and Adapter Options	HD	HG
L4		Austenitic 316 SST Bolts	•	•
Code		Meter Options	HD	HG
M5		LCD Meter for Aluminum Housing (Housing Codes A, B, C, and D only)	•	•
M6		LCD Meter for SST Housing (Housing Codes J, K, and L only)	•	•
Code		Other Options	HD	HG
Q4		Calibration Data Sheet	•	•
J1		Local Zero Adjustment Only	•	•
		NOTE: Local zero and span adjustments are standard unless Option Code J1 or J3 is specified.		
J3		No Local Zero or Span Adjustment	•	•
		NOTE: Local zero and span adjustments are standard unless Option Code J1 or J3 is specified.		
T1		Transient Protection Terminal Block	•	•
		NOTE: Not available with hazardous locations certification Option Code I1 or K6.		
C1		Custom Software Configuration (Completed CDS 00806-0100-4001 required with order)	•	•
C2		0.8–3.2 V dc Output with Digital Signal Based on HART Protocol (Output Code M only)	•	•
C4		Analog Output Levels Compliant with NAMUR Recommendation NE43, 27-June-1996	•	•
		NOTE: NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.		
CN		Analog Output Levels Compliant with NAMUR Recommendation NE43, 27-June-1996: Alarm Configuration—Low	•	•
		NOTE: NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.		
P1		Hydrostatic Testing	•	•
P2		Cleaning for Special Service	•	•
P3		Cleaning for <1 PPM Chlorine/Fluorine	•	•
D3		¼–18 NPT Process Connections (No flange adapters)	•	•
D8		Ceramic Ball Drain/Vents	•	•
V5		External Ground Screw Assembly	•	•
Typical Model Number:		3051HG 2 A 2 2 A H 2 1 A B5		

TABLE 5-10. Model 3051P Reference Class Transmitter

Model	Transmitter Type (Select One)			PD	PG	
3051PD	Model 3051P Reference Class Differential Pressure Transmitter			•	•	
3051PG	Model 3051P Reference Class Gage Pressure Transmitter				•	
PRESSURE RANGES (RANGE/MIN. SPAN)						
Code	3051PD	3051PG		PD	PG	
2	-250 to 250 inH <sub>2</sub> O/25 inH <sub>2</sub> O (-62,2 to 62,2 kPa/6,2 kPa)	-250 to 250 inH <sub>2</sub> O/2.5 inH <sub>2</sub> O (-62,2 to 62,2 kPa/0,6 kPa)		•	•	
3	-1000 to 1000 inH <sub>2</sub> O/100 inH <sub>2</sub> O (-248 to 248 kPa/25 kPa)	-407 to 1000 inH <sub>2</sub> O/10 in H <sub>2</sub> O (-101 to 249 kPa/2,5 kPa)		•	•	
4	Not Applicable	-14.7 to 300 psi/3 psi (-101 to 2 070 kPa/20,7 kPa)			•	
5	Not Applicable	-14.7 to 2000 psig/20 psi (-101 to 13 800 kPa/138 kPa)			•	
<i>NOTE: 3051PG lower range limit varies with atmospheric pressure.</i>						
Code	Output			PD	PG	
A	4-20 mA with Digital Signal Based on HART Protocol			•	•	
MATERIALS OF CONSTRUCTION						
Code	Process Flange Type	Flange Material	Drain/Vent	Flange Adapters	PD	PG
2	Coplanar	SST	SST	SST	•	•
0 <sup>(1)</sup>	Alternate Flange—See Option H2, HJ, HK, HL, FA, FB, FC, FD, FP, FQ, S5				•	•
Code	Isolating Diaphragm				PD	PG
2	316L SST				•	•
Code	O-ring Material				PD	PG
A	Glass-Filled TFE				•	•
Code	Fill Fluid				PD	PG
1	Silicone				•	•
2	Inert (Halocarbon)				•	•
Code	Housing Material	Conduit Entry Size		PD	PG	
A	Polyurethane-covered Aluminum	½-14 NPT		•	•	
B	Polyurethane-covered Aluminum	M20 x 1.5 (CM20)		•	•	
C	Polyurethane-covered Aluminum	PG 13.5		•	•	
D	Polyurethane-covered Aluminum	G½		•	•	
J	SST	½-14 NPT		•	•	
K	SST	M20 x 1.5 (CM20)		•	•	
L	SST	PG 13.5		•	•	
Code	Alternate Flange Options (Requires Materials of Construction Code 0)				PD	PG
H2	Traditional Flange, 316 SST Drain/Vent, SST Flange Adapter				•	•
HJ	DIN Compliant Traditional Flange, SST, 7/16 in. Adapter/Manifold Bolting				•	•
HK	DIN Compliant Traditional Flange, SST, 10 mm Adapter/Manifold Bolting				•	•
HL	DIN Compliant Traditional Flange, SST, 12mm Adapter/Manifold Bolting				•	•
FA	Level Flange, SST, 2 in., ANSI Class 150, Vertical Mount				•	•
FB	Level Flange, SST, 2 in., ANSI Class 300, Vertical Mount				•	•
FC	Level Flange, SST, 3 in., ANSI Class 150, Vertical Mount				•	•
FD	Level Flange, SST, 3 in., ANSI Class 300, Vertical Mount				•	•
FP	DIN Level Flange, SST, DN 50, PN 40, Vertical Mount				•	•
FQ	DIN Level Flange, SST, DN 80, PN 40, Vertical Mount				•	•
Code	Integral Mount Manifold Options				PD	PG
S5	Assemble to Model 305 Integral Manifold (Refer to PPL 00814-0100-4733 for Pricing Information)				•	•
Code	Integral Mount Primary Elements (Optional)				PD	PG
S4	Factory Assembly to Rosemount Primary Element (Diamond II+Annubar/Model 1195 Integral Orifice) <i>NOTE: With the primary element installed, the maximum operating pressure will equal the lesser of either the transmitter or the primary element. Option is available for factory assembly to range 2-3 transmitters only.</i>				•	•

Rosemount Model 3051 Transmitter for Flow, Level, and Pressure Measurement

TABLE 5-10. (continued) Model 3051P Reference Class Transmitter

Code	Mounting Bracket Options	PD	PG
B4	Coplanar Flange Bracket for 2-in. Pipe or Panel Mounting, All SST	.	.
B1	Traditional Flange Bracket for 2-in. Pipe or Panel Mounting, CS Bolts	.	.
B2	Traditional Flange Bracket for Panel Mounting, CS Bolts	.	.
B7	B1 Bracket with Series 300 SST Bolts	.	.
B8	B2 Bracket with Series 300 SST Bolts	.	.
BA	SST B1 Bracket with Series 300 SST Bolts	.	.
BC	SST B3 Bracket with Series 300 SST Bolts	.	.
Code	Hazardous Locations Certification Options	PD	PG
E5	FM Explosionproof Approval	.	.
I5	FM Non-incendive and Intrinsic Safety Approval	.	.
K5	FM Explosionproof and Intrinsic Safety Approval	.	.
I1	BASEEFA/CENELEC Intrinsic Safety Certification <i>NOTE: Not available with low-power Option Code M.</i>	.	.
N1	BASEEFA Type N Certification <i>NOTE: Not available with low-power Option Code M.</i>	.	.
E8	CESI/CENELEC Flameproof Certification	.	.
E4	JIS Flameproof Certification <i>NOTE: Not available with low-power Option Code M.</i>	.	.
C6	Canadian Standards Association (CSA) Explosionproof and Intrinsic Safety Approval (Requires 42.4 V dc maximum power supply)	.	.
K6	Combination of CSA and CENELEC Explosionproof and Intrinsic Safety Approval <i>NOTE: Not available with low-power Option Code M.</i>	.	.
KB	Combination of FM and CSA Explosionproof and Intrinsic Safety Approvals <i>NOTE: Not available with low-power Option Code M.</i>	.	.
I7	SAA Intrinsic Safety Certification	.	.
E7	SAA Flameproof Certification	.	.
N7	SAA Type N Certification	.	.
Code	Other Options	PD	PG
Q4	Calibration Data Sheet	.	.
Q8	Material Traceability Certification per EN 10204 3.1B <i>NOTE: This option is available for the sensor module housing and Coplanar or traditional flanges and adapters.</i>	.	.
L4	Austenitic 316 SST Bolts	.	.
L5	ANSI/ASTM-A-193-B7M Bolts	.	.
L6	Monel Bolts	.	.
M5	LCD Meter for Aluminum Housing (Housing Codes A, B, C, and D only)	.	.
M6	LCD Meter for SST Housing (Housing Codes J, K, and L only)	.	.
J1	Local Zero Adjustment Only <i>NOTE: Local zero and span adjustments are standard unless Option Code J1 or J3 is specified.</i>	.	.
J3	No Local Zero or Span Adjustment <i>NOTE: Local zero and span adjustments are standard unless Option Code J1 or J3 is specified.</i>	.	.
T1	Transient Protection Terminal Block <i>NOTE: Not available with hazardous locations certification Option Code I1.</i>	.	.
C1	Custom Software Configuration (Completed CDS 00806-0100-4001 required with order)	.	.
C4	Analog Output Levels Compliant with NAMUR Recommendation NE43, 27-June-1996 <i>NOTE: NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.</i>	.	.
CN	Analog Output Levels Compliant with NAMUR Recommendation NE43, 27-June-1996: Alarm Configuration-Low <i>NOTE: NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.</i>	.	.
P1	Hydrostatic Testing	.	.
P2	Cleaning for Special Service	.	.
P3	Cleaning for <1 PPM Chlorine/Fluorine	.	.
D3	¼-18 NPT Process Connections (No flange adapters)	.	.
D7	Coplanar Flange Without Drain/Vent Ports	.	.
V5	External Ground Screw Assembly	.	.
<b>Typical Model Number:</b> 3051PD 3 A 2 2 A 1 A B4			

(1) NOTE: May impact temperature performance under certain conditions.

## CONFIGURATION INFORMATION

### Standard Configuration

Unless otherwise specified, transmitter is shipped as follows:

#### Engineering Units

<b>Differential/Gage:</b>	inH <sub>2</sub> O (Range 0, 1, 2, and 3) psi (Range 4 and 5)
<b>Absolute/3051T:</b>	psi (all ranges)
<b>4 mA (1 V dc):</b>	0 (engineering units above)
<b>20 mA (5 V dc):</b>	Upper range limit
<b>Output:</b>	Linear
<b>Flange type:</b>	Specified model code option
<b>Flange material:</b>	Specified model code option
<b>O-ring material:</b>	Specified model code option
<b>Drain/vent:</b>	Specified model code option
<b>Integral meter:</b>	Installed or none
<b>Alarm:</b>	Upscale
<b>Software tag:</b>	(Blank)

### Custom Configuration (Option Code C1)

If Option Code C1 is ordered, the customer may specify the following data in addition to the standard configuration parameters.

- Output Information
- Transmitter Information
- LCD Meter Configuration
- Hardware Selectable Information
- Signal Selection

Refer to Configuration Data Sheet 00806-0100-4001.

### Tagging

Three customer tagging options are available:

1. Standard SST hardware tag is wired to the transmitter. Tag character height is 0.125 in. (3,18 mm), 56 characters maximum.
2. Tag may be permanently stamped on transmitter nameplate upon request, 56 characters maximum.
3. Tag may be stored in transmitter memory (30 characters maximum). Software tag is left blank unless specified.

### Optional Model 305 or Model 306 Integral Manifolds

Factory assembled to Model 3051C and Model 3051T transmitters. Refer to the following Rosemount documents for more information:

Product Data Sheet 00813-0100-4773

Product Data Sheet 00813-0200-4733

### Optional Conventional Manifolds (Packaged Separately)

A wide offering of two-, three-, and five-valve manifolds manufactured by Anderson Greenwood and PGI International are available.

#### Part No. 01151-0150-0001

3-Valve Manifold, Carbon Steel  
(Anderson, Greenwood & Co., M4AVIC)

#### Part No. 01151-0150-0002

3-Valve Manifold, 316 SST  
(Anderson, Greenwood & Co., M4AVIS)

Please consult your Rosemount representative.



**Optional Diaphragm and Sanitary Seals**

Refer to Product Data Sheet 00813-0100-4016 or 00813-0201-4016.

**Output Information**

Output range points must be the same unit of measure. Available units of measure include:

inH <sub>2</sub> O	inH <sub>2</sub> O@4 °C <sup>(1)</sup>	psi	Pa
inHg	ftH <sub>2</sub> O	bar	kPa
mmH <sub>2</sub> O	mmH <sub>2</sub> O@4 °C <sup>(1)</sup>	mbar	torr
mmHg	g/cm <sup>2</sup>	kg/cm <sup>2</sup>	atm

(1) Not available on low power or previous versions.

**Shipping Weights**

TABLE 5-11. Transmitter Weights without Options

Transmitter	Add Weight In lb (kg)
Model 3051C/P	6.0 (2,7)
Model 3051L	See Table 5-12
Model 3051H	13.6 (6,2)
Model 3051T	3.0 (1,4)

TABLE 5-12. Model 3051L Weights without Options

Flange	Flush lb. (kg)	2-in. Ext. lb (kg)	4-in. Ext. lb (kg)	6-in. Ext. lb (kg)
2-in., 150	12.5 (5,7)	—	—	—
3-in., 150	17.5 (7,9)	19.5 (8,8)	20.5 (9,3)	21.5 (9,7)
4-in., 150	23.5 (10,7)	26.5 (12,0)	28.5 (12,9)	30.5 (13,8)
2-in., 300	17.5 (7,9)	—	—	—
3-in., 300	22.5 (10,2)	24.5 (11,1)	25.5 (11,6)	26.5 (12,0)
4-in., 300	32.5 (14,7)	35.5 (16,1)	37.5 (17,0)	39.5 (17,9)
2-in., 600	15.3 (6,9)	—	—	—
3-in., 600	25.2 (11,4)	27.2 (12,3)	28.2 (12,8)	29.2 (13,2)
DN 50 / PN 40	13.8 (6,2)	—	—	—
DN 80 / PN 40	19.5 (8,8)	21.5 (9,7)	22.5 (10,2)	23.5 (10,6)
DN 100 / PN 10/16	17.8 (8,1)	19.8 (9,0)	20.8 (9,5)	21.8 (9,9)
DN 100 / PN 40	23.2 (10,5)	25.2 (11,5)	26.2 (11,9)	27.2 (12,3)

TABLE 5-13. Transmitter Options Weights

Code	Option	Add lb (kg)
J, K, L	Stainless Steel Housing (T)	3.9 (1,8)
J, K, L	Stainless Steel Housing (C, L, H, P)	3.1 (1,4)
M5	LCD Meter for Aluminum Housing	0.5 (0,2)
M6	LCD Meter for SST Housing	1.25 (0,6)
B4	SST Mounting Bracket for <i>Coplanar</i> Flange	1.0 (0,5)
B1, B2, B3	Mounting Bracket for Traditional Flange	2.3 (1,0)
B7, B8, B9	Mounting Bracket for Traditional Flange	2.3 (1,0)
BA, BC	SST Bracket for Traditional Flange	2.3 (1,0)
B5, B6	Mounting Bracket for Model 3051H	2.9 (1,3)
H2	Traditional Flange	2.4 (1,1)
H3	Traditional Flange	2.7 (1,2)
H4	Traditional Flange	2.6 (1,2)
H7	Traditional Flange	2.5 (1,1)
F1, G1, FC	Level Flange—3 in., 150	10.8 (4,9)
F2, G2, FD	Level Flange—3 in., 300	14.3 (6,5)
FA	Level Flange—2 in., 150	10.7 (4,8)
FB	Level Flange—2 in., 300	14.0 (6,3)
FP	DIN Level Flange, SST, DN 50, PN 40	8.3 (3,8)
FQ	DIN Level Flange, SST, DN 80, PN 40	13.7 (6,2)

## ROSEMOUNT SMART FAMILY® INSTRUMENTS

Rosemount SMART FAMILY® instruments may be installed in pressure, temperature, level, and flow applications.

All SMART FAMILY instruments are designed to communicate using Highway Addressable Remote Transducer (HART) protocol with the hand-held HART Communicator and Fisher-Rosemount Control Systems.

### Related Product Data Sheets

Model 1195 Integral Orifice: PDS 00813-0100-4686

Model 305/Model 306 Integral Manifolds: PDS 00813-0100-4733 and PDS 00813-0200-4733

Model 1199 Diaphragm Seals: PDS 00813-0100-4016 (Worldwide) and PDS 00813-0201-4016 (European)

Diamond II+Annubar: PDS 00813-0100-4760

Model 3051 with FOUNDATION fieldbus: PDS 00813-0100-4774

Model 3051 Draft Range Transmitter (CD0):  
PDS 00813-0600-4001

**PARTS LIST**

Item numbers are references to figure callouts (pages 42-46).

TABLE 5-14. Model 3051C Differential Sensor Modules

Model 3051C Sensor Modules (Min. Span/Range)	Silicone Fill		Inert Fill	
	Part Number		Part Number	
<i>Note: One spare part is recommended for every 50 transmitters.</i>				
<i>Note: Listed by Range and Process Isolator Order Numbers.</i>				
<b>-3 to 3/0.1 inH<sub>2</sub>O, Range 0 (includes Traditional SST flange and SST bolts).</b>				
<b>316L SST</b>	03031-1045-0002	•	03031-1145-0002	•
<b>-25 to 25 inH<sub>2</sub>O/0.5 inH<sub>2</sub>O, Range 1</b>				
316L SST	03031-1045-0012	•	03031-1145-0012	•
Hastelloy C-276	03031-1045-0013	•	03031-1145-0013	•
Monel	03031-1045-0014	•	03031-1145-0014	•
Gold-plated Monel	03031-1045-0016	•	03031-1145-0016	•
Gold-plated 316 SST	03031-1045-0017	•	03031-1145-0017	•
<b>-250 to 250 inH<sub>2</sub>O/2.5 inH<sub>2</sub>O, Range 2</b>				
316L SST	03031-1045-0022	•	03031-1145-0022	•
Hastelloy C-276	03031-1045-0022	•	03031-1145-0022	•
Monel	03031-1045-0024	•	03031-1145-0024	•
Tantalum	03031-1045-0025	•	03031-1145-0025	•
Gold-plated Monel	03031-1045-0026	•	03031-1145-0026	•
Gold-plated 316 SST	03031-1045-0027	•	03031-1145-0027	•
<b>-1000 to 1000 inH<sub>2</sub>O/10 inH<sub>2</sub>O, Range 3</b>				
316L SST	03031-1045-0032	•	03031-1145-0032	•
Hastelloy C-276	03031-1045-0033	•	03031-1145-0033	•
Monel	03031-1045-0034	•	03031-1145-0034	•
Tantalum	03031-1045-0035	•	03031-1145-0035	•
Gold-plated Monel	03031-1045-0036	•	03031-1145-0036	•
Gold-plated 316 SST	03031-1045-0037	•	03031-1145-0037	•
<b>-300 to 300 psi/3 psi, Range 4</b>				
316L SST	03031-1045-2042	•	03031-1145-2042	•
Hastelloy C-276	03031-1045-2043	•	03031-1145-2043	•
Monel	03031-1045-2044	•	03031-1145-2044	•
Tantalum	03031-1045-2045	•	03031-1145-2045	•
Gold-plated Monel	03031-1045-2046	•	03031-1145-2046	•
Gold-plated 316 SST	03031-1045-2047	•	03031-1145-2047	•
<b>-2000 to 2000/20 psi, Range 5</b>				
316L SST	03031-1045-2052	•	03031-1145-2052	•
Hastelloy C-276	03031-1045-2053	•	03031-1145-2053	•
Monel	03031-1045-2054	•	03031-1145-2054	•
Tantalum	03031-1045-2055	•	03031-1145-2055	•
Gold-plated Monel	03031-1045-2056	•	03031-1145-2056	•
Gold-plated 316 SST	03031-1045-2057	•	03031-1145-2057	•

TABLE 5-15. Model 3051C Gage Sensor Modules

Model 3051C Gage Modules (Min. Span/Range)	Silicone Fill		Inert Fill	
	Part Number		Part Number	
Note: One spare part is recommended for every 50 transmitters. Note: Listed by Range and Process Isolator Order Numbers.				
<b>-250 to 250 inH<sub>2</sub>O/2.5 inH<sub>2</sub>O, Range 2</b>				
316L SST	03031-1045-0022	•	03031-1145-0022	•
<i>Hastelloy C-276</i>	03031-1045-0023	•	03031-1145-0023	•
<i>Monel</i>	03031-1045-0024	•	03031-1145-0024	•
Tantalum	03031-1045-0025	•	03031-1145-0025	•
Gold-plated <i>Monel</i>	03031-1045-0026	•	03031-1145-0026	•
Gold-plated 316 SST	03031-1045-0027	•	03031-1145-0027	•
<b>-335 to 1000 inH<sub>2</sub>O/10 inH<sub>2</sub>O, Range 3</b>				
316L SST	03031-1045-0032	•	03031-1145-0032	•
<i>Hastelloy C-276</i>	03031-1045-0033	•	03031-1145-0033	•
<i>Monel</i>	03031-1045-0034	•	03031-1145-0034	•
Tantalum	03031-1045-0035	•	03031-1145-0035	•
Gold-plated <i>Monel</i>	03031-1045-0036	•	03031-1145-0036	•
Gold-plated 316 SST	03031-1045-0037	•	03031-1145-0037	•
<b>-12 to 300 psi/3 psi, Range 4</b>				
316L SST	03031-1045-1042	•	03031-1145-1042	•
<i>Hastelloy C-276</i>	03031-1045-1043	•	03031-1145-1043	•
<i>Monel</i>	03031-1045-1044	•	03031-1145-1044	•
Tantalum	03031-1045-1045	•	03031-1145-1045	•
Gold-plated <i>Monel</i>	03031-1045-1046	•	03031-1145-1046	•
Gold-plated 316 SST	03031-1045-1047	•	03031-1145-1047	•
<b>-12 to 2000 psi/20 psi, Range 5</b>				
316L SST	03031-1045-1052	•	03031-1145-1052	•
<i>Hastelloy C-276</i>	03031-1045-1053	•	03031-1145-1053	•
<i>Monel</i>	03031-1045-1054	•	03031-1145-1054	•
Tantalum	03031-1045-1055	•	03031-1145-1055	•
Gold-plated <i>Monel</i>	03031-1045-1056	•	03031-1145-1056	•
Gold-plated 316 SST	03031-1045-1057	•	03031-1145-1057	•

TABLE 5-16. Model 3051C Absolute Sensor Modules

Model 3051C Absolute Sensor Modules (Min. Span/Range)	Silicone Fill		Inert Fill	
	Part Number		Part Number	
Note: One spare part is recommended for every 50 transmitters.				
Note: Listed by Range and Process Isolator Order Numbers.				
<b>0 to 0.167 psia/5 psia, Range 0 (Includes Traditional SST flange and SST bolts).</b>				
316L SST	03031-2020-0002	•	—	—
Hastelloy C-276	03031-2020-0003	•	—	—
Monel	03031-2020-0004	•	—	—
Gold-plated Monel	03031-2020-0006	•	—	—
Gold-plated 316 SST	03031-2020-0007	•	—	—
<b>0 to 30 psia/0.3 psia, Range 1</b>				
316L SST	03031-2020-0012	•	—	—
Hastelloy C-276	03031-2020-0013	•	—	—
Monel	03031-2020-0014	•	—	—
Gold-plated Monel	03031-2020-0016	•	—	—
Gold-plated 316 SST	03031-2020-0017	•	—	—
<b>0 to 150/1.5 psia, Range 2</b>				
316L SST	03031-2020-0022	•	—	—
Hastelloy C-276	03031-2020-0023	•	—	—
Monel	03031-2020-0024	•	—	—
Gold-plated Monel	03031-2020-0026	•	—	—
Gold-plated 316 SST	03031-2020-0027	•	—	—
<b>0 to 800 psia/8 psia, Range 3</b>				
316L SST	03031-2020-0032	•	—	—
Hastelloy C-276	03031-2020-0033	•	—	—
Monel	03031-2020-0034	•	—	—
Gold-plated Monel	03031-2020-0036	•	—	—
Gold-plated 316 SST	03031-2020-0037	•	—	—

TABLE 5-17. Model 3051T Gage and Absolute Pressure Transmitters.

		Silicone Fill			Inert Fill				
Item No.	Model 3051T Sensor Modules <sup>(1)</sup>	Isolating Diaphragm	Housing Material	Part Number		Part Number			
8	<b>Gage Sensor Module<sup>(2)</sup></b> <b>0-0.3/30 psig, Range 1</b> 1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female G1/2A DIN 16288 Male  1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female	316L SST	Aluminum	03031-3112-3112	•	03031-3112-1112	•		
		<i>Hastelloy C</i>	Aluminum	03031-3112-3113	•	03031-3112-1113	•		
		316L SST	Aluminum	03031-3102-3112	•	03031-3102-1112	•		
		<i>Hastelloy C</i>	Aluminum	03031-3102-3113	•	03031-3102-1113	•		
		316L SST	Aluminum	03031-3132-3112	•	03031-3132-1112	•		
		316L SST	SST	03031-3111-3112	•	03031-3111-1112	•		
		<i>Hastelloy C</i>	SST	03031-3111-3113	•	03031-3111-1113	•		
		316L SST	SST	03031-3101-3112	•	03031-3101-1112	•		
		<i>Hastelloy C</i>	SST	03031-3101-3113	•	03031-3101-1113	•		
		8	<b>Gage Sensor Module<sup>(2)</sup></b> <b>0-1.5/150 psig, Range 2</b> 1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female G1/2A DIN 16288 Male  1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female	316L SST	Aluminum	03031-3112-3122	•	03031-3112-1122	•
				<i>Hastelloy C</i>	Aluminum	03031-3112-3123	•	03031-3112-1123	•
				316L SST	Aluminum	03031-3102-3122	•	03031-3102-1122	•
				<i>Hastelloy C</i>	Aluminum	03031-3102-3123	•	03031-3102-1123	•
				316L SST	Aluminum	03031-3132-3122	•	03031-3132-1122	•
316L SST	SST			03031-3111-3122	•	03031-3111-1122	•		
<i>Hastelloy C</i>	SST			03031-3111-3123	•	03031-3111-1123	•		
316L SST	SST			03031-3101-3122	•	03031-3101-1122	•		
<i>Hastelloy C</i>	SST			03031-3101-3123	•	03031-3101-1123	•		
8	<b>Gage Sensor Module<sup>(2)</sup></b> <b>0-8/800 psig, Range 3</b> 1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female G1/2A DIN 16288 Male  1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female			316L SST	Aluminum	03031-3112-3132	•	03031-3112-1132	•
				<i>Hastelloy C</i>	Aluminum	03031-3112-3133	•	03031-3112-1133	•
				316L SST	Aluminum	03031-3102-3132	•	03031-3102-1132	•
				<i>Hastelloy C</i>	Aluminum	03031-3102-3133	•	03031-3102-1133	•
				316L SST	Aluminum	03031-3132-3132	•	03031-3132-1132	•
		316L SST	SST	03031-3111-3132	•	03031-3111-1132	•		
		<i>Hastelloy C</i>	SST	03031-3111-3133	•	03031-3111-1133	•		
		316L SST	SST	03031-3101-3132	•	03031-3101-1132	•		
		<i>Hastelloy C</i>	SST	03031-3101-3133	•	03031-3101-1133	•		
		8	<b>Gage Sensor Module<sup>(2)</sup></b> <b>0-40/4000 psig, Range 4</b> 1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female G1/2A DIN 16288 Male  1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female	316L SST	Aluminum	03031-3112-3142	•	03031-3112-1142	•
				<i>Hastelloy C</i>	Aluminum	03031-3112-3143	•	03031-3112-1143	•
				316L SST	Aluminum	03031-3102-3142	•	03031-3102-1142	•
				<i>Hastelloy C</i>	Aluminum	03031-3102-3143	•	03031-3102-1143	•
				316L SST	Aluminum	03031-3132-3142	•	03031-3132-1142	•
316L SST	SST			03031-3111-3142	•	03031-3111-1142	•		
<i>Hastelloy C</i>	SST			03031-3111-3143	•	03031-3111-1143	•		
316L SST	SST			03031-3101-3142	•	03031-3101-1142	•		
<i>Hastelloy C</i>	SST			03031-3101-3143	•	03031-3101-1143	•		
8	<b>Absolute Sensor Module<sup>(2)</sup></b> <b>0-0.3/30 psig, Range 1</b> 1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female G1/2A DIN 16288 Male  1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female			316L SST	Aluminum	03031-3112-3012	•	03031-3112-1012	•
		<i>Hastelloy C</i>	Aluminum	03031-3112-3013	•	03031-3112-1013	•		
		316L SST	Aluminum	03031-3102-3012	•	03031-3102-1012	•		
		<i>Hastelloy C</i>	Aluminum	03031-3102-3013	•	03031-3102-1013	•		
		316L SST	Aluminum	03031-3132-3012	•	03031-3132-1012	•		
		316L SST	SST	03031-3111-3012	•	03031-3111-1012	•		
		<i>Hastelloy C</i>	SST	03031-3111-3013	•	03031-3111-1013	•		
		316L SST	SST	03031-3101-3012	•	03031-3101-1012	•		
		<i>Hastelloy C</i>	SST	03031-3101-3013	•	03031-3101-1013	•		

**Rosemount Model 3051 Transmitter for Flow, Level, and Pressure Measurement**

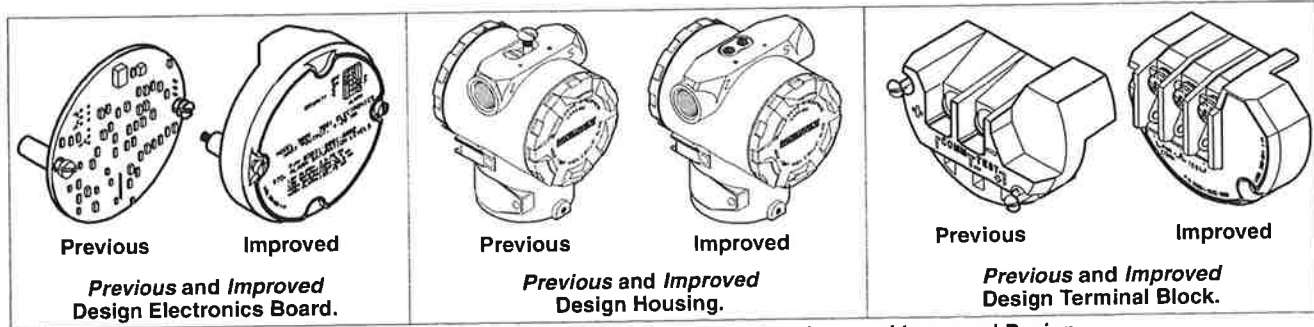
TABLE 5-17. (continued) Model 3051T Gage and Absolute Pressure Transmitters.

Item No.	Model 3051T Sensor Modules <sup>(1)</sup>	Isolating Diaphragm	Housing Material	Silicone Fill		Inert Fill											
				Part Number		Part Number											
8	<b>Absolute Sensor Module<sup>(2)</sup></b> <b>0-1.5/150 psig, Range 2</b> 1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female G 1/2A DIN 16288 Male  1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female	316L SST <i>Hastelloy C</i> 316L SST <i>Hastelloy C</i>	Aluminum Aluminum Aluminum Aluminum	03031-3112-3022 03031-3112-3023 03031-3102-3022 03031-3102-3023	• • • •	03031-3112-1022 03031-3112-1023 03031-3102-1022 03031-3102-1023	• • • •										
								316L SST	Aluminum	03031-3132-3022	•	03031-3132-1022	•				
														316L SST <i>Hastelloy C</i>	SST SST	03031-3111-3022 03031-3111-3023	• •
								316L SST <i>Hastelloy C</i>	SST SST	03031-3101-3022 03031-3101-3023	• •	03031-3101-1022 03031-3101-1023	• •				
		8	<b>Absolute Sensor Module<sup>(2)</sup></b> <b>0-8/800 psig, Range 3</b> 1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female G 1/2A DIN 16288 Male  1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female	316L SST <i>Hastelloy C</i> 316L SST <i>Hastelloy C</i>	Aluminum Aluminum Aluminum Aluminum	03031-3112-3032 03031-3112-3033 03031-3102-3032 03031-3102-3033	• • • •							03031-3112-1032 03031-3112-1033 03031-3102-1032 03031-3102-1033	• • • •		
								316L SST	Aluminum	03031-3132-3032	•	03031-3132-1032	•				
																316L SST <i>Hastelloy C</i>	SST SST
								316L SST <i>Hastelloy C</i>	SST SST	03031-3101-3032 03031-3101-3033	• •	03031-3101-1032 03031-3101-1033	• •				
				8	<b>Absolute Sensor Module<sup>(2)</sup></b> <b>0-40/4000 psig, Range 4</b> 1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female G 1/2A DIN 16288 Male  1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female	316L SST <i>Hastelloy C</i> 316L SST <i>Hastelloy C</i>	Aluminum Aluminum Aluminum Aluminum							03031-3112-3042 03031-3112-3043 03031-3102-3042 03031-3102-3043	• • • •	03031-3112-1042 03031-3112-1043 03031-3102-1042 03031-3102-1043	• • • •
								316L SST	Aluminum	03031-3132-3042	•	03031-3132-1042	•				
								316L SST <i>Hastelloy C</i>	SST SST	03031-3101-3042 03031-3101-3043	• •	03031-3101-1042 03031-3101-1043	• •				
						8	<b>Absolute Sensor Module<sup>(2)</sup></b> <b>0-2000/10000 psig, Range 5</b> 1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female G 1/2A DIN 16288 Male  1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female							316L SST <i>Hastelloy C</i> 316L SST <i>Hastelloy C</i>	Aluminum Aluminum Aluminum Aluminum	03031-3112-3052 03031-3112-3053 03031-3102-3052 03031-3102-3053	• • • •
								316L SST	Aluminum	03031-3122-3052	•	03031-3122-1052	•				
316L SST <i>Hastelloy C</i>	SST SST																
								316L SST <i>Hastelloy C</i>	SST SST	03031-3101-3052 03031-3101-3053	• •	03031-3101-1052 03031-3101-1053	• •				

(1) For Model 3051TG Range 5 spare module, order absolute configuration and perform zero trim for gage calibrations.  
 (2) One spare part is recommended for every 50 transmitters.

TABLE 5-18. Model 3051C Differential, Gage, Absolute, and Liquid Level Transmitters.

Item No.	Part Description	Part Number						
<b>Electronics Board—Assembly Required</b>			<b>CD</b>	<b>CG</b>	<b>CA</b>	<b>L</b>	<b>H</b>	<b>T</b>
6	Improved Standard (4–20 mA/HART protocol) <sup>(1)</sup>	03031-0001-0002	•	•	•	•	•	•
6	Improved NAMUR Compliant (4–20 mA/HART protocol) <sup>(1)</sup>	03031-0001-0003	•	•	•	•	•	•
6	Low Power (1–5/0.8–3.2 Volts) <sup>(1)</sup>	03031-0001-1001	•	•	•	•	•	•



Electronics Board, Housing, and Terminal Block, Previous and Improved Design.

3051-OVERG01A, N01A, E01A



**Rosemount Model 3051 Transmitter for Flow, Level, and Pressure Measurement**

TABLE 5-18. (continued) Model 3051C Differential, Gage, Absolute, and Liquid Level Transmitters.

Item No.	Part Description	Part Number	CD	CG	CA	L	H	T
<b>Electronics Housing, Covers, Terminal Block</b>								
NOTE: See drawings below for Previous and Improved Electronics Boards, Housings, and Terminal Blocks. For information on ordering "Previous Design" spare parts, contact your local Rosemount office. In the U.S., call the Response Center at 1-800-654-7768.								
<b>Improved Standard (4-20 mA)</b>								
<b>Aluminum Housing</b>								
4	Electronics Housing without Terminal Block							
	½-14 NPT conduit, Includes RFI Filters	03031-0635-0001	•	•	•	•	•	•
	M20×1.5 (CM20) conduit, Includes RFI filters	03031-0635-0002	•	•	•	•	•	•
	PG 13.5 conduit, Includes RFI Filters	03031-0635-0003	•	•	•	•	•	•
	G½ conduit, Includes RFI Filters	03031-0635-0004	•	•	•	•	•	•
1	Electronics Cover (Includes wiring label) <sup>(2)</sup>	03031-0292-0001	•	•	•	•	•	•
3	Standard Terminal Block Assembly <sup>(1)</sup>	03031-0332-0003	•	•	•	•	•	•
3	Transient Terminal Block Assy. (Option T1) <sup>(2)</sup>	03031-0332-0004	•	•	•	•	•	•
5	Local Zero and Span Kit <sup>(1)</sup>	03031-0293-0002	•	•	•	•	•	•
	External Ground Assembly (Option V5) <sup>(1)</sup>	03031-0398-0001	•	•	•	•	•	•
<b>Improved Standard (4-20 mA)</b>								
<b>316 SST Housing</b>								
4	Electronics Housing without Terminal Block							
	½-14 NPT conduit, Includes RFI Filters	03031-0635-0041	•	•	•	•	•	•
	M20×1.5 (CM20) conduit, Includes RFI Filters	03031-0635-0042	•	•	•	•	•	•
	PG 13.5 conduit, Includes RFI Filters	03031-0635-0043	•	•	•	•	•	•
1	Electronics Cover (Includes wiring label) <sup>(2)</sup>	03031-0292-0002	•	•	•	•	•	•
3	Standard Terminal Block Assembly <sup>(1)</sup>	03031-0332-0003	•	•	•	•	•	•
3	Transient Terminal Block Assy. (Option T1) <sup>(2)</sup>	03031-0332-0004	•	•	•	•	•	•
5	Local Zero and Span Kit <sup>(1)</sup>	03031-0293-0002	•	•	•	•	•	•
	External Ground Assembly (Option V5) <sup>(1)</sup>	03031-0398-0001	•	•	•	•	•	•
<b>Improved Low Power Aluminum Housing</b>								
4	Electronics Housing without Terminal Block							
	½-14 NPT conduit, Includes RFI Filters	03031-0635-0101	•	•	•	•	•	•
1	Electronics Cover (Includes wiring label) <sup>(2)</sup>	03031-0292-0001	•	•	•	•	•	•
3	Low Power Terminal Block Assembly <sup>(1)</sup>	03031-0332-1001	•	•	•	•	•	•
3	Low Power Transient Terminal Block Assembly (Option T1) <sup>(2)</sup>	03031-0332-1002	•	•	•	•	•	•
5	Local Zero and Span Kit <sup>(1)</sup>	03031-0293-0002	•	•	•	•	•	•
	External Ground Assembly (Option V5) <sup>(1)</sup>	03031-0398-0001	•	•	•	•	•	•
<b>Improved Low Power 316 SST Housing</b>								
4	Electronics Housing without Terminal Block							
	½-14 NPT conduit, Includes RFI Filters	03031-0635-0141	•	•	•	•	•	•
1	Electronics Cover (Includes wiring label) <sup>(2)</sup>	03031-0292-0002	•	•	•	•	•	•
3	Low Power Terminal Block Assembly <sup>(1)</sup>	03031-0332-1001	•	•	•	•	•	•
3	Low Power Transient Terminal Block Assembly (Option T1) <sup>(2)</sup>	03031-0332-1002	•	•	•	•	•	•
5	Local Zero and Span Kit <sup>(1)</sup>	03031-0293-0002	•	•	•	•	•	•
	External Ground Assembly (Option V5) <sup>(1)</sup>	03031-0398-0001	•	•	•	•	•	•

TABLE 5-18. (continued) Model 3051C Differential, Gage, Absolute, and Liquid Level Transmitters.

Item No.	Part Description	Part Number						
			CD	CG	CA	L	H	T
<b>Flanges</b>								
11	<b>Process Flanges</b>							
	Differential Coplanar Flange		•	—	—	—	—	—
	Nickel-plated Carbon Steel	03031-0388-0025	•	—	—	—	—	—
	316 SST	03031-0388-0022	•	—	—	—	—	—
	Hastelloy C	03031-0388-0023	•	—	—	—	—	—
	Monel	03031-0388-0024	•	—	—	—	—	—
11	Gage/Absolute Coplanar Flange		—	•	•	—	—	—
	Nickel-plated Carbon Steel	03031-0388-1025	—	•	•	—	—	—
	316 SST	03031-0388-1022	—	•	•	—	—	—
	Hastelloy C	03031-0388-1023	—	•	•	—	—	—
	Monel	03031-0388-1024	—	•	•	—	—	—
	Coplanar Flange Alignment Screw (package of 2 screws)	03031-0309-0001	•	•	•	—	—	—
	Traditional Flange		•	•	•	—	—	—
	316 SST	03031-0320-0002	•	•	•	—	—	—
	Hastelloy C	03031-0320-0003	•	•	•	—	—	—
	Monel	03031-0320-0004	•	•	•	—	—	—
22	Level Flange, Vertical Mount		•	•	•	—	—	—
	2 in., Class 150, SST	03031-0393-0221	•	•	•	—	—	—
	2 in., Class 300, SST	03031-0393-0222	•	•	•	—	—	—
	3 in., Class 150, SST	03031-0393-0231	•	•	•	—	—	—
	3 in., Class 300, SST	03031-0393-0232	•	•	•	—	—	—
	DIN, DN 50, PN 40	03031-0393-1002	•	•	•	—	—	—
DIN, DN 80, PN 40	03031-0393-1012	•	•	•	—	—	—	
35	3051H Flanges		—	—	—	—	•	—
	Process Flange	02051-0072-0002	—	—	—	—	•	—
	Blank Flange (GP Low Side)	02051-0236-0002	—	—	—	—	•	—
<b>Flange Adapter Union</b>			<b>CD</b>	<b>CG</b>	<b>CA</b>	<b>L</b>	<b>H</b>	<b>T</b>
15	Nickel-plated Carbon Steel	02024-0069-0005	•	•	•	—	—	—
	316 SST	02024-0069-0002	•	•	•	—	—	—
	Hastelloy C	02024-0069-0003	•	•	•	—	—	—
	Monel	02024-0069-0004	•	•	•	—	—	—
<b>Drain/Vent Valve Kits</b>			<b>CD</b>	<b>CG</b>	<b>CA</b>	<b>L</b>	<b>H</b>	<b>T</b>
9	<b>Differential Drain/Vent Kits<sup>(1)</sup></b>		•	—	—	—	•	—
	316 SST Stem and Seat Kit	01151-0028-0022	•	—	—	—	•	—
	Hastelloy C Stem and Seat Kit	01151-0028-0023	•	—	—	—	•	—
	Monel Stem and Seat Kit	01151-0028-0024	•	—	—	—	•	—
	316 SST Ceramic Ball Drain/Vent Kit	01151-0028-0122	•	—	—	—	•	—
	Hastelloy C Ceramic Ball Drain/Vent Kit	01151-0028-0123	•	—	—	—	•	—
Monel Ceramic Ball Drain/Vent Kit	01151-0028-0124	•	—	—	—	•	—	
	<b>Gage/Absolute Drain/Vent Kits<sup>(1)</sup></b>		—	•	•	•	•	—
	316 SST Stem and Seat Kit	01151-0028-0012	—	•	•	•	•	—
	Hastelloy C Stem and Seat Kit	01151-0028-0013	—	•	•	•	•	—
	Monel Stem and Seat Kit	01151-0028-0014	—	•	•	•	•	—
	316 SST Ceramic Ball Drain/Vent Kit	01151-0028-0112	—	•	•	•	•	—
	Hastelloy C Ceramic Ball Drain/Vent Kit	01151-0028-0113	—	•	•	•	•	—
Monel Ceramic Ball Drain/Vent Kit (Each kit contains parts for one transmitter.)	01151-0028-0114	—	•	•	•	•	—	
<b>O-Ring Packages</b>			<b>CD</b>	<b>CG</b>	<b>CA</b>	<b>L</b>	<b>H</b>	<b>T</b>
2	Electronic Housing, Cover (Std. and Meter) <sup>(1)</sup>	03031-0232-0001	•	•	•	•	•	•
7	Electronics Housing, Module <sup>(1)</sup>	03031-0233-0001	•	•	•	•	•	•
10	Process Flange, Glass-filled Teflon <sup>(1)</sup>	03031-0234-0001	•	•	•	—	—	—
	Process Flange, Graphite-filled Teflon	03031-0234-0002	•	•	•	—	—	—
12	Flange Adapter, Glass-filled Teflon <sup>(1)</sup>	03031-0242-0001	•	•	•	—	—	—
	Flange Adapter, Graphite-filled Teflon	03031-0242-0002	•	•	•	—	—	—
38	3051H Process Flange, TFE	02051-0167-0001	—	—	—	—	•	—

**Rosemount Model 3051 Transmitter for Flow, Level, and Pressure Measurement**

TABLE 5-18. (continued) Model 3051C Differential, Gage, Absolute, and Liquid Level Transmitters.

Item No.	Part Description	Part Number						
			CD	CG	CA	L	H	T
	<b>Mounting Brackets</b>							
	Coplanar Flange Bracket Kit							
	B4 Bracket, SST, 2-in. Pipe Mount, SST Bolts	03031-0189-0003	•	•	•	—	—	—
	3051T Bracket Kit							
	B4 Bracket, SST, 2-in. Pipe Mount, SST Bolts	02088-0071-0001	—	—	—	—	—	•
	<b>Traditional Flange Bracket Kits</b>							
	B1 Bracket, 2-in. Pipe Mount, CS Bolts	03031-0313-0001	•	•	•	—	—	—
	B2 Bracket, Panel Mount, CS Bolts	03031-0313-0002	•	•	•	—	—	—
	B3 Flat Bracket for 2-in. Pipe Mount, CS Bolts	03031-0313-0003	•	•	•	—	—	—
	B7 (B1 Style Bracket with SST Bolts)	03031-0313-0007	•	•	•	—	—	—
	B8 (B2 Style Bracket with SST Bolts)	03031-0313-0008	•	•	•	—	—	—
	B9 (B3 Style Bracket with SST Bolts)	03031-0313-0009	•	•	•	—	—	—
	BA (SST B1 Bracket with SST Bolts)	03031-0313-0011	•	•	•	—	—	—
	BC (SST B3 Bracket with SST Bolts)	03031-0313-0013	•	•	•	—	—	—
	<b>3051H Bracket Kits</b>							
	B5 Universal Bracket for 2-in. Pipe and Panel Mount, CS Bolts	03051-1081-0001	—	—	—	—	•	—
	B6 Universal Bracket for 2-in. Pipe or Panel Mount, SST Bolts	03051-1081-0002	—	—	—	—	•	—

TABLE 5-18. (continued) Model 3051C Differential, Gage, Absolute, and Liquid Level Transmitters.

Item No.	Part Description	Part Number						
			CD	CG	CA	L	H	T
<b>Bolt Kits</b>								
25	<b>Coplanar Flange</b>							
	Flange Bolt Kit {44 mm (1.75 in.)}							
	Carbon Steel (set of 4)	03031-0312-0001	•	•	•	—	—	—
	316 SST (set of 4)	03031-0312-0002	•	•	•	—	—	—
	ANSI/ASTM-A-193-B7M	03031-0312-0003	•	•	•	—	—	—
	<i>Monel</i>	03031-0312-0004	•	•	•	—	—	—
26	Flange/Adapter Bolt Kit {73 mm (2.88 in.)}							
	Carbon Steel (set of 4)	03031-0306-0001	•	•	•	—	—	—
	316 SST (set of 4)	03031-0306-0002	•	•	•	—	—	—
	ANSI/ASTM-A-193-B7M	03031-0306-0003	•	•	•	—	—	—
	<i>Monel</i>	03031-0306-0004	•	•	•	—	—	—
27	Manifold/Flange Kit {57 mm (2.25 in.)}							
	Carbon Steel (set of 4)	03031-0311-0001	•	—	—	—	—	—
	316 SST (set of 4)	03031-0311-0002	•	—	—	—	—	—
	ANSI/ASTM-A-193-B7M	03031-0311-0003	•	—	—	—	—	—
	<i>Monel</i>	03031-0311-0004	•	—	—	—	—	—
28	<b>Traditional Flange</b>							
	Differential Flange and Adapter Bolt Kit {44 mm (1.75 in.)}							
	Carbon Steel (set of 8)	03031-0307-0001	•	—	—	—	—	—
	316 SST (set of 8)	03031-0307-0002	•	—	—	—	—	—
	ANSI/ASTM-A-193-B7M	03031-0307-0003	•	—	—	—	—	—
	<i>Monel</i>	03031-0307-0004	•	—	—	—	—	—
	Gage/Absolute Flange and Adapter Bolt Kit							
	Carbon Steel (set of 6)	03031-0307-1001	—	•	•	—	—	—
	316 SST (set of 6)	03031-0307-1002	—	•	•	—	—	—
	ANSI/ASTM-A-193-B7M	03031-0307-1003	—	•	•	—	—	—
	<i>Monel</i>	03031-0307-1004	—	•	•	—	—	—
	Manifold/Traditional Flange Bolts		Use Bolts Supplied with Anderson Greenwood Manifold					
	Carbon Steel		Use Bolts Supplied with Anderson Greenwood Manifold					
	316 SST		Use Bolts Supplied with Anderson Greenwood Manifold					
23	<b>Level Flange, Vertical Mount</b>							
	Flange Bolt Kit							
24	Carbon Steel (set of 4)	03031-0395-0001	•	•	•	—	—	—
	316 SST (set of 4)	03031-0395-0002	•	•	•	—	—	—
	<i>(Each kit contains bolts for one transmitter.)</i>							
36	<b>3051H Flange</b>							
	Process Flange Bolt Kit, Carbon Steel	02051-0164-0001	—	—	—	—	•	—
	Flange Bolt (set of 4)							
37	Flange Nut (set of 4)							
	Adapter Bolts (set of 4)							
36	Process Flange Bolt Kit, 316 SST	02051-0164-0002	—	—	—	—	•	—
	Bolt for Process Flange (set of 4)							
	Nut for Process Flange (set of 4)							
37	Adapter Bolts (set of 4)							

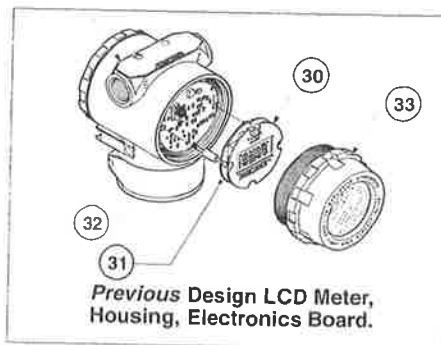
(1) One spare part is recommended for every 25 transmitters.  
 (2) One spare part is recommended for every 50 transmitters

TABLE 5-19. Indicating Meter Option

Item No.	Part Description	Part Number	CD	CG	CA	L	H	T
<b>Meter for Improved Aluminum Housing</b>								
	<i>Meter Kit</i>	03031-0193-0101	•	•	•	•	•	•
30	Meter Display							
31	Captive Mounting Hardware							
32	10-pin Interconnection Header							
33	Cover Assembly							
	<i>Meter Hardware Only</i>	03031-0193-0103	•	•	•	•	•	•
30	Meter Display							
31	Captive Mounting Hardware							
32	10-pin Interconnection Header							
	<i>Cover Assembly Kit</i>	03031-0193-0002	•	•	•	•	•	•
	<i>Meter Hardware Only</i>	03031-0193-0103	•	•	•	•	•	•
30	Meter Display							
31	Captive Mounting Hardware							
32	10-pin Interconnection Header							
	<i>Cover Assembly Kit</i>	03031-0193-0012	•	•	•	•	•	•
	<i>Meter Hardware Only</i>	03031-0193-0103	•	•	•	•	•	•
30	Meter Display							
31	Captive Mounting Hardware							
32	10-pin Interconnection Header							
	<i>Cover Assembly Kit</i>	03031-0193-0012	•	•	•	•	•	•
<b>Meter for Previous Aluminum Housing</b>								
30-33	<i>Previous Meter Kit</i> <sup>(1)</sup>	03031-0193-0001	•	•	•	•	•	•
NOTE: Previous Meter Kit includes meter display, captive mounting hardware, 6-pin interconnection header, and cover assembly.								
	<i>Improved Kit for Previous Aluminum Housing</i> <sup>(1)</sup>	03031-0193-1101	•	•	•	•	•	•
30	Meter Display							
31	Captive Mounting Hardware							
32	10-pin Interconnection Header							
33	Cover Assembly							
30-32	<i>Previous Meter Hardware Only</i> <sup>(1)</sup>	03031-0193-0003	•	•	•	•	•	•
NOTE: Previous Meter Hardware includes meter display, captive mounting hardware, and 6-pin interconnection header only.								
30	<i>Improved Meter for Previous Housing</i>	03031-0193-1103	•	•	•	•	•	•
31	Captive Mounting Hardware							
32	10-pin Interconnection Header							
	<i>Cover Assembly Kit</i>	03031-0193-0002	•	•	•	•	•	•



3051-3031A05A

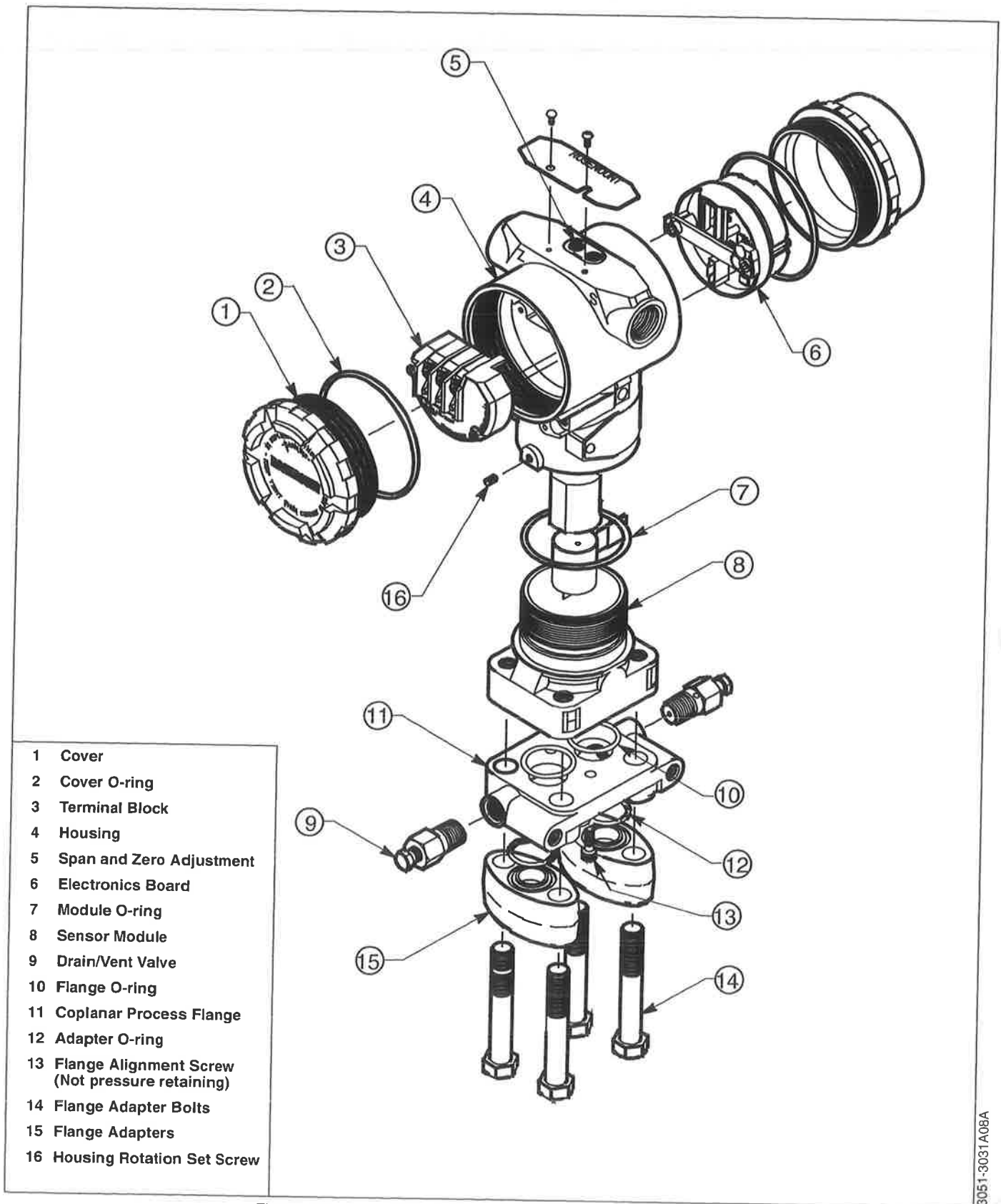


3051-3031B05A

LCD Meter and Housing Exploded Views, Improved and Previous Design.

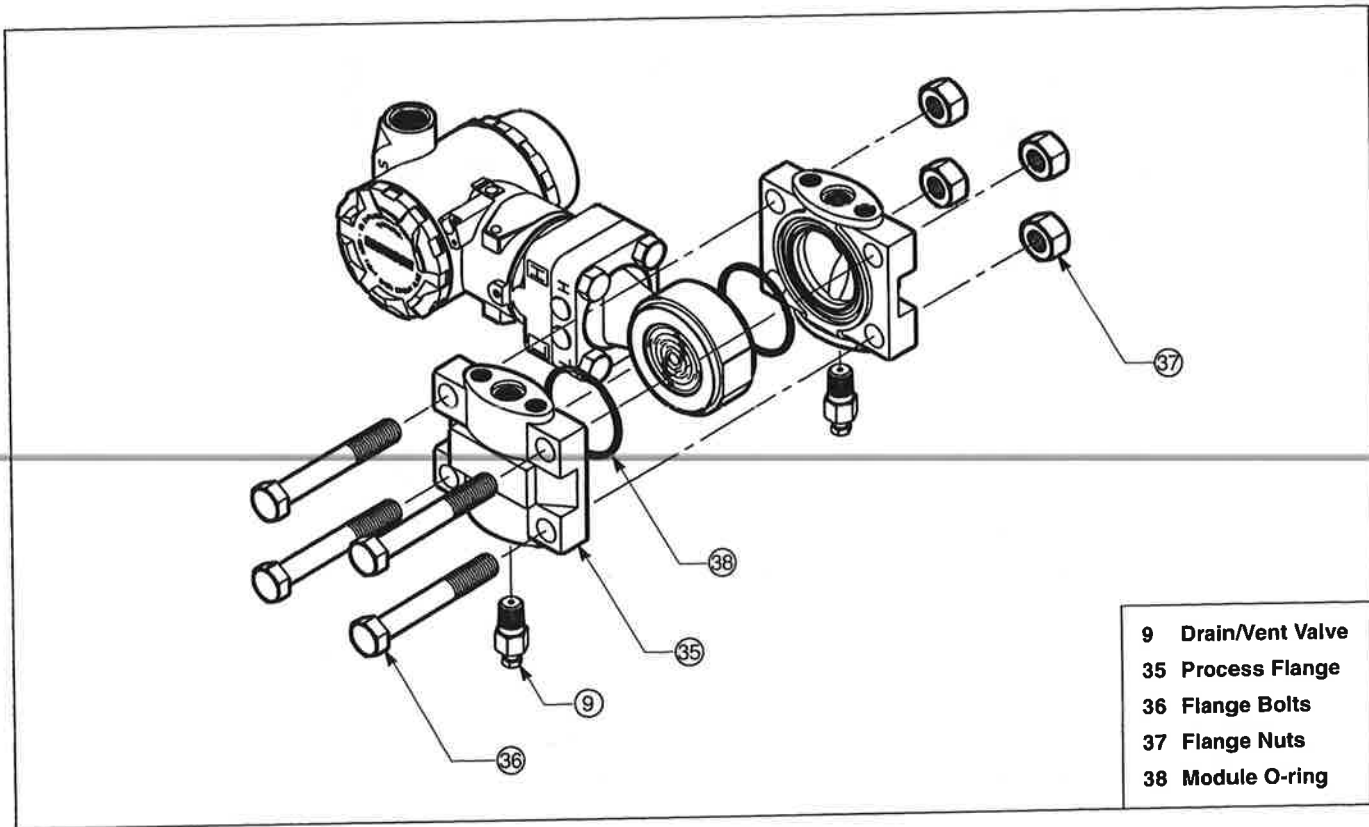
TABLE 5-19. Indicating Meter Option

Item No.	Part Description	Part Number	CD	CG	CA	L	H	T
<b>Meter for Previous 316 SST Housing</b>								
30-33	Previous Meter Kit <sup>(1)</sup>	03031-0193-0011	•	•	•	•	•	•
<i>NOTE: Previous Meter Kit includes meter display, captive mounting hardware, 6-pin interconnection header, and cover assembly.</i>								
30	Improved Kit for Previous SST Housing <sup>(1)</sup>	03031-0193-1111	•	•	•	•	•	•
31	Meter Display							
32	Captive Mounting Hardware							
33	10-pin Interconnection Header							
33	Cover Assembly							
30-32	Previous Meter Hardware Only <sup>(1)</sup>	03031-0193-0003	•	•	•	•	•	•
<i>NOTE: Previous Meter Hardware includes meter display, captive mounting hardware, and 6-pin interconnection header only.</i>								
30	Improved Meter for Previous Housing <sup>(1)</sup>	03031-0193-1103	•	•	•	•	•	•
31	Meter Display							
32	Captive Mounting Hardware							
32	10-pin Interconnection Header							
	Cover Assembly Kit	03031-0193-0012	•	•	•	•	•	•



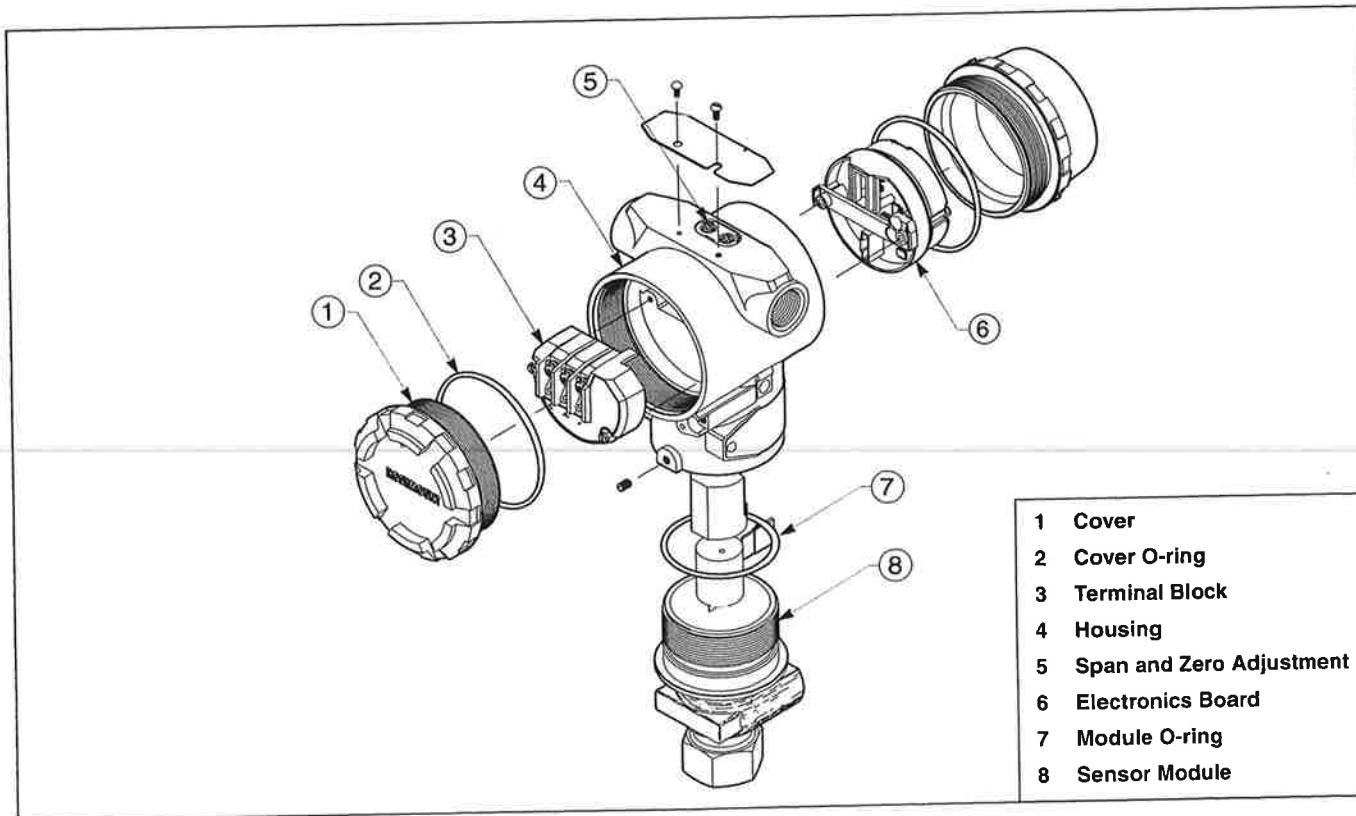
3051-3031A08A

Figure 5-2. Model 3051C Exploded View (with Coplanar Flange).



3051-3051HB2A

Figure 5-3. Model 3051H Exploded View.



3051-3051A08A

Figure 5-4. Model 3051T Exploded View.



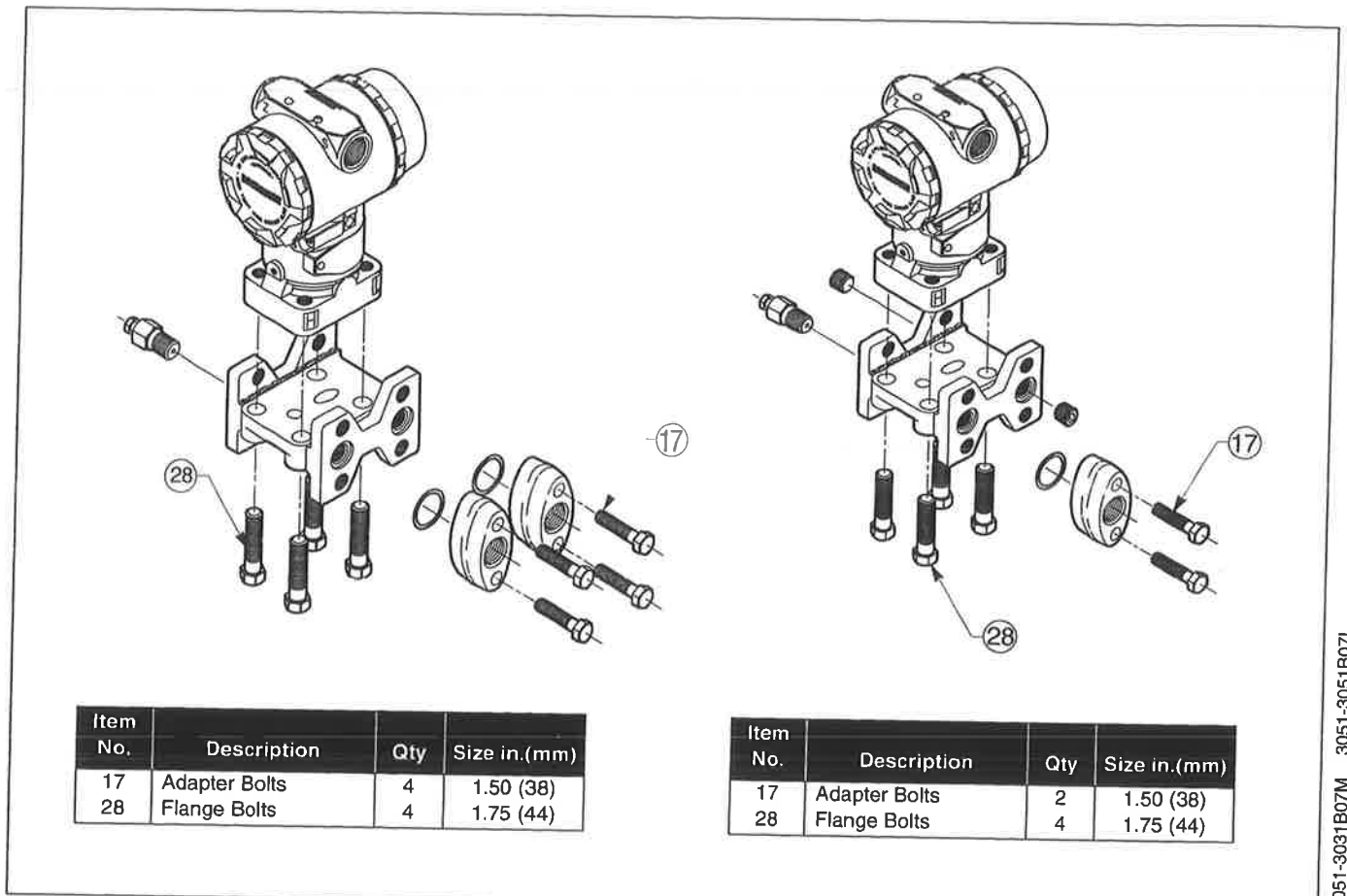
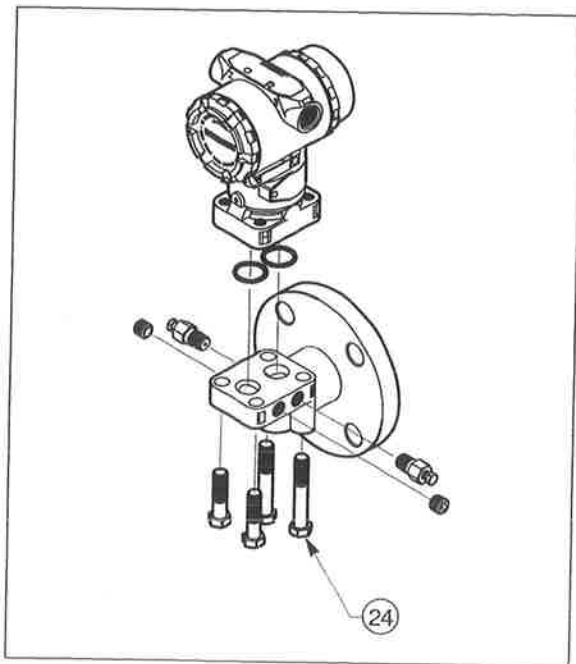


Figure 5-5. Traditional Flange Configuration.



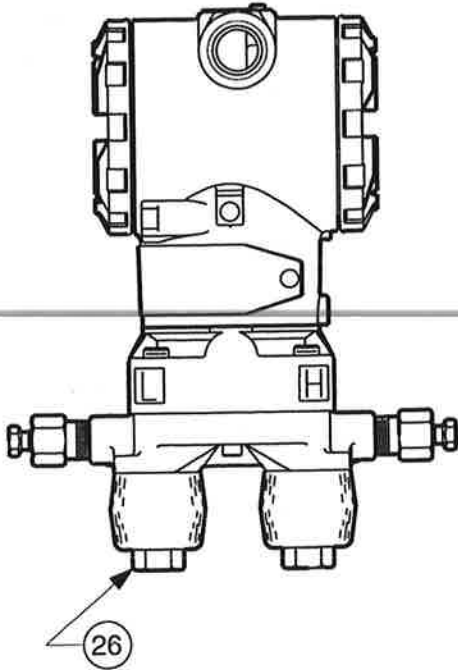
3001-3001A01G

Item No.	Description	Qty	Size in.(mm)
24	Flange Bolts	2	1.75 (44)
		2	2.875 (73)

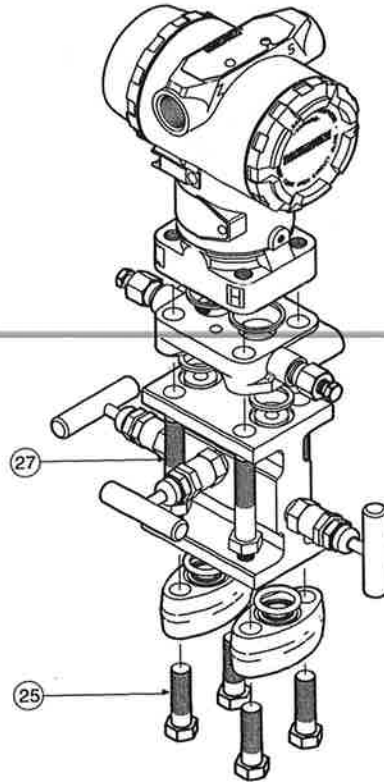
Figure 5-6. Level Flange, Vertical Mount.

3051-3031B07M 3051-3051B07L

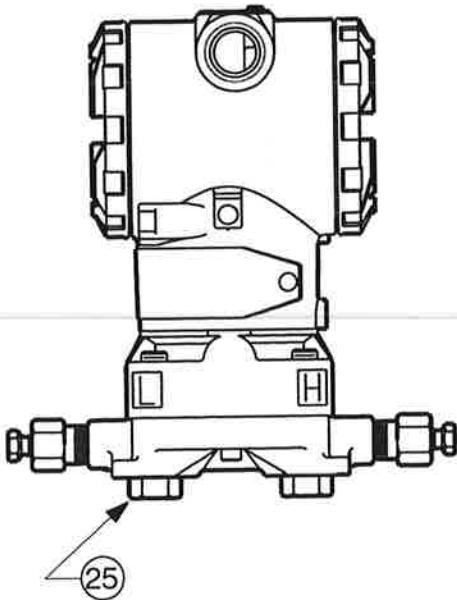
Transmitter with  
Coplanar Flange and  
Flange/Adapter Bolts



Transmitter with *Coplanar* Flange,  
3-Valve Manifold, and Flange Adapters  
(Differential Version)



Transmitter with  
*Coplanar* Flange and  
Flange Bolts



Item No.	Description	Qty	Size in.(mm)
25	Adapter Bolts	4	1.50 (38)
26	Flange/Adapter Bolts	4	2.88 (73)
27	Manifold/Flange Bolts	4	2.25 (57)

Item No.	Description	Qty	Size in.(mm)
25	Flange Bolts	4	1.75 (44)

Figure 5-7. Bolting Configurations for *Coplanar* Flange (Top-Differential/Bottom-Gage/Absolute).

3051-3031E06D 3051-305-3031A29P

3051-3031E06F

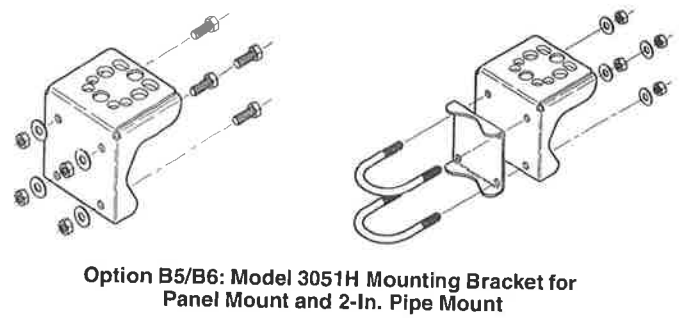
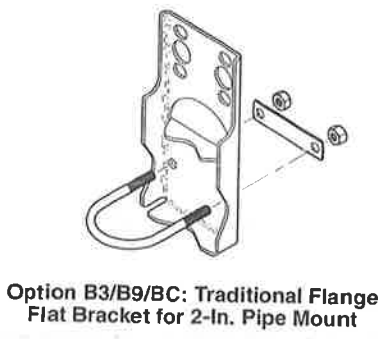
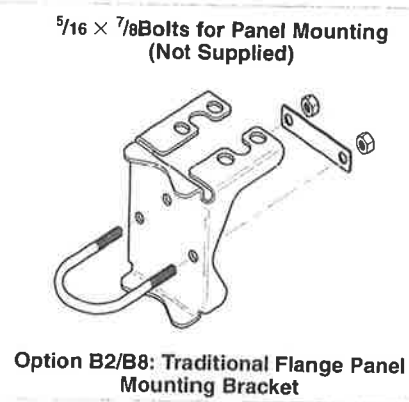
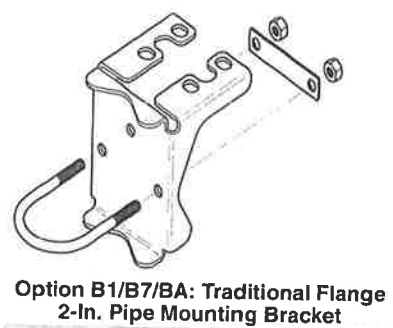
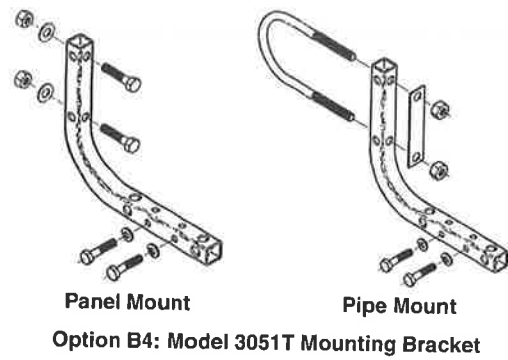
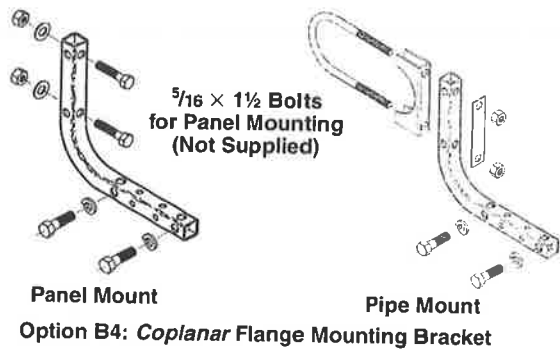


Figure 5-8. Mounting Bracket Kits.

3051-3031-I04B, J04B, I04B, I04B, 2088-2088A04A, 3051-3031C19A, H19A, F19B, G19A

**OVERVIEW**

The options available with the Model 3051 can ease installation, improve the security of control systems, and simplify use. Included in this section is a description of LCD meter diagnostic messages.

**SAFETY MESSAGES**

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

**Warnings (⚠)****⚠ WARNING****Explosions can result in death or serious injury.**

- Do not remove the instrument cover in explosive environments when the circuit is alive.
- Both transmitter covers must be fully engaged to meet explosionproof requirements.
- Before connecting a communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or nonincendive field wiring practices.

**⚠ WARNING****Electrical shock can result in death or serious injury.**

- Avoid contact with the leads and terminals.

**LOCAL ZERO AND SPAN ADJUSTMENT OPTIONS**

The integral zero and span adjustments can be used for adjusting the analog output without the use of a HART communicator. Option Code J1 provides only external local zero adjustment. Option Code J3 excludes both the local zero and span adjustments.

The push-button span and zero adjustments are hidden by the certification label on top of the transmitter. Loosen the label screw and rotate the label counterclockwise to expose the adjustments.

**Activating Local Zero and Span Adjustments**

To activate local zero and span adjustments, locate the Z and S buttons on top of the transmitter. Press and hold either button for two seconds.

**NOTE**

On previous style Model 3051 transmitters, the zero and span settings are magnetic screws. To activate the previous style adjustments, unscrew the magnetic zero or span screw until it pops up. Leave it popped up for two seconds, then screw it back down.

## Disabling Local Zero and Span Adjustments

The local zero and span adjustments on the Model 3051 can be controlled three ways:

1. **Transmitter Security Jumper.** Enabling the transmitter security jumper on the circuit board prevents all changes to the transmitter's configuration data. The security jumper prevents configuration changes from HART communicators and from the local zero and span adjustments. See "Transmitter Security" on page 2-4.
2. **Communicator Software Lockout Sequence.** The communicator software lockout sequence disables only the span and zero adjustments. Changes can still be made using the HART communicator. See "Local Zero and Span Adjustment Options" on page 6-1.
3. **Remove the Zero and Span Buttons.** To remove the local zero and span buttons, use a small screwdriver to remove the blue plastic cover plate securing the buttons to the transmitter housing. After removing the cover plate, the button assemblies—including buttons, springs, and magnets—will slide out. For future use, store the buttons separately to ensure that the magnets maintain their proper strength.

## LCD METER

The LCD meter provides local indication of the output and abbreviated diagnostic messages governing transmitter operation. The meter is located on the electronics module side of the transmitter, maintaining direct access to the signal terminals. An extended cover is required to accommodate the meter.

The meter features a two-line display with five digits for reporting the process variable on the top line and six characters for displaying engineering units on the bottom line<sup>(1)</sup>. The new LCD meter can also display flow and level scales. The meter uses both lines to display diagnostic messages. The meter can be configured to display the following information:

- engineering units
- percent of range
- user-configurable LCD scale<sup>(2)</sup>
- alternating between any two of the above

(1) Previous versions differ slightly.

(2) Not available on previous versions of the LCD meter or with low-power transmitters.

## Custom Meter Configuration

The user-configurable scale is a feature that enables the LCD meter to display flow, level, or custom pressure units. The meter can be configured using a Model 275 HART Communicator (see Table A-1 on page A-3) or AMS.

The user-configurable scale feature can define:

- decimal point position
- upper range values
- lower range values
- engineering units
- transfer function

To configure the meter using AMS, click the **LOCAL DISPLAY** tab on the **CONFIGURATION PROPERTIES** screen. To configure the meter with a HART communicator, perform the following procedure:

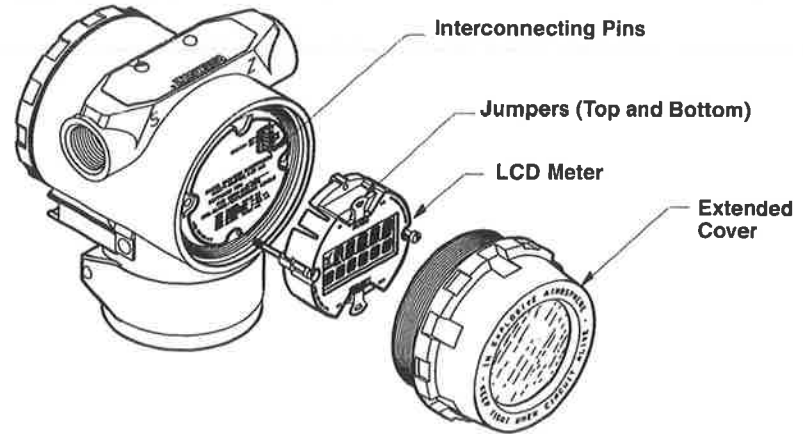


1. Connect the communicator to the transmitter. Before connecting a communicator in an explosive atmosphere, make sure the instruments in the loop are installed according to intrinsically safe or nonincendive field wiring practices.
2. From the **ONLINE** screen, select *1 Device Setup, 3 Basic Setup, 7 Meter Options, 2 Custom Meter Setup*.
3. To specify decimal point position:
  - a. Select *1 Sel dec pt pos*. Choose the decimal point representation that will provide the most accurate output for your application. For example, when outputting between 0 and 75 GPM, choose *XX.XXX*.
  - b. Go to step 8.
4. To specify a custom upper range value:
  - a. Select *2 CM Upper Value*. Type the value that you want the transmitter to read at the 20 mA point.
  - b. Go to step 8.
5. To specify a custom lower range value:
  - a. Select *3 CM Lower Value*. Type the value that you want the transmitter to read at the 4 mA point.
  - b. Go to step 8.
6. To define custom units:
  - a. Select *4 CM Units*. Enter the custom units (five characters maximum) that you want the meter to display.
  - b. Go to step 8.
7. To choose the transmitter transfer function for the meter:
  - a. Select *5 CM xfer fnct*. Enter the transmitter transfer function for the meter. Select *sq root* to display flow units. The custom meter transfer function is independent of the analog output transfer function.
8. Select **F2 SEND** to upload the configuration to the transmitter.



See "Safety Messages" on page 6-1 for complete warning information.

FIGURE 6-1. Exploded View of the Model 3051 with Optional LCD Meter.



3051-A05E

### Installing the Meter

For transmitters ordered with the LCD meter, the meter is shipped installed. Installing the meter on an existing Model 3051 transmitter requires a small instrument screwdriver and the meter kit.

The kits vary depending on the version of transmitter electronics. Examine the following numbers carefully to ensure you are installing the correct kit.

#### For Use with Shrouded Electronics Board

##### Meter Kits

Option M5: P/N 03031-0193-0101

Option M6: P/N 03031-0193-0111

#### For Use with Non-Shrouded Electronics Board

##### Meter Kits


Option M5: P/N 03031-0193-0001

Option M6: P/N 03031-0193-0011

The meter kit includes:

- one LCD meter assembly
- one extended cover with O-ring installed
- two nylon standoffs
- two captive screws
- one ten-pin interconnection header

Use the following procedure and Figure 6-1 to install the LCD meter. If the meter is an upgrade from a previous version, upgrade the electronics board before attempting to install the meter.


1. **IF** the transmitter is installed in a loop, **THEN** secure the loop and disconnect power.
-  2. Remove the transmitter cover opposite the field terminal side. Do not remove the instrument covers in explosive environments when the circuit is alive.
3. Remove the failure mode and alarm jumpers from the electronics module and insert them in their new positions above and below the meter readout on the meter assembly.

---


**NOTE**

On previous versions, remove only the alarm jumper.

---

4. Insert the interconnection header in the ten-pin socket exposed by removal of the jumpers. (Previous versions of the meter use a six-pin connector.)
5. Remove the two captive screws from the electronics module. To do so, loosen the screws to release the module, then pull out the screws until they are stopped by the captive thread inside of the circuit board standoffs. Continue loosening the screws and remove them.
6. If necessary, rotate the electronics housing up to 180 degrees (left or right) to improve field access or to better view the LCD meter. To rotate the housing:
  - a. Loosen the housing rotation set screw using a  $\frac{9}{64}$ -in. hex wrench.
  - b. Turn the housing up to 180 degrees to the left or right of its original (as shipped) position. **Do not rotate the housing more than 180 degrees without first performing a disassembly procedure (see "Disassembly Procedures" on page 4-3). Over-rotation will sever the electrical connection between the sensor module and the electronics module.**
  - c. Retighten the housing rotation set screw.
7. Decide which direction to orient the meter. Insert the long meter screws into the two holes on the meter assembly that coincide with the holes on the electronics module. You can install the meter in 90-degree increments for easy viewing. Position one of the four connectors on the back of the meter assembly to accept the interconnection header.
8. Attach the meter assembly to the electronics module by threading the screws into the captive threads and attaching the meter assembly to the interconnection pins. Tighten the screws to secure the meter assembly and electronics board in place.
-  9. Attach and tighten the extended cover. Transmitter covers must be fully engaged to meet explosion proof requirements and to achieve the proper environmental seal.

Note the following LCD temperature limits:

 See "Safety Messages" on page 6-1 for complete warning information.



**Operating:** -4 to 175 °F (-20 to 80 °C)

**Storage:** -40 to 185 °F (-40 to 85 °C)

**NOTE**

Electronics board revision 5.3.163 or later (all shrouded designs) are able to verify alarm current levels. After replacing the transmitter electronics board, sensor module, or LCD meter, an alarm level test is recommended before returning the transmitter to service (see "Alarm Level Verification" on page 2-3).

FIGURE 6-2. Model 3051 with Optional LCD Meter.



## Diagnostic Messages

In addition to the output, the LCD meter displays abbreviated operation, error, and warning messages for troubleshooting the transmitter. Messages appear according to their priority, with normal operating messages appearing last. To determine the cause of a message, use a Model 275 HART Communicator to further interrogate the transmitter. A description of each LCD diagnostic message follows.

### Error

Error messages appear on the LCD meter display to inform you of serious problems effecting the operation of the transmitter. The meter displays an error message until the error condition is corrected, and the analog output is driven to the specified alarm level. No other transmitter information is displayed during an alarm condition.

#### **FAIL<sup>(1)</sup>**

The transmitter CPU board and the sensor module are incompatible. If you encounter this message, contact Rosemount Customer Central at 800-999-9307 if you need assistance.

(1) For previous versions of the meter, FAIL MODULE and FAIL ELECT were also grouped into the FAIL message. When dealing with a FAIL message on a previous version meter, review the information in the FAIL MODULE and FAIL ELECT sections as well.

## FAIL MODULE

The sensor module is disconnected or is malfunctioning. Verify that the sensor module ribbon cable is connected to the back of the electronics board. If the ribbon cable is properly connected, there is a problem within the sensor module. Possible sources of problems include:

- Pressure or temperature updates are not being received in the sensor module.
- A non-volatile memory fault that will effect transmitter operation has been detected in the module by the memory verification routine.

Some non-volatile memory faults are user-repairable. Use a Model 275 HART Communicator to diagnose the error and determine if it is repairable. Any error message that ends in "FACTORY" is not repairable. In cases of non-user-repairable errors, you must replace the sensor module. See "Disassembly Procedures" on page 4-3 or contact Rosemount Customer Central at 800-999-9307 if you need assistance.

## FAIL ELECT

The transmitter electronics board is malfunctioning due to an internal fault. Some of the FAIL ELECT errors are user-repairable. Use a Model 275 HART Communicator to diagnose the error and determine if it is repairable. Any error message that ends in "FACTORY" is not repairable. In cases of non user-repairable errors, you must replace the electronics board. See "Remove the Electronics Board" on page 4-4 or contact Rosemount Customer Central at 800-999-9307 if you need assistance.

## FAIL CONFIG

A memory fault has been detected in a location that could effect transmitter operation, and is user-accessible. To correct this problem, use a Model 275 HART Communicator to interrogate and reconfigure the appropriate portion of the transmitter memory. Contact Rosemount Customer Central at 800-999-9307 if you need assistance.

## Warnings

Warnings appear on the LCD meter display to alert you of user-repairable problems with the transmitter, or current transmitter operations. Warnings appear alternately with other transmitter information until the warning condition is corrected or the transmitter completes the operation that warrants the warning message.

## NOTE

The warning messages on previous versions of the LCD meter may vary slightly from those listed here, but they represent the same warning.

## PRESS LIMIT

The process variable read by the transmitter is outside of the transmitter's range.

## TEMP LIMIT

The secondary temperature variable read by the transmitter is outside of the transmitter's range.

**CURR FIXED**

The transmitter is in multidrop mode. The analog output is not tracking pressure changes.

**CURR SATURD**

The pressure read by the module is outside of the specified range, and the analog output has been driven to saturation levels. See "Failure Mode Alarm" on page 2-2.

**LOOP TEST**

A loop test is in progress. During a loop test or 4–20 mA trim, the analog output is set to a fixed value. The meter display alternates between the current selected in milliamps and "LOOP TEST."

**XMTR INFO**

A non-volatile memory fault has been detected in the transmitter memory by the memory verification routine. The memory fault is in a location containing transmitter information. To correct this problem, use a Model 275 HART Communicator to interrogate and reconfigure the appropriate portion of the transmitter memory. This warning does not effect the transmitter operation. Contact Rosemount Customer Central at 800-999-9307 if you need assistance.

**Operation**

Normal operation messages appear on the LCD meter to confirm actions or inform you of transmitter status. Operation messages are displayed with other transmitter information, and warrant no action to correct or alter the transmitter settings.

**ZERO PASS**

The zero value, set with the local zero adjustment button, has been accepted by the transmitter, and the output should change to 4 mA.

**ZERO FAIL**

The zero value, set with the local zero adjustment button, exceeds the maximum rangedown allowed for a particular range, or the pressure sensed by the transmitter exceeds the sensor limits.

**SPAN PASS**

The span value, set with the local span adjustment button, has been accepted by the transmitter, and the output should change to 20 mA.

**SPAN FAIL**

The span value, set with the local span adjustment button, exceeds the maximum rangedown allowed for a particular range, or the pressure sensed by the transmitter exceeds the sensor limits.

**LOCAL DSBLD**

This message appears during reranging with the integral zero and span buttons and indicates that the transmitter local zero and span adjustments have been disabled. The adjustments may have been disabled by the transmitter security jumper on the transmitter circuit board or through software commands from the Model 275. See "Transmitter Security" on page 2-4 for information on the position of the security jumper, and "Disabling Local Zero and Span Adjustments" on page 6-2 for information on the software lockout.

**WRITE PROTECT**

This message appears if you attempt to change the transmitter configuration data while the security jumper is in the **ON** position. See "Transmitter Security" on page 2-4 for more information about the security jumper.

**MOUNTING BRACKETS**

Optional mounting brackets available with the Model 3051 facilitate mounting to a 2-inch pipe or to a panel. The standard bracket (Option B4) for use with the Coplanar flange and the Model 3051T is stainless steel with stainless steel bolts. Figure 3-10 on page 3-14 shows bracket dimensions and mounting configurations for the B4 option.

Options B1–B3 and B7–B9 are sturdy, epoxy-polyester-painted brackets designed for use with the traditional flange. The B1–B3 brackets have carbon steel bolts, while the B7–B9 brackets have stainless steel bolts. The BA and BC brackets are stainless steel with stainless steel bolts. The B1/B7/BA and B3/B9/BC style brackets support 2-inch pipe mounting installations, and the B2/B8 style brackets support panel mounting. Figures 3-12 and 3-13 on page 3-16 show these optional mounting brackets.

When installing the transmitter to one of the optional mounting brackets, torque the bolts to 125 inch-pounds. See "Mounting" on page 3-9 for additional mounting considerations.

**Custom Configuration (C1)**

The C1 option allows the customer to specify the following data in addition to the standard configuration parameters in the software memory:

Descriptor	Message
Date	Damping
Remote Seal	Write Protect Jumper Setting
Burst Mode Configuration	Multidrop Configuration
Alarm Jumper Setting	Local Zero and Span Control
Custom Meter Display Configuration	

A Model 3051 Configuration Data Sheet (CDS) begins on page 6-15. Use the CDS to record configuration data and options.

**Level Flange (F1, F2, G1, G2, FA, FB, FC, and FD)**

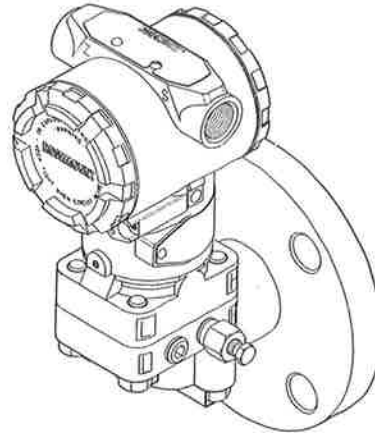
This option provides a flange for the Model 3051C that converts it to a horizontal mount level transmitter or a vertical mount level transmitter. A vented fitting on the low pressure side of the flange makes it suitable for use with a gage pressure transmitter. The fitting can be removed and replaced with impulse piping or wet leg connections when a low pressure reference is required for differential pressure measurements.

**Vertical Mount (FA, FB, FC, FD, FP, and FQ)**

Figure 6-3 shows the vertical mount level flange. Flanges are available in the sizes and ratings indicated by the following option codes:

Option	Description	Flange Rating
FA	316 SST, 2 in., ANSI Class 150, Vertical Mount	275 psi at 100 °F
FB	316 SST, 2 in., ANSI Class 300, Vertical Mount	720 psi at 100 °F
FC	316 SST, 3 in., ANSI Class 150, Vertical Mount	275 psi at 100 °F
FD	316 SST, 3 in., ANSI Class 300, Vertical Mount	720 psi at 100 °F
FP	DIN Level Flange, SST, DN 50, PN 40, Vertical Mount	40 bar at 120 °C
FQ	DIN Level Flange, SST, DN 80, PN 40, Vertical Mount	40 bar at 120 °C

FIGURE 6-3. Vertical Mount Level Flange.



3001-3001A01A

**Traditional Flange (H2, H3, H4, H7, HJ, HK, and HL)**

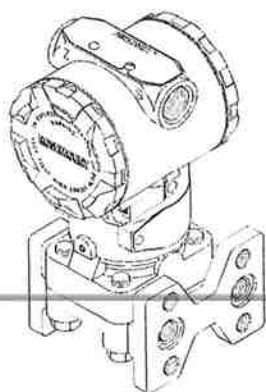
The traditional flange option converts the mounting configuration of the Model 3051 to one similar to traditional style transmitters. This allows the Model 3051 to replace traditional transmitters without changing existing manifolds, impulse piping, or bracket arrangements. The traditional flange also allows a higher process temperature at the process ports (300 °F [149 °C]) because of its ability to dissipate heat. Process ports on the traditional flange meet DIN STD. 19213 with 2.13 ± 0.008 in. (54 ± 0.203 mm) connection centers. Different traditional flange materials of construction are as follows:

TABLE 6-1. Traditional Flange Materials and Bolt Sizes.

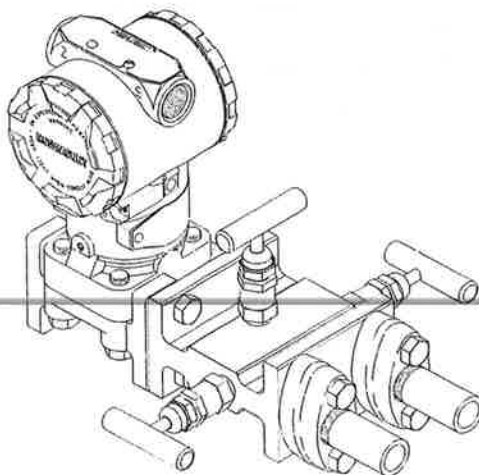
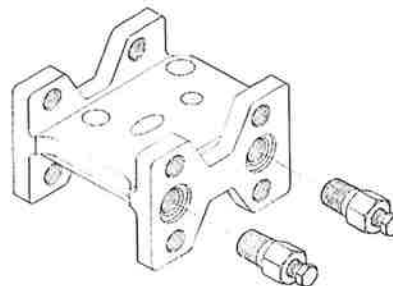
Option Code	Flange Material	Drain/Vent Valve Material	Flange Adapter Material	Flange to Adapter Bolt Size Length/Diameter
H2	316 SST	SST	SST	7/16-in.
H3	Hastelloy C	Hastelloy C	Hastelloy C	7/16-in.
H4	Monel	Monel	Monel	7/16-in.
H7	316 SST	Hastelloy C	SST	7/16-in.
HJ	SST	SST	SST	7/16-in.
HK	SST	SST	N/A	10 mm
HL	SST	SST	N/A	12 mm

The traditional flange fits most existing mounting brackets. If a new bracket is required, use one of the bracket options described earlier. Figure 6-5 shows the traditional flange.

FIGURE 6-4. Traditional Flange.

TRADITIONAL FLANGE  
AND MODEL 3051C

CONNECTION TO A MANIFOLD

TRADITIONAL FLANGE WITH  
DRAIN/VENTS

3051-3031B07A, B07C, A35A

Figure 3-16 on page 3-20 shows the bolts used to mount the traditional flange to the transmitter. The  $\frac{3}{4}$ -inch bolts supplied with the standard Anderson, Greenwood & Co. manifold (Rosemount Part No. 1151-0150-0001 or 1151-0150-0002) will fit the traditional flange and manifold. Bolts supplied with other manifolds may need a  $\frac{7}{16}$ -inch washer to accommodate the extra length. The user should make sure the mounting bolt in the upper corner of the traditional flange does not push against the module. A clearance of at least  $\frac{1}{16}$ -in. (4,2 mm) should be allowed. Install the manifold bolts as in **Section 3: Installation**.

### Optional Flange and Adapter Bolts (L4, L5, and L6)

Option Codes L4, L5, and L6 replace the standard carbon steel flange and adapter bolts with alternative materials as described:

- L4:** Austenitic 316SST bolts
- L5:** ASTM-A-193-B7M bolts
- L6:** Monel bolts

## Transient Protection Terminal Block (T1)

The transient protection terminal block option increases the Model 3051 Pressure Transmitter's ability to withstand electrical transients induced by lightning, welding, heavy electrical equipment, or switch gears. Model 3051 Pressure Transmitters, with integral transient protection installed, meet the standard performance specifications as outlined in this product manual. In addition, the transient protection circuitry meets IEEE Standard 587, Category B and IEEE Standard 472, Surge Withstand Capability.

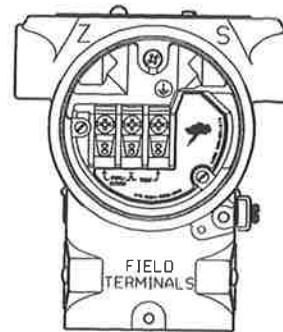
Transient protection terminal blocks can be ordered as an option (Option Code T1), or as a spare part to retrofit existing Model 3051 transmitters in the field. The spare part number for the transient protection terminal block assembly is 03031-0332-0002.

### NOTE

Installation of the transient protection terminal block does not provide transient protection unless the Model 3051 transmitter case is properly grounded. See page 3-22 for grounding information.

The transient protection terminal block option is not offered with Option Code I1 (BASEEFA/CENELEC Intrinsic Safety Certification).

FIGURE 6-5. Transient Protection Terminal Block (Option Code T1).



3051-F02A

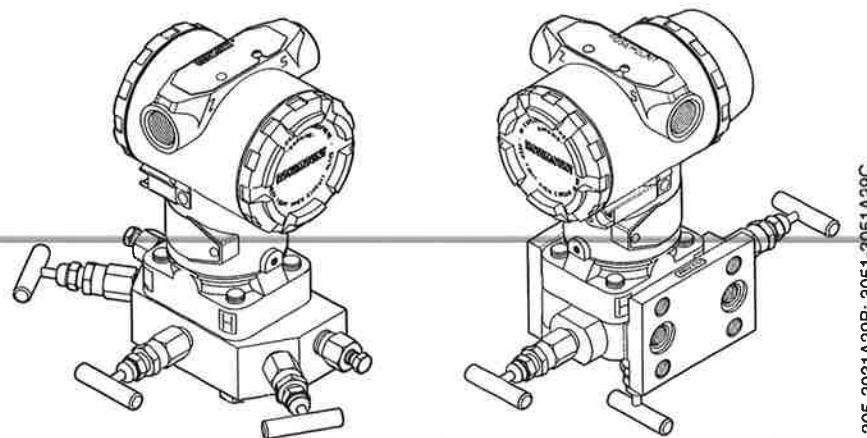
## Installation Procedure

Option Code T1 is shipped installed when ordered at the same time as the Model 3051. To install the transient protection terminal block on an existing transmitter, refer to "Remove the Terminal Block" on page 4-3 to remove the existing terminal block, and refer to "Install the Terminal Block" on page 4-8 to install the transient protection terminal block.

## MODEL 305 AND 305 INTEGRAL MANIFOLDS

The Model 305 is available in two designs: the traditional and the Coplanar. The traditional Model 305 Integral Manifold can be mounted to the Rosemount Model 1195 Integral Orifice or to most primary elements with mounting adapters in the market today. The Model 306 Integral Manifold is used with a Model 3051T transmitter to provide block and bleed valve capabilities of up to 10,000 psi (690 bar).

FIGURE 6-6. Model 305 Integral Manifold.




MODEL 305 COPLANAR DESIGN

MODEL 305 TRADITIONAL DESIGN

### Model 305 Integral Manifold Installation Procedure


To install a Model 305 Integral Manifold to a Model 3051 transmitter:

1.  Inspect the Teflon sensor module O-rings. If the O-rings are undamaged, reusing them is recommended. If the O-rings are damaged (if they have nicks or cuts, for example), replace them with new O-rings.

#### IMPORTANT

If replacing the O-rings, take care not to scratch or deface the O-ring grooves or the surface of the isolating diaphragm while you remove the damaged O-rings.

2. Install the Integral Manifold on the sensor module. Use the four 2.25-in. manifold bolts for alignment. Finger tighten the bolts, then tighten the bolts incrementally in a cross pattern to final torque value. See "Bolt Installation" on page 3-18 for complete bolt installation information and torque values. When fully tightened, the bolts should extend through the top of the module housing.

 See "Safety Messages" on page 6-1 for complete warning information.



3. If the Teflon sensor module O-rings have been replaced, the flange bolts should be re-tightened after installation to compensate for cold flow of the O-rings.

**NOTE**

Always perform a zero trim on the transmitter/manifold assembly after installation to eliminate any mounting effects.

4. Install drain/vent valves:
  - a. Starting at the base of the valve with the threaded end pointing toward the installer, apply two clockwise turns of the sealing tape. Tighten the seat into the Integral Manifold to 250 in-lb (28,3 N-m).
  - b. Orient the opening on the valve so that the process fluid will drain toward the ground and away from personnel when the valve is opened. Tighten the drain/vent valve stem into the seat to  $70 \pm 10$  in-lb (7,9 N-m).

**Model 306 Integral Manifold Installation Procedure**

The Model 306 Manifold is for use only with a Model 3051T transmitter.

 Assemble the Model 306 Manifold to the Model 3051T with a thread sealant.

FIGURE 6-7. Model 306 Integral Manifold.



3051-3051AC1A

MODEL 3051 4-20 mA/HART OUTPUT SMART PRESSURE TRANSMITTERS CONFIGURATION DATA SHEET

00806-0100-4001 English Rev. AB

CONFIGURATION DATA SHEET

Customer: P.O. No.: Model No.: Line Item: SST Tag No.: Software Tag:

OUTPUT INFORMATION: (Software Selectable)

4 mA (1, 0.8 Volts) = 0\* 20 mA (5, 3.2 Volts) = Upper Range Limit\* Key to Symbols \* = Default Value(1) Pressure Units = inH2O\*, psi\*, Pa, ftH2O, inHg, bar, kPa, g/cm2, mbar, Torr, mmH2O, inH2O at 4 °C(5), Atm, kg/cm2, mmHg, mmH2O at 4 °C(5) Output = Linear\*, Square Root (For DP transmitters only) Damping(4) = 0.00, 0.05, 0.10, 0.20, 0.40, 0.80, 1.60, 3.20, 12.8, 25.6 seconds

TRANSMITTER INFORMATION: (Software Selectable)

Descriptor(4): (16 characters) Message(4): (32 characters) Date(4): Day Month Year Local Span and Zero: Enabled\*, Disabled

LCD METER CONFIGURATION (Software Adjustable - M5 or M6 option must be specified in model number)

Meter Display Type(4): Eng. Units only, Alternate Eng. Units & % of Range \*, % of Range only, Alternate Eng. Units & Custom Display(5), Custom Display only(5), Alternate % of Range & Custom Display(5) Custom Display Configuration: (must be filled out if Custom Display is selected as meter type) Decimal Point Position (fixed) Indicate decimal point location X X X X X Enter Lower Range Value (Decimal point must be in the same position as specified above.) (circle sign) + - Default is +000.00 Enter Upper Range Value (Decimal point must be in the same position as specified above.) (circle sign) + - Default is +100.00 Custom Units Available characters: A-Z, 0-9, /, \*, %, (blank) Default is %RNGE Custom Display Transfer Function (Independent of Analog Output) Linear\*, Square Root

(1) Default values may be different outside the U.S.A. Consult your Rosemount Sales Representative for details. (2) inH2O for CD/CG Ranges 1-3. (3) psi for CD/CG Ranges 4 and 5, all CA ranges. (4) C1 Option required for configuration of this parameter. (5) Not available with low power output.

# Rosemount Model 3051 Smart Pressure Transmitters

## HARDWARE SELECTABLE INFORMATION

Alarm Option:  High★  Low

Transmitter Security:  Off★  On

**NOTE:**

Specify C4 Option in model structure when ordering NAMUR-compliant alarm and saturation limits.<sup>(1)</sup>

## SIGNAL SELECTION: (Software Selectable)

4–20 mA with simultaneous digital signal based on HART protocol★

Burst mode of HART digital process variable<sup>(2)</sup>

Burst mode output options:

Primary variable in engineering units

Primary variable in percent of range

All dynamic variables in engineering units

All dynamic variables in engineering units and the primary variable mA value

Multidrop Communication<sup>(2)(3)</sup>

Choose transmitter address (1-15)<sup>(4)</sup>: \_\_\_\_\_

(1) Not available with low power output.

(2) C1 Option required for configuration of this parameter

(3) This option fixes the transmitter analog output at 4mA.

(4) Default address is 1 if multidrop communication is selected.

Model 3051C Differential/Gage Pressure Transmitter Range Limits

Units	Range 0 Span		Range 1 Span		Range 2 Span		Range 3 Span		Range 4 Span		Range 5 Span	
	min	max	min	max	min	max	min	max	min	max	min	max
inH <sub>2</sub> O	-3.0	3.0	0.5	25	2.5	250	10	1000	83.040	8304	553.60	55360
inHg	-0.22027	0.22027	0.03678	1.8389	0.18389	18.389	0.73559	73.559	6.1081	610.81	40.720	4072.04
ftH <sub>2</sub> O	-0.25	0.25	0.04167	2.08333	0.20833	20.8333	0.83333	83.3333	6.9198	691.997	46.13	4613.31
mmH <sub>2</sub> O	-76.19996	76.19996	12.7	635.5	63.553	6355	254	25421	2110.95	211095	14073	1407301
mmHg	-5.59492	5.59492	0.93416	46.7082	4.67082	467.082	18.6833	1868.33	155.145	15514.5	1034.3	103430
psi	-0.10819	1.10819	0.01806	0.903	0.0902	9.03183	0.36127	36.127	3	300	20	2000
bar	-0.00746	0.00746	0.00125	0.06227	0.00623	0.62272	0.02491	2.491	0.20684	20.6843	1.37895	137.895
mbar	-7.45927	7.45927	1.2454	62.2723	6.22723	622.723	24.9089	2490.89	206.843	20684.3	1378.95	137895
g/cm <sup>2</sup>	-7.60634	7.60634	1.26775	63.3875	6.33875	633.875	25.355	2535.45	210.547	21054.7	1406.14	140614
kg/cm <sup>2</sup>	-0.00761	0.00761	0.00127	0.0635	0.00635	0.635	0.0254	2.54	0.21092	21.0921	1.40614	140.614
Pa	-745.92724	745.92724	124.545	6227.23	622.723	62160.6	2490.89	249089	20684.3	2068430	137895	13789500
kPa	-0.74593	0.74593	0.12545	6.2272	0.62272	62.2723	2.49089	249.089	20.6843	2068.43	137.895	13789.5
torr	-5.59491	5.59491	0.93416	46.7082	4.67082	467.082	18.6833	1868.33	155.145	15514.5	1034.3	103430
atm	-0.00736	0.00736	0.00123	0.06146	0.00615	0.61460	0.02458	2.458	0.20414	20.4138	1.36092	136.092

**NOTE**

When used with the HART Communicator Model 275 or the Rosemount Model 268 Communicator, ±5% adjustment ability is allowed on the sensor limit to allow for unit conversions.

Model 3051P Differential/Gage Pressure Transmitter Range Limits								
Units	Range 2 Span		Range 3 Span		Range 4 Span <sup>(1)</sup>		Range 5 Span <sup>(1)</sup>	
	min	max	min	max	min	max	min	max
inH <sub>2</sub> O	25	250	100	1000	830.40	8304	5536.0	55360
inHg	1.8389	18.389	7.3559	73.559	61.081	610.81	407.20	4072.04
ftH <sub>2</sub> O	2.08333	20.8333	8.3333	83.3333	69.200	691.997	461.3	4613.31
mmH <sub>2</sub> O	635.5	6355	2542	25421	21109.5	211095	140730	1407301
mmHg	46.7082	467.082	186.833	1868.33	1551.45	15514.5	10343	103430
psi	0.903	9.03183	3.6127	36.127	30	300	200	2000
bar	0.06227	0.62272	0.2491	2.491	2.0684	20.6843	13.7895	137.895
mbar	62.2723	622.723	249.089	2490.89	2068.43	20684.3	13789.5	137895
g/cm <sup>2</sup>	63.3875	633.875	253.55	2535.45	2105.47	21054.7	14061.4	140614
kg/cm <sup>2</sup>	0.0635	0.635	0.254	2.54	2.1092	21.0921	14.0614	140.614
Pa	6216.06	62160.6	24908.9	249089	206843	2068430	1378950	13789500
kPa	6.2272	62.2723	24.9089	249.089	206.843	2068.43	1378.95	13789.5
torr	46.7082	467.082	186.833	1868.33	1551.45	15514.5	10343	103430
atm	0.06146	0.61460	0.2458	2.458	2.0414	20.4138	13.6092	136.092

**NOTE**

When used with the HART Communicator Model 275 or the Rosemount Model 268 Communicator,  $\pm 5\%$  adjustment ability is allowed on the sensor limit to allow for unit conversions.

(1) Range 4 and 5 spans are only available with gage pressure transmitters.

Model 3051L/3051H Pressure Transmitter Range Limits								
Units	Range 2 Span		Range 3 Span		Range 4 Span		Range 5 Span (3051H Only)	
	min	max	min	max	min	max	min	max
inH <sub>2</sub> O	2.5	250	10	1000	83.040	8304	553.60	55360
inHg	0.18389	18.389	0.73559	73.559	6.1081	610.81	40.720	4072.04
ftH <sub>2</sub> O	0.20833	20.8333	0.83333	83.3333	6.9198	691.997	46.13	4613.31
mmH <sub>2</sub> O	63.553	6355	254	25421	2110.95	211095	14073	1407301
mmHg	4.67082	467.082	18.6833	1868.33	155.145	15514.5	1034.3	103430
psi	0.0902	9.03183	0.36127	36.127	3	300	20	2000
bar	0.00623	0.62272	0.02491	2.491	0.20684	20.6843	1.37895	137.895
mbar	6.22723	622.723	24.9089	2490.89	206.843	20684.3	1378.95	137895
g/cm <sup>2</sup>	6.33875	633.875	25.355	2535.45	210.547	21054.7	1406.14	140614
kg/cm <sup>2</sup>	0.00635	0.635	0.0254	2.54	0.21092	21.0921	1.40614	140.614
Pa	622.723	62160.6	2490.89	249089	20684.3	2068430	137895	13789500
kPa	0.62272	62.2723	2.49089	249.089	20.6843	2068.43	137.895	13789.5
torr	4.67082	467.082	18.6833	1868.33	155.145	15514.5	1034.3	103430
atm	0.00615	0.61460	0.02458	2.458	0.20414	20.4138	1.36092	136.092

**NOTE**

When used with the HART Communicator Model 275 or the Rosemount Model 268 Communicator,  $\pm 5\%$  adjustment ability is allowed on the sensor limit to allow for unit conversions.

# Rosemount Model 3051 Smart Pressure Transmitters

Model 3051T Gage and Absolute Pressure Transmitter Range Limits										
Units	Range 1 Span		Range 2 Span		Range 3 Span		Range 4 Span		Range 5 Span	
	min	max	min	max	min	max	min	max	min	max
inH <sub>2</sub> O	8.30397	831.889	41.5198	4159.45	221.439	22143.9	1107.2	110720	55360	276799
inHg	0.61081	61.0807	3.05403	305.403	16.2882	1628.82	81.441	8144.098	4072.04	20360.2
ftH <sub>2</sub> O	0.69199	69.3241	3.45998	345.998	18.4533	1845.33	92.2663	9226.63	4613.31	23066.6
mmH <sub>2</sub> O	211.10	21130	1054.60	105460.3	5634.66	563466	28146.1	2814613	1407301	7036507
mmHg	15.5145	1551.45	77.5723	7757.23	413.72	41372	2068.6	206860.0	103430	517151
psi	0.3	30	1.5	150	8	800	40	4000	2000	10000
bar	0.02068	3.06843	0.10342	10.3421	0.55158	55.1581	2.75791	275.7905	137.895	689.476
mbar	20.6843	2068.43	103.421	10342.11	551.581	55158.1	2757.91	275790.5	137895	689476
g/cm <sup>2</sup>	21.0921	2109.21	105.461	10546.1	561.459	56145.9	2807.31	280730.6	140614	703067
kg/cm <sup>2</sup>	0.02109	2.10921	0.10546	10.5461	0.56246	56.2456	2.81228	281.228	140.614	701.82
Pa	2068.43	206843	10342.1	1034212	55158.1	5515811	275791	27579054	13789500	68947600
kPa	2.06843	206.843	10.3421	1034.21	55.1581	5515.81	275.791	27579.05	13789.5	68947.6
torr	15.5145	1551.45	77.5726	7757.26	413.721	413721	2068.6	206859.7	103430	517151
atm	0.02041	2.04138	0.10207	10.2069	0.54437	54.4368	2.72184	272.1841	136.092	680.46

**NOTE**  
When used with the HART Communicator Model 275 or the Rosemount Model 268 Communicator, ±5% adjustment ability is allowed on the sensor limit to allow for unit conversions.

Model 3051C Absolute Pressure Transmitter Range Limits										
Units	Range 0 Span		Range 1 Span		Range 2 Span		Range 3 Span		Range 4 Span	
	min	max	min	max	min	max	min	max	min	max
inH <sub>2</sub> O	4.62254	138.399	8.30397	831.889	41.5198	4151.98	221.439	22143.9	1107.2	110720
inHg	0.34002	10.1801	0.61081	61.0807	3.05403	305.403	16.2882	1628.82	81.441	8144.098
ftH <sub>2</sub> O	0.38521	11.5333	0.69199	69.3241	3.45998	345.998	18.4533	1845.33	92.2663	9226.63
mmH <sub>2</sub> O	117.510	3518.2	211.10	21130	6.35308	635.308	5634.66	563466	28146.1	2814613
mmHg	8.63642	258.575	15.5145	1551.45	1055.47	105547	413.72	41372	2068.6	206860.0
psi	0.16667	5	0.3	30	1.5	150	8	800	40	4000
bar	0.01151	0.34474	0.02068	2.06843	0.10342	10.342	0.55158	55.1581	2.75791	275.7905
mbar	11.5142	344.738	20.6843	2068.43	103.421	10342.1	551.581	55158.1	2757.91	275790.5
g/cm <sup>2</sup>	11.74	350.91	21.0921	2109.21	105.27	105.27	561.459	56145.9	2807.31	280730.6
kg/cm <sup>2</sup>	0.01174	0.35154	0.02109	2.10921	0.10546	10.546	0.56246	56.2456	2.81228	281.228
Pa	1151.42	34473.8	2068.43	206843	10342.1	1034210	55158.1	5515811	275791	27579054
kPa	1.15142	34.4738	2.06843	206.843	10.3421	1034.21	55.1581	5515.81	275.791	27579.05
torr	8.63642	258.575	15.5145	1551.45	77.5726	7757.26	413.721	413721	2068.6	206859.7
atm	0.01136	0.34023	0.02041	2.04138	0.10207	10.207	0.54437	54.4368	2.72184	272.1841

**NOTE**  
When used with the HART Communicator Model 275 or the Rosemount Model 268 Communicator, ±5% adjustment ability is allowed on the sensor limit to allow for unit conversions.

# HART Communicator

## INTRODUCTION

This appendix provides basic communicator information on the Model 275 HART Communicator when used with a Model 3051 Smart Pressure Transmitter.

This brief appendix will familiarize you with the HART Communicator but is not meant to replace the HART Communicator product manual. For complete information on the HART Communicator, refer to the HART Communicator Product Manual, publication number 00809-0100-4275.

### NOTE

You must upgrade the software in your HART Communicator in order to take advantage of the additional features of the improved Model 3051. If you initiate communication with an improved Model 3051 using a Communicator that has a previous version of the transmitter Device Descriptors (DDs), the communicator will display the following message:

NOTICE: Upgrade 275 software to access XMTR function.  
Continue with old description?

If you select **YES**, the communicator will communicate properly with the transmitter using the existing Model 3051 DDs. However, software features added since the revision of the DDs in the communicator will not be accessible. If you select **NO**, the communicator will default to a generic transmitter functionality.

Contact your nearest Rosemount Service Center or Sales Representative to upgrade your communicator.

## SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

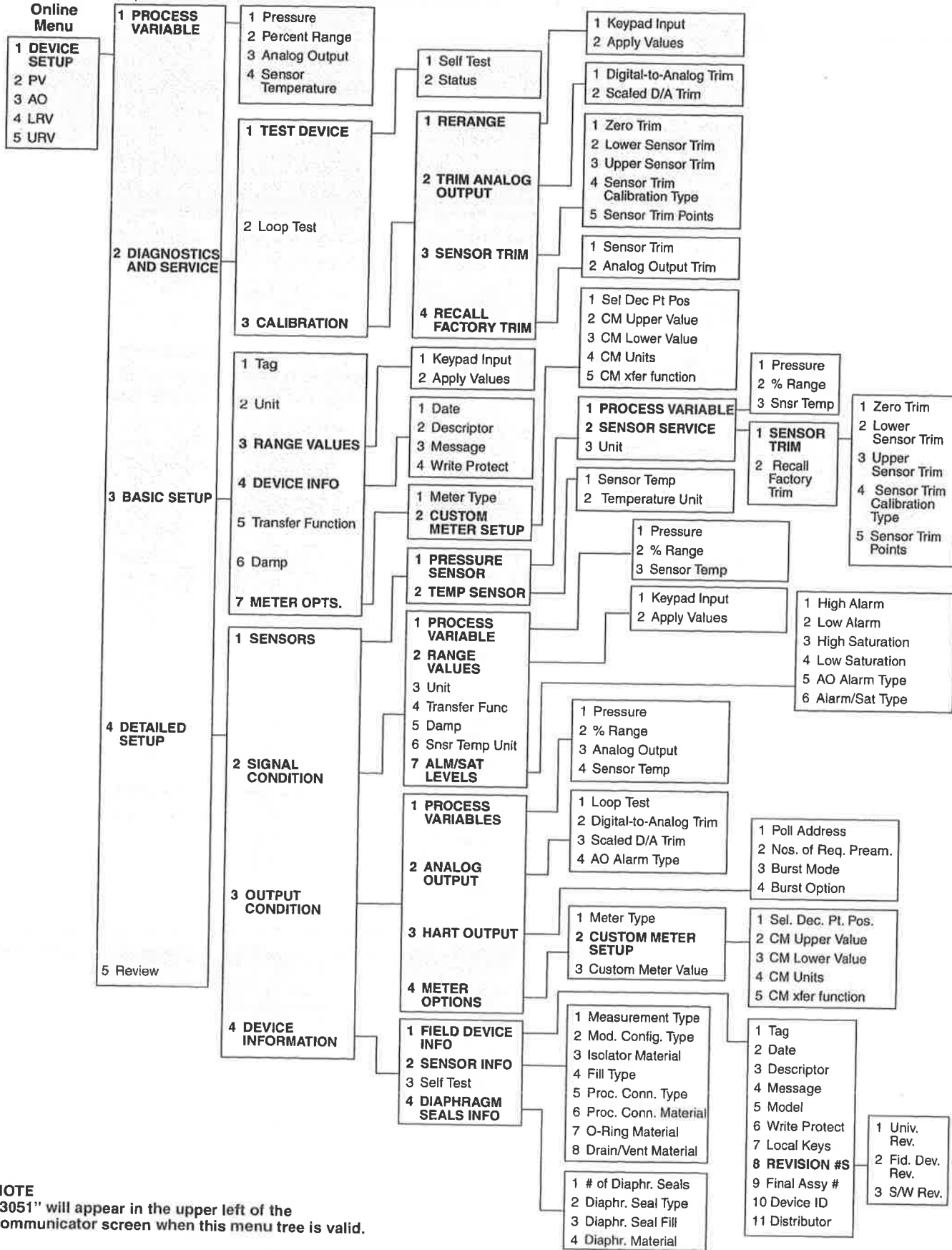
### Warnings (⚠)

#### ⚠ WARNING

**Explosions can result in death or serious injury.**

- Do not remove the transmitter covers in explosive environments when the circuit is alive.
- Both transmitter covers must be fully engaged to meet explosionproof requirements.
- Before connecting a communicator in an explosive atmosphere, make sure the instruments in the loop are installed according to intrinsically safe or nonincendive field wiring practices.

FIGURE A-1. HART Communicator Menu Tree for Improved Model 3051.



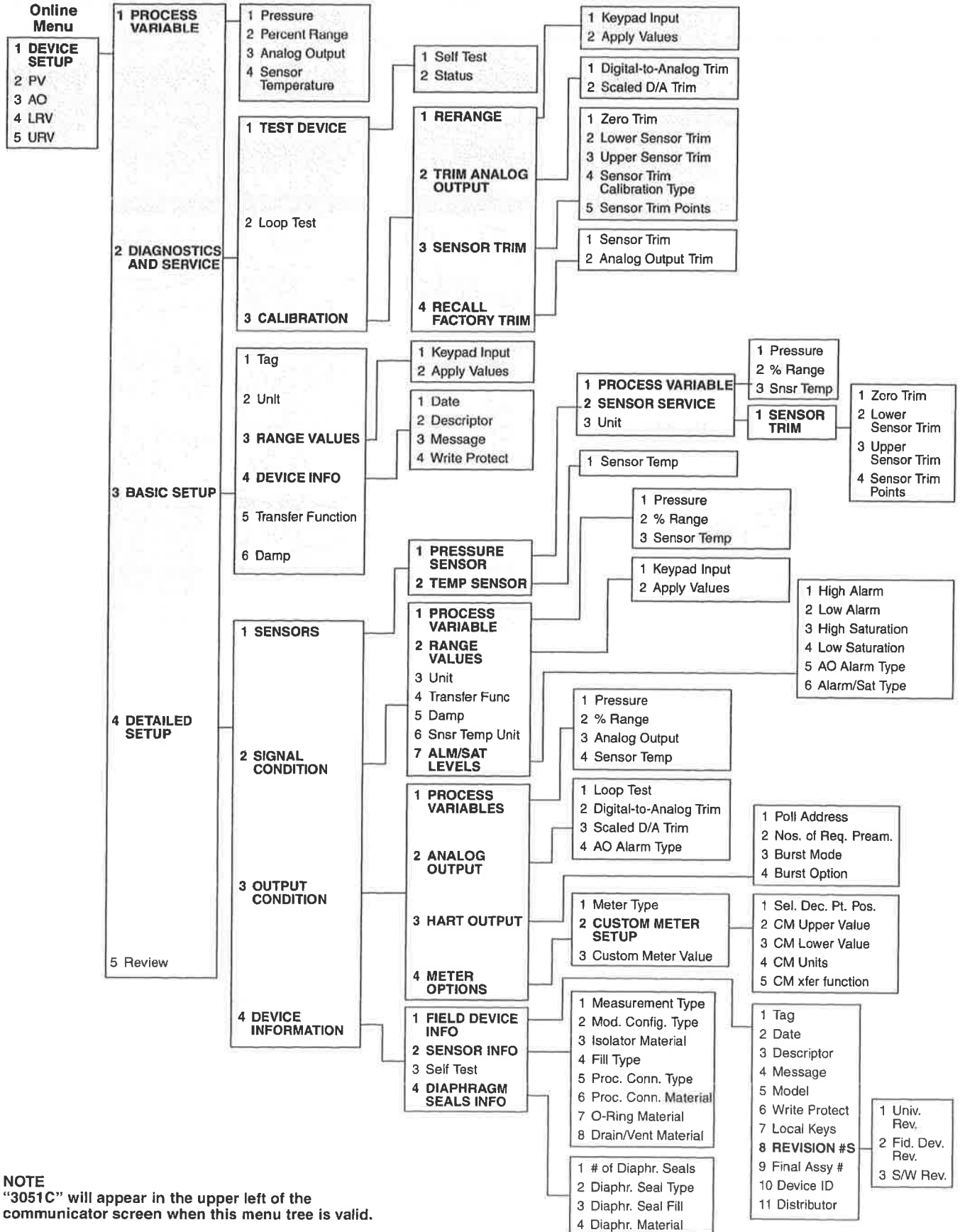
NOTE  
 "3051" will appear in the upper left of the communicator screen when this menu tree is valid.

TABLE A-1. HART Fast Key Sequences for the *Improved Model 3051*.

Function	HART Fast Key Sequence
Alarm and Saturation Levels	1, 4, 2, 7
Analog Output Alarm Type	1, 4, 3, 2, 4
Burst Mode Control	1, 4, 3, 3, 3
Burst Operation	1, 4, 3, 3, 3
Clone Data	See page 2-29
Custom Meter Configuration	1, 3, 7, 2
Custom Meter Value	1, 4, 3, 4, 3
✓ Damping	1, 3, 6
Date	1, 3, 4, 1
Descriptor	1, 3, 4, 2
Digital To Analog Trim (4–20 mA Output)	1, 2, 3, 2, 1
Disable Local Span/Zero Adjustment	1, 4, 4, 1, 7
Field Device Info	1, 4, 4, 1
Full Trim	1, 2, 3, 3
Keypad Input – Rerange	1, 2, 3, 1, 1
Local Zero and Span Control	1, 4, 4, 1, 7
Loop Test	1, 2, 2
Lower Sensor Trim	1, 2, 3, 3, 2
Message	1, 3, 4, 3
Meter Options	1, 4, 3, 4
Number Of Requested Preambles	1, 4, 3, 3, 2
Poll Address	1, 4, 3, 3, 1
Poll a Multidropped Transmitter	Left Arrow, 4, 1, 1
✓ Range Values	1, 3, 3
Rerange	1, 2, 3, 1
Scaled D/A Trim (4–20 mA Output)	1, 2, 3, 2, 2
Self Test (Transmitter)	1, 2, 1, 1
Sensor Info	1, 4, 4, 2
Sensor Temperature	1, 1, 4
Sensor Trim Points	1, 2, 3, 3, 5
Status	1, 2, 1, 2
✓ Tag	1, 3, 1
✓ Transfer Function (Setting Output Type)	1, 3, 5
Transmitter Security (Write Protect)	1, 3, 4, 4
Trim Analog Output	1, 2, 3, 2
✓ Units (Process Variable)	1, 3, 2
Upper Sensor Trim	1, 2, 3, 3, 3
Zero Trim	1, 2, 3, 3, 1
NOTE: A check (✓) indicates the basic configuration parameters. At minimum, these parameters should be verified as part of the configuration and startup procedure.	



FIGURE A-2. HART Communicator Menu Tree for *Previous Model 3051*.



NOTE  
 "3051C" will appear in the upper left of the communicator screen when this menu tree is valid.

TABLE A-2. HART Fast Key Sequences for the *Previous* Model 3051.

Function	HART Fast Key Sequence
Analog Output Alarm	1, 4, 3, 3
Burst Mode Control	1, 4, 3, 4, 3
Burst Operation	1, 4, 3, 4, 4
Clone Data	See page 2-29
✓ Damping	1, 3, 6
Date	1, 3, 4, 1
Descriptor	1, 3, 4, 2
Digital To Analog Trim (4–20 mA Output)	1, 2, 3, 2, 1
Disable Local Span/Zero Adjustment	1, 4, 4, 1, 7
Field Device Info	1, 4, 4, 1
Full Trim	1, 2, 3, 3
Keypad Input	1, 2, 3, 1, 1
Loop Test	1, 2, 2
Lower Sensor Trim	1, 2, 3, 3, 2
Message	1, 3, 4, 3
Meter Type	1, 4, 3, 5
Number Of Requested Preambles	1, 4, 3, 4, 2
Poll Address	Left Arrow, 5, 1
✓ Range Values	1, 3, 3
Rerange	1, 2, 3, 1
Scaled D/A Trim (4–20 mA Output)	1, 2, 3, 2, 2
Self Test (Transmitter)	1, 2, 1, 1
Sensor Info	1, 4, 4, 2
Sensor Temperature	1, 1, 4
Sensor Trim Points	1, 2, 3, 3, 4
Status	1, 2, 1, 2
✓ Tag	1, 3, 1
✓ Transfer Function (Setting Output Type)	1, 3, 5
Transmitter Security (Write Protect)	1, 3, 4, 4
Trim Analog Output	1, 2, 3, 2
✓ Units (Process Variable)	1, 3, 2
Upper Sensor Trim	1, 2, 3, 3, 3
Zero Trim	1, 2, 3, 3, 1
Analog Output Alarm	1, 4, 3, 3
Burst Mode Control	1, 4, 3, 4, 3
Burst Operation	1, 4, 3, 4, 4
Clone Data	See page 2-29.
✓ Damping	1, 3, 6

NOTE: A check (✓) indicates the basic configuration parameters. At minimum, these parameters should be verified as part of the configuration and startup procedure.

## CONNECTIONS AND HARDWARE

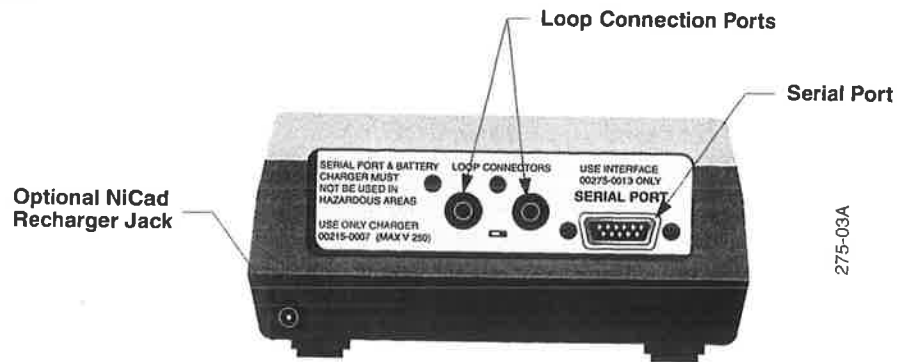
**⚠** The HART Communicator Model 275 can interface with a transmitter from the control room, the instrument site, or any wiring termination point in the loop through the rear connection panel as shown in Figure A-3. Do not make connections to the serial port or NiCad recharger jack in an explosive atmosphere. To communicate, connect the HART Communicator in parallel with the instrument or load resistor. The connections are non-polarized. Before connecting the HART Communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or nonincendive field wiring practices.

### NOTE

The HART Communicator needs a minimum of 250 ohms resistance in the loop to function properly.

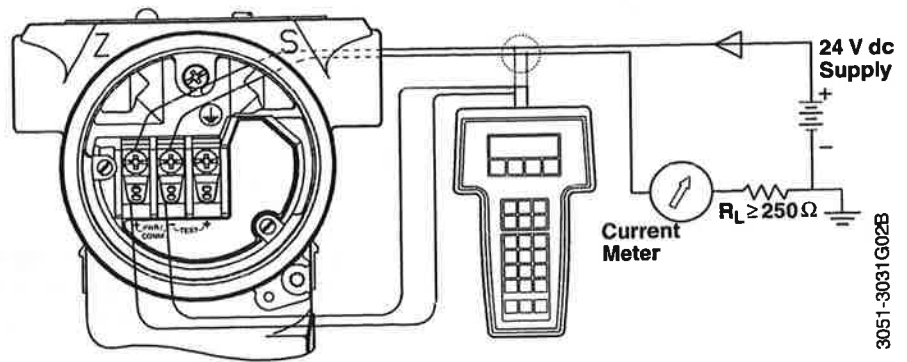
The HART Communicator is not a measurement device and does not need to be calibrated; it is a communications device through which you can read and adjust the transmitter configuration information. All variable outputs displayed by the communicator are functions of the transmitter.

FIGURE A-3. Rear Connection Panel with Optional NiCad Recharger Pack.



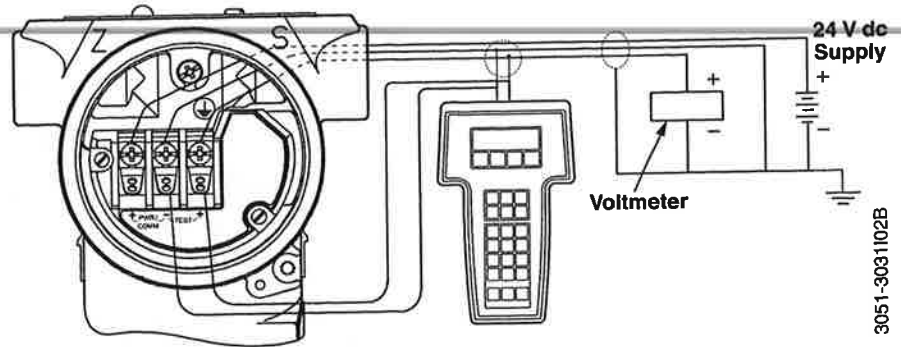
**⚠** See "Safety Messages" on page A-1 for complete warning information.

FIGURE A-4. Bench Hook-up  
(4–20 mA Transmitters).



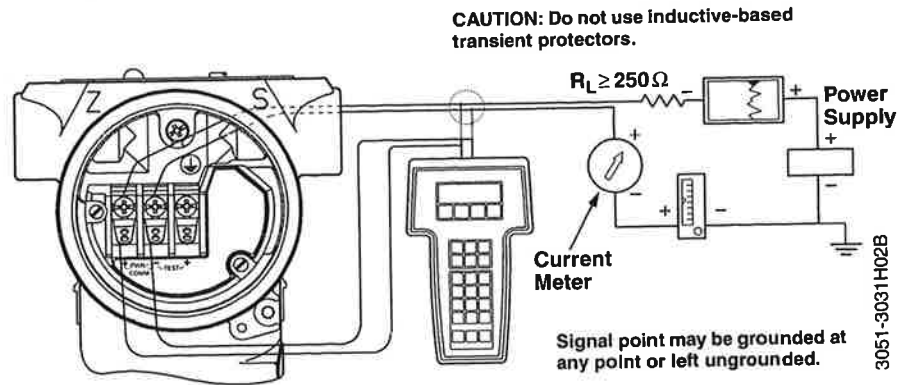
3051-3031G02B

FIGURE A-5. Bench Hook-up  
(Low Power Transmitters).



3051-3031I02B

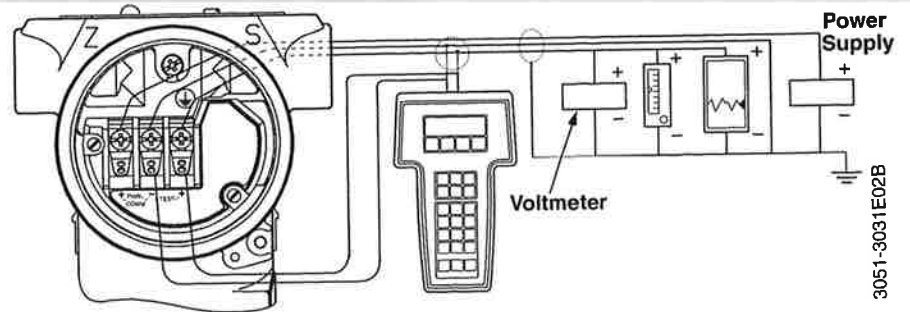
FIGURE A-6. Field Hook-up  
(4–20 mA Transmitters).



Signal point may be grounded at any point or left ungrounded.

3051-3031H02B

FIGURE A-7. Field Hook-up  
(Low Power Transmitters).

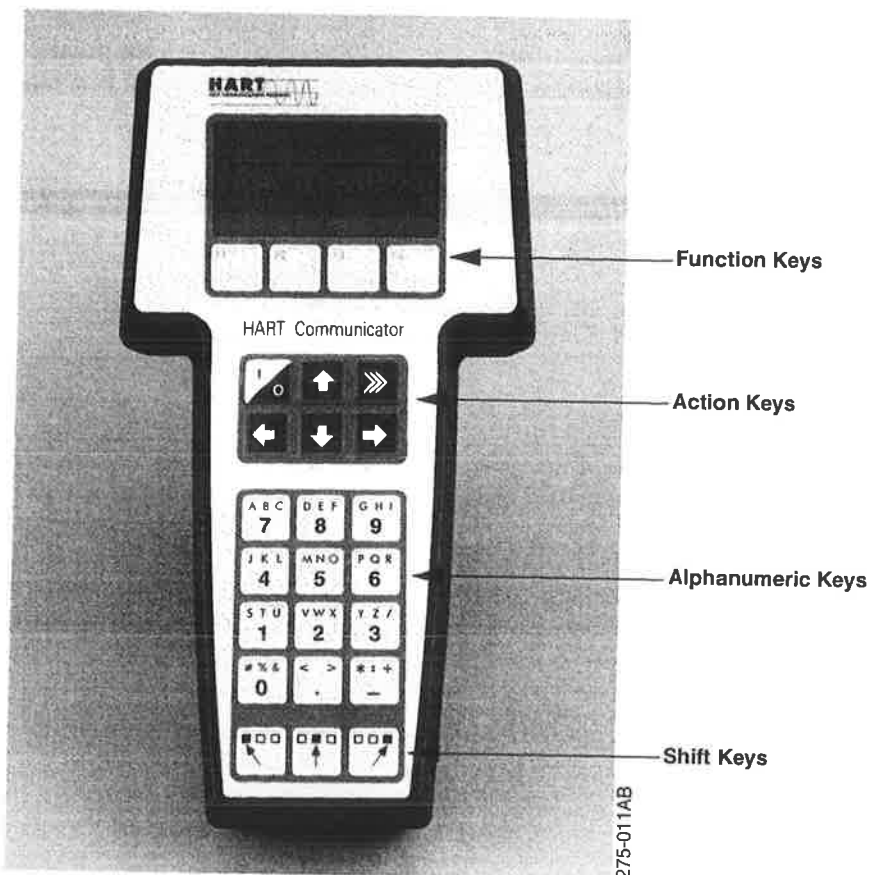


3051-3031E02B

## COMMUNICATOR KEYS

The keys of the HART Communicator include action, function, alphanumeric, and shift keys.

FIGURE A-8. Model 275 HART Communicator.



### Action Keys

As shown in Figure A-8, the action keys are the six blue, white, and black keys located above the alphanumeric keys. The function of each key is described as follows:

#### ON/OFF Key

Use this key to power the HART Communicator. When the communicator is turned on, it searches for a transmitter on the 4–20 mA loop. If a device is not found, the communicator displays the message “No Device Found. Press OK.”

If a HART-compatible device is found, the communicator displays the **ONLINE MENU** with device ID and tag.

#### Directional Keys

Use these keys to move the cursor up, down, left, or right. The **RIGHT ARROW** key also selects menu options, and the **LEFT ARROW** key returns to the previous menu.

**Hot Key** 

Use this key to quickly access important, user-selectable options when connected to a HART-compatible device. Pressing the **HOT KEY** turns the HART Communicator on and displays the Hot Key Menu. See “Customizing the Hot Key Menu” in the HART Communicator manual for more information.

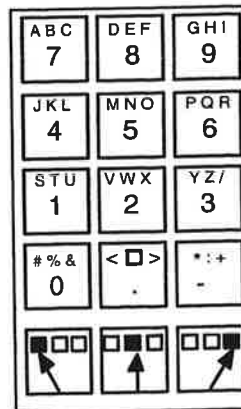
**Function Keys**



Use the four software-defined function keys, located below the LCD, to perform software functions. On any given menu, the label appearing above a function key indicates the function of that key for the current menu. As you move among menus, different function key labels appear over the four keys. For example, in menus providing access to on-line help, the **HELP** label may appear above the **F1** key. In menus providing access to the **ONLINE MENU**, the **HOME** label may appear above the **F3** key. Simply press the key to activate the function. See your HART Communicator manual for details on specific function key definitions.

**Alphanumeric and Shift Keys**

FIGURE A-9. HART Communicator Alphanumeric and Shift Keys.



275-0383A

**Data Entry**

Some menus require data entry. Use the alphanumeric and shift keys to enter all alphanumeric information into the HART Communicator. If you press an alphanumeric key alone from within an edit menu, the bold character in the center of the key appears. These large characters include the numbers zero through nine, the decimal point (.), and the dash symbol (-).

To enter an alphabetic character, first press the shift key that corresponds to the position of the letter you want on the alphanumeric key. Then press the alphanumeric key. For example, to enter the letter “R”, first press the right shift key, then the “6” key (see Figure A-10). Do not press these keys simultaneously, but one after the other.

FIGURE A-10. Data Entry Key Sequence.



275-0532A,  
0343A

## Fast Key Sequences

HART fast key sequences provide quick on-line access to transmitter variables and functions. Instead of stepping your way through the menu structure using the action keys, you can press a HART fast key sequence to move from the **ONLINE MENU** to the desired variable or function. On-screen instructions guide you through the rest of the screens.

## Fast Key Sequence Conventions

The fast key sequences for the Model 275 use the following conventions for their identification:

**1 through 9**—Refer to the keys located directly below the dedicated keypad.

**Left Arrow**—Refers to the **LEFT ARROW** directional key.

## Fast Key Sequence Example

HART fast key sequences are made up of the series of numbers corresponding to the individual options in each step of the menu structure. For example, from the **ONLINE MENU** you can change the date. Following the menu structure, press 1 to reach *Device Setup*, press 3 for *Basic Setup*, press 4 for *Device Info*, press 1 for *Date*. The corresponding HART fast key sequence is 1, 3, 4, 1.

HART fast keys are operational only from the **ONLINE MENU**. If you use them consistently, you will need to return to the **ONLINE MENU** by pressing **HOME (F3)** when it is available. If you do not start at the **ONLINE MENU**, the HART fast key sequences will not function properly.

Use Table A-1, an alphabetical listing of every on-line function, to find the corresponding HART fast key sequences. These codes are applicable only to Model 3051 transmitters and the HART Communicator.

## MENUS AND FUNCTIONS

The HART Communicator is a menu driven system. Each screen provides a menu of options that can be selected as outlined above, or provides direction for input of data, warnings, messages, or other instructions.

## Main Menu

When the HART Communicator is turned on, one of two menus will appear. If the HART Communicator is connected to an operating loop, the communicator will find the device and display the **ONLINE MENU** (see below). If it is not connected to a loop, the communicator will indicate that no device was found. When you press **OK (F4)**, it will display the **MAIN** menu.

The **MAIN** menu provides the following options:

- *Offline*—The Offline option provides access to offline configuration data and simulation functions.
- *Online*—The Online option checks for a device and if it finds one, brings up the **ONLINE MENU**.
- *Transfer*—The Transfer option provides access to options for transferring data either from the HART Communicator (memory) to the transmitter (device) or vice versa. Transfer is used to move off-line data from the HART Communicator to the transmitter, or to retrieve data from a transmitter for off-line revision.

**NOTE**

Online communication with the transmitter automatically loads the current transmitter data to the HART Communicator. Changes in on-line data are made active by pressing **SEND (F2)**. The transfer function is used only for off-line data retrieval and sending.

- *Frequency Device*—The Frequency Device option displays the frequency output and corresponding pressure output of current-to-pressure transmitters.
- *Utility*—The Utility option provides access to the contrast control for the HART Communicator LCD screen and to the autopoll setting used in multidrop applications.

Once selecting a **MAIN** menu option, the HART Communicator provides the information you need to complete the operation. If further details are required, consult the HART Communicator manual.

**Online Menu**

The **ONLINE MENU** can be selected from the **MAIN** menu as outlined above, or it may appear automatically if the HART Communicator is connected to an active loop and can detect an operating transmitter.

**NOTE**

The **MAIN** menu can be accessed from the **ONLINE MENU**. Press the left arrow action key to deactivate the on-line communication with the transmitter and to activate the **MAIN** menu options.

When configuration variables are reset in the on-line mode, the new settings are not activated until the data is sent to the transmitter. Press **SEND (F2)** when it is activated to update the process variables of the transmitter.

On-line mode is used for direct evaluation of a particular meter, re-configuration, changing parameters, maintenance, and other functions.

**Diagnostic Messages**

The following pages contain a list of messages used by the HART Communicator (HC) and their corresponding descriptions.

Variable parameters within the text of a message are indicated with *<variable parameter>*.

Reference to the name of another message is identified by *[another message]*.

Message	Description
1k snsr EEPROM error-factory ON	Replace the sensor module
1k snsr EEPROM error-user-no out ON	Use the HART communicator to reset the following parameters: remote seal isolator, remote seal fill fluid, flange material, o-ring material, transmitter type, remote seal type, flange type, meter type, number of remote seals.
1k snsr EEPROM error-user ON	Perform a full trim to recalibrate the transmitter.
4k micro EEPROM error-factory ON	Replace the electronics board.
4k micro EEPROM error-user-no out ON	Use the hart communicator to reset the message field.



Message	Description
<b>4k mlcro EEPROM error-user ON</b>	Use the HART communicator to reset the following parameters: units, range values, damping, analog output, transfer function, tag, scaled meter values. Perform a d/a trim to ensure that the error is corrected.
<b>4k snsr EEPROM error-factory ON</b>	Replace the sensor module.
<b>4k snsr EEPROM error-user ON</b>	Use the HART communicator to reset the temperature units and the calibration type.
<b>Add item for ALL device types or only for this ONE device type.</b>	Asks the user whether the hot key item being added should be added for all device types or only for the type of device that is connected.
<b>Command Not Implemented</b>	The connected device does not support this function.
<b>Communication Error</b>	The communicator and the device are not communicating correctly. Check all connections between the communicator and the device and resend the information.
<b>Configuration memory not compatible with connected device</b>	The configuration stored in memory is incompatible with the device to which a transfer has been requested.
<b>CPU board not initialized ON</b>	The electronics board is not initialized. Replace the electronics board.
<b>CPU EEPROM write failure ON</b>	Message sent to electronics board from HART signal failed. Replace the electronics board.
<b>Device Busy</b>	The connected device is busy performing another task.
<b>Device Disconnected</b>	The device failed to respond to a command. Check all connections between the communicator and the device and resend the command.
<b>Device write protected</b>	Device is in write-protect mode. Data can not be written.
<b>Device write protected. Do you still want to shut off?</b>	Device is in write-protect mode. Press YES to turn the HART communicator off and lose the unsent data.
<b>Display value of variable on hotkey menu?</b>	Asks whether the value of the variable should be displayed adjacent to its label on the hotkey menu if the item being added to the hotkey menu is a variable.
<b>Download data from configuration memory to device</b>	Press the SEND softkey to transfer information from the communicator memory to the device.
<b>Exceed field width</b>	Indicates that the field width for the current arithmetic variable exceeds the device-specified description edit format.
<b>Exceed precision</b>	Indicates that the precision for the current arithmetic variable exceeds the device-specified description edit format.
<b>Ignore next 50 occurrences of status?</b>	Select YES to ignore the next 50 occurrences of device status, or select no to display every occurrence.
<b>Illegal character</b>	An invalid character for the variable type was entered.
<b>Illegal date</b>	The day portion of the date is invalid.

Message	Description
<b>Illegal month</b>	The month portion of the date is invalid.
<b>Illegal year</b>	The year portion of the date is invalid.
<b>Incompatible CPU board and module ON</b>	Upgrade the electronics board or the sensor module to the current revision.
<b>Incomplete exponent</b>	The exponent of a scientific notation floating point variable is incomplete.
<b>Incomplete field</b>	The value entered is not complete for the variable type.
<b>Looking for a device</b>	Polling for multidropped devices at addresses 1–15.
<b>Local buttons operator error ON</b>	Illegal pressure applied during zero or span operation. Repeat the process after verifying the correct pressures.
<b>Mark as read only variable on hotkey menu?</b>	Asks whether the user should be allowed to edit the variable from the hotkey menu if the item being added to the hotkey menu is a variable.
<b>Module EEPROM write failure ON</b>	Message sent to the module from the HART signal failed. Replace the sensor module.
<b>No device configuration in configuration memory</b>	There is no configuration saved in memory available to re-configure off-line or transfer to a device.
<b>No Device Found</b>	Poll of address zero fails to find a device, or poll of all addresses fails to find a device if auto-poll is enabled.
<b>No hotkey menu available for this device.</b>	There is no menu named "hotkey" defined in the device description for this device.
<b>No pressure updates ON</b>	No pressure updates being received from the sensor module. Verify that the sensor module ribbon cable is attached correctly. Or replace the sensor module.
<b>No offline devices available.</b>	There are no device descriptions available to be used to configure a device offline.
<b>No simulation devices available.</b>	There are no device descriptions available to simulate a device.
<b>No temperature updates ON</b>	No temperature updates being received from the sensor module. Verify that the sensor module ribbon cable is attached correctly. Or replace the sensor module.
<b>No UPLOAD_VARIABLES in ddl for this device</b>	There is no menu named "upload_variables" defined in the device description for this device. This menu is required for offline configuration.
<b>No Valid Items</b>	The selected menu or edit display contains no valid items.
<b>OFF KEY DISABLED</b>	Appears when the user attempts to turn the HC off before sending modified data or before completing a method.
<b>Online device disconnected with unsent data. RETRY or OK to lose data.</b>	There is unsent data for a previously connected device. Press RETRY to send data, or press OK to disconnect and lose unsent data.

Message	Description
<b>Out of memory for hotkey configuration. Delete unnecessary items.</b>	There is no more memory available to store additional hotkey items. Unnecessary items should be deleted to make space available.
<b>Overwrite existing configuration memory</b>	Requests permission to overwrite existing configuration either by a device-to-memory transfer or by an offline configuration. User answers using the softkeys.
<b>Press OK...</b>	Press the OK softkey. This message usually appears after an error message from the application or as a result of HART communications.
<b>Restore device value?</b>	The edited value that was sent to a device was not properly implemented. Restoring the device value returns the variable to its original value.
<b>ROM checksum error ON</b>	Checksum of transmitter software has detected a fault. Replace the electronics board.
<b>Save data from device to configuration memory</b>	Prompts user to press SAVE softkey to initiate a device-to-memory transfer.
<b>Saving data to configuration memory.</b>	Data is being transferred from a device to configuration memory.
<b>Sending data to device.</b>	Data is being transferred from configuration memory to a device.
<b>Sensor board not initialized ON</b>	The sensor module electronics board is not initialized. Replace the sensor module.
<b>There are write only variables which have not been edited. Please edit them.</b>	There are write-only variables which have not been set by the user. These variables should be set or invalid values may be sent to the device.
<b>There is unsent data. Send it before shutting off?</b>	Press YES to send unsent data and turn the HC off. Press NO to turn the HC off and lose the unsent data.
<b>Too few data bytes received</b>	Command returns fewer data bytes than expected as determined by the device description.
<b>Transmitter Fault</b>	Device returns a command response indicating a fault with the connected device.
<b>Units for &lt;variable label&gt; has changed. Unit must be sent before editing, or invalid data will be sent.</b>	The engineering units for this variable have been edited. Send engineering units to the device before editing this variable.
<b>Unsent data to online device. SEND or LOSE data</b>	There is unsent data for a previously connected device which must be sent or thrown away before connecting to another device.

Message	Description
<b>Upgrade 275 software to access XMTR function. Continue with old description?</b>	The communicator does not contain the most recent Model 3051 Device Descriptors (DDs). Select YES to communicate using the existing DDs. Select NO to abort communication.
<b>Use up/down arrows to change contrast. Press DONE when done.</b>	Gives direction to change the contrast of the HC display.
<b>Value out of range</b>	The user-entered value is either not within the range for the given type and size of variable or not within the min/max specified by the device.
<b>&lt;message&gt; occurred reading/writing &lt;variable label&gt;</b>	Either a read/write command indicates too few data bytes received, transmitter fault, invalid response code, invalid response command, invalid reply data field, or failed pre- or post-read method; or a response code of any class other than SUCCESS is returned reading a particular variable.
<b>&lt;variable label&gt; has an unknown value. Unit must be sent before editing, or invalid data will be sent.</b>	A variable related to this variable has been edited. Send related variable to the device before editing this variable.



# Model 268 Communicator

## INTRODUCTION

This appendix provides basic communicator information on the Rosemount Model 268 SMART FAMILY Interface when used with a Model 3051 Smart Pressure Transmitter.

### NOTE

All additional features of the Model 3051 are only accessible by using a HART Communicator Model 275. The Model 268 SMART FAMILY Interface will only provide features accessible with the existing Model 3051 Device Descriptors (DD) present in the Model 268. For full functionality, use a Model 275 Communicator. Contact your nearest Rosemount Service Center or Sales Representative for details.

## SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

### Warnings (⚠)

#### ⚠ WARNING

**Explosions can result in death or serious injury.**

- Do not remove the transmitter covers in explosive environments when the circuit is alive.
- Both transmitter covers must be fully engaged to meet explosionproof requirements.
- Before connecting a communicator in an explosive atmosphere, make sure the instruments in the loop are installed according to intrinsically safe or nonincendive field wiring practices.

# Rosemount Model 3051 Smart Pressure Transmitters

Figure B-1. Model 268 Menu Tree.

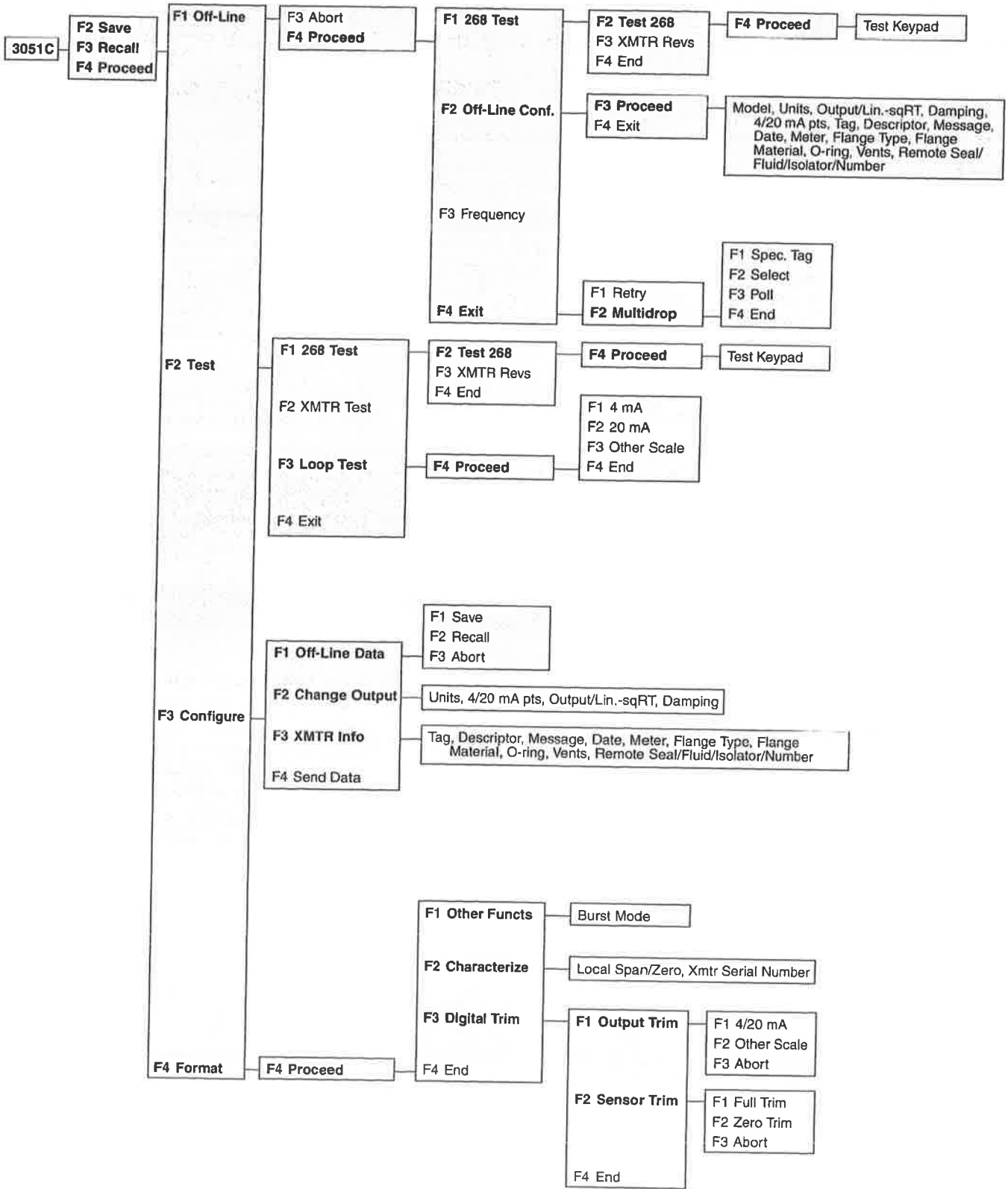


TABLE B-1. Model 268 Fast Key Equivalents.

Function	Model 268 Fast Key Sequence
Analog Output	F3, F2
Analog Output Alarm	Not Applicable
Burst Mode Control	F4, F4, F1
Burst Operation	Not Applicable
Calibration	Not Applicable
Clone Data	F4, F4, F1
Damping	F3, F2, (F1 x 3)
Date	F3, F3, (F1 x 3)
Descriptor	F3, F3, F1
Digital To Analog Trim (4–20 mA Output)	F4, F4, F3
Disable Local Span/Zero Adjustment	F4, F4, F2
Field Device Info	F3, F3
Full Trim	F4, F4, F3, F2, F1
Keypad Input (Trim Points)	F3, F2, F1
Loop Test	F2, F3
Lower Range Value	Process Variable Key, F2
Lower Sensor Trim	F4, F4, F3, F2, F1, F2
Message	F3, F3, F1, F1
Meter Type	F3, F3, (F1 x 4)
Number Of Requested Preambles	Not Applicable
Percent Range	Not Applicable
Poll Address	F1, F4, F4, F2, F3
Pressure	Process Variable Key
Range Values	F3, F2, F1
Rerange	F4, F4, F3, F1, F1
Scaled D/A Trim (4–20 mA Output)	F4, F4, F3, F1, F2
Self Test (Transmitter)	F2, F2
Sensor Info	F3, F3
Sensor Temperature	Process Variable Key, F3
Sensor Trim Points	F3, F2, F1
Status	Not Applicable
Tag	F3, F3
Transfer Function (Setting Output Type)	F3, F2, F1, F1
Transmitter Security (Write Protect)	Not Applicable
Trim Analog Output	F4, F4, F3, F1
Units (Process Variable)	F3, F2
Upper Range Value	Process Variable Key, F2
Upper Sensor Trim	F4, F4, F3, F2, F1, F3
Zero Trim	F4, F4, F3, F2, F2



## CONNECTIONS AND HARDWARE

The Model 268 can communicate with a transmitter from the control room, the transmitter site, or any other wiring termination point in the loop. To communicate, it must be connected in parallel with the transmitter; the connections are non-polarized.

Figure B-2. Bench Hook-up (4–20 mA Transmitters).

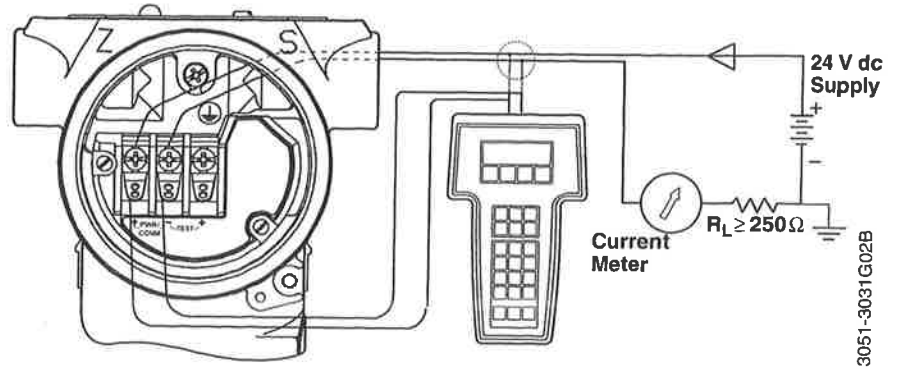


Figure B-3. Bench Hook-up (Low Power Transmitters).

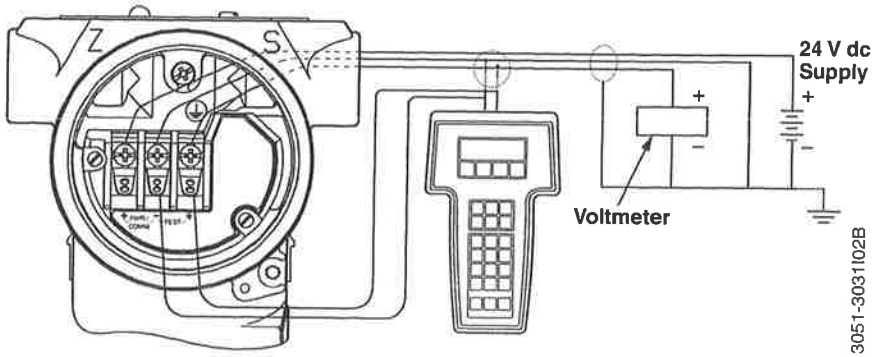


Figure B-4. Field Hook-up  
(4–20 mA Transmitters).

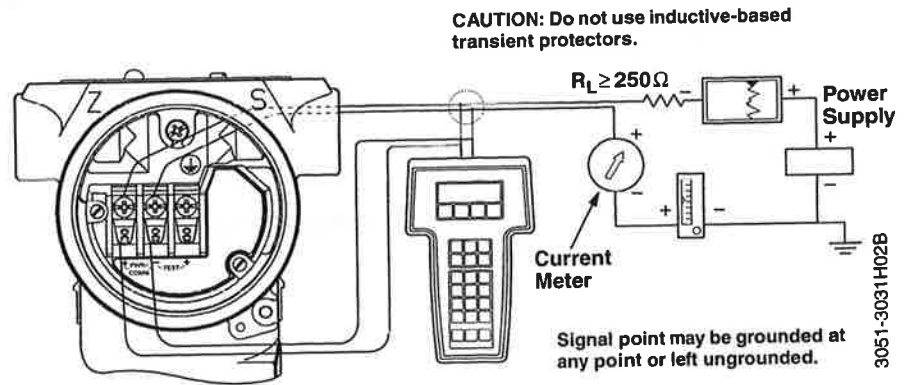
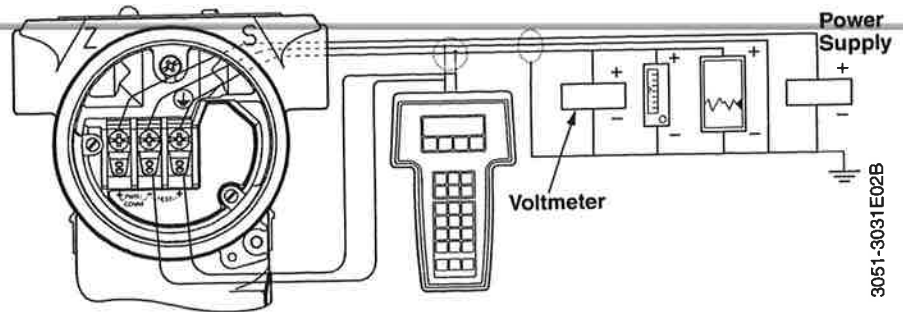


Figure B-5. Field Hook-up  
(Low Power Transmitters).



## COMMUNICATOR KEYS

### Dedicated Keys

The keys of the Model 268 include the alphanumeric, dedicated, and function keys that vary depending on the task being performed. The dedicated key functions are always the same.

#### On/Off

Use this key to turn the unit on and off. When the Model 268 is turned **ON**, it searches for a transmitter in the 4–20 mA loop. If no transmitter is found, the Model 268 offers the opportunity to try again, select **MULTI DROP** or **OFF-LINE**.

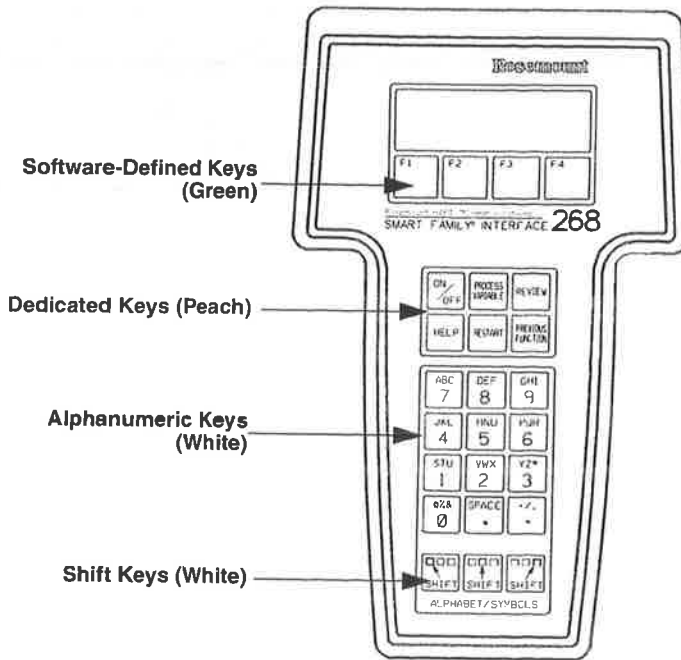
#### Process Variable

Use the **PROCESS VARIABLE** key to display up-to-date process variable readings from the transmitter in engineering units, milliamps, pulse rate, and shedding rate. It also displays totalized flow.

#### Review

The **REVIEW** key allows you to step through all the information currently held in the four memory locations of the transmitter and Model 268—SAFE MEM, OFLN MEM, WORK REG, and XMTR MEM.

Figure B-6. Model 268 Communicator.



268-2681A01C

**Help**

Use the Help key to explain the software-defined key functions (F1-F4) in detail.

**Restart**

Use the Restart key to initiate communication with a transmitter while the Model 268 is still turned on. Upon connection to a new transmitter, pressing this key loads information from the new transmitter into the Model 268 working register.

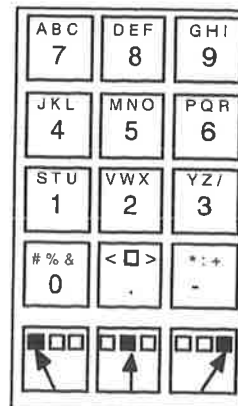
**Previous Function**

The Previous Function key returns you to the previous decision level and allows you to select a different software-defined key function.

**Alphanumeric and Shift Keys**

Some menus require data entry. Use the alphanumeric and shift keys to enter all alphanumeric information into the Model 268.

Figure B-7. Model 268 Communicator Alphanumeric and Shift Keys.



275-0383A

If you press an alphanumeric key alone from within an edit menu, the bold character in the center of the key appears. These characters include the numbers zero through nine, the decimal point (.), and the dash symbol (-).

To enter an alphabetic character, first press the shift key that corresponds to the position of the letter you want on the alphanumeric key. Then press the alphanumeric key. For example, to enter the letter "R," first press the right shift key, then the "6" key (see Figure B-8). Do not press these keys simultaneously, but one after the other.

Figure B-8. Data Entry Key Sequence.



275-0532A  
0343A

### Function Keys

Use the four software-defined function keys, located below the LCD, to perform software functions. On any given menu, the label appearing above a function key indicates the function of that key for the current menu. As you move among menus, different function key labels appear over the four keys.

### Fast Key Sequences

The Model 268 fast key sequences provide quick on-line access to transmitter variables and functions. Instead of stepping your way through the menu structure, you can press a fast key sequence to move from the Home Menu to the desired variable or function. On-screen instructions guide you through the rest of the screens.

### Fast Key Sequence Conventions

The fast key sequences for the Model 268 use the following conventions for their identification:

**F1, F2, F3, F4**—Refer to each function key located directly below the LCD on the Model 268.

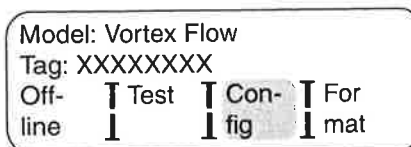
**(F2 x 7)**—Means to push the **F2** key seven consecutive times.

**Process Variable**—Refers to the dedicated key located below the function keys on the Model 268.

To return to the **HOME MENU**, use the function keys to exit the current task and press the **PREVIOUS FUNCTION** key as many times as necessary.

The fast key sequences are applicable only from the **HOME MENU**. The **HOME MENU** lists the model and tag, and labels the four function keys **OFFLINE**, **TEST**, **CONFIGURE** and **FORMAT** (see Figure B-9). After completing a task, return to the Home Menu if you intend to use the fast key sequences. Fast key sequences will not work from any other Model 268 screen.

Figure B-9. Model 268 Home Screen



To return to the **HOME MENU**, use the function keys to exit the current task and press the **PREVIOUS FUNCTION** key as many times as necessary. When the **HOME MENU** appears, you can use another fast key sequence to reach a desired task.

**NOTE**

In order to complete certain tasks, you must first set the loop to manual control. Fast key sequence steps often include the warning to return the loop to manual. If the loop is not in manual control, be sure to watch for this screen. If it comes up during the fast key sequence, set the loop to manual before continuing with the task.

**Fast Key Sequence Example**

**Date**

To change the Date following the menu structure, you would start at the **HOME MENU** and press F3 for *Configure*, F3 for *Xmtr Info*, and F1 three times in a row to reach the *Date* function. The fast key sequence is F3, F3, (F1 x 3).

**Diagnostic Messages**

The following table provides a guide to Model 268 diagnostic messages.

Message	Description
<b>CAUTION— Progressing will clear OfIn Mem</b>	OFLN Memory is cleared for new information.
<b>Data saved in OFLN Mem for downloading</b>	Off-line configuration data are saved in the Off-line Memory and can be downloaded or sent to the flowmeter at an appropriate time.
<b>Different XMTR type connected—XMTR Mem not changed</b>	Flowmeter did not accept data sent because the data is meant for a different type of transmitter.
<b>ERR—Filter Auto Adj</b>	The low pass filter auto-adjust sequence error occurs under the following conditions: <ul style="list-style-type: none"> <li>• no flow in pipe</li> <li>• filter tracking disabled</li> </ul> Remedy conditions and repeat function.
<b>ERR—Not xmtr command</b>	Flowmeter does not understand the command sent by the Model 268. Press F4, RESTART to restart the flowmeter, or press F3 to suppress the error message and REVIEW the software revision level. You may need to contact the Rosemount Service Center.
<b>ERR—Xmtr will not support command</b>	The flowmeter does not understand the Model 268 command. Press F4, RESTART or press F3, REVIEW to review the software revision level of the flowmeter. Check compatibility.
<b>Errors Detected— XMTR Mem not changed</b>	Flowmeter did not accept data because it contained nonpermissible values. Data errors must be corrected and the data sent again.
<b>Making changes permanent— PLEASE WAIT</b>	Data is being sent to flowmeter and flowmeter is accepting the data.
<b>No data modified to send</b>	Data with no changes is being sent. Press F4 to continue.
<b>No data saved in OFLN Mem</b>	There are no data in the Off-line Memory to review.

Message	Description
<b>No data saved in SAFE Mem</b>	There are no data in the Safe Memory to review.
<b>OfIn Mem not compatible with WORK REGS -Data not transferred</b>	The data stored in Off-line Memory and Working Register are from different kinds of transmitters, or the Off-line Memory is empty. Press F4, REVIEW, F2 to see the data in Off-line Memory and connect the Model 268 to similar transmitter.
<b>SAFE Mem from diff Xmtr than WORK REGS-Data not transferred</b>	Data in the Safe Memory and Working Register are from different transmitters. Press F4, REVIEW, F1 and find the flowmeter serial number. Connect the Model 268 to the flowmeter with that serial number and press RESTART.
<b>SAFE Mem not compatible with WORK REGS-Data not transferred</b>	The unique identifier in the Safe Memory and the transmitter are different. Press F4, REVIEW, F1 to see the data in the Safe Memory. Connect the Model 268 to the matching transmitter and press RESTART.
<b>WARN-Used nearest legal table value</b>	The value entered has too many decimal places. The Model 8800 defaults to the closest value available.
<b>WARN-Value entered is illegal, re-enter</b>	The Model 268 will not accept the entered value. Enter an acceptable value (see relevant section in manual).
<b>WARN-Value out of limits, altered by 268, re-check data</b>	The Model 268 could not store the entered value so it changed to the maximum allowable value. Check the new value.
<b>WARNING-Control loop should be in manual</b>	Before sending the data that could affect the 4-20 mA output signal, set the loop to manual control. After it is set, press F4.
<b>WARNING-Data transmission error</b>	Previous communication between Model 268 and the flowmeter was not successful. If this message appears repeatedly, check the loop for a source of noise that could corrupt the signal.
<b>WARNING-Loop may be returned to auto</b>	After completing a communication that required the loop to be set in manual, you may return the loop to automatic control.
<b>WARNING-Match xmtr S/N to nameplate S/N</b>	Check to be sure that the entered flowmeter serial number is the same as that on the flowmeter nameplate.
<b>WARNING-Not on line</b>	The key you have pressed is not applicable for off-line configuration tasks.
<b>WARNING-Process has been aborted</b>	Indicates that the self-test has been aborted by pressing any key.
<b>WARNING-Some of the changes were not saved in the xmtr mem</b>	Flowmeter did not receive all configuration changes. Note differences in configuration data and reconfigure the flowmeter accordingly.
<b>WARNING-This address already being used</b>	Another transmitter is already using the entered multi-drop address. Enter a new address.
<b>WARNING-This will erase work reg</b>	Data in the Working Register will be replaced with data from a another location.

Message	Description
<b>WARNING–Xmtr/ 268 not in communication</b>	Model 268 did not get answer from flowmeter: <ul style="list-style-type: none"> <li>• Check connections</li> <li>• Check that power is reaching flowmeter</li> <li>• Check for minimum 250 ohms resistance in loop</li> </ul>
<b>WARNING–Xmtr in output mode</b>	During start-up and restart, the transmitter milliamp output does not reflect the process variable. Press F4.
<b>WARNING–Xmtr is not communicating</b>	Model 268 did not get answer from flowmeter: <ul style="list-style-type: none"> <li>• Check connections</li> <li>• Check that power is reaching flowmeter</li> <li>• Check for minimum 250 ohms resistance in loop</li> </ul>
<b>WARNING–268 does not know this Xmtr</b>	Model 268 recognizes a Rosemount transmitter in the loop but cannot communicate with it. The message usually indicates a software revision level incompatibility between the Model 268 and the transmitter.
<b>XMTR Mem diff than WORK Regs– XMTR not changed</b>	Data in the Working Register and in the flowmeter have different unique identifiers. The Model 268 was probably connected to different flowmeter without RESTART or power-off/power-on sequence. Press RESTART to erase the Working Register or save the Working Register to the Off-line Memory and download to the proper flowmeter at a later time.
<b>Xmtr still busy</b>	Flowmeter is running a computational or diagnostic routine and cannot respond to the Model 268 instructions. Press the PREVIOUS FUNCTION key to cancel.

# Approval Drawings

## OVERVIEW

Index of intrinsically safe Factory Mutual barrier systems and entity parameters for Models 3051C/L/P/H/T and 3001C/S (Drawing Number 03031-1019, Rev AA), pages C-2 through C-10.

Index of intrinsically safe C.S.A. barrier systems for Models 3051C/L/P/H/T and 3001C/S (Drawing Number 03031-1024, Rev AA), pages C-11 through C-14.

Index of SAA Entity Concept approvals, which are intrinsically safe when used in the circuit with SAA approved barriers that meet the listed entity parameters for Models 3051C/L/P/H/T and 3001C/S (Drawing Number 03031-1026, Rev AA), pages C-15 and C-16.

Index of intrinsically safe barrier systems and entity parameters for the Model 268 SMART FAMILY Interface (Drawing Number 00268-0031, Rev M), pages C-17 through C-23.



CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY	REVISIONS				
	REV	DESCRIPTION	CHG. NO.	APP'D	DATE
	AA	ADD FIELDBUS	RTC1004088	M.L.M.	5/28/98

ENTITY APPROVALS FOR

- |        |        |
|--------|--------|
| 3051C  | 3001C  |
| 3051L  | 3001CL |
| 3051P  | 3001CH |
| 3051H  | 3001S  |
| 3051CA | 3001SL |
| 3051T  | 3001SH |

OUTPUT CODE A (4-20 MA HART) SEE SHEETS 2-4  
 OUTPUT CODE M (LOW POWER) SEE SHEETS 5-6  
 OUTPUT CODE F (FIELDBUS) SEE SHEETS 7-9

THE ROSEMOUNT TRANSMITTERS LISTED ABOVE ARE F.M. APPROVED AS INTRINSICALLY SAFE WHEN USED IN CIRCUIT WITH F.M. APPROVED BARRIERS WHICH MEET THE ENTITY PARAMETERS LISTED IN THE CLASS I, II, AND III, DIVISION 1 GROUPS INDICATED. TEMP CODE T4. ADDITIONALLY, THE ROSEMOUNT 751 FIELD SIGNAL INDICATOR FSM, APPROVED AS INTRINSICALLY SAFE WHEN CONNECTED IN CIRCUIT WITH ROSEMOUNT TRANSMITTERS (FROM ABOVE) AND F.M. APPROVED BARRIERS WHICH MEET THE ENTITY PARAMETERS LISTED FOR CLASS I, II, AND III, DIVISION 1, GROUPS INDICATED, TEMP CODE T4.

TO ASSURE AN INTRINSICALLY SAFE SYSTEM, THE TRANSMITTER AND BARRIER MUST BE WIRED IN ACCORDANCE WITH THE BARRIER MANUFACTURER'S FIELD WIRING INSTRUCTIONS AND THE APPLICABLE CIRCUIT DIAGRAM.

CAD Maintained, (MICROSTATION).

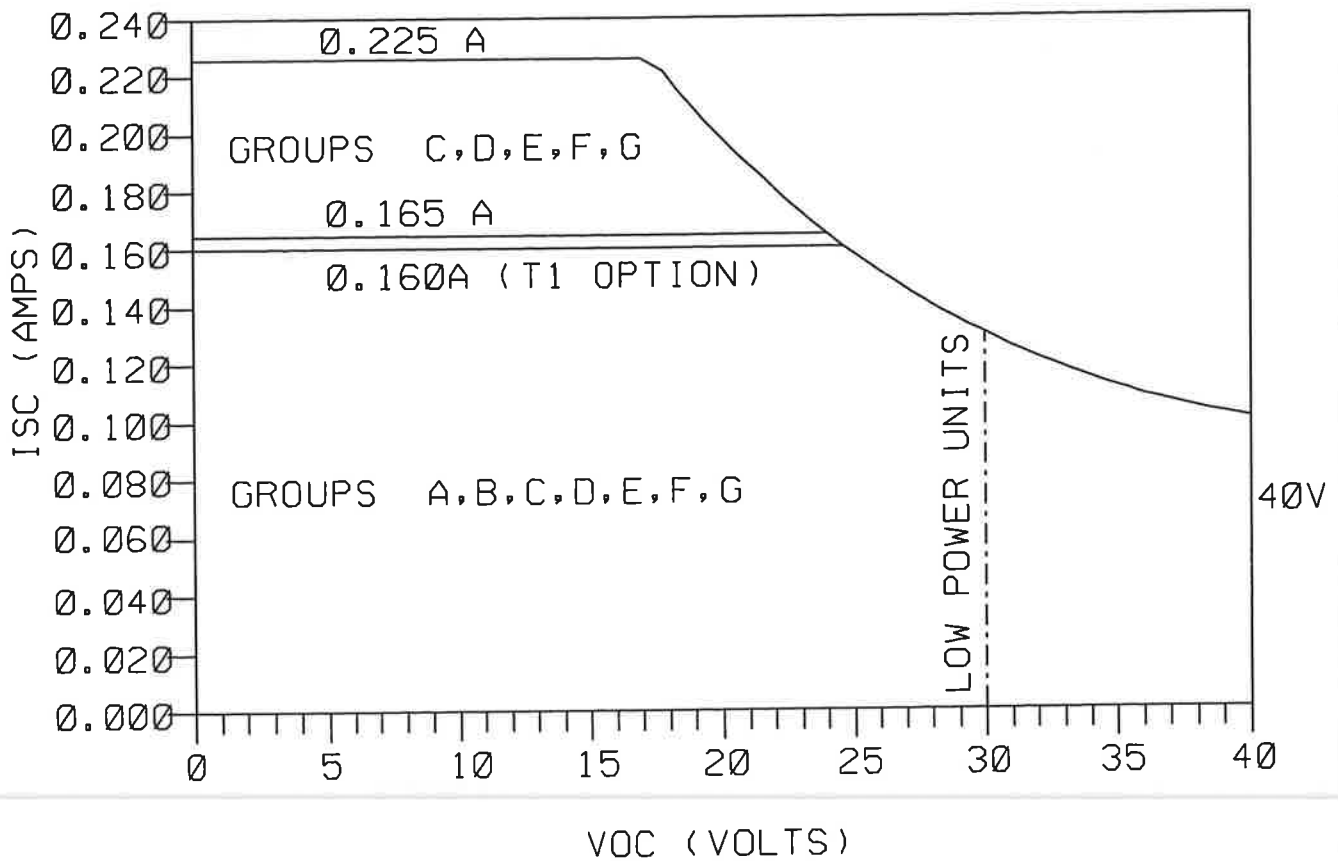
UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125	CONTRACT NO.	<b>ROSEMOUNT MEASUREMENT</b>		ROSEMOUNT INC. 12001 TECHNOLOGY DRIVE EDEN PRAIRIE, MN 55344 USA
	DR. <b>MIKE DOBE</b> 03/21/89	FISHER-ROSEMOUNT		
	CHK'D	TITLE		
	APP'D. <b>KELLY ORTH</b> 03/22/89	INDEX OF I.S. F.M. FOR 3051C/L/P/H/T & 3001C/S		
-TOLERANCE- .X . .1 [2.5] .XX . .02 [0.5] .XXX . .010 [0.25]	APP'D. GOVT.	SIZE A	FSCM NO	DWG NO. 03031-1019
FRACTIONS      ANGLES . 1/32              . 2°		SCALE N/A	WT.	SHEET 1 OF 9
DO NOT SCALE PRINT				

1019A01A

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004088		

BARRIER PARAMETERS (APPLICABLE TO OUTPUT CODES A & M)

P<sub>MAX</sub> = 1WATT



ROSEMOUNT INC.  
 12001 TECHNOLOGY DRIVE  
 EDEN PRAIRIE, MN 55344 USA

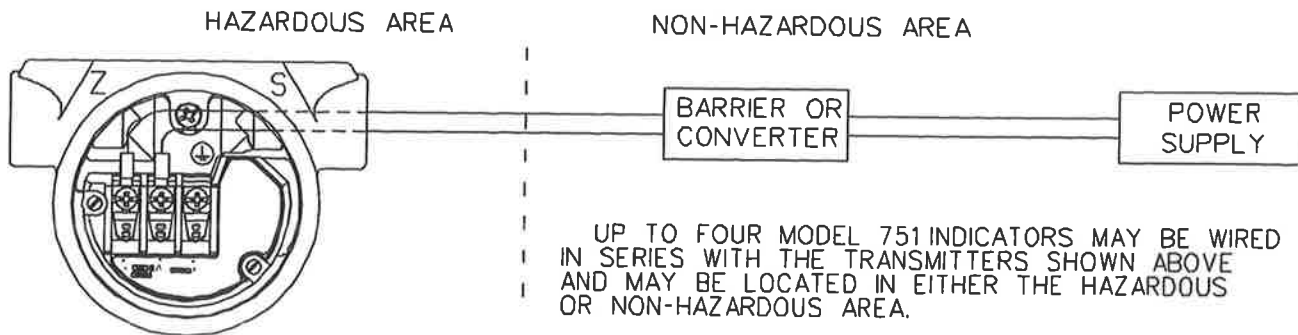
CAD Maintained, (MICROSTATION).

DR. <b>MIKE DOBE</b>	SIZE A	FSCM NO	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT.	SHEET 2 OF 9

1019A02A

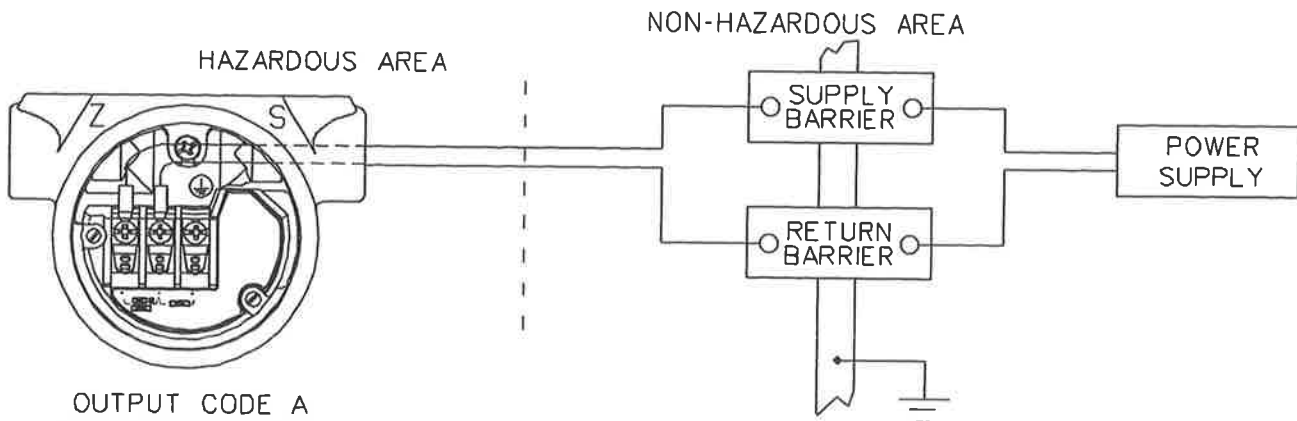
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004088		

CIRCUIT DIAGRAM 1  
ONE BARRIER OR CONVERTER:  
SINGLE OR DUAL CHANNEL



OUTPUT CODE A  
MODELS INCLUDED  
3051C, L, P, H, T, CA  
3001C, CL, CH, S, SL, SH

CIRCUIT DIAGRAM 2  
SUPPLY AND RETURN BARRIERS  
(ONLY FOR USE WITH BARRIERS APPROVED IN THIS CONFIGURATION)



OUTPUT CODE A  
MODELS INCLUDED  
3051C, L, P, H, T, CA  
3001C, CL, CH, S, SL, SH

ROSEMOUNT INC.  
12001 TECHNOLOGY DRIVE  
EDEN PRAIRIE, MN 55344 USA

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DR.	<b>MIKE DOBE</b>	SIZE	A	FSCM NO		DWG NO.	03031-1019
ISSUED		SCALE	N/A	WT.		SHEET	3 OF 9



1019A03A

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004088		

ENTITY CONCEPT APPROVALS

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAX. OPEN CIRCUIT VOLTAGE (VOC OR VT) AND MAX. SHORT CIRCUIT CURRENT (ISC OR IT) AND MAX. POWER (VOC X ISC/4) OR (VT X IT/4), FOR THE ASSOCIATED APPARATUS MUST BE LESS THAN OR EQUAL TO THE MAXIMUM SAFE INPUT VOLTAGE (VMAX), MAXIMUM SAFE INPUT CURRENT (IMAX), AND MAXIMUM SAFE INPUT POWER (PMAX) OF THE INTRINSICALLY SAFE APPARATUS. IN ADDITION, THE APPROVED MAX. ALLOWABLE CONNECTED CAPACITANCE (CA) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE CAPACITANCE AND THE UNPROTECTED INTERNAL CAPACITANCE (CI) OF THE INTRINSICALLY SAFE APPARATUS. AND THE APPROVED MAX. ALLOWABLE CONNECTED INDUCTANCE (LA) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE INDUCTANCE AND THE UNPROTECTED INTERNAL INDUCTANCE (LI) OF THE INTRINSICALLY SAFE APPARATUS.

FOR OUTPUT CODE A NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.

CLASS I, DIV. 1, GROUPS A AND B

$V_{MAX} = 40V$	$V_T$ OR $V_{OC}$ IS LESS THAN OR EQUAL TO 40V
$I_{MAX} = 165MA$	$I_T$ OR $I_{SC}$ IS LESS THAN OR EQUAL TO 165MA
$P_{MAX} = 1 \text{ WATT}$	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
$C_I = .01\mu F$	$C_A$ IS GREATER THAN $.01\mu F$
$L_I = 10\mu H$	$L_A$ IS GREATER THAN $10\mu H$

\* FOR T1 OPTION:

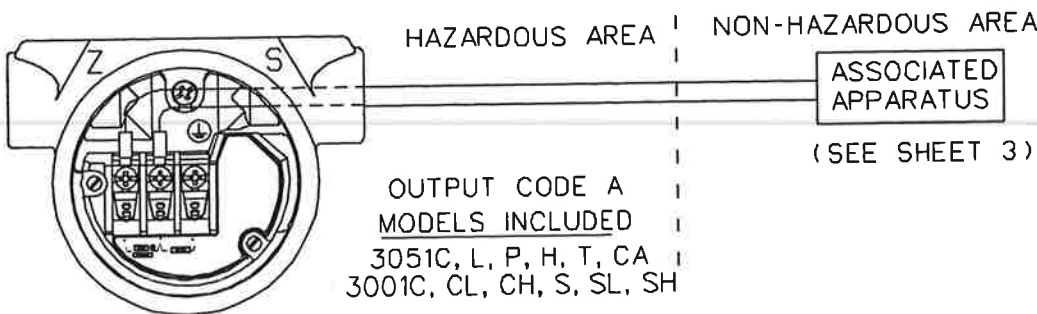
$I_{MAX} = 160MA$	$I_T$ OR $I_{SC}$ IS LESS THAN OR EQUAL TO 160MA
$L_I = 1.05MH$	$L_A$ IS GREATER THAN 1.05MH

CLASS I, DIV. 1, GROUPS C AND D

$V_{MAX} = 40V$	$V_T$ OR $V_{OC}$ IS LESS THAN OR EQUAL TO 40V
$I_{MAX} = 225MA$	$I_T$ OR $I_{SC}$ IS LESS THAN OR EQUAL TO 225MA
$P_{MAX} = 1 \text{ WATT}$	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
$C_I = .01\mu F$	$C_A$ IS GREATER THAN $.01\mu F$
$L_I = 10\mu H$	$L_A$ IS GREATER THAN $10\mu H$

\* FOR T1 OPTION:

$L_I = 1.05MH$	$L_A$ IS GREATER THAN 1.05MH
----------------	------------------------------



ROSEMOUNT INC. 12001 TECHNOLOGY DRIVE EDEN PRAIRIE, MN 55344 USA		CAD Maintained, (MICROSTATION).		
DR. <b>MIKE DOBE</b>	SIZE <b>A</b>	FSCM NO	DWG NO. <b>03031-1019</b>	
ISSUED	SCALE <b>N/A</b>	WT.	SHEET <b>4 OF 9</b>	

1019A04A

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004088		

FOR OUTPUT CODE M

CLASS I, DIV. 1, GROUPS A AND B

$V_{MAX} = 30V$	$V_T$ OR $V_{OC}$ IS LESS THAN OR EQUAL TO 30V
$I_{MAX} = 165MA$	$I_T$ OR $I_{SC}$ IS LESS THAN OR EQUAL TO 165MA
$P_{MAX} = 1 \text{ WATT}$	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
$C_I = .042\mu F$	$C_A$ IS GREATER THAN $.042\mu F$
$L_I = 10\mu H$	$L_A$ IS GREATER THAN $10\mu H$

\*

FOR T1 OPTION:

$L_I = 0.75MH$	$L_A$ IS GREATER THAN $0.75MH$
----------------	--------------------------------

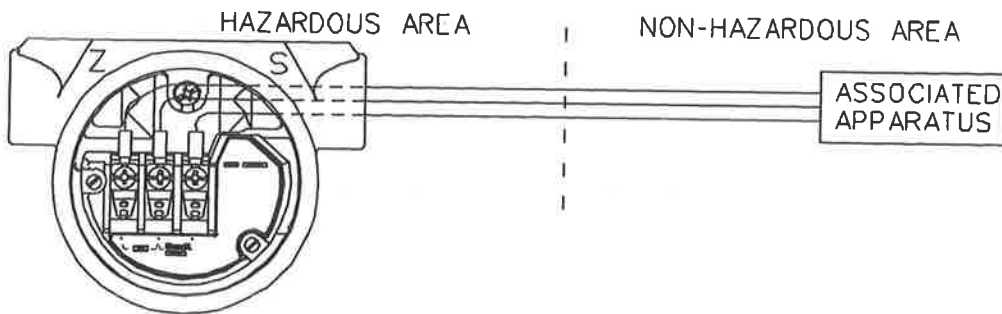
CLASS I, DIV. 1, GROUPS C AND D

$V_{MAX} = 30V$	$V_T$ OR $V_{OC}$ IS LESS THAN OR EQUAL TO 30V
$I_{MAX} = 225MA$	$I_T$ OR $I_{SC}$ IS LESS THAN OR EQUAL TO 225MA
$P_{MAX} = 1 \text{ WATT}$	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
$C_I = .042\mu F$	$C_A$ IS GREATER THAN $.042\mu F$
$L_I = 10\mu H$	$L_A$ IS GREATER THAN $10\mu H$

\*

FOR T1 OPTION:

$L_I = 0.75MH$	$L_A$ IS GREATER THAN $0.75MH$
----------------	--------------------------------



OUTPUT CODE M  
AVAILABLE FOR THE MODELS LISTED

3051C	3051H
3051L	3051CA
3051P	3051T

ROSEMOUNT INC. 12001 TECHNOLOGY DRIVE EDEN PRAIRIE, MN 55344 USA	
DR.	<b>MIKE DOBE</b>
ISSUED	

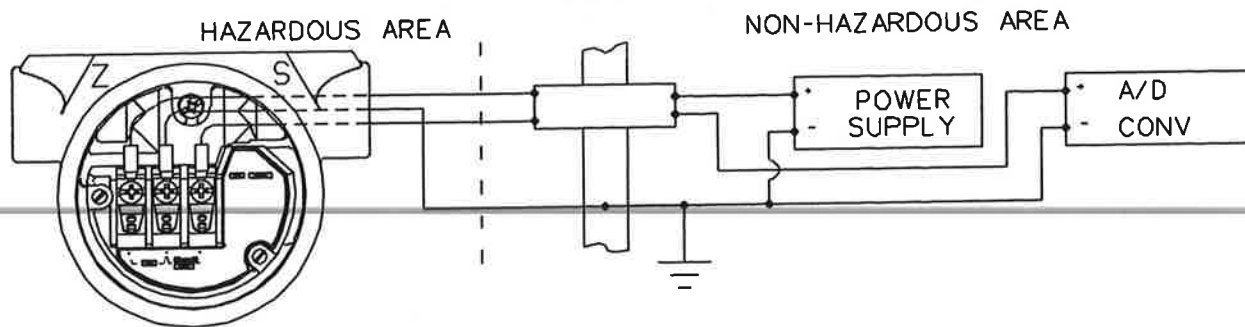
CAD Maintained, (MICROSTATION).		
SIZE	FSCM NO	DWG NO.
A		03031-1019
SCALE	N/A	WT.
		SHEET 5 OF 9



1019A05A

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004088		

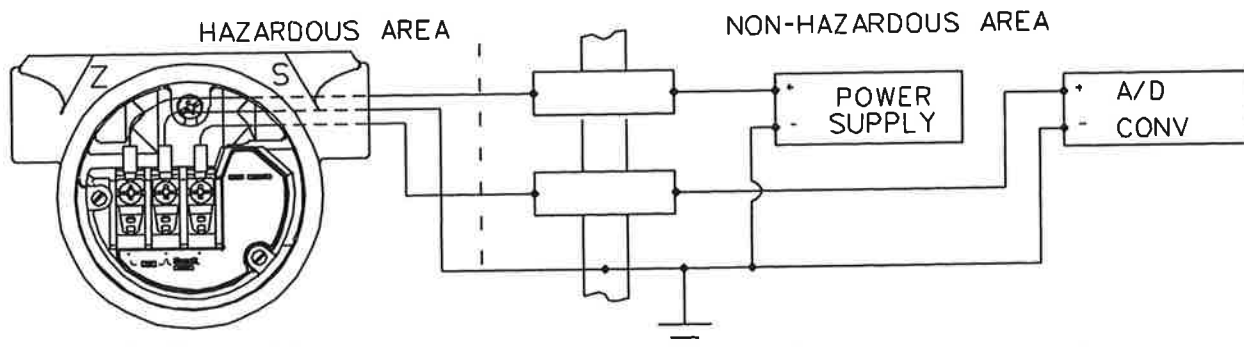
CIRCUIT DIAGRAM 3  
ONE DUAL CHANNEL BARRIER



OUTPUT CODE M  
AVAILABLE FOR THE MODELS LISTED

3051C	3051H
3051L	3051CA
3051P	3051T

CIRCUIT DIAGRAM 4  
TWO SINGLE CHANNEL BARRIERS  
(ONLY FOR USE WITH BARRIERS APPROVED  
IN THIS CONFIGURATION)



OUTPUT CODE M  
AVAILABLE FOR THE MODELS LISTED

3051C	3051H
3051L	3051CA
3051P	3051T

ROSEMOUNT INC. 12001 TECHNOLOGY DRIVE EDEN PRAIRIE, MN 55344 USA	
DR.	<b>SANDI MANSON</b>
ISSUED	

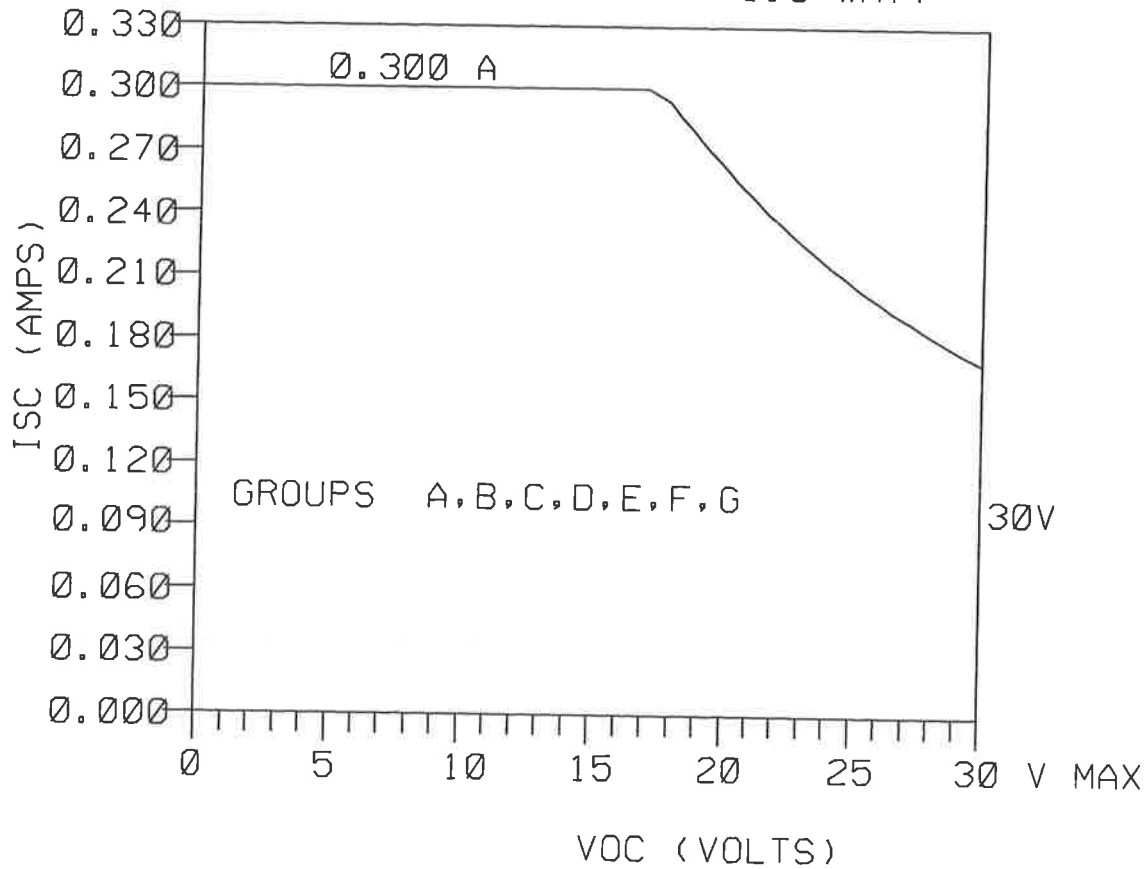
SIZE	FSCM NO	DWG NO.	CAD Maintained, (MICROSTATION).	
A		03031-1019		
SCALE	N/A	WT.	SHEET	6 OF 9

1019A06A

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004088		

3051 WITH FOUNDATION FIELDBUS.  
(OUTPUT CODE F)

BARRIER PARAMETERS (APPLICABLE TO OUTPUT CODE F)  
P<sub>MAX</sub> = 1.3 WATT



ROSEMOUNT INC.  
12001 TECHNOLOGY DRIVE  
EDEN PRAIRIE, MN 55344 USA

DR. **Myles Lee Miller**  
ISSUED

SIZE  
A

FSCM NO  
SCALE N/A WT.

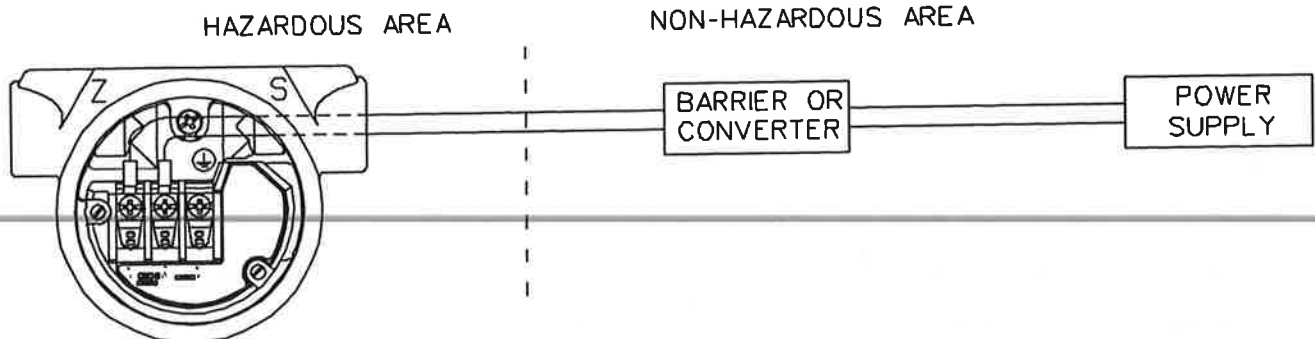
CAD Maintained, (MICROSTATION).  
DWG NO. 03031-1019  
SHEET 7 OF 9



1019A07A

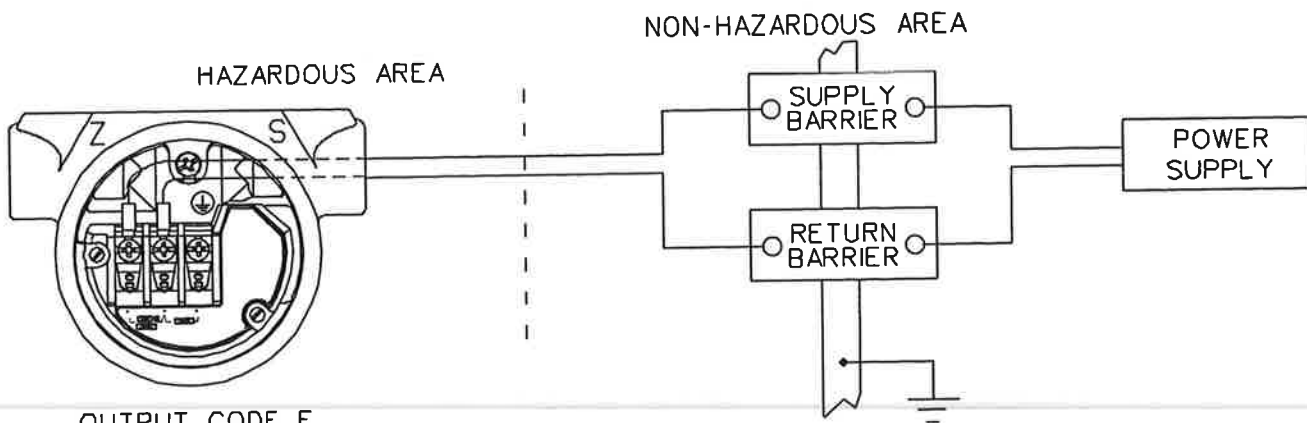
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004088		

CIRCUIT DIAGRAM 1  
ONE BARRIER OR CONVERTER:  
SINGLE OR DUAL CHANNEL



OUTPUT CODE F  
MODELS INCLUDED  
3051C, L, P, H, T, CA  
3001C, CL, CH

CIRCUIT DIAGRAM 2  
SUPPLY AND RETURN BARRIERS  
(ONLY FOR USE WITH BARRIERS APPROVED IN THIS CONFIGURATION)



OUTPUT CODE F  
MODELS INCLUDED  
3051C, L, P, H, T, CA  
3001C, CL, CH

ROSEMOUNT INC.  
12001 TECHNOLOGY DRIVE  
EDEN PRAIRIE, MN 55344 USA

DR. **Myles Lee Miller**

ISSUED

SIZE		FSCM NO		DWG NO.	
A				03031-1019	
SCALE	N/A	WT.		SHEET	8 OF 9

CAD Maintained, (MICROSTATION).



1019A08A



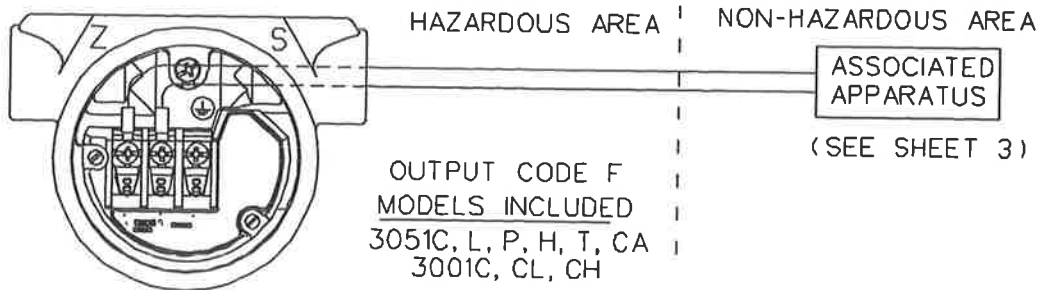
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004088		

ENTITY CONCEPT APPROVALS

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAX. OPEN CIRCUIT VOLTAGE ( $V_{OC}$  OR  $V_T$ ) AND MAX. SHORT CIRCUIT CURRENT ( $I_{SC}$  OR  $I_T$ ) AND MAX. POWER ( $V_{OC} \times I_{SC}/4$ ) OR ( $V_T \times I_T/4$ ), FOR THE ASSOCIATED APPARATUS MUST BE LESS THAN OR EQUAL TO THE MAXIMUM SAFE INPUT VOLTAGE ( $V_{MAX}$ ), MAXIMUM SAFE INPUT CURRENT ( $I_{MAX}$ ), AND MAXIMUM SAFE INPUT POWER ( $P_{MAX}$ ) OF THE INTRINSICALLY SAFE APPARATUS. IN ADDITION, THE APPROVED MAX. ALLOWABLE CONNECTED CAPACITANCE ( $C_A$ ) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE CAPACITANCE AND THE UNPROTECTED INTERNAL CAPACITANCE ( $C_I$ ) OF THE INTRINSICALLY SAFE APPARATUS, AND THE APPROVED MAX. ALLOWABLE CONNECTED INDUCTANCE ( $L_A$ ) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE INDUCTANCE AND THE UNPROTECTED INTERNAL INDUCTANCE ( $L_I$ ) OF THE INTRINSICALLY SAFE APPARATUS.

FOR OUTPUT CODE F NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.  
CLASS I, DIV. 1, GROUPS A, B, C AND D

$V_{MAX} = 30V$	$V_T$ OR $V_{OC}$ IS LESS THAN OR EQUAL TO 30V
$I_{MAX} = 300MA$	$I_T$ OR $I_{SC}$ IS LESS THAN OR EQUAL TO 300MA
$P_{MAX} = 1.3 \text{ WATT}$	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1.3 WATT
$C_I = 0\mu F$	$C_A$ IS GREATER THAN $0\mu F$
$L_I = 0\mu H$	$L_A$ IS GREATER THAN $0\mu H$



ROSEMOUNT INC.  
12001 TECHNOLOGY DRIVE  
EDEN PRAIRIE, MN 55344 USA

DR. **Myles Lee Miller**

ISSUED

SIZE	FSCM NO	DWG NO.	CAD Maintained, (MICROSTATION).	
A		03031-1019		
SCALE	N/A	WT.	SHEET	9 OF 9



CONFIDENTIAL AND PROPRIETARY  
INFORMATION IS CONTAINED  
HEREIN AND MUST BE  
HANDLED ACCORDINGLY

REVISIONS

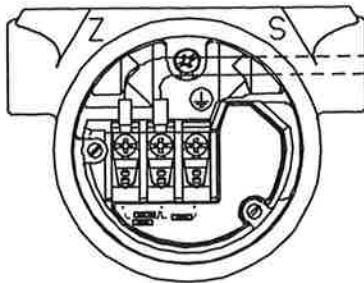
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA	ADD FIELDBUS	RTC1004232	M.L.M.	5/28/98

CSA INTRINSIC SAFETY APPROVALS  
CIRCUIT CONNECTION WITH BARRIER OR CONVERTER

Ex ia  
INTRINSICALLY SAFE/SECURITE INTRINSEQUE  
4-20 mA, ("A" OUTPUT CODE)

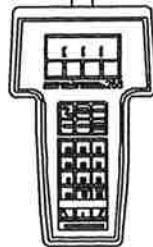
HAZARDOUS AREA

NON-HAZARDOUS AREA



ROSEMOUNT \*\*  
MODELS INCLUDED  
[WITH OR WITHOUT T1  
(TRANSIENT PROTECTION) OPTION]

3051C, L, P, H, T, CA  
3001C, CL, CH, S, SL, SH



ROSEMOUNT  
MODEL 268 or 275 SMART  
FAMILY INTERFACE

BARRIER OR  
CONVERTER

WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS  
MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.

AVERTISSEMENT - RISQUE D'EXPLOSION - LA SUBSTITUTION DE COMPOSANTS  
PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS  
DE CLASSE 1, DIVISION 2.

\*\* FOR THE LOW POWER OPTION, SEE PAGE 3 FOR THE CIRCUIT  
CONNECTION WITH BARRIER OR CONVERTER. FOR FIELDBUS ("F" OUTPUT CODE),  
SEE PAGE 4 FOR PARAMETERS AND CIRCUIT CONNECTION TO BARRIER.

CAD Maintained, (MICROSTATION).

UNLESS OTHERWISE SPECIFIED  
DIMENSIONS IN INCHES (mm)  
REMOVE ALL BURRS AND  
SHARP EDGES. MACHINE  
SURFACE FINISH 125

-TOLERANCE-

.X = .1 [2.5]

.XX = .02 [0.5]

.XXX = .010 [0.25]

FRACTIONS

ANGLES

• 1/32

• 2°

DO NOT SCALE PRINT

CONTRACT NO.

DR.

Mike Dobe 08/27/90

CHK'D

APP'D. GLEN MONZO 8/31/90

APP'D. GOVT.

ROSEMOUNT MEASUREMENT

FISHER ROSEMOUNT

ROSEMOUNT INC.  
12001 TECHNOLOGY DRIVE  
EDEN PRAIRIE, MN 55344 USA

TITLE

INDEX OF I.S. CSA FOR  
3051C/L/P/H/T & 3001C/S

SIZE

FSCM NO

DWG NO.

A

03031-1024

SCALE

N/A

WT.

SHEET 1 OF 4

1024A01A

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004232		

4-20 MA, ("A" OUTPUT CODE)

DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV.1
CSA APPROVED SAFETY BARRIER	30 V OR LESS * 330 OHMS OR MORE * 28 V OR LESS * 300 OHMS OR MORE 25 V OR LESS 200 OHMS OR MORE * 22 V OR LESS * 180 OHMS OR MORE	GROUPS A, B, C, D
FOXBORO CONVERTER 2A1-12V-CGB, 2A1-13V-CGB, 2AS-131-CGB, 3A2-12D-CGB, 3A2-13D-CGB, 3AD-131-CGB, 3A4-12D-CGB, 2AS-121-CGB, 3F4-12DA		GROUPS B, C, D
CSA APPROVED SAFETY BARRIER	30 V OR LESS 150 OHMS OR MORE	GROUPS C, D

LOW POWER, ("M" OUTPUT CODE)

DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV.1
CSA APPROVED SAFETY BARRIER	SUPPLY $\leq 28V \geq$ 300 \\ RETURN $\leq 10V \geq$ 47 \	GROUPS A, B, C, D
	SUPPLY $\leq 30V \geq$ 150 \\ RETURN $\leq 10V \geq$ 47 \	GROUPS C, D

\* MAY BE USED WITH ROSEMOUNT MODEL 268 or 275 SMART FAMILY INTERFACE.

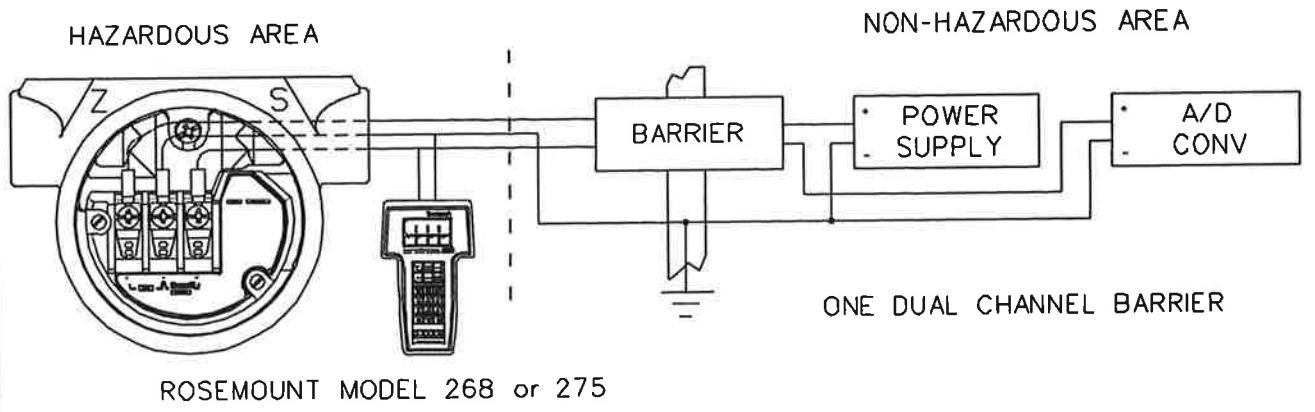
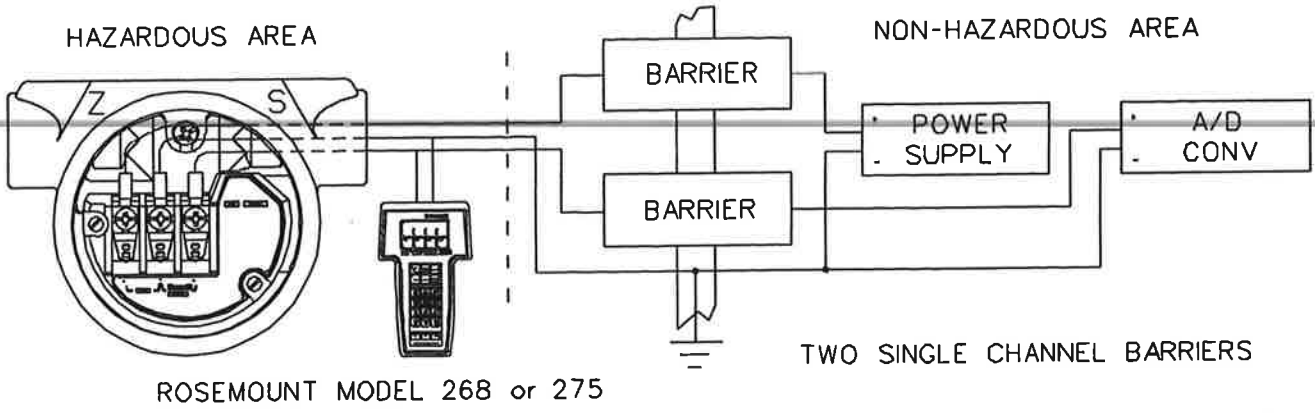
ROSEMOUNT INC. 12001 TECHNOLOGY DRIVE EDEN PRATRIE, MN 55344 USA		CAD Maintained, (MICROSTATION).		
DR. <b>Mike Dobe</b>	SIZE A	FSCM NO.	DWG NO.	03031-1024
ISSUED	SCALE N/A	WT.	SHEET 2 OF 4	

1024A02A

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004232		

CSA INTRINSIC SAFETY APPROVALS  
 3051C LOW POWER CIRCUIT CONNECTION WITH INTRINSIC SAFETY BARRIERS

Ex ia  
 INTRINSICALLY SAFE/SECURITE INTRINSEQUE  
 LOWPOWER, ("M" OUTPUT CODE)



APPROVED FOR CLASS 1, DIVISION 1, GROUPS A,B,C,D WHEN USED IN CIRCUIT WITH TWO CSA APPROVED SINGLE CHANNEL SAFETY BARRIERS, ONE WITH APPROVED SAFETY PARAMETERS OF 28 VOLTS OR LESS AND 300 OHMS OR MORE IN +PWR LINE, AND ONE WITH APPROVED SAFETY PARAMETERS OF 10 VOLTS OR LESS AND 47 OHMS OR MORE IN Vout LINE, OR ONE CSA APPROVED DUAL CHANNEL SAFETY BARRIER WITH IDENTICAL APPROVED SAFETY PARAMETERS CONNECTED IN LIKE MANNER, AS ABOVE.

APPROVED FOR CLASS 1, DIVISION 1, GROUPS C,D WHEN USED IN CIRCUIT WITH TWO CSA APPROVED SINGLE CHANNEL SAFETY BARRIERS, ONE WITH APPROVED SAFETY PARAMETERS OF 30 VOLTS OR LESS AND 150 OHMS OR MORE IN +PWR LINE AND ONE WITH APPROVED SAFETY PARAMETERS OF 10 VOLTS OR LESS AND 47 OHMS OR MORE IN Vout LINE.

ROSEMOUNT INC. 12001 TECHNOLOGY DRIVE EDEN PRAIRIE, MN 55344 USA		CAD Maintained, (MICROSTATION).		
DR.	<b>SANDI MANSON</b>	SIZE A	FSCM NO	DWG NO. 03031-1024
ISSUED		SCALE N/A	WT. ———	SHEET 3 OF 4

1024A03A

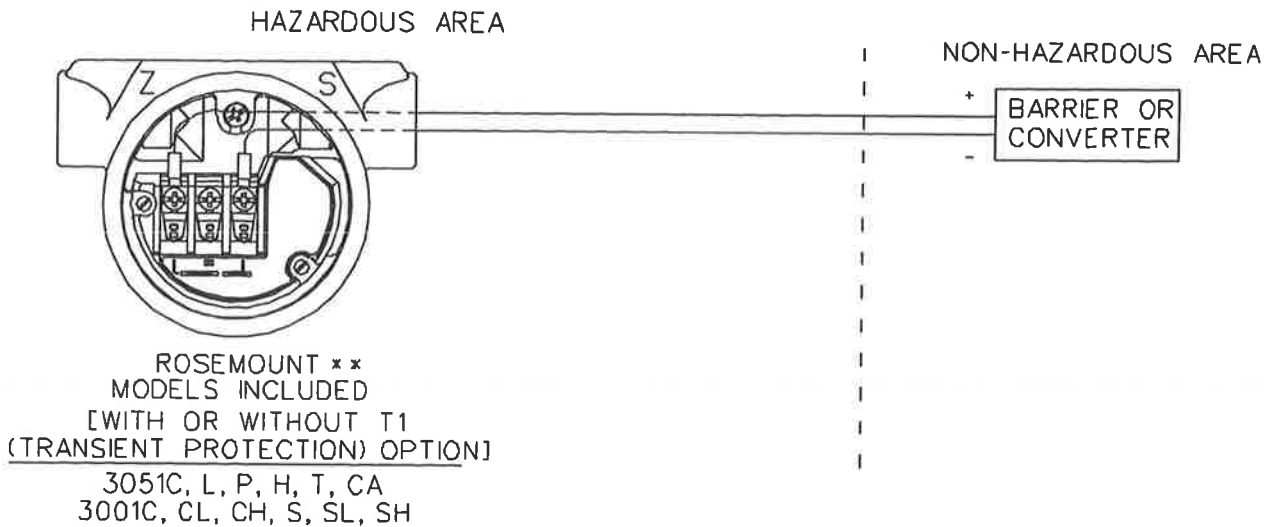
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004232		

FIELD BUS, ("F" OUTPUT CODE)

DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV.1
CSA APPROVED SAFETY BARRIER	30 V OR LESS	GROUPS A, B, C, D
	300 OHMS OR MORE	
	28 V OR LESS	
	235 OHMS OR MORE	
	25 V OR LESS	
	160 OHMS OR MORE	
	22 V OR LESS	
	100 OHMS OR MORE	

CSA INTRINSIC SAFETY APPROVALS  
CIRCUIT CONNECTION WITH BARRIER OR CONVERTER

Ex ia  
INTRINSICALLY SAFE/SECURITE INTRINSEQUE  
FIELD BUS, ("F" OUTPUT CODE)



WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS  
MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.

AVERTISSEMENT - RISQUE D'EXPLOSION - LA SUBSTITUTION DE COMPOSANTS  
PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS  
DE CLASSE I, DIVISION 2.

ROSEMOUNT INC. 12001 TECHNOLOGY DRIVE EDEN PRAIRIE, MN 55344 USA		CAD Maintained, (MICROSTATION).		
DR.	<b>Myles Lee Miller</b>	SIZE A	FSCM NO	DWG NO. 03031-1024
ISSUED		SCALE N/A	WT.	SHEET 4 OF 4



1024A04A

CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY

REVISIONS

REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA	UPDATE ENTITY PARAMETERS	RTC1002910	J.D.J.	12/2/97

SAA ENTITY CONCEPT APPROVALS

THE ROSEMOUNT PRESSURE TRANSMITTERS LISTED BELOW ARE INTRINSICALLY SAFE WHEN USED IN THE CIRCUIT WITH SAA APPROVED BARRIERS WHICH MEET THE LISTED ENTITY PARAMETERS.

APPROVED TRANSMITTERS \*

3051C 3051H 3001C 3001S  
 3051L 3051T 3001CL3001SL  
 3051P 3051CA 3001CH3001SH

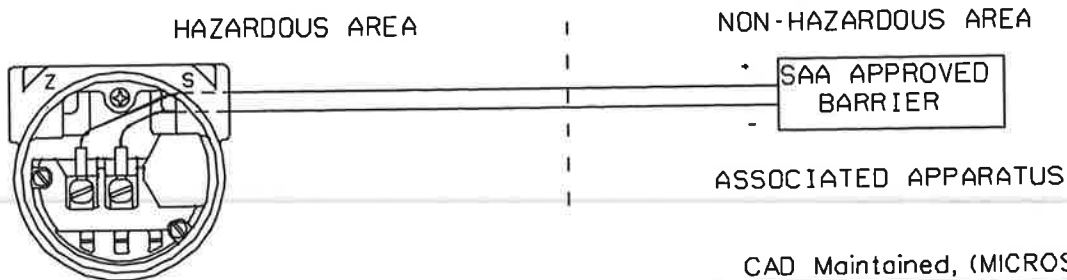
\* SEE SHEET 2 FOR LOW POWER CONFIGURATION.

ENTITY PARAMETER FOR EX IA IIC T6 CLASS I, ZONE 0 PROTECTION:

APPARATUS PARAMETER	BARRIER PARAMETER
VMAX - 30V IMAX - 200MA PMAX - 0.9W	VOC IS LESS THAN OR EQUAL TO 30V ISC IS LESS THAN OR EQUAL TO 200MA $\frac{VOC * ISC}{4}$ IS LESS THAN OR EQUAL TO 0.9W
CI - 0.01μ F LI - 10μH FOR T1 OPTION ONLY	CA IS GREATER THAN 0.01 MICROFARADS LA IS GREATER THAN 10 MICROHENRIES
IMAX = 160MA LI = 1.05MH	ISC IS LESS THAN OR EQUAL TO 160MA LA IS GREATER THAN 1.05 MILLIHENRIES

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM.

TO ASSURE AN INTRINSICALLY SAFE SYSTEM THE TRANSMITTER AND BARRIER MUST BE WIRED IN ACCORDANCE WITH THE BARRIER MANUFACTURERS FIELD WIRING INSTRUCTIONS AND THE CIRCUIT DIAGRAM SHOWN BELOW.



CAD Maintained, (MICROSTATION).

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES (mm). REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125

-TOLERANCE-

.X - .1 [2.5]  
 .XX - .02 [0.5]  
 .XXX - .010 [0.25]

FRACTIONS ANGLES  
 1/32 2°

DO NOT SCALE PRINT

CONTRACT NO.	
DR. <b>Mike Dobe</b>	12/30/91
CHK'D	
APP'D. <b>GLEN MONZO</b>	5/8/92
APP'D. GOVT.	

**ROSEMOUNT MEASUREMENT**  
 FISHER-ROSEMOUNT

ROSEMOUNT INC.  
 12001 TECHNOLOGY DRIVE  
 EDEN PRAIRIE, MN 55344 USA

TITLE SAA I.S. INDEX FOR 3051 & 3001			
SIZE A	FSCM NO.	DWG NO. 03031-1026	
SCALE N/A	WT.	SHEET 1 OF 2	

1026A01A

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1002910		

### SAA ENTITY CONCEPT APPROVALS

THE ROSEMOUNT LOW POWER CONFIGURED PRESSURE TRANSMITTERS LISTED BELOW ARE SAA APPROVED AS INTRINSICALLY SAFE WHEN USED IN THE CIRCUIT WITH SAA APPROVED BARRIERS WHICH MEET THE LISTED ENTITY PARAMETERS.

#### APPROVED TRANSMITTERS WITH LOW POWER CONFIGURATION

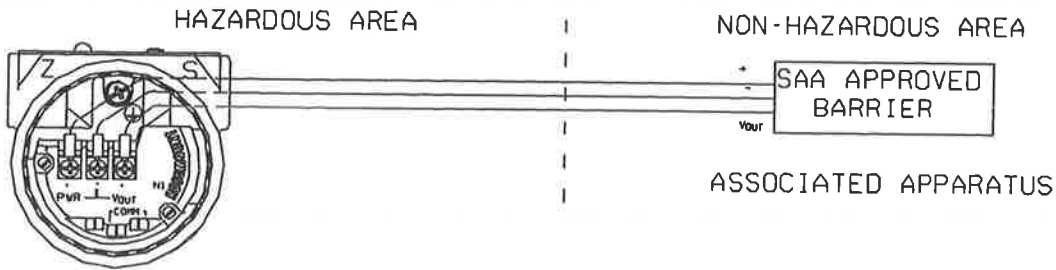
- 3051C      3051T
- 3051L      3051CA
- 3051P
- 3051H

ENTITY PARAMETER FOR EX IA IIC T6 CLASS I, ZONE 0 PROTECTION:

APPARATUS PARAMETER	BARRIER PARAMETER
VMAX = 30V	VOC IS LESS THAN OR EQUAL TO 30V
IMAX = 200MA	ISC IS LESS THAN OR EQUAL TO 200MA
PMAX = 0.9W	$\frac{VOC \times ISC}{4}$ IS LESS THAN OR EQUAL TO 0.9W
CI = 0.042 F	CA IS GREATER THAN 0.042 MICROFARADS
LI = 10μH	LA IS GREATER THAN 10 MICROHENRIES
FOR T1 OPTION ONLY	
LI = 0.75MH	LA IS GREATER THAN 0.75 MILLIHENRIES

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM.

TO ASSURE AN INTRINSICALLY SAFE SYSTEM THE TRANSMITTER AND BARRIER MUST BE WIRED IN ACCORDANCE WITH THE BARRIER MANUFACTURERS FIELD WIRING INSTRUCTIONS AND THE CIRCUIT DIAGRAM SHOWN BELOW.



ROSEMOUNT INC.  
12001 TECHNOLOGY DRIVE  
EDEN PRAIRIE, MN 55344 USA

CAD Maintained, (MICROSTATION).

DR. <b>Mike Dobe</b>	SIZE <b>A</b>	FSCM NO	DWG NO. <b>03031-1026</b>
ISSUED	SCALE <b>N/A</b>	WT.	SHEET <b>2 OF 2</b>

1026A02A

CONFIDENTIAL AND PROPRIETARY  
INFORMATION IS CONTAINED  
HEREIN AND MUST BE  
HANDLED ACCORDINGLY

REVISIONS

REV	DESCRIPTION	CHG. NO.	APP'D	DATE
G	ADD SHT 4&5. DELETE CLASS II & I	I. 636328	<b>B.S.J.</b>	08/01/90
H	ADD 3051 P/L/H. 3001C CL /CH	636904	<b>K.D.V.</b>	09/06/90
J	ADD SHT. 6. FIX TBL. 1.	638723	<b>B.S.J.</b>	01/02/91
K	ADD 3044C	641710	<b>W.R.K.</b>	06/13/91
L	ADD 3001S & SHT 7 FOR 3051C-LP	642380	<b>G.E.M.</b>	07/13/91
M	ADD 3095	653145	<b>K.D.V.</b>	4/8/93

THE ROSEMOUNT MODEL 268 SMART FAMILY INTERFACE IS APPROVED BY FACTORY MUTUAL AS INTRINSICALLY SAFE FOR THE CLASS I, DIVISION 1 GROUPS INDICATED WHEN USED IN CIRCUIT WITH THE BARRIERS AND CONVERTERS LISTED BELOW AND THE ROSEMOUNT SMART FAMILY TRANSMITTERS DEPICTED IN THE ACCOMPANYING CIRCUIT DIAGRAMS.

APPROVED FOR  
CLASS I  
DIVISION 1. GROUPS

BARRIER  
MANUFACTURER

MODEL

FOXBORO

2AI-12V-FGB  
2AI-13V-FGB  
2AS-13I-FGB  
3A2-120-CS-E/FGB-A  
3A2-130-CS-E/FGB-A

A, B, C, D

HONEYWELL

38545-000-0110-113-F5B5  
38545-000-0110-111/112-F5B5

C, D

MTL

115  
122  
322  
715  
722

A, B, C, D

R. STAHL

8901/31-199/100/7  
8901/30-199/100/7  
8901/31-280/165/7  
8901/30-280/165/7

C, D  
C, D

[ 8903/51-200/050/7  
8901/31-086/150/7

A, B, C, D  
A, B, C, D

[ 8901/31-280/165/7  
8901/31-086/150/7

C, D  
C, D

9005/01-245/060  
9005/01-252/100

A, B, C, D  
A, B, C, D

TAYLOR

5850FL81200  
5851FL81200  
1130FF21000  
1130FF22000  
1135FF21000  
1135FF22000

C, D

CAD Maintained, (MICROSTATION).

UNLESS OTHERWISE SPECIFIED  
DIMENSIONS IN INCHES [mm].  
REMOVE ALL BURRS AND  
SHARP EDGES. MACHINE  
SURFACE FINISH 125

CONTRACT NO.

DR. **MIKE DOBE** 2/7/90

CHK'D

APP'D. **K. CARLSON** 03/13/90

APP'D. GOV'T.

**ROSEMOUNT MEASUREMENT**  
FISHEROSEMOUNT

ROSEMOUNT INC.  
12001 TECHNOLOGY DRIVE  
EDEN PRAIRIE, MN 55344 USA

TITLE

INDEX OF I.S. BARRIER  
SYSTEMS FOR MOD. 268  
SMART FAMILY INTERFACE

SIZE FSCM NO

A

DWG NO.

00268-0031

SCALE

WT.

SHEET 1 OF 7

DO NOT SCALE PRINT

0031A01A



REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
M		653145		

ENTITY CONCEPT APPROVALS

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAXIMUM OPEN CIRCUIT VOLTAGE ( $V_T$  OR  $V_{DC}$ ) AND MAXIMUM SHORT CIRCUIT CURRENT ( $I_T$  OR  $I_{SC}$ ) AND MAXIMUM OUTPUT POWER ( $\frac{V_{DC} \times I_{SC}}{4}$  OR  $\frac{V_T \times I_T}{4}$ ), FOR THE ASSOCIATED APPARATUS MUST BE LESS THAN OR EQUAL TO THE MAXIMUM SAFE INPUT VOLTAGE ( $V_{MAX}$ ), MAXIMUM SAFE INPUT CURRENT ( $I_{MAX}$ ) AND MAXIMUM SAFE INPUT POWER ( $P_{MAX}$ ) OF THE INTRINSICALLY SAFE APPARATUS, IN ADDITION, THE APPROVED MAXIMUM ALLOWABLE CONNECTED CAPACITANCE ( $C_A$ ) AND INDUCTANCE ( $L_A$ ) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE MAXIMUM UNPROTECTED INTERNAL CAPACITANCE ( $C_I$ ) AND INDUCTANCE ( $L_I$ ) OF THE INTRINSICALLY SAFE APPARATUS. THE APPROVED ENTITY CONCEPT PARAMETERS ARE AS FOLLOWS:

NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.

INPUT PARAMETERS (CLASS I, DIV. 1, GROUPS A, B, C, D)

VMAX = 32 VDC				$V_T$ or $V_{oc}$ of barrier must be $\leq 32$ Vdc
IMAX = 186 MA				$I_T$ or $I_{sc}$ of barrier must be $\leq 186$ mA
CI = 0.01 UF				$C_A$ of barrier must be $\geq 0.01 \mu F$
LI = 1.1 MH				$L_A$ of barrier must be $\geq 1.1$ mH
PMAX:	1.1W	0.8W	0.6W	$\frac{V_{oc} \times I_{sc}}{4}$ of barrier must be $\leq$ specified value.
TEMP CODE	T4A	T5	T6	

OUTPUT PARAMETERS

VOC = 1.5 V.D.C.  
 ISC = 27 MA  
 $C_A = 10,000 \mu F$   
 $L_A = 46$  MH

ROSEMOUNT INC.  
 12001 TECHNOLOGY DRIVE  
 EDEN PRAIRIE, MN 55344 USA

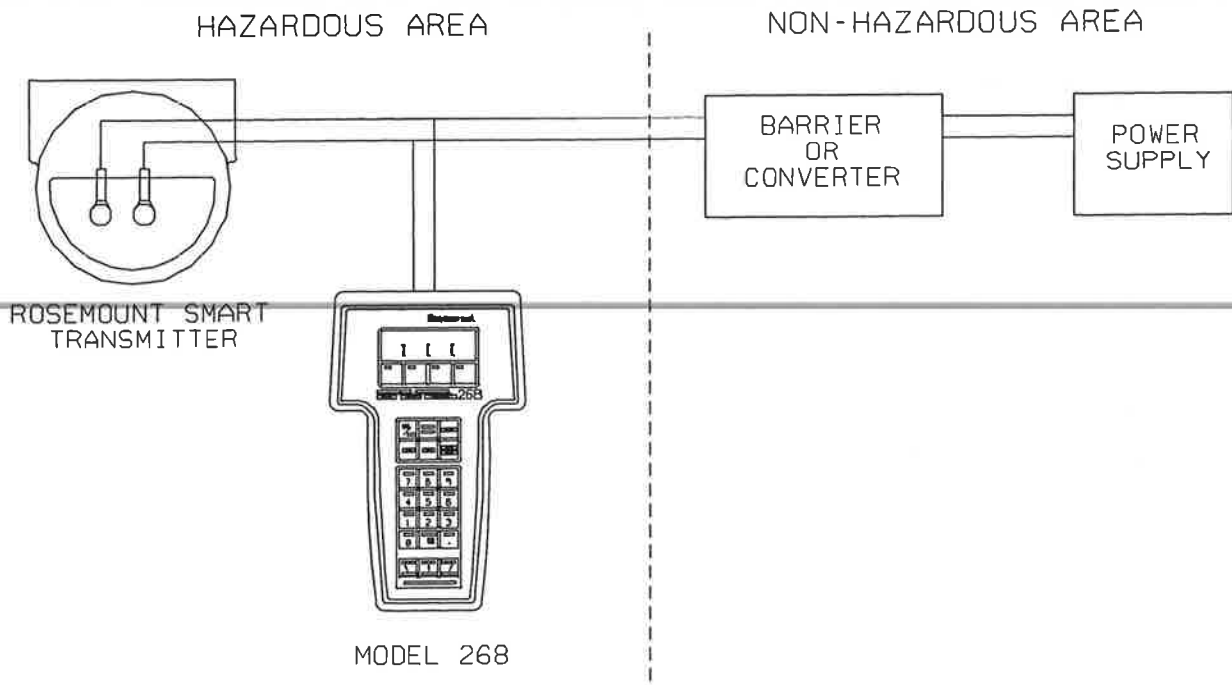
CAD Maintained, (MICROSTATION).

DR.	<b>D.PEARSON</b>	SIZE	A	FSCM NO		DWG NO.	00268-0031
ISSUED		SCALE	N/A	WT.		SHEET	2 OF 7



0031A02A

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
M		653145		



ROSEMOUNT SMART TRANSMITTERS

- MODEL 1151 SMART
- MODEL 3051
- MODEL 3051C, 3051P, 3051L, 3051H, 3051CA
- MODEL 3044
- MODEL 3044C
- MODEL 3001C, 3001CL, 3001CH
- MODEL 3311
- MODEL 3001S, 3001SL, 3001SH
- MODEL 3095

UP TO FOUR MODEL 751 INDICATORS MAY BE WIRED IN SERIES WITH THE TRANSMITTERS SHOWN ABOVE AND MAY BE LOCATED IN EITHER THE HAZARDOUS OR NON-HAZARDOUS AREA

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12001 TECHNOLOGY DRIVE  
EDEN PRAIRIE, MN 55344 USA

DR. **D. PEARSON**

ISSUED

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SIZE	FSCM NO	DWG NO.
A		00268-0031
SCALE	N/A	WT.
		SHEET 3 OF 7



0031A03A

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
M		653145		

THE MAXIMUM ALLOWABLE CONNECTED INDUCTANCE ( $L_a$ ) OF THE ASSOCIATED APPARATUS IS DETERMINED BY ADDING 27 mA TO THE  $I_{sc}$  OF THE BARRIER ( $I_m = I_{sc} + 27\text{mA}$ ) AND ENTERING TABLE 1 (SHT 5) AT THE RESULTING VALUE,  $I_m$ , OR THE NEXT HIGHER VALUE OF  $I_m$ , TO DETERMINE THE  $L_a$ , (THE  $L_a$  MUST INCLUDE THE  $L_1$  OF THE MODEL 268, WHICH IS 1.1mH).

EXAMPLE #1:  $I_{sc}$  OF BARRIER = 100mA.

$$I_m = 100\text{mA} + 27\text{mA} = 127\text{mA}$$

ENTER TABLE AT  $I_m = 130\text{mA}$ ;  $L_a = 2.0\text{mH}$

--WARNING-- BEFORE CONNECTING THE MODEL 268 INTO THE LOOP, DETERMINE THE CONNECTED INDUCTANCE OF THE SYSTEM BY ADDING THE  $L_1$  OF THE TRANSMITTER, CABLE, AND MODEL 268. THE SUM MUST BE LESS THAN THE  $L_a$  DETERMINED FROM THE TABLE IN ORDER FOR THE MODEL 268 TO BE CONNECTED INTO THE LOOP. IF THE CONNECTED INDUCTANCE IS GREATER THAN THE VALUE DETERMINED FROM THE TABLE, A BARRIER WITH A LOWER  $I_{sc}$  MUST BE CHOSEN.

EXAMPLE #2: BARRIER  $I_{sc}$  = 41.8mA; BARRIER  $L_a$  = 20.0mH

$$I_m = 41.8\text{mA} + 27\text{mA} = 68.8\text{mA};$$

ENTER TABLE AT 70mA AND READ  $L_a = 7.5\text{mH}$

ADD CONNECTED INDUCTANCE OF SYSTEM:

MODEL 268	$L_1 = 1.1\text{mH}$
MODEL 3051 TRANSMITTER	$L_1 = 0.48\text{mH}$
INDUCTANCE OF LOOP WIRING	1.0mH
-----	
TOTAL CONNECTED INDUCTANCE	= 2.58mH

TOTAL CONNECTED INDUCTANCE IS LESS THAN  $L_a = 7.5$  mH AS DETERMINED ABOVE AND IS ALSO LESS THAN THE BARRIER  $L_a$ . THE MODEL 268 MAY SAFELY BE CONNECTED INTO THE LOOP. IF THE MODEL 751 INDICATORS ARE USED, THEIR TOTAL INDUCTANCE (LABEL VALUE \* NUMBER OF INDICATORS) MUST ALSO BE INCLUDED.

ROSEMOUNT INC. 12001 TECHNOLOGY DRIVE EDEN PRAIRIE, MN 55344 USA		CAD Maintained, (MICROSTATION).		
DR. <b>S.BARDUSON</b>	30JUL90	SIZE A	FSCM NO	DWG NO. <b>00268-0031</b>
ISSUED		SCALE N/A	WT.	SHEET 4 OF 7



0031A04A

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
M		653145		

Im (mA)	La (mH)
150	1.3
145	1.5
140	1.6
130	2.0
120	2.5
110	3.0
100	4.0
90	5.0
85	5.5
80	6.0
75	6.7
70	7.5
65	8.8
62	9.5
60	10.0
57	11.0
55	12.0
50	15.0
45	19.0
40	23.0
35	31.0

TABLE 1

ROSEMOUNT INC.  
12001 TECHNOLOGY DRIVE  
EDEN PRAIRIE, MN 55344 USA

CAD Maintained, (MICROSTATION).

DR. **S.BARDUSON** 30JUL90

SIZE  
A

FSCM NO

DWG NO.

00268-0031

ISSUED

SCALE

N/A

WT.

SHEET

5 OF

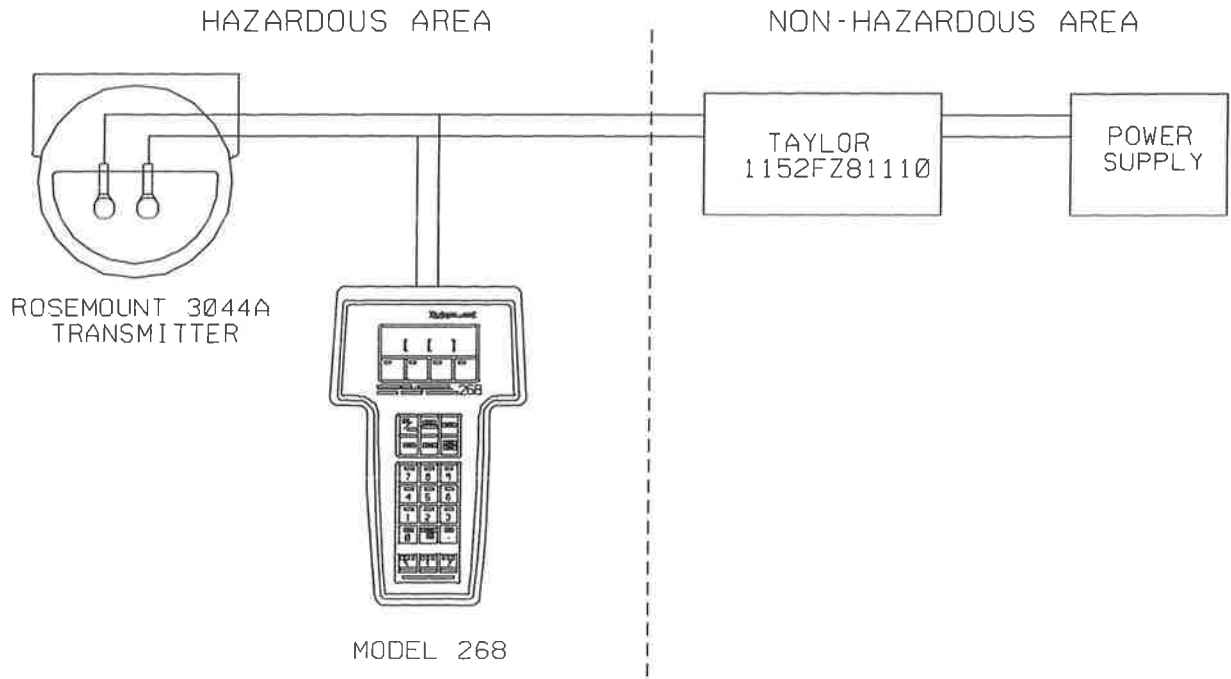
7

0031A05A



REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE

TAYLOR 1152FZ81110 SYSTEM



ROSEMOUNT 3044A SMART TRANSMITTERS MAY BE PLACED IN A CLASS I, DIVISION I, GROUP A, B, C, D HAZARDOUS LOCATION AS SHOWN ABOVE. THE LOOP POWER IS LIMITED BY A TAYLOR 1152FZ81110 INTRINSIC SAFETY BARRIER. THE ROSEMOUNT 268 MAY ALSO BE CONNECTED IN THE LOOP AS SHOWN. FOR CABLE WITH CAPACITANCE OF 60 PF/FT OR LESS AND INDUCTANCE OF .2 UH/FT OR LESS; CABLE LENGTHS OF UP TO 1600 FEET ARE ALLOWED .

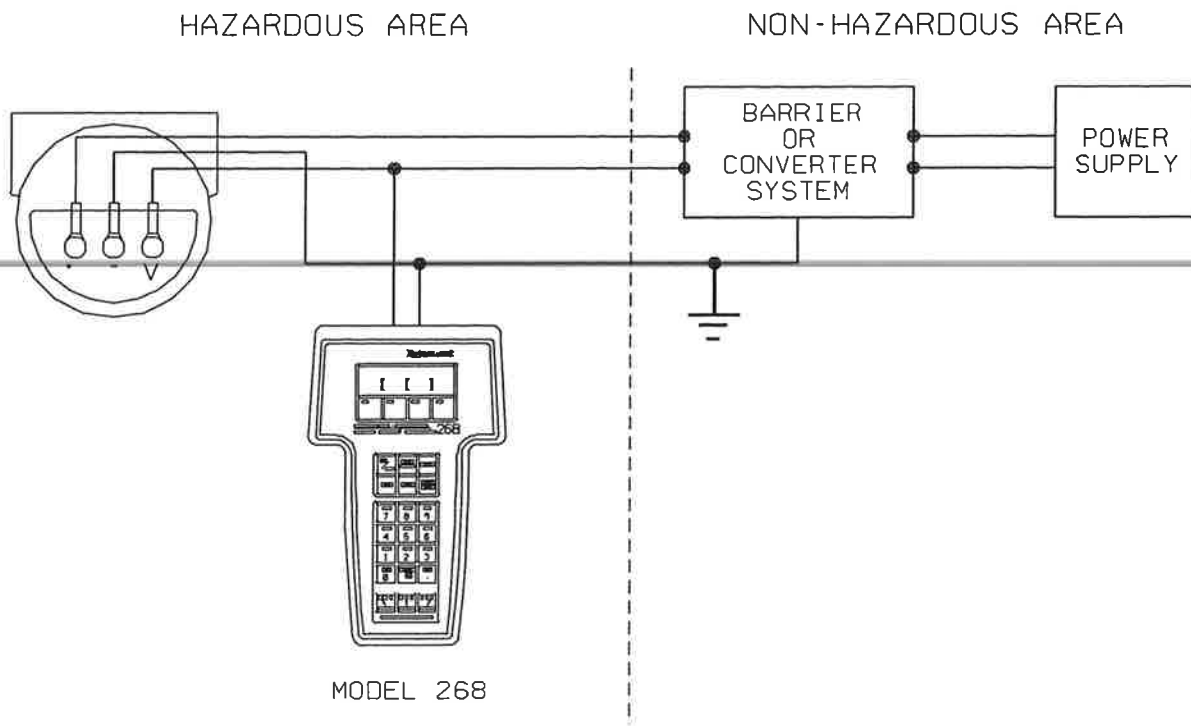
- TRANSMITTER: ROSEMOUNT 3044A
- BARRIER: TAYLOR 1152FZ81110
- COMMUNICATOR: ROSEMOUNT 268
- CABLE: CMAX = 60 PF/FT
- LMAX = .2 UH/FT
- MAX. LENGTH = 1600 FT

ROSEMOUNT INC. 12001 TECHNOLOGY DRIVE EDEN PRAIRIE, MN 55344 USA		CAD Maintained, (MICROSTATION).		
DR. <b>C. SCRIBNER</b> 12/21/90	SIZE <b>A</b>	FSCM NO	DWG NO. <b>00268-0031</b>	
ISSUED	SCALE <b>N/A</b>	WT.	SHEET <b>6</b> OF	<b>7</b>



0031A06A

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
M		653145		



CONNECTION FOR LOW POWER VERSIONS  
OF THE FOLLOWING  
ROSEMOUNT SMART TRANSMITTERS

- MODEL 3051C, 3051P, 3051L, 3051H, 3051CA
- MODEL 3001C, 3001CL, 3001CH
- MODEL 3001S, 3001SL, 3001SH

ROSEMOUNT INC.  
12001 TECHNOLOGY DRIVE  
EDEN PRAIRIE, MN 55344 USA

CAD Maintained, (MICROSTATION).

DR. <b>SANDI MANSON</b> 8/8/91	SIZE A	FSCM NO	DWG NO. 00268-0031
ISSUED	SCALE N/A	WT. _____	SHEET 7 OF 7

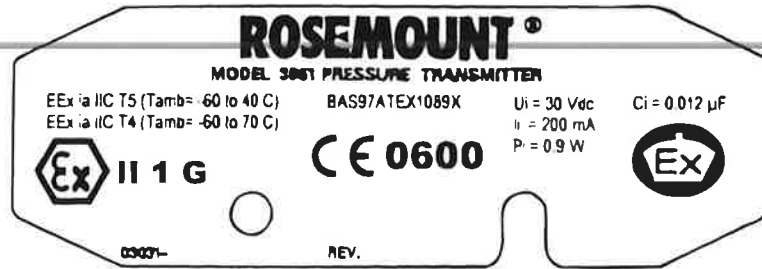
0031A07A



# European ATEX Directive Information

## CENELEC/BASEEFA Intrinsic Safety

Rosemount Model 3051 Pressure Transmitters that have the following label attached, have been certified to comply with Directive 94/9/EC of the European Parliament and the Council as published in the Official Journal of the European Communities No. L 100/1 on 19-April-1994.



3051LAB

The following information is provided as part of the labeling of the transmitter:

- Name and address of the manufacturer (may be any of the following):
  - Rosemount USA
  - Rosemount England
  - Rosemount Germany
  - Rosemount Singapore

CE 0600

- Complete model number (see Section 5 Specifications and Reference Data).
- The serial number of the device
- Year of construction
- Marking for explosion protection:
  - EEEx ia IIC T5 (T<sub>amb</sub>= -60 to 40 °C)
  - EEEx ia IIC T4 (T<sub>amb</sub>= -60 to 70 °C)
  - U<sub>i</sub> = 30 Vdc, I<sub>i</sub> = 200mA, P<sub>i</sub> = 0.9 W, C<sub>i</sub> = 0.012 mF

Ex II 1 G

### Special conditions for safe use (X):

Model 3051 transmitters fitted with the transient protection terminal block are not capable of withstanding the 500 V insulation test required by Clause 6.4.12 of EN 50 020 (1994), and this must be taken into account when installing the apparatus.





---

# Glossary

## Analog Output Trim

Digital Trim operation that allows adjustment of the output electronics to conform to the plant standard. Three types of analog output trim are available: 4–20 mA Trim, 4–20 mA Other Scale, and Low Power. See “Analog Output Trim” on page 2-27.

## Cloning

Off-line operation that uses the Model 268 to copy configuration data from one transmitter to one or more other transmitters that require the same data. See “Saving, Recalling, and Cloning Configuration Data” on page 2-29.

## Commissioning

Functions performed with a HART-based communicator and the transmitter which test the transmitter, test the loop, and verify transmitter configuration data. See “Commissioning the Model 3051 on the bench with a HART-Based Communicator” on page 2-9.

## Configuration

Process of setting parameters that determine how the transmitter operates. See page 2-1.

## Damping

Output function that increases the response time of the transmitter to smooth the output when there are rapid input variations. See “Damping” on page 2-17.

## Descriptor

Sixteen-character field for additional identification of the transmitter, its use, or location. The descriptor is stored in the transmitter and can be changed using the HART-based communicator.

## Digital Trim

Format function that allows you to adjust the transmitter characterization for purposes of digital calibration to plant standards. Digital Trim includes two separate operations: Sensor Trim and Analog Output Trim. See pages 2-24 and 2-27.

## Failure Mode Alarm

Transmitter function that drives the analog output to a jumper-selectable high or low value in the event of an electronics failure. See “Failure Mode Alarm” on page 2-2.

## Factory Characterization

Factory process during which each sensor module is subjected to pressures and temperatures covering the full operating range. The sensor module memory stores data generated from this process for use by the microprocessor in correcting the transmitter output during operation.

## Full Trim

Sensor Trim function in which two accurate, end-point pressures are applied, and all output is linearized between them. The selected end points should always be equal to or outside the LRV and URV. See “Full Trim” on page 2-25.

## HART (Highway Addressable Remote Transducer) Protocol

Communications standard that provides simultaneous analog and digital signal transmission between control rooms and field devices such as transmitters. All Rosemount SMART FAMILY products communicate using the HART protocol.

<b>Lower Range Limit (LRL)</b>	Lowest value of the measured variable that the transmitter can be configured to measure.
<b>Lower Range Value (LRV)</b>	Lowest value of the measured variable that the analog output of the transmitter is currently configured to measure.
<b>Multidropping</b>	The connection of several transmitters to a single communications transmission line. Communication between the host and the transmitters takes place digitally with the analog output of the transmitters deactivated. See "Multidrop Communication" on page 2-31.
<b>Reranging</b>	Configuration function that changes the transmitter 4 and 20 mA settings. See "Rerange" on page 2-14.
<b>Send Data</b>	HART-based communicator command that transfers configuration data from the hand-held communicator's memory to the transmitter memory.
<b>Sensor Trim</b>	Digital Trim function that allows you to adjust the digital process variable reading to a precise pressure input. Zero Trim and Full Trim are the two Sensor Trim functions. See page 2-24.
<b>Smart</b>	Term used to describe instruments that are microprocessor-based and feature advanced communications capabilities. See <b>Section 1: Introduction</b> .
<b>SMART FAMILY</b>	Rosemount pressure, temperature, level, and flow instruments with microprocessor-based digital electronics.
<b>Span</b>	Algebraic difference between the upper and lower range values.
<b>Tag</b>	Eight-character field for identifying the transmitter. The tag is stored in the transmitter and can be changed using the Model 268 and the Transmitter Information function.
<b>Transmitter Address</b>	Unique number (1-15) used to identify a multidropped transmitter. Transmitters that are not multidropped have 0 as an address. See page 2-31.
<b>Transmitter Security</b>	Jumper-selectable feature that prevents accidental or deliberate changes to configuration data. See "Transmitter Security" on page 2-4.
<b>Upper Range Limit (URL)</b>	Highest value of the measured variable that the transmitter can be configured to measure.
<b>Upper Range Value (URV)</b>	Highest value of the measured variable that the analog output of the transmitter is currently configured to measure.
<b>Zero Trim</b>	A zero-based, one-point adjustment used in differential pressure applications to compensate for mounting position effects or zero shifts caused by static pressure. See "Zero Trim" on page 2-25.

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PROPAK SYSTEMS LTD POSTAL BAG # 2 AIRDRIE, ALBERTA, CANADA T4B 2C3				PRESSURE GAGES			SHEET 1 OF	
							SPEC NO FILE 14.11.P	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : PRESSURE INDICATORS				NO	BY	DATE	REVISION	
				0	PC	99/12/17	FOR PURCHASE	
				1	PC	5/24/00	CONNECTION WAS 1/2"	
							JOB # 99404	
							DATE	
							REQ.	
							BY	
							CHK'D	
							APPR.	
							PP	
1. TYPE: DIRECT RDG X 21-103 kPA(GA) RECEIVER OTHER 2. MOUNTING: SURFACE LOCAL X FLUSH 3. DIAL: DIAMETER 63mm (2.5") COLOR MFR STD. 4. CASE: CAST IRON ALUMINUM PHENOL OTHER THERMOPLASTIC 5. RING: SCREWED HINGED SLIP STD X OTHER 6. BLOW-OUT PROTECTION: NONE BACK DISC SOLID FRONT OTHER 7. LENS GLASS ACRYLIC X 8. OPTIONS: SIPHON MATERIAL SNUBBER PRESSURE LIMIT VALUE MOVEMENT DAMPING 9. NOMINAL ACCURACY REQUIRED MFG. STD.				10. OTHER 11. PRESS ELEMENT: BOURDON X BELLOWS OTHER 12. ELEMENT MTL: BRONZE STEEL SS 316 OTHER 13. SOCKET MTL: BRONZE STEEL SS X OTHER 14. CONNECTION-NPT: 14 mm X 21 mm OTHER BOTTOM X BACK 15. MOVEMENT: BRONZE SS X NYLON OTHER 16. DIAPHRAGM SEAL MFG. TYPE WETTED PART MTL OTH MTL FLUID FILL PROCESS CONN. GAGE CONN.				
TAG NO.	REV	QTY	RANGE kPag	LIQUID FILLED	OPERATING PRESS. kPag	SERVICES	NOTES	ASSEMBLY & UNIT #
PI-222	0	1	0-1103	YES	207	ENGINE FUEL GAS		
PI-227	0	1	0-1103	YES	689	STARTER GAS		
PI-259	0	1	0-1103	YES	690	LUBE OIL		
PI-286	0	1	0-103	YES	41	PACKING VENT		
PI-287	0	1	0-414	YES	172	PACKING VENT		
MFR: WIKA (OR EQUAL) MODEL NUMBER: MODEL 233.53 P.O. NUMBER NOTES:								

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3				PRESSURE CONTROL VALVE PILOTS AND REGULATORS				SHEET OF SPEC NO FILE 14,11,P			
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : UTILITY PRESSURE REGULATORS				NO	BY	DATE	REVISION	JOB # 99404			
				0	PC	99/12/17	FOR PURCHASE	DATE			
				1	DP	00/04/01	RESET PRV-221	REQ.			
				2	PC	5/24/00	DELETED PRV-220/227	BY	CHK'D	APPR.	
								PC			
G	1	TAG NO.	PRV-221	PRV-225							
E	2	SERVICE	FUEL GAS	FUEL GAS							
N	3	LINE NO. / VESSEL NO.	FG-002-A-33	FG-004-A-33							
F	4	LINE SIZE / SCHED. NO.	33 mm / sch. 80	33 mm / sch. 80							
L	5	FUNCTION	FORWARD PRESSURE	BACK PRESSURE							
	6	TYPE OF BODY	GLOBE	GLOBE							
	7	BODY SIZE	33 mm	9.5 mm	33 mm	STD.	mm	mm	mm	mm	mm
	8	GUIDING	NO. OF PORTS	TOP	ONE	TOP & PORT	ONE				
B	9	END CONN. & RATING	33 mm FNPT	33 mm FNPT							
O	10	BODY MATERIAL	DUCTILE IRON	CAST IRON							
D	11	PACKING MATERIAL	MFR. STANDARD (TFE)	MFR. STANDARD							
Y	12	LUBRICATOR	ISOLAT. VALVE								
	13	SEAL TYPE									
	14	TRIM FORM	MFR. STANDARD	MFR. STANDARD							
	15	TRIM MATERIAL	ALUMINUM / NITRILE	ALUMINUM							
	16	SEAT MATERIAL	ALUMINUM	SST / NITRILE							
	17	REQUIRED SEAT TIGHTNESS	MFR. STANDARD	MFR. STANDARD							
	18	MAX. ALLOW SOUND LEV. dBA	<85	<85							
A	19	TYPE OF ACTUATOR	SPRING & DIAPHRAGM	SPRING & DIAPHRAGM							
C	20	PILOT									
T	21	SUPPLY TO PILOT									
/	22	SELF CONT.	EXT. CONN.	YES	YES						
P	23	DIAPHRAGM MATERIAL	NITRILE	NITRILE							
I	24	DIAPHRAGM RATING	1724 kPa	MFR. STANDARD							
L	25	SPRING RANGE	103 to 276	kPa	69-414	kPa	kPa	kPa	kPa	kPa	
O	26	SET POINT	172	kPa	241	kPa	kPa	kPa	kPa		
T	27	SPRING COLOR (P/N)	GREEN (# 10B3077 X012)	CADMIUM (# 1B7883 27022)							
A	28	FILT REG	SUPPLY GAGE								
C	29	LINE STRAINER									
C	30	HOUSING VENT									
E	31	INTERNAL RELIEF									
S	32	OPTIONS									
S	33										
	34	FLOW UNITS	SCFH	SCFH							
	35	FLUID	SWEET NATURAL GAS	SWEET NATURAL GAS							
S	36	QUANT. MAX.	MAX. Cg	11750	20000	29					
E	37	QUANT. OPER.	OPER Cg		3280						
R	38	VALVE Cg	VALVE FL	28.6							
V	39	NORM IN PRES	NORM DELTA P	1034 kPa(g)	kPa	207 kPa(g)	kPa	kPa(g)	kPa	kPa(g)	kPa
i	40	MAX. INLET PRESS.		1034 kPa	1034 kPa						
C	41	MAX. SHUT OFF	MAX. DELTA P	kPa(g)	1034 kPa	kPa(g)	1034 kPa	kPa(g)	kPa	kPa(g)	kPa
E	42	TEMP. MAX.	OPERATING	82 ° C	16 ° C	66 ° C	16 ° C	° C	° C	° C	° C
	43	OPER. SP. GR.	MOL. WT.	0.65	18.827	0.65	18.827				
	44	OPER. VISC.	% FLASH								
	45	% SUPERHEAT	% SOLIDS								
	46	VAPOR PRESS	CRIT PRESS	kPag	kPag	kPag	kPag	kPag	kPag	kPag	kPag
	47	PREDICTED SOUND LEVEL dBA									
	48	MANUFACTURER	FISHER	FISHER							
	49	MODEL NO.	627	1805-1							
	50	P. O. NUMBER									
NOTES:											

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3				PRESSURE CONTROL VALVE PILOTS AND REGULATORS				SHEET OF			
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : PRESSURE REGULATORS				NO	BY	DATE	REVISION	SPEC NO		FILE 14,11,P	
				1	PC	99/12/17	FOR PURCHASE	JOB # 99404		DATE	
								BY	CHK'D	APPR.	
G	1	TAG NO.	PRV-286	PRV-287	PRV-130						
E	2	SERVICE	FUEL GAS SUPPLY	FUEL GAS SUPPLY	PRESSURE RELIEF						
N	3	LINE NO./VESSEL NO.			T-130						
C	4	LINE SIZE / SCHED. NO.	13 mm TUBING	13 mm TUBING	48 mm						
L	5	FUNCTION	Forward Pressure Regulator	Forward Pressure Regulator	PROTECT VESSEL						
	6	TYPE OF BODY	GLOBE	GLOBE	GLOBE						
	7	BODY SIZE	STD mm 3.2 mm	STD mm 3.2 mm	48 mm 27 mm	mm	12 mm				
	8	GUIDING	NO. OF PORTS	TOP ONE	TOP ONE	TOP ONE	ONE				
	9	END CONN. & RATING	13 mm FNPT, 2000#	13 mm FNPT, 2000#	48 mm FNPT						
	10	BODY MATERIAL	ALUMINUM	ALUMINUM	WCB						
	11	PACKING MATERIAL	MFR. STANDARD	MFR. STANDARD	MFR. STANDARD						
	12	LUBRICATOR	ISOLAT. VALVE								
	13	SEAL TYPE			METAL, CLASS IV						
	14	TRIM FORM	MFR. STANDARD	MFR. STANDARD	MFR. STANDARD						
	15	TRIM MATERIAL	ALUMINUM / NITRILE	ALUMINUM / NITRILE	NACE						
	16	SEAT MATERIAL	NITRILE	NITRILE	NACE						
	17	REQUIRED SEAT TIGHTNESS	MFR. STANDARD	MFR. STANDARD	MFR. STANDARD						
	18	MAX. ALLOW SOUND LEV. dBA									
	19	TYPE OF ACTUATOR	SPRING & DIAPHRAGM	SPRING & DIAPHRAGM	SPRING & DIAPHRAGM						
	20	PILOT									
	21	SUPPLY TO PILOT									
	22	SELF CONT.	EXT. CONN.	YES	YES	YES					
	23	DISPHRAGM MATERIAL	NITRILE NACE	NITRILE NACE	NITRILE NACE						
	24	DISPHRAGM RATING	758 kPa	758 kPa	2069 kPa						
	25	SPRING RANGE	34 TO 241 kPa	34 TO 241 kPa	34 TO 241 kPa	kPa	kPa				
	26	SET POINT	41 kPa	172 kPa	100 kPa	kPa	kPa				
	27	SPRING COLOR (P/N)	CAD PLATED (1B7883 27022)	CAD PLATED (1B7883 27022)	DARK GREY						
	28	FILT REG	SUPPLY GAGE								
	29	LINE STRAINER									
	30	HOUSING VENT									
	31	INTERNAL RELIEF									
	32	OPTIONS			NACE						
	33		VENTABLE BONNET	VENTABLE BONNET	VENTABLE BONNET						
	34	FLOW UNITS	SCFH	SCFH	SCFH						
	35	FLUID	SWEET GAS	SWEET GAS	SOUR HC VAPOUR						
	36	QUANT. MAX.	MAX. Cv	1290 8.5	1290 8.5	NOTE 1					
	37	QUANT. OPER.	OPER Cv	310	310	900					
	38	VALVE CV	VALVE FL	0.28	0.28	104					
	39	NORM IN PRES	NORM DELTA P	700 kPa(g) kPa	700 kPa(g) kPa	20 kPa(g) kPa	kPa(g) kPa				
	40	MAX. INLET PRESS.		1724 kPa	1724 kPa	101 kPa	kPa				
	41	MAX. SHUT OFF	MAX. DELTA P	kPa(g) kPa	kPa(g) kPa	kPa(g) kPa	kPa(g) kPa	kPa(g) kPa			
	42	TEMP. MAX.	OPERATING	66 ° C 16 ° C	66 ° C 16 ° C	66 ° C 16 ° C	16 ° C	° C 16 ° C			
	43	OPER. SP. GR.	MOL. WT.	0.65 18.827	0.65 18.827	0.65 18.827					
	44	OPER. VISC.	% FLASH								
	45	% SUPERHEAT	% SOLIDS								
	46	VAPOR PRESS	CRIT PRESS	kPag kPag	kPag kPag	kPag kPag	kPag kPag	kPag kPag			
	47	PREDICTED SOUND LEVEL dBA									
	48	MANUFACTURER	FISHER	FISHER	FISHER						
	49	MODEL NO.	67-CFR	67-CFR	98H NACE						
	50	P. O. NUMBER									

NOTES:

1. MAX FLOW BASED ON WIDE OPEN FLOW THROUGH ORIFICE.



PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3				PRESSURE RELIEF VALVES				SHEET OF		
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : PRESSURE SAFETY VALVES				NO	BY	DATE	REVISION	SPEC NO	FILE 14.11.P	
				0	PC	12/21/99	FOR PURCHASE	JOB #	99404	
				1	DP	01/04/00	RESET PSV-202 + RETAG ALL	DATE		
				2	PC	5/23/00	REVISED PSV-200 MODEL #	REQ.		
				3	GWW	10/31/00	REVISE TO ACTUAL OPERATING INFO.	BY	CHK'D	APPR.
G 1	TAG NO.	PSV-200		PSV-202		PSV-203				
E 2	SERVICE	1ST STAGE CYLINDER		2ND STAGE CYLINDER		3RD STAGE CYLINDER				
N 3	LINE NO. / VESSEL NO.	K-200A		K-202		K-203				
E 4	FULL NOZZLE / SEMI NOZZLE	FULL		FULL		FULL				
R 5	SAFETY OR RELIEF	SAFETY		SAFETY		SAFETY				
A 6	CONV, BELLOW, PILOT OP	CONVENTIONAL		CONVENTIONAL		CONVENTIONAL				
L 7	BONNET TYPE	BOLTED		BOLTED		BOLTED				
C 8	SIZE : INLET	OUTLET	60 mm	89 mm	48 mm	60 mm	48 mm	73 mm		
O 9	FLANGE RATING OR SCREWED	300#	150#	600#	150#	900#	300#			
N 10	TYPE OF FACING	RF	RF	RF	RF	RTJ	RF			
M 11	BODY AND BONNET	WCB		WCB		WCB				
A 12	SEAT AND DISC	316 SS		316 SS		316 SS				
T 13	RESILIENT SEAT SEAL									
E 14	GUIDES AND RINGS	316 SS		316 SS		316 SS				
R 15	SPRING	ALLOY STEEL		ALLOY STEEL		ALLOY STEEL				
I 16	BELLOWS	---		---		---				
L 17										
O 18	CAP : SCREWED / BOLTED	SCREWED		SCREWED		SCREWED				
P 19	LEVER : PLAIN / PACKED	---		---		---				
T 20	TEST GAG	---		---		---				
I 21										
O 22										
N 23										
B 24	CODE	ASME SECTION VIII		ASME SECTION VIII		ASME SECTION VIII				
A 25	BASIS	FULL FLOW		FULL FLOW		FULL FLOW				
S 26	WETTED AREA	m <sup>2</sup>	---	---	---	---	---			
27										
28	FLUID	NATURAL GAS		NATURAL GAS		NATURAL GAS				
F 29	FLUID STATE	VAPOR		VAPOR		VAPOR				
L 29	REQUIRED CAPACITY	11.80 MMSCFD $\Delta$		11.80 MMSCFD $\Delta$		11.80 MMSCFD $\Delta$				
U 30	MOL. WEIGHT	OPER. SP. GR.	17.958 $\Delta$	17.958 $\Delta$	17.958 $\Delta$	17.958 $\Delta$				
I 31	OPER. PRESS.	SET PRESS.	2683 $\Delta$ kPa(g)	3412 kPa(g)	4857 $\Delta$ kPa(g)	8720 kPa(g)	8356 $\Delta$ kPa(g)	11377 kPa(g)		
D 32	OPER. TEMP.	REL. TEMP.	107 $\Delta$ °C	107 $\Delta$ °C	100 $\Delta$ °C	100 °C	96 $\Delta$ °C	96 $\Delta$ °C		
D 33	BACK PRESS.:	CONSTANT	kPa(g)	kPa(g)	kPa(g)	kPa(g)	kPa(g)	kPa(g)		
D 34		VARIABLE	kPa(g)	kPa(g)	kPa(g)	kPa(g)	kPa(g)	kPa(g)		
A 35		TOTAL	kPa(g)	kPa(g)	kPa(g)	kPa(g)	kPa(g)	kPa(g)		
T 36	% ALLOWABLE OVERPRESSURE	10		10		10				
A 37	OVERPRESSURE FACTOR	0.975 $\Delta$		0.975 $\Delta$		0.975 $\Delta$				
38	COMPRESSIBILITY FACTOR	0.974 $\Delta$		0.957 $\Delta$		0.929 $\Delta$				
39	LATENT HEAT OF VAPORIZATION									
40	RATIO OF SPECIFIC HEATS	1.287 $\Delta$		1.287 $\Delta$		1.287 $\Delta$				
41	OPERATING VISCOSITY (cP)									
42	BAROMETER PRESSURE kPa	92.53 $\Delta$		92.53 $\Delta$		92.53 $\Delta$				
43	DESIGN TEMPERATURE	-28/149°C		-28/149°C		-28/149°C				
44										
45	CALCULATED AREA	485.99 $\Delta$	mm <sup>2</sup>	189.88 $\Delta$	mm <sup>2</sup>	142.93 $\Delta$	mm <sup>2</sup>	mm <sup>2</sup>		
46	SELECTED AREA	506.45	mm <sup>2</sup>	198.064	mm <sup>2</sup>	198.064	mm <sup>2</sup>	mm <sup>2</sup>		
47	ORIFICE DESIGNATION	H		F		F				
48	MANUFACTURER	CROSBY		CROSBY		CROSBY				
49	MODEL NO.	2 H 3 JOS 35 J $\Delta$		1-1/2 F 2 JOS 45 J		1-1/2 F 2-1/2 JOS 55 J				
50	P. O. NUMBER									

NOTES:

1. NACE MR-1075 LEVEL 1 MATERIAL REQUIRED.

AREA. UNIT # :

ISA FORM SM20.53

MPSV.XLT

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		PRESSURE INSTRUMENTS			SHEET _____ OF _____ SPEC NO _____ FILE 14.11.P	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : PRESSURE TRANSMITTERS		NO	BY	DATE	REVISION	JOB # 99404
		1	PC	99/12/21	ISSUED FOR PURCHASE	DATE
		2	DP	03/04/00	WAS PT-210	RFQ
		3	PC	5/24/00	TAG # WAS PT-121	BY _____ CHK'D _____ APPR. _____

1	TAG NO.: PT-100	SERVICE: PLANT INLET
2	FUNCTIONS	RECORD _____ INDICATE _____ CONTROL _____ BLIND _____ TRANS. <u>X</u> OTHER _____
3	CASE	MFR STD <u>X</u> NOM SIZE _____ COLOR: MFR STD <u>X</u> OTHER _____
4	MOUNTING	FLUSH _____ SURFACE _____ YOKE _____ OTHER _____
5	ENCLOSURE CLASS	GENERAL PURPOSE _____ WEATHER PROOF _____ EXPLOSION PROOF _____ CLASS <u>1, DIV. 2, GR. C &amp; D</u> FOR USE IN INTRINSICALLY SAFE SYSTEM <u>X</u> OTHER _____
6	POWER SUPPLY	117 V 60Hz _____ OTHER AC _____ DC <u>X</u> VOLTS <u>24</u>
7	CHART	STRIP _____ ROLL _____ FOLD _____ CIRCULAR _____ TIME MARKS _____
8	CHART DRIVE	SPEED _____ POWER _____
9	SCALES	TYPE _____ RANGE 1 _____ 2 _____ 3 _____ 4 _____
10	TRANSMITTER OUTPUT	4 - 20 mA <u>X</u> 10 - 50 mA _____ 21 - 103 kPa(g) _____ 42 - 206 kPa (g) _____ OTHER _____ FOR RECEIVER SEE SPEC. SHEET _____
11	CONTROL MODES	P = PROP ( GAIN ), I = INTEGRAL ( AUTO RESET ), D = DERIVATIVE ( RATE ), SUB : S = SLOW F = FAST P _____ PI _____ PD _____ PID _____ IF _____ DF _____ IS _____ DS _____ OTHER _____
12	ACTION	ON MEAS. INCREASE OUTPUT INCREASES _____ DECREASES _____
13	AUTO - MAN SWITC	NONE _____ MFR STD _____ OTHER _____
14	SET POINT ADJ.	MANUAL _____ EXTERNAL _____ REMOTE _____ OTHER _____
15	MANUAL REG.	NONE _____ MFR STD _____ OTHER _____
16	OUTPUT	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(ga) _____ 42 - 206 kPa (ga) _____ OTHER _____
17	SERVICE	GAGE PRES <u>X</u> VACUUM _____ ABSOLUTE _____ COMPOUND _____
18	ELEMENT TYPE	DIAPHRAGM <u>X</u> HELIX _____ BOURDON _____ BELLOWS _____ OTHER _____
19	MATERIAL	316 SS <u>X</u> BER. COPPER _____ OTHER _____
20	RANGE	FIXED <u>0- 2068 kPag</u> MAX. <u>7584 kPag</u> BURST <u>7584 kPag</u> OVERRANGE PROTECTION TO _____
21	PROCESS DATA	PRESSURE : NORMAL <u>413 kPag</u> MAX. <u>4516 kPag</u> ELEMENT RANGE _____
22	PROCESS CONN.	14 mm NPT <u>X</u> 21 mm NPT _____ OTHER <u>c/w 21 mm NPT BUSHING, note 1</u> LOCATION : BOTTOM <u>X</u> BACK _____ OTHER _____
23	ALARM SWITCHES	QUANTITY _____ FORM _____ RATING _____
24	FUNCTION	PRESSURE _____ DEVIATION _____ CONTACTS TO _____ ON INC. PRESS _____
25	OPTIONS	FILT - REG. _____ SUP. GAGE _____ OUTPUT GAGE _____ CHARTS _____ DIAPH SEAL _____ TYPE _____ DISPH _____ BOT BOWL _____ CONN. _____ CAPILLARY : LENGTH _____ MATERIAL _____ OTHER _____
26	MFR. & MODEL NO.	<u>WIKA</u>
27	MODEL NO.	<u>892.13.520</u>
28	P. O. NUMBER	_____

NOTES:

- SUPPLIER TO PROVIDE BUSHING ADAPTOR CONVERTING STANDARD PROCESS CONNECTION TO 1/2" NPT.

AREA. UNIT #: 152

# 67CF Series Filter Regulators

## Introduction

### Scope of Manual

This manual provides instructions and parts lists for 67CF Series filter regulators. Instructions and parts lists for other equipment mentioned in this instruction manual, as well as for other 67 Series regulators, are found in separate manuals.

### Product Description

The 67CF Series direct-operated regulators are equipped with a filter for removing particles from the supply gas. They are typically used to provide constantly controlled, reduced pressures to pneumatic and electropneumatic controllers and other instruments. These are suitable for most air or gas applications. Other applications include providing reduced pressures to air chucks, air jets, and spray guns.

The Type 67CFR regulator has an integral low-capacity internal relief valve. A downstream pressure increase above the outlet pressure setting moves the diaphragm assembly off the soft seat, venting the excess pressure through a hole or vent in the spring case.

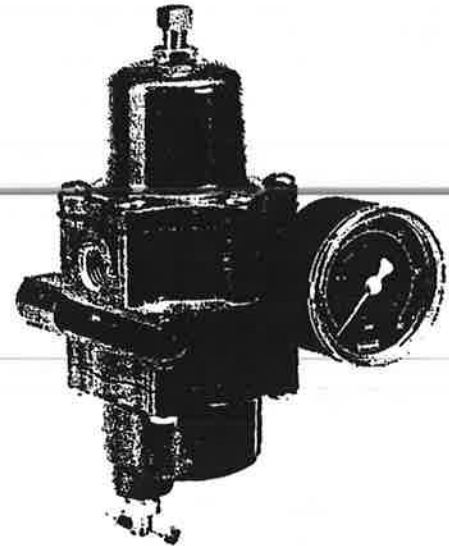
### Specifications

Some general 67CF Series ratings and other specifications are given on page 2. A label on the spring case gives the control spring range for a given regulator as it comes from the factory.

### Installation

#### Note

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



W7412

Figure 1. Typical Type 67CF Filter Regulator with Optional Gauge.

### WARNING

Personal injury, property damage, equipment damage, or leakage due to escaping gas or bursting of pressure-containing parts may result if this regulator is over-pressured or is installed where service conditions could exceed the limits given in the specifications, or where conditions exceed any ratings of the adjacent piping or piping connections. To avoid such injury or damage, provide pressure-relieving or pressure-limiting devices (as required by the appropriate code, regulation, or standard) to prevent service conditions from exceeding those limits.

**FISHER**

FISHER-ROSEMOUNT™ Managing The Process Better.

## Specifications

### Body Size, Inlet and Outlets Connection Style

1/4-inch NPT screwed

### Maximum Inlet Pressure (Body Rating)<sup>(1)</sup>

250 psig (17,2 bar)

### Outlet Pressure Ranges

OUTLET PRESSURE RANGES, PSIG (bar)	CONTROL SPRING DATA		
	Part Number	Color	Wire Diameter, Inch (mm)
0 to 20 (0 to 1,4)	T14130T0012	green stripe	0.135 (3,43)
0 to 35 (0 to 2,4)	T14059T0012	silver	0.156 (3,96)
0 to 60 (0 to 4,1)	T14058T0012	blue stripe	0.170 (4,32)
0 to 125 (0 to 8,6)	T14060T0012	red stripe	0.207 (5,26)

### Maximum Emergency Outlet Pressure<sup>(1)</sup>

50 psi (3,4 bar) over outlet pressure setting

### Wide-Open Flow Coefficients

Main Valve:  $C_v$ : 11.7;  $C_c$ : 0.36;  $C_i$ : 32.2

Internal Relief Valve:  $C_g$ : 1.45;  $C_v$ : 0.045;  $C_i$ : 32.8

### Pressure Registration

Internal

### Accuracy

**Inlet Sensitivity:** Less than 0.2 psig (0,014 bar) change in outlet pressure for every 25 psig (1,72 bar) change in inlet pressure

**Repeatability:** 0.1 psig (0,0069 bar)<sup>(2)</sup>

**Air Consumption:** testing repeatedly shows no discernible leakage

### Regulator Temperature Capabilities

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

**With Fluoroelastomer (FKM):**

0° to 300°F (-18° to 149°C)

**With Silicone (VMQ)<sup>(3)</sup>:** -60° to 180°F (-51° to 82°C)

### Drain Valve and Spring Case Vent Location

Aligned with inlet, other positions optional

### Type 67CFR Internal Relief Performance

Low capacity for minor seat leakage only; other overpressure protection must be provided if inlet pressure can exceed the maximum pressure rating of downstream equipment or exceeds maximum outlet pressure rating of the Type 67CFR

### Filter Capabilities

**Free Area:** 12 times pipe area

**Micron Rating:**

*Cellulose Element:* 40 microns

*Glass Fiber Element:* 10 microns

*Stainless Steel Element:* 40 microns

### Approximate Unit Weight

1 pound (0,5 kg)

### Options

- Handwheel adjusting screw
- NACE (MR0175) compliant construction
- Ammonia service construction
- Panel mount (includes spring case with 1/4-inch vent, handwheel, and panel mounting nut)
- Closing cap (available on spring case with 1/4-inch NPT vent)
- Aluminum or stainless steel drain valve
- Fluoroelastomer (FKM) elastomers for high temperatures and/or corrosive chemicals
- Silicone (VMQ) elastomers for cold temperatures
- Triple scale outlet pressure gauge (brass or stainless steel)
- Stainless steel stem on the valve plug
- Fixed bleed restriction mounted in the side outlet
- Tire valve in second outlet
- Pipe plug in second outlet

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

2. Repeatability is the measure of the regulator's ability to return to setpoint consistently when traveling from steady state to transient to steady state.

3. Silicone is not compatible with hydrocarbon gas.



## WARNING

The internal relief valve of the Type 67CFR regulator does not provide full overpressure protection. The internal relief valve is designed for minor seat leakage only. If maximum inlet pressure to the Type 67CFR exceeds maximum pressure ratings of the downstream equipment or exceeds maximum allowable outlet pressure of the Type 67CFR, additional overpressure protection is required.

1. Regulator operation within ratings does not preclude the possibility of damage from debris in the lines or from external sources. Regulators should be inspected for damage periodically and after any overpressure condition.

2. Only personnel qualified through training and experience should install, operate, and maintain a regulator. Make sure that there is no damage to or foreign material in the regulator. Also ensure that all tubing and piping is free of debris.



3. Install the regulator so that flow is from the IN to the OUT connection as marked on the regulator body.

4. For best drainage, orient the drain valve (key 2) to the lowest possible point on the dripwell (key 5). This orientation may be improved by rotating the dripwell with respect to the body (key 1).



## WARNING

**A regulator may vent some gas to the atmosphere. In hazardous or flammable gas service, vented gas may accumulate and cause personal injury, death, or property damage due to fire or explosion. Vent a regulator in hazardous gas service to a remote, safe location away from air intakes or any hazardous area. The vent line or stack opening must be protected against condensation or clogging.**

5. A clogged spring case vent hole may cause the regulator to function improperly. To keep this vent hole from being plugged (and to keep the spring case from collecting moisture, corrosive chemicals, or other foreign material) orient the vent to the lowest possible point on the spring case or otherwise protect it.

Inspect the vent hole regularly to make sure it is not plugged. Spring case vent hole orientation may be changed by rotating the spring case with respect to the body. A 1/4-inch NPT spring case vent may be remotely vented by installing obstruction-free tubing or piping into the vent. Protect the remote vent by installing a screened vent cap on the remote end of the vent pipe.

6. For use in regulator shutdown, install upstream block and vent valves and downstream block and vent valves (if required), or provide some other suitable means of properly venting the regulator inlet and outlet pressures. Install a pressure gauge to monitor instruments on startup.

7. Apply a good grade of pipe compound to the male pipe threads before making connections, making sure not to get the pipe compound inside the regulator.

8. Install tubing fitting or piping into the 1/4-inch NPT inlet connection on the body (key 1) and into the 1/4-inch NPT body outlet connection.

9. The second 1/4-inch NPT outlet can be used for a gauge or other use. If not used, it must be plugged.

## Installing a 67CF Series Regulator in an Existing Installation

When installing a 67CF Series regulator in an existing installation, it may be necessary to use spacers (key 34, figure 6) to adapt the installation. If the mounting bolts are too long, place a spacer on the bolt (see figure 6). To be sure the regulator is secure, the bolts should have at least two full threads of engagement.

## Startup and Adjustment

Key numbers are referenced in figure 2.

1. With proper installation completed and downstream equipment properly adjusted, slowly open the upstream and downstream shutoff valve (when used) while using pressure gauges to monitor pressure.



## WARNING

**To avoid personal injury, property damage, or equipment damage caused by bursting of pressure containing parts or explosion of accumulated gas, never adjust the control spring to produce an outlet pressure higher than the upper limit of the outlet pressure range for that particular spring. If the desired outlet pressure is not within the range of the control spring, install a spring of the proper range according to the diaphragm parts maintenance procedure.**

2. If outlet pressure adjustment is necessary, monitor outlet pressure with a gauge during the adjustment procedure. The regulator is adjusted by loosening the locknut (key 19), if used, and turning the adjusting screw or handwheel (key 18) clockwise to increase or counterclockwise to decrease the outlet pressure setting. Retighten the locknut to maintain the adjustment position.

## Shutdown

First, close the nearest upstream block valve and then close the nearest downstream block valve (when used). Next, open the downstream vent valve. Since the regulator remains open in response to the

decreasing downstream pressure, pressure between the closed block valves will be released through the open vent valve.

## Maintenance

Regulator parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement of parts depends on the severity of service conditions and upon applicable codes and government regulations. Open the drain valve (key 2) regularly to empty accumulated liquid from the dripwell (key 5).

### Note

**If sufficient clearance exists, the body (key 1) may remain mounted on other equipment or in a line or panel during maintenance unless the entire regulator will be replaced.**



### WARNING

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

## Filter Element and Trim Maintenance

Key numbers are referenced in figures 2 and 3.

1. Remove four dripwell screws (key 3) from the dripwell (key 5) and separate the dripwell and O-ring (key 4) from the body (key 1). The filter retainer (key 9), filter element (key 6), and gasket (key 26) may come off with dripwell. If not, remove these parts.
2. Inspect the removed parts for damage and debris. Replace any damaged parts. If a replacement is not available, the filter element may be cleaned.
3. To remove the valve cartridge assembly, grasp the end of cartridge and pull it straight out of body (key 1). Replace with new cartridge assembly. The cartridge

assembly may be disassembled and parts may be cleaned or replaced. If the soft seat (key 15) was removed, make sure it is properly snapped into place before installing the valve cartridge assembly.

4. Apply lubricant to the O-ring (key 14), then align cartridge key to keyway in body and insert. Reinstall the gasket (key 26), filter (key 6), and filter retainer (key 9). Reinstall the O-ring (key 4), secure the dripwell with screws (key 3), and torque to 24 to 36 inch-pounds (2,7 to 4,1 N·m).

## Diaphragm Maintenance

Key numbers are referenced in figure 2.

1. Back out the adjusting screw or handwheel (key 18) until compression is removed from the spring (key 17).
2. Remove the six spring case screws (key 3) to separate the spring case (key 7) from the body (key 1). Remove the upper spring seat (key 20) and spring (key 17).
3. Remove the diaphragm assembly (key 16), inspect the diaphragm, and replace the assembly, if necessary.
4. Place the diaphragm assembly (key 16) on the body (key 1) as shown in figure 4. Push down on the diaphragm assembly to make sure the valve plug (key 11) strokes smoothly and approximately 1/16-inch (2 mm).

### Note

**In step 5, if installing a control spring of a different range, be sure to delete the spring range originally appearing on the label and indicate the new spring range.**

5. Stack the control spring (key 17) and upper spring seat (key 20) onto the diaphragm assembly (key 16).
6. Install the spring case (key 7) on the body (key 1) with the vent oriented to prevent clogging or entrance of moisture. Install the six spring case screws (key 3) using a crisscross pattern and torque to 24 to 36 inch-pounds (3 to 4 N·m).
7. When all maintenance is complete, refer to the Startup and Adjustment section to put the regulator back into operation and adjust the pressure setting. Tighten the locknut (key 19) if used, and install the closing cap if used.

## Parts Ordering

When corresponding with the Fisher Sales Office or Sales Representative about this regulator, include the type number and all other pertinent information printed on the label. Specify the eleven-character part number when ordering new parts from the following parts list.

## Parts List

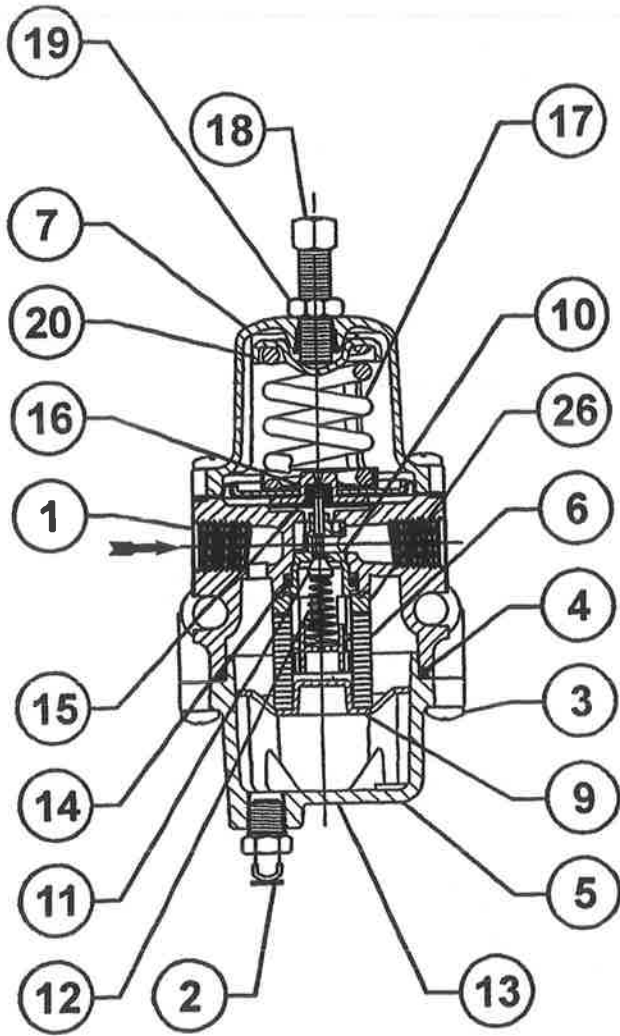
Key	Description	Part Number
	<b>Parts Kit</b>	
	Includes valve cartridge assembly (contains keys 10, 11, 12, 13, 14, and 15), diaphragm assembly (key 16), filter element (key 6), filter gasket (key 26), and four screws (key 3)	
	<b>Type 67CF (without relief)</b>	
	Brass stem with nitrile plug	R67CFX00012
	Aluminum stem with nitrile plug (NACE)	R67CFX00N12
	<b>Type 67CFR (with relief)</b>	
	Brass stem with nitrile plug	R67CFRX0012
	Aluminum stem with nitrile plug (NACE)	R67CFRX0N12
	<b>Valve Cartridge Assembly Only</b>	
	Brass stem	
	With nitrile plug	T14121T0012
	With fluoroelastomer plug	T14121T0022
	Aluminum stem	
	with nitrile plug	T14121T0042
	with nitrile plug (NACE)	T14121T0052
1	Body, Aluminum	T80432T0012
2	Drain Valve	
	Brass	1K418918992
	Aluminum	1K4189000B2
	Stainless steel	AH3946X0012
3	Flange Screw	
	Standard spring case and spring case with 1/4-inch NPT vent (10 required)	T13526T0012
	For wire seal	
	Flange Screw (9 required)	T13526T0012
	Flange Screw (1 required)	14B3987X012
4 <sup>(1)</sup>	O-Ring	
	Nitrile (NBR)	T14057T0012
	Fluoroelastomer (FKM)	T14057T0022
	Silicone (VMQ)	T14057T0032
5	Dripwell	T21040T0012
6 <sup>(1)</sup>	Filter Element	
	Cellulose (40 microns) (standard)	1F257706992
	Glass fiber (10 microns)	17A1457X012
	Stainless steel (40 microns)	15A5967X012
7	Spring Case, Aluminum	
	Drilled hole vent (standard)	T14070T0012
	1/4-inch NPT vent	T14070T0022
9	Filter Retainer	T14052T0012
10 <sup>(1, 2)</sup>	Valve Cartridge	T80434T0012
11 <sup>(1, 2)</sup>	Valve Plug	
	Brass stem, nitrile (NBR) plug	T14053T0012
	Aluminum stem, fluoroelastomer (FKM) plug	T14053T0022
	Aluminum stem, nitrile (NBR) plug	T14053T0032

Key	Description	Part Number
12 <sup>(1, 2)</sup>	Valve Spring	
	Stainless steel	T14105T0012
	Inconel (NACE)	T14116T0012
13 <sup>(1, 2)</sup>	Valve Retainer	T14071T0012
14 <sup>(1, 2)</sup>	O-Ring	
	Nitrile (NBR)	T14063T0012
	Fluoroelastomer (FKM)	T14063T0022
	Silicone (VMQ)	T14063T0032
15 <sup>(1, 2)</sup>	Soft Seat	
	Nitrile (NBR)	T14055T0012
	Fluoroelastomer (FKM)	T14055T0022
16 <sup>(1)</sup>	Diaphragm Assembly	
	67CF (without relief)	
	Nitrile (NBR)	T14119T0022
	Fluoroelastomer (FKM)	T14119T0042
	Type 67CFR (with relief)	
	Nitrile (NBR)	T14119T0012
	Fluoroelastomer (FKM)	T14119T0032
	Silicone (VMQ)	T14119T0052
17	Spring	
	Types 67CF and 67CFR, Plated steel (standard)	
	0 to 20 psig (0 to 1,4 bar), Green stripe	T14130T0012
	0 to 35 psig (0 to 2,4 bar), Silver	T14059T0012
	0 to 60 psig (0 to 4,1 bar), Blue stripe	T14058T0012
	0 to 125 psig (0 to 8,6 bar), Red stripe	T14060T0012
	Type 67CFR (NACE), Inconel (NACE)	
	0 to 35 psig (0 to 2,4 bar), Silver stripe	T14113T0012
	0 to 60 psig (0 to 4,1 bar), Blue	T14114T0012
	0 to 125 psig (0 to 8,6 bar), Red	T14115T0012
18	Adjusting Screw	
	For standard spring case	
	Square head (standard)	T14061T0012
	Handwheel	T14102T0012
	Wire seal (not shown)	T14104T0012
	For spring case with 1/4-inch NPT vent	
	Square head for closing cap	T14101T0012
	Handwheel	T14103T0012
19	Locknut	1A946324122
20	Upper Spring Seat	1B798525062
22	Pressure Gauge	
	Brass	
	0 to 30 psig/0 to 2 bar/0 to 0,2 MPa	11B8579X022
	0 to 60 psig/0 to 4 bar/0 to 0,4 MPa	11B8579X032
	0 to 160 psig/0 to 11 bar/0 to 1,1 MPa	11B8579X042
	Stainless Steel	
	0 to 30 psig/0 to 2 bar/0 to 0,2 MPa	11B9639X012
	0 to 60 psig/0 to 4 bar/0 to 0,4 MPa	11B9639X022
	0 to 160 psig/0 to 11 bar/0 to 1,1 MPa	11B9639X032
23	1/4-Inch Pipe Plug	
	Socket head, steel	1C333528992
	Hex head, stainless steel	1A767535072
24	Tire Valve	1H447099022
26 <sup>(1)</sup>	Filter Gasket	
	Nitrile (NBR)	T14081T0012
	Fluoroelastomer (FKM)	T14081T0022
31	Panel Mounting Nut	10B2657X012
32	Wire Seal (not shown)	1U7581000A2
33	Closing Cap	23B9152X012
34	Spacer	T14123T0012
35	Mounting adaptor plate for Fisher 2500 Series Controller	T21043T0012

1. Recommended Spare Part

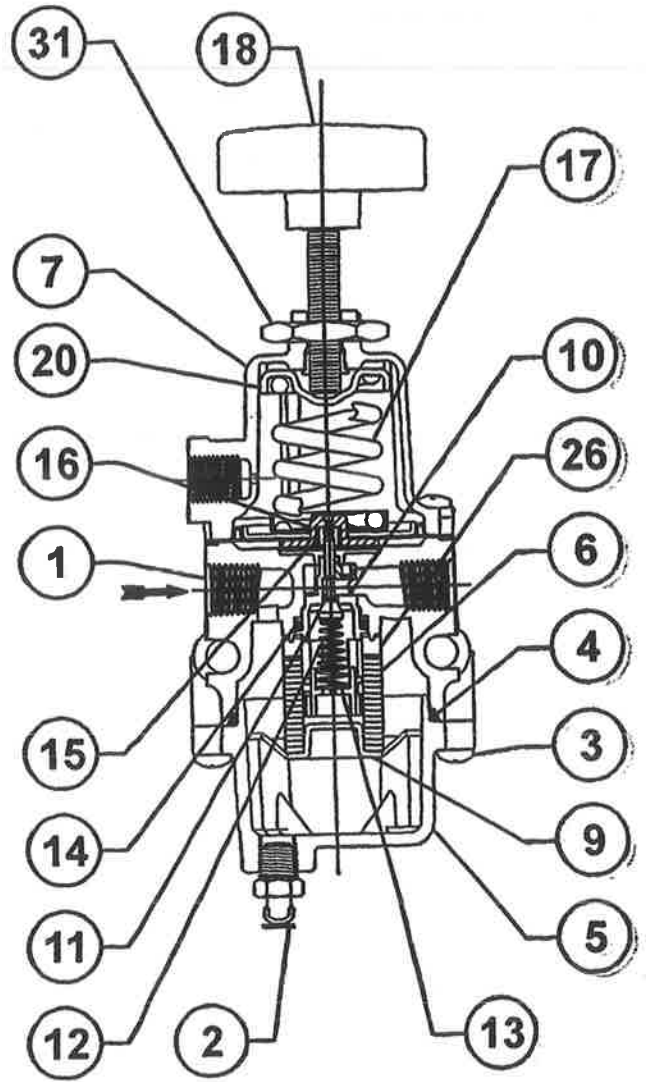
2. Valve cartridge assembly includes keys 10, 11, 12, 13, 14, and 15.

# 67CF Series



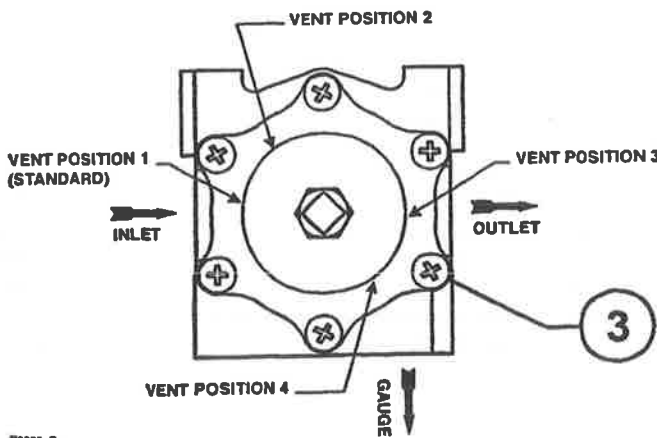
B2690

**STANDARD CONSTRUCTION**



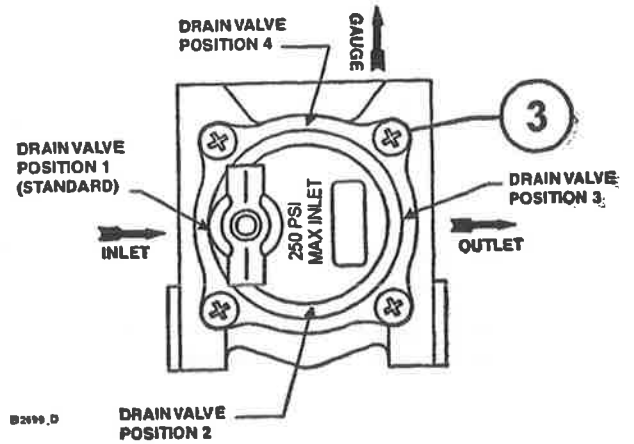
B2696

**PANEL MOUNT OPTION  
(INCLUDES HANDWHEEL, MOUNTING NUT,  
AND 1/4-INCH NPT SPRING CASE VENT)**



B2699.C

**SPRING CASE VENT POSITIONS**



B2699.D

**DRAIN VALVE POSITIONS**

*Figure 2. 67CF Series Assembly Drawings*

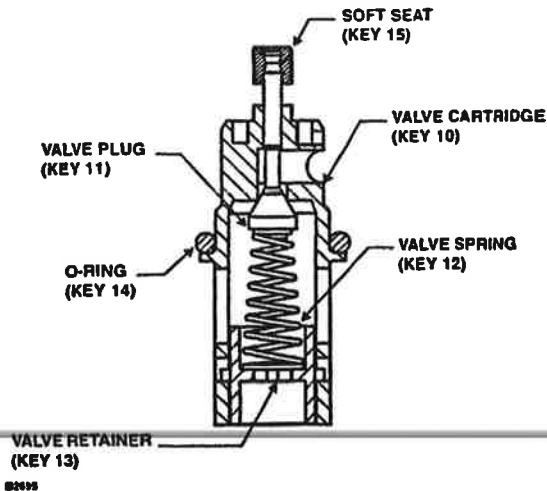


Figure 3. Valve Cartridge Assembly

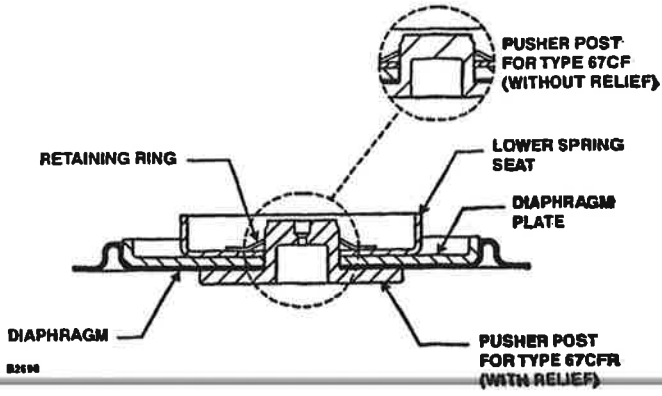


Figure 4. Diaphragm Assembly (Key 16)

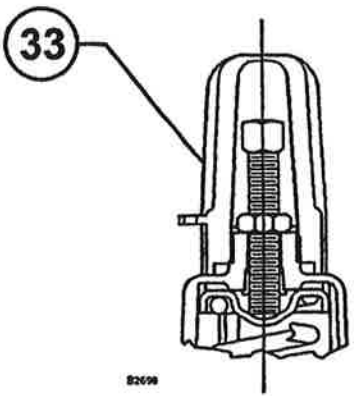


Figure 5. Optional Closing Cap (Only Available with the 1/4-inch Spring Case Vent)

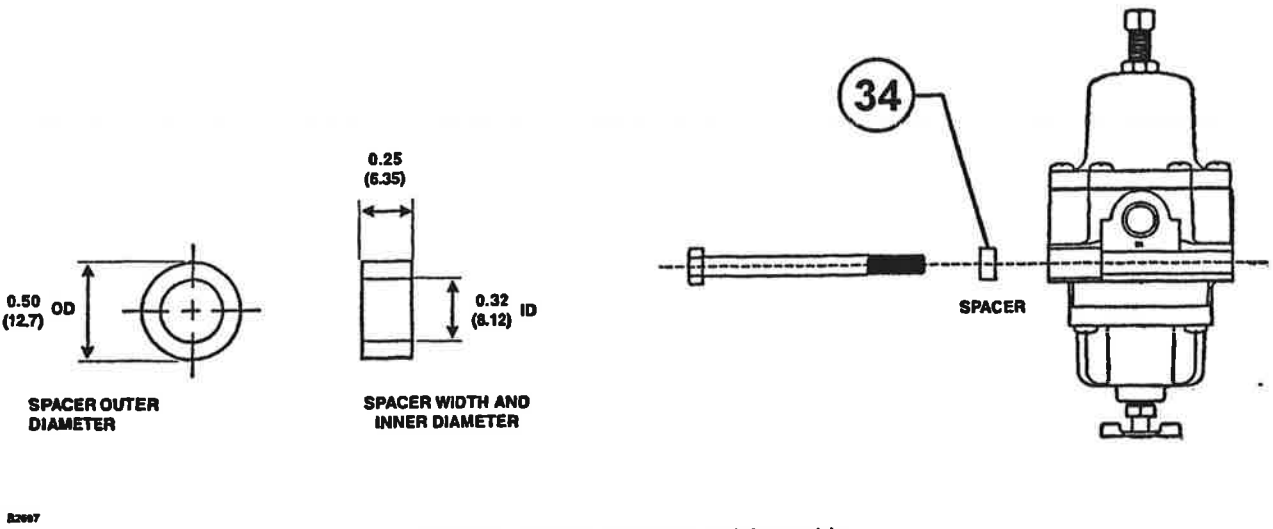


Figure 6. Spacer Diameter and Assembly  
(For Installing 67CF Series Regulator in an Existing Installation if the Mounting Bolts are too Long)

# 67CF Series

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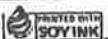
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**FISHER-ROSEMOUNT™ Managing The Process Better.**

# 67CF Series Installation Sheet

## Introduction

This installation sheet covers the installation and startup of the 67CF Series filter regulators. If maintenance is required, refer to the 67CF Series Instruction Manual, form 5469. Contact your Fisher Sales Representative or Sales Office to receive a copy of the instruction manual.

## Specifications

- **Maximum Inlet Pressure:**  
250 psig (17.2 bar)
- **Maximum Outlet Pressure:**  
50 psi (3.4 bar) over outlet pressure setting
- **Outlet Pressure Ranges:**  
0 to 35 psig (0 to 1,4 bar)  
0 to 60 psig (0 to 2,4 bar)  
0 to 125 psig (0 to 8,6 bar)
- **Temperature Capabilities with Nitrile (NBR):**  
-40° to 180°F (-40°C to 82°C)

## Installation



### WARNING

Personal injury, property damage, equipment damage, or leakage due to escaping gas or bursting of pressure-containing parts may result if this regulator is overpressured or is installed where service conditions could exceed the limits given in the specifications, or where conditions exceed any ratings of the adjacent piping or piping connections. To avoid such injury or damage, provide pressure-relieving or pressure-limiting devices (as required by the appropriate code, regulation, or standard) to prevent service conditions from exceeding those limits.

The internal relief valve in the Type 67CFR regulator does not provide full overpressure protection. The internal relief valve is designed for minor seat leakage only. If maximum inlet pressure to the Type 67CFR exceeds the maximum pressure ratings of the downstream equipment or exceeds the maximum allowable outlet pressure of the Type 67CFR, additional overpressure protection is required.

1. Regulator operation within ratings does not preclude the possibility of physical damage from external sources

or debris in the lines. Regulators should be inspected for damage periodically and after an overpressure condition.

2. Only personnel qualified through training and experience should install, operate, and maintain a regulator. Make sure there is no damage to or foreign material in the regulator and all tubing/piping is free of debris.

3. Install the regulator so that flow is from the IN to the OUT connection as marked on the regulator body.

4. For best drainage, orient the drain valve (key 2) to the lowest possible point on the dripwell (key 5). This orientation may be improved by rotating the dripwell with respect to the body (key 1).



### WARNING

A regulator may vent some gas to the atmosphere. In hazardous or flammable gas service, vented gas may accumulate and cause personal injury, death, or property damage due to fire or explosion. Vent a regulator in hazardous gas service to a remote, safe location away from air intakes or any hazardous area. The vent line or stack opening must be protected against condensation or clogging.

5. A clogged spring case vent hole may cause the regulator to function improperly. To keep this vent hole from being plugged (and to keep the spring case from collecting moisture, corrosive chemicals, or other foreign material) orient the vent to the lowest possible point on the spring case or otherwise protect it. Inspect the vent hole regularly to make sure it is not plugged. Spring case vent hole orientation may be changed by rotating the spring case with respect to the body. A 1/4-inch NPT spring case vent may be remotely vented by installing tubing or piping into the vent.

6. For regulator shutdown, install upstream block and vent valves and downstream block and vent valves (if required), or provide some other suitable means of properly venting the regulator inlet and outlet pressures.

7. Apply a good grade of pipe compound to the male pipe threads before making connections, making sure not to get the pipe compound inside the regulator.

8. Install tubing fitting or piping into the 1/4-inch NPT inlet connection on the body (key 1) and into the 1/4-inch NPT body outlet connection.

9. The second 1/4-inch NPT outlet can be used for a gauge or other use. If not used, it must be plugged.

**FISHER**

# 67CF Series

10. When installing a 67CF Series regulator in an existing installation, it may be necessary to use spacers to adapt the installation. If the mounting bolts are too long, place a spacer on the bolt. To be sure the regulator is secure, the bolts should have at least two full threads of engagement.

## Startup and Adjustment

1. With proper installation completed and downstream equipment properly adjusted, slowly open the upstream and downstream shutoff valve (when used) while using pressure gauges to monitor pressure.

### WARNING

To avoid personal injury, property damage, or equipment damage caused by bursting of pressure containing parts or explosion of accumulated gas, never adjust the control spring to produce an outlet pressure higher than the upper limit of the outlet pressure range for that particular spring. If the desired outlet pressure is not within the range of the control spring, install a spring of the proper range.

2. If outlet pressure adjustment is necessary, monitor outlet pressure with a gauge during the adjustment procedure. The regulator is adjusted by loosening the locknut (key 19), if used, and turning the adjusting screw or handwheel (key 18) clockwise to increase or counter-clockwise to decrease the outlet pressure setting. Tighten the locknut to maintain the adjustment position.

## Parts List

Key	Description	Key	Description
1	Body	16 <sup>(1)</sup>	Diaphragm Assembly
2	Drain Valve	17	Spring
3	Flange Screw	18	Adjusting Screw
4 <sup>(1)</sup>	O-Ring	19	Locknut
5	Dripwell	20	Upper Spring Seat
6 <sup>(1)</sup>	Filter Element	22	Pressure Gauge
7	Spring Case	23	1/4-Inch Pipe Plug
9	Filter Retainer	24	Tire Valve
10 <sup>(1, 2)</sup>	Valve Cartridge	26 <sup>(1)</sup>	Filter Gasket
11 <sup>(1, 2)</sup>	Valve Plug	31	Panel Mounting Nut
12 <sup>(1, 2)</sup>	Valve Spring	32	Wire Seal
13 <sup>(1, 2)</sup>	Valve Retainer	33	Closing Cap
14 <sup>(1, 2)</sup>	O-Ring	34	Spacer
15 <sup>(1, 2)</sup>	Soft Seat		

1. Recommended Spare Part  
2. Valve cartridge assembly includes keys 10, 11, 12, 13, 14, and 15.

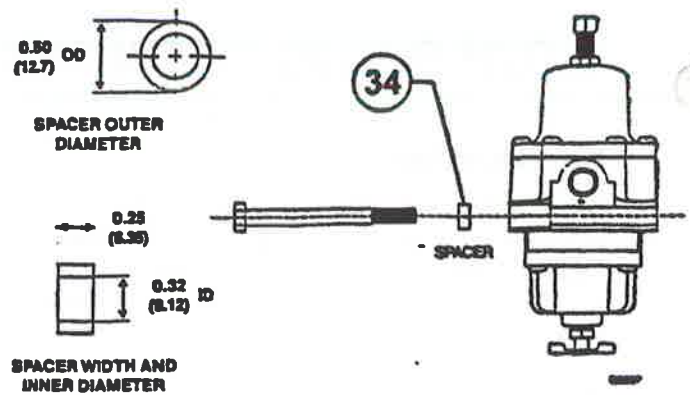


Figure 1. Spacer Diameter and Installation

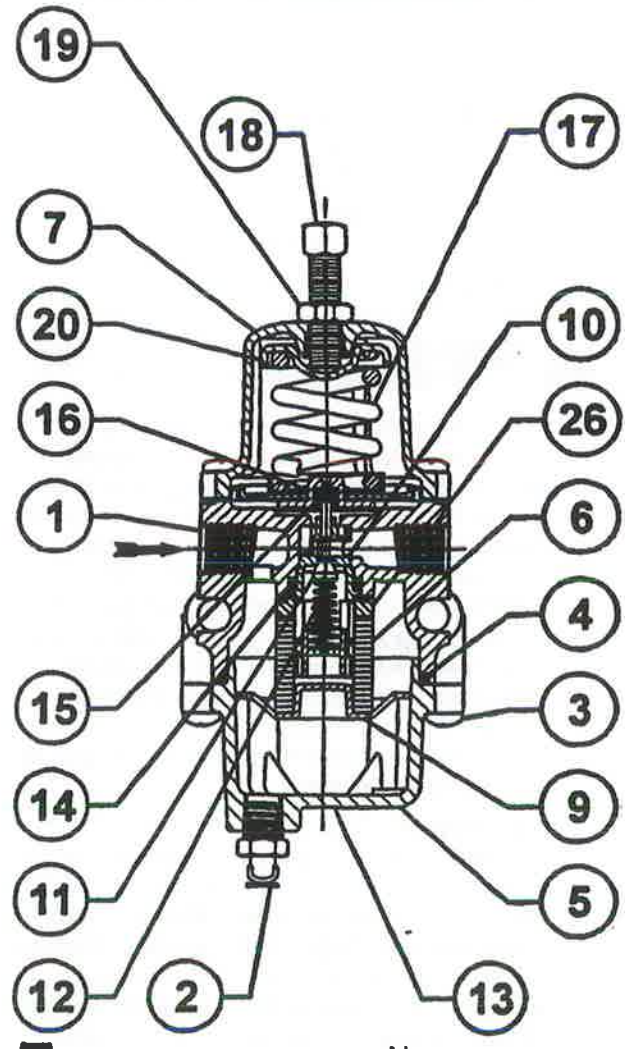


Figure 2. 67CF Series Assembly Drawings

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Fisher Controls

Instruction Manual

**Type 98L and Type 98H Back Pressure and Relief Valves****FISHER®**

August 1993

Form 1570

**WARNING**

Fisher relief valves must be installed, operated and maintained in accordance with federal, state, and local codes, rules and regulations; and Fisher instructions.

If the spring case develops a leak or if the outlet continually vents gas, service to the unit may be required. Failure to correct trouble could result in a hazardous condition. Only a qualified person must install or service the unit.

**Introduction**

Type 98L and Type 98H (see figure 1) are self-operated, spring-loaded back pressure or relief valves. Typical applications include use in wash tanks, small heaters, fuel and oil lines, air supply systems, test fixtures, and sterilizers. Relief pressure ranges are 2 to 38 psig (0.14 to 2.6 bar), in four ranges, for the Type 98L and 15 to 200 psig (1.03 to 13.8 bar), in eight ranges, for the Type 98H. Type 98L body sizes are 1/4, 1/2, 3/4 and 1-inch. Type 98H body sizes are 1/4, 1/2, 3/4, 1, 1-1/2 and 2-inch.

**Specifications**

Specifications for the Type 98L and 98H backpressure and relief valves are given in table 1.



W6155

TYPE 98H



W6156

TYPE 98L

Figure 1. Type 98L & 98H Back Pressure and Relief Valves



Table 1. Specifications

<p><b>Available Constructions</b></p> <p><b>Type 98L:</b> Self-operated with standard adjusting screw. Relief pressure ranges are 2 to 38 psig (0.14 to 2.6 bar).</p> <p><b>Type 98H:</b> Self-operated with standard adjusting screw. Relief pressure ranges are 15 to 200 psig (1.03 to 13.8 bar).</p>		<p><b>Allowable Temperature Ranges<sup>(5)</sup></b></p> <p><b>Nitrile Parts:</b> - 20 to 200°F (- 29 to 93°C)</p> <p><b>Neoprene Parts:</b> - 40 to 150°F (- 40 to 66°C)</p> <p><b>Fluoroelastomer Parts:</b> 0 to 300°F (- 18 to 149°C)</p> <p><b>Metal Diaphragm and Seat</b></p> <p><i>Cast Iron Body and Spring Case:</i> - 40 to 406°F (- 40 to 208°C)</p> <p><i>Steel Body and Spring Case:</i> - 20 to 450°F (- 29 to 232°C)</p> <p><i>Stainless Steel Body and Spring Case:</i> - 40 to 450°F (- 40 to 232°C)</p>		
<p><b>End Connection Style</b></p> <p>NPT screwed, socket weld, or ANSI flanged-14 inches face to face (DIN flanged-356mm face to face)</p>		<p><b>Approximate Weight, lb (kg)</b></p> <p><b>Type 98H</b></p> <p>1/4-inch Body: 7 (3.18)</p> <p>1/2-inch Body: 7 (3.18)</p> <p>3/4-inch Body: 16 (7.26)</p> <p>1-inch Body: 16 (7.26)</p> <p>1-1/2-inch Body: 55 (25)</p> <p>2-inch Body: 55 (25)</p> <p><b>Type 98L</b></p> <p>1/4-inch Body: 6 (2.80)</p> <p>1/2-inch Body: 13 (5.90)</p> <p>3/4-inch Body: 30 (13.6)</p> <p>1-inch Body: 30 (13.6)</p>		
<p><b>Body Sizes</b></p> <p>■ 1/4, ■ 1/2, ■ 3/4, ■ 1, ■ 1-1/2, ■ 2</p>				
<p><b>Maximum Inlet Pressures, Psig<sup>(1,5)</sup> (Set Pressure Plus Buildup)</b></p>				
<p><b>TYPE NUMBER</b></p>	<p><b>STEEL (WCB) OR STAINLESS STEEL BODY/ ALL TRIMS TO 150°F<sup>(2)</sup> (66°C)</b></p>	<p><b>CAST IRON BODY</b></p>		
		<p>All Trims to 150°F<sup>(3)</sup> (66°C)</p>	<p>Metal Trims<sup>(4)</sup></p>	
		<p>To 315°F (66°C)</p>	<p>To 406°F (208°C)</p>	
98L	125 (52)	60 (16)	60 (16)	60 (16)
98H	300 (149)	300 (149)	300 (149)	250 (121)
<p><b>Relief Pressure Ranges</b></p> <p>See table 2</p>				
<p>1. Relief pressure setting plus maximum allowable buildup over setting.                  2. Or fluoroelastomer trims to 300°F (149°C) or metal trims to 450°F (232°C).                  3. Or fluoroelastomer trims to 300°F (149°C).                  4. Interpolate for intermediate pressure ratings.                  5. The pressure/temperature limits in this bulletin and any applicable standard limitation should not be exceeded.</p>				

Table 2. Relief Pressure Ranges

BODY SIZE, INCHES	98L RANGE		98H RANGE		COLOR CODE	PART NUMBER
	Psi	Bar	Psi	Bar		
1/4	2 to 17	0.1 to 1.2	15 to 35	1.0 to 2.4	Yellow	1E392527022
	6 to 14	0.4 to 1.0	25 to 75	1.7 to 5.2	Green	1E392627012
	12 to 25	0.8 to 1.7	70 to 140	4.8 to 9.7	Red	1E392727142
	20 to 38	1.4 to 2.6	130 to 200	9.0 to 13.8	Blue	1L346127142
1/2	2 to 17	0.1 to 1.2	15 to 35	1.0 to 2.4	Yellow	1E395627022
	6 to 14	0.4 to 1.0	25 to 75	1.7 to 5.2	Green	1D745527142
	12 to 25	0.8 to 1.7	70 to 140	4.8 to 9.7	Red	1D395727192
	20 to 38	1.4 to 2.6	130 to 200	9.0 to 13.8	Blue	1L380027142
3/4 & 1	2 to 17	0.1 to 1.2	15 to 35	1.0 to 2.4	Yellow	1E398927022
	6 to 14	0.4 to 1.0	25 to 75	1.7 to 5.2	Green	1E399027142
	12 to 25	0.8 to 1.7	70 to 140	4.8 to 9.7	Red	1D399127162
	20 to 38	1.4 to 2.6	130 to 200	9.0 to 13.8	Blue	1L380127232
1-1/2 & 2	---	---	5 to 35	0.3 to 2.4	Dark Gray	1E792327092
	---	---	20 to 65	1.4 to 4.5	Light Blue	1E795327082
	---	---	50 to 100	3.4 to 6.9	Light Gray	1E795427082
	---	---	80 to 170	5.6 to 11.7	Black	1P788827082

1. All springs may be backed off to 0 psig (bar). However, highest capacities and best performances are obtained by using these springs in their recommended ranges. Psi (bar) rather than psig (bar) are used for differential relief constructions.

## Installation

Unbox and inspect the valve. Remove pipe scale and other foreign material from the connecting pipeline. Apply a suitable pipe compound to the male threads. The relief valve can be installed in any position as long as the flow is in the direction indicated by the arrow cast on the body.

Maximum operating temperatures for the Type 98L and 98H relief valves are as follows:

Elastomer diaphragm or seat: 150°F (66°C)

Metal diaphragm and seat: 406°F (208°C) with cast iron body and spring case or 450°F (232°C) with steel or stainless steel body and spring case

## Vents

### WARNING

If the process fluid is hazardous, install remote vent lines to carry fluid to a safe area.

If remote venting is necessary, an optional tapped vent in the spring case is available. Install remote vent lines in the spring case and outlet openings. The vent lines must have the largest practical diameter and be as short as possible with a minimum number of bends or elbows.

## Overpressure

### WARNING

Overpressuring any portion of this equipment may result in equipment damage, leaks in the relief valve, or personal injury due to bursting of pressure-containing parts. The system should be inspected after any overpressure condition.

Relief or back pressure ranges are from 2 to 200 psig (0.14 to 13.8 bar). The individual spring range of your relief valve is stamped on the nameplate.

Maximum inlet pressures depend upon body materials and temperatures. See table 1 for the maximum inlet pressure of the valve. The valve should be inspected for damage after any overpressure condition.

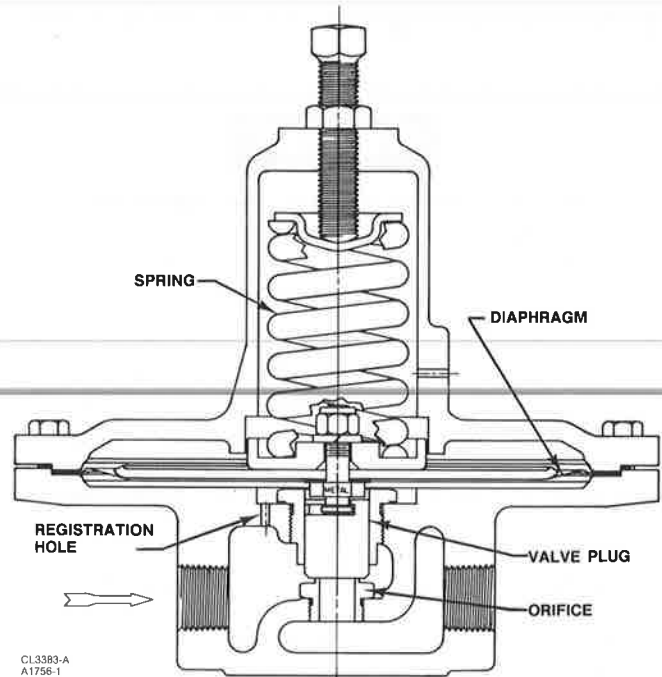


Figure 2. Type 98L Relief Valve Operational Schematic

## Adjustment

Each unit is factory set for the pressure specified on your order. The allowable spring range is stamped on the nameplate. If a pressure setting beyond the indicated range is required, substitute the appropriate spring. Be sure to label the valve to indicate the new pressure range.

Always use a pressure gauge to monitor pressure when making adjustments.

Loosen the locknut (key 17). To increase the setting, turn the adjusting screw (key 15) clockwise. Turn the adjusting screw counterclockwise to decrease the setting. Tighten the locknut.

## Principle Of Operation

Relief or back pressure valves respond to changes in upstream pressure. Pressure changes register under the diaphragm (see figure 2) through a registration hole in the valve body. When the pressure increases beyond the spring setting, the diaphragm pressure overcomes the spring compression. This causes the valve plug to move away from the orifice. The flow line through the valve is open and excess pressure is vented. When upstream pressure drops back to normal, the valve resumes its closed position.

## Maintenance

### WARNING

**To avoid personal injury and equipment damage, isolate the valve from all pressure. Cautiously release pressure from the valve before attempting disassembly.**

Due to normal wear and damage that may occur from external sources, relief valve parts such as the O-rings, gaskets, diaphragm, orifice, and valve plug should be inspected periodically and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions or the requirements of state and federal laws.

Instructions are given below for disassembly of the Type 98L and 98H back pressure relief valves. These valves do not have to be removed from the pipeline to inspect internal parts. Suitable lubricants are indicated on the assembly drawings. Apply the lubricants as the relief valve is being reassembled. Refer to figures 3 and 4 while servicing the relief valve.

1. Relieve the spring tension by loosening the locknut (key 17) and turning the adjusting screw (key 15) counterclockwise. Remove the cap screws (key 16). Lift off the spring case (key 2), spring (key 11), and upper spring seat (key 9).

2. Lift out the diaphragm unit which includes the pusher post (key 6), lower spring seat (key 8), diaphragm head (key 25, Type 98L), diaphragm (key 12), washer (key 7), and valve plug (key 4). (There will be two diaphragms if the diaphragm material is metal or fluoroelastomer.)

3. Check the orifice (key 3). If it needs replacing or repairing, unscrew the valve plug guide (key 5) and then the orifice. The valve plug can be removed by sliding it off of the pusher post.

#### Note

**If damage to elastomer or metal seating surfaces is severe, replace the orifice and valve plug O-ring with new parts. However, by following the lapping procedure below, it is possible to repair metal seating surfaces if they are only slightly worn or scratched.**

4. Lapping procedure:

a. Place a small amount of 500-grit silicon carbide or aluminum oxide lapping compound on a flat surface such as a piece of heavy plate glass.

Table 3. Torque Specifications

Body Size, Inches	Spring Case Ft-Lbs	Orifice Ft-Lbs
1/4	4.5 - 5.0	8 - 12
1/2	10 - 13	29 - 35
3/4 - 1	24 - 30	33 - 42
1-1/2 - 2	40 - 50	140 - 170

b. Take the valve plug or orifice and move it in a figure 8 motion on the lapping compound. Do not allow the part to tip or rock since this would round the corners.

c. Repeat step b for each part, using an 800-grit or 1000-grit silicon carbide or aluminum oxide lapping compound.

d. Wash away all traces of the lapping compound. To help prevent scratching the seating surfaces, a light coat of oil may be applied before returning the valve plug and orifice to the body. See table 3 for torque specifications.

5. Return the orifice and valve plug guide to the body.

6. To replace the valve plug O-ring (key 22), remove the screw (key 24) and O-ring retainer (key 21) from the plug. Remove and replace the O-ring.

7. Separate the remainder of the diaphragm unit parts. Take the locknut (key 26) off of the pusher post. Slide off the washer (key 23), lower spring seat, diaphragm head (Type 98L), diaphragm, washer (key 7), and gasket (key 10).

8. Slip the plug onto the pusher post.

#### Note

**If a metal diaphragm is to be replaced by a elastomer diaphragm or a elastomer diaphragm by a metal diaphragm, a new pusher post is required. Each diaphragm material requires a different length pusher post.**

9. Replace the diaphragm gasket (key 19) if necessary.

10. Slip gasket, washer, diaphragm, diaphragm head, lower spring seat, and washer back onto the pusher post. Screw on the locknut and return the unit to the body.

11. Set the spring in the lower spring seat and place the upper spring seat on the spring.

12. Put the spring case over the spring and onto the body. Tighten the cap screws finger tight only.

13. To ensure proper slack in the diaphragm, apply some spring compression by turning the adjusting screw clockwise. Finish tightening the cap screws.

## Parts Ordering

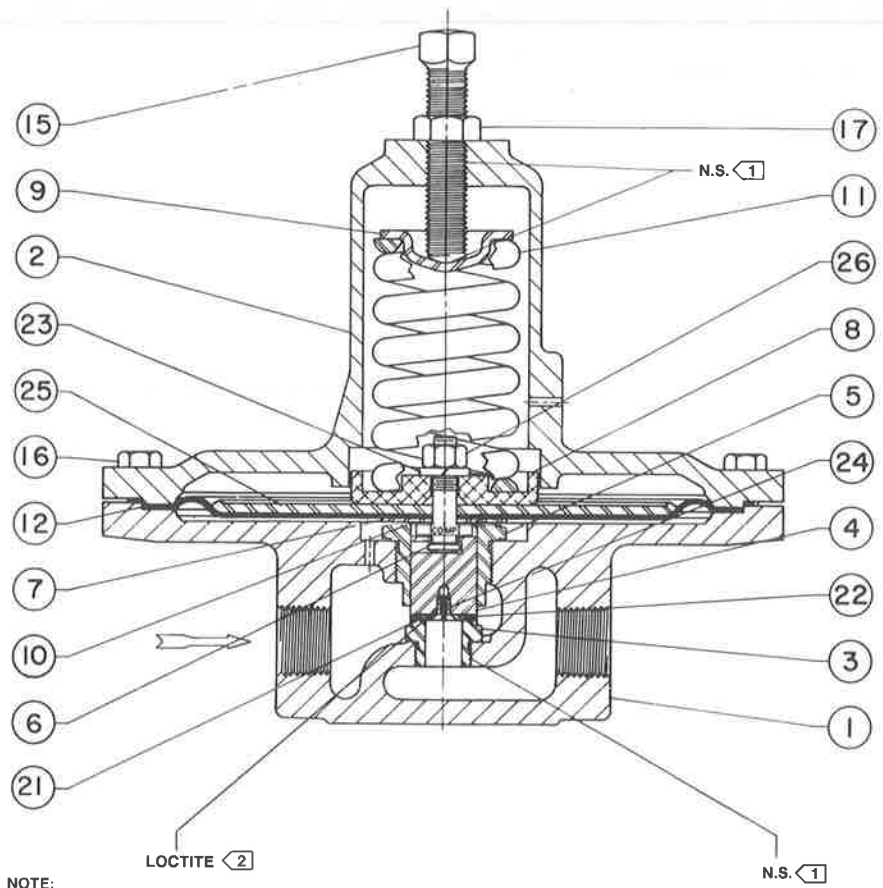
When corresponding with your Fisher sales office or sales representative about this equipment, be sure to include the type number and other information stamped on the nameplate.

When ordering replacement parts, reference the key number of each needed part and specify the eleven-character part number as found in the following parts list.

## Parts List

Key	Description	Part Number
	<b>Note</b>	
	<b>In this parts list, parts marked NACE are intended for corrosion-resistant service as detailed in the National Association of Corrosion Engineers (NACE) standard MR0175-92.</b>	
	Parts kit (included are keys 3, 4, 10, 12, 19, 21, 22 and 24). Also included for 98H only is key 14.	
	<b>Elastomer Trim</b>	
	1/4-inch body	R98H X000012
	1/2-inch body	R98H X000022
	3/4 and 1-inch body	R98H X000032
	1-1/2 and 2-inch body	
	Type 98H only	R98H X000072
	<b>Metal Trim</b>	
	1/4-inch body	R98H X000042
	1/2-inch body	R98H X000052
	3/4 and 1-inch body	R98H X000062
	1-1/2 and 2-inch body	
	Type 98H only	R98H X000082
1	Body	See following table
2	Spring Case	
	Type 98H	
	Cast iron	
	1/4-inch body	2E3912 19012
	1/2-inch body	2J4962 19012
	3/4 and 1-inch bodies	3E3978 19012
	1-1/2 and 2-inch bodies	4P7840 19012
	Steel	
	1/4-inch body	2J1275 22012
	1/2-inch body	2L4163 22012
	3/4 and 1-inch bodies	3E4087 22012
	1-1/2 and 2-inch bodies	3P7904 22012

Key	Description	Part Number
2	Spring Case (Continued)	
	Type 98L	
	Cast iron	
	1/4-inch body	2E3913 19012
	1/2-inch body	3J4963 19012
	3/4 and 1-inch bodies	4E3979 19012
	Steel	
	1/4-inch body	2J1279 22012
	1/2-inch body	3L4161 22012
	3/4 and 1-inch bodies	4E5929 22012
3*	Orifice	See following table
4*	Valve Plug	See following table
5	Valve Plug Guide	
	416 stainless steel	
	1/4-inch body	1L3458 35132
	1/2-inch bodies	1L3416 35132
	3/4 and 1-inch bodies	1L3429 35132
	1-1/2 and 2-inch bodies	1P7885 35132
	316 stainless steel	
	1/4-inch body (NACE)	1L3458 35072
	1/2-inch body (NACE)	1L3416 35072
	3/4 and 1-inch bodies (NACE)	1L3429 35072
	1-1/2 and 2-inch bodies (NACE)	
	Type 98H only	1P7885 35072
6	Pusher Post	See following table
7	Washer (elastomer diaphragm only)	
	416 stainless steel trim	
	1/4-inch body	1L3447 36012
	1/2-inch body	1L3398 36012
	3/4 and 1-inch bodies	1L3428 36012
	316 stainless steel trim	
	1/4-inch body, std	1L3447 36142
	(NACE)	1L3447 X0012
	1/2-inch body, std	1L3398 35072
	(NACE)	1L3398 40032
	3/4 and 1-inch bodies, std	1L3428 36142
	(NACE)	1L3428 X0022
8	Lower Spring Seat	
	1/4-inch body, aluminum	1L3446 09012
	1/2-inch body, aluminum	1L3397 08012
	3/4 and 1-inch bodies, aluminum	1L3427 08012
	1-1/2 and 2-inch bodies	
	Type 98H only, steel zinc plated	1P7877 24152
9	Upper Spring Seat, steel pl	
	1/4-inch body	1B7985 25062
	1/2-inch body	1D6671 25072
	3/4 and 1-inch bodies	1E3987 25072
	1-1/2 and 2-inch bodies	
	Type 98H only	1P7876 24092
10*	Gasket, composition	
	(2 req'd for metal diaphragm)	
	1/4-inch body	1L3448 04022
	1/2-inch body	1L3411 04022
	3/4 and 1-inch bodies	1L3434 04022
	1-1/2 and 2-inch bodies (metal diaphragm only) (2 req'd)	
	Type 98H only	1P7880 04022
11	Relief Valve Spring	See following table
12*	Diaphragm	See following table
13	Nameplate, aluminum	
	(not shown)	11A5494 X0A2
14*	O-Ring, Type 98H only	
	1-1/2 and 2-inch bodies, elastomer seat only	
	Nitrile	1C7822 06992
	Fluoroelastomer	1K7561 06382
	Fluoroelastomer (NACE)	1K7561 35072

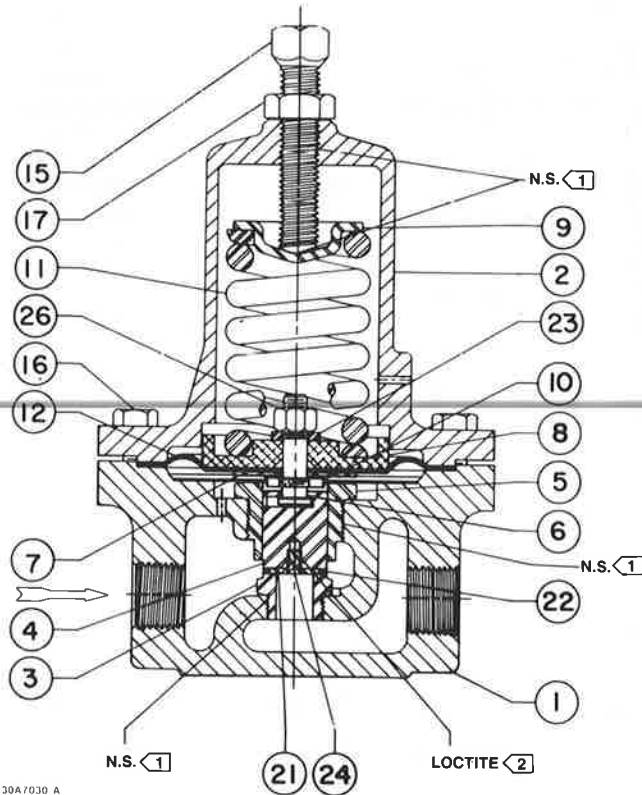


NOTE:  
 PARTS NOT SHOWN 13, 18, & 20  
 1 NEVER-SEEZ MARK OWNED BY COMPOUND CORP.  
 2 LOCTITE GRADE "A" MARK OWNED BY LOCTITE CORP.  
 30A7028  
 A1757-1

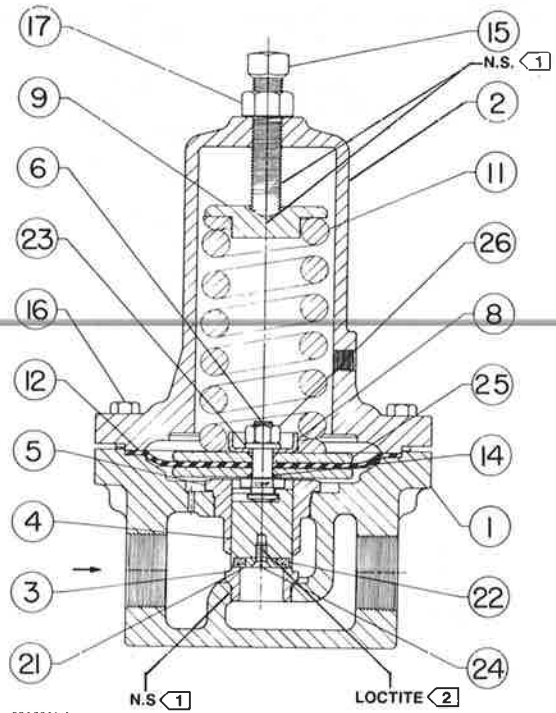
Figure 3. Type 98L Relief Valve Assembly Drawing

Key	Description	Part Number	Key	Description	Part Number
15	Adjusting Screw, steel pl 1/4-inch body Standard	1E6399 28992	17	Jam Nut, steel zinc plated 1/4-inch body	1A3522 24122
	1/2-inch body Standard	1D9954 48702		3/4 and 1-inch bodies	1A3537 24122
	For handwheel	1J4964 28982		1-1/2 and 2-inch bodies	1A3192 24122
	3/4 and 1-inch bodies Standard	1A3308 28982	18	Drive Screw (not shown) Stainless steel (2 req'd)	1A3681 24112
	1-1/2 and 2-inch bodies Standard, Type 98H only	1A6801 28992	19*	Diaphragm Gasket, elastomer Use w/302 stainless steel diaphragm	1A3682 28982
16	Cap Screw, steel pl Type 98L			Type 98H	
	1/4-inch body (10 req'd)	1A4078 24052		1/4-inch body	1E3931 04022
	1/2-inch body (10 req'd)	1A3816 24052		1/2-inch body	1E3961 04022
	3/4 and 1-inch bodies (12 req'd)	1A3369 24052		3/4 and 1-inch bodies	1E3993 04022
	Type 98H			1-1/2 and 2-inch bodies	1P7879 04022
	1/4-inch body (6 req'd)	1A3917 24052		Type 98L	
	1/2-inch body (8 req'd)	1A3526 24052		1/4-inch body	1E3940 04022
	3/4 and 1-inch bodies (8 req'd)	1A3418 24052		1/2-inch body	1E3970 04022
	1-1/2 and 2-inch bodies (8 req'd)	1K5684 28982		3/4 and 1-inch bodies	1E3904 04022

\* Recommended spare part.



1/4, 1/2, 3/4, AND 1-INCH SIZES



1-1/2 AND 2-INCH SIZES

NOTE:  
 PARTS NOT SHOWN 13, 18, & 20  
 1 NEVER-SEEZ MARK OWNED BY NEVER-SEEZ CORP.  
 2 LOCTITE GRADE "A" MARK OWNED BY LOCTITE CORP.

Figure 4. Type 98H Relief Valve Assembly Drawing

Key	Description	Part Number	Key	Description	Part Number
21	O-Ring Retainer (elastomer seat only)		22	L-Ring, Type 98H only	
	1/4-inch body			Elastomer seat only	
	416 stainless steel	1L3460 35132		1-1/2 and 2-inch bodies	
	316 stainless steel (NACE)	1L3460 35072		Nitrile	1P7874 03202
	1/2-inch body			Fluoroelastomer	1P7874 06382
	416 stainless steel	1L3415 35232	23	Lockwasher, steel	
	316 stainless steel (NACE)	1L3415 35072		1/4 and 1/2-inch bodies	1C2256 28982
	3/4 and 1-inch bodies			3/4 and 1-inch bodies	1H6243 28992
	416 stainless steel	1L3430 35132		1-1/2 and 2-inch bodies, Type 98H only	1A4878 28992
	316 stainless steel (NACE)	1L3430 35072	24	Machine Screw, stainless steel	
	1-1/2 and 2-inch bodies, Type 98H only			Elastomer seat only	
	416 stainless steel	1P7875 35132		1/4-inch body (NACE)	1L3462 38992
	316 stainless steel (NACE)	1P7875 35072		1/2-inch body (NACE)	1L3444 38992
22*	O-Ring (elastomer seat only)			3/4 and 1-inch bodies (NACE)	1L3435 38992
	1/4-inch body			1-1/2 and 2-inch bodies (NACE)	
	Nitrile	1C8538 06992		Type 98H only	1P7886 38992
	Fluoroelastomer	1C8538 X0052			
	1/2-inch body				
	Nitrile	1D2888 06992			
	Fluoroelastomer	1N5301 06382			
	3/4 and 1-inch bodies				
	Nitrile	1C7821 06992			
	Fluoroelastomer	1N1632 06382			

\* Recommended spare part.

# Types 98L and 98H



## Key 11 Relief Valve Spring

BODY SIZE, INCHES	98L RANGE		98H RANGE		COLOR CODE	PART NUMBER
	Psi	Bar	Psi	Bar		
1/4	2 to 17	0.1 to 1.2	15 to 35	1.0 to 2.4	Yellow	1E392527022
	6 to 14	0.4 to 1.0	25 to 75	1.7 to 5.2	Green	1E392627012
	12 to 25	0.8 to 1.7	70 to 140	4.8 to 9.7	Red	1E392727142
	20 to 38	1.4 to 2.6	130 to 200	9.0 to 13.8	Blue	1L346127142
1/2	2 to 17	0.1 to 1.2	15 to 35	1.0 to 2.4	Yellow	1E395627022
	6 to 14	0.4 to 1.0	25 to 75	1.7 to 5.2	Green	1D745527142
	12 to 25	0.8 to 1.7	70 to 140	4.8 to 9.7	Red	1D395727192
	20 to 38	1.4 to 2.6	130 to 200	9.0 to 13.8	Blue	1L380027142
3/4 & 1	2 to 17	0.1 to 1.2	15 to 35	1.0 to 2.4	Yellow	1E398927022
	6 to 14	0.4 to 1.0	25 to 75	1.7 to 5.2	Green	1E399027142
	12 to 25	0.8 to 1.7	70 to 140	4.8 to 9.7	Red	1D399127162
	20 to 38	1.4 to 2.6	130 to 200	9.0 to 13.8	Blue	1L380127232
1-1/2 & 2	---	---	5 to 35	0.3 to 2.4	Dark Gray	1E792327092
	---	---	20 to 65	1.4 to 4.5	Light Blue	1E795327082
	---	---	50 to 100	3.4 to 6.9	Light Gray	1E795427082
	---	---	80 to 170	5.6 to 11.7	Black	1P788827082

## Key 12\* Diaphragm

TYPE NUMBER	BODY SIZE, INCHES	DIAPHRAGM MATERIAL		
		Neoprene	Fluoroelastomer (2 req'd)	302 SST (2 req'd)
98L	1/4	1L345302112	1L345302402	1L345436012
	1/2	1L341302112	1L341302402	1L341436012
	3/4, 1	1L342302112	1L342302402	1L342236012
98H	1/4	1L344902112	1L344902402	1L345036012
	1/2	1L341202112	1L341202402	1L339936012
	3/4, 1	1L343302112	1L3433X0032	1L343236012
	1-1/2, 2	1P788102192	11A1347X012	1P787836012

\* Recommended spare part.

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**Fisher Controls**

For information, contact Fisher Controls:  
Marshalltown, Iowa 50158 USA  
Cernay 68700 France

Sao Paulo 05424 Brazil  
Singapore 0512





## Types 98L and 98H

Key	Description	Part Number	Key	Description	Part Number
25	Diaphragm Head Type 98L, steel zinc plated		28	Handwheel, zinc 1/2-inch body only	1J4961 44012
	1/4-inch body	1L3455 25072	29	Machine Screw, steel pl 1/2-inch body	
	1/2-inch body	1L3396 25072		With handwheel only	1A8517 28982
	3/4 and 1-inch bodies	1L3421 25072	30	Lockwasher, steel 1/2-inch body	
	Type 98H, steel			With handwheel only	1A3523 32992
	1-1/2 and 2-inch bodies (2 req'd)		51	NACE Tag, not shown	19A6034 X012
	Standard	1P7882 25012	52	Tag Wire, not shown (NACE)	1U7581 X0022
	(NACE)	1P7882 35072			
26	Locknut, steel zinc plated				
	1/4 and 1/2-inch bodies	1L8723 24122			
	3/4 and 1-inch bodies	1L8722 24122			
	1-1/2 and 2-inch bodies, Type 98H only	1P7887 24122			

### Key 1 Regulator Body, NPT

BODY SIZE, INCHES	TYPE 98H				TYPE 98L			
	NACE	For Other Than Sour Gas Corrosion Resistance Applications			NACE	For Other Than Sour Gas Corrosion Resistance Applications		
		Cast Iron	Steel	316 SST		Cast Iron	Steel	316 SST
1/4	1L3721X0052	1L346419012	1L372122012	1L372133092	1L3723X0022	1L346519012	1L372322012	1L372333092
1/2	2L3687X0022	2L339519012	2L368722012	2L368733092	2L3689X0032	2L339219012	2L368922012	2L368933092
3/4	2L3734X0062	2L342519012	2L373422012	2L373433092	2L3182X0022	2L341919012	2L318222012	2L318233092
1	2L3735X0032	2L342619012	2L373522012	2L373533092	2L3183X0042	2L342019012	2L318322012	2L318333092
1-1/2	3P7868X0022	3P786819012	3P786822012	3P786833092	---	---	---	---
2	3P7867X0042	3P786719012	3P786722012	3P786733092	---	---	---	---

### Key 1 Regulator Body, ANSI Class 150 & 300 Flanges

BODY SIZE, INCHES	TYPE 98H BODY MATERIAL				TYPE 98L BODY MATERIAL			
	Steel		Stainless Steel		Steel		Stainless Steel	
	ANSI Class				ANSI Class			
	150	300	150	300	150	300	150	300
1/2	1V5178X0012	---	1V5178X0022	---	---	---	---	
3/4	---	---	---	---	2V4264X0022	---	---	
1	2V3805X0012	2U8048X0012	2V3805X00B2	2U8048X0022	2V3641X0022	2U8047X0012	2V3641X0012	
1-1/2	21B0804X012	1V4541X0012	21B0804X022	1V4541X0022	---	---	---	
2	10A0192X012	10A4986X012	10A0192X022	1V4541X0022	---	---	---	

### Key 1 Regulator Body, Socket Weld

BODY SIZE, INCHES	TYPE 98H BODY MATERIAL		TYPE 98L BODY MATERIAL	
	Steel	Stainless Steel	Steel	Stainless Steel
1/2	2L9673X0022	2L9673X0012	---	---
3/4	---	---	2N4463X0012	---
1	2N414422012	2N4144X0012	2N445222012	2N4452X0012
1-1/2	3V4542X0012	3V4542X0022	---	---
2	30A0191X012	30A0191X032	---	---

Key 3 Orifice

BODY SIZE, INCHES	METAL TO METAL SEAT		ELASTOMER SEAT		
			NACE	For Other Than Sour Gas Corrosion Resistance Applications	
	416 SST	316 SST		416 SST	316 SST
1/4	1E391646172	1E391635072	1L345935072	1L345935132	1L345935072
1/2	1E395046172	1E395035072	1L341735072	1L341735132	1L341735072
3/4, 1	1E398046172	1E398035072	1L343135072	1L343135132	1L343135072
Type 98H only 1-1/2, 2	2P787046172	2P787035072	1P787135072	1P787135132	1P787135072

Key 4\* Valve Plug

BODY SIZE, INCHES	METAL TO METAL SEAT		ELASTOMER SEAT		
			NACE	For Other Than Sour Gas Corrosion Resistance Applications	
	416 SST	316 SST		416 SST	316 SST
1/4	1L345246172	1L345235072	1L345135072	1L345135132	1L345135072
1/2	1L344146172	1L344135162	1L344335072	1L344335132	1L344335072
3/4, 1	1L343746172	1L343735162	1L343635072	1L343635132	1L343635072
Type 98H only 1-1/2, 2	1P787246172	1P787235072	1P787335072	1P787346172	1P787335072

Key 6 Pusher Post

BODY SIZE, INCHES	METAL DIAPHRAGM		ELASTOMER SEAT		
			NACE	For Other Than Sour Gas Corrosion Resistance Applications	
	416 SST	316 SST		416 SST	316 SST
1/4	1L345735132	1L345735072	1L345635072	1L345635132	1L345635072
1/2	1E344535132	1L344535072	1L344235072	1L344235132	1L344235072
3/4, 1	1L343935132	1L343935072	1L343835072	1L343835132	1L343835072
Type 98H only 1-1/2, 2	1P788335132	1P788335072	1P788435072	1P788435132	1P788435072

Fisher Controls

Installation Manual

**Type 67AF and 67AFR Filter  
Regulators**

November 1989

Form 5267

**Introduction**

This installation manual only covers the installation, startup, and adjustment procedures for Type 67AF and 67AFR regulators. If maintenance is required, refer to the Type 67AF and 67AFR Instruction Manual, Form 5144. To receive a copy of the instruction manual, contact your Fisher sales office or sales representative.

**Installation****WARNING**

Personal injury, property damage, equipment damage, or leakage due to escaping gas or bursting of pressure-containing parts may result if this regulator is over-pressured or is installed where service conditions could exceed the limits given in table 1. To avoid such injury or damage, provide pressure-relieving or pressure-limiting devices (as required by the appropriate code, regulation, or standard) to prevent service conditions from exceeding those limits. A Type 67AFR regulator, because of its low-capacity internal relief,

does provide very limited downstream overpressure protection, but it should not be considered complete protection against overpressure.

The vent should be kept open to permit free flow of air into and out of the regulator. Protect openings against the entrance of rain, snow, ice formation, paint, mud, insects, or any other foreign material that could plug the vent or vent line.

Additionally, physical damage to the regulator could cause personal injury or property damage due to escaping gas. To avoid such injury or damage, install the regulator in a safe location.

Regulator operation within ratings does not preclude the possibility of damage from debris in the lines or from external sources. A regulator should be inspected for damage periodically and after any overpressure condition.

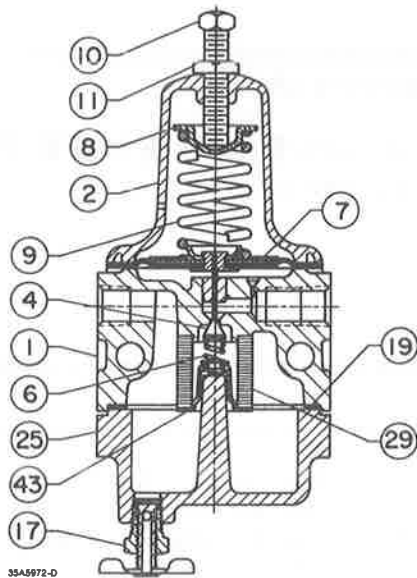
**Note**

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

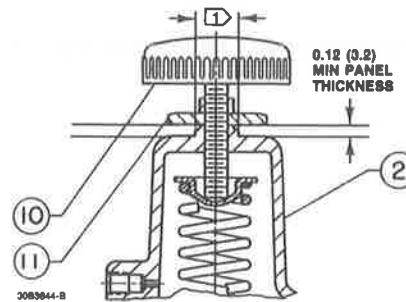
Table 1. Specifications

<b>Maximum Allowable Inlet Pressure<sup>(1)</sup></b> 250 psig (17 bar)	<b>Internal Relief Performance (Type 67AFR Regulator Only)</b> Low capacity for seat leakage only; external relief valve must be provided if inlet pressure can exceed maximum emergency outlet pressure rating or rating of downstream equipment
<b>Outlet Pressure Ranges (4 spring ranges)</b> 3 to 100 psig (0.21 to 6.9 bar)	
<b>Maximum Emergency Outlet Pressure<sup>(1)</sup></b> 50 psig (3.4 bar) over outlet pressure setting, or 100 psig (7.6 bar), whichever is greater	<b>Temperature Capabilities<sup>(1)</sup></b> <b>Nitrile Parts:</b> -20°F to 150°F (-29°C to 66°C) <b>Fluoroelastomer Parts:</b> 0°F to 350°F (-18°C to 177°C)

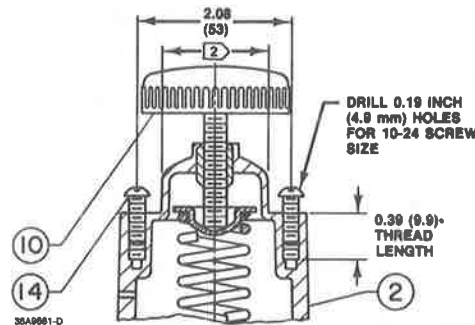
1. The pressure/temperature limits in this manual, and any applicable code or standard limitations, must not be exceeded.



NOTE:  
 1 0.72 (18.3) SPRING CASE PANEL BOSS.  
 2 1.47 TO 1.48 (37.4 TO 37.7) SPRING CASE PANEL BOSS.



1-HOLE PANEL MOUNTING DETAIL



3-HOLE PANEL MOUNTING DETAIL

INCH (mm)

Key	Description	10	Adjusting Screw	19	Gasket
		10	Handwheel	20	Control Spring Label (not shown)
1	Body Assembly	11	Locknut (not used w/panel mtg. spring)	21	Pipe Plug (for use only w/2-outlet body, not shown)
2	Spring Case	11	Mounting Nut (for use only w/1-hole panel mtg. spring case)	21	Pressure gauge (for use only w/2-outlet body, not shown)
4	Plug/Stem Assembly	12	Machine Screw (not shown)	25	Filter Cap
6	Plug Spring	14	Mounting Screw (for use only w/3-hole panel mtg. spring case)	28	Closing Cap
7	Diaphragm Assembly	17	Drain Valve	29	Filter Element
8	Control Spring Seat	18	Cap Screw (not shown)	43	Retainer Assembly
9	Control Spring				

Figure 1. Type 67AF and 67AFR Regulator Assemblies

1. Only personnel qualified through training and experience should install, operate, and maintain a regulator. For a regulator that is shipped separately, make sure that there is no damage to, or foreign material in, the regulator. Also ensure that all tubing and piping have been blown free.

2. For best filter drainage, orient the drain valve (key 17, figure 1) to the lowest possible point on the filter cap (key 25, figure 1). This orientation may be improved by rotating the filter cap with respect to the body assembly.

**WARNING**

**A regulator may vent some gas to the atmosphere. In hazardous or flammable gas service, vented gas may accumulate and**

**cause personal injury, death, or property damage due to fire or explosion. Vent a regulator in hazardous gas service to a remote, safe location away from air intakes or any hazardous area. The vent line or stack opening must be protected against condensation or clogging.**

3. A Type 67AF or 67AFR regulator with the optional tapped spring case may be remotely vented by installing tubing into the 1/4-inch NPT vent tapping. Provide protection on a remote vent by installing a screened vent cap, such as Fisher Type Y602 series, in the remote end of the vent pipe.

4. To adjust the regulator, turn the adjusting screw (key 10) clockwise to increase outlet pressure. Do not exceed the pressure range of the control spring.

While this information is presented in good faith and believed to be accurate, Fisher Controls does not guarantee satisfactory results from reliance upon such information. Nothing contained herein is to be construed as a warranty or guarantee, express or implied, regarding the performance, merchantability, fitness

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Fisher Controls

Instruction Manual

## 627 Series Self-Operated Pressure Reducing Regulators



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Form 5252

### Introduction

#### Scope of Manual

This manual provides instructions for the installation, adjustment, maintenance, and parts ordering for the 627 Series regulators. These regulators usually are shipped separate for line installation, although sometimes they are shipped installed on other equipment. Refer to the instruction manual for the other equipment for installation and operating instructions.

### Description

The 627 Series self-operated pressure reducing regulators (figure 1) are for high and low pressure systems. These regulators can be used with natural gas, air, or a variety of other gases. Performance characteristics vary according to construction (see the AVAILABLE CONFIGURATIONS specification in table 1).

### Specifications

Table 1 gives some general specifications for the 627 Series regulators. The nameplates (figure 2) gives detailed information for a particular regulator as it comes from the factory.

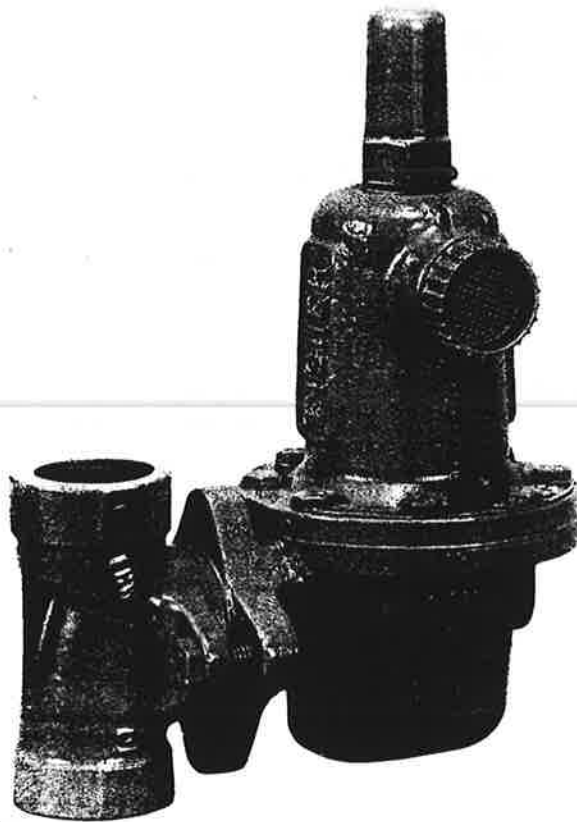


Figure 1. Typical 627 Series Self-Operated Pressure Reducing Regulator



NUMBER 1



NUMBER 2

Figure 2. Nameplates

Table 1. Specifications

<b>Available Constructions</b>	<b>Maximum Body Outlet Pressure<sup>(1)</sup> (Type 627M, 627MR, and 627HM Only)</b>
<p><b>Type 627:</b> Self-operated pressure reducing regulator equipped with a pitot tube for greater regulated capacities (figure 7)</p>	<p>2000 psig (138 bar) for screwed steel, 1480 psig (102 bar) for RF flanged steel, or 1000 psig (69 bar) for ductile iron. (Type 627 and 627R are limited by maximum diaphragm casing pressure)</p>
<p><b>Type 627R:</b> Type 627 with internal relief and with an open throat (figure 8)</p>	<b>Port Diameters</b>
<p><b>Type 627M:</b> Type 627 with a stem seal between the body outlet pressure and diaphragm case. Pressure is measured under the diaphragm through the 1/4-inch NPT downstream control line connection (figure 9)</p>	<p>See table 2</p>
<p><b>Type 627MR:</b> Type 627M with internal relief (figure 10)</p>	<b>Internal Relief Performance</b>
<p><b>Type 627H:</b> Type 627 with a diaphragm limiter to deliver a higher outlet pressure (figure 11)</p>	<p><b>Type 627R:</b> See table 4</p>
<p><b>Type 627HM:</b> Type 627H with a stem seal between the body outlet pressure and diaphragm case. Pressure is measured under the diaphragm through two 1/4-inch NPT downstream control line connections (figure 12)</p>	<p><b>Type 627MR:</b> Limited by field-installed control line piping</p>
<b>Body Sizes</b>	<b>Temperature Capabilities<sup>(1)</sup></b>
<p>3/4, 1, or 2-inch</p>	<p>– 20 to 180°F (– 29 to 82°C)</p>
<b>End Connection Styles</b>	<b>Pressure Registration</b>
<p>NPT screwed with 3/4, 1, or 2-inch sizes ANSI Class 300 and 600 raised face (RF) flanged with 1 or 2-inch sizes</p>	<p><b>Type 627, 627H or 627R:</b> Internal <b>Type 627M, 627HM or 627MR:</b> External through 1/4-inch NPT control line connection in the diaphragm casing</p>
<b>Maximum Inlet Pressure<sup>(1)</sup> (Body Rating)</b>	<b>De-Icer System</b>
<p>2000 psig (138 bar) for screwed steel, 1480 psig (102 bar) for RF flanged steel, or 1000 psig (69 bar) for ductile iron</p>	<p>See figure 3 and Type 627M Regulator De-Icer System Application section</p>
<b>Maximum Valve Disk Inlet Pressure Rating<sup>(1)</sup></b>	<b>Relief Indicator</b>
<p>2000 psig (138 bar) for nylon disk or 1000 psig (69 bar) for nitrile disk</p>	<p>For 627R and 627MR (see figures 8 &amp; 9)</p>
<b>Maximum Operating Inlet Pressure, Pressure Differential, and Outlet Pressure Ranges<sup>(1)</sup></b>	<b>Spring Case Vent Connection</b>
<p>See table 2 for pressures by port and spring range</p>	<p>3/4-inch NPT female with removable screened vent assembly</p>
<b>Maximum Spring and Diaphragm Casing Pressure<sup>(1)</sup></b>	<b>Control Line Connection (Type 627M, 627HM or 627MR Only)</b>
<p>See table 3</p>	<p>1/4-inch NPT female</p>
<p><sup>1</sup>. The pressure/temperature limits in this manual and any applicable standard or code limitation should not be exceeded.</p>	<b>Approximate Weight</b>
	<p><b>With Ductile Iron or Steel Casings:</b> 10 pounds (4.5 kg) <b>With Aluminum Casings:</b> 6.3 pounds (2.8 kg)</p>

Table 2. Maximum Inlet Pressures, Differential Pressures and Outlet Pressure Ranges

TYPE NUMBER	OUTLET PRESSURE RANGE AND CONTROL SPRING (COLOR)	U.S. UNITS			METRIC UNITS		
		Port Dia., Inches	Maximum Inlet Pressure, Psig	Maximum Differential Pressure, Psid	Port Dia., mm	Maximum Inlet Pressure, Bar	Maximum Differential Pressure, Bar
627 and 627M <sup>(3)</sup>	5 <sup>(2)</sup> to 20 psig (0.34 to 1.4 bar) 10B3076 X012 (yellow)	3/32	2000 <sup>(1)</sup>	2000 <sup>(1)</sup>	2.4	138 <sup>(1)</sup>	138 <sup>(1)</sup>
		1/8	1000	1000	3.2	69.0	69.0
		3/16	750	750	4.8	51.7	51.7
		1/4	500	500	6.4	34.5	34.5
		3/8	300	300	9.5	20.7	20.7
		1/2	250	250	12.7	13.8	13.8
	15 to 40 psig (1.0 to 2.8 bar) 10B3077 X012 (green)	3/32	2000 <sup>(1)</sup>	2000 <sup>(1)</sup>	2.4	138 <sup>(1)</sup>	138 <sup>(1)</sup>
		1/8	1500 <sup>(1)</sup>	1500 <sup>(1)</sup>	3.2	103 <sup>(1)</sup>	103 <sup>(1)</sup>
		3/16	1000 <sup>(1)</sup>	1000	4.8	69.0	69.0
		1/4	750	750	6.4	51.7	51.7
		3/8	500	500	9.5	34.5	34.5
		1/2	300	300	12.7	20.7	20.7
35 to 80 psig (2.4 to 5.5 bar) 10B3078 X012 (blue)	3/32	2000 <sup>(1)</sup>	2000 <sup>(1)</sup>	2.4	138 <sup>(1)</sup>	138 <sup>(1)</sup>	
	1/8	2000 <sup>(1)</sup>	2000 <sup>(1)</sup>	3.2	138 <sup>(1)</sup>	138 <sup>(1)</sup>	
	3/16	1750 <sup>(1)</sup>	1750 <sup>(1)</sup>	4.8	121 <sup>(1)</sup>	121 <sup>(1)</sup>	
	1/4	1500 <sup>(1)</sup>	1500 <sup>(1)</sup>	6.4	103 <sup>(1)</sup>	103 <sup>(1)</sup>	
	3/8	1000	1000	9.5	69.0	69.0	
	1/2	750	750	12.7	51.7	51.7	
70 to 150 psig (4.8 to 10.3 bar) 10B3079 X012 (red)	3/32	2000 <sup>(1)</sup>	2000 <sup>(1)</sup>	2.4	138 <sup>(1)</sup>	138 <sup>(1)</sup>	
	1/8	2000 <sup>(1)</sup>	2000 <sup>(1)</sup>	3.2	138 <sup>(1)</sup>	138 <sup>(1)</sup>	
	3/16	2000 <sup>(1)</sup>	2000 <sup>(1)</sup>	4.8	138 <sup>(1)</sup>	138 <sup>(1)</sup>	
	1/4	1750 <sup>(1)</sup>	1750 <sup>(1)</sup>	6.4	121 <sup>(1)</sup>	121 <sup>(1)</sup>	
	3/8	1250 <sup>(1)</sup>	1250 <sup>(1)</sup>	9.5	86.2 <sup>(1)</sup>	86.2 <sup>(1)</sup>	
	1/2	750	750	12.7	51.7	51.7	
627R and 627MR	5 <sup>(2)</sup> to 20 psig (0.34 to 1.4 bar) 10B3076 X012 (yellow)	3/32	2000 <sup>(1)</sup>	2000 <sup>(1)</sup>	2.4	138 <sup>(1)</sup>	138 <sup>(1)</sup>
		1/8	1000	1000	3.2	69.0	69.0
		3/16	750	750	4.8	51.7	51.7
		1/4	500	500	6.4	34.5	34.5
		3/8	300	300	9.5	20.7	20.7
		1/2	200	200	12.7	13.8	13.8
	15 to 40 psig (1.0 to 2.8 bar) 10B3077 X012 (green)	3/32	2000 <sup>(1)</sup>	2000 <sup>(1)</sup>	2.4	138 <sup>(1)</sup>	138 <sup>(1)</sup>
		1/8	1500 <sup>(1)</sup>	1500 <sup>(1)</sup>	3.2	103 <sup>(1)</sup>	103 <sup>(1)</sup>
		3/16	1000	1000	4.8	69.0	69.0
		1/4	750	750	6.4	51.7	51.7
		3/8	300	300	9.5	20.7	20.7
		1/2	200	200	12.7	13.8	13.8
35 to 80 psig (2.4 to 5.5 bar) 10B3078 X012 (blue)	3/32	2000 <sup>(1)</sup>	2000 <sup>(1)</sup>	2.4	138 <sup>(1)</sup>	138 <sup>(1)</sup>	
	1/8	1750 <sup>(1)</sup>	1750 <sup>(1)</sup>	3.2	121 <sup>(1)</sup>	121 <sup>(1)</sup>	
	3/16	1000	1000	4.8	69.0	69.0	
	1/4	750	750	6.4	51.7	51.7	
	3/8	300	300	9.5	20.7	20.7	
	1/2	200	200	12.7	13.8	13.8	
70 to 150 psig (4.8 to 10.3 bar) 10B3079 X012 (red)	3/32	2000 <sup>(1)</sup>	2000 <sup>(1)</sup>	2.4	138 <sup>(1)</sup>	138 <sup>(1)</sup>	
	1/8	1000	1000	3.2	69.0	69.0	
	3/16	500	500	4.8	34.5	34.5	
	1/4	300	300	6.4	20.7	20.7	
	3/8	200	200	9.5	13.8	13.8	
	1/2	200	200	12.7	13.8	13.8	
627H and 627HM <sup>(3)</sup>	140 to 250 psig (9.7 to 17.2 bar) 10B3078 X012 (blue)	3/32	2000 <sup>(1)</sup>	2000 <sup>(1)</sup>	2.4	138 <sup>(1)</sup>	138 <sup>(1)</sup>
		1/8	2000 <sup>(1)</sup>	2000 <sup>(1)</sup>	3.2	138 <sup>(1)</sup>	138 <sup>(1)</sup>
		3/16	1750 <sup>(1)</sup>	1750 <sup>(1)</sup>	4.8	121 <sup>(1)</sup>	121 <sup>(1)</sup>
		1/4	1500 <sup>(1)</sup>	1000	6.4	103 <sup>(1)</sup>	69.0
		3/8	1000	500	9.5	69.0	34.5
		1/2	750	250	12.7	51.7	13.8
	240 to 500 psig (16.5 to 34.5 bar) 10B3079 X012 (red)	3/32	2000	2000 <sup>(1)</sup>	2.4	138 <sup>(1)</sup>	138 <sup>(1)</sup>
		1/8	2000	2000 <sup>(1)</sup>	3.2	138 <sup>(1)</sup>	138 <sup>(1)</sup>
		3/16	1750	1750 <sup>(1)</sup>	4.8	121 <sup>(1)</sup>	121 <sup>(1)</sup>
		1/4	1500	1000	6.4	103 <sup>(1)</sup>	69.0
		3/8	1000	500	9.5	69.0	34.5
		1/2	750	250	12.7	51.7	13.8

- For inlet pressure in excess of 1000 psig (69 bar), refer to the maximum body and disk pressure ratings in the specification table.
- For pressure settings under 10 psig (0.69 bar), inlet pressure should be limited to approximately 100 psig (6.9 bar) so the set point adjustment can be obtained.

- The unbalance forces change from the wide open monitor mode to an active regulator mode such that the Type 627M or 627HM should have a 3/8-inch (9.5 mm) or larger seat ring when used as a wide open monitor.

Table 3. Maximum Spring and Diaphragm Casing Pressure<sup>(1)</sup>

	SPRING AND DIAPHRAGM CASING STYLE	TYPE 627		TYPE 627R		TYPE 627M		TYPE 627MR		TYPE 627H & 627HM	
		Psig	Bar	Psig	Bar	Psig	Bar	Psig	Bar	Psig	Bar
Maximum pressure to spring and diaphragm casings to prevent leak to atmosphere other than relief action (internal parts damage may occur)	Die Cast Aluminum	250	17.2	250	17.2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	Ductile Iron	250	17.2	250	17.2	250	17.2	250	17.2	N.A.	N.A.
	Steel	250	17.2	250	17.2	250	17.2	250	17.2	800	55.2
Maximum pressure to spring and diaphragm casings to prevent burst of casings during abnormal operation (leak to atmosphere and internal parts damage may occur)	Die Cast Aluminum	375	25.9	375	25.9	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	Ductile Iron	465	32.0	465	32.0	465	32.0	465	32.0	N.A.	N.A.
	Steel	1200	82.7	1200	82.7	1200	82.7	1200	82.7	1200	82.7
Maximum diaphragm casing overpressure (above set point) to prevent damage to internal parts	All Styles	60	4.1	120	8.3	60	4.1	120	8.3	120	8.3

1. If the spring case is pressurized, a metal adjusting screw cap is required. Contact the Fisher sales office or Fisher sales representative.

## WARNING

Personal injury, property damage, equipment damage, or leakage due to escaping gas or bursting of pressure-containing parts may result if this regulator is overpressured or is installed where service conditions could exceed the limits given in tables 1, 2, 3, and 4, or where conditions exceed any ratings of the adjacent piping or piping connections

To avoid such injury or damage, provide pressure-relieving or pressure-limiting devices (as required by the appropriate code, regulation, or standard) to prevent service conditions from exceeding those limits. The Type 627R or 627MR regulator with internal relief will provide downstream overpressure protection within the limits given in tables 1, 2, 3 and 4. If these limits are exceeded additional downstream overpressure protection must be provided by the user.

Additionally, physical damage to the regulator could cause personal injury or property damage due to escaping gas. To avoid such injury or damage, install the regulator in a safe location.

## Installation

Regulator operation within ratings does not preclude the possibility of damage from debris in the lines or from external sources. A regulator should be inspected for damage periodically and after any overpressure condition. Key numbers referenced in this section are shown in figures 7 through 12. Ensure that the operating temperature capabilities listed in table 1 are not exceeded.

Like most regulators, 627 Series regulators have outlet pressure ratings that are lower than their inlet pressure ratings. A pressure relieving or pressure limiting device must be provided by the user for the Type 627, 627H, 627M, and 627HM regulators if the inlet pressure can exceed the outlet pressure rating, since these regulators do not have internal relief.

Type 627R regulators provide internal relief which limits the total outlet pressure buildup over setpoint. Use table 4 to determine the total outlet pressure. This internal relief may be adequate for the application, if not, provide additional pressure relief or a pressure limiting device downstream.

### Note

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

Perform steps 1 through 6 for all types of regulators:

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



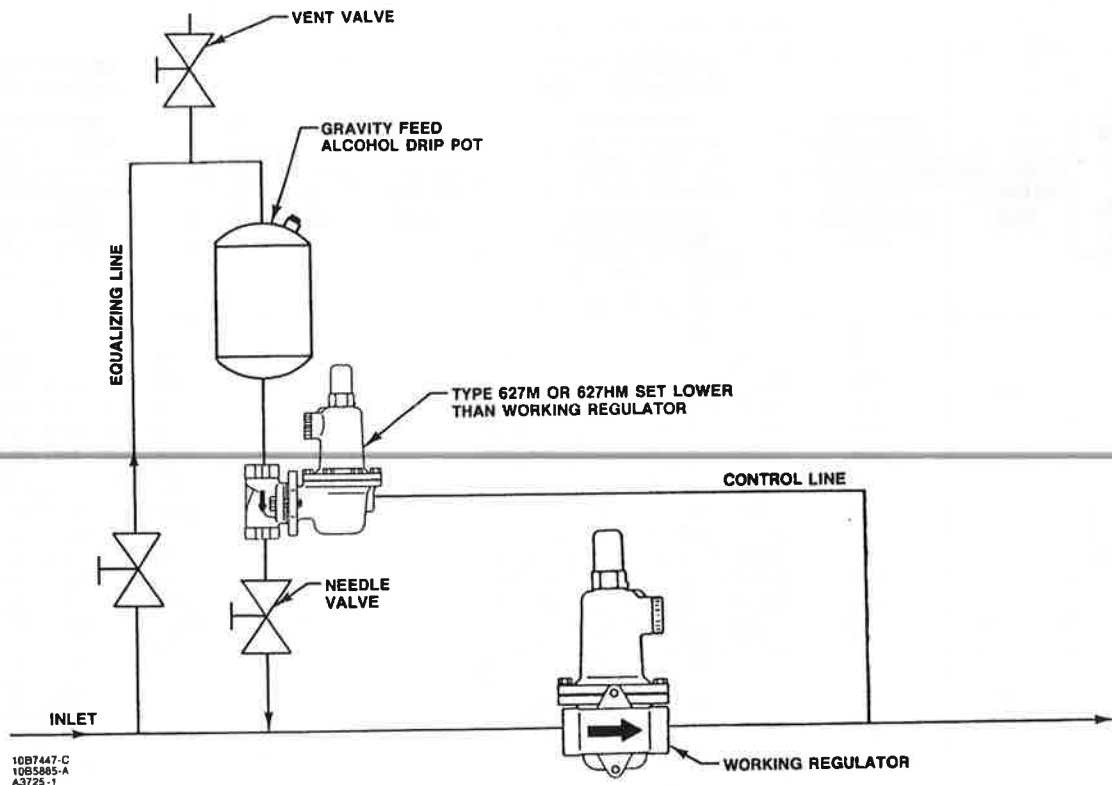


Figure 3. Schematic of De-Icer System

## WARNING

A regulator may vent some gas to the atmosphere. In hazardous or flammable gas service, vented gas may accumulate and cause personal injury, death, or property damage due to fire or explosion. Vent a regulator in hazardous gas service to a remote, safe location away from air intakes or any hazardous area. The vent line or stack opening must be protected against condensation or clogging.

6. Position the body (key 1) and/or diaphragm spring case (key 29) so it will not collect moisture or debris into the screened vent. If the regulator requires repositioning, refer to the body area maintenance procedures and/or the diaphragm case area maintenance procedures in the Maintenance section to reposition the screened vent for the application.

**Perform steps 7 through 9 for Type 627M, 627HM, and 627MR regulators only:**

7. A Type 627M, 627HM, or 627MR regulator requires a downstream control line. Install the control line before putting the regulator into operation.

8. Ensure that the downstream control line piping is at least 3/8-inch or larger outside diameter tubing and

connected to a straight section of outlet piping 10 diameters downstream of the regulator.

9. A hand valve should be installed in the control line. This hand valve can be used to throttle down and dampen outlet pulsations in control pressure which may cause instability or cycling of the regulator.

## Remote Vent Line Installation

All 627 series regulators have a vent assembly installed in the 3/4-inch NPT spring case vent opening. The vent assembly can be removed to install a remote vent line if necessary. Remote vent lines must have the largest practical diameter. The vent line should be as short as possible with a minimum number of bends or elbows.

Protect the remote vent opening against entrance of rain, snow, or any other foreign material that may plug the vent or vent line and prevent proper operation of the regulator. Periodically check the vent opening to be sure it is not plugged with foreign debris.

## Type 627M or 627HM Regulator De-Icer System Application

For the Type 627M or 627HM regulator de-icer system, refer to the application shown in figure 3. With a large pressure drop across the working regulator, ice can

Table 4. Type 627R Internal Relief Performance<sup>(1)</sup>

OUTLET PRESSURE RANGE AND CONTROL SPRING INFORMATION	OUTLET PRESSURE SETTING, PSIG	MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE, PSIG	MAXIMUM INLET PRESSURE <sup>(2)</sup> - PSIG							OUTLET PRESSURE SETTING, BAR	MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE, BAR	MAXIMUM INLET PRESSURE <sup>(2)</sup> - BAR					
			Maximum Inlet Pressure To Keep Maximum Allowable Downstream System Pressure From Being Exceeded									Maximum Inlet Pressure To Keep Maximum Allowable Downstream System Pressure From Being Exceeded					
			Port Diameter - Inches									Port Diameter - mm					
			3/32	1/8	3/16	1/4	3/8	1/2	2.4			3.2	4.8	6.4	9.5	12.7	
5 <sup>(3)</sup> to 20 psig (0.34 to 1.4 bar) 10B3076 X012 (yellow)	10	60	1250	740	320	190	95	75	0.69	4.1	86.2	51.0	22.1	13.1	6.6	5.2	
		100	2000	1500	620	390	180	130		6.9	138	103	42.7	26.9	12.4	9.0	
		125	2000	1900	830	480	220	160		8.6	138	131	57.2	33.1	15.2	11.0	
		175	2000	2000	1100	670	320	220		12.1	138	138	75.8	46.2	22.1	15.2	
		200	2000	2000	1300	770	360	260		13.8	138	138	89.6	53.1	24.8	17.9	
		250	2000	2000	1600	960	450	320		17.2	138	138	110	66.2	31.0	22.1	
	15	60	1000	620	260	170	90	70	1.0	4.1	69.0	42.7	17.9	11.7	6.2	4.8	
		100	2000	1400	610	370	170	130		6.9	138	96.5	42.1	25.5	11.7	9.0	
		125	2000	1900	810	480	220	160		8.6	138	131	55.8	33.1	15.2	11.0	
		175	2000	2000	1100	670	320	220		12.1	138	138	75.8	46.2	22.1	15.2	
		200	2000	2000	1300	770	360	260		13.8	138	138	89.6	53.1	24.8	17.9	
		250	2000	2000	1600	960	450	320		17.2	138	138	110	66.2	31.0	22.1	
	20	60	850	490	210	130	80	65	1.4	4.1	58.6	33.8	14.5	9.0	5.5	4.6	
		100	2000	1300	600	360	170	120		6.9	138	89.6	41.4	24.8	11.7	8.3	
		125	2000	1800	800	480	220	160		8.6	138	124	55.2	33.1	15.2	11.0	
175		2000	2000	1100	670	320	220	12.1		138	138	75.8	46.2	22.1	15.2		
200		2000	2000	1300	770	360	260	13.8		138	138	89.6	53.1	24.8	17.9		
250		2000	2000	1600	960	450	320	17.2		138	138	110	66.2	31.0	22.1		
15 to 40 psig (1.0 to 2.8 bar) 10B3077 X012 (green)	15	60	1000	380	210	130	80	65	1.0	4.1	69.0	26.2	14.5	9.0	5.5	4.5	
		100	2000	1300	590	350	170	120		6.9	138	89.6	40.7	24.1	11.7	8.3	
		125	2000	1800	800	470	220	160		8.6	138	124	55.2	32.4	15.2	11.0	
		175	2000	2000	1100	640	320	220		12.1	138	138	75.8	44.1	22.1	15.2	
		200	2000	2000	1300	780	370	260		13.8	138	138	89.6	53.8	25.5	17.9	
		250	2000	2000	1600	960	450	320		17.2	138	138	110	66.2	31.0	22.1	
	20	60	630	200	150	100	70	65	1.4	4.1	43.4	13.8	10.3	6.9	4.8	4.5	
		100	2000	1200	550	330	160	120		6.9	138	82.7	37.9	22.8	11.0	8.3	
		125	2000	1700	760	450	210	160		8.6	138	117	52.4	31.0	14.5	11.0	
		175	2000	2000	1100	630	320	220		12.1	138	138	75.8	43.4	22.1	15.2	
		200	2000	2000	1300	770	360	260		13.8	138	138	89.6	53.1	24.8	17.9	
		250	2000	2000	1600	960	460	320		17.2	138	138	110	66.2	31.7	22.1	
	30	100	2000	950	450	260	140	110	2.1	6.9	138	65.5	31.0	17.9	9.7	7.6	
		125	2000	1500	670	400	190	150		8.6	138	103	46.2	27.6	13.1	10.3	
		175	2000	2000	1000	610	300	220		12.1	138	138	69.0	42.0	20.7	15.2	
		200	2000	2000	1200	760	360	260		13.8	138	138	82.7	52.4	24.8	17.9	
		250	2000	2000	1600	970	460	320		17.2	138	138	110	66.9	31.7	22.1	
		40	100	1500	700	330	200	120		108	2.8	6.9	103	48.3	22.8	13.8	8.3
	125		2000	1300	560	340	180	140	8.6	138		89.6	38.6	23.4	12.4	9.7	
	175		2000	1800	1000	550	290	220	12.1	138		124	69.0	37.9	20.0	15.2	
	200		2000	2000	1200	730	350	250	13.8	138		138	82.7	50.3	24.1	17.2	
	250		2000	2000	1600	970	460	320	17.2	138		138	110	66.9	31.7	22.1	

- Continued -

form within this regulator. The formation of ice decreases the size of the port opening, so the regulator is unable to supply enough flow to satisfy the downstream demand. When the downstream pressure falls below the outlet pressure setting of the Type 627M or 627HM regulator, the disk assembly of the Type 627M or 627HM regulator moves off its seat ring, permitting alcohol to flow into the main gas line. The alcohol carried to the main regulator by the flow stream prevents additional ice from forming on the seat ring. When normal flow resumes, and as pressure in the downstream system is restored, the Type 627M or 627HM regulator shuts off.

## Startup and Adjustment

### Startup

**WARNING**

To avoid personal injury or property damage due to explosion or damage to regulator or downstream components during startup, release downstream pressure to prevent an overpressure condition on the diaphragm of the regulator.

Table 4. Type 627R Internal Relief Performance<sup>(1)</sup> (Continued)

OUTLET PRESSURE RANGE AND CONTROL SPRING INFORMATION	OUTLET PRESSURE SETTING, PSIG	MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE, PSIG	MAXIMUM INLET PRESSURE <sup>(2)</sup> - PSIG						OUTLET PRESSURE SETTING, BAR	MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE, BAR	MAXIMUM INLET PRESSURE <sup>(2)</sup> - BAR					
			Maximum Inlet Pressure To Keep Maximum Allowable Downstream System Pressure From Being Exceeded								Maximum Inlet Pressure To Keep Maximum Allowable Downstream System Pressure From Being Exceeded					
			Port Diameter - Inches								Port Diameter - mm					
			3/32	1/8	3/16	1/4	3/8	1/2			2.4	3.2	4.8	6.4	9.5	12.7
35 to 80 psig (2.4 to 5.5 bar) 10B3078 X012 (blue)	40	125	2000	1100	500	300	170	140	2.8	8.6	138	75.8	34.5	20.7	11.7	9.7
		150	2000	1600	750	440	230	180		10.3	138	110	51.7	30.3	15.9	12.4
		175	2000	2000	980	580	290	220		12.1	138	138	67.6	40.0	20.0	15.2
		200	2000	2000	1200	720	340	250		13.8	138	138	82.7	49.6	23.4	17.2
		250	2000	2000	1600	940	450	320		17.2	138	138	110	64.8	31.0	22.1
	50	125	1400	820	400	230	150	140	3.4	8.6	96.5	56.5	27.6	15.9	10.3	9.7
		150	2000	1400	650	370	210	170		10.3	138	96.5	44.8	25.5	14.5	11.7
		175	2000	1900	700	530	270	210		12.1	138	131	48.3	36.5	18.6	14.5
		200	2000	2000	1100	670	330	240		13.8	138	138	75.8	46.2	22.8	16.5
		250	2000	2000	1500	920	430	320		17.2	138	138	103	63.4	29.6	22.1
	60	125	900	450	270	190	140	130	4.1	8.6	62.1	31.0	18.6	13.1	9.7	9.0
		150	1700	1100	540	300	190	160		10.3	117	75.8	37.2	20.7	13.1	11.0
175		2000	1700	780	470	250	200	12.1		138	117	53.8	32.4	17.2	13.8	
200		2000	2000	1000	610	310	230	13.8		138	138	69.0	42.0	21.4	15.9	
250		2000	2000	1400	880	420	310	17.2		138	138	96.5	60.7	29.0	21.4	
70	150	1200	850	430	250	170	160	4.8	10.3	82.7	58.6	29.6	17.2	11.7	11.0	
	175	2000	1400	670	400	230	190		12.1	138	96.5	46.2	27.6	15.9	13.1	
	200	2000	2000	920	550	280	230		13.8	138	138	63.4	37.9	19.3	15.9	
	250	2000	2000	1300	830	400	310		17.2	138	138	89.6	57.2	27.6	21.4	
80	150	800	500	300	200	160	150	5.5	10.3	55.2	34.5	20.7	13.8	11.0	10.3	
	175	1500	1200	550	330	210	190		12.1	103	82.7	37.9	22.8	14.5	13.1	
	200	2000	1700	800	480	270	220		13.8	138	117	55.2	33.1	18.6	15.2	
	250	2000	2000	1200	770	390	300		17.2	138	138	82.7	53.1	26.9	20.7	
70 to 150 psig (4.8 to 10.3 bar) 10B3079 X012 (red)	70	175	1900	600	400	260	200	175	4.8	12.1	131	41.4	27.6	17.9	13.8	12.0
		200	2000	1200	630	380	250	210		13.8	138	82.7	43.4	26.2	17.2	14.5
		250	2000	2000	1100	680	360	290		17.2	138	138	75.8	46.9	24.8	20.0
	80	175	1400	250	240	200	190	175	5.5	12.1	96.5	17.2	16.5	13.8	13.1	12.1
		200	2000	960	520	330	240	210		13.8	138	66.2	35.9	22.8	16.5	14.5
		250	2000	2000	1000	620	350	280		17.2	138	138	69.0	42.7	24.1	19.3
	100	200	1500	250	240	230	210	210	6.9	13.8	103	17.2	16.5	15.9	14.5	14.5
		250	2000	1600	770	520	320	270		17.2	138	110	53.1	35.9	22.1	18.6
125	2000	1000	500	390	290	260	260	8.6	138	69.0	34.5	26.9	20.0	17.9		
150	1200	260	260	260	260	260	260	4.8	17.2	82.7	17.9	17.9	17.9	17.9	17.9	

1. The internal relief performance values were obtained by removing the disk assembly.  
 2. For inlet pressures in excess of 1000 psig (69 bar), refer to the maximum body and disk pressure ratings in the specification table.  
 3. For settings under 10 psig (0.69 bar), inlet pressure should be limited to approximately 100 psig (6.9 bar) so the set point adjustment can be obtained. Shaded areas indicate maximum inlet pressures allowed during system malfunction only. Table 1 gives the maximum inlet pressure for normal regulator operation.

**In order to avoid an overpressure condition and possible equipment damage, pressure gauges should always be used to monitor pressures during start-up.**

1. Slowly open the upstream shutoff valve.
2. Slowly open the downstream shutoff valve.
3. Check all connections for leaks.
4. Make final control spring adjustments according to the adjustment procedures.

**Adjustment**

The range of allowable pressure settings is marked on the nameplate (figure 2). If a pressure setting beyond this range is necessary, substitute the appropriate regulator control spring. Change the nameplate to indicate the new pressure range.

Before increasing the setting, refer to tables 2, 3, or 4. Review the pressure limits for the control spring range being used and be certain that the new pressure setting will not result in an overpressure condition.

Table 5. Maximum Torque Values

Key Number <sup>(1)</sup>	Description	Foot Pounds	Newton Meters
2	Seat ring	25	34
3	Cap screw (w/aluminum diaphragm casing)	16	22
	Cap screw (w/ductile iron or steel diaphragm casing)	25	34
18	Lever, cap screw	7	9
22	Diaphragm connector nut	17	23
26	Guide retainer (For Type 627R and 627MR only)	3	4
37	Spring case cap screw (w/aluminum or ductile iron diaphragm casing)	7	9
	Spring case cap screw (w/steel diaphragm casing)	35	47
46	Diaphragm cap screw (w/Type 627 or 627M)	7	9
	Diaphragm cap screw (w/Type 627H or 627HM)	14	19

1. Refer to figures 7 through 10 for key number locations.

**Note**

**Always use a pressure gauge to monitor pressure when making adjustments.**

Refer to figures 7 through 12 for key number locations.

1. Remove the adjusting screw cap (key 36).
2. Loosen the locknut (key 34).
3. Increase the outlet pressure setting by turning the adjusting screw (key 35) clockwise. Decrease the outlet pressure setting by turning the adjusting screw counterclockwise.
4. When the desired pressure is obtained, hold the adjusting screw (key 35) in place and tighten the locknut (key 34).

**Shutdown****WARNING**

**To avoid personal injury or property damage due to explosion or damage to regulator or downstream components during shutdown, release downstream pressure to prevent an overpressure condition on the diaphragm of the regulator.**

1. Close the nearest upstream shutoff valve.
2. Close the nearest downstream shutoff valve.

3. Open the vent valve between the regulator and the downstream shutoff valve nearest to it.

4. For a Type 627, 627H, or 627R regulator, the regulator will open to release pressure between the upstream shutoff valve and the regulator.

5. A Type 627M, 627HM, or 627MR regulator requires venting the control line and downstream pressure from the regulator before maintenance. The pressure between these shutoff valves is released through the open regulator because the disk assembly remains open in response to the decrease in control line pressure.

**Maintenance**

Unless otherwise specified, the following maintenance procedures apply to all types of regulators. For a summary of maximum torque values required for all types of regulators, refer to table 5.

Due to normal wear, damage from external sources, or debris in the air or gas line, regulator parts such as the disk assembly, seat ring, and diaphragm must be inspected periodically and replaced as necessary to ensure correct performance. The frequency of inspection and replacement depends upon the severity of conditions and the requirements of state and federal laws. Normal wear of the seat ring and disk assembly is accelerated with high pressure drops and with large amounts of impurities in the flow stream. Instructions are given below for replacing the disk assembly, seat ring, diaphragm, and O-rings. These procedures may also be used for disassembly required for inspection and replacement of other parts.

## Problem Indication for Type 627R and 627MR Regulators

### WARNING

Isolate the regulator from all pressure to avoid personal injury and equipment damage due to explosion or sudden release of process pressure. Cautiously release pressure from the regulator before attempting disassembly.

The vent assembly is equipped with a relief indicator (key 49, figure 4). The cap for the relief indicator snaps over the vent assembly opening. If the relief valve opens wide, exhaust gas pops the cap off the screen vent assembly opening indicating a problem with the regulator. If the cap pops off, refer to the shutdown and to the body area maintenance procedures to inspect the disk assembly and seat ring.

If the disk assembly and seat ring are not damaged, refer to the diaphragm and spring case area maintenance procedures in this section.

The disk assembly and seat ring can be inspected, removed, and replaced without removing the regulator body from the line connections. Refer to the body area maintenance procedures.

### Body Area Maintenance Procedures

These procedures are for gaining access to the disk assembly, seat ring, diaphragm casing O-ring and stem assembly. All pressure must be released from the diaphragm casing before the following steps can be performed.

While using the following procedures, refer to figures 7 through 12 for key number locations unless otherwise directed.

#### Replacing the Disk Assembly or Seat Ring

1. To inspect and replace the disk assembly (key 9) or seat ring (key 2), remove the cap screws (key 3, figure 5), and separate the diaphragm casing (key 5) from the body (key 1).

2. Inspect and, if necessary, remove the seat ring (key 2). If removed, coat the threads of the replacement seat ring with lubricant (key 38) and torque to 25 foot-pounds (34 N•m).

3. Inspect the disk assembly and, if necessary, remove the hair pin clip (key 13) that holds the disk assembly (key 9) in place. If replacing the disk assembly is the only maintenance required, skip to step 16.



Figure 4. Relief Indicator

#### Replacing the Stem Assembly

If it is necessary to perform maintenance on the stem assembly, continue with steps 4 through 8 and 15 through 19 for Type 627, 627H, and 627R regulators, or steps 9 through 19 for Type 627M, 627HM, and 627MR regulators.

#### Perform steps 4 through 8 for Type 627, 627H, and 627R Regulators only:

4. For Type 627, 627H, and 627R regulators (figure 5), use steps 5 through 8 to remove and replace the stem assembly.

5. Remove the boost body (key 6), stabilizer (key 7), and stem guide (key 8) from the diaphragm casing (key 5). Unhook and remove the stem (key 10) from the diaphragm casing (key 5).

6. Remove and inspect the diaphragm casing O-ring (key 4, figure 7, 8, or 11) and replace it if necessary.

7. Apply lubricant (key 42) to a replacement diaphragm casing O-ring (key 4, figure 7, 8, or 11) and install it onto the boost body (key 6). Skip to step 14.

8. For the Type 627 or 627H regulators, be sure to insert the pitot tube (tab) into the outlet side of the body (see figure 7 or 11). Skip to step 14.

#### Perform steps 9 through 19 for Type 627M, 627HM, and 627MR Regulators only:

9. For Type 627M, 627HM, and 627MR regulators (figure 5), use steps 10 through 14 to remove and replace the stem assembly.

10. To remove the blocked throat (key 43), insert a screw driver blade into the groove provided in the throat and pry it out of the diaphragm casing (key 5). Inspect and replace parts as necessary.

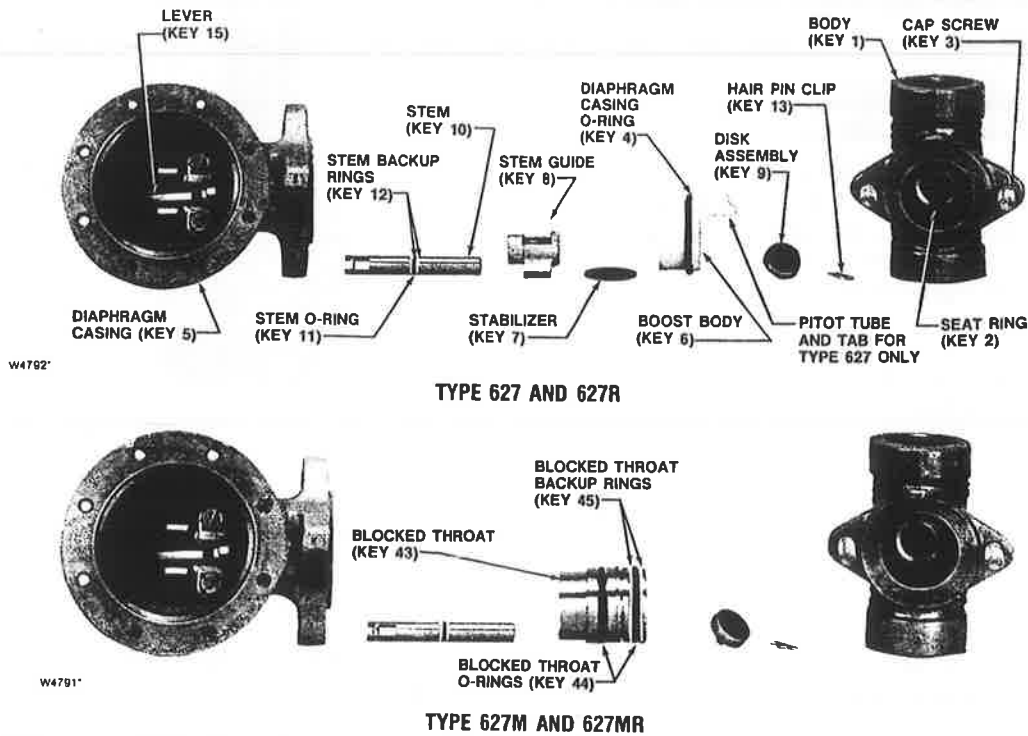


Figure 5. Stem Assemblies

11. Inspect and, if necessary, replace the blocked throat O-rings (key 44, figure 5) and backup rings (key 45, figure 5).

12. Apply lubricant (key 42) to replacement blocked throat O-rings (key 44) and backup rings (key 45).

13. Apply lubricant (key 42) to the replacement stem O-ring (key 11) and stem backup rings (key 12) and install them on the stem (key 10).

14. For assembly, insert the stem (key 10) into the diaphragm casing (key 5) and hook it on the lever (key 15).

15. Insert parts into the diaphragm casing (key 5) that were removed in steps 5 and 6 or step 10 (see figure 5).

16. Install the the disk assembly (key 9), line up the hole in the disk assembly and stem (key 10) and insert the hair pin clip (key 13).

17. Position the diaphragm casing plus attached parts in relation to the body (key 1) so that they are correct for the application.

18. Secure the diaphragm casing to the body with the cap screws (key 3, figure 5). For an aluminum diaphragm casing (key 5), torque the cap screws (key 3) to 16 foot-pounds (22 N·m). For ductile iron or steel diaphragm casings, torque the cap screws (key 3) to 25 foot-pounds (34 N·m).

19. It may be necessary to reposition the diaphragm spring case to prevent rain, ice, and foreign debris from entering the spring case. Refer to the diaphragm and spring case area maintenance procedures, steps 1, 2, and 21 through 25.

## Diaphragm and Spring Case Area Maintenance Procedures

These procedures are for gaining access to the control spring, diaphragm assembly, and lever assembly. All spring pressure must be released from the diaphragm casing before these steps can be performed.

While using the following procedures, refer to figures 7 through 12 for key number locations unless otherwise directed.

1. Remove the adjusting screw cap (key 36), loosen the lock nut, and turn the adjusting screw (key 35) counterclockwise until all compression is removed from the control spring (key 32).

2. Remove the spring case cap screws (key 37), the nameplates, and lift off the spring case (key 29). If changing the control spring (key 32) or repositioning the spring case (key 29) is the only maintenance required, install the replacement control spring or rotate the spring case so it is correct for the application. Skip to step 21. For diaphragm area maintenance, continue with step 3.

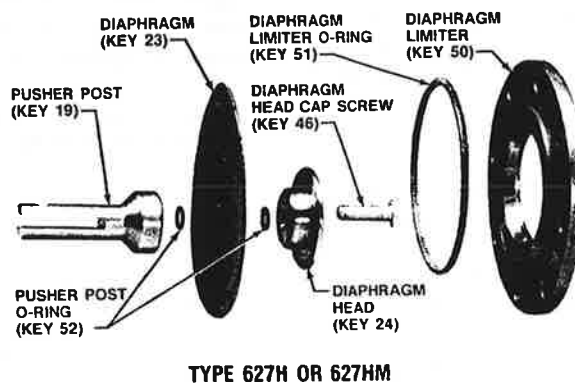
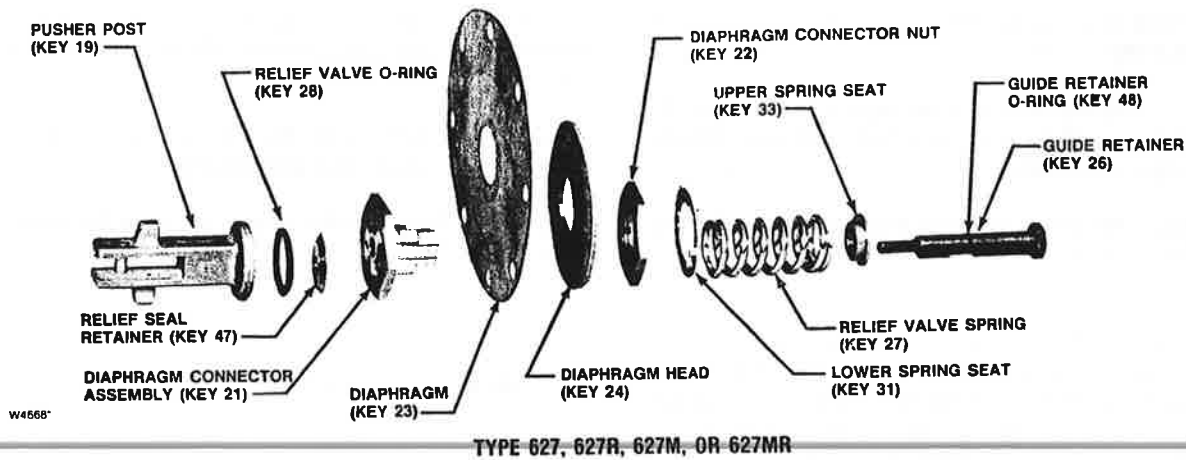


Figure 6. Diaphragm Assembly

3. Remove the diaphragm limiter and O-ring (keys 50 and 51, on the Type 627H or 627HM only). Remove the diaphragm assembly by tilting it so that the pusher post (key 19) slips off the lever (key 15).

4. If it is necessary to replace the lever assembly, remove the lever cap screws (key 18).

5. Install the replacement lever (key 15) into the lever retainer (key 16) by inserting the lever pin (key 17). Secure the lever assembly into the diaphragm casing with the cap screws (key 18) and torque the cap screws to 7 foot-pounds (9 N·m).

If it is necessary to perform maintenance on the diaphragm assembly, continue with steps 6 through 11 and step 20 for Type 627, 627H, 627M, and 627HM regulators, or steps 12 through 19 for Type 627R and 627MR regulators.

**Perform steps 6 through 11 for Type 627, 627H, 627M, and 627HM Regulators only:**

6. For Type 627, 627H, 627M, and 627HM regulators (figures 5 & 6), use steps 7 through 11 to disassemble and reassemble the diaphragm assembly.

7. Remove the diaphragm head cap screw (key 46), lower spring seat (key 31, Type 627 or 627M only), and diaphragm head (key 24). On the Type 627H or 627HM, remove the diaphragm cap screw O-rings (key 52). Separate the diaphragm (key 23) from the pusher post (key 19).

8. Install the diaphragm (key 23), in reverse order in step 7, on the pusher post (key 19), insert and finger tighten the diaphragm head cap screw (key 46).

9. Hook the pusher post on the lever (key 15), then turn the diaphragm (key 23) to match the holes in the diaphragm with the holes in the spring casing.

10. Unhook the pusher post from the lever and torque the diaphragm head cap screw (key 46) to 7 foot-pounds (9 N·m) for the Type 627 or 627M. On the Type 627H or 627HM torque the diaphragm head cap screw to 14 foot-pounds (18 N·m)

11. Hook the pusher post on the lever (key 15) and check the hole alignment. If necessary, loosen the cap screw (key 46) and reposition the diaphragm (key 23) on the pusher post (key 19). Retorque the screw (see step 10). Skip to step 20.

**Perform steps 12 through 19 for Type 627R and 627MR Regulators only:**

12. For Type 627R and 627MR regulators (figure 6), use steps 13 through 19 to disassemble and reassemble the diaphragm assembly:

13. Remove the guide retainer (key 26) and separate the diaphragm parts. Refer to figure 6 for the sequence of parts.

14. To remove the diaphragm (key 23), remove the diaphragm connector nut (key 22) and lift off the diaphragm head (key 24) and diaphragm (key 23) from the connector assembly (key 21). Do not attempt to disassemble the connector assembly (key 21).

15. Position the replacement diaphragm (key 23) on the connector assembly (key 21), install the diaphragm head (key 24) and connector nut (key 22), then torque to 17 foot-pounds (32 N•m).

16. If necessary, replace the guide retainer O-ring (key 48) and, set the guide retainer (key 26) aside, ready for assembly.

17. On the pusher post (key 19) install the relief seal O-ring (key 28) and lubricate (key 42). Also, install the relief seal retainer (key 47), diaphragm connector assembly (key 21, with attached parts) relief spring (key 27), upper relief spring seat (key 33), and guide retainer (key 26). Torque the guide retainer (key 26) to 3 foot-pounds (4 N•m).

18. Hook the pusher post (with attached parts) on the lever (key 15) to check the alignment of the holes in the diaphragm with the holes in the spring casing. If the holes do not line up, unhook the pusher post from the lever, hold the pusher post, and rotate the diaphragm to the correct position.

19. Install the lower spring seat (key 31) over the relief spring so it rests flat on the connector nut (key 22).

20. Insert the diaphragm assembly into the diaphragm casing (key 5) and hook the pusher post on the lever (key 15).

21. Install the control spring (key 32) and upper spring seat (key 33), and apply lubricant (key 38) to the upper spring seat (key 33).

22. Install the spring case (key 29) so that the screened vent assembly (key 30) is in the correct position for the application. Place the nameplates (key 39) over the screw holes, insert the spring case cap screws (key 37), and finger tighten.

23. Screw in the adjustment screw to put slack into the diaphragm (key 23).

24. Using a crisscross pattern, finish tightening the spring case cap screws (key 37) to 7 foot-pounds (9 N•m) of torque.

25. If necessary, refer to the installation and/or the startup and adjustment procedures.

26. Install the adjusting screw cap (key 34) after regulator adjustment.

## Parts Ordering

When corresponding with your Fisher sales office or sales representative about this regulator, always reference the type number which is found on the nameplate (key 39, figures 7 through 12).

When ordering replacement parts, reference the key number of each needed part as found in the following parts list.

## Parts List

Key	Description	Part Number
	Type 627 Parts Kit with aluminum/nitrile trim (includes keys 4, 9, 11, 12, and 23)	R627 X000A12
	Type 627 Parts Kit with stainless steel/nitrile trim (includes keys 4, 9, 11, 12, and 23)	R627 X000S12
	Type 627R Parts Kit with aluminum/nitrile trim (includes keys 4, 9, 11, 12, 23, 28, and 48)	R627R X00A12
	Type 627R Parts Kit with stainless steel/nitrile trim (includes keys 4, 9, 11, 12, 23, 28, and 48)	R627R X00S12
1	Body	
	Ductile iron	
	1000 psig (69 bar) max inlet pressure	
	3/4-inch NPT size	30B3046 X012
	1-inch NPT size	30B3048 X012
	2-inch NPT size	30B3096 X012
	Steel	
	2000 psig (138 bar) max inlet pressure	
	3/4-inch NPT size	30B3050 X012
	1-inch NPT size	30B3051 X012
	2-inch NPT size	30B7452 X012
	Steel, raised face flanged, ANSI Class 600	
	1480 psig (102 bar) max inlet pressure	
	1-inch size	40B6754 X012
	2-inch size	40B6756 X012
2*	Seat ring	
	Aluminum	
	3/32-inch (2.4 mm) port diameter	0R0441 09022
	1/8-inch (3.2 mm) port diameter	1A9367 09012
	3/16-inch (4.8 mm) port diameter	009912 09012
	1/4-inch (6.4 mm) port diameter	0B0420 09012
	3/8-inch (9.5 mm) port diameter	0B0422 09012
	1/2-inch (12.7 mm) port diameter	1A9288 09012

\*Recommended spare part.



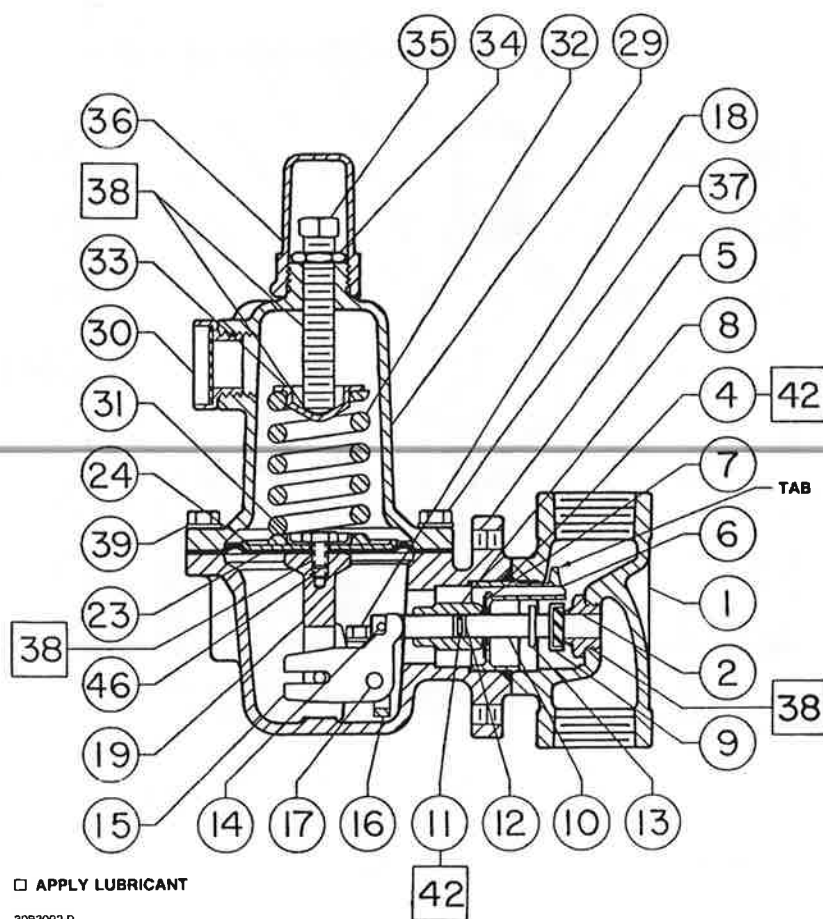


Figure 7. Type 627 Regulator Components

Key	Description	Part Number	Key	Description	Part Number
2*	Seat ring (Cont.) 303 Stainless steel 3/32-inch (2.4 mm) port diameter 1/8-inch (3.2 mm) port diameter 3/16-inch (4.8 mm) port diameter 1/4-inch (6.4 mm) port diameter 3/8-inch (9.5 mm) port diameter 1/2-inch (12.7 mm) port diameter 316 Stainless steel, NACE <sup>(1)</sup> construction only 3/32-inch (2.4 mm) port diameter 1/8-inch (3.2 mm) port diameter 3/16-inch (4.8 mm) port diameter 1/4-inch (6.4 mm) port diameter 3/8-inch (9.5 mm) port diameter 1/2-inch (12.7 mm) port diameter	0R0441 35032 1A9367 35032 009912 35032 0B0420 35032 0B0422 35032 1A9288 35032  0R0441 X0012 1A9367 X0022 009912 X0012 0B0420 X0012 0B0422 X0012 1A9288 X0012	5	Diaphragm Case For Type 627 or 627R Aluminum w/o 1/8-inch gauge tap Aluminum with 1/8-inch gauge tap for Type 627 only Ductile iron w/o 1/8-inch gauge tap Ductile iron with 1/8-inch gauge tap for Type 627 only Steel For Type 627M or 627MR Ductile iron Steel For Type 627H Steel For Type 627HM Steel	40B3084 X012 11B5380 X012 30B3053 X012 31B0641 X012 30B3104 X012  39A5987 X012 30B8734 X012  30B3104 X012 30B8734 X012
3	Cap Screw (not shown), (2 req'd) Type 627 and 627R w/aluminum diaphragm case, pl steel All Types w/ductile iron diaphragm case, pl steel or steel diaphragm case, pl steel	18A1087 X012 1C4038 24052 1C4030 24052	6	Boost Body (not for Type 627M, 627HM, or 627MR), Delrin <sup>(2)</sup> For Type 627 or 627H For Type 627R	30B3056 X012 30B3057 X012
4*	Diaphragm Case O-Ring (Type 627, 627H, or 627R only), nitrile	17A2325 X022	7	Stabilizer (for Type 627, 627H, & 627R only), nitrile	10B3060 X012
			8	Stem Guide (for Type 627, 627H, & 627R only), powdered metal	20B3061 X012

\*Recommended spare part.

1. National Association of Corrosion Engineers (NACE) standard MR-01-75.  
2. Trademark of E.I. du Pont De Nemours Co.

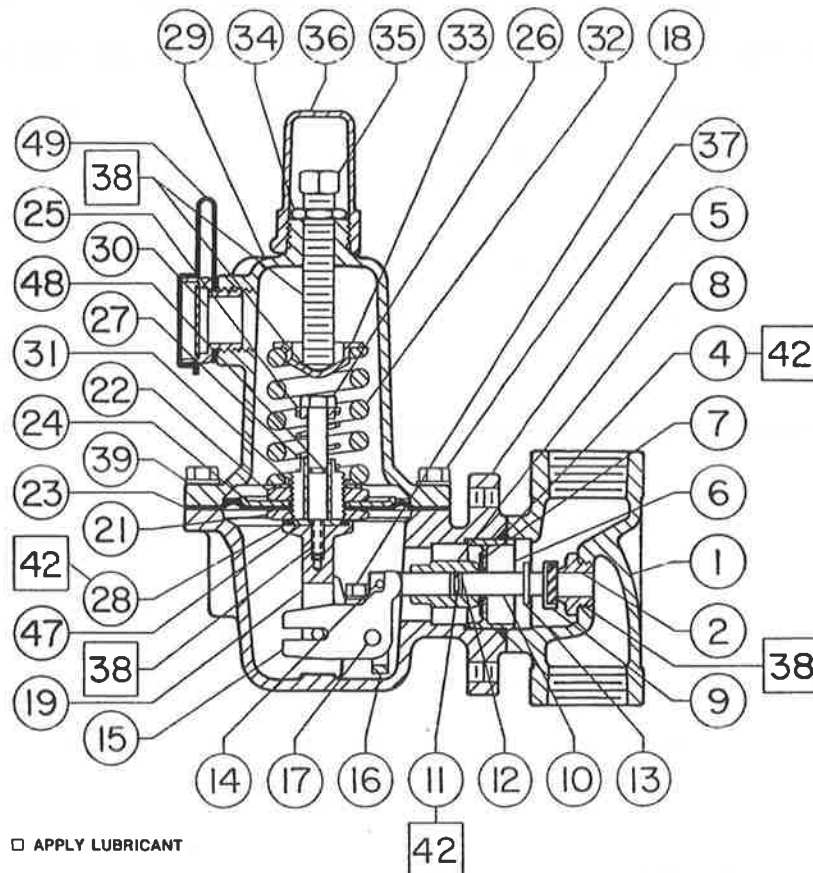


Figure 8. Type 627R Regulator Components

Key	Description	Part Number	Key	Description	Part Number
9*	Disk Assembly (for all port diameters)		19	Pusher Post, aluminum	
	Aluminum holder and nitrile disk	1C4248 X0212		For Type 627 or 627M	10B3098 X012
	303 Stainless steel holder and nitrile disk	1C4248 X0202		For Type 627R or 627MR	10B3098 X022
	Aluminum holder and nylon disk	1C4248 X00A2		For Type 627H or 627HM	
	303 Stainless steel holder and nylon disk	1C4248 X0062		(416 stainless steel)	10B3098 X032
	NACE construction only		21	Diaphragm Connector (for Type 627R or 627MR only), stainless steel	10B6758 X012
	Aluminum holder and nitrile disk	1C4248 X0212			
	316 Stainless steel holder and nitrile disk	1C4248 X0252	22	Diaphragm Connector Nut (for Type 627R or 627MR only), stainless steel	10B7449 X012
	Aluminum holder and nylon disk	1C4248 X00A2	23*	Diaphragm, nitrile	
	316 Stainless steel holder and nylon disk	1C4248 X0262		For Type 627 or 627M w/aluminum or ductile iron diaphragm case	10B3069 X012
10	Stem			For Type 627 or 627M w/steel diaphragm case	10B8735 X012
	303 stainless steel	10B3059 X012		For Type 627R or 627MR w/aluminum or ductile iron diaphragm case	10B3068 X012
	316 stainless steel (NACE)	10B3059 X022		For Type 627R or 627MR w/steel diaphragm case	10B8736 X012
11*	Stem O-Ring, nitrile	1D6875 06992		For Type 627H or 627HM w/steel diaphragm case (diaphragm is neoprene with nylon fabric)	12B0178 X012
12	Stem Backup Ring, TFE (2 req'd)	1K7868 06992	24	Diaphragm Head, zn pl steel	
13	Hair Pin Clip, stainless steel	10B3058 X012		For Type 627 or 627M	1D6664 28982
14	Drive Pin, zn pl steel	1A9532 28982		For Type 627R or 627MR	10B3071 X012
15	Lever, zn pl steel	20B3063 X012		For Type 627H or 627HM	
16	Lever Retainer, zn pl steel	30B3097 X012		(416 stainless steel)	12B0175 X012
17	Lever Pin				
	Stainless steel	10B3083 X012			
	316 stainless steel (NACE)	10B3083 X022			
18	Lever Cap Screw (2 req'd)				
	Plated steel	10B7454 X012			
	316 stainless steel (NACE)	10B7454 X022			

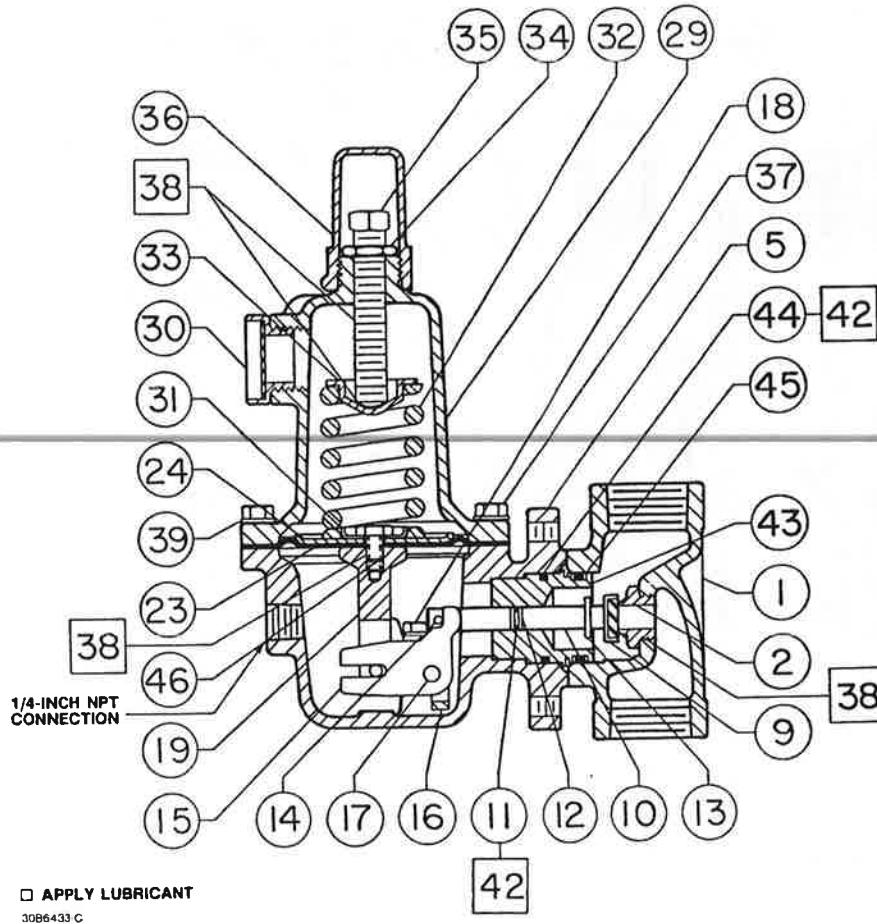


Figure 9. Type 627M Regulator Components

Key	Description	Part Number	Key	Description	Part Number
25	Relief Spring Seat (for Type 627R or 627MR only), steel	10B7446 X012	32	Control Spring, pl steel 5 to 20 psig range (0.34 to 1.4 bar), yellow color code	10B3076 X012
26	Guide Retainer (for Type 627R or 627MR only), stainless steel	10B7450 X012		15 to 40 psig range (1.0 to 2.8 bar), green color code	10B3077 X012
27	Relief Spring (for Type 627R or 627MR only), pl steel	10B6757 X012		35 to 80 psig range (2.4 to 5.5 bar), blue color code	10B3078 X012
28*	Relief Seal O-Ring (for Type 627R or 627MR only), nitrile	1J1085 06992		70 to 150 psig range (4.8 to 10.3 bar), red color code	10B3079 X012
29	Spring Case For Type 627 or 627R Aluminum Ductile iron Steel	40B3086 X012 30B3055 X012 30B3102 X012		140 to 250 psig range (9.6 to 17.2 bar), blue color code, used in a Type 627H or 627HM	10B3078 X012
	For Type 627M or 627MR Ductile iron Steel	30B3055 X012 30B3102 X012	33	Upper Spring Seat, pl steel	10B3079 X012 1D6671 25072
	For Type 627H or 627HM Steel	30B3102 X012	34	Locknut, zn pl steel	1D6677 28982
30	Screened Vent Assembly, plastic	10B3093 X012	35	Adjusting Screw, pl steel For Type 627 or 627M For Type 627H or 627HM For Type 627R or 627MR	10B3081 X012 10B3081 X012 10B3080 X012
31	Lower Spring Seat, zn pl steel For Type 627 or 627M For Type 627R or 627MR	1D6666 25072 20B3073 X012	36	Adjusting Screw Cap, plastic	20B3082 X012

\*Recommended spare part.

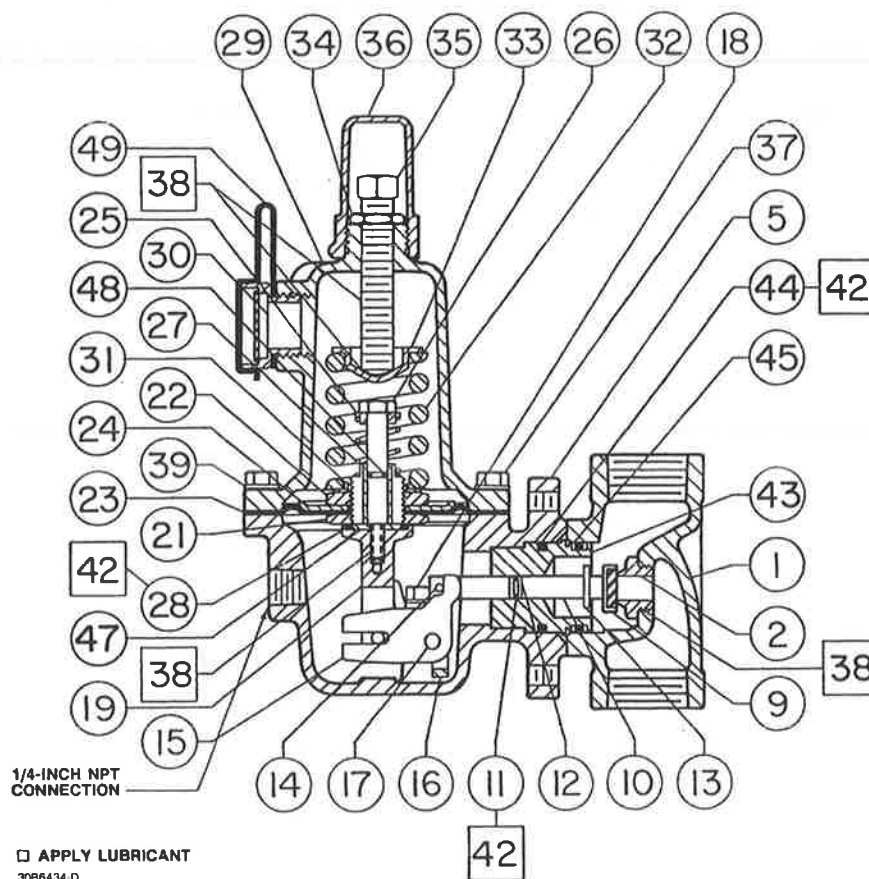


Figure 10. Type 627MR Regulator Components

Key	Description	Part Number	Key	Description	Part Number
37	Spring Case Cap Screw, pl steel (8 req'd) For aluminum or ductile iron diaphragm case For steel diaphragm case Type 627H or 627HM, steel diaphragm case	1A3917 24052 10B8737 X012 1A3464 24052	43	Blocked Throat (for Type 627M, 627HM or 627MR only), stainless steel	10B3085 X012
38*	Lubriplate Mag-1 <sup>(3)</sup> , Lubricant, 0.9 pound can. Not furnished with regulator	1M1100 X0012	44	Blocked Throat O-Ring (for Type 627M, 627HM, or 627MR only), nitrile (2 req'd)	1E2643 06992
39	Nameplate For aluminum and ductile iron spring cases Aluminum Number 1 Number 2 For Type 627H, 627HM and steel spring cases Stainless steel Number 1 Number 2	10B3679 X032 10B3679 X022 11B6572 X022 11B6572 X032	45	Blocked Throat Backup Ring (for Type 627M, 627HM, or 627MR only), TFE (2 req'd)	10B3106 X012
42*	Dow Corning 33 <sup>(4)</sup> , Lubricant, Not furnished with regulator	T13078 T0012	46	Diaphragm Head Cap Screw, steel For Type 627 or 627M For Type 627H or 627HM	1K9207 24052 1C3791 24052
			47	Relief Seal Retainer (for Type 627R or 627MR only), stainless steel	10B7445 X012
			48*	Guide Retainer O-Ring (for Type 627R or 627MR only), nitrile	1D6825 06992
			49	Relief Indicator (for Type 627R or 627MR only), rubber (not shown)	30B3100 X012
			50	Diaphragm Limiter	22B0176 X012
			51*	Diaphragm Limiter O-Ring	1K8776 06992
			52*	Pusher Post O-Ring (2 Req'd)	1C8538 06992

\*Recommended spare part.  
3. Trademark of Fiske Brothers Refining Co.  
4. Trademark of Tretolite Division of Petrolite Corp.

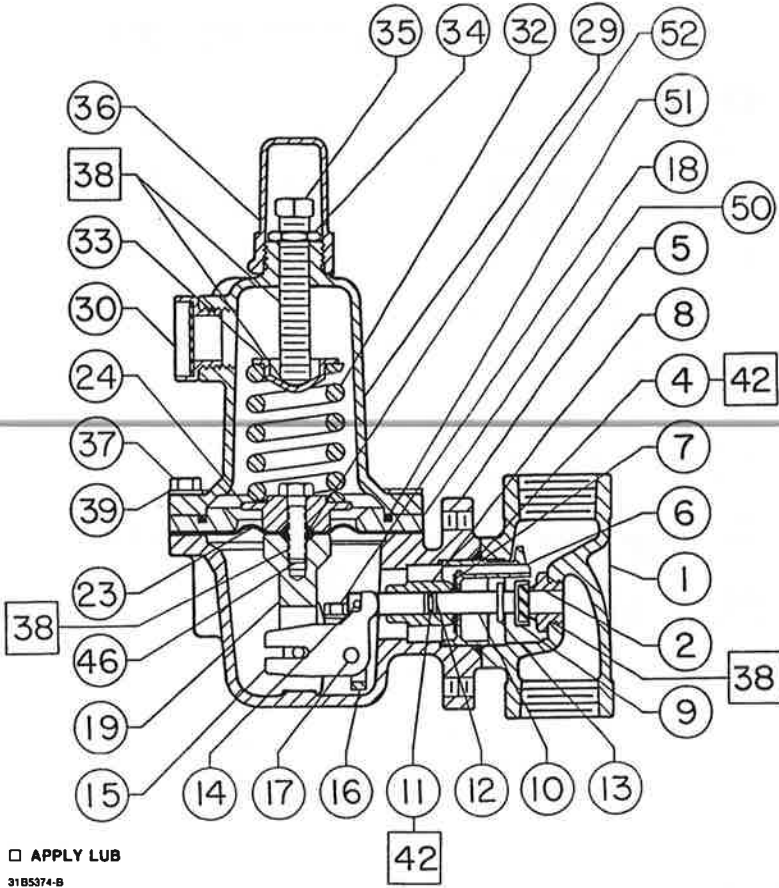


Figure 11. Type 627H Regulator Components

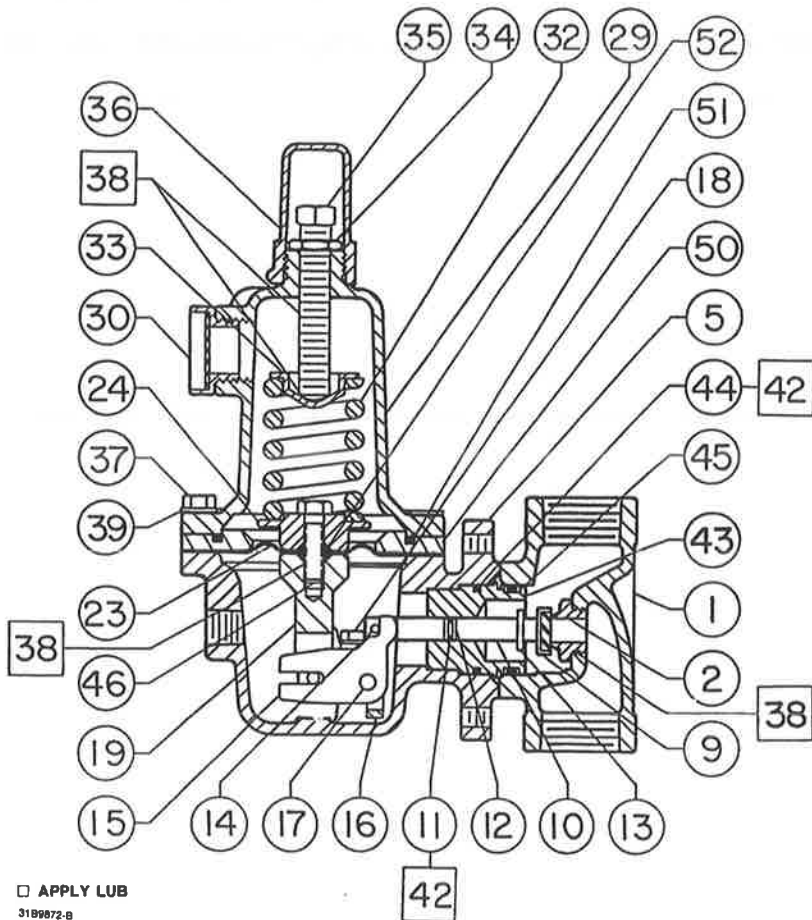


Figure 12. Type 627HM Regulator Components

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**Fisher Controls**

For information, contact Fisher Controls:  
Marshalltown, Iowa 50158 USA  
Rochester, Kent, England ME2 2EZ

Sao Paulo 05424 Brazil  
Singapore 2158

# CUSTOMER SERVICE REPORT

99404-152

PRV-221



Serve the Customer First

## SPARTAN CONTROLS LTD.

- CALGARY, PHONE: (403) 207-0700 FAX: (403) 207-0873
- EDMONTON, PHONE: (403) 468-5463 FAX: (403) 466-4624
- GRANDE PRAIRIE, PHONE: (403) 539-1161 FAX (403) 532-2608
- FORT MCMURRAY, PHONE: (403) 790-0440 FAX: (403) 790-1535
- FORT ST. JOHN, PHONE: (604) 785-0285 FAX: (604) 785-0280
- 

NUMBER **10916**  
PAGE 1 OF **1**  
SERIAL # \_\_\_\_\_

P.O./S.A. Number <b>107838</b>	Project Number	Date <b>23 June 2000</b>	CLASS OF SERVICE <input checked="" type="checkbox"/> Chargeable <input type="checkbox"/> Warranty <input type="checkbox"/> Serv. Agreement <input type="checkbox"/>	TYPE OF SERVICE <input checked="" type="checkbox"/> Start Up <input checked="" type="checkbox"/> Field Service <input type="checkbox"/> Consultation <input type="checkbox"/> Shop Repair <input type="checkbox"/>	TYPE OF EQUIPMENT <input type="checkbox"/> DCS <input type="checkbox"/> SCADA <input type="checkbox"/> MI <input type="checkbox"/> Sterling <input checked="" type="checkbox"/> VRC <input type="checkbox"/> PANEL <input type="checkbox"/> ASSEMBLER <input type="checkbox"/>
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COMPANY NAME & SITE ADDRESS  
**Propak  
440 East Lake Road Airdrie**

LSD \_\_\_\_\_ W \_\_\_\_\_ M \_\_\_\_\_

CUSTOMER CONTACT  
**Wayne Gordon**

CUSTOMER PHONE # \_\_\_\_\_

INVOICE LOCATION \_\_\_\_\_

Description of Problem/Service  
**Re-set regulator**

S.C.L. Service Tech/Engineer  
**Roy Doyle - Baker**

S.C.L. Technical Sales Person  
**Colleen Hays**

SERVICE TIME LOG					LABOUR AND EXPENSES				PARTS BREAKDOWN			
Date	Trav. T	Std. T	OT	DT		Qty.	Unit Rate	Total	Description and/or P/N	Qty.	Unit Price	Total
<b>23 June</b>		<b>1/2</b>			Trav. T							
					Std. T	<b>1/2</b>						
					OT							
					DT							
					Mileage							
					Airfare							
					Car Rent							
					Lodging							
					Meals							
<b>Hour Totals</b>												
					<b>Total Labor &amp; Expense</b> <sup>1</sup>				<b>Total Parts Cost</b> <sup>2</sup>			

DESCRIPTION OF SERVICES Total Charges Total of 1 + 2 = 3 G.S.T. CHARGED SEPARATELY <sup>3</sup>

**Re-set fisher 627-439 to 172 KPa.**

**SENT TO SHOP**

**JUN 23 2000**

*[Signature]*

**RECEIVED**

**JUN 23 2000**

*[Signature]*

*(on shelf)*

I HEREBY ACKNOWLEDGE RECEIPT OF SERVICES

**CUSTOMER SIGNATURE:** \_\_\_\_\_

Fisher Controls

Instruction Manual

**1805 Series Relief Valves**

December 1975

Form 1211

Incorporates Errata Sheet Dated November 1985

**WARNING**

Fisher relief valves must be installed, operated, and maintained in accordance with federal, state, and local codes, rules, and regulations and Fisher instructions.

If the spring case develops a leak or if the outlet continuously vents gas, service to the unit may be required. Failure to correct trouble could result in a hazardous condition.

Call a gas service man to service the relief valve. Only a qualified person must install or service the unit.

**INTRODUCTION**

The 1805 Series relief valves are primarily designed for use in farm tap applications where a safety relief valve is needed between the first and second stage regulators. The 1805 Series is suitable for service on natural gas, air, propane, or any operating medium that is not corrosive to the internal parts. Relief pressure ranges from 5 to 125 psi. Maximum pressure, including buildup, is 150 psi.

*Table 1. Type Number Description*

Type Number	Size (Inches)	Distinctive Construction Features
1805-1	3/4 & 1	Zinc spring case
1805-2	3/4 & 1	Cast iron spring case, closing cap with 1/4" NPT vent placed over the adjusting screw
1805-3	1-1/2 & 2	Cast iron spring case, closing cap with 1/4" NPT vent placed over the adjusting screw
1805-4	3/4 & 1	Cast iron spring case
1805-5	1-1/2 & 2	Cast iron spring case
1805-6	3/4 & 1	1805-1 with screen in outlet
1850-7	3/4 & 1	Cast iron spring case, closing cap with 1/4" NPT vent placed over adjusting screw, screen in outlet

©by Fisher Controls Company 1975



W0611

*Figure 1. Type 1805 Relief Valve*

**INSTALLATION**

After uncrating, check the relief valve for shipping damage. Remove pipe scale and other foreign material from the connecting pipeline. Coat the male pipe threads with a suitable pipe compound. The unit can be installed in any position as long as the flow is in the direction indicated by the arrow cast on the body.

Protect the outlet and vents from entrance of rain, snow, or other foreign material that may plug them. Outdoor installations should include a rain cap over the vents and outlet if they point upward. Periodically check the openings to ensure that they are not plugged.

Protect the relief valve against damage from vehicles or other external sources.

Operative temperature range for the 1805 Series relief valves is  $-20^{\circ}\text{F}$  to  $+150^{\circ}\text{F}$ .



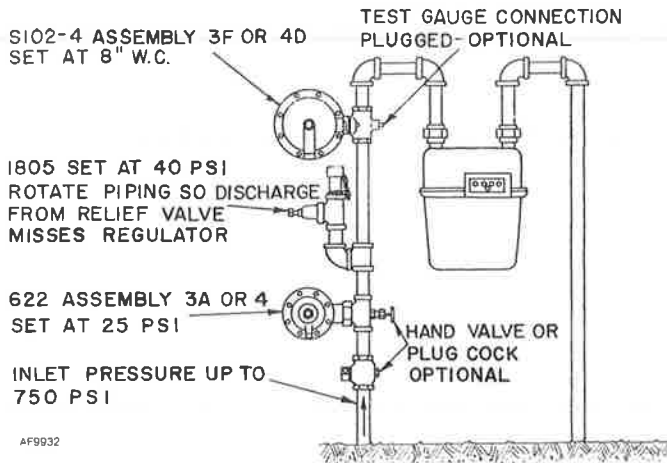


Figure 2. Typical Farm Tap Installation

**Vents**

**WARNING**

Venting gas may accumulate and be an explosion hazard under enclosed conditions such as in pit or underground installations. Install remote vent lines to carry gas to a safe area.

If remote vent lines are necessary, use the Types 1805-2, -3, or -7 which have 1/4" NPT vent connections in the closing cap. Remove the screen, if one is present in the outlet, and install remote vent lines in the outlet and closing cap openings. Remote vent lines must have the largest practical diameter. The vent lines should be as short as possible with a minimum number of bends or elbows.

**Overpressure**

Relief pressure ratings are from 5 to 125 psi. The maximum inlet pressure, including buildup, is 150 psi. System operation within these limitations does not eliminate the possibility of damage from external sources or from debris in the gas line. The relief valve should be inspected for damage regularly and after any overpressure condition.

**Adjustment**

The range of allowable pressure settings is stamped on the spring case (Types 1805-1, -2, -4, -6, and -7) or on the nameplate (Types 1805-3 and -5). If a pressure setting beyond the indicated range is required, substitute the appropriate spring. Be sure to label the relief valve to indicate the new pressure range. Always use a pressure gauge to monitor pressure when making adjustments.

1. On Types 1805-2, -3, and -7 remove the closing cap (key 17).
2. Loosen hex nut (key 15).

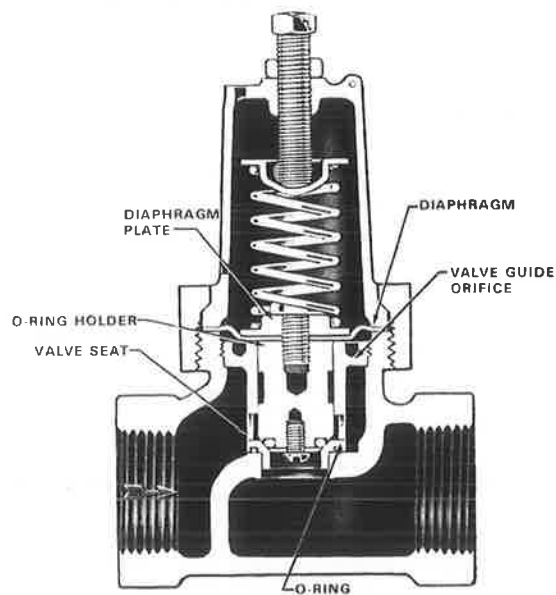
3. To increase the relief setting, turn the adjusting screw (key 14) clockwise. To decrease the relief setting, turn the adjusting screw counterclockwise.

4. Tighten the hex nut.

**PRINCIPLE OF OPERATION**

See figure 3. Relief valves respond to changes in upstream pressure. If upstream pressure increases and exceeds the relief valve setting, the valve will open and allow gas to vent to the atmosphere. When upstream pressure returns to normal level (below the setting of the relief valve), the relief valve automatically closes and normal system operation resumes.

In the 1805 Series relief valves, the upstream pressure registers underneath the diaphragm. Gas reaches the diaphragm through the space between the O-ring holder and the valve guide orifice in 3/4" and 1" bodies or through registration holes in the valve guide orifice in 1-1/2" and 2" bodies (see figure 4). When the upstream pressure increases beyond the spring setting, the force on the diaphragm overcomes spring compression. The O-ring holder moves upward, carrying the O-ring away from the valve seat. This opens the flow line, allows gas to flow to the atmosphere, and relieves the overpressure condition. When upstream pressure registered on the diaphragm decreases to a level below that of the spring setting of the relief valve, the spring force pushes the diaphragm plate and O-ring holder toward the valve seat. Contact between O-ring and valve seat prevents further flow to atmosphere.



W0613

## MAINTENANCE

### WARNING

To avoid personal injury and equipment damage, isolate the relief valve from all pressure. Cautiously release pressure from the relief valve before attempting disassembly.

Due to normal wear that may occur in relief valves, the O-rings and diaphragm must be inspected periodically and replaced as necessary. The frequency of inspection and replacement depends upon the severity of service conditions or the requirements of state and federal laws. Instructions are given below for disassembly of the relief valve and replacement of the O-rings and diaphragm. The 1805 Series relief valves do not have to be removed from the pipeline to inspect internal parts. Refer to figure 4 while servicing the relief valves.

1. To ease spring compression, remove the closing cap (key 17, Types 1805-2, -3, and -7), loosen the hex nut (key 15), and turn the adjusting screw (key 14) counterclockwise.

2. Unscrew the union nut (key 16) and remove it with the spring case (key 13), spring (key 11), and upper spring seat (key 12).

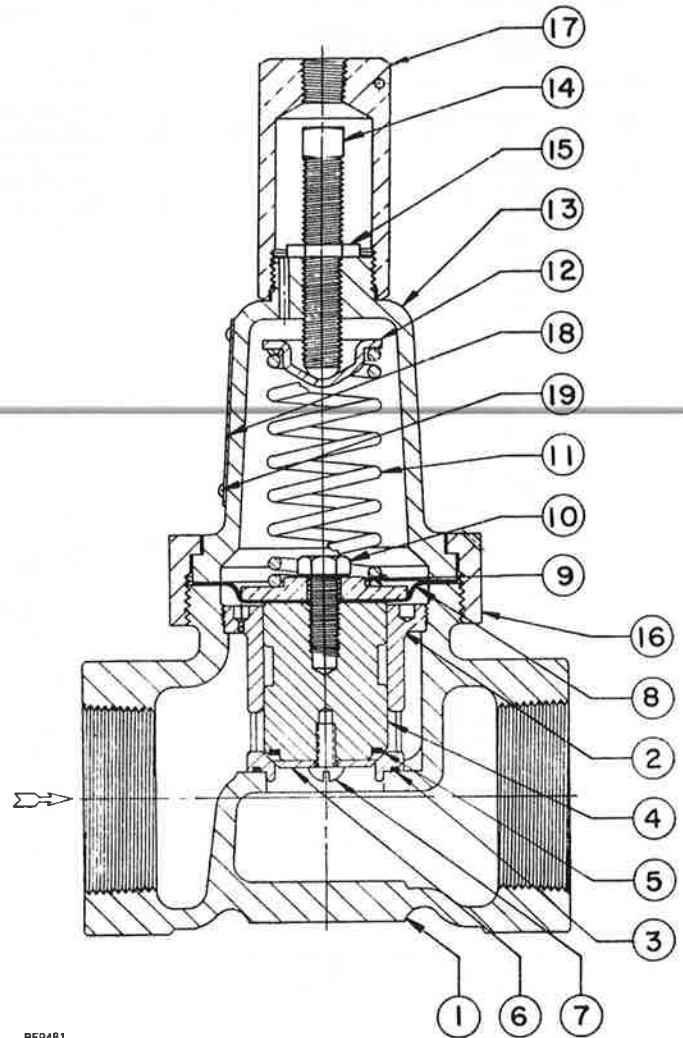
3. Pull the O-ring holder (key 4) out of the valve guide orifice (key 2).

4. Remove the diaphragm cap screw (key 10) from the O-ring holder. Take off the diaphragm plate (key 9) and inspect the diaphragm (key 8).

5. Take the machine screw (key 7) out of the opposite end of O-ring holder, remove the O-ring washer (key 6) and inspect the O-ring (key 5).

6. Remove the valve guide orifice (key 2) from the body and check the Tetra-seal\* O-ring (key 3).

7. Reassemble the relief valve in reverse order of the above steps. To ensure proper slack in the diaphragm, tighten the union nut finger-tight only. Turn the adjusting screw clockwise to apply some spring force to the diaphragm. Complete the tightening of the union nut.



BE9461

Figure 4. Type 1805-3

## TYPE NUMBER

When corresponding with a Fisher representative or the factory concerning these relief valves, include the type number and all other pertinent information stamped on the spring case, closing cap, or on the nameplate. Specify the eleven-character part number when ordering new parts from the following parts list.



**PARTS LIST**

Key	Description	Part Number	Key	Description	Part Number		
1	Valve Body 1805-1, -2 & -4 3/4" NPT Cast iron Malleable Iron WCB Steel Heat-treated for sour gas corrosion resistance capability <sup>(1)</sup> For other than sour gas applications 1" NPT Cast iron Malleable iron WCB Steel Heat-treated for sour gas corrosion resistance capability For other than sour gas applications 1805-3 & -5 1-1/2" cast iron 2" cast iron 1805-6 & -7 3/4" cast iron 1" cast iron	1E6211 19012 1F1920 19062  1R6879 X0022 1R6879 X0012  1E6212 19012 1F1921 19062  2U7426 X0012 2U7426 22012  1E8240 19012 1E8243 19012  1H2425 19012 1H2426 19012	5*	O-Ring, nitrile 3/4" & 1" body size 1-1/2" & 2" body size 6 O-Ring Washer, SST 3/4" & 1" body size 1-1/2" & 2" body size 7 Machine Screw, Zn pl steel 3/4" & 1" body size For sour gas corrosion resistance capability For other than sour gas applications 1-1/2" & 2" body size 8* Diaphragm, nitrile 3/4" & 1" body size 1-1/2" & 2" body size 9 Diaphragm Plate, brass 3/4" & 1" body size 1-1/2" & 2" body size 10 Cap Screw, steel pl 3/4" & 1" body size 1-1/2" & 2" body size 11 Spring, steel, Cd pl 3/4" & 1" body size 5-35 psig 10-60 psig 20-125 psig 1-1/2" & 2" body size 5-20 psig 10-50 psig 35-125 psig 12 Upper Spring Seat, steel pl 3/4" & 1" body size 1-1/2" & 2" body size	1D2888 06992 1C5622 06992 1D3359 35072 1E8242 35072 1P1001 X0012 1P1001 28982 1A8991 28992 1E6217 02052 1E8241 02052 1E6218 14012 1E8247 14012 1D1946 28992 1E7603 24052 1B9860 27212 1B7883 27022 1B7884 27022 1D8923 27022 1D6659 27022 1E5436 27142 1B7985 25062 1D6671 25072	13 Spring Case 3/4" & 1" body size Zinc Cast Iron 1-1/2" & 2" body size Cast iron 14 Adjusting Screw 3/4" & 1" body size Steel, Cd pl Brass 1-1/2" & 2" body size Brass 15 Hex Nut, steel pl 3/4" & 1" body size 1-1/2" & 2" body size 16 Union Nut, malleable iron 1805-1 & -6 1805-2, -4 & -7 1805-3 & -5 17 Closing Cap, brass 1805-2 & -7 1805-3 18 Name Plate, aluminum 1-1/2" & 2" body size 19 Drive Screw, steel pl (4 req'd) 1-1/2" & 2" body size 20 Screen, monel (not shown) 1805-6 & -7 21 Snap Ring, SST (not shown) 1805-6 & -7 22 NACE Tag, 18-8 stainless steel (not shown) 23 Tag Wire, 304 stainless steel (not shown)	2E6219 44012 2E7708 19012 2E8249 19042 1E6221 28982 1E7709 14012 1E5432 14012 1A9463 24122 1D6677 28982 1E4711 19062 1C4249 19062 1E7666 19062 1E7706 14012 1E8239 14012 1E2401 11992 1E5017 28982 1E5648 43122 1E5649 37022 19A6034 X012 1U7581 X0022

\*Recommended spare part.  
1. As detailed in National Association of Corrosion Engineers (NACE) standard MR-01-75.

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**Fisher Controls**

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Cernay 68700 France

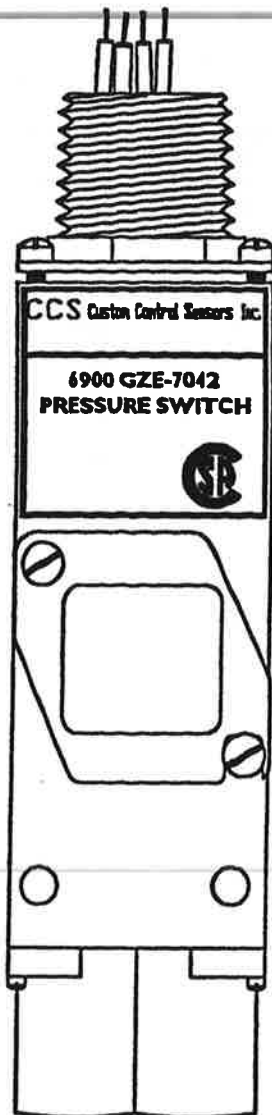
Sao Paulo 05424 Brazil  
Singapore 0512

# INSTALLATION AND OPERATION MANUAL

for  
**CUSTOM CONTROL SENSORS INC.**  
**DUAL-SNAP PRESSURE SWITCH**  
**SERIES 6900GZE\*-7042**

Pressure: 1 to 2500 psi

*Sold and Serviced by* **TELEMATIC CONTROLS INC.**



## OPERATING AND ORDERING DATA:

### PRESSURE SWITCHES MODEL 6900GZE\*-7042

FREE LEADS  
 1/2" STAINLESS STEEL PRESSURE  
 PORT & DIAPHRAGM

Model Number	Max. Sys. Press. psi	Proof (Test) Press. psi	Adj. Set-Point Range		Approx. Dead-band psi	Wetted Parts
			On. Incr. Press. psi	On Decr. Press. psi		
6900GZE12-7042	500	750	3 - 20	1 - 18	2	316SS Viton
6900GZE14-7042	500	750	9 - 75	3 - 69	6	
6900GZE16-7042	1500	2000	18 - 150	6 - 138	12	
6900GZE18-7042	1500	2000	45 - 375	15 - 345	30	
6900GZE20-7042	2000	3000	300 - 1000	225 - 925	75	
6900GZE22-7042	3000	4500	700 - 2500	520 - 2320	180	

## ELECTRICAL CHARACTERISTICS:

### Rating of Switch Element

VOLTS	AMPERES	VOLTS	AMPERES
	Res.		Res.
250AC-50/60 Hz	11	125AC-50/60Hz	11
125DC	0.5	30 DC	5

### Standard Features:

- \* U.L./CSA - See Note
- \* Explosion proof:  
Div. 1,2
- \* NEMA: 4,7,9 & 13
- \* Weatherproof
- Ambient Temp. Range  
- 30° to 160° F  
- 34° to 71° C

## CUSTOMER SPECIFICS

PROPAK SYSTEMS LIMITED.

Purchase Order No.: 57965-285

Telematic Work Order No.: 920787

Model      Tag No.      Calibration

EXTERNALLY  
ADJUSTABLE

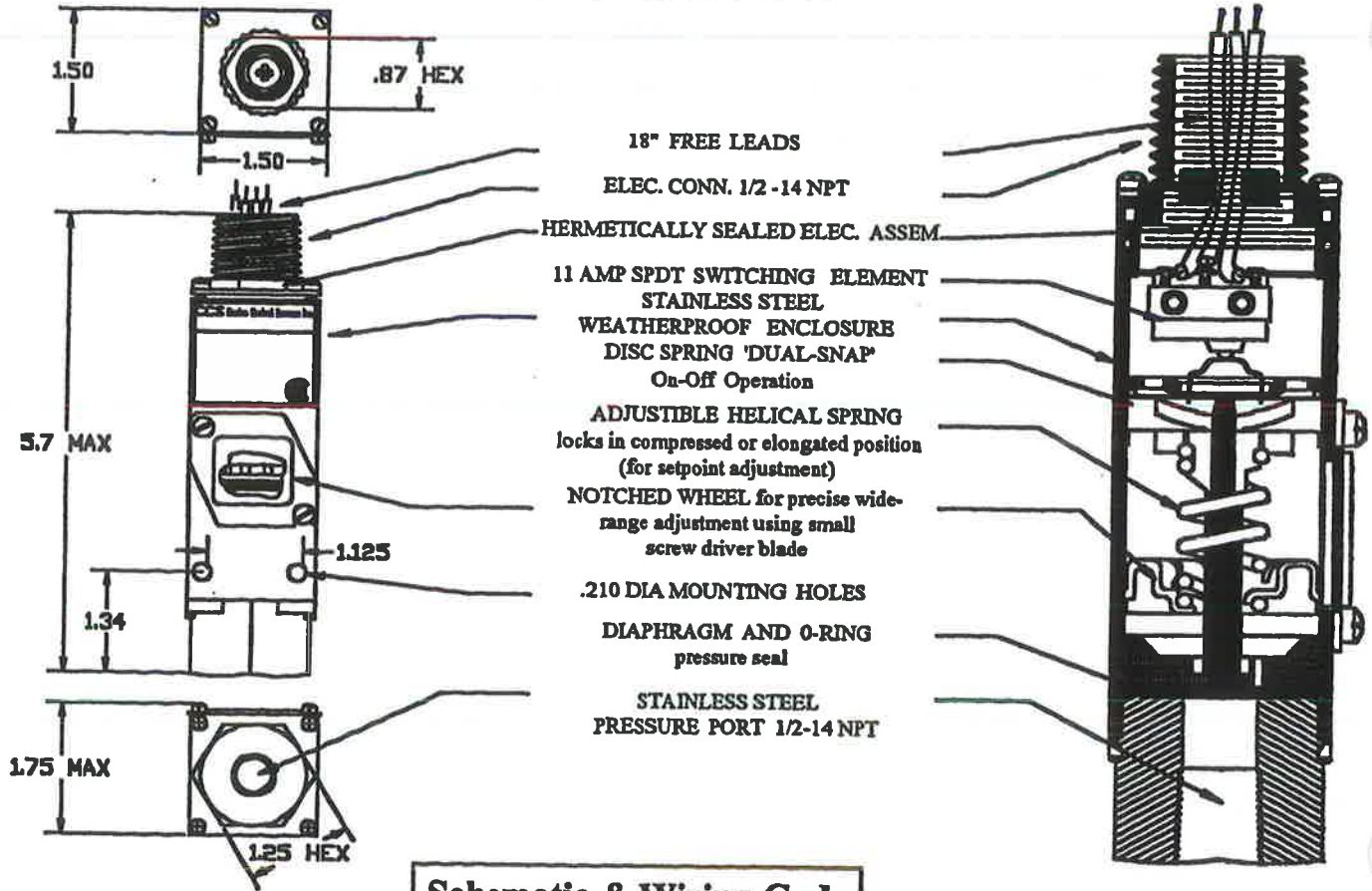
WIDE RANGE  
DIAPHRAGM

Shipping Wt. Approx.  
28 oz. (794 grams)

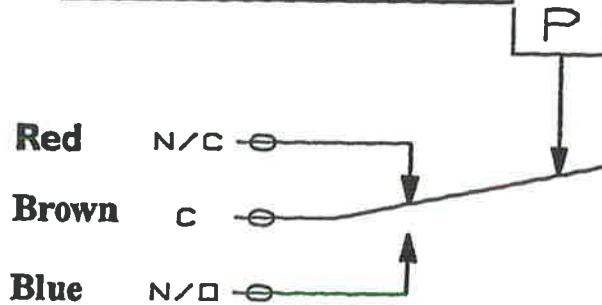
### NOTE:

Div. 1 explosion proof and hermetically sealed electrical assembly Part No. 46-1058, listed by both Underwriters Laboratories Inc., (File No. E32961) and CSA Testing Laboratories (File No. 22921) for hazardous locations, Class I, Groups A,B,C and D; Class II, groups E,F, and G

## Assembly Drawing



## Schematic & Wiring Code



## CAUTIONS FOR INSTALLATION AND USE OF CCS DUAL-SNAP PRESSURE, TEMPERATURE, AND FLOW SENSORS:

**SAFETY:** The pressure, temperature and flow switches shown in the catalog are electromechanical devices and therefore are not suitable for use as safety devices. Installations should conform to Canadian Electrical Codes (CEC).

**MEDIA:** System media must be compatible with the specified wetted materials. Oxygen media cannot be utilized without special cleaning and packaging provided by the factory.

**OPERATING CONDITIONS:** The electrical load, ambient temperature ranges and proof pressure specified must not be exceeded. Surge pressurization should not exceed 200,000 psi per second to diaphragm switch models and 1 million psi per second to piston switch models. In installations that will be subject to severe shock, vibration, or other hostile environmental conditions, contact the factory to determine suitability.

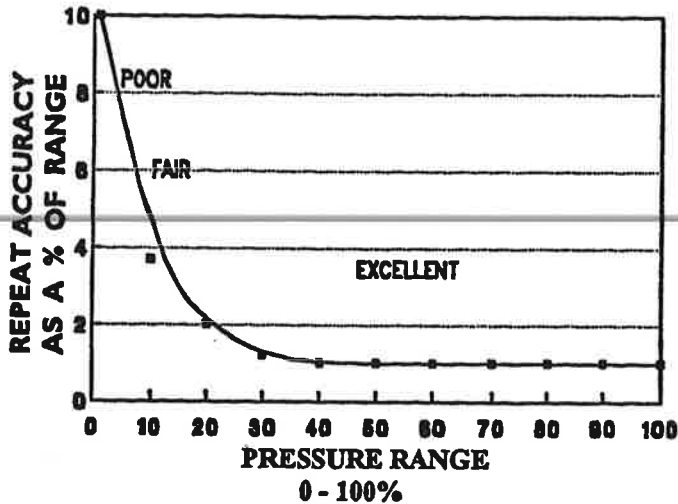
**ADJUSTMENT:** Field adjustable units should be set no closer than 1/2 turn from either end of their adjustment range.

**CSA/UL/BASFEFA:** Field repairs or modifications of "listed" units may void the listing of the repaired or modified unit.

# APPLICATION AND TECHNICAL INFORMATION

## PRESSURE SWITCH

### APPROXIMATE PRESSURE SENSING PERFORMANCE CHARACTERISTICS



### Surge and Ripples

The Disc spring design used in DUAL-SNAP switches makes them relatively impervious to surges or pump ripples that may be expected in conventional hydraulic systems.

This resistance to sharp pressure changes in the media has been the prime reason for many customers changing to DUAL-SNAP pressure switches after experiencing false shutdown and failure with other competitive design principles such as flat metal diaphragms, bourdon tubes and bellows type. This makes DUAL-SNAP switches particularly suitable for rugged applications on off the road machinery, heavy presses and systems using pulsating piston pumps.

### Pressure Switch Application Conditions

**Ambient Temperature:** the pressure switch should be installed wherever possible in a location that has the most constant ambient temperature available.

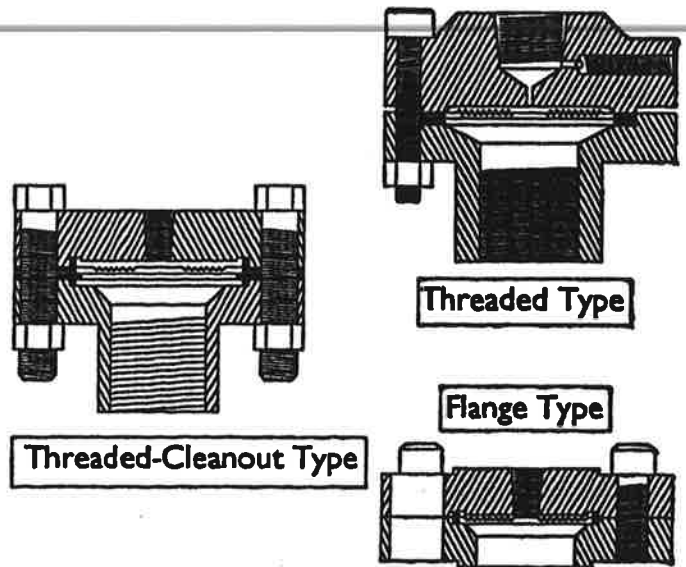
**Steam Service:** For steam or other high temperature applications the pressure switch should be mounted with the pressure connection up and with three or four circular loops, or pigtails, in the pressure lines. The vertical mounting allows condensate to accumulate in the dead ended pressure line and to be cooled in the pigtail which acts as a temperature buffer between the sensing element and the steam.

### Corrosive Fluids

Occasionally liquids or gases are encountered that are not compatible with the "wetted parts" as shown in the catalogue. When this occurs it is common practice to use a chemical seal as an interface between the corrosive fluid and the pressure switch.

Telematic Controls can arrange to drop ship switches to any manufacturer of chemical seals that the customer may specify, or can supply them if asked (Note: The customer can then place a purchase order with appropriate instructions directly with his source of supply so that the supplier can then coordinate the customer's wishes with the chemical seal that will be assembled, filled, calibrated and tested to fit the needs outlined.)

### Typical and readily available CHEMICAL SEALS



### Pressure Switch Installation

The pressure switches can be mounted in any position. When the electrical conduit is connected, it is recommended that the conduit line (if it is over 6 feet in length) be clamped firmly close to the switch to keep thermal expansion from causing it to place a high stress load onto the housing of the pressure switch. If moisture in the conduit line is a potential problem, it is recommended that a potting Y connection be placed between the switch and the conduit. This will eliminate drainage from the electrical conduit into the pressure switch housing.

Line mounting is possible and recommended for any of our "Compact" pressure switches. Installation must not impose loads on connections.

### Seismic Shock and Vibration

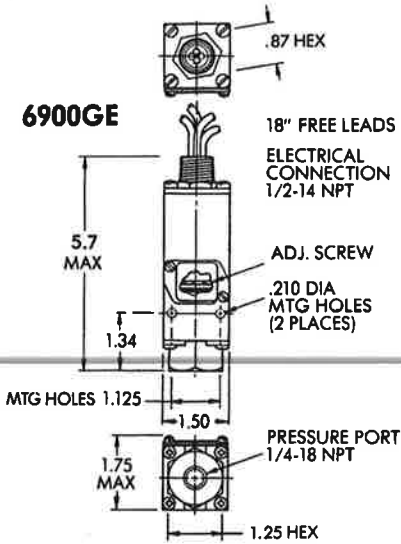
Due to their unique design principle, DUAL-SNAP pressure and temperature switches will meet all the conventional seismic shock and vibration specifications now being applied to many projects such as power plants for ecological protection. These specifications by their severity eliminate the use of mercury filled switching elements and many vibration critical sensing elements found in most competitive designs.

# EXTERNAL ADJUSTMENT

# WIDE RANGE DIAPHRAGM PISTON

# PRESSURE

## INSTALLATION DRAWING



6900GE & 6900PE  
SHIPPING WT.  
APPROX. 16 OZ.  
(467 GRAMS)

Press. 1 to 6500 psi

**SERIES:**  
**6900GE**  
**6900PE**

### Standard Features:

- U.L./CSA — See Note
- Explosion Proof: Div. 1, 2
- NEMA: 4, 7, 9, 13

### AMBIENT TEMP. RANGE

- 30° to 160° F
- 34° to 71° C

## OPERATING AND ORDERING DATA:

PRESSURE SWITCHES MODEL 6900GE		1/4" ALUMINUM PRESSURE PORT AND POLYIMIDE DIAPHRAGM					
Max. Sys. Press. psi	Proof (Test) Press. psi	Adj. Set-Point Range		Approx. Dead band psi	Model No. and Wetted Parts		
		On Incr. Press. psi	On Decr. Press. psi		MODEL SPDT-Std.	MODEL DPDT "M"	Wetted Parts
500	750	3-20	1-18	2	6900GE12	6900GEM12	Aluminum Polyimide Buna N
500	750	6-75	2-71	4	6900GE14	6900GEM14	
1500	2000	12-150	4-142	8	6900GE16	6900GEM16	
1500	2000	30-375	10-355	20	6900GE18	6900GEM18	
2000	3000	300-1000	250-950	50	6900GE20	6900GEM20	
3000	4500	700-2500	600-2400	100	6900GE22	6900GEM22	

PRESSURE SWITCHES MODEL 6900PE		PISTON PRESSURE SWITCH WITH 1/4" ALUMINUM PRESSURE PORT		• FOR HIGH CYCLING—LONG LIFE— HYDRAULIC APPLICATIONS			
Hyd. psi	Hyd. psi						
2000	3000	15-200	5-190	10	6900PE32	6900PEM32	Aluminum 400 SS Buna N Teflon
3000	5000	150-1600	40-1490	110	6900PE34	6900PEM34	
5000	7500	500-3200	330-3030	170	6900PE36	6900PEM36	
10,000	13,000	2000-6500	1500-6000	500	6900PE38	6900PEM38	

## ELECTRICAL CHARACTERISTICS:

### Rating of Switch Element

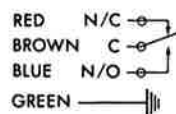
VOLTS	AMPERES	
	SPDT	DPDT "M"
	Res.	Res.
125 AC—50/60 Hz	11	11
250 AC—50/60 Hz	11	11
30 DC	5	5
125 DC	.5	.5

## SCHEMATIC AND WIRING CODE

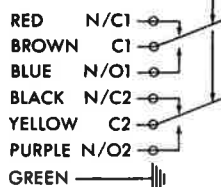
SPDT—Standard

DPDT "M"

COLOR OF LEADS - P



COLOR OF LEADS P



### NOTE:

Div. 1 explosion-proof and hermetically sealed electrical assembly Part No. 46-1058 (46-1061 for "M" model option), listed by both Underwriter's Laboratories, Inc. (File No. E32961) and CSA Testing Laboratories (File No. 22921) for hazardous locations, Class 1, Groups A, B, C, and D; Class 2 Groups E, F, and G.

## HOW TO ORDER:

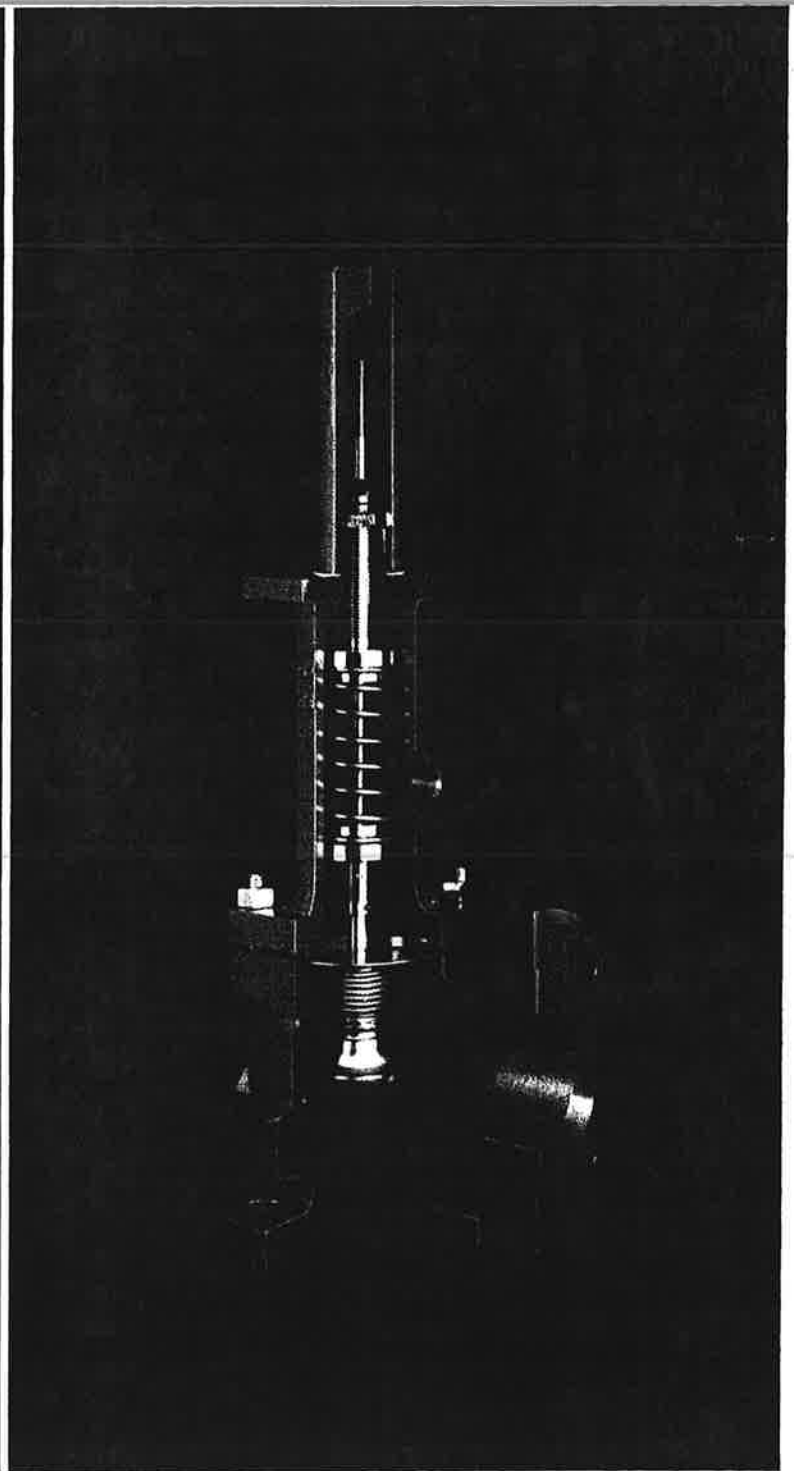
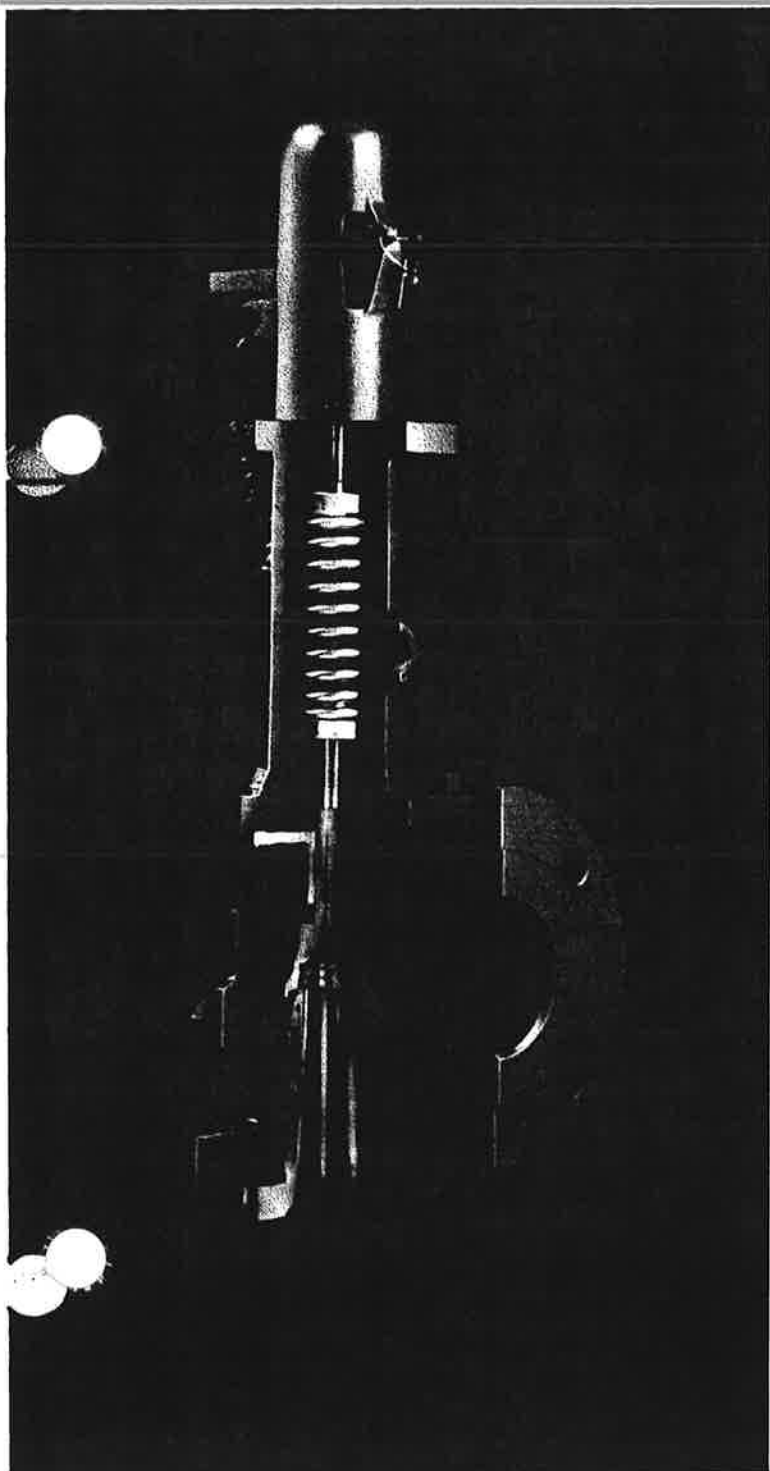
1. Specify model number.

## CALL FOR ADDITIONAL OPTIONS

## Crosby® Style JOS, JBS and JLT

Complete Range of Flanged, Full Nozzle  
Pressure Relief Valves for  
Dependable Overpressure Protection

PSV-200/202/203





# Crosby® Styles JOS, JBS and JLT Pressure Relief Valves for Gas, Vapor and Liquid Service

## Features and Benefits

### Full Compliance with ASME Code Requirements

Crosby Styles JOS, JBS and JLT valves are manufactured in accordance with ASME Boiler and Pressure Vessel Code, Section VIII.

### National Board Certified Capacities

Relieving capacities are certified by the National Board of Boiler and Pressure Vessel Inspectors. Certification includes air, steam and water.

### Positive Operating Characteristics

Crosby Styles JOS, JBS and JLT pressure relief valves have been designed with single nozzle ring control which allows the user to adjust the valve to the process system.

### Excellent Seat Tightness

Precision lapped flat metal-to-metal or soft seats provide reliable seat tightness for a broad variety of applications.

### Easy Interchangeability, Flexibility and Versatility

Fully interchangeable from conventional to bellows to liquid trim constructions, from metal to soft seats, and from closed to open bonnets with minimum parts changes.

### Maximum Corrosion Resistance

Nozzle, disc insert and most internal parts are 316 stainless steel. All 316 stainless steel, *Monel*\*, *Hastelloy*\*\* and NACE optional constructions are available.

### Reduced Installation Costs

Crosby Styles JLT-JOS and JLT-JBS provide high efficiency at 10% overpressure permitting selection of smaller valves and associated piping.

### Economical to Maintain

Stable, chatter-free valve operation prolongs valve life and reduces frequency of seat maintenance.

### Reduced Down Time

Crosby pressure relief valves are fully backed by a worldwide manufacturing and sales organization, including spare parts inventories and repair services.

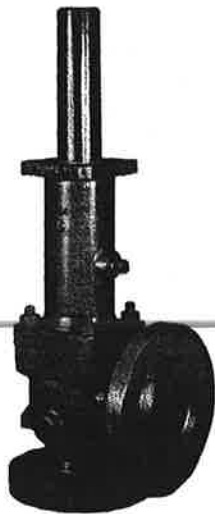
\*Monel is a registered trademark of the International Nickel Company, Inc.

\*\*Hastelloy is a registered trademark of Haynes International, Inc.

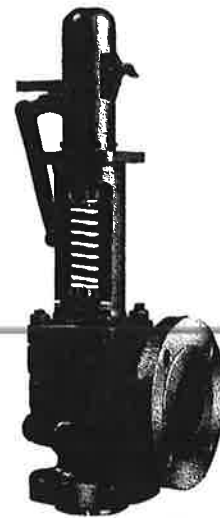
## Table of Contents

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**Crosby® Styles JOS, JBS and JLT Pressure Relief Valves  
cover process plant overpressure protection applications  
and complement our other extensive lines  
to satisfy your diversified requirements**



**Style JOS and JBS  
Style JLT-JOS and JLT-JBS**



**Style JOS-H  
(With Open Bonnet)**

**INTRODUCTION**

Crosby Styles JOS/JBS/JLT and JOS-H pressure relief valves are backed by over 120 years of pioneering research and development. Designed to provide high quality standardized overpressure protection to the process and power industries, the JOS/JBS/JLT unified line of pressure relief valves provides overpressure protection for air, gas, steam, vapor and liquid applications.

Standard sizes are 1" D 2" to 8" T2 10" with inlet flange ratings of ANSI Cl 150, 300, 600, 900, 1500 and 2500. Standard outlet flanges are ANSI Cl 150 or Cl 300 depending on valve size and rating. Optional materials of construction are available for special applications such as cryogenic service or conditions involving corrosive fluids. In addition, materials are available conforming to NACE MR0175.

**Codes and Standards**

JOS/JBS/JLT and JOS-H full nozzle top guided pressure relief valves are manufactured in accordance with requirements of ASME Code, Section VIII and capacities are certified by the National Board of Boiler and Pressure Vessel Inspectors.

They also comply with the recommended standards of the U.S. Coast Guard (U.S.C.G.) and conform to API Standards 526 and 527.

**Sizing**

For information pertaining to sizing and selection, refer to the CROSBY-SIZE Computer Sizing Program and the Crosby Pressure Relief Valve Engineering Handbook.

**Seat Design**

Styles JOS/JBS/JLT pressure relief valves are available with flat metal-to-metal seats or soft seats for optimum tightness and minimal maintenance. Details on O-ring materials and pressure/temperature limitations are on page 9. All O-rings are standard commercial sizes.

**Caps/Lifting Lever Top Constructions**

Both Type J screwed cap and Type L bolted cap are offered with or without test rods. Also available are Type C regular lifting lever, Type D packed lifting lever and Type E packed lifting lever with test rod. See pages 12 and 13.

**Optional Steam Jackets**

For applications where the valve must remain hot to prevent service fluid from solidifying, optional steam jackets are available. Contact the factory.

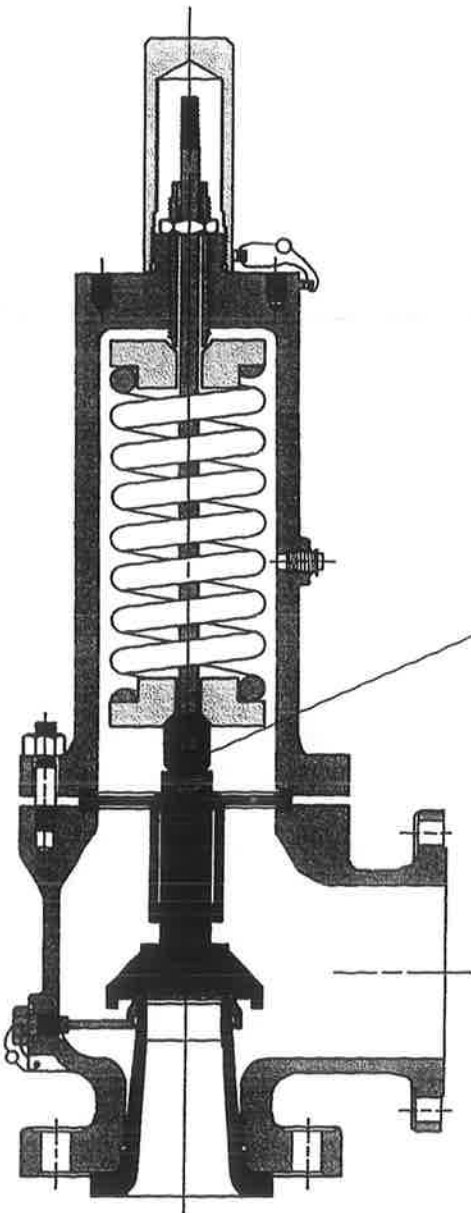
<b>Sizes:</b>	1" D 2" to 8" T2 10"*
<b>Orifices:</b>	D (0.110 sq.in.) to T2 (27.872 sq.in.)* D (71 sq.mm) to T2 (17981 sq.mm)*
<b>Inlet Ratings:</b>	ANSI Cl 150, 300, 600, 900, 1500 and 2500
<b>Temperature Range:</b>	-450F to +1000F (-268C to +538C)
<b>Pressure Range:</b>	JOS and JLT-JOS: 15 to 6000 psig (1.03 to 413.79 barg)** JBS and JLT-JBS: 25 to 6000 psig (1.72 to 413.79 barg)**

\*Larger sizes are available on application. \*\* Consult Factory for lower set pressures.

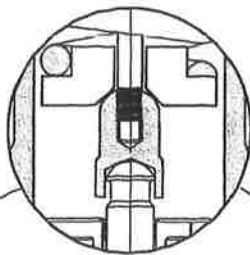
See Catalog No. 307 for details.

Please refer to Warranty and Warnings on page 63.  3

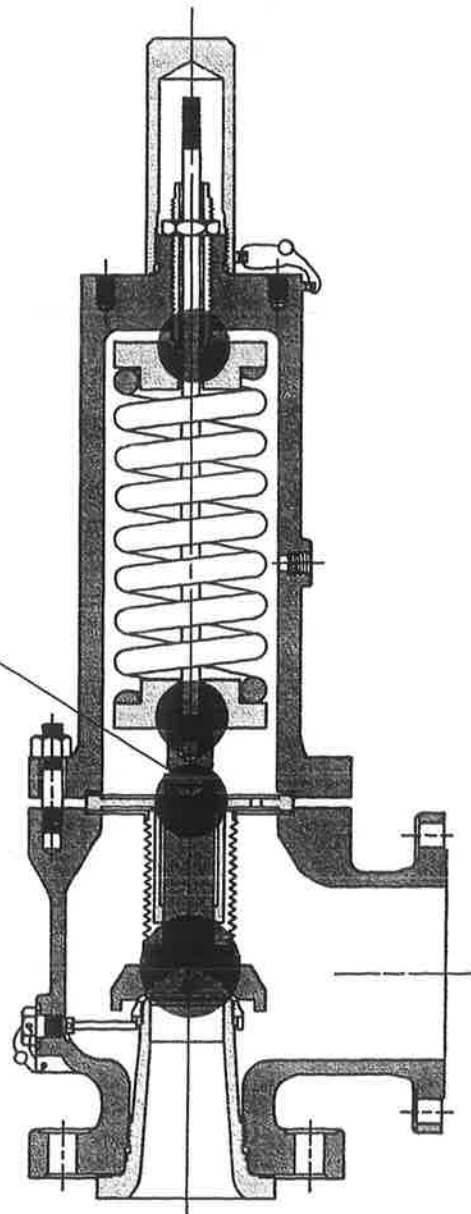
**Crosby® Styles JOS, JBS, and JLT Pressure Relief Valves**  
 handle process fluids in hostile environments;  
 provide seat tightness and reliable performance you need



All internal parts shown in color are stainless steel as standard.



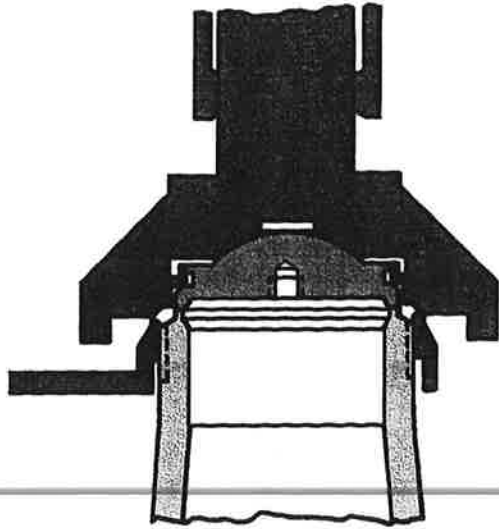
Spindle construction  
 on smaller valves  
 thru K orifice



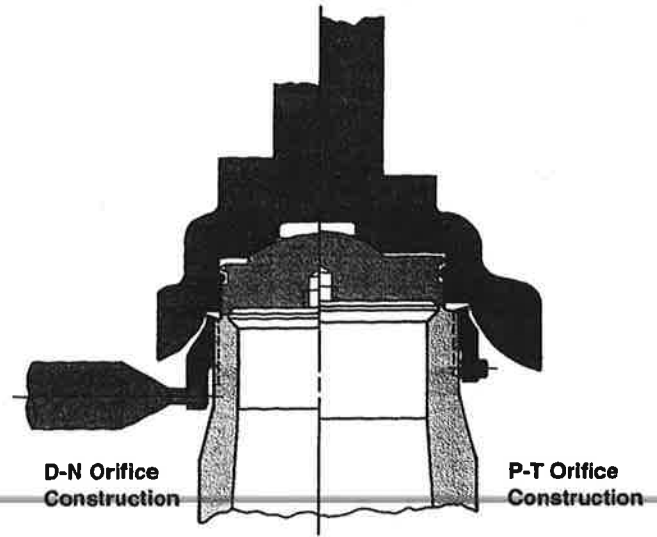
Ball joints above and below guide assure a tight seal and proper alignment, prevent valve seat damage due to seat rotation during set pressure adjustment.



Balanced bellows protects Style JBS valve and environment against effects of corrosive and toxic fluids; assures top performance under conditions of superimposed and built-up variable back pressure in the discharge line.



**Standard Style JOS**  
Standard Trim with metal-to-metal seat



**Optional Style JLT Liquid Trim with metal-to-metal seat (Standard)**

### Rugged construction/high performance

Exceptionally rugged, standardized construction is provided in a design that can be easily converted from conventional to balanced bellows type. The disc holder is centered and aligned in a hard, corrosion-resistant, stainless steel guide for durability and high performance. The two-piece disc holder/disc insert construction provides thermal balancing assuring maximum seat tightness. Stainless steel internal parts allow standard Style JOS/JBS/JLT valves to be used "off-the-shelf" for most process overpressure protection applications.

Single nozzle ring control permits shop or field adjustment to ensure relieving at full capacity flow within allowable 10% overpressure at all possible ring positions.

### Corrosion resistant materials

To accommodate severe conditions or corrosive fluid, Crosby Styles JOS/JBS/JLT pressure relief valves are available in a number of special material combinations such as Monel, Hastelloy and stainless steel. For pressure relief valves meeting the material requirements of NACE Standard MR0175 for sour gas service, see pages 60 and 61.

Selection of corrosion resistant materials requires complete knowledge of the process fluid. The special materials detailed in this catalog cover the majority of requirements. Where specific applications require materials of construction not shown in this catalog, consult Crosby or your local Crosby sales representative.

### Extreme temperature service

For applications involving unusually high and low temperatures, Crosby offers five different combinations of valve materials which incorporate the recommendations of American Petroleum Institute Standard 526 or an upgrade thereof. Materials of construction are available for temperatures ranging from -450F to +1000F (-268C to +538C). See pages 10 and 11. For applications above +1000F (+538C) contact Crosby.

### High coefficient of discharge

Crosby Style JLT pressure relief valves for liquid service offer a significant increase in capacity at 10% overpressure. This high capacity, in many cases, results in economic use of a smaller valve with an associated reduction in piping costs.

### Stable operation

Crosby's smooth, stable operation over a wide range of system conditions significantly reduces noise and vibration. This results in lower maintenance and repair costs.

### Commercial metal-to-metal seat tightness

Styles JOS/JBS/JLT valves are engineered to provide the tightest possible shutoff in a metal-to-metal seat. The finely lapped and thermally balanced two-piece disc assembly is protected by ball joints above and below the guide and at the spring washers. These ball joints prevent rotational damage to the free floating disc insert during set pressure adjustments, and assure proper alignment, performance and easy-to-maintain seat tightness. Refer to pages 4 and 62.

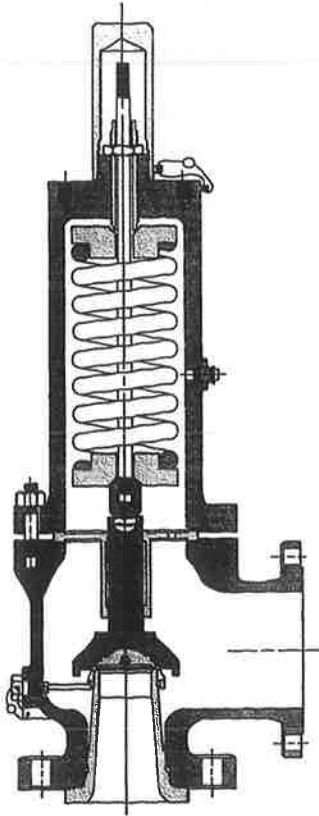
### Exceptional soft seat tightness

For exceptional tightness, Crosby offers an O-ring soft seat design capable of handling pressures to 1480 psig (102 barg). Standard O-ring materials include Viton\*, Buna N, EPDM, TFE, silicone rubber and Kalrez\*\*. Temperature and pressure limits of each material are shown on page 9. Other soft seat materials may be available on application. Consult Crosby.

\* Reg. U.S. Pat. Office for Du Pont's fluoroelastomer.

\*\* Reg. U.S. Pat. Office for Du Pont's perfluoroelastomer parts.

# Style Variations

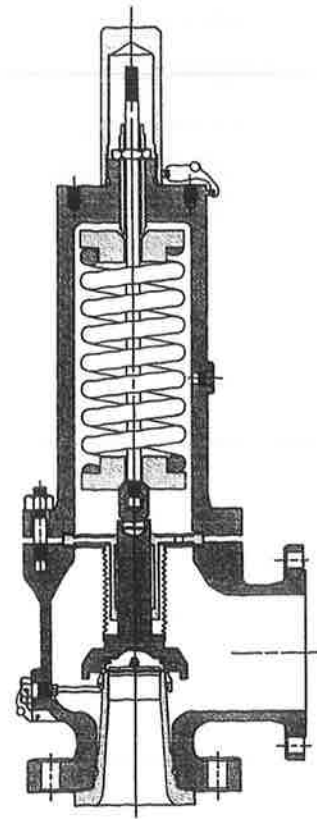


**Style JOS**

## Crosby Conventional Style JOS

Crosby Style JOS is the basic conventional pressure relief valve most frequently used in process applications. This valve has a closed bonnet that contains the process fluid within the valve preventing any release to the atmosphere. Style JOS closed bonnet valves may be specified with a screwed or bolted cap, or with a regular or packed lifting lever. The bonnet vent is always plugged. For steam service, the JOS valve may also be supplied with an open bonnet and a regular lifting lever (Style JOS-H).

Conventional pressure relief valves are installed when the discharge is either into a short tailpipe that vents directly to the atmosphere or when the discharge is into a low pressure exhaust system designed to contain the fluid.



**Style JBS**

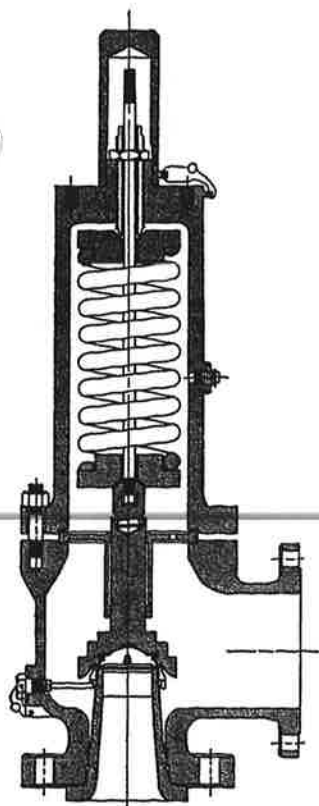
## Crosby Balanced Bellows Style JBS

Crosby Style JBS incorporates a balanced bellows to provide satisfactory valve performance when the developed back pressure becomes excessive. The balanced bellows design will assure that valve characteristics such as lift and relieving capacity, opening and closing pressure, and stability are not unduly influenced by static pressure in the discharge manifold.

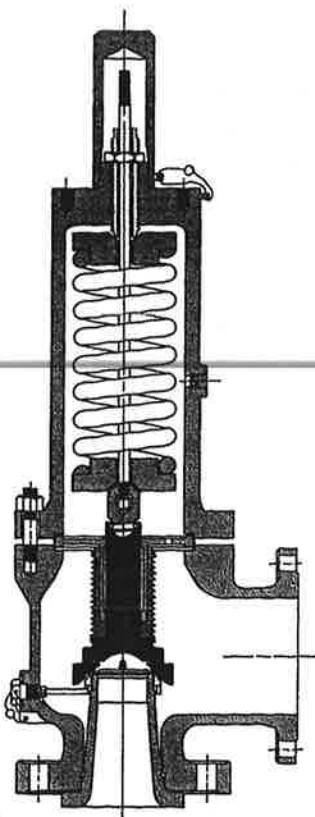
Balanced pressure relief valves must be installed when the built up back pressure in the exhaust system is allowed to exceed 10% of the valve set pressure. Style JBS valves must also be installed when the back pressure is superimposed and variable. A more detailed explanation on back pressure is available in the Crosby Engineering Handbook.

The bonnet is vented to monitor bellows integrity.

Aside from balancing, the bellows in Style JBS may be used to isolate the spring and guiding surfaces in the valve from corrosive and dirty fluids and shield the spring from high temperature service.



**Style JLT-JOS**



**Style JLT-JBS**

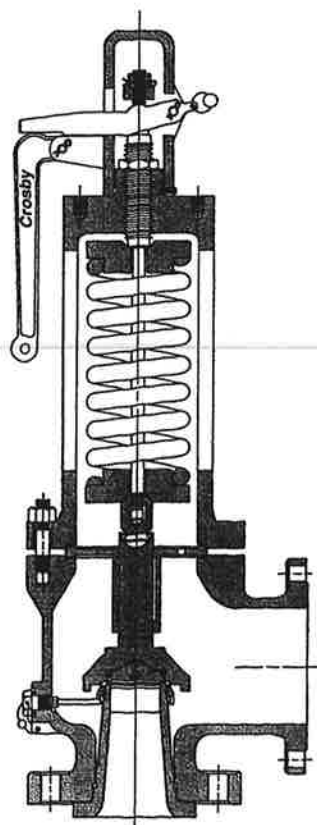
## Crosby Liquid Service Valves Styles JLT-JOS and JLT-JBS

Crosby Style JLT pressure relief valve for liquid service has been designed with a unique patented internal trim that provides stable non-chattering valve performance on incompressible fluid applications. This superior high performance valve for liquid service has increased capacity at 10% overpressure that often permits the use of a smaller valve with an associated reduction in piping costs. The blowdown is adjustable and an O-ring soft seat design is also available when exceptional seat tightness is required.

Crosby Style JLT valves have been capacity certified on water at 10% overpressure and meet all the requirements of ASME Code Section VIII.

## Crosby Style JOS-H

Style JOS-H with open bonnet and Type C regular lifting lever is available for ASME Code Section VIII steam applications. Only the bonnet need be changed to convert a Style JOS Type C to Style JOS-H. With the open bonnet feature, carbon steel spring material can be used to +650F (+343C).



**Style JOS-H**

# JOS, JBS and JLT Style Designations



1" D 2"  
thru  
8" T2 10"  
(5)

JOS-Conventional  
JBS- With bellows  
JLT-JOS-Conventional with liquid trim<sup>(1)</sup>  
JLT-JBS-Bellows with liquid trim<sup>(1)</sup>  
JBS-BP-Bellows with back pressure balancing piston  
JLT-JBS-BP - Bellows with liquid trim and back pressure balancing piston<sup>(1)</sup>  
JOS-H - Conventional JOS with open bonnet for ASME Code Section VIII steam service to +650F(+343C)<sup>(2)</sup>

1 - CI 150 Flange  
2 - CI 300 Flange  
3 - CI 300 Flange  
4\* - CI 600 Flange  
5 - CI 900 Flange  
6 - CI 1500 Flange  
7 - CI 2500 Flange

\*Except "T" and "T2" orifice is CI 300 flange

2 - -450F to -76F (-268C to -60C)  
4 - -75F to -21F (-59C to -30C)  
5\* - -20F to +450F (-29C to +232C)  
6 - +451F to +800F (+233C to +427C)  
7 - +801F to +1000F (+428C to +538C)

\*Except for Style JOS-H with open bonnet, carbon steel spring may be used to +650F(+343C)

Material Variations  
(4)

None - Standard Materials  
S - All 316 St.St.  
S4 - All 316 St.St. except body, bonnet, cap and spring  
M - All Monel with Monel or Inconel spring  
M1 - Monel nozzle and disc insert  
M4 - All Monel except body, bonnet, cap, spring and washers  
M5 - All Monel except spring and washers  
H - All Hastelloy C  
H1 - Hastelloy C nozzle and disc insert  
H4 - All Hastelloy C except body, bonnet, cap, spring and washers  
H5 - All Hastelloy C except spring and washers

When ordering soft seats, specify material.

Caps and Lifting Levers  
(Type)

Type J - (Standard) screwed cap  
Type K - Screwed cap with test rod  
Type C- Regular lifting lever<sup>(6)</sup>  
Type D- Packed lifting lever<sup>(6)</sup>  
Type E- Packed lifting lever with test rod<sup>(6)</sup>  
Type L- Bolted cap  
Type M- Bolted cap with test rod

Special top constructions are also available such as Type F - Air Operated Lifting Device

**Optional Caps for Height Restricted Applications**  
Type A- Screwed cap  
Type B- Screwed cap with test rod  
Type G- Bolted cap  
Type H- Bolted cap with test rod

**Available Options:**

O-ring soft seats	Flanges to international standards
Flange facings such as ring type joint	Special flanges
Sour gas service materials and certifications	Stellited nozzle and disc insert
Special CI 300 outlets (where not standard)	Special casting or machined surface tests
Special Teflon (FEP) bellows coating	Special cleaning
Special spring coatings or plating	Special painting or coatings
Block bodies	Special Testing
Bonnet and cap inside painting or plastic coating	Steam jacketed bodies
Bug screens	Supplementary loading
Special materials not cataloged	

**CAUTION!**  
Refer to pages 14 through 43 to verify that the JOS/JBS/JLT model number specified is available in the size, style and pressure/temperature rating combination selected.

**How to Order**

Examples:

(1) To specify a G orifice (0.503 sq.in.) (325 sq.mm) Style JOS conventional valve with standard materials for liquid service at 700 psig (48.2 barg) and at +700F (+371C) with a packed lifting lever, the following designation applies:  
**1-1/2 G 2-1/2 JLT-JOS-46 - D**

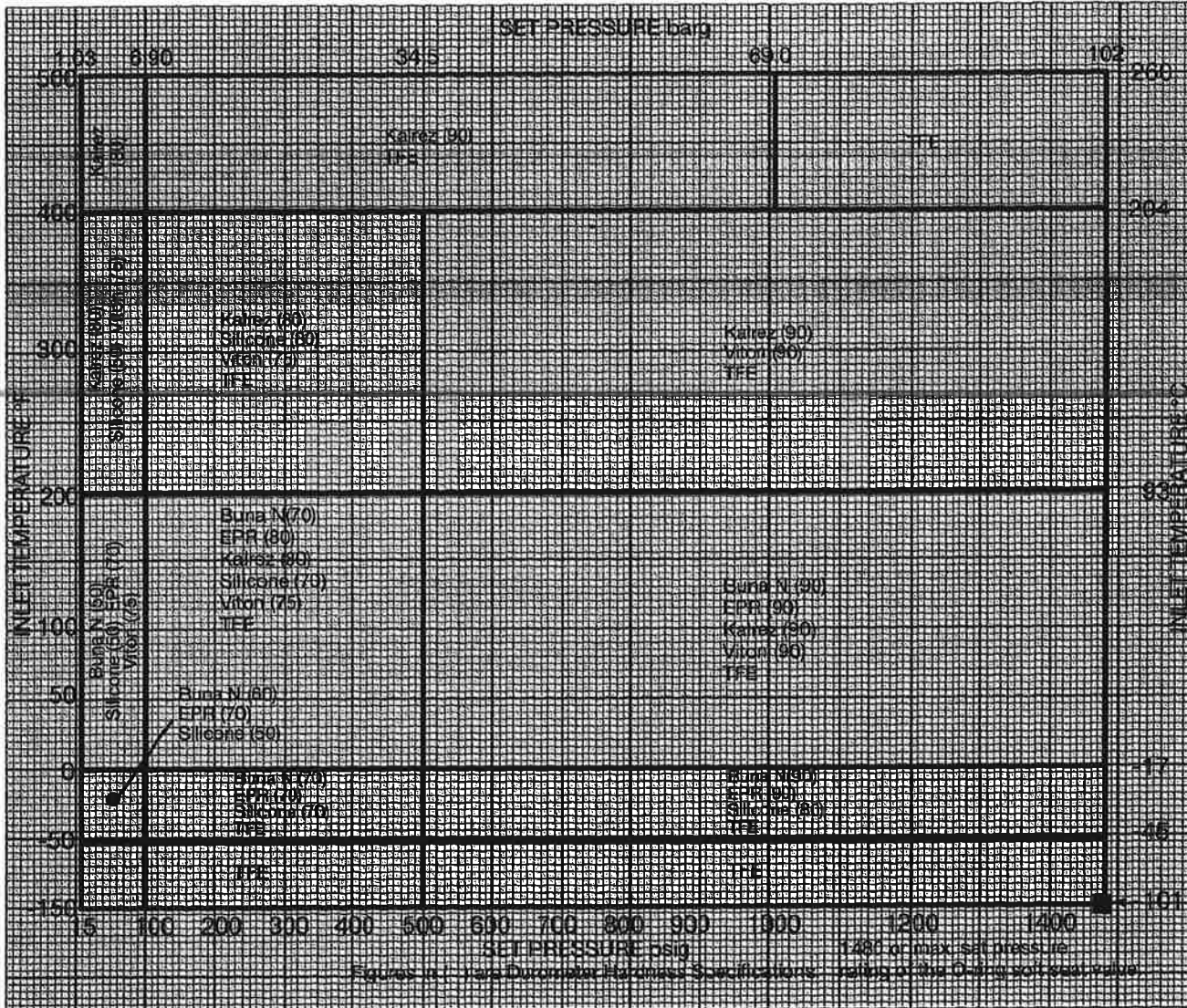
(2) To specify an M orifice (3.60 sq.in.)(2323 sq.mm) Style JBS bellows valve with back pressure balancing piston, Monel nozzle and disc insert, and Kalrez O-ring soft seats for gas service at 200 psig (13.7 barg) and +400F (+204C) with screwed cap and test rod, the following designation applies:  
**4M6 JBS-BP-25-M1 - K with Kalrez**

(3) To specify a K orifice (1.838 sq.in.)(1186 sq.mm) Style JOS conventional valve with open bonnet and standard materials for ASME Code Section VIII steam service at 600 psig (41.3 barg) and +600F (+316C) with a regular lifting lever, the following designation applies:  
**3K4 JOS-H-45-C**

Notes:

(1) Style designations "JLT-JOS," "JLT-JBS," or "JLT-JBS-BP" signify Styles JOS, JBS or JBS-BP with liquid trim for liquid service.  
(2) Upper temperature limit is +650F (+343C) for Style JOS-H open bonnet valve for ASME Code Section VIII steam service.  
(3) See pages 14-43 for appropriate maximum set pressures and temperatures.  
(4) See pages 10-13 for complete listings of materials of construction.  
(5) Larger sizes are available. Ask for Catalog No. 307.  
(6) ASME Code Section VIII rules require that pressure relief valves for water service over +140F (+60C), steam and air shall have a lifting device.

# O-Ring Soft Seat Materials and Pressure/Temperature Limits

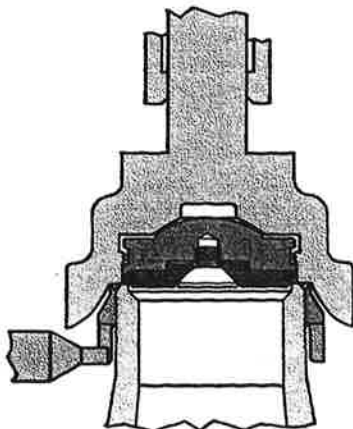


EPR = Ethylene Propylene Rubber

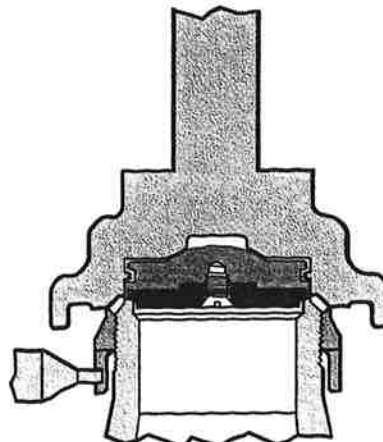
Note: Other soft seat materials are available on request.

For O-ring seats below -150F (-101C) consult Crosby.

For steam service, metal-to-metal seats are recommended; consult Crosby if soft seats are required.



**JLT O-Ring  
Soft Seat**



**JOS/JBS O-Ring  
Soft Seat**

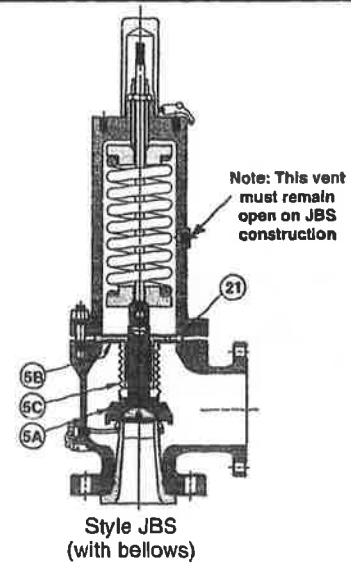
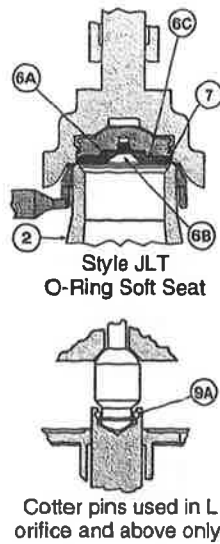
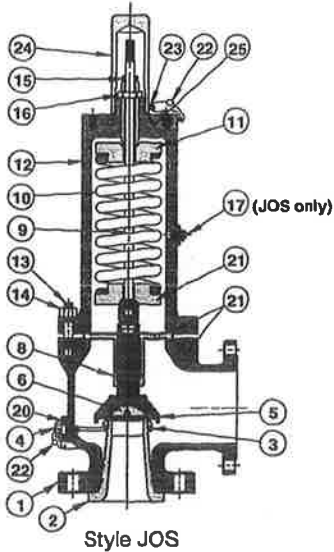
MAXIMUM SET PRESSURE LIMITS		
ORIFICE	MAXIMUM SET PRESSURE	
	psig	barg
D	1480	102
E	1480	102
F	1480	102
G	1480	102
H	1480	102
J	1480	102
K	1480	102
L	1000	68.9
M	1100	75.8
N	1000	68.9
P	1000	68.9
Q	600	41.3
R	300	20.6
T	300	20.6
T2	300	20.6



# JOS/JBS/JLT Valve Materials

## Standard Materials - Body/Bonnet/Spring Materials per API Standard 526<sup>(5)</sup>

Ref. No.	Part Name	JOS/JBS ( )5 -20F to +450F (-29C to +232C)	JOS/JBS ( )6 +451F to +800F (+233C to +427C)	JOS/JBS ( )7 +801F to +1000F (+428C to +538C)	JOS/JBS ( )4 -75F to -21F (-59C to -30C)	JOS/JBS ( )2 -450F to -76F (-268C to -60C)
1	Body	Carbon Steel SA-216 Gr. WCB	Carbon Steel SA-216 Gr. WCB	Chrome Moly Steel SA-217 Gr. WC6	316 St.St. SA-351 Gr. CF8M	316 St. St. SA-351 Gr. CF8M
2	Nozzle	316 St.St.	316 St.St.	316 St.St.	316 St.St.	316 St.St.
3	Nozzle Ring	316 St.St.	316 St.St.	316 St.St.	316 St.St.	316 St.St.
4	Set Screw	416 St.St.	416 St.St.	416 St.St.	416 St.St.	316 St.St.
+ 5	Disc Holder	316L St.St.	316L St.St.	316L St.St.	316L St.St.	316L St.St.
+ 5A	Disc Holder	316L St.St.	316L St.St.	316L St.St.	316L St.St.	316L St.St.
+ 5B	Bellows Top Flange <sup>(12)</sup>	316L St.St.	316L St.St.	316L St.St.	316L St.St.	316L St.St.
+ 5C	Bellows	316L St.St.	316L St.St.	316L St.St.	316L St.St.	316L St.St.
+6, +6A	Disc Insert	316 St.St. <sup>(6)</sup>	316 St.St. <sup>(6)</sup>	316 St.St. <sup>(6)</sup>	316 St.St.	316 St.St.
+ 6B	Retainer Screw(s)	316 St.St.	316 St.St.	316 St.St.	316 St.St.	316 St.St.
+ 6C	O-Ring Retainer	316 St.St.	316 St.St.	316 St.St.	316 St.St.	316 St.St.
+ 7	O-Ring <sup>(7)</sup>	Specify	Specify	Specify	Specify	Specify
8	Guide	St.St. <sup>(1)</sup>	St.St. <sup>(1)</sup>	St.St. <sup>(1)</sup>	St.St. <sup>(1)</sup>	St.St. <sup>(1)</sup>
9	Spindle	416 St.St. <sup>(2)</sup>	416 St.St. <sup>(2)</sup>	416 St.St. <sup>(2)</sup>	416 St.St.	316 St.St.
9A	Spindle Cotter Pins	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
10	Spring	Carbon St. <sup>(3)</sup>	Alloy St. <sup>(3)(8)</sup>	Alloy St. <sup>(3)(8)</sup>	Carbon St. <sup>(3)</sup>	316 St.St.
11	Spring Washer(s)	Steel	Steel	Steel	Steel	316 St.St.
12	Bonnet	Carbon St. SA-216 Gr. WCB	Carbon St. SA-216 Gr. WCB	Chrome Moly St. SA-217 Gr. WC6	316 St.St. SA-351 Gr. CF8M	316 St.St. SA-351 Gr. CF8M
13	Bonnet Stud	Alloy St. <sup>(4)</sup>	Alloy St. <sup>(4)</sup>	Alloy St. <sup>(4)</sup>	304 St.St.	304 St.St.
14	Bonnet Nut	Steel	Steel	Steel	304 St.St.	304 St.St.
15	Adjusting Bolt	416 St.St.	416 St.St.	416 St.St.	416 St.St.	316 St.St.
16	Adj. Bolt Nut	Steel	Steel	Steel	316 St.St.	316 St.St.
17	Pipe Plug (Bonnet)	Steel	Steel	Steel	316 St.St.	316 St.St.
+ 20	Set Screw Gasket	*	*	*	*	*
+ 21	Guide Gasket	*	*	*	*	*
22	Seal & Wire	Lead & St.St.	Lead & St.St.	Lead & St.St.	Lead & St.St.	Lead & St.St.
23	Seal Clip	St.St.	St.St.	St.St.	St. St.	St. St.
24	Type J Cap	Carbon St.	Carbon St.	Carbon St.	316 St.St.	316 St.St.
+ 25	Cap Gasket	*	*	*	*	*



## Variations From Standard Materials

316 Stainless Steel		Monel				Hastelloy				Ref. No.
(X) S4	(X) S	(X) M1	(X) M4	(X) M5	(X) M	(X) H1	(X) H4	(X) H5	(X) H	
Carbon Steel SA-216 Gr. WCB	316 St.St. SA-351 Gr. CF8M	Carbon Steel SA-216 Gr. WCB	Carbon St. SA-216 Gr. WCB	Monel ASTM A 494 Gr. M35-1 <sup>(11)</sup>	Monel ASTM A 494 Gr. M35-1 <sup>(11)</sup>	Carbon St. SA-216 Gr. WCB	Carbon St. SA-216 Gr. WCB	Hast. C SA-494 Gr. CW-12MW	Hast. C SA-494 Gr. CW-12MW	1
316 St.St.	316 St.St.	Monel	Monel	Monel	Monel	Hast. C	Hast. C	Hast. C	Hast. C	2
316 St.St.	316 St.St.	316 St.St.	Monel	Monel	Monel	316 St.St.	Hast. C	Hast. C	Hast. C	3
316 St.St.	316 St.St.	416 St.St.	Monel	Monel	Monel	416 St.St.	Monel	Hast. C	Hast. C	4
316L St.St.	316L St.St.	316L St.St.	Monel	Monel	Monel	316L St.St.	Hast. C	Hast. C	Hast. C	+ 5
316L St.St.	316L St.St.	316L St.St.	Monel	Monel	Monel	316L St.St.	Hast. C	Hast. C	Hast. C	+ • 5A
316L St.St.	316L St.St.	316L St.St.	Monel	Monel	Monel	316L St.St.	Hast. C	Hast. C	Hast. C	+ • 5B
316L St.St.	316L St.St.	316L St.St.	Monel	Monel	Monel	316L St.St.	Hast. C	Hast. C	Hast. C	+ • 5C
316 St.St. <sup>(6)</sup>	316 St.St. <sup>(6)</sup>	Monel	Monel	Monel	Monel	Hast. C	Hast. C	Hast. C	Hast. C	+6,+6A
316 St.St.	316 St.St.	Monel	Monel	Monel	Monel	Hast. C	Hast. C	Hast. C	Hast. C	+ 6B
316 St.St.	316 St.St.	Monel	Monel	Monel	Monel	Hast. C	Hast. C	Hast. C	Hast. C	+ 6C
Specify St.St. <sup>(1)</sup>	Specify St.St. <sup>(1)</sup>	Specify St.St. <sup>(1)</sup>	Specify Monel	Specify Monel	Specify Monel	Specify St.St. <sup>(1)</sup>	Specify Hast. C	Specify Hast. C	Specify Hast. C	+ 7
316 St.St.	316 St.St.	416 St.St. <sup>(2)</sup>	Monel	Monel	Monel	416 St.St. <sup>(2)</sup>	Monel	Hast. C	Hast. C	8
316 St.St.	316 St.St.	416 St.St. <sup>(2)</sup>	Monel	Monel	Monel	416 St.St. <sup>(2)</sup>	Monel	Hast. C	Hast. C	9
Stainless Steel	Stainless Steel	Stainless Steel	Monel	Monel	Monel	Stainless Steel	Monel	Hastelloy or Monel	Hastelloy or Monel	9A
Carbon St. <sup>(3)</sup> or Alloy Steel <sup>(3)(8)</sup>	316 St.St. or Inconel X750 <sup>(10)</sup>	Carbon St. <sup>(3)</sup> or Alloy St. <sup>(3)(8)</sup>	Carbon St. Nickel Plated <sup>(9)</sup>	Carbon St. Nickel Plated <sup>(9)</sup>	Monel or Inconel X750	Carbon St. <sup>(3)</sup> or Alloy St. <sup>(3)(8)</sup>	Carbon St. Nickel Plated <sup>(9)</sup>	Carbon St. Nickel Plated <sup>(9)</sup>	Hast. C	10
316 St.St.	316 St.St.	Steel	316 St.St.	316 St.St.	Monel	Steel	316 St.St.	316 St.St.	Hast.C	11
Carbon St. SA-216 Gr. WCB	316 St. St. SA-351 Gr. CF8M	Carbon St. SA-216 Gr. WCB	Carbon St. SA-216 Gr. WCB	Monel ASTM A 494 Gr. M35-1 <sup>(11)</sup>	Monel ASTM A 494 Gr. M35-1 <sup>(11)</sup>	Carbon St. SA-216 Gr. WCB	Carbon St. SA-216 Gr. WCB	Hast. C SA-494 Gr. CW-12MW	Hast. C SA-494 Gr. CW-12MW	12
Alloy St. <sup>(4)</sup>	304 St.St.	Alloy St. <sup>(4)</sup>	Alloy St. <sup>(4)</sup>	304 St.St.	304 St.St.	Alloy St. <sup>(4)</sup>	Alloy St. <sup>(4)</sup>	Hast. C	Hast. C	13
Steel	304 St.St.	Steel	Steel	304 St.St.	304 St.St.	Steel	Steel	Hast. C	Hast. C	14
316 St.St.	316 St.St.	416 St. St.	Monel	Monel	Monel	416 St.St.	Monel	Hast. C	Hast. C	15
316 St.St.	316 St.St.	Steel	Monel	Monel	Monel	Steel	Monel	Hast. C	Hast. C	16
Steel	316 St.St.	Steel	Steel	Monel	Monel	Steel	Steel	Hastelloy	Hastelloy	17
*	*	*	*	*	*	*	*	*	*	+ 20
*	*	*	*	*	*	*	*	*	*	+ 21
Lead & St.St.	Lead & St.St.	Lead & St.St.	Lead & St.St.	Lead & St.St.	Lead & St.St.	Lead & St.St.	Lead & St.St.	Lead & St.St.	Lead & St.St.	22
St.St.	St.St.	St.St.	St.St.	St.St.	St. St.	St.St.	St.St.	St.St.	St.St.	23
Carbon St.	316 St.St.	Carbon St.	Carbon St.	Monel	Monel	Carbon St.	Carbon St.	Hast. C	Hast. C	24
*	*	*	*	*	*	*	*	*	*	+ 25

• Subassembly

+ Recommended spare parts

\* Organic fiber non-asbestos

(1) Corrosion resistant stainless steel ASTM A 297 Gr. HE

(2) 17-4PH Spindle Point on D and E orifice Style JBS ( ) 5, 6 and 7 valves only.

(3) Corrosion resistant coating.

(4) ASME SA 193 Gr. B7

(5) Crosby may upgrade to an alternative material.

(6) 17-4PH stainless steel for steam service above 450 psig (31.03 barg).

(7) See page 9 for O-ring soft seat materials and pressure/temperature limits.

(8) Crosby may upgrade to Inconel X750.

(9) For temperatures above +450F (+232C), Crosby will supply either alloy steel nickel plated or Inconel X750 springs.

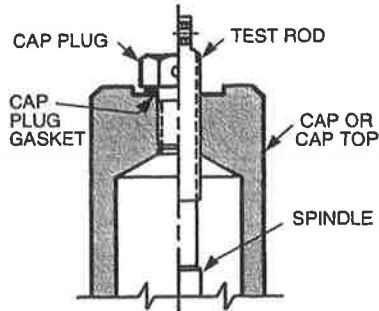
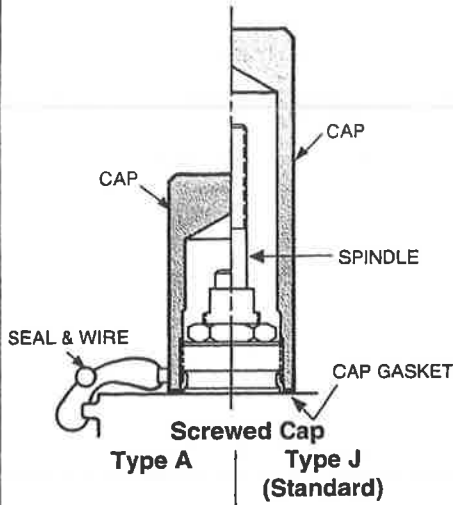
(10) Temperature limit for 316 stainless steel spring is +450F (+232C).

(11) Permitted by ASME Code Case 1750-10

(12) Top flange on D and E orifice bellows is 316 stainless steel.

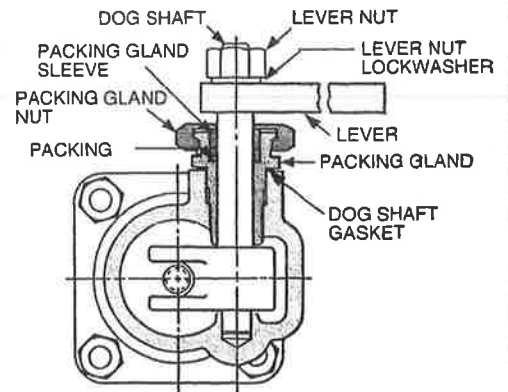
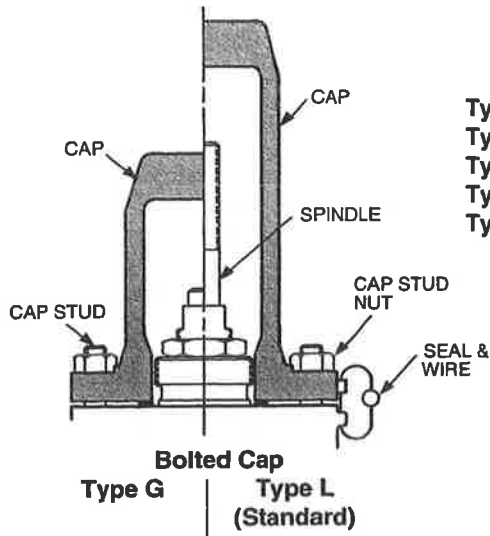
**Note:** Cotter pins used to lock spindle into disc holder are in L orifice and above only.

# Caps and Lifting Levers

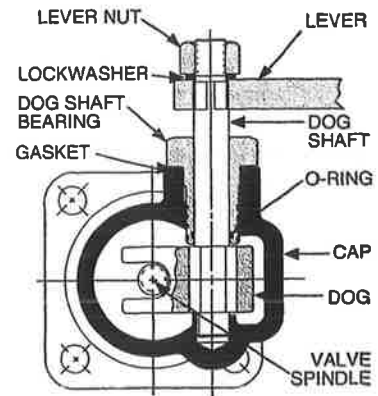


**Cap and Test Rod**

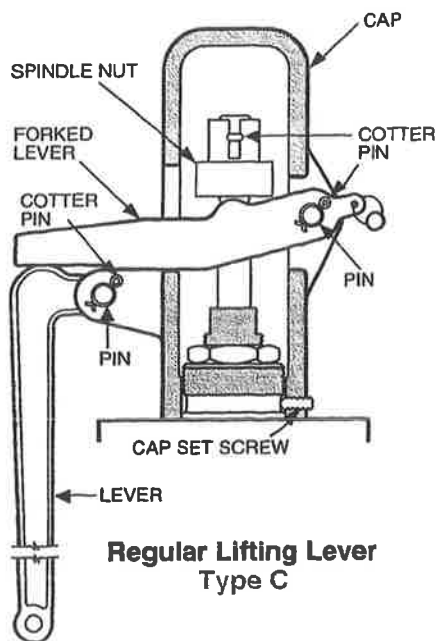
- Type B - Screwed Cap**
- Type E - Packed Lifting Lever**
- Type H - Bolted Cap**
- Type K - Screwed Cap (Standard)**
- Type M - Bolted Cap (Standard)**



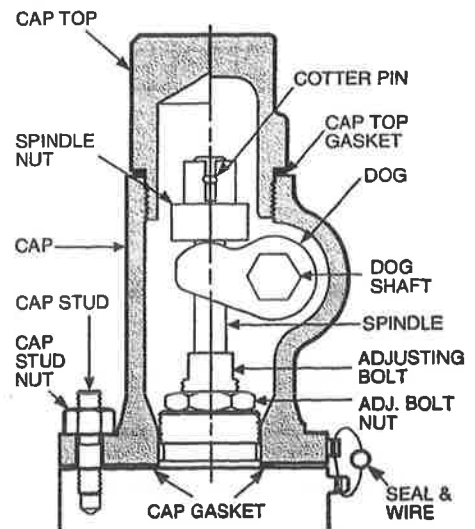
**Packed Lifting Lever Type D**  
**(Top View of Packing Gland construction used for special materials)**



**Packed Lifting Lever Type D**  
**Top View**



**Regular Lifting Lever Type C**



**Packed Lifting Lever Type D**

Styles JOS/JBS/JLT pressure relief valves are regularly furnished with closed bonnet and screwed cap over the adjusting bolt. The following types of top construction are available except where otherwise indicated.

**Screwed Cap (Type J Standard)** - Where no lifting lever is required.

**Bolted Cap (Type L)** - Where no lifting lever is required. Available on special order.

**LIFTING LEVERS:**

**Regular (Type C)** - for steam and air service where the valve cap is not required to be tight on the discharge side and where conditions are such that periodic testing is desirable. Regular lifting levers may be furnished with a supplementary gagging device on special order.

**Packed (Type D)** - For services where tightness on the discharge side is necessary and where conditions are such that periodic testing is desirable. Also recommended for hot water services.

**TEST RODS:**

**Types K, E or M** - Valves with screwed caps, packed lifting levers or bolted caps can be fitted to accommodate test rods which will hold the valve closed when the equipment on which they are installed is hydrostatically tested.

**Type J** screwed cap changes to **Type K** with test rod.

**Type D** packed lifting lever changes to **Type E** with test rod.

**Type L** bolted cap changes to **Type M** with test rod.

**HEIGHT RESTRICTED APPLICATIONS:**

For applications where there are height restrictions, cap types A,B,G and H are available.

**CAUTION:** Test rods should never be tightened more than fingertight. Overtightening may damage internal parts. Moreover, a test rod should never be kept on the valve during operation of the equipment. During normal operation the test rod is replaced with cap plug and gasket to maintain tightness on the discharge side.

**Caps and Lifting Lever Materials**

Ref. No.	Part Name	STANDARD MATERIAL	VARIATIONS FROM STANDARD MATERIALS						
		JOS/JBS-( )5,6,7 -20F to +1000F (-29C to +538C)	JOS/JBS-( )4 -75F to -21F (-59C to -30C)	JOS/JBS-( )2 -450F to -78F (-268C to -80C)	( )S	( )S4	( )M & ( )M5†	( )M4 & ( )H4†	( )H & ( )H5†
24	Cap(J,K,D, E,L and M)	Carbon Steel	316 St.St.	316 St.St.	316 St.St.	Carbon Steel	Monel	Carbon Steel	Hastelloy C
	Cap (C)	Malleable Iron	Malleable Iron	316 St.St.	316 St.St.	Malleable Iron	Monel	Malleable Iron	Hastelloy C
36	Cap Top(D,E)	Steel	316 St.St.	316 St.St.	316 St.St.	Steel	Monel	Steel	Hastelloy C
31	Cap Set Screw(C)	St.St.	St.St.	St.St.	St.St.	St.St.	St.St.	St.St.	Hastelloy C
40	Cap Stud	Alloy Steel	304 St.St.	304 St.St.	304 St.St.	Alloy Steel	304 St.St.	Alloy Steel	Hastelloy C
41	Cap Stud Nut	Steel	304 St.St.	304 St.St.	304 St.St.	Steel	304 St.St.	Steel	Hastelloy C
48	Lever (D & E)	Steel	Steel	316 St.St.	316 St.St.	Steel	316 St.St.	Steel	316 St.St.
32, 35	Lever(C), Forked Lever (C)	Malleable Iron	Malleable Iron	316 St.St.	316 St.St.	Malleable Iron	316 St.St.	Malleable Iron	316 St.St.
33	Pin(Lever, Forked Lever)	Steel	Steel	St.St.	St.St.	Steel	316 St.St.	Steel	St.St.
34	Cotter Pins	Steel	Steel	St.St.	St.St.	Steel	St.St.	Steel	St.St.
49	Lever Nut (D&E)	Steel	Steel	316 St.St.	316 St.St.	316 St.St.	St.St.	316 St.St.	316 St.St.
50	Lever Nut Lockwasher	Steel	Steel	St.St.	St.St.	Steel	St.St.	Steel	St.St.
30	Spindle Nut	Steel	Steel	316 St.St.	316 St.St.	316 St.St.	Monel	Monel	Hastelloy C
38	Dog	Steel	Steel	316 St.St.	316 St.St.	316 St.St.	Monel	Monel	Hastelloy C
39	Dog Shaft	416 St.St.	416 St.St.	316 St.St.	316 St.St.	316 St.St.	Monel	Monel	Hastelloy C
46	Dog Shaft Bearing	416 St.St.	416 St.St.	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
45	Dog Shaft Bearing O-Ring	Viton	Viton	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
57	Packing Gland	Note 1	Note 1	316 St.St.	316 St.St.	316 St.St.	Monel	Monel	Monel
58	Packing Gland Sleeve	Note 1	Note 1	316 St.St.	316 St.St.	416 St.St.	Monel	416 St.St.	Monel
59	Packing Gland Nut	Note 1	Note 1	316 St.St.	316 St.St.	Steel	Monel	Steel	Monel
56	Packing	Note 1	Note 1	Teflon	Teflon	Teflon	Teflon	Teflon	Teflon
27	Test Rod (K,E,M)	416 St.St.	416 St.St.	416 St.St.	416 St.St.	416 St.St.	416 St.St.	416 St.St.	416 St.St.
28	Cap Plug (K,E,M)	416 St.St.	416 St.St.	316 St.St.	316 St.St.	416 St.St.	Monel	416 St.St.	Hastelloy C
25,29 37,47	Gaskets	.	.	.	.	.	.	.	.

†Special material valves ( )M1 and ( )H1 use caps and lifting gear of standard materials.

\*Organic Fiber Non-Asbestos

Note 1: Packing gland construction is standard for special material valves.

# Specifications - Crosby Styles JOS, JBS, JLT and JOS-H

**D Orifice**  
**0.110 sq. in.**  
**(71 sq. mm)**  
**Effective Area**

**Sizes and Pressure/Temperature Limits**  
 (See also Set Pressure Chart Opposite)

**Low Set Pressure Limits:**  
**JOS = 10 psig (0.68 barg)**  
**JBS = 25 psig (1.72 barg)**  
**JLT-JOS = 15 psig (1.03 barg)**  
**JLT-JBS = 25 psig (1.72 barg)**

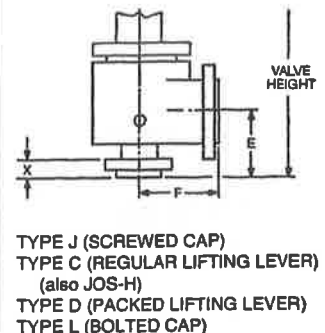
Valve Style	Valve Size	Inlet x Orifice x Outlet	Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig						Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg	
					Inlet						JOS †	JBS †	Inlet						JOS †	JBS †
					-450F to -76F	-75F to -21F	-20F to +100F	+450F	+800F	+1000F			-268C to -60C	-59C to -30C	-29C to +38C	+232C	+427C	+538C		
JOS-15	15	1D2	150	150			285	185			285	230			19.6	12.7			19.6	15.8
JBS-25	25	1D2	300	150			285	285			285	230			19.6	19.6			19.6	15.8
JLT-35	35	1D2	300	150			740	615			285	230			51.0	42.4			19.6	15.8
*JOS-H-45	45	1D2	600	150			1480	1235			285	230			102	85.1			19.6	15.8
JOS-55	55	1½D2	900	300			2220	1845			600	600			153	127			41.3	41.3
JBS-65	65	1½D2	1500	300			3705	3080			600	600			255	212			41.3	41.3
JLT-75	75	1½D2½	2500	300			6000	5135			740	600			413	354			51.0	41.3
JOS-16	16	1D2	150	150			185	80			285	230			12.7	5.51			19.6	15.8
JBS-26	26	1D2	300	150			285	285			285	230			19.6	19.6			19.6	15.8
JLT-36	36	1D2	300	150			615	410			285	230			42.4	28.2			19.6	15.8
JOS-H-46	46	1D2	600	150			1235	825			285	230			85.1	56.8			19.6	15.8
JOS-56	56	1½D2	900	300			1845	1235			600	600			127	85.1			41.3	41.3
JBS-66	66	1½D2	1500	300			3080	2060			600	600			212	142			41.3	41.3
JLT-76	76	1½D2½	2500	300			5135	3430			740	600			354	236			51.0	41.3
JOS-37	37	1D2	300	150					510	225	285	230					35.1	15.5	19.6	15.8
JBS-47	47	1D2	600	150					1015	445	285	230					69.9	30.6	19.6	15.8
JOS-H-57	57	1½D2	900	300					1525	670	600	600					105	46.1	41.3	41.3
JBS-67	67	1½D2	1500	300					2540	1115	600	600					175	76.8	41.3	41.3
JLT-77	77	1½D2½	2500	300					4230	1860	740	600					291	128	51.0	41.3
JOS-14	14	1D2	150	150		275					275	230		18.9					18.9	15.8
JBS-24	24	1D2	300	150		275					275	230		18.9					18.9	15.8
JBS-34	34	1D2	300	150		720					275	230		49.6					18.9	15.8
JLT-44	44	1D2	600	150		1440					275	230		99.2					18.9	15.8
JOS-12	12	1D2	150	150	275						275	230	18.9						18.9	15.8
JBS-22	22	1D2	300	150	275						275	230	18.9						18.9	15.8
JBS-32	32	1D2	300	150	720						275	230	49.6						18.9	15.8
JLT-42	42	1D2	600	150	1440						275	230	99.2						18.9	15.8

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).  
 †Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.  
 Valves set below 15 psig (1.03 barg) cannot be stamped with the ASME Code Symbol. Only metal seated valves may be set below 15 psig.

## Dimensions and Weights

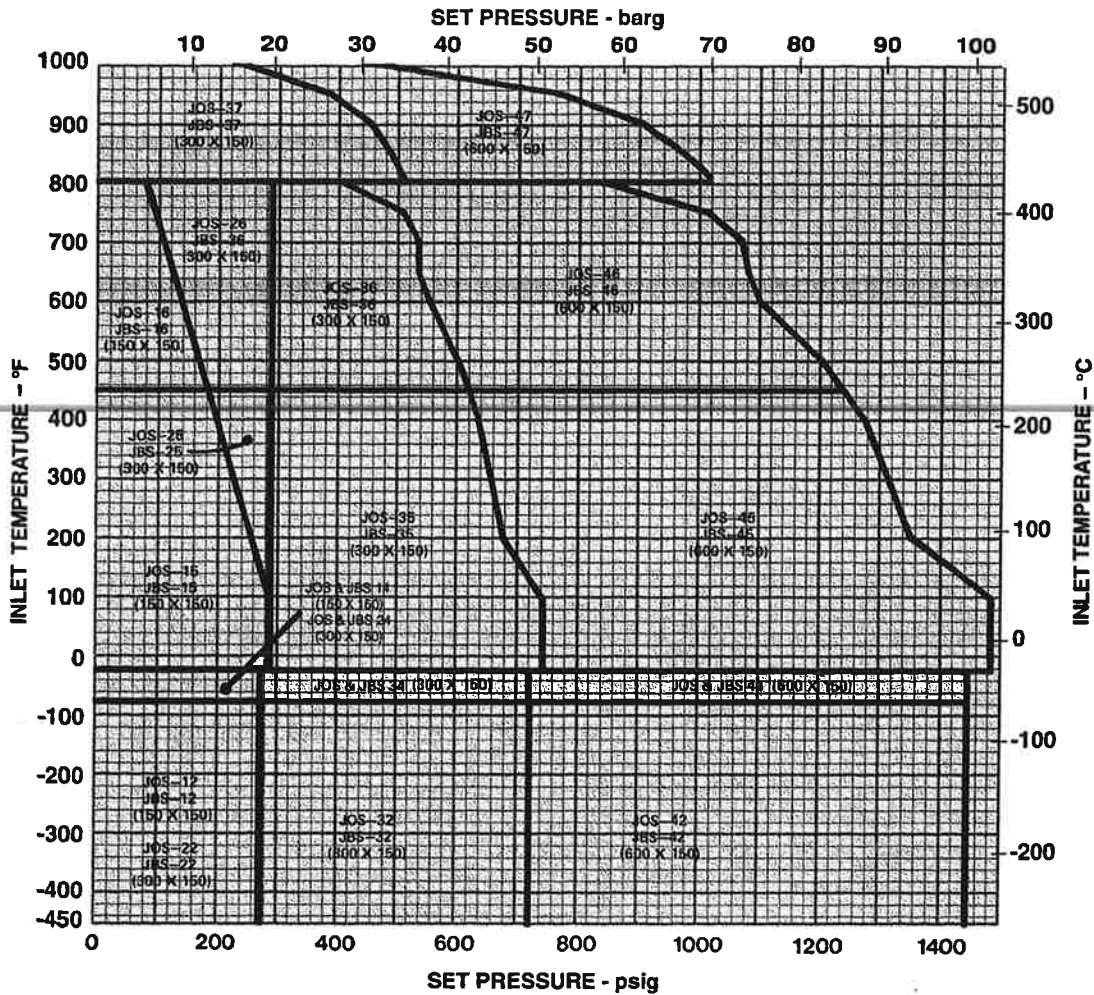
### D Orifice

Valve Style	Valve Dimensions - in. (mm)	Valve Dimensions - in. (mm)						Approx. Weight lbs(kg) Type J
		Center to Face		Use To Find Bolt Length	Approximate Height			
		Inlet	Outlet		Valve (Cap) Type			
		E	F	X	J & L	C	D	
JOS-12,14,15,16,22,24,25,26		4-1/8 (105)	4-1/2 (114)	1-9/16 (40)	19-3/4 (502)	19 (483)	19-1/2 (495)	36 (16)
JBS-32,34,35,36,37		4-1/8 (105)	4-1/2 (114)	1-9/16 (40)	19-3/4 (502)	19 (483)	19-1/2 (495)	36 (16)
JLT-42,44,45,46,47		4-1/8 (105)	4-1/2 (114)	1-9/16 (40)	19-3/4 (502)	19 (483)	19-1/2 (495)	36 (16)
JOS-55,56,57,65,66,67		4-1/8 (105)	5-1/2 (140)	2 (51)	20-1/2 (521)	19-3/4 (502)	20-1/4 (514)	65 (29)
JBS-75,76,77		5-1/2 (140)	6-1/2 (165)	2-1/2 (64)	21-3/4 (552)	21 (533)	21-1/2 (546)	75 (34)

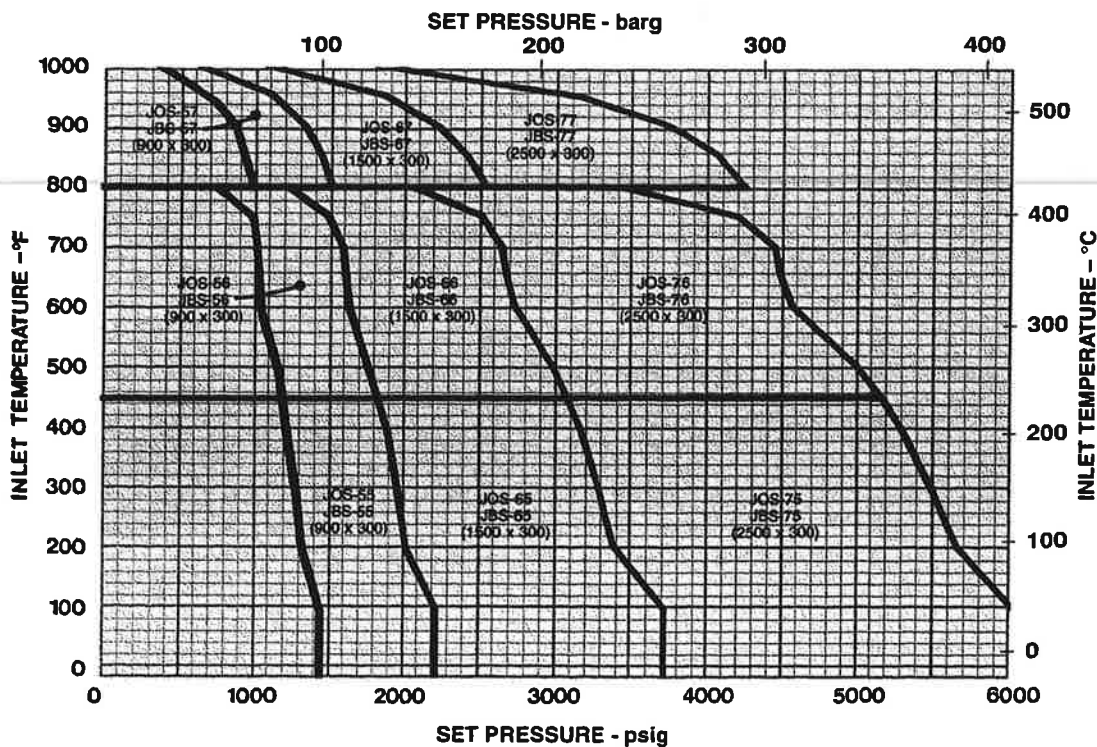


# Pressure-Temperature Limit Chart - To ANSI CI 600

**D Orifice**  
**0.110 sq. in.**  
**(71 sq. mm)**  
**Effective Area**



# Pressure-Temperature Limit Chart - ANSI CI 900, CI 1500, CI 2500



# Specifications - Crosby Styles JOS, JBS, JLT and JOS-H

**E Orifice**  
 0.196 sq. in.  
 (126 sq. mm)  
 Effective Area

**Sizes and Pressure/Temperature Limits**  
 (See also Set Pressure Chart Opposite)

**Low Set Pressure Limits:**  
 JOS = 8 psig (0.55 barg)  
 JBS = 25 psig (1.72 barg)  
 JLT-JOS = 15 psig (1.03 barg)  
 JLT-JBS = 25 psig (1.72 barg)

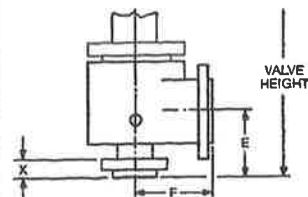
Valve Style	Valve Size		Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig						Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg		
	Inlet x Orifice x Outlet	Inlet	Outlet	Inlet						JOS †	JBS †	Inlet						JOS †	JBS †		
				-450F to -76F	-75F to -21F	-20F to +100F	* +450F	+800F	+1000F			-268C to -60C	-59C to -30C	-29C to +38C	* +232C	+427C	+538C				
JOS-25 JBS-25 JLT-35 *JOS-H-45	15 25 35 45	1E2 1E2 1E2 1E2	150 300 300 600	150 150 150 150			285 285 740 1480	185 285 615 1235			285 285 285 285	230 230 230 230			19.6 19.6 51.0 102	12.7 19.6 42.4 85.1			19.6 19.6 19.6 19.6	15.8 15.8 15.8 15.8	
JOS-65 JBS-65 JLT-75	55 65 75	1½E2 1½E2 1½E2½	900 1500 2500	300 300 300			2220 3705 6000	1845 3080 5135			600 600 740	600 600 600			153 255 413	127 212 354			41.3 41.3 51.0	41.3 41.3 41.3	
JOS-26 JBS-36 JLT-36 JOS-H-46	16 26 36 46	1E2 1E2 1E2 1E2	150 300 300 600	150 150 150 150				185 285 615 1235	80 285 410 825			285 285 285 285	230 230 230 230			12.7 19.6 42.4 85.1	5.51 19.6 28.2 56.8			19.6 19.6 19.6 19.6	15.8 15.8 15.8 15.8
JOS-66 JBS-66 JLT-76	56 66 76	1½E2 1½E2 1½E2½	900 1500 2500	300 300 300				1845 3080 5135	1235 2060 3430			600 600 740	600 600 600			127 212 354	85.1 142 236			41.3 41.3 51.0	41.3 41.3 41.3
JOS-37 JBS-47 JLT-47 JOS-H-47	37 47 47 47	1E2 1E2 1E2 1E2	300 600 600 600	150 150 150 150					510 1015	225 445	285 285	230 230					35.1 69.9	15.5 30.6	19.6 19.6	15.8 15.8	
JOS-67 JBS-67 JLT-77	57 67 77	1½E2 1½E2 1½E2½	900 1500 2500	300 300 300					1525 2540 4230	670 1115 1860	600 600 740	600 600 600					105 175 291	46.1 76.8 128	41.3 41.3 51.0	41.3 41.3 41.3	
JOS-14 JBS-24 JLT-34 JLT-44	14 24 34 44	1E2 1E2 1E2 1E2	150 300 300 600	150 150 150 150		275 275 720 1440					275 275 275 275	230 230 230 230		18.9 18.9 49.6 99.2					18.9 18.9 18.9 18.9	15.8 15.8 15.8 15.8	
JOS-22 JBS-32 JLT-42	12 22 32 42	1E2 1E2 1E2 1E2	150 300 300 600	150 150 150 150	275 275 720 1440						275 275 275 275	230 230 230 230	18.9 18.9 49.6 99.2						18.9 18.9 18.9 18.9	15.8 15.8 15.8 15.8	

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).  
 †Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.  
 Valves set below 15 psig (1.03 barg) cannot be stamped with the ASME Code Symbol. Only metal seated valves may be set below 15 psig.

## Dimensions and Weights

## E Orifice

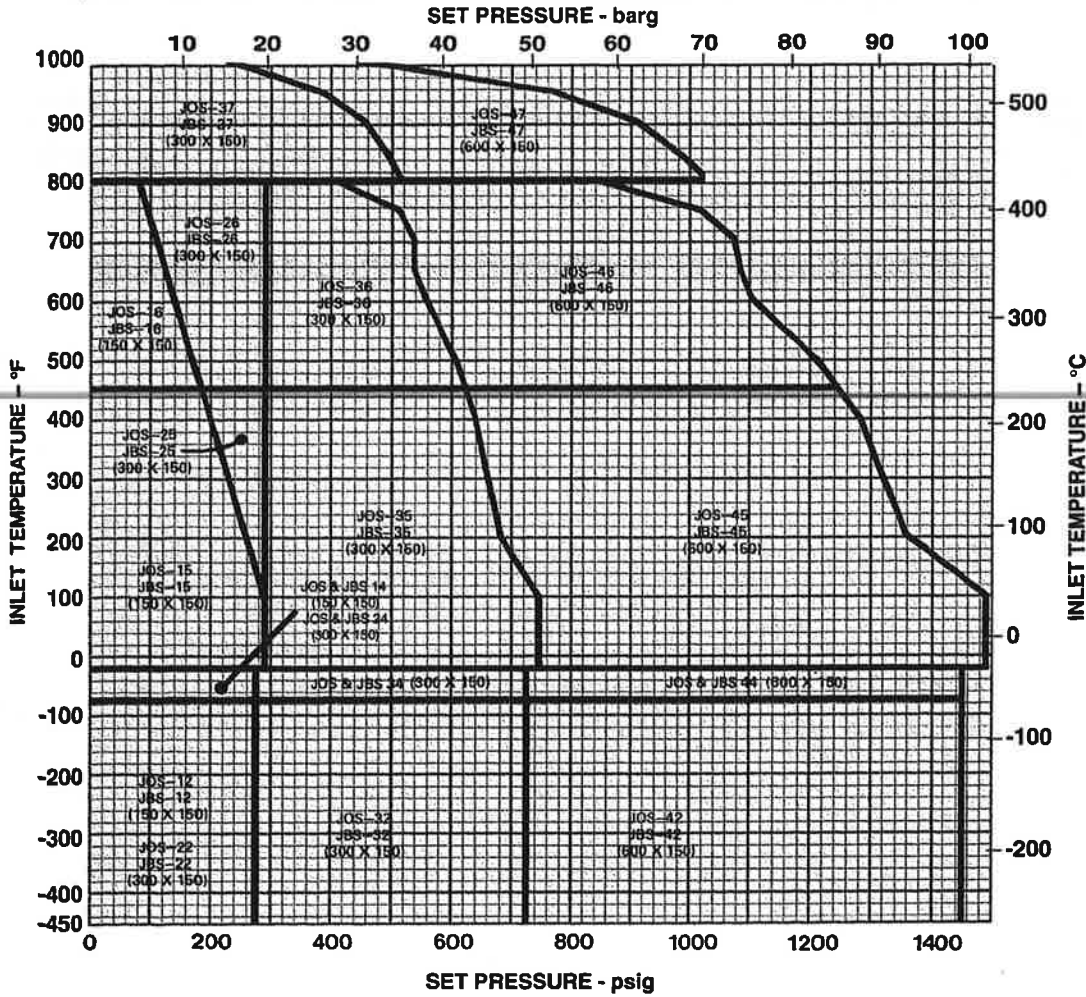
Valve Style	Valve Style	Valve Dimensions - In. (mm)						Approx. Weight lbs(kg) Type J
		Center to Face		Use To Find Bolt Length	Approximate Height			
		Inlet	Outlet		Valve (Cap) Type			
		E	F	X	J & L	C	D	
JOS-12,14,15,16,22,24,25,26 JBS-32,34,35,36,37 JLT-42,44,45,46,47 JOS-H-42,44,45,46,47	12,14,15,16,22,24,25,26	4-1/8 (105)	4-1/2 (114)	1-9/16 (40)	19-3/4 (502)	19 (483)	19-1/2 (495)	36 (16)
	32,34,35,36,37	4-1/8 (105)	4-1/2 (114)	1-9/16 (40)	19-3/4 (502)	19 (483)	19-1/2 (495)	36 (16)
	42,44,45,46,47	4-1/8 (105)	4-1/2 (114)	1-9/16 (40)	19-3/4 (502)	19 (483)	19-1/2 (495)	36 (16)
JOS-55,56,57,65,66,67 JBS-75,76,77 JLT-75,76,77	55,56,57,65,66,67	4-1/8 (105)	5-1/2 (140)	2 (51)	20-1/2 (521)	19 3/4 (502)	20-1/4 (514)	65 (29)
	75,76,77	5-1/2 (140)	6-1/2 (165)	2-1/2 (64)	21-3/4 (532)	21 (533)	21-1/2 (546)	75 (34)



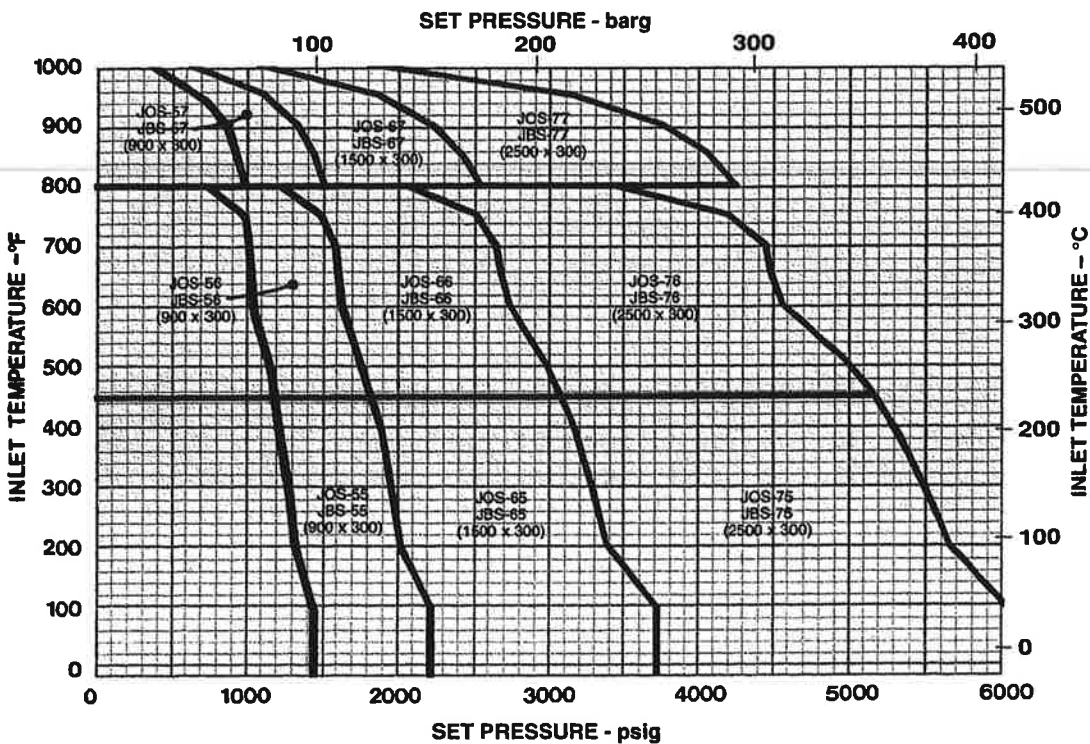
TYPE J (SCREWED CAP)  
 TYPE C (REGULAR LIFTING LEVER)  
 (also JOS-H)  
 TYPE D (PACKED LIFTING LEVER)  
 TYPE L (BOLTED CAP)

# Pressure-Temperature Limit Chart - To ANSI CI 600

**E Orifice**  
 0.196 sq. in.  
 (126 sq.mm)  
 Effective Area



# Pressure-Temperature Limit Chart - ANSI CI 900, CI 1500, CI 2500





# Specifications - Crosby Styles JOS, JBS, JLT and JOS-H

**F Orifice**  
**0.307 sq. in.**  
**(198 sq. mm)**  
**Effective Area**

**Sizes and Pressure/Temperature Limits**  
 (See also Set Pressure Chart Opposite)

**Low Set Pressure Limits:**  
**JOS = 5 psig (0.34 barg)**  
**JBS = 10 psig (0.68 barg)**  
**JLT-JOS = 15 psig (1.03 barg)**  
**JLT-JBS = 25 psig (1.72 barg)**

Valve Style	Valve Size	Inlet x Orifice x Outlet	Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig							Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg	
					Inlet							JOS †	JBS †	Inlet						JOS †	JBS †
					450F to -75F	-75F to -21F	-20F to +100F	+450F	+800F	+1000F	-268C to -60C			-50C to -30C	-29C to -38C	+232C	+427C	+538C			
JOS-15	15	1 1/2 F2	150	150			285	185			285	230			19.6	12.7			19.6	15.8	
JBS-25	25	1 1/2 F2	300	150			285	285			285	230			19.6	19.6			19.6	15.8	
JLT-35	35	1 1/2 F2	300	150			740	615			285	230			51.0	42.4			19.6	15.8	
*JOS-H-45	45	1 1/2 F2	600	150			1480	1235			285	230			102	85.1			19.6	15.8	
JOS-55	55	1 1/2 F2 1/2	900	300			2220	1845			740	500			153	127			51.0	34.4	
JBS-65	65	1 1/2 F2 1/2	1500	300			3705	3080			740	500			255	212			51.0	34.4	
JLT-75	75	1 1/2 F2 1/2	2500	300			5000	5000			740	500			344	344			51.0	34.4	
JOS-16	16	1 1/2 F2	150	150				185	80		285	230			12.7	5.5			19.6	15.8	
JBS-26	26	1 1/2 F2	300	150				285	285		285	230			19.6	19.6			19.6	15.8	
JLT-36	36	1 1/2 F2	300	150				615	410		285	230			42.4	28.2			19.6	15.8	
JOS-H-46	46	1 1/2 F2	600	150				1235	825		285	230			85.1	56.8			19.6	15.8	
JOS-56	56	1 1/2 F2 1/2	900	300				1845	1235		740	500			127	85.1			51.0	34.4	
JBS-66	66	1 1/2 F2 1/2	1500	300				3080	2060		740	500			212	142			51.0	34.4	
JLT-76	76	1 1/2 F2 1/2	2500	300				5000	3430		740	500			344	236			51.0	34.4	
JOS-37	37	1 1/2 F2	300	150						510	225	285	230					35.1	15.5	19.6	15.8
JBS-47	47	1 1/2 F2	600	150						1015	445	285	230					69.9	30.6	19.6	15.8
JOS-57	57	1 1/2 F2 1/2	900	300						1525	670	740	500					105	46.1	51.0	34.4
JBS-67	67	1 1/2 F2 1/2	1500	300						2540	1115	740	500					175	76.8	51.0	34.4
JLT-77	77	1 1/2 F2 1/2	2500	300						4230	1860	740	500					291	128	51.0	34.4
JOS-14	14	1 1/2 F2	150	150		275					275	230			18.9				18.9	15.8	
JBS-24	24	1 1/2 F2	300	150		275					275	230			18.9				18.9	15.8	
JBS-34	34	1 1/2 F2	300	150		720					275	230			49.6				18.9	15.8	
JLT-44	44	1 1/2 F2	600	150		1440					275	230			99.2				18.9	15.8	
JOS-12	12	1 1/2 F2	150	150	275						275	230	18.9						18.9	15.8	
JBS-22	22	1 1/2 F2	300	150	275						275	230	18.9						18.9	15.8	
JBS-32	32	1 1/2 F2	300	150	720						275	230	49.6						18.9	15.8	
JLT-42	42	1 1/2 F2	600	150	1440						275	230	99.2						18.9	15.8	

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).

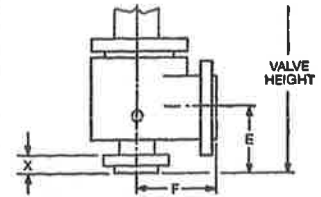
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

Valves set below 15 psig (1.03 barg) cannot be stamped with the ASME Code Symbol. Only metal seated valves may be set below 15 psig.

## Dimensions and Weights

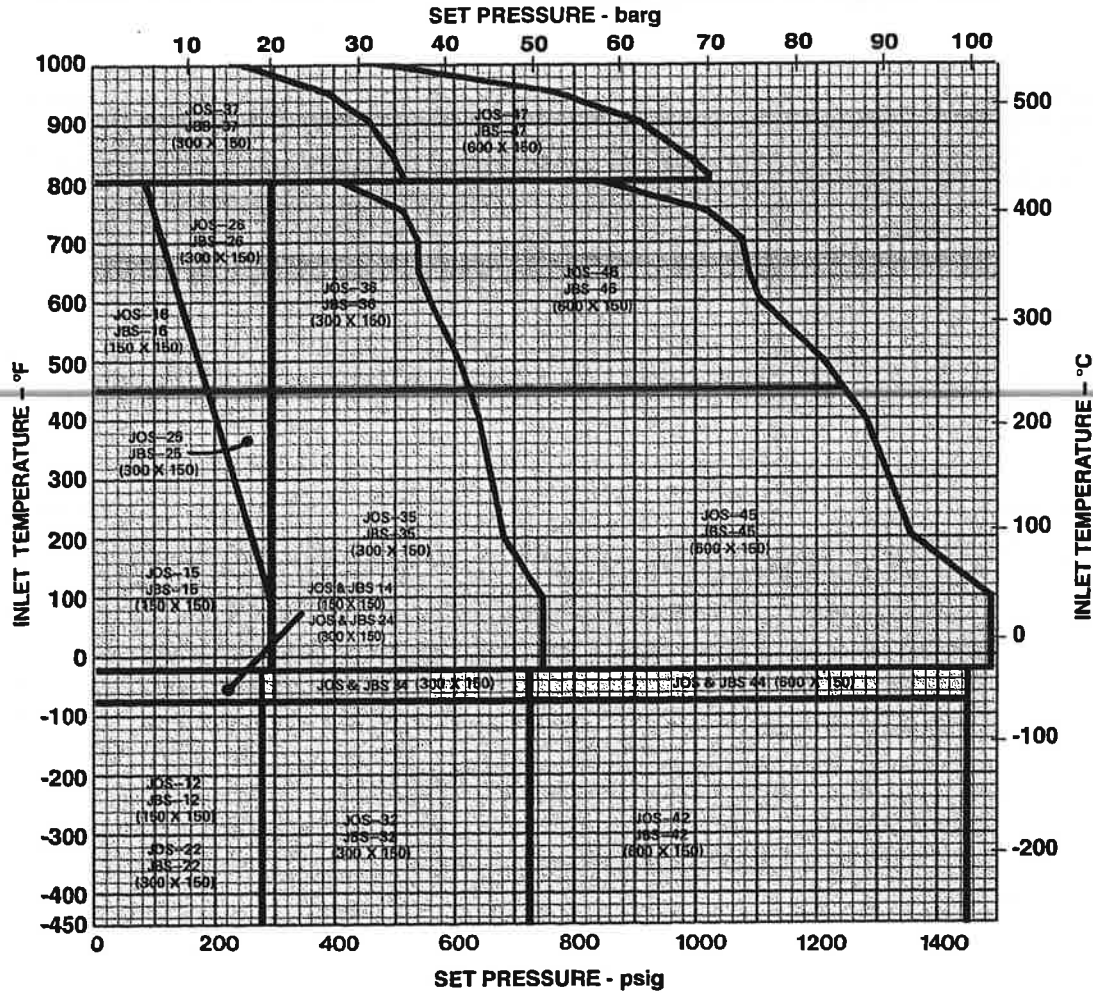
## F Orifice

Valve Style	Valve Dimensions - In. (mm)							Approx. Weight lbs(kg)
	Center to Face		Use To Flnd Bolt Length	Approximate Height			Type J	
	Inlet	Outlet		Valve (Cap) Type				
	E	F	X	J & L	C	D		
JOS-12,14,15,16 22,24,25,26 32,34,35,36,37 42,44,45,46,47 55,56,57,65,66,67 75,76,77	4-7/8 (124)	4-3/4 (121)	1-3/4 (44)	23-1/4 (591)	22-1/2 (572)	23-1/4 (597)	50 (23)	
	4-7/8 (124)	6 (152)	1-3/4 (44)	23-1/4 (591)	22-1/2 (572)	23-1/4 (591)	50 (23)	
	4-7/8 (124)	6 (152)	1-3/4 (44)	23-1/4 (591)	22-1/2 (572)	23-1/4 (591)	50 (23)	
	4-7/8 (124)	6 (152)	2 (51)	23 (584)	21-1/4 (540)	21-3/4 (552)	65 (29)	
	5-1/2 (140)	6-1/2 (165)	2-1/2 (64)	26-3/4 (679)	26 (660)	26-3/4 (679)	85 (39)	

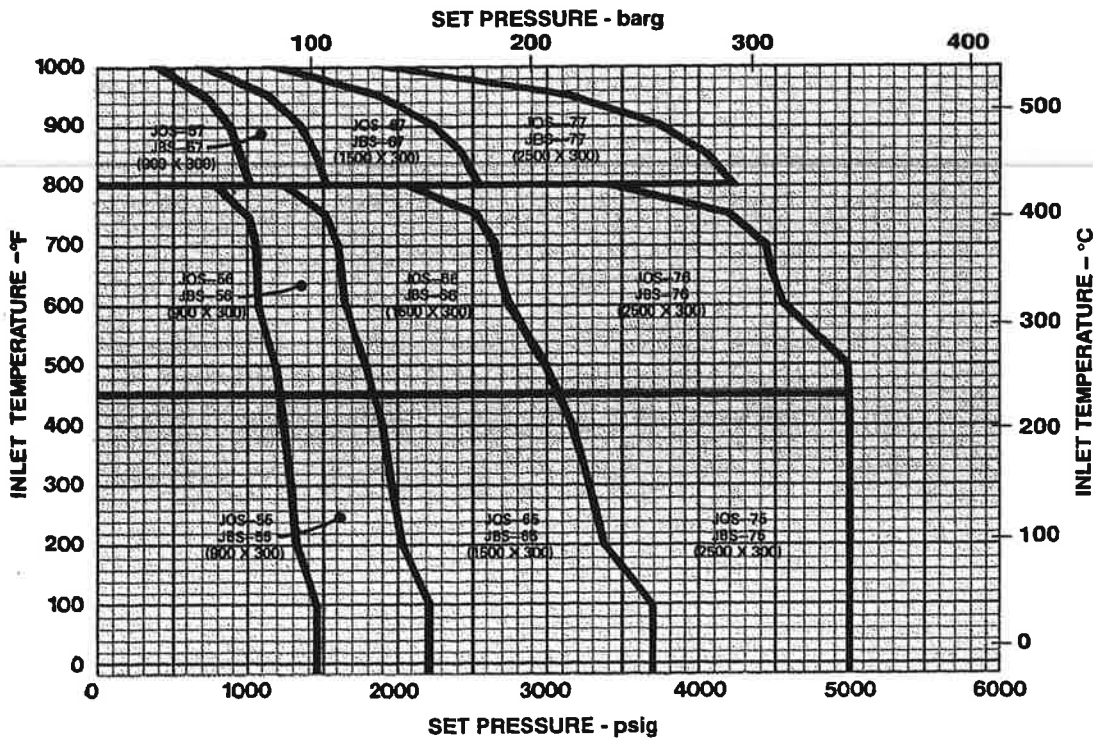


TYPE J (SCREWED CAP)  
 TYPE C (REGULAR LIFTING LEVER)  
 (also JOS-H)  
 TYPE D (PACKED LIFTING LEVER)  
 TYPE L (BOLTED CAP)

# Pressure-Temperature Limit Chart - To ANSI CI 600



# Pressure-Temperature Limit Chart - ANSI CI 900, CI 1500, CI 2500



# Specifications - Crosby Styles JOS, JBS, JLT and JOS-H

**G Orifice**  
**0.503 sq. in.**  
**(325 sq. mm)**  
**Effective Area**

**Sizes and Pressure/Temperature Limits**  
**(See also Set Pressure Chart Opposite)**

**Low Set Pressure Limits:**  
**JOS = 5 psig (0.34 barg)**  
**JBS = 15 psig (1.03 barg)**  
**JLT-JOS = 15 psig (1.03 barg)**  
**JLT-JBS = 25 psig (1.72 barg)**

Valve Style	Valve Size Inlet x Orifice x Outlet	Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig						Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg	
				Inlet						JOS ↑	JBS ↑	Inlet						JOS ↑	JBS ↑
				-450F to -76F	-75F to -21F	-20F to +100F	* +450F	+800F	+1000F			-268C to -60C	-59C to -30C	-29C to +38C	* +232C	+427C	+538C		
JOS-15 JBS-25 JLT-35 *JOS-H-45	1 1/2 G2 1/2	150 300 300 600	150 150 150 150			285 285 740 1480	185 285 615 1235			285 285 285 285	230 230 230 230			19.6 19.6 51.0 102	12.7 19.6 42.4 85.1			19.6 19.6 19.6 19.6	15.8 15.8 15.8 15.8
JOS-55 JBS-65 JLT-75	1 1/2 G2 1/2 2G3 2G3	900 1500 2500	300 300 300			2220 3705 3705	1845 3080 3705			740 740 740	470 470 470			153 255 255	127 212 255			51.0 51.0 51.0	32.4 32.4 32.4
JOS-16 JBS-26 JLT-36 JOS-H-46	1 1/2 G2 1/2	150 300 300 600	150 150 150 150				185 285 615 1235	80 285 410 825		285 285 285 285	230 230 230 230			12.7 19.6 42.4 85.1	5.51 19.6 28.2 56.8			19.6 19.6 19.6 19.6	15.8 15.8 15.8 15.8
JOS-56 JBS-66 JLT-76	1 1/2 G2 1/2 2G3 2G3	900 1500 2500	300 300 300				1845 3080 3705	1235 2060 3430		740 740 740	470 470 470			127 212 255	85.1 142 236			51.0 51.0 51.0	32.4 32.4 32.4
JOS-37 JBS-47 JLT-47 JOS-H-47	1 1/2 G2 1/2 1 1/2 G2 1/2	300 600	150 150					510 1015	225 445	285 285	230 230				35.1 69.9	15.5 30.6		19.6 19.6	15.8 15.8
JOS-57 JBS-67 JLT-77	1 1/2 G2 1/2 2G3 2G3	900 1500 2500	300 300 300					1525 2540 3705	670 1115 1860	740 740 740	470 470 470				105 175 255	46.1 76.8 128		51.0 51.0 51.0	32.4 32.4 32.4
JOS-14 JBS-24 JLT-34 JLT-44	1 1/2 G2 1/2 1 1/2 G2 1/2 1 1/2 G2 1/2 1 1/2 G2 1/2	150 300 300 600	150 150 150 150		275 275 720 1440					275 275 275 275	230 230 230 230		18.9 18.9 49.6 99.2					18.9 18.9 18.9 18.9	15.8 15.8 15.8 15.8
JOS-12 JBS-22 JLT-32 JLT-42	1 1/2 G2 1/2 1 1/2 G2 1/2 1 1/2 G2 1/2 1 1/2 G2 1/2	150 300 300 600	150 150 150 150	275 275 720 1440						275 275 275 275	230 230 230 230	18.9 18.9 49.6 99.2						18.9 18.9 18.9 18.9	15.8 15.8 15.8 15.8

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).

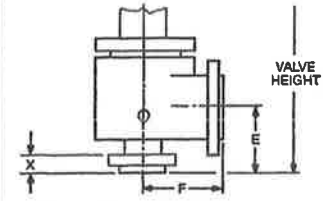
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

Valves set below 15 psig (1.03 barg) cannot be stamped with the ASME Code Symbol. Only metal seated valves may be set below 15 psig.

## Dimensions and Weights

## G Orifice

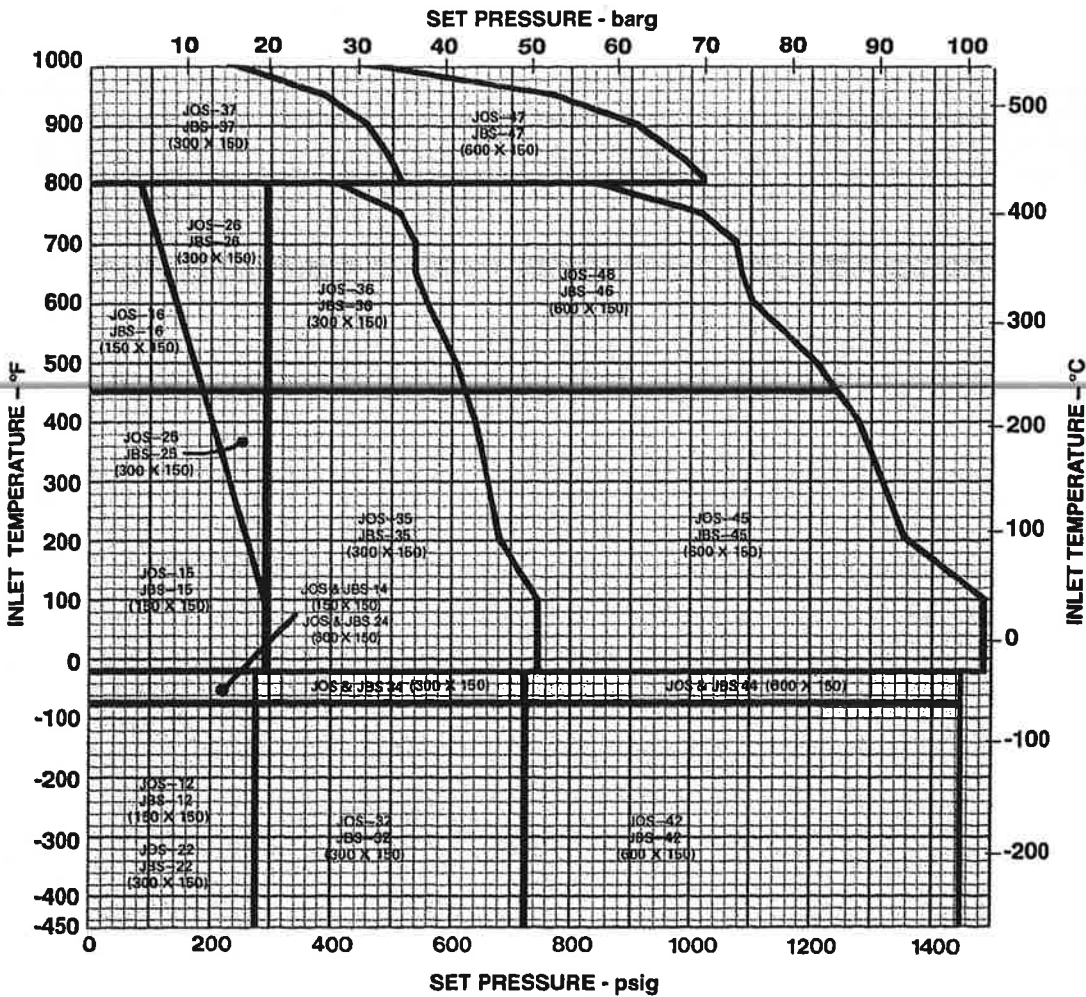
Valve Style	Valve Style	Valve Dimensions - in. (mm)						Approx. Weight lbs(kg) Type
		Center to Face		Use To Find Bolt Length	Approximate Height			
		Inlet	Outlet		X	Valve (Cap) Type		
		E	F	J & L		C	D	
JOS-12,14,15,16 22,24,25,26 32,34,35,36 37,47 JBS-42,44,45,46 JLT-55,56,57 JOS-H-65,66,67,75,76,77	12,14,15,16 22,24,25,26	4-7/8 (124)	4-3/4 (121)	1-3/4 (44)	23-1/4 (591)	22-1/2 (572)	23-1/4 (591)	50 (23)
	32,34,35,36 37,47	4-7/8 (124)	6 (152)	1-3/4 (44)	23-1/4 (591)	22-1/2 (572)	23-1/4 (591)	50 (23)
	42,44,45,46	4-7/8 (124)	6 (152)	1-3/4 (44)	23-1/4 (591)	22-1/2 (572)	23-1/4 (591)	50 (23)
	55,56,57	4-7/8 (124)	6 (152)	2 (51)	26 (660)	25-1/4 (641)	26 (660)	70 (32)
	65,66,67,75,76,77	6-1/8 (156)	6-3/4 (171)	2-3/4 (70)	27 (686)	26-1/4 (667)	27 (686)	90 (41)



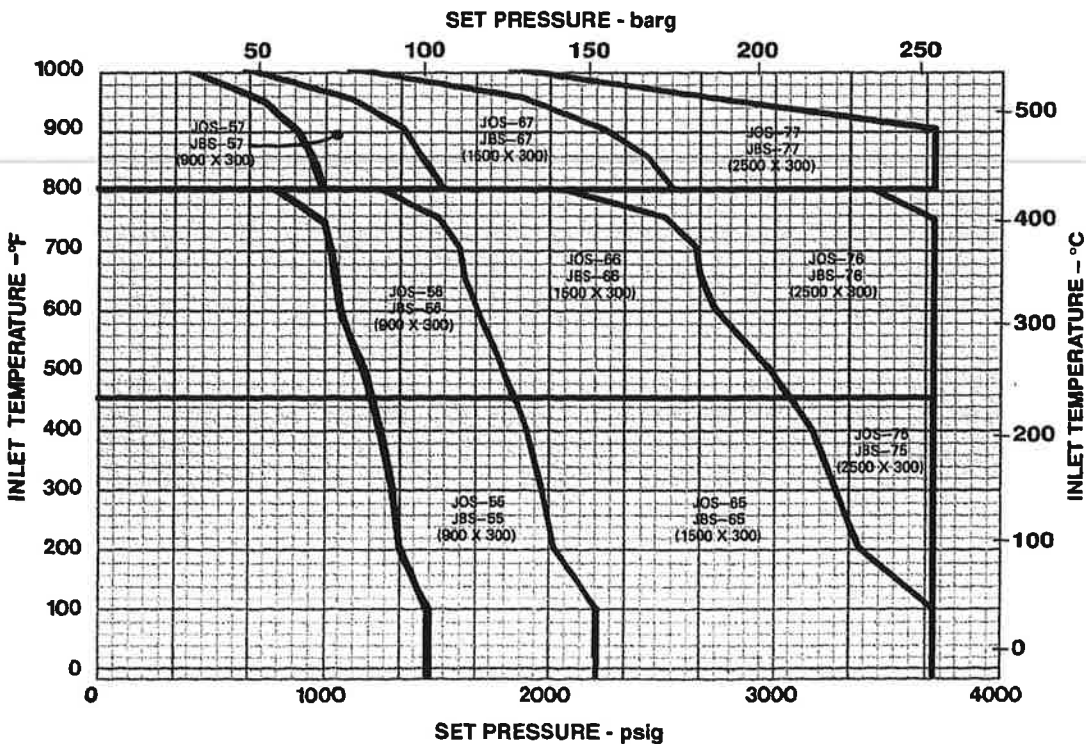
TYPE J (SCREWED CAP)  
 TYPE C (REGULAR LIFTING LEVER)  
 (also JOS-H)  
 TYPE D (PACKED LIFTING LEVER)  
 TYPE L (BOLTED CAP)

# Pressure-Temperature Limit Chart - To ANSI CI 600

**G Orifice**  
**0.503 sq. in.**  
**(325 sq.mm)**  
**Effective Area**



# Pressure-Temperature Limit Chart - ANSI CI 900, CI 1500, CI 2500



# Specifications - Crosby Styles JOS, JBS, JLT and JOS-H

**H Orifice**  
 .785 sq. in.  
 (506 sq. mm)  
 Effective Area

**Sizes and Pressure/Temperature Limits**  
 (See also Set Pressure Chart Opposite)

**Low Set Pressure Limits:**  
 JOS = 5 psig (0.34 barg)  
 JBS = 10 psig (0.68 barg)  
 JLT-JOS = 15 psig (1.03 barg)  
 JLT-JBS = 25 psig (1.72 barg)

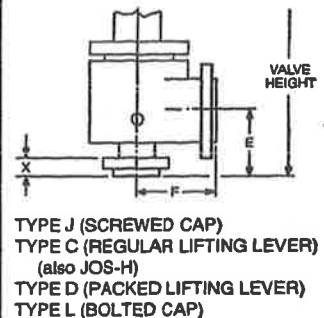
Valve Style	Valve Size Inlet & Orifice x Outlet	Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig							Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg	
				Inlet									Inlet							
				Inlet	Outlet	-450F to -76F	-75F to -21F	-20F to +100F	+450F	+800F	+1000F	JOS ↑	JBS ↑	-268C to -60C	-59C to -30C	-29C to +38C	+232C	+427C	+538C	JOS ↑
JOS-15	1 1/2 H3	150	150			285	185			285	230			19.6	12.7			19.6	15.8	
JBS-25	1 1/2 H3	300	150			285	285			285	230			19.6	19.6			19.6	15.8	
JLT-35	2 H3	300	150			740	615			285	230			51.0	42.4			19.6	15.8	
JOS-H-45	2 H3	600	150			1480	1235			285	230			102	85.1			19.6	15.8	
JOS-55	2 H3	900	150			2220	1845			285	230			153	127			19.6	15.8	
JBS-65	2 H3	1500	300			2750	2750			740	415			189	189			51.0	28.6	
JOS-16	1 1/2 H3	150	150				185	80		285	230			12.7	5.51			19.6	15.8	
JBS-26	1 1/2 H3	300	150				285	285		285	230			19.6	19.6			19.6	15.8	
JLT-36	2 H3	300	150				615	410		285	230			42.4	28.2			19.6	15.8	
JOS-H-46	2 H3	600	150				1235	825		285	230			85.1	56.8			19.6	15.8	
JOS-56	2 H3	900	150				1845	1235		285	230			127	85.1			19.6	15.8	
JBS-66	2 H3	1500	300				2750	2060		740	415			189	142			51.0	28.6	
JOS-37	2 H3	300	150					510	225	285	230						35.1	15.5	19.6	15.8
JBS-47	2 H3	600	150					815	445	285	230						56.2	30.6	19.6	15.8
JOS-H-57	2 H3	900	150							285	230						84.4	46.1	19.6	15.8
JBS-67	2 H3	1500	300							740	415						140	76.8	51.0	28.6
JOS-14	1 1/2 H3	150	150		275					275	230		18.9					18.9	15.8	
JBS-24	1 1/2 H3	300	150		275					275	230		18.9					18.9	15.8	
JLT-34	2 H3	300	150		720					275	230		49.6					18.9	15.8	
JOS-H-44	2 H3	600	150		1440					275	230		99.2					18.9	15.8	
JOS-12	1 1/2 H3	150	150	275						275	230	18.9						18.9	15.8	
JBS-22	1 1/2 H3	300	150	275						275	230	18.9						18.9	15.8	
JLT-32	2 H3	300	150	720						275	230	49.6						18.9	15.8	
JOS-H-42	2 H3	600	150	1440						275	230	99.2						18.9	15.8	

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).  
 †Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.  
 Valves set below 15 psig (1.03 barg) cannot be stamped with the ASME Code Symbol. Only metal seated valves may be set below 15 psig.

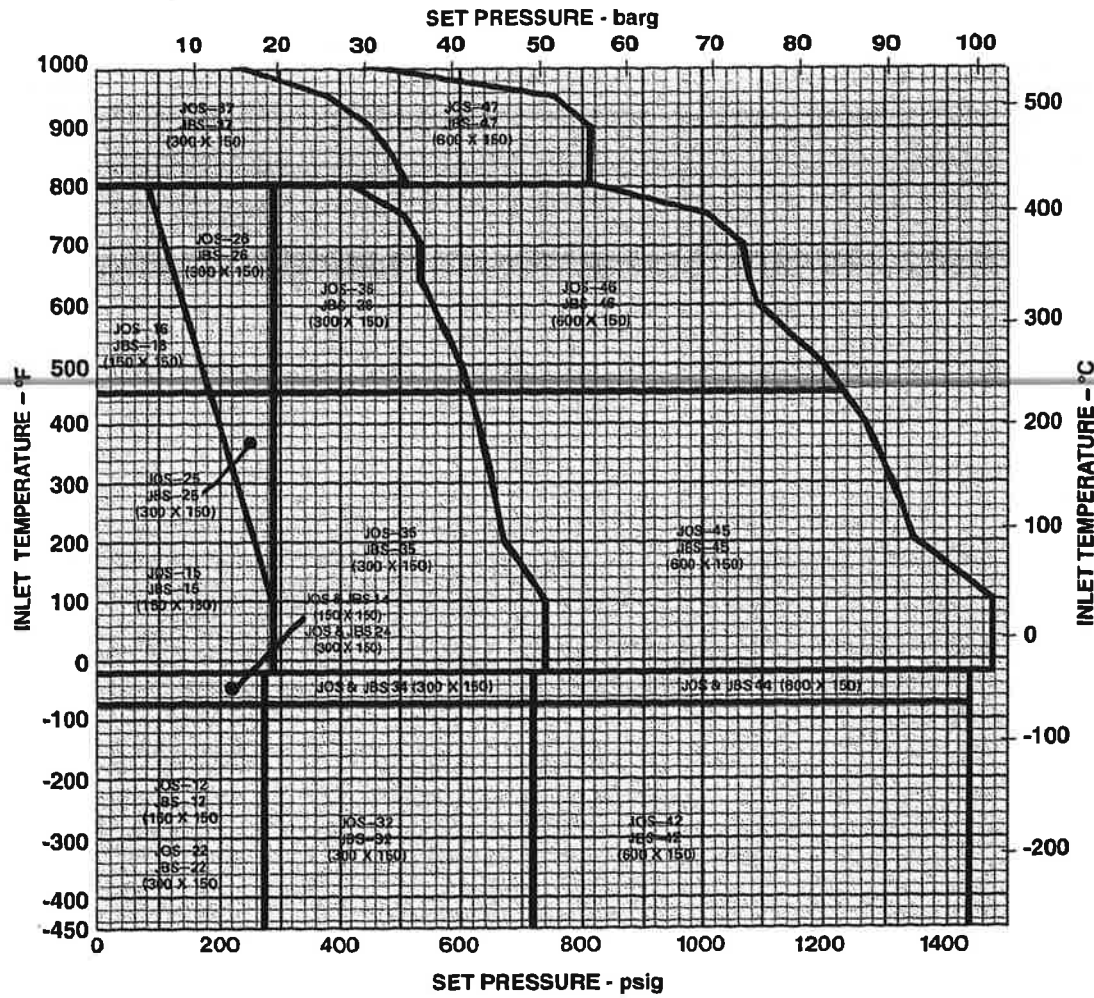
## Dimensions and Weights

## H Orifice

Valve Style	Valve Dimensions - In. (mm)	Valve Dimensions - In. (mm)						Approx. Weight lbs(kg)
		Center to Face		Use To Find Bolt Length	Approximate Height			
		Inlet	Outlet		Valve (Cap) Type			
		E	F	X	J & L	C	D	J
JOS-12,14,15,16	22,24,25,26	5-1/8	4-7/8	1-11/16	23-1/2	22-3/4	23-1/4	55
		(130)	(124)	(43)	(597)	(578)	(591)	(25)
JOS-32,34,35,36	37,47	5-1/8	4-7/8	1-13/16	23-1/2	22-3/4	23-1/4	60
		(130)	(124)	(46)	(597)	(578)	(591)	(27)
JOS-42,44,45,46		6-1/16	6-3/8	1-13/16	26-3/4	26	26-3/4	75
		(154)	(162)	(46)	(679)	(660)	(679)	(34)
JOS-55,56,57,65,66,67		6-1/16	6-3/8	2-5/16	28-1/4	27-1/2	28-1/4	110
		(154)	(162)	(59)	(718)	(699)	(718)	(50)

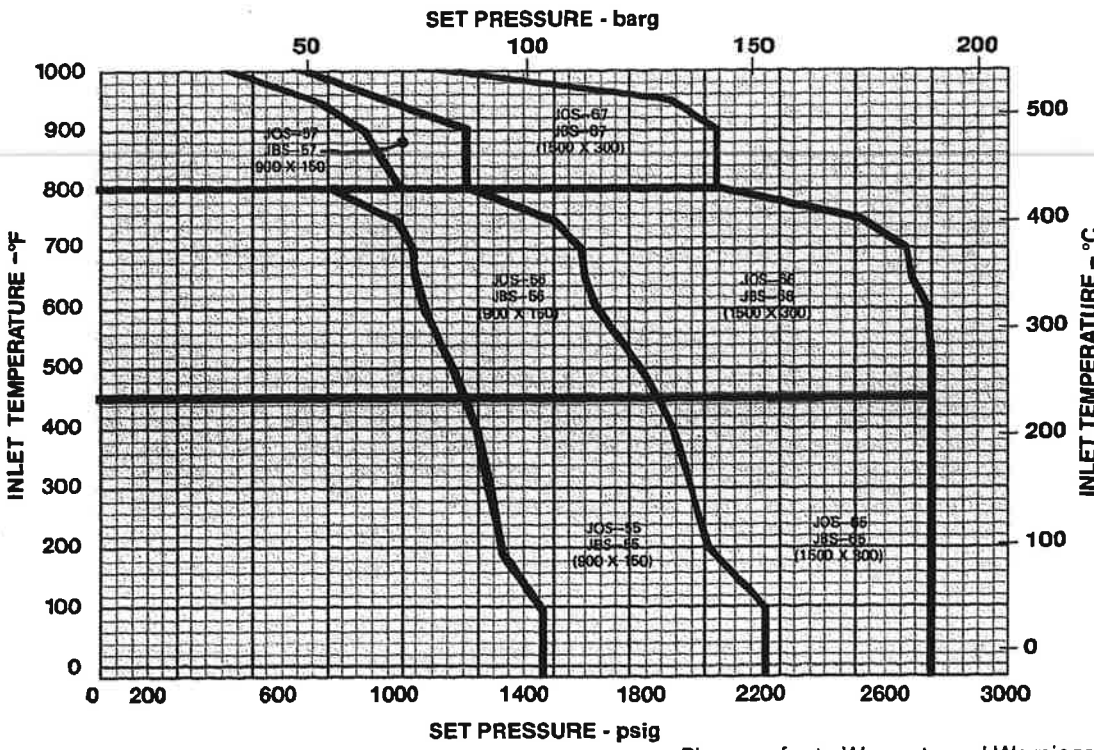


# Pressure-Temperature Limit Chart - To ANSI CI 600



**H Orifice**  
 785 sq. in.  
 (506 sq. mm)  
 Effective Area

# Pressure-Temperature Limit Chart - ANSI CI 900, CI 1500



# Specifications - Crosby Styles JOS, JBS, JLT and JOS-H

**J Orifice**  
**1.287 sq. in.**  
**(830 sq. mm)**  
**Effective Area**

**Sizes and Pressure/Temperature Limits**  
 (See also Set Pressure Chart Opposite)

**Low Set Pressure Limits:**  
 JOS = 5 psig (0.34 barg)  
 JBS = 9 psig (0.62 barg)  
 JLT-JOS = 15 psig (1.03 barg)  
 JLT-JBS = 25 psig (1.72 barg)

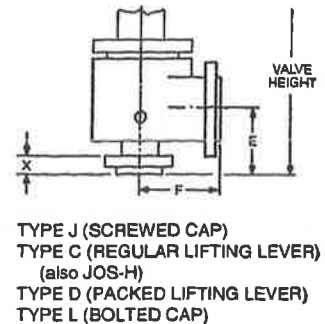
Valve Style	Valve Size		Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig						Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg		
	Inlet x Orifice x Outlet	Inlet	Outlet	Inlet						JOS †	JBS †	Inlet						JOS †	JBS †		
				-450F to -76F	-75F to -21F	-20F to +100F	* +450F	+800F	+1000F			-268C to -50C	-59C to -30C	-29C to +38C	* +232C	+427C	+538C				
JOS- JBS- JLT- *JOS-H-	15 25 35 45	2J3 2J3 2 1/2 J4 2 1/2 J4	150 300 300 600	150 150 150 150			285 285 740 1480	185 285 615 1235			285 285 285 285	230 230 230 230			19.6 19.6 51.0 102	12.7 19.6 42.4 85.1			19.6 19.6 19.6 19.6	15.8 15.8 15.8 15.8	
JOS- JBS- JLT-	55 65	3J4 3J4	900 1500	150 300			2220 2700	1845 2700			285 600	230 230			153 186	127 186			19.6 41.3	15.8 15.8	
JOS- JBS- JLT- JOS-H-	16 26 36 46	2J3 2J3 2 1/2 J4 2 1/2 J4	150 300 300 600	150 150 150 150				185 285 615 1235	80 285 410 825		285 285 285 285	230 230 230 230				12.7 19.6 42.4 85.1	5.51 19.6 28.2 56.8			19.6 19.6 19.6 19.6	15.8 15.8 15.8 15.8
JOS- JBS- JLT-	56 66	3J4 3J4	900 1500	150 300				1845 2700	1235 2060		285 600	230 230				127 186	85.1 142			19.6 41.3	15.8 15.8
JOS- JBS- JLT- JOS-H-	37 47	2 1/2 J4 2 1/2 J4	300 600	150 150					510 815	225 445	285 285	230 230					35.1 56.1	15.5 30.6	19.6 19.6	15.8 15.8	
JOS- JBS- JLT-	57 67	2 1/2 J4 3J4	900 1500	150 300					1225 2040	670 1115	285 600	230 230					84.4 140	46.1 76.8	19.6 41.3	15.8 15.8	
JOS- JBS- JLT-	14 24 34 44	2J3 2J3 2 1/2 J4 2 1/2 J4	150 300 300 600	150 150 150 150		275 275 720 1440					275 275 275 275	230 230 230 230			18.9 18.9 49.6 99.2				18.9 18.9 18.9 18.9	15.8 15.8 15.8 15.8	
JOS- JBS- JLT-	12 22 32 42	2J3 2J3 2 1/2 J4 2 1/2 J4	150 300 300 600	150 150 150 150	275 275 500 625						275 275 275 275	230 230 230 230	18.9 18.9 34.4 43.0						18.9 18.9 18.9 18.9	15.8 15.8 15.8 15.8	

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).  
 †Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.  
 Valves set below 15 psig (1.03 barg) cannot be stamped with the ASME Code Symbol. Only metal seated valves may be set below 15 psig.

## Dimensions and Weights

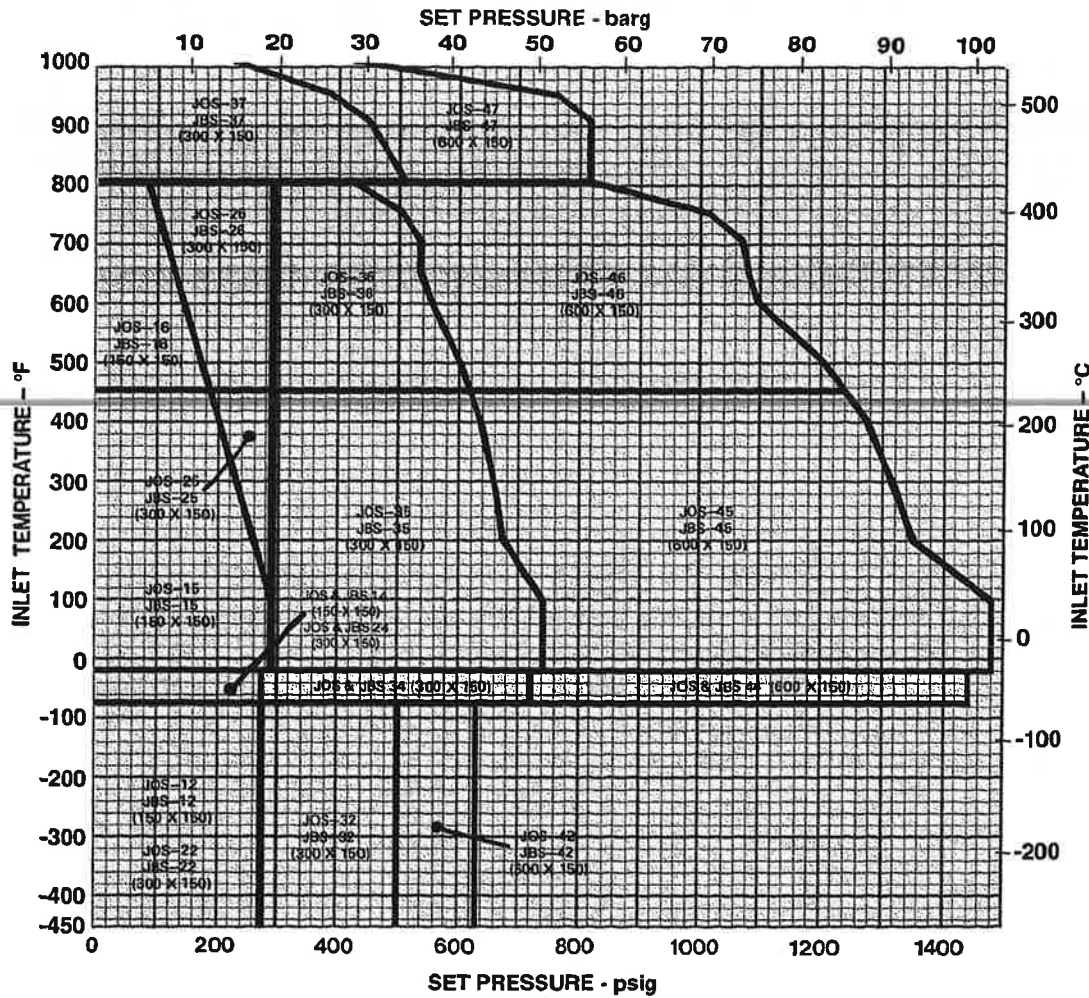
## J Orifice

Valve Style	Valve Dimensions - in. (mm)							Approx. Weight lbs(kg) Type J
	Center to Face		Use To Find Bolt Length	Approximate Height				
	Inlet	Outlet		Valve (Cap) Type				
	E	F	X	J & L	C	D		
JOS- JBS- JLT- JOS-H-	12,14,15,16 22,24,25,26	5-3/8 (137)	4-7/8 (124)	1-11/16 (43)	23-3/4 (603)	23-1/4 (591)	23-3/4 (603)	66 (30)
	32,34,35,36,37,47	5-3/8 (137)	5-5/8 (143)	2-1/16 (52)	26-3/4 (679)	26 (660)	26-3/4 (679)	89 (40)
	42,44,45,46	6-1/8 (156)	6-3/4 (171)	2-1/8 (54)	29-1/2 (749)	28-3/4 (730)	29-1/2 (749)	115 (52)
	57	6-1/8 (156)	6-3/4 (171)	2-7/16 (62)	29-1/2 (749)	28-3/4 (730)	29-1/2 (749)	140 (64)
	55,56,65,66,67	7-1/4 (184)	7-1/8 (181)	2-11/16 (68)	32-1/2 (826)	31-3/4 (806)	32-1/2 (826)	155 (70)

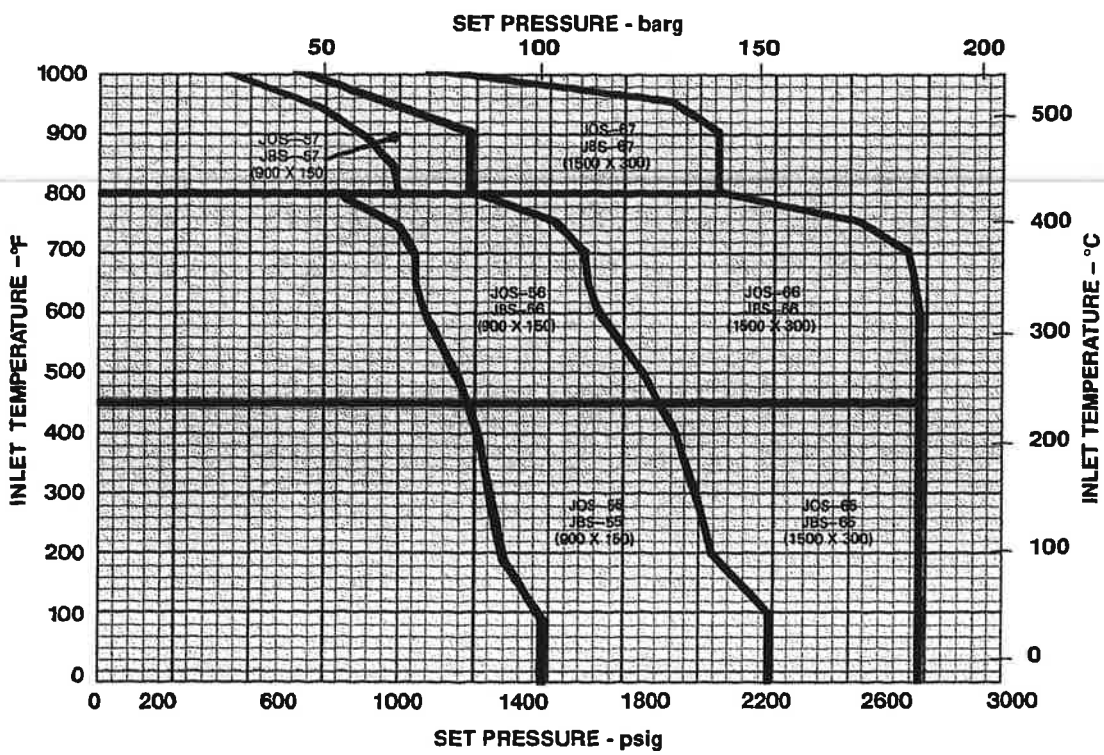


# Pressure-Temperature Limit Chart - To ANSI CI 600

**J Orifice**  
**1.287 sq. in.**  
**(830 sq. mm)**  
**Effective Area**



# Pressure-Temperature Limit Chart - ANSI CI 900, CI 1500





# Specifications - Crosby Styles JOS, JBS, JLT and JOS-H

**K Orifice**  
**1.838 sq. in.**  
**(1186 sq. mm)**  
**Effective Area**

**Sizes and Pressure/Temperature Limits**  
 (See also Set Pressure Chart Opposite)

**Low Set Pressure Limits:**  
**JOS = 5 psig (0.34 barg)**  
**JBS = 9 psig (0.62 barg)**  
**JLT-JOS = 15 psig (1.03 barg)**  
**JLT-JBS = 25 psig (1.72 barg)**

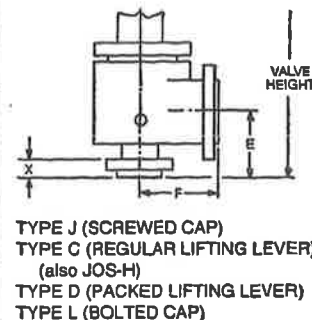
Valve Style	Valve Size	Inlet x Orifice x Outlet	Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig						Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg			
			Inlet	Outlet	Inlet						JOS †	JBS †	Inlet						JOS †	JBS †		
					-450F to -76F	-75F to -21F	-20F to +100F	+450F	+800F	+1000F			-268C to -60C	-59C to -30C	-29C to +38C	+232C	+427C	+538C				
JOS-15	3K4	150	150				285	185			285	150				19.6	12.7			19.6	10.3	
JBS-25	3K4	300	150				285	285			285	150				19.6	19.6			19.6	10.3	
JLT-35	3K4	300	150				740	615			285	150				51.0	42.4			19.6	10.3	
*JOS-H-45	3K4	600	150				1480	1235			285	200				102	85.1			19.6	13.7	
JOS-55	3K6	900	150				2220	1845			285	200				153	127			19.6	13.7	
JBS-65	3K6	1500	300				2220	2220			600	200				153	153			41.3	13.7	
JOS-16	3K4	150	150					185	80		285	150				12.7	5.51			19.6	10.3	
JBS-26	3K4	300	150					285	285		285	150				19.6	19.6			19.6	10.3	
JLT-36	3K4	300	150					615	410		285	150				42.4	28.2			19.6	10.3	
JOS-H-46	3K4	600	150					1235	825		285	200				85.1	56.8			19.6	13.7	
JOS-56	3K6	900	150					1845	1235		285	200				127	85.1			19.6	13.7	
JBS-66	3K6	1500	300					2220	2060		600	200				153	142			41.3	13.7	
JOS-37	3K4	300	150						510	225	285	150							35.1	15.5	19.6	10.3
JBS-47	3K4	600	150						815	445	285	200							56.1	30.6	19.6	13.7
JOS-H-57	3K4	900	150								285	200							84.4	46.1	19.6	13.7
JBS-67	3K6	1500	300								600	200				140	76.8			41.3	13.7	
JOS-14	3K4	150	150			275					275	150				18.9				18.9	10.3	
JBS-24	3K4	300	150			275					275	150				18.9				18.9	10.3	
JLT-34	3K4	300	150			720					275	150				49.6				18.9	10.3	
JOS-H-44	3K4	600	150			1440					275	200				99.2				18.9	13.7	
JOS-12	3K4	150	150	275							275	150	18.9							18.9	10.3	
JBS-22	3K4	300	150	275							275	150	18.9							18.9	10.3	
JOS-32	3K4	300	150	525							275	150	36.1							18.9	10.3	
JLT-42	3K4	600	150	600							275	200	41.3							18.9	13.7	

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).  
 †Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.  
 Valves set below 15 psig (1.03 barg) cannot be stamped with the ASME Code Symbol. Only metal seated valves may be set below 15 psig.

## Dimensions and Weights

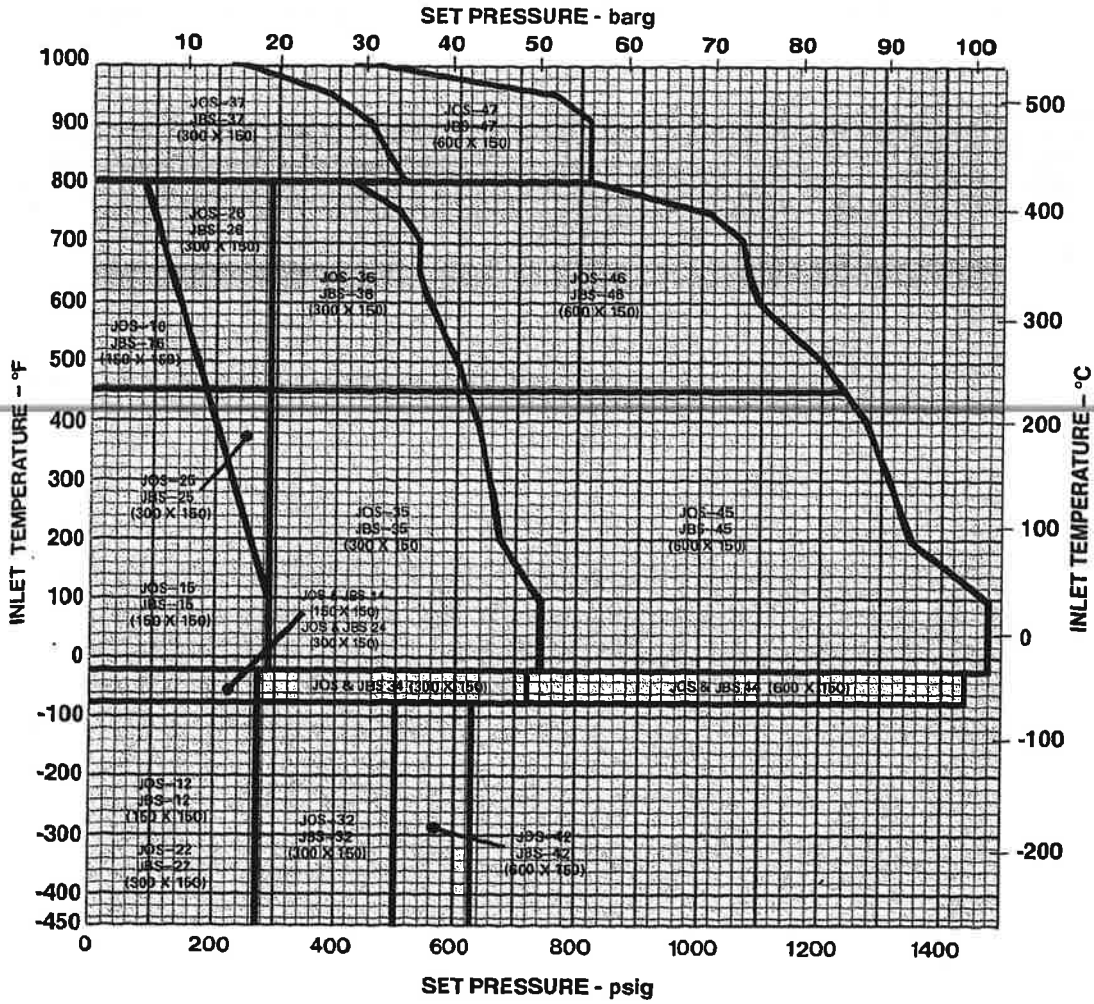
## K Orifice

Valve Style	Valve Dimensions - In. (mm)							Approx. Weight lbs(kg) Type J
	Center to Face		Use To Find Bolt Length	Approximate Height				
	Inlet	Outlet		Valve (Cap) Type				
	E	F	X	J & L	C	D		
JOS-12,14,15,16 22,24,25,26 32,34,35,36, 37,47 42,44,45,46 57 55,56 65,66,67	6-1/8	6-3/8	2-1/8	29-3/4	29	29-3/4	116	
	(156)	(162)	(54)	(756)	(737)	(756)	(52)	
	6-1/8	6-3/8	2-1/8	29-3/4	29	29-3/4	117	
	(156)	(162)	(54)	(756)	(737)	(756)	(53)	
	7-1/4	7-1/8	2-1/8	33	32-1/2	33-1/4	160	
	(184)	(181)	(54)	(838)	(826)	(845)	(73)	
	7-1/4	7-1/8	2-5/16	33	32-1/2	33-1/4	175	
	(184)	(181)	(59)	(838)	(826)	(845)	(79)	
7-13/16	8-1/2	2-11/16	39	38	38-3/4	185		
(198)	(216)	(68)	(991)	(965)	(984)	(84)		
7-3/4	8-1/2	2-11/16	39	38	38-3/4	195		
(197)	(216)	(68)	(991)	(965)	(984)	(88)		

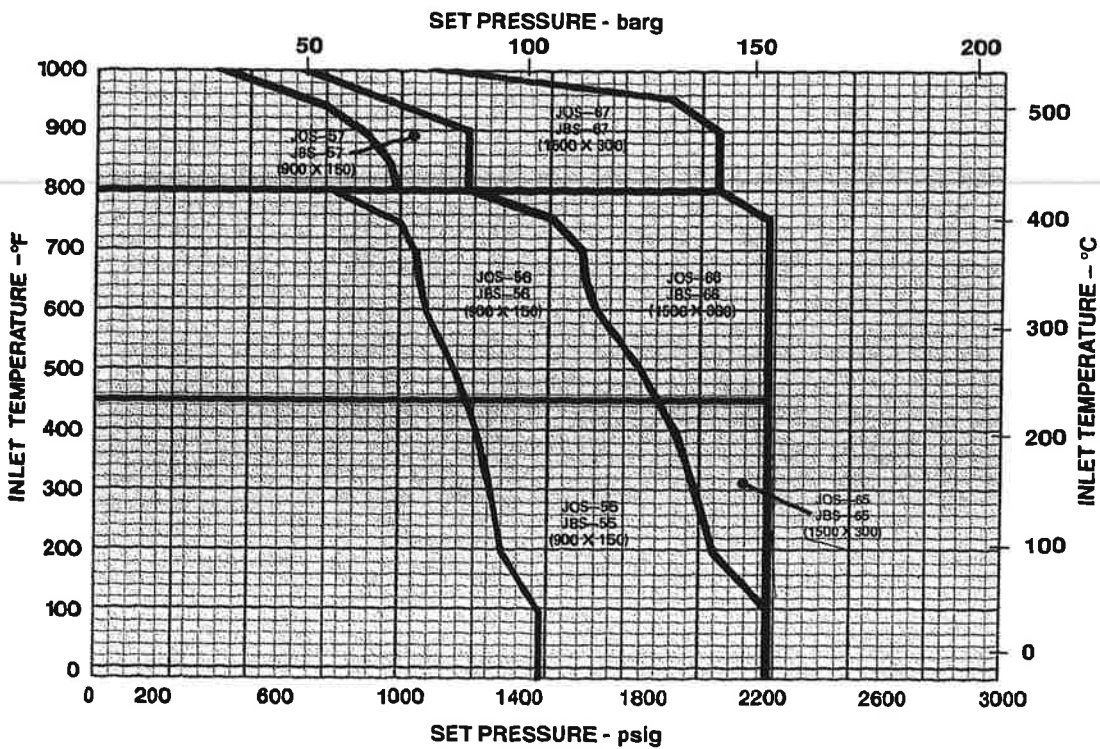


# Pressure-Temperature Limit Chart - To ANSI CI 600

**K Orifice**  
 1.838 sq. in.  
 (1186 sq.mm)  
 Effective Area



# Pressure-Temperature Limit Chart - ANSI CI 900, CI 1500



# Specifications - Crosby Styles JOS, JBS, JLT and JOS-H

**L Orifice**  
**2.853 sq. in.**  
**(1841 sq. mm)**  
**Effective Area**

**Sizes and Pressure/Temperature Limits**  
 (See also Set Pressure Chart Opposite)

**Low Set Pressure Limits:**  
**JOS = 6 psig (0.41 barg)**  
**JBS = 8 psig (0.55 barg)**  
**JLT-JOS = 15 psig (1.03 barg)**  
**JLT-JBS = 25 psig (1.72 barg)**

Valve Style	Valve Size		Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig						Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg			
	Inlet x Orifice x Outlet	Inlet	Outlet	Inlet						JOS †	JBS †	Inlet						JOS †	JBS †			
				-450F to -76F	-76F to -21F	-20F to +100F	* +450F	+800F	+1000F			-268C to -60C	-59C to -30C	-29C to +38C	* +232C	+427C	+538C					
JOS- JBS- JLT- *JOS-H-	15 25 35 45	3L4 3L4 4L6 4L6	150 300 300 600	150 150 150 150			285 285 740 1000	185 285 615 1000			285 285 285 285	100 100 170 170					19.6 19.6 51.0 68.9	12.7 19.6 42.4 68.9			19.6 19.6 19.6 19.6	6.89 6.89 11.7 11.7
JOS- JBS- JLT-	55	4L6	900	150			1500	1500			285	170			103	103					19.6	11.7
JOS- JBS- JLT- JOS-H-	16 26 36 46	3L4 3L4 4L6 4L6	150 300 300 600	150 150 150 150				185 285 615 1000	80 285 410 825		285 285 285 285	100 100 170 170					12.7 19.6 42.4 68.9	5.51 19.6 28.2 56.8			19.6 19.6 19.6 19.6	6.89 6.89 11.7 11.7
JOS- JBS- JLT-	56 66	4L6 4L6	900 1500	150 150				1500 1500	1235 1500		285 285	170 170					103 103	85.1 103			19.6 19.6	11.7 11.7
JOS- JBS- JLT- JOS-H-	37 47	4L6 4L6	300 600	150 150					510 1000	225 445	285 285	170 170						35.1 68.9	15.5 30.6		19.6 19.6	11.7 11.7
JOS- JBS- JLT-	57 67	4L6 4L6	900 1500	150 150					1500 1500	670 1115	285 285	170 170					103 103	46.1 76.8			19.6 19.6	11.7 11.7
JOS- JBS- JLT-	14 24 34 44	3L4 3L4 4L6 4L6	150 300 300 600	150 150 150 150		275 275 720 1000					275 275 275 275	100 100 170 170				18.9 18.9 49.6 68.9				18.9 18.9 18.9 18.9	6.89 6.89 11.7 11.7	
JOS- JBS- JLT-	12 22 32 42	3L4 3L4 4L6 4L6	150 300 300 600	150 150 150 150	275 275 535 535						275 275 275 275	100 100 170 170	18.9 18.9 36.8 36.8							18.9 18.9 18.9 18.9	6.89 6.89 11.7 11.7	

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).

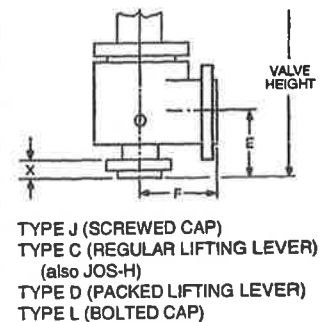
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

Valves set below 15 psig (1.03 barg) cannot be stamped with the ASME Code Symbol. Only metal seated valves may be set below 15 psig.

## Dimensions and Weights

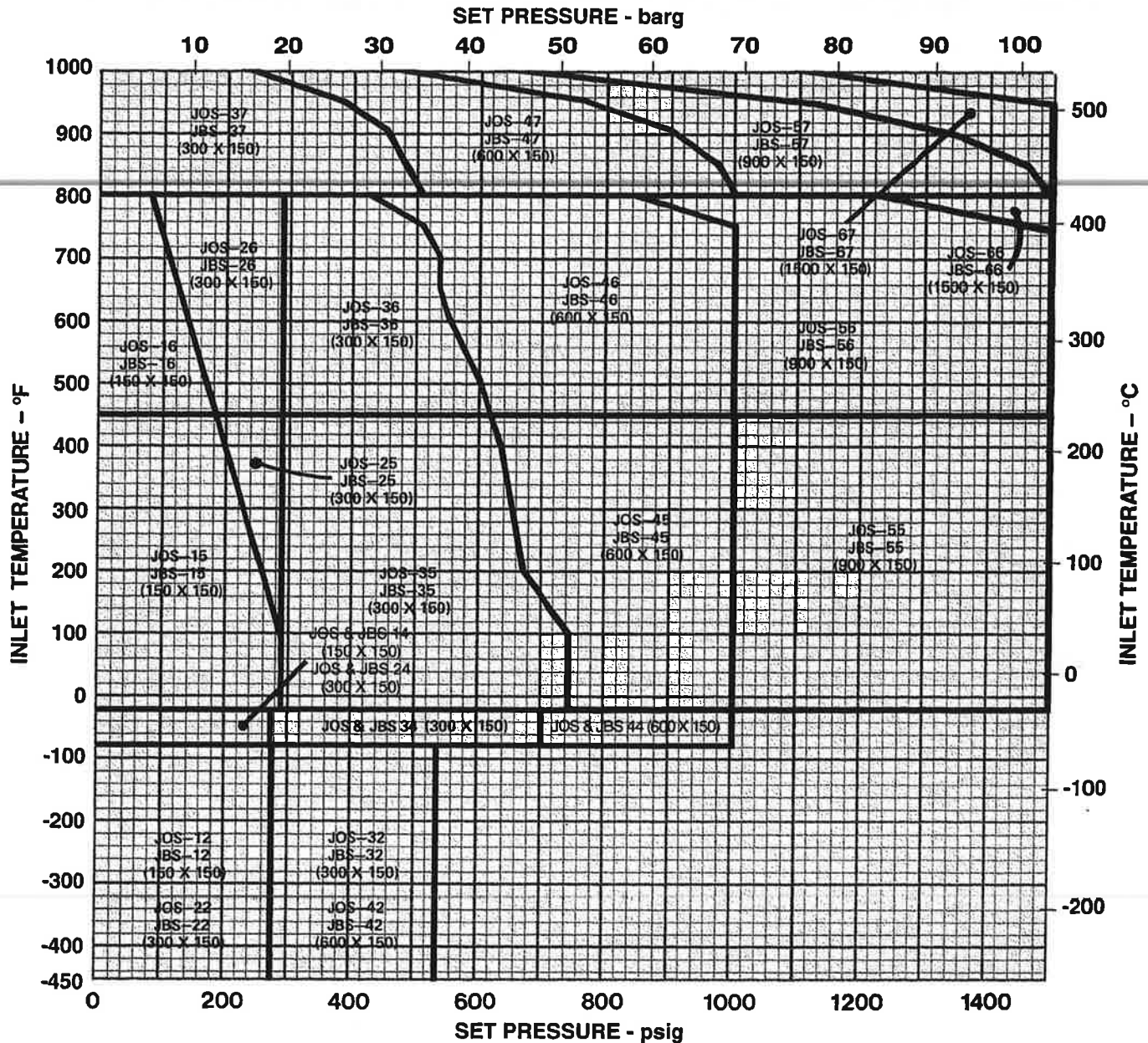
### L Orifice

Valve Style	Valve Dimensions - in. (mm)						Approx. Weight lbs(kg) Type J	
	Center to Face		Use To Find Bolt Length	Approximate Height				
	Inlet	Outlet		Valve (Cap) Type				
	E	F	X	J & L	C	D		
JOS- JBS- JLT- JOS-H-	12,14,15,16, 22,24,25,26	6-1/8 (156)	6-1/2 (165)	2 (51)	34 (864)	33-1/4 (845)	34 (864)	152 (69)
	32,34,35,36,37	7-1/16 (179)	7-1/8 (181)	2-1/8 (54)	34 (864)	34-1/4 (870)	34-1/4 (870)	192 (87)
	42,44,45,46,47	7-1/16 (179)	8 (203)	2-3/8 (60)	35-1/4 (895)	34-3/4 (883)	35-1/4 (895)	226 (103)
	55,56,57,66,67	7-3/4 (197)	8-3/4 (222)	2-15/16 (75)	39-3/4 (1010)	38-3/4 (984)	39-1/2 (1003)	270 (122)



# Pressure-Temperature Limit Chart

**L Orifice**  
**2.853 sq. in.**  
**(1841 sq.mm)**  
**Effective Area**



# Specifications - Crosby Styles JOS, JBS, JLT and JOS-H

**M Orifice**  
**3.60 sq. in.**  
**(2323 sq. mm)**  
**Effective Area**

**Sizes and Pressure/Temperature Limits**  
 (See also Set Pressure Chart Opposite)

**Low Set Pressure Limits:**  
 JOS = 8 psig (0.55 barg)  
 JBS = 10 psig (0.68 barg)  
 JLT-JOS = 15 psig (1.03 barg)  
 JLT-JBS = 25 psig (1.72 barg)

Valve Style	Valve Size		Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig						Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg		
	Inlet x Orifice x Outlet	Inlet	Outlet	Inlet						JOS †	JBS †	Inlet						JOS †	JBS †		
				-450F to -76F	-75F to -21F	-20F to +100F	+450F	+800F	+1000F			-258C to -60C	-59C to -30C	-29C to +38C	+232C	+427C	+538C				
JOS- JBS- JLT- *JOS-H-	15 25 35 45	4M6 4M6 4M6 4M6	150 300 300 600	150 150 150 150			285 285 740 1100	185 285 615 1100			285 285 285 285	80 80 160 160			19.6 19.6 51.0 75.8	12.7 19.6 42.4 75.8			19.6 19.6 19.6 19.6	5.51 5.51 11.0 11.0	
JOS- JBS- JLT- JOS-H-	16 26 36 46	4M6 4M6 4M6 4M6	150 300 300 600	150 150 150 150				185 285 615 1100	80 285 410 825			285 285 285 285	80 80 160 160			12.7 19.6 42.4 75.8	5.51 19.6 28.2 56.8			19.6 19.6 19.6 19.6	5.51 5.51 11.0 11.0
JOS- JBS- JLT-	56	4M6	900	150			1100	1100			285	160			75.8	75.8			19.6	11.0	
JOS- JBS- JLT- JOS-H-	37 47	4M6 4M6	300 600	150 150					510 1015	225 445	285 285	160 160					35.1 69.9	15.5 30.6	19.6 19.6	11.0 11.0	
JOS- JBS- JLT-	57	4M6	900	150					1100	670	285	160					75.8	46.1	19.6	11.0	
JOS- JBS- JLT-	14 24 34 44	4M6 4M6 4M6 4M6	150 300 300 600	150 150 150 150		275 275 720 1100					275 275 275 275	80 80 160 160		18.9 18.9 49.6 75.8				18.9 18.9 18.9 18.9	5.51 5.51 11.0 11.0		
JOS- JBS- JLT-	12 22 32 42	4M6 4M6 4M6 4M6	150 300 300 600	150 150 150 150	275 275 525 600						275 275 275 275	80 80 160 160	18.9 18.9 36.1 41.3					18.9 18.9 18.9 18.9	5.51 5.51 11.0 11.0		

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).

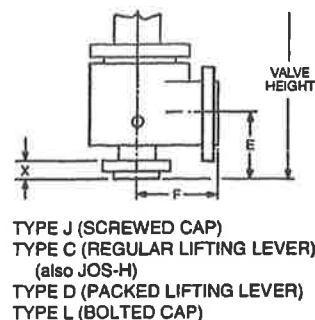
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

Valves set below 15 psig (1.03 barg) cannot be stamped with the ASME Code Symbol. Only metal seated valves may be set below 15 psig.

## Dimensions and Weights

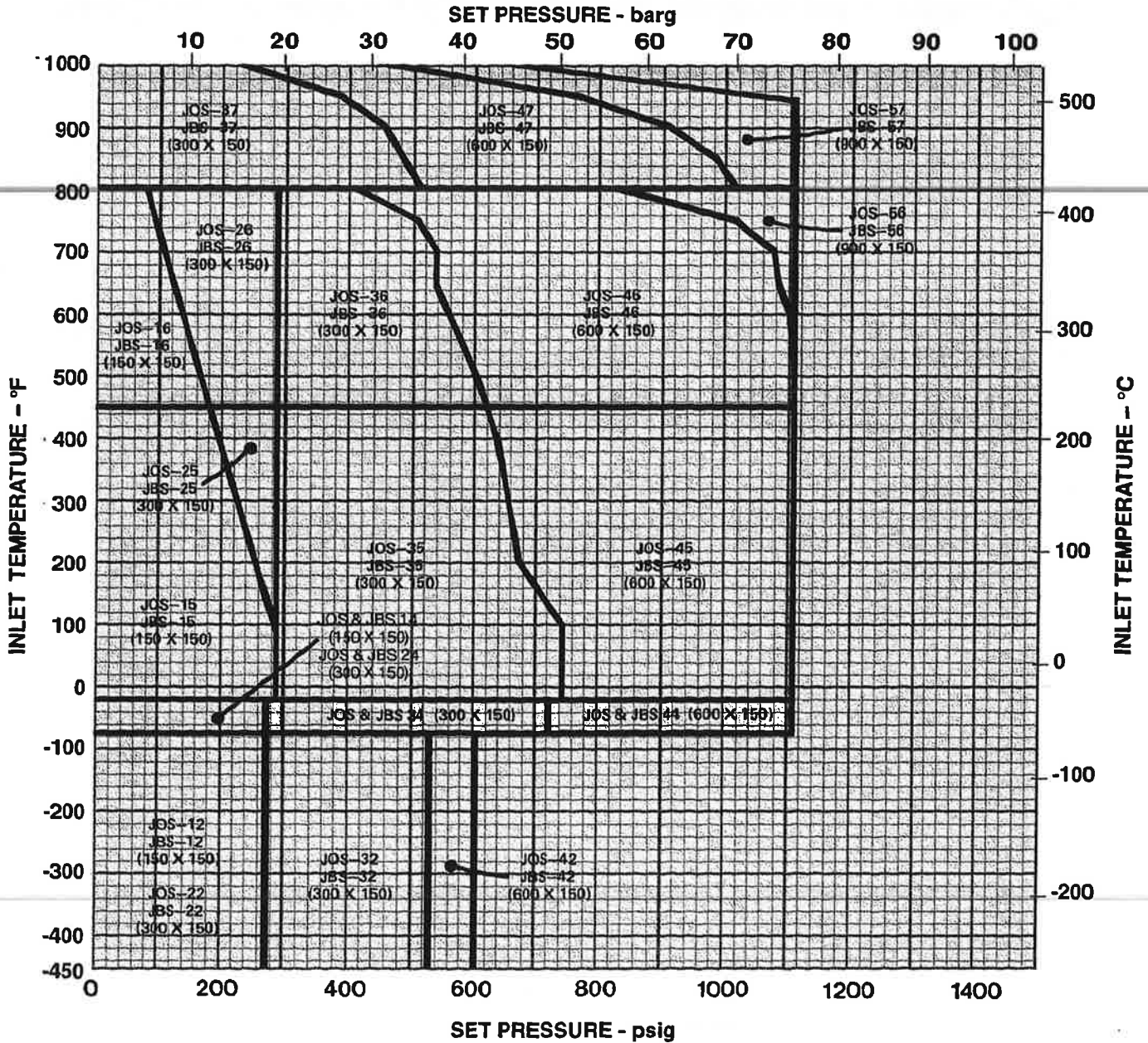
M Orifice

Valve Style	Valve Dimensions - in. (mm)	Valve Dimensions - in. (mm)						Approx. Weight lbs(kg)
		Center to Face		Use To Find Bolt Length	Approximate Height			
		Inlet	Outlet		J & L	C	D	
JOS- JBS- JLT- JOS-H-	12,14,15,16, 22,24,25,26	7 (178)	7-1/4 (184)	2-1/8 (54)	33-1/2 (851)	33 (838)	33-3/4 (857)	201 (91)
	32,34,35,36,37	7 (178)	7-1/4 (184)	2-1/8 (54)	36 (914)	35-1/2 (902)	36 (914)	222 (101)
	42,44,45,46,47	7 (178)	8 (203)	2-7/16 (62)	42 (1067)	41 (1041)	41-3/4 (1060)	265 (120)
	56,57	7 3/4 (197)	8-3/4 (222)	2-9/16 (65)	42-3/4 (1086)	41-3/4 (1060)	42-1/2 (1080)	290 (132)



# Pressure-Temperature Limit Chart

**M Orifice**  
**3.60 sq. in.**  
**(2323 sq.mm)**  
**Effective Area**



# Specifications - Crosby Styles JOS, JBS, JLT and JOS-H

**N Orifice**  
4.34 sq. in.  
(2800 sq. mm)  
Effective Area

**Sizes and Pressure/Temperature Limits**  
(See also Set Pressure Chart Opposite)

**Low Set Pressure Limits:**  
JOS = 8 psig (0.55 barg)  
JBS = 10 psig (0.68 barg)  
JLT-JOS = 15 psig (1.03 barg)  
JLT-JBS = 25 psig (1.72 barg)

Valve Style	Valve Size		Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig						Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg	
	Inlet x Orifice x Outlet	Inlet	Outlet	Inlet						JOS †	JBS †	Inlet						JOS †	JBS †	
				-450F to -76F	-75F to -21F	-20F to +100F	+450F	+800F	+1000F			-260C to -60C	-50C to -30C	-20C to +30C	+32C	+42C	+53C			
JOS- JBS- JLT- *JOS-H-	15 25 35 45	4N6 4N6 4N6 4N6	150 300 300 600	150 150 150 150			285 285 740 1000	185 285 615 1000			285 285 285 285	80 80 160 160			19.6 19.6 51.0 68.9	12.7 19.6 42.4 68.9			19.6 19.6 19.6 19.6	5.51 5.51 11.0 11.0
JOS- JBS- JLT- JOS-H-	16 26 36 46	4N6 4N6 4N6 4N6	150 300 300 600	150 150 150 150			185 285 615 1000	80 285 410 825			285 285 285 285	80 80 160 160			12.7 19.6 42.4 68.9	5.51 19.6 28.2 56.8			19.6 19.6 19.6 19.6	5.51 5.51 11.0 11.0
JOS- JBS- JLT- JOS-H-	37 47	4N6 4N6	300 600	150 150				510 1000	225 445	285 285	160 160					35.1 68.9	15.5 30.6	19.6 19.6	11.0 11.0	
JOS- JBS- JLT-	14 24 34 44	4N6 4N6 4N6 4N6	150 300 300 600	150 150 150 150		275 275 720 1000				275 275 275 275	80 80 160 160		18.9 18.9 49.6 68.9					18.9 18.9 18.9 18.9	5.51 5.51 11.0 11.0	
JOS- JBS- JLT-	12 22 32 42	4N6 4N6 4N6 4N6	150 300 300 600	150 150 150 150	275 275 450 500					275 275 275 275	80 80 160 160	18.9 18.9 31.0 34.4						18.9 18.9 18.9 18.9	5.51 5.51 11.0 11.0	

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).

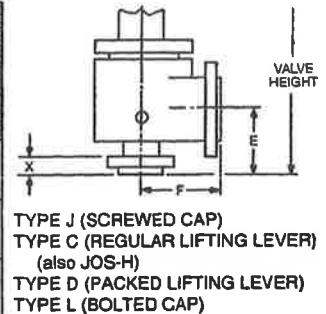
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

Valves set below 15 psig (1.03 barg) cannot be stamped with the ASME Code Symbol. Only metal seated valves may be set below 15 psig.

## Dimensions and Weights

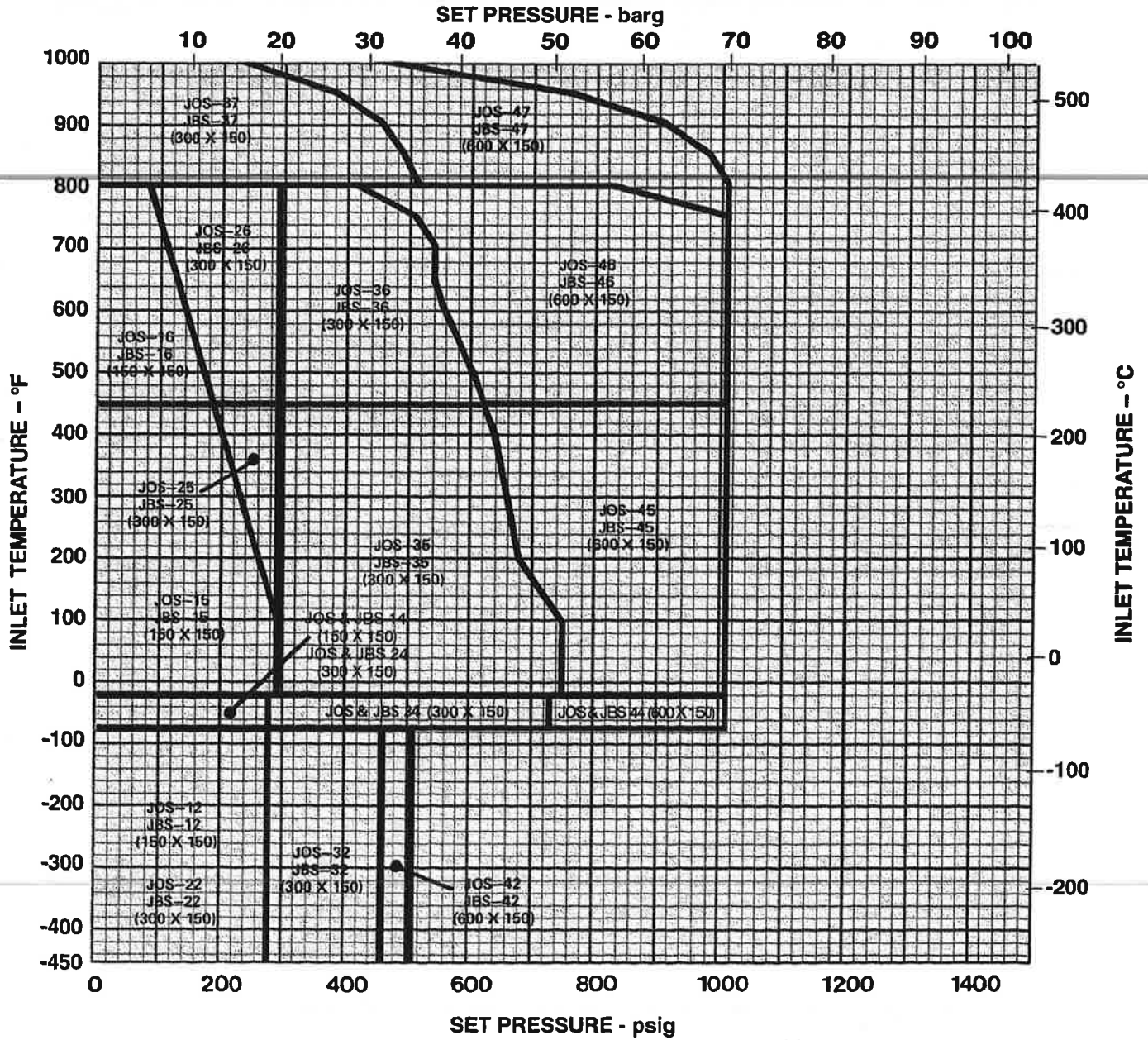
### N Orifice

Valve Style	Valve Dimensions - in. (mm)	Valve Dimensions - in. (mm)						Approx. Weight (lbs/kg)
		Center to Face		Use To Find Bolt Length	Approximate Height			
		Inlet	Outlet		Valve (Cap) Type			
		E	F	X	J & L	C	D	
JOS- JBS- JLT- JOS-H-	12,14,15,16, 22,24,25,26 32,34,35,36,37 42,44,45,46,47	7-3/4 (197)	8-1/4 (210)	2-1/8 (54)	43-1/4 (1099)	42-1/4 (1073)	43 (1092)	260 (118) 280 (127) 297 (135)



# Pressure-Temperature Limit Chart

**N Orifice**  
**4.34 sq. in.**  
**(2800 sq.mm)**  
**Effective Area**





# Specifications - Crosby Styles JOS, JBS, JLT and JOS-H

**P Orifice**  
**6.38 sq. in.**  
**(4116 sq. mm)**  
**Effective Area**

**Sizes and Pressure/Temperature Limits**  
**(See also Set Pressure Chart Opposite)**

**Low Set Pressure Limits:**  
**JOS = 7 psig (0.48 barg)**  
**JBS = 8 psig (0.55 barg)**  
**JLT-JOS = 15 psig (1.03 barg)**  
**JLT-JBS = 25 psig (1.72 barg)**

Valve Style	Valve Size	Inlet x Orifice x Outlet	Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig						Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg	
			Inlet	Outlet	Inlet						JOS ↑	JBS ↑	Inlet						JOS ↑	JBS ↑
					-450F to -76F	-75F to -21F	-20F to +100F	+450F	+800F	+1000F			268C to -60C	50C to -38C	29C to +38C	+232C	+427C	+538C		
JOS-15 JBS-25 JLT-35 *JOS-H-45	4P6	150 300 300 600	150 150 150 150			285 185 525 1000	185 285 525 1000			285 285 285 285	80 80 150 150			19.6 19.6 36.1 68.9	12.7 19.6 36.1 68.9			19.6 19.6 19.6 19.6	5.51 5.51 10.3 10.3	
JOS-16 JBS-26 JLT-36 JOS-H-46	4P6	150 300 300 600	150 150 150 150				185 285 525 1000	80 285 410 825			285 285 285 285	80 80 150 150			12.7 19.6 36.1 68.9	5.51 19.6 28.1 56.8			19.6 19.6 19.6 19.6	5.51 5.51 10.3 10.3
JOS-37 JBS-47	4P6	300 600	150 150					510 1000	225 445		285 285	150 150					35.1 68.9	15.5 30.6	19.6 19.6	10.3 10.3
JOS-14 JBS-24 JLT-34 JLT-44	4P6	150 300 300 600	150 150 150 150		275 275 525 1000						275 275 275 275	80 80 150 150		18.9 18.9 36.1 68.9					18.9 18.9 18.9 18.9	5.51 5.51 10.3 10.3
JOS-12 JBS-22 JBS-32 JLT-42	4P6	150 300 300 600	150 150 150 150	175 175 300 480							275 275 275 275	80 80 150 150	12.0 12.0 20.6 33.0						18.9 18.9 18.9 18.9	5.51 5.51 10.3 10.3

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).

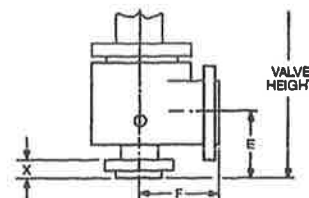
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

Valves set below 15 psig (1.03 barg) cannot be stamped with the ASME Code Symbol. Only metal seated valves may be set below 15 psig.

## Dimensions and Weights

## P Orifice

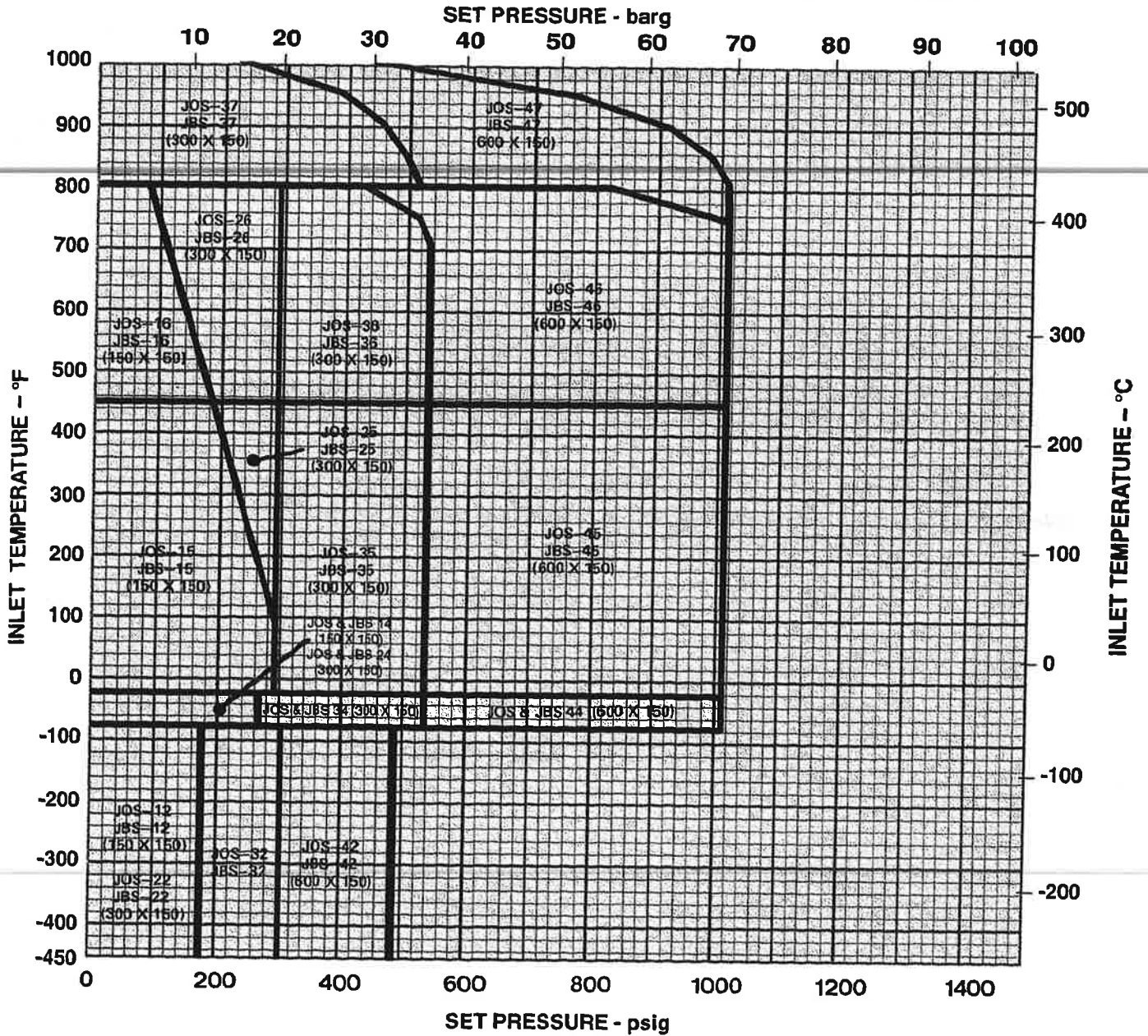
Valve Style	Valve Dimensions - In. (mm)	Valve Dimensions - In. (mm)						Approx. Weight lbs(kg)
		Center to Face		Use To Find Bolt Length	Approximate Height			
		Inlet	Outlet		J & L	C	D	
JOS-12,14,15,16, JBS-22,24,25,26	7-1/8 (181)	9 (229)	2-1/8 (54)	42-1/2 (1080)	41-1/2 (1054)	42-1/4 (1073)	270 (122)	
JLT-32,34,35,36,37 JOS-H-42,44,45,46,47	8-7/8 (225)	10 (254)	2-1/8 (54)	44-1/4 (1124)	43-1/4 (1099)	44 (1118)	286 (130)	
	8-7/8 (225)	10 (254)	2-9/16 (65)	46-1/2 (1181)	45-1/2 (1156)	46-1/4 (1175)	401 (182)	



TYPE J (SCREWED CAP)  
 TYPE C (REGULAR LIFTING LEVER)  
 (also JOS-H)  
 TYPE D (PACKED LIFTING LEVER)  
 TYPE L (BOLTED CAP)

# Pressure-Temperature Limit Chart

**P Orifice**  
**6.38 sq. in.**  
**(4116 sq.mm)**  
**Effective Area**



# Specifications - Crosby Styles JOS, JBS, JLT and JOS-H

**Q Orifice**  
**11.05 sq. in.**  
**(7129 sq. mm)**  
**Effective Area**

**Sizes and Pressure/Temperature Limits**  
**(See also Set Pressure Chart Opposite)**

**Low Set Pressure Limits:**  
**JOS = 5 psig (0.34 barg)**  
**JBS = 7 psig (0.48 barg)**  
**JLT-JOS = 15 psig (1.03 barg)**  
**JLT-JBS = 25 psig (1.72 barg)**

Valve Style	Valve Size	Inlet x Orifice x Outlet	Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig						Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg	
					Inlet								Inlet							
					Inlet	Outlet	-450F to -76F	-75F to -21F	-20F to +100F	* +450F	+800F	+1000F	JOS †	JBS †	-268C to -60C	-59C to -30C	-29C to +38C	* +232C	+427C	+538C
JOS-15	6Q8	150	150			165	165			115	70				11.3	11.3			7.92	4.82
JBS-25	6Q8	300	150			165	165			115	70				11.3	11.3			7.92	4.82
JLT-35	6Q8	300	150			300	300			115	115				20.6	20.6			7.92	7.92
JOS-H-45	6Q8	600	150			600	600			115	115				41.3	41.3			7.92	7.92
JOS-16	6Q8	150	150				165	80		115	70				11.3	5.51			7.92	4.82
JBS-26	6Q8	300	150				165	165		115	70				11.3	11.3			7.92	4.82
JLT-36	6Q8	300	150				300	300		115	115				20.6	20.6			7.92	7.92
JOS-H-46	6Q8	600	150				600	600		115	115				41.3	41.3			7.92	7.92
JOS-37	6Q8	300	150					165	165	115	115						11.3	11.3	7.92	7.92
JBS-47	6Q8	600	150					600	445	115	115						41.3	30.6	7.92	7.92
JOS-14	6Q8	150	150		165					115	70		11.3						7.92	4.82
JBS-24	6Q8	300	150		165					115	70		11.3						7.92	4.82
JBS-34	6Q8	300	150		300					115	115		20.6						7.92	7.92
JLT-44	6Q8	600	150		600					115	115		41.3						7.92	7.92
JOS-12	6Q8	150	150	165						115	70	11.3							7.92	4.82
JBS-22	6Q8	300	150	165						115	70	11.3							7.92	4.82
JBS-32	6Q8	300	150	250						115	115	17.2							7.92	7.92
JLT-42	6Q8	600	150	300						115	115	20.6							7.92	7.92

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).

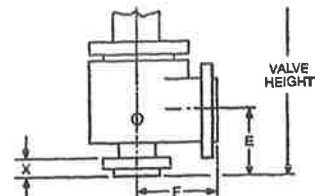
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

Valves set below 15 psig (1.03 barg) cannot be stamped with the ASME Code Symbol. Only metal seated valves may be set below 15 psig.

## Dimensions and Weights

## Q Orifice

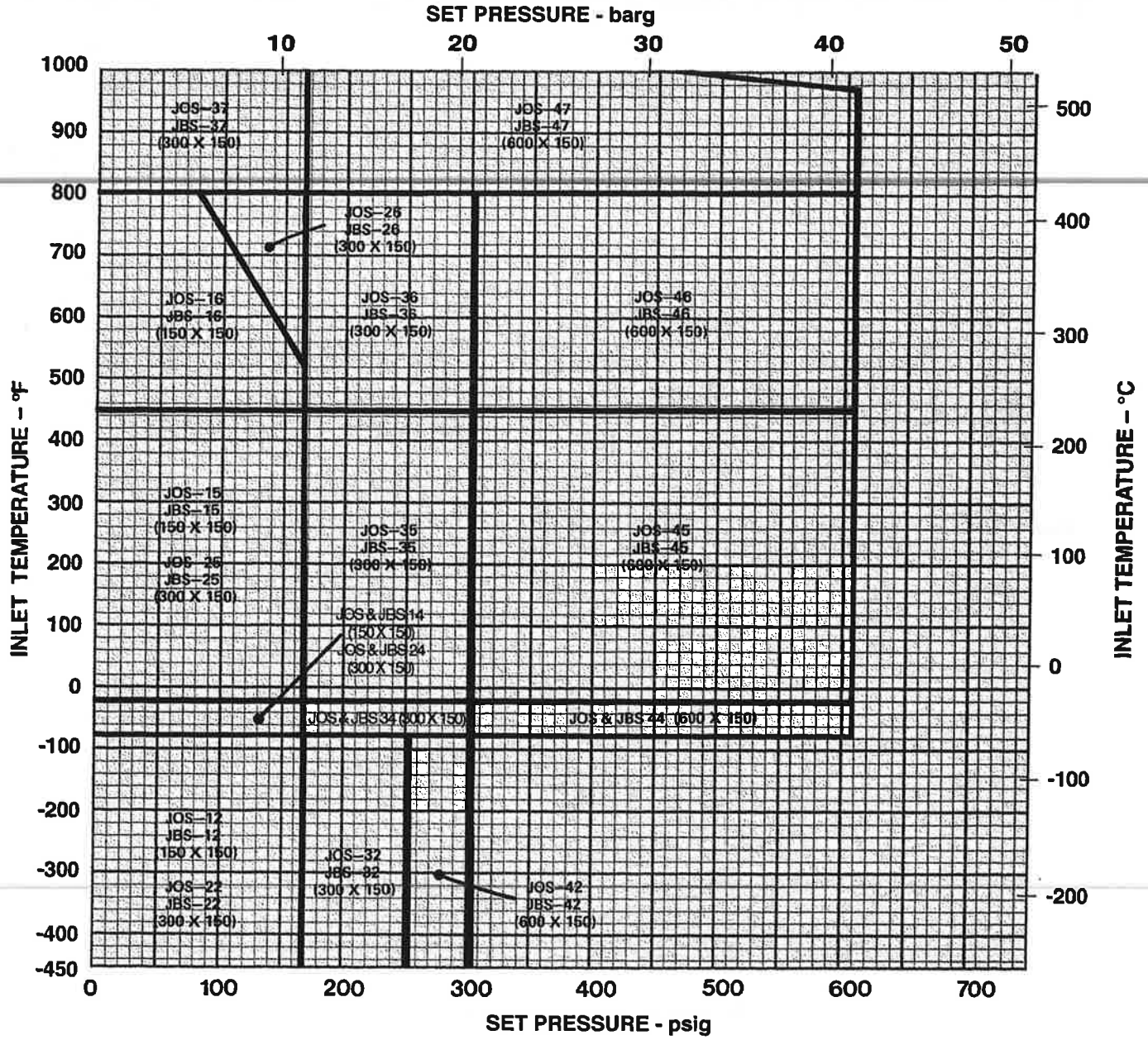
Valve Style	Valve Dimensions - In. (mm)	Valve Dimensions - In. (mm)						Approx. Weight lbs(kg) Type J
		Center to Face		Use To Find Bolt Length	Approximate Height			
		Inlet	Outlet		Valve (Cap) Type			
		E	F	X	J & L	C	D	
JOS-12,14,15,16, JBS-22,24,25,26	9-7/16 (240)	9-1/2 (241)	2-5/16 (59)	47-3/4 (1213)	46-3/4 (1187)	47-1/2 (1207)	481 (218)	
JLT-32,34,35,36,37 JOS-H-42,44,45,46,47	9-7/16 (240)	9-1/2 (241)	2-5/16 (59)	47-3/4 (1213)	46-3/4 (1187)	47-1/2 (1207)	492 (223)	
	9-7/16 (240)	9-1/2 (241)	2-15/16 (75)	51-3/4 (1314)	50-3/4 (1289)	51-1/2 (1308)	565 (256)	



TYPE J (SCREWED CAP)  
 TYPE C (REGULAR LIFTING LEVER)  
 (also JOS-H)  
 TYPE D (PACKED LIFTING LEVER)  
 TYPE L (BOLTED CAP)

# Pressure-Temperature Limit Chart

**Q Orifice**  
 11.05 sq. in.  
 (7129 sq.mm)  
 Effective Area



# Specifications - Crosby Styles JOS, JBS, JLT and JOS-H

**R Orifice**  
**16.0 sq. in.**  
**(10323 sq. mm)**  
**Effective Area**

**Sizes and Pressure/Temperature Limits**  
 (See also Set Pressure Chart Opposite)

**Low Set Pressure Limits:**  
 JOS = 8 psig (0.55 barg)  
 JBS = 8 psig (0.55 barg)  
 JLT-JOS = 15 psig (1.03 barg)  
 JLT-JBS = 25 psig (1.72 barg)

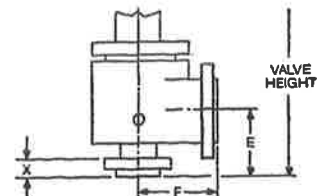
Valve Style	Valve Size		Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig						Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg				
	Inlet x Orifice x Outlet	Inlet			Outlet	Inlet							Inlet										
			-45F to -76F	-75F to -21F		-20F to +100F	+450F	+800F	+1000F	JOS †	JBS †	-268C to -60C	-59C to -30C	-29C to +38C	+232C	+427C	+538C	JOS †	JBS †				
JOS-15 JBS-25 JLT-35 JOS-H-45	6R8 6R8 6R10 6R10	150 300 300 600	150 150 150 150			100 100 230 300	100 100 230 300				60 60 100 100	60 60 100 100				6.89 6.89 15.8 20.6	6.89 6.89 15.8 20.6			4.13 4.13 6.89 6.89	4.13 4.13 6.89 6.89		
JOS-16 JBS-26 JLT-36 JOS-H-46	6R8 6R8 6R10 6R10	150 300 300 600	150 150 150 150			100 100 230 300	80 100 230 300				60 60 100 100	60 60 100 100				6.89 6.89 15.8 20.6	5.51 6.89 15.8 20.6			4.13 4.13 6.89 6.89	4.13 4.13 6.89 6.89		
JOS-37 JBS-47 JLT-47 JOS-H-47	6R8 6R10	300 600	150 150					100 300	100 300		60 100	60 100						6.89 20.6	6.89 20.6			4.13 6.89	4.13 6.89
JOS-14 JBS-24 JLT-34 JLT-44	6R8 6R8 6R10 6R10	150 300 300 600	150 150 150 150		100 100 230 300						60 60 100 100	60 60 100 100		6.89 6.89 15.8 20.6							4.13 4.13 6.89 6.89	4.13 4.13 6.89 6.89	
JOS-12 JBS-22 JLT-32 JLT-42	6R8 6R8 6R10 6R10	150 300 300 600	150 150 150 150	55 55 150 200							60 60 100 100	60 60 100 100	3.79 3.79 10.3 13.7								4.13 4.13 6.89 6.89	4.13 4.13 6.89 6.89	

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).  
 †Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.  
 Valves set below 15 psig (1.03 barg) cannot be stamped with the ASME Code Symbol. Only metal seated valves may be set below 15 psig.

## Dimensions and Weights

**R Orifice**

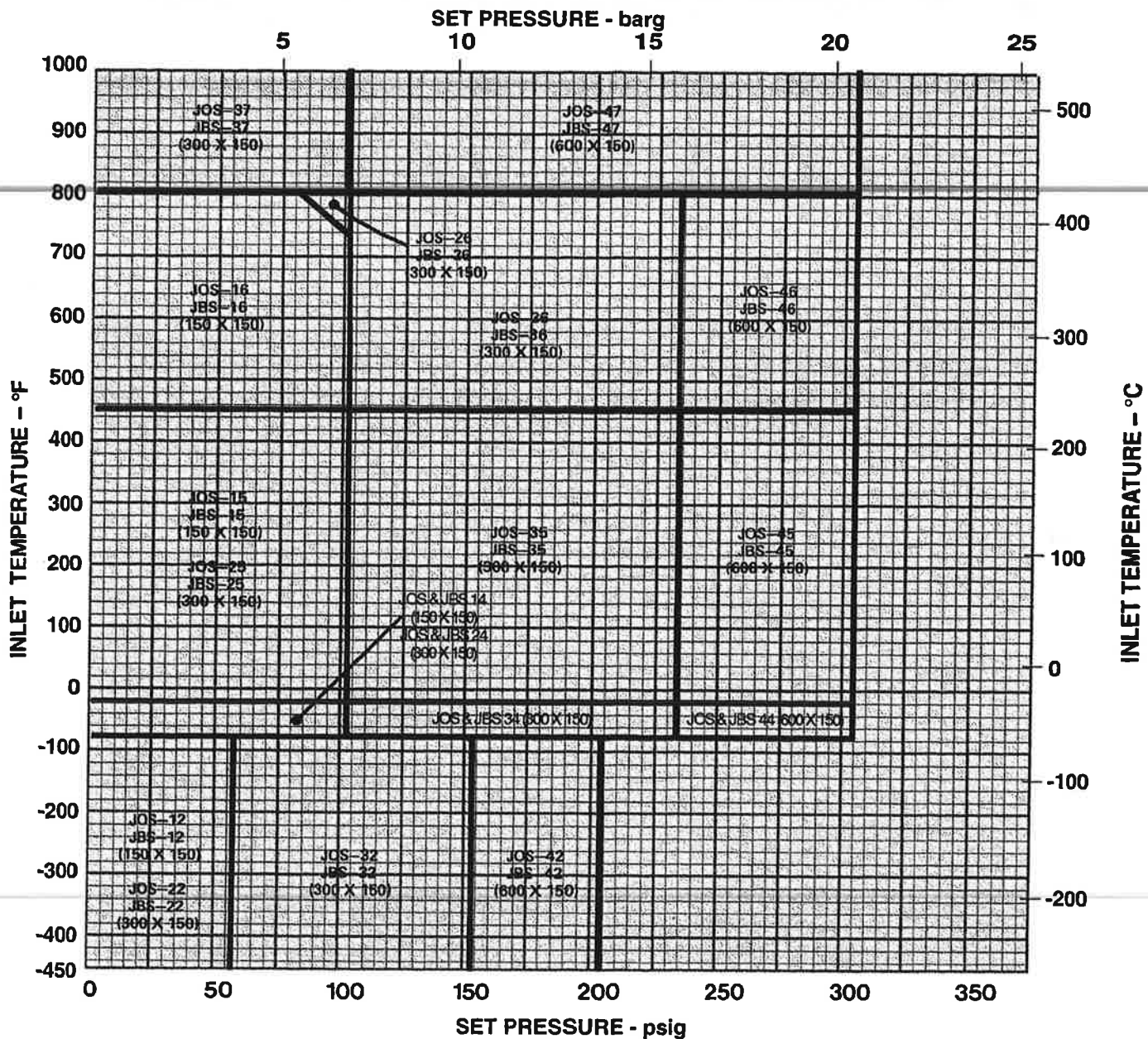
Valve Style	Valve Dimensions - in. (mm)	Valve Dimensions - in. (mm)						Approx. Weight (lb/kg)	Approx. Type
		Center to Face		Use To Find Bolt Length	Approximate Height				
		Inlet	Outlet		J & L	C	D		
JOS-12,14,15,16, JBS-22,24,25,26	12,14,15,16, 22,24,25,26	9-7/16 (240)	9-1/2 (241)	2-5/16 (59)	53-1/4 (1353)	52-1/2 (1334)	53-1/4 (1353)	564 (256)	J
JLT-32,34,35,36,37 JOS-H-42,44,45,46,47	32,34,35,36,37 42,44,45,46,47	9-7/16 (240)	10-1/2 (267)	2-5/16 (59)	53-1/4 (1353)	52-1/2 (1334)	53-1/4 (1353)	602 (273)	J
		9-7/16 (240)	10-1/2 (267)	2-3/4 (70)	53-1/4 (1353)	52-1/2 (1334)	53-1/4 (1353)	631 (286)	J



TYPE J (SCREWED CAP)  
 TYPE C (REGULAR LIFTING LEVER)  
 (also JOS-H)  
 TYPE D (PACKED LIFTING LEVER)  
 TYPE L (BOLTED CAP)

# Pressure-Temperature Limit Chart

**R Orifice**  
 16.0 sq. in.  
 (10323 sq.mm)  
 Effective Area



# Specifications - Crosby Styles JOS, JBS, JLT and JOS-H

T Orifice  
26.0 sq. in.  
(16774 sq. mm)  
Effective Area

Sizes and Pressure/Temperature Limits  
(See also Set Pressure Chart Opposite)

Low Set Pressure Limits:  
JOS = 8 psig (0.55 barg)  
JBS = 8 psig (0.55 barg)  
JLT-JOS = 15 psig (1.03 barg)  
JLT-JBS = 25 psig (1.72 barg)

Valve Style	Valve Size	Inlet x Orifice x Outlet	Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig						Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg	
			Inlet	Outlet	Inlet						JOS †	JBS †	Inlet						JOS †	JBS †
					-450F to -76F	-75F to -21F	-20F to +100F	* +450F	+800F	+1000F			-268C to -60C	-59C to -30C	-29C to +38C	* +232C	+427C	+538C		
JOS- JBS- JLT- *JOS-H-	15 25 35 45	8T10 8T10 8T10 8T10	150 300 300 300	150 150 150 150			65 65 120 300	65 65 120 300			30 30 60 100	30 30 60 100			4.48 4.48 8.27 20.6	4.48 4.48 8.27 20.6			2.06 2.06 4.13 6.89	2.06 2.06 4.13 6.89
JOS- JBS- JLT- JOS-H-	16 26 36 46	8T10 8T10 8T10 8T10	150 300 300 300	150 150 150 150			65 65 120 300	65 65 120 300			30 30 60 100	30 30 60 100			4.48 4.48 8.27 20.6	4.48 4.48 8.27 20.6			2.06 2.06 4.13 6.89	2.06 2.06 4.13 6.89
JOS- JBS- JLT- JOS-H-	37	8T10	300	150					300	225	60	60					20.6	15.5	4.13	4.13
JOS- JBS- JLT-	14 24 34	8T10 8T10 8T10	150 300 300	150 150 150		65 65 120					30 30 60	30 30 60		4.48 4.48 8.27					2.06 2.06 4.13	2.06 2.06 4.13
JOS- JBS- JLT-	12 22 32	8T10 8T10 8T10	150 300 300	150 150 150	50 50 65						30 30 60	30 30 60	3.44 3.44 4.48						2.06 2.06 4.13	2.06 2.06 4.13

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).

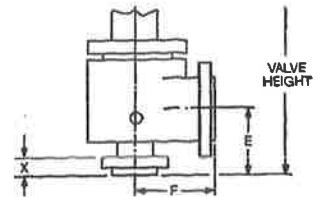
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

Valves set below 15 psig (1.03 barg) cannot be stamped with the ASME Code Symbol. Only metal seated valves may be set below 15 psig.

## Dimensions and Weights

### T Orifice

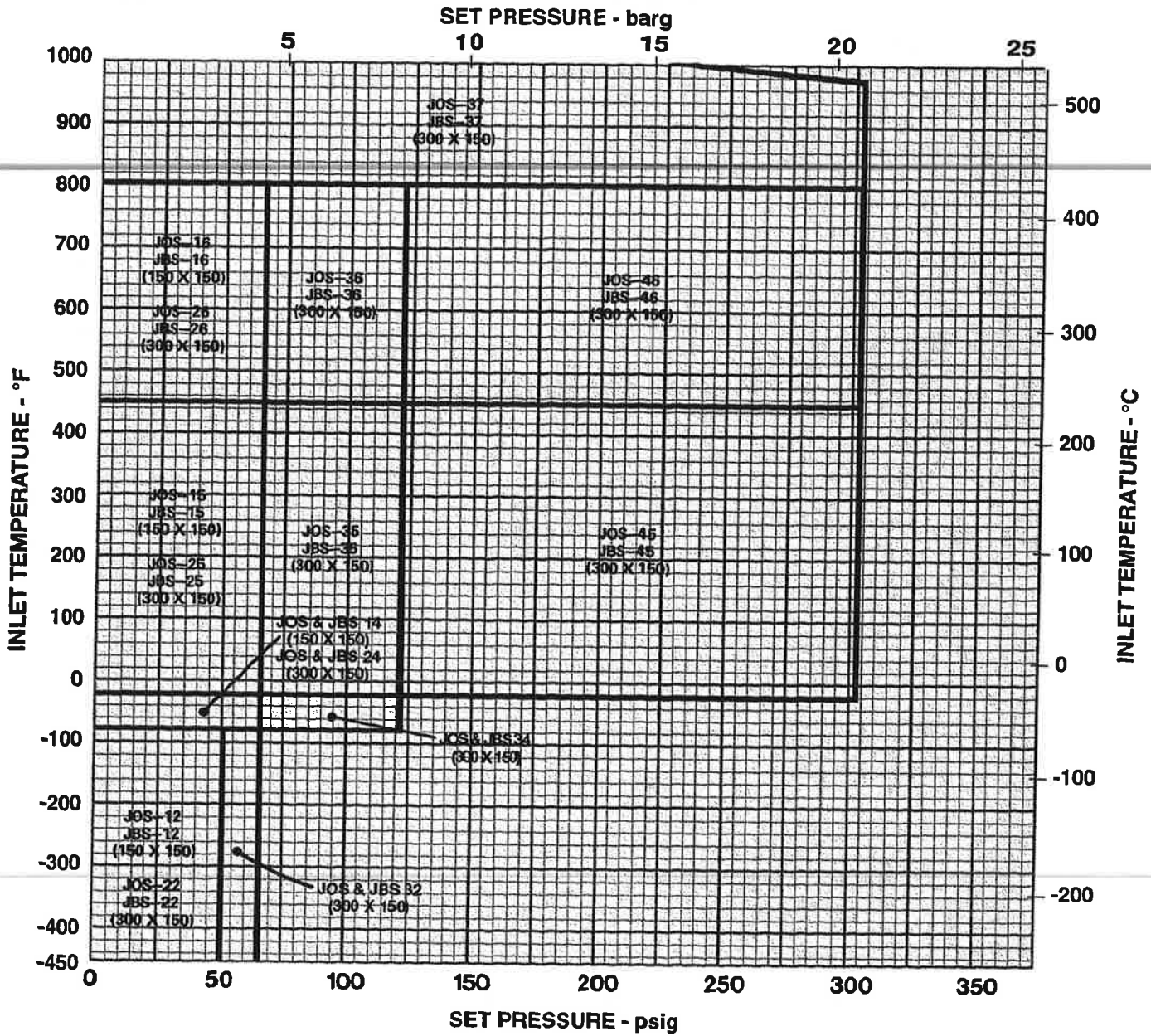
Valve Style		Valve Dimensions - In. (mm)						Approx. Weight lbs(kg) Type J
		Center to Face		Use To Find Bolt Length	Approximate Height			
		Inlet	Outlet		Valve (Cap) Type			
		E	F	X	J & L	C	D	
JOS- JBS- JLT- JOS-H-	12,14,15,16, 22,24,25,26 32,34,35,36,37 45,46	10-7/8 (276) 10-7/8 (276) 10-7/8 (276)	11 (279) 11 (279) 11 (279)	2-9/16 (65) 2-9/16 (65) 2-9/16 (65)	59-1/2 (1511) 59-1/2 (1511) 59-1/2 (1511)	58-1/2 (1486) 58-1/2 (1486) 58-1/2 (1486)	59-1/4 (1505) 59-1/4 (1505) 59-1/4 (1505)	882 (400) 902 (409) 930 (422)



TYPE J (SCREWED CAP)  
TYPE C (REGULAR LIFTING LEVER)  
(also JOS-H)  
TYPE D (PACKED LIFTING LEVER)  
TYPE L (BOLTED CAP)

# Pressure-Temperature Limit Chart

**T Orifice**  
**26.0 sq. in.**  
**(16774 sq.mm)**  
**Effective Area**





# Specifications - Crosby Styles JOS, JBS and JOS-H

**T2 Orifice**  
**27.872 sq. in.**  
**(17981 sq. mm)**  
**Effective Area**

**Sizes and Pressure/Temperature Limits**  
**(See also Set Pressure Chart Opposite)**

**Low Set Pressure Limits:**  
**JOS = 8 psig (0.55 barg)**  
**JBS = 8 psig (0.55 barg)**

Valve Style	Valve Size		Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig						Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg	
	Inlet x Orifice x Outlet	Inlet	Outlet	Inlet						JOS †	JBS †	Inlet						JOS †	JBS †	
				-450F to -76F	-75F to -21F	-20F to +100F	+450F	+800F	+1000F			-288C to -60C	-59C to -30C	-29C to +38C	* +232C	+427C	+538C			
JOS- JBS- JOS-H-	15 25 35 45	8T210 8T210 8T210 8T210	150 300 300 300	150 150 150 150			65 65 120 300	65 65 120 300			30 30 60 100	30 30 60 100			4.48 4.48 8.27 20.6	4.48 4.48 8.27 20.6			2.06 2.06 4.13 6.89	2.06 2.06 4.13 6.89
JOS- JBS- JOS-H-	16 26 36 46	8T210 8T210 8T210 8T210	150 300 300 300	150 150 150 150			65 65 120 300	65 65 120 300			30 30 60 100	30 30 60 100			4.48 4.48 8.27 20.6	4.48 4.48 8.27 20.6			2.06 2.06 4.13 6.89	2.06 2.06 4.13 6.89
JOS- JBS- JOS-H-	37	8T210	300	150					300	225	60	60					20.6	15.5	4.13	4.13
JOS- JBS-	14 24 34	8T210 8T210 8T210	150 300 300	150 150 150		65 65 120					30 30 60	30 30 60		4.48 4.48 8.27					2.06 2.06 4.13	2.06 2.06 4.13
JOS- JBS-	12 22 32	8T210 8T210 8T210	150 300 300	150 150 150	50 50 65						30 30 60	30 30 60	3.44 3.44 4.48						2.06 2.06 4.13	2.06 2.06 4.13

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).

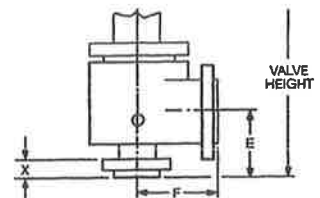
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

Valves set below 15 psig (1.03 barg) cannot be stamped with the ASME Code Symbol. Only metal seated valves may be set below 15 psig.

## Dimensions and Weights

T2 Orifice

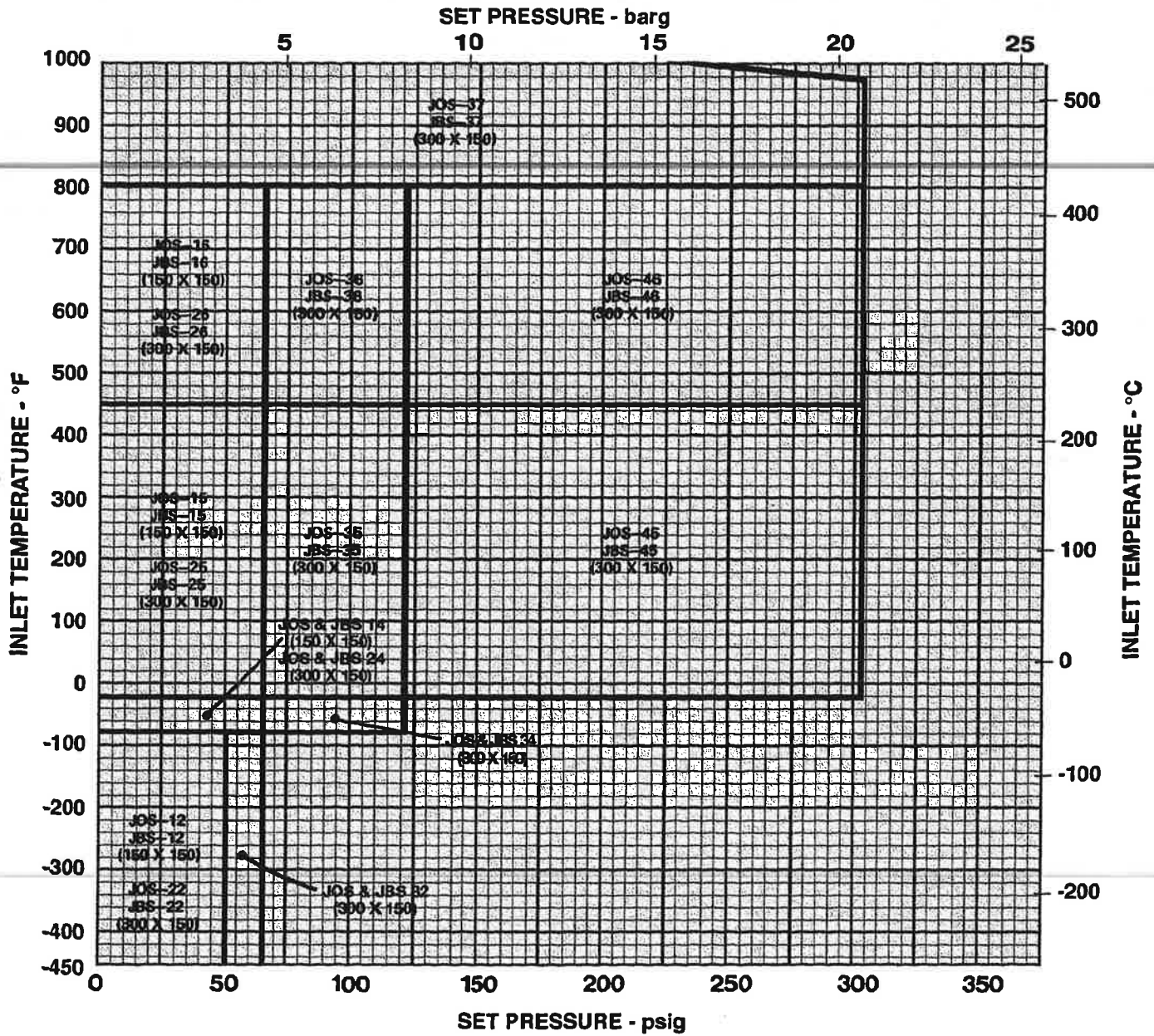
Valve Style	Valve Dimensions - in. (mm)						Approx. Weight lbs(kg)	
	Center to Face		Use To Find Bolt Length	Approximate Height				
	Inlet	Outlet		Valve (Cap) Type				
	E	F	X	J & L	C	D	J	
JOS- JBS- JOS-H-	12,14,15,16, 22,24,25,26	10-7/8 (276)	11 (279)	2-9/16 (65)	59-1/2 (1511)	58-1/2 (1486)	59-1/4 (1505)	882 (400)
	32,34,35,36,37	10-7/8 (276)	11 (279)	2-9/16 (65)	59-1/2 (1511)	58-1/2 (1486)	59-1/4 (1505)	902 (409)
	45,46	10-7/8 (276)	11 (279)	2-9/16 (65)	59-1/2 (1511)	58-1/2 (1486)	59-1/4 (1505)	930 (422)



TYPE J (SCREWED CAP)  
 TYPE C (REGULAR LIFTING LEVER)  
 (also JOS-H)  
 TYPE D (PACKED LIFTING LEVER)  
 TYPE L (BOLTED CAP)

# Pressure-Temperature Limit Chart

**T2 Orifice**  
 27.872 sq. in.  
 (17981 sq.mm)  
 Effective Area



# Air Capacities

## Styles JOS and JBS

Capacity in standard cubic feet per minute of air at 60F and 10% overpressure.† Valve discharging to atmospheric pressure.

**Set Pressures**  
5-780 psig

USCS UNITS  
United States Customary System

Shaded values are JOS only

Capacities certified by the National Board of Boiler and Pressure Vessel Inspectors and in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII.

Note: For air capacities, USCS Units are exact equivalents of Imperial Units.

Set Pressure (psig)	ORIFICE LETTER DESIGNATION AND EFFECTIVE AREA, sq. in.															
	D 0.110	E 0.196	F 0.307	G 0.503	H 0.785	J 1.287	K 1.838	L 2.853	M 3.60	N 4.34	P 6.38	Q 11.05	R 16.0	T 26.0	T2 27.872	
*1 psi incr.	2.1	3.8	6.0	9.8	15.4	25.3	36.1	56.1	70.8	85.3	125	217	314	511	548	
*5 psi incr.	10.8	19.2	30.2	49.4	77.2	126	180	280	354	426	627	1087	1574	2557	2742	
5			121	199	311	510	728					4379				
6			128	211	329	540	771	1197				4637				
7			135	221	345	566	808	1255			2807	4862				
8		89.9	140	230	360	590	843	1308	1651	1991	2927	5069	7340	11928	12787	
9		93.6	146	240	374	614	877	1362	1719	2072	3047	5277	7641	12417	13312	
10	54.5	97.1	152	249	388	637	910	1413	1783	2150	3161	5475	7928	12883	13810	
15	64.3	114	179	294	459	752	1075	1668	2105	2538	3731	6463	9359	15208	16303	
20	74.1	132	207	339	529	867	1239	1924	2427	2926	4302	7451	10790	17533	18796	
30	93.8	167	261	429	669	1098	1568	2434	3071	3703	5443	9428	13652	22184	23782	
40	115	205	322	528	824	1351	1929	2995	3780	4557	6699	11802	16800	27300	29266	
50	137	244	382	627	978	1604	2291	3557	4488	5411	7954	13777	19948	32416	34750	
60	158	282	443	726	1133	1857	2653	4118	5196	6265	9209	15951	23097	37532	40235	
70	180	321	503	825	1287	2111	3014	4679	5905	7119	10465	18125	26245	42648	45719	
80	202	360	563	924	1442	2364	3376	5241	6613	7973	11720	20300	29393	47764	51203	
90	223	398	624	1023	1596	2617	3738	5802	7321	8827	12976	22474	32542	52880	56688	
100	245	437	684	1122	1751	2870	4099	6364	8030	9680	14231	24648	35690	57996	62172	
120	288	514	805	1319	2059	3377	4823	7486	9447	11388	16742	28997	41986	68228	73141	
140	331	591	926	1517	2368	3883	5546	8609	10863	13096	19253	33345	48283	78460	84109	
160	375	668	1047	1715	2677	4390	6269	9732	12280	14804	21763	37694	54580	88692	95078	
180	418	745	1168	1913	2986	4896	6993	10855	13697	16512	24274	42043	60876	98924	106047	
200	461	822	1288	2111	3295	5403	7716	11977	15114	18220	26785	46391	67173	109156	117015	
220	505	900	1409	2309	3604	5909	8439	13100	16530	19928	29296	50740	73469	119388	127984	
240	548	977	1530	2507	3913	6416	9163	14223	17947	21636	31806	55088	79766	129620	138953	
260	591	1054	1651	2705	4222	6922	9886	15346	19364	23344	34317	59437	86063	139852	149922	
280	634	1131	1772	2903	4531	7429	10609	16468	20780	25052	36828	63785	92359	150084	160890	
300	678	1208	1892	3101	4840	7935	11333	17591	22197	26760	39339	68134	98656	160316	171859	
320	721	1285	2013	3299	5149	8442	12056	18714	23614	28468	41850	72483				
340	764	1362	2134	3497	5458	8948	12779	19837	25031	30176	44360	76831				
360	808	1439	2255	3695	5767	9455	13503	20959	26447	31884	46871	81180				
380	851	1517	2376	3893	6076	9961	14226	22082	27864	33592	49382	85528				
400	894	1594	2497	4091	6384	10468	14949	23205	29281	35300	51893	89877				
420	937	1671	2617	4289	6693	10974	15673	24328	30698	37008	54403	94226				
440	981	1748	2738	4487	7002	11481	16396	25451	32114	38716	56914	98574				
460	1024	1825	2859	4685	7311	11987	17119	26573	33531	40424	59425	102923				
480	1067	1902	2980	4883	7620	12494	17843	27696	34948	42132	61936	107271				
500	1111	1979	3101	5081	7929	13000	18566	28819	36365	43840	64446	111620				
520	1154	2057	3221	5278	8238	13506	19289	29942	37781	45548	66957	115969				
540	1197	2134	3342	5476	8547	14013	20013	31064	39198	47256	69468	120317				
560	1241	2211	3463	5674	8856	14519	20736	32187	40615	48963	71979	124666				
580	1284	2288	3584	5872	9165	15026	21459	33310	42032	50671	74490	129014				
600	1327	2365	3705	6070	9474	15532	22182	34433	43448	52379	77000	133363				
620	1370	2442	3826	6268	9783	16039	22906	35555	44865	54087	79511					
640	1414	2519	3946	6466	10092	16545	23629	36678	46282	55795	82022					
660	1457	2596	4067	6664	10401	17052	24352	37801	47698	57503	84533					
680	1500	2674	4188	6862	10709	17558	25076	38924	49115	59211	87043					
700	1544	2751	4309	7060	11018	18065	25799	40046	50532	60919	89554					
720	1587	2828	4430	7258	11327	18571	26522	41169	51949	62627	92065					
740	1630	2905	4550	7456	11636	19078	27246	42292	53365	64335	94576					
760	1673	2982	4671	7654	11945	19584	27969	43415	54782	66043	97087					
780	1717	3059	4792	7852	12254	20091	28692	44538	56199	67751	99597					

\*Not valid below 30 psig set pressure.

†Capacities below 30 psig set pressure are calculated at 3 psi overpressure.

# Air Capacities Styles JOS and JBS

Set Pressures  
800-6000 psig

USCS UNITS  
(United States Customary System)

Capacity in standard cubic feet per minute of air at 60F and 10% overpressure. Valve discharging to atmospheric pressure.

Capacities certified by the National Board of Boiler and Pressure Vessel Inspectors and in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII.

Note: For air capacities, USCS Units are exact equivalents of Imperial Units.

Set Pressure (psig)	ORIFICE LETTER DESIGNATION AND EFFECTIVE AREA, sq. in.														
	D 0.110	E 0.196	F 0.307	G 0.503	H 0.785	J 1.287	K 1.838	L 2.853	M 3.60	N 4.34	P 6.38	Q 11.05	R 16.0	T 26.0	T2 27.872
1 psi incr.	2.1	3.8	6.0	9.8	15.4	25.3	36.1	56.1	70.8	85.3	125	217	314	511	548
5 psi incr.	10.8	19.2	30.2	49.4	77.2	126	180	280	354	426	627	1087	1574	2557	2742
800	1760	3136	4913	8050	12563	20597	29416	45860	57616	69459	102108				
820	1803	3214	5034	8248	12872	21104	30139	46783	59032	71167	104619				
840	1847	3291	5155	8446	13181	21610	30862	47906	60449	72875	107130				
860	1890	3368	5275	8644	13490	22117	31586	49029	61866	74583	109640				
880	1933	3445	5396	8842	13799	22623	32309	50151	63283	76291	112151				
900	1976	3522	5517	9039	14108	23130	33032	51274	64699	77999	114662				
920	2020	3599	5638	9237	14417	23636	33756	52397	66116	79707	117173				
940	2063	3676	5759	9435	14726	24143	34479	53520	67533	81415	119683				
960	2106	3753	5879	9633	15034	24649	35202	54642	68950	83123	122194				
980	2150	3831	6000	9831	15343	25156	35926	55765	70366	84831	124705				
1000	2193	3908	6121	10029	15652	25662	36649	56888	71783	86538	127216				
1100	2409	4293	6725	11019	17197	28195	40266	62502	78867						
1200	2626	4679	7329	12009	18742	30727	43882	68116							
1300	2842	5065	7933	12998	20286	33259	47499	73729							
1400	3059	5450	8537	13988	21831	35792	51115	79343							
1480	3232	5759	9021	14780	23067	37818	54009	83834							
1500	3275	5836	9141	14978	23375	38324	54732								
1600	3492	6222	9746	15968	24920	40857	58349								
1700	3708	6607	10350	16957	26465	43389	61965								
1800	3924	6993	10954	17947	28009	45921	65582								
1900	4141	7379	11558	18937	29554	48454	69198								
2000	4357	7764	12162	19927	31099	50986	72815								
2100	4574	8150	12766	20916	32643	53519	76432								
2200	4790	8536	13370	21906	34188	56051	80048								
2300	5007	8921	13974	22896	35733	58584									
2400	5223	9307	14578	23886	37277	61116									
2500	5440	9693	15182	24875	38822	63648									
2600	5656	10078	15786	25865	40366	66181									
2700	5872	10464	16390	26855	41911	68713									
2800	6089	10850	16994	27845											
2900	6305	11235	17599	28834											
3000	6522	11621	18203	29824											
3100	6738	12007	18807	30814											
3200	6955	12392	19411	31804											
3300	7171	12778	20015	32793											
3400	7388	13164	20619	33783											
3500	7604	13549	21223	34773											
3600	7820	13935	21827	35763											
3700	8037	14321	22431	36752											
3800	8253	14706	23035												
3900	8470	15092	23639												
4000	8686	15478	24243												
4200	9119	16249	25452												
4400	9552	17020	26660												
4600	9985	17792	27868												
4800	10418	18563	29076												
5000	10851	19334	30284												
5200	11284	20106													
5400	11717	20877													
5600	12149	21648													
5800	12582	22420													
6000	13015	23191													

# Water Capacities

## Styles JLT-JOS and JLT-JBS

Capacity in U.S. gallons per minute of water at 70F and 10% overpressure.

**Differential Pressures  $\Delta P^*$  USCS UNITS**  
**5-1040 psi†** (United States Customary System)

Capacities certified by the National Board of Boiler and Pressure Vessel Inspectors and in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII.

Note: USCS Units for water and liquids are U.S. gallons per minute (1 U.S. gallon equals 0.8327 Imperial gallon).

Diff.* Pressure $\Delta P$ (psi)	ORIFICE LETTER DESIGNATION AND EFFECTIVE AREA, sq. in.													
	D 0.110	E 0.196	F 0.307	G 0.503	H 0.785	J 1.287	K 1.838	L 2.853	M 3.60	N 4.34	P 6.38	Q 11.05	R 16.0	T 26.0
5	6.9	12.3	19.3	31.6	49.3	80.9	115	179	226	273	401	695	1006	1635
10	9.7	17.4	27.3	44.7	69.8	114	163	253	320	386	567	983	1423	2313
15	11.9	21.3	33.4	54.8	85.5	140	200	310	392	472	695	1204	1743	2833
20	13.8	24.6	38.6	63.3	98.7	161	231	359	453	546	802	1390	2013	3271
40	19.5	34.8	54.6	89.5	139	229	327	507	640	772	1135	1966	2847	4627
60	23.9	42.7	66.9	109	171	280	400	621	784	946	1390	2408	3487	5667
80	27.6	49.3	77.2	126	197	323	462	718	906	1092	1605	2781	4027	6543
100	30.9	55.1	86.3	141	220	362	517	802	1013	1221	1795	3109	4502	7316
120	33.9	60.4	94.6	155	241	396	566	879	1109	1337	1966	3406	4932	8014
140	36.6	65.2	102	167	261	428	611	949	1198	1445	2124	3679	5327	8656
160	39.1	69.7	109	179	279	458	654	1015	1281	1544	2270	3933	5695	9254
180	41.5	73.9	115	189	296	485	693	1077	1359	1638	2408	4171	6040	9815
200	43.7	78.0	122	200	312	512	731	1135	1432	1727	2538	4397	6367	10346
220	45.9	81.8	128	209	327	537	767	1190	1502	1811	2662	4612	6678	10851
240	47.9	85.4	133	219	342	561	801	1243	1569	1891	2781	4817	6975	11334
260	49.9	88.9	139	228	356	583	833	1294	1633	1969	2894	5013	7259	11797
280	51.7	92.2	144	236	369	606	865	1343	1695	2043	3004	5203	7533	12242
300	53.6	95.5	149	245	382	627	895	1390	1754	2115	3109	5385	7798	12672
320	55.3	98.6	154	253	395	647	925	1436	1812	2184	3211	5562	8054	13087
340	57.0	101	159	260	407	667	953	1480	1867	2251	3310	5733		
360	58.7	104	163	268	419	687	981	1523	1922	2317	3406	5899		
380	60.3	107	168	275	430	705	1008	1565	1974	2380	3499	6061		
400	61.9	110	172	283	441	724	1034	1605	2026	2442	3590	6218		
420	63.4	113	177	290	452	742	1059	1645	2076	2502	3679	6372		
440	64.9	115	181	296	463	759	1084	1684	2124	2561	3765	6522		
460	66.3	118	185	303	473	776	1109	1721	2172	2619	3850	6669		
480	67.8	120	189	310	483	793	1133	1758	2219	2675	3933	6812		
500	69.2	123	193	316	493	809	1156	1795	2265	2730	4014	6952		
520	70.5	125	196	322	503	825	1179	1830	2310	2784	4093	7090		
540	71.9	128	200	328	513	841	1201	1865	2354	2837	4171	7225		
560	73.2	130	204	334	522	857	1223	1899	2397	2890	4248	7358		
580	74.5	132	208	340	531	872	1245	1933	2439	2941	4323	7488		
600	75.8	135	211	346	541	887	1266	1966	2481	2991	4397	7616		
620	77.0	137	215	352	550	901	1287	1999	2522	3040	4470	7742		
640	78.3	139	218	358	558	916	1308	2031	2562	3089	4541	7866		
660	79.5	141	221	363	567	930	1328	2062	2602	3137	4612	7988		
680	80.7	143	225	369	576	944	1348	2093	2641	3184	4681			
700	81.8	145	228	374	584	958	1368	2124	2680	3231	4750			
720	83.0	147	231	379	592	971	1387	2154	2718	3277	4817			
740	84.2	150	235	385	600	985	1406	2183	2755	3322	4883			
760	85.3	152	238	390	608	998	1425	2213	2792	3366	4949			
780	86.4	154	241	395	616	1011	1444	2242	2829	3410	5014			
800	87.5	156	244	400	624	1024	1462	2270	2865	3454	5077			
820	88.6	157	247	405	632	1037	1481	2298	2900	3497	5141			
840	89.7	159	250	410	640	1049	1499	2326	2936	3539	5203			
860	90.7	161	253	415	647	1062	1516	2354	2970	3581	5264			
880	91.8	163	256	419	655	1074	1534	2381	3005	3622	5325			
900	92.8	165	259	424	662	1086	1551	2408	3039	3663	5385			
920	93.8	167	262	429	670	1098	1568	2435	3072	3704	5445			
940	94.9	169	264	433	677	1110	1585	2461	3105	3744	5504			
960	95.9	170	267	438	684	1122	1602	2487	3138	3783	5562			
980	96.9	172	270	443	691	1133	1619	2513	3171	3823	5620			
1000	97.8	174	273	447	698	1145	1635	2538	3203	3862	5677			
1020	98.8	176	275	452	705	1156	1651	2564	3235	3900	5733			
1040	99.8	177	278	456	712	1167	1667	2589	3266	3938	5789			

\*Differential Pressure ( $\Delta P$ ) equals inlet pressure (set pressure plus overpressure) at flowing conditions minus back pressure.  
 †See pages 14 to 43 for Minimum and Maximum Set Pressure Limits.

# Water Capacities

## Styles JLT-JOS and JLT-JBS

Capacity in U.S. gallons per minute of water at 70F and 10% overpressure.

**Differential Pressures  $\Delta P^*$  USCS UNITS**  
**1060-6600 psf† (United States Customary System)**

Capacities certified by the National Board of Boiler and Pressure Vessel Inspectors and in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII.

Note: USCS Units for water and liquids are U.S. gallons per minute (1 U.S. gallon equals 0.8327 Imperial gallon).

Diff. Pressure $\Delta P$ (psf)	ORIFICE LETTER DESIGNATION AND EFFECTIVE AREA, sq. in.													
	D 0.110	E 0.196	F 0.307	G 0.503	H 0.785	J 1.287	K 1.838	L 2.853	M 3.60	N 4.34	P 6.30	Q 11.05	R 16.0	T 26.0
1060	100	179	281	460	719	1179	1683	2613	3298	3976	5845			
1080	101	181	283	465	725	1190	1699	2638	3329	4013	5900			
1100	102	182	286	469	732	1201	1715	2662	3359	4050	5954			
1120	103	184	289	473	739	1212	1730	2686	3390					
1140	104	186	291	477	745	1222	1746	2710	3420					
1160	105	187	294	482	752	1233	1761	2734	3450					
1180	106	189	296	486	758	1244	1776	2757	3479					
1200	107	191	299	490	765	1254	1791	2781	3509					
1220	108	192	301	494	771	1264	1806	2804						
1240	109	194	304	498	777	1275	1821	2827						
1260	109	195	306	502	784	1285	1835	2849						
1280	110	197	309	506	790	1295	1850	2872						
1300	111	198	311	510	796	1305	1864	2894						
1320	112	200	313	514	802	1315	1879	2916						
1340	113	201	316	518	808	1325	1893	2938						
1360	114	203	318	521	814	1335	1907	2960						
1380	114	204	320	525	820	1345	1921	2982						
1400	115	206	323	529	826	1355	1935	3003						
1420	116	207	325	533	832	1364	1949	3025						
1440	117	209	327	537	838	1374	1962	3046						
1460	118	210	330	540	844	1383	1976	3067						
1480	119	212	332	544	849	1393	1989	3088						
1500	119	213	334	548	855	1402	2003	3109						
1600	123	220	345	566	883	1448	2068	3211						
1700	127	227	356	583	910	1493	2132							
1800	131	234	366	600	937	1536	2194							
1900	134	240	376	616	962	1578	2254							
2000	138	246	386	633	987	1619	2313							
2100	141	252	395	648	1012	1659	2370							
2200	145	258	405	663	1036	1698	2425							
2300	148	264	414	678	1059	1736	2480							
2400	151	270	423	693	1082	1774	2533							
2500	154	275	431	707	1104	1810								
2600	157	281	440	721	1126	1846								
2700	160	286	448	735	1147	1881								
2800	163	291	457	748	1168	1916								
2900	166	297	465	762	1189	1950								
3000	169	302	473	775	1209	1983								
3100	172	307	480	788										
3200	175	312	488	800										
3300	177	316	496	813										
3400	180	321	503	825										
3500	183	326	511	837										
3600	185	330	518	849										
3700	188	335	525	860										
3800	190	339	532	872										
3900	193	344	539	883										
4000	195	348	546	895										
4100	198	353	553											
4200	200	357	559											
4300	202	361	566											
4400	205	365	573											
4500	207	369	579											
4600	209	374	585											
4700	212	378	592											
4800	214	382	598											
4900	216	386	604											
5000	218	390	610											
5500	229	409	640											
6000	239	427												
6600	251	448												

\* Differential Pressure ( $\Delta P$ ) equals inlet pressure (set pressure plus overpressure) at flowing conditions minus back pressure.

† See pages 14 to 43 for Minimum and Maximum Set Pressure Limits.

# Saturated Steam Capacities Unfired Pressure Vessel Service Styles JOS and JBS

Capacity in pounds per hour of steam at 10% overpressure.<sup>†</sup>  
Valve discharging to atmospheric pressure.

Set Pressures  
5-550 psig

USCS UNITS  
(United States Customary System)

Shaded values are JOS only

Capacities certified by the National Board of Boiler and Pressure Vessel Inspectors and in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII.

Set Pressure (psig)	ORIFICE LETTER DESIGNATION AND EFFECTIVE AREA, sq. in.														
	D 0.110	E 0.196	F 0.307	G 0.503	H 0.785	J 1.287	K 1.838	L 2.853	M 3.60	N 4.34	P 6.38	Q 11.05	R 16.0	T 26.0	T2 27.872
*1 psi incr.	6.0	10.8	16.9	27.7	43.3	71.0	101	157	198	239	352	610	883	1436	1539
*5 psi incr.	30.3	54.1	84.7	138	216	355	507	787	994	1198	1761	3051	4418	7180	7697
5			341	559	873	1431	2044					12292			
6			361	592	924	1516	2165	3361				13018			
7			379	621	969	1589	2270	3524			7881	13649			
8		252	395	647	1010	1657	2367	3674	4636	5589	8216	14231	20606	33484	35895
9		262	411	674	1052	1725	2464	3824	4826	5818	8553	14814	21450	34857	37367
10	152	272	427	699	1091	1790	2556	3968	5007	6036	8873	15369	22254	36163	38766
15	180	321	504	825	1288	2113	3017	4684	5911	7126	10475	18143	26271	42690	45764
20	208	371	581	952	1486	2436	3479	5400	6814	8215	12077	20917	30288	49218	52762
30	263	469	735	1204	1880	3082	4402	6833	8622	10394	15280	26466	38322	62273	66757
40	324	577	904	1482	2313	3793	5417	8409	10610	12792	18804	32569	47159	76634	82151
50	384	685	1074	1760	2747	4504	6432	9984	12599	15189	22328	38672	55996	90995	97546
60	445	794	1244	2038	3180	5215	7447	11560	14587	17586	25852	44776	64834	105355	112941
70	506	902	1413	2316	3614	5925	8463	13136	16576	19983	29376	50879	73671	119716	128336
80	567	1010	1583	2593	4048	6636	9478	14712	18564	22380	32900	56982	82509	134677	143730
90	628	1118	1752	2871	4481	7347	10493	16288	20552	24777	36424	63086	91346	148438	159125
100	688	1227	1922	3149	4915	8058	11508	17864	22541	27174	39948	69189	100183	162798	174520
110	749	1335	2091	3427	5348	8769	12523	19439	24529	29572	43472	75292	109021	177159	189915
120	810	1443	2261	3705	5782	9480	13539	21015	26518	31969	46996	81396	117858	191520	205309
130	871	1552	2430	3983	6216	10191	14554	22591	28506	34366	50520	87499	126696	205881	220704
140	931	1660	2600	4260	6649	10901	15569	24167	30495	36763	54044	93602	135533	220242	236099
150	992	1768	2770	4538	7083	11612	16584	25743	32483	39160	57567	99706	144370	234602	251494
160	1053	1876	2939	4816	7516	12323	17599	27318	34471	41557	61091	105809	153208	248963	266888
170	1114	1985	3109	5094	7950	13034	18615	28894	36460	43954	64615	111912	162045	263324	282283
180	1174	2093	3278	5372	8383	13745	19630	30470	38448	46352	68139	118016	170883	277685	297678
190	1235	2201	3448	5649	8817	14456	20645	32046	40437	48749	71663	124119	179720	292045	313073
200	1296	2309	3617	5927	9251	15167	21660	33622	42425	51146	75187	130222	188557	306406	328468
210	1357	2418	3787	6205	9684	15877	22675	35198	44413	53543	78711	136326	197395	320767	343862
220	1417	2526	3957	6483	10118	16588	23690	36773	46402	55940	82235	142429	206232	335128	359257
230	1478	2634	4126	6761	10551	17299	24706	38349	48390	58337	85759	148532	215070	349489	374652
240	1539	2742	4296	7039	10985	18010	25721	39925	50379	60734	89283	154636	223907	363849	390047
250	1600	2851	4465	7316	11419	18721	26736	41501	52367	63132	92807	160739	232744	378210	405441
260	1660	2959	4635	7594	11852	19432	27751	43077	54356	65529	96330	166842	241582	392571	420836
270	1721	3067	4804	7872	12286	20143	28766	44652	56344	67926	99854	172946	250419	406932	436231
280	1782	3175	4974	8150	12719	20853	29782	46228	58332	70323	103378	179049	259257	421292	451626
290	1843	3284	5144	8428	13153	21564	30797	47804	60321	72720	106902	185152	268094	435653	467020
300	1903	3392	5313	8706	13586	22275	31812	49380	62309	75117	110426	191256	276931	450014	482415
310	1964	3500	5483	8983	14020	22986	32827	50956	64298	77514	113950	197359			
320	2025	3608	5652	9261	14454	23697	33842	52532	66286	79912	117474	203462			
330	2086	3717	5822	9539	14887	24408	34858	54107	68274	82309	120998	209566			
340	2146	3825	5991	9817	15321	25119	35873	55683	70263	84706	124522	215669			
350	2207	3933	6161	10095	15754	25830	36888	57259	72251	87103	128046	221772			
360	2268	4041	6331	10373	16188	26540	37903	58835	74240	89500	131570	227876			
370	2329	4150	6500	10650	16622	27251	38918	60411	76228	91897	135094	233979			
380	2389	4258	6670	10928	17055	27962	39934	61986	78217	94294	138617	240082			
390	2450	4366	6839	11206	17489	28673	40949	63562	80205	96692	142141	246186			
400	2511	4474	7009	11484	17922	29384	41964	65138	82193	99089	145665	252289			
410	2572	4583	7178	11762	18356	30095	42979	66714	84182	101486	149189	258392			
420	2632	4691	7348	12039	18789	30806	43994	68290	86170	103883	152713	264496			
430	2693	4799	7518	12317	19223	31516	45010	69866	88159	106280	156237	270599			
440	2754	4908	7687	12595	19657	32227	46025	71441	90147	108677	159761	276702			
450	2815	5016	7857	12873	20090	32938	47040	73017	92135	111074	163285	282806			
460	2876	5124	8026	13151	20524	33649	48055	74593	94124	113472	166809	288909			
470	2936	5232	8196	13429	20957	34360	49070	76169	96112	115869	170333	295012			
480	2997	5341	8365	13706	21391	35071	50086	77745	98101	118266	173857	301116			
490	3058	5449	8535	13984	21825	35782	51101	79320	100089	120663	177380	307219			
500	3119	5557	8704	14262	22258	36492	52116	80896	102077	123060	180904	313322			
510	3179	5665	8874	14540	22692	37203	53131	82472	104066	125457	184428	319426			
520	3240	5774	9044	14818	23125	37914	54146	84048	106054	127854	187952	325529			
530	3301	5882	9213	15096	23559	38625	55162	85624	108043	130252	191476	331632			
540	3362	5990	9383	15373	23993	39336	56177	87200	110031	132649	195000	337736			
550	3422	6098	9552	15651	24426	40047	57192	88775	112020	135046	198524	343839			

<sup>†</sup>Capacities below 30 psig set pressure are calculated at 3 psig overpressure.  
\*Not valid below 30 psig set pressure.

# Saturated Steam Capacities Unfired Pressure Vessel Service Styles JOS and JBS

Capacity in pounds per hour of  
steam at 10% overpressure.  
Valve discharging to atmospheric  
pressure.

**Set Pressures** **USCS UNITS**  
560-1700 psig (United States Customary System)

Capacities certified by the National Board of  
Boiler and Pressure Vessel Inspectors and  
in accordance with the ASME Boiler and  
Pressure Vessel Code, Section VIII.

Set Pressure (psig)	ORIFICE LETTER DESIGNATION AND EFFECTIVE AREA, sq. in.														
	D 0.110	E 0.196	F 0.307	G 0.503	H 0.785	J 1.287	K 1.838	L 2.853	M 3.50	N 4.34	P 6.38	Q 11.05	R 16.0	T 26.0	T2 27.872
1 psi incr.	6.0	10.8	16.9	27.7	43.3	71.0	101	157	198	239	352	610	863	1436	1539
5 psi incr.	30.3	54.1	84.7	138	216	355	507	787	994	1198	1761	3051	4418	7180	7697
560	3483	6207	9722	15929	24860	40758	58207	90351	114008	137443	202048	349942			
570	3544	6315	9891	16207	25293	41468	59222	91927	115996	139840	205572	356046			
580	3605	6423	10061	16485	25727	42179	60238	93503	117985	142237	209096	362149			
590	3665	6531	10231	16762	26160	42890	61253	95079	119973	144634	212620	368252			
600	3726	6640	10400	17040	26594	43601	62268	96655	121962	147032	216144	374356			
620	3848	6856	10739	17596	27461	45023	64298	99806	125938	151826	223191				
640	3969	7073	11078	18152	28328	46444	66329	102958	129915	156620	230239				
660	4091	7289	11418	18707	29196	47866	68359	106109	133892	161415	237287				
680	4212	7506	11757	19263	30063	49288	70390	109261	137869	166209	244335				
700	4334	7722	12096	19819	30930	50710	72420	112413	141846	171003	251383				
720	4455	7939	12435	20374	31797	52131	74450	115564	145823	175797	258430				
740	4577	8155	12774	20930	32664	53553	76481	118716	149799	180592	265478				
760	4698	8372	13113	21486	33531	54975	78511	121868	153776	185386	272526				
780	4820	8588	13452	22041	34399	56396	80541	125019	157753	190180	279574				
800	4941	8805	13792	22597	35266	57818	82572	128171	161730	194975	286622				
820	5063	9021	14131	23152	36133	59240	84602	131323	165707	199769	293670				
840	5184	9238	14470	23708	37000	60662	86633	134474	169684	204563	300717				
860	5306	9454	14809	24264	37867	62083	88663	137626	173660	209357	307765				
880	5427	9671	15148	24819	38734	63505	90693	140777	177637	214152	314813				
900	5549	9887	15487	25375	39602	64927	92724	143929	181614	218946	321861				
920	5670	10104	15826	25931	40469	66348	94754	147081	185591	223740	328909				
940	5792	10320	16165	26486	41336	67770	96785	150232	189568	228535	335957				
960	5913	10537	16505	27042	42203	69192	98815	153384	193545	233329	343004				
980	6035	10753	16844	27598	43070	70614	100845	156536	197521	238123	350052				
1000	6156	10970	17183	28153	43937	72035	102876	159687	201498	242917	357100				
1020	6278	11187	17522	28709	44805	73457	104906	162839	205475						
1040	6399	11403	17861	29265	45672	74879	106937	165991	209452						
1060	6521	11620	18200	29820	46539	76300	108967	169142	213429						
1080	6642	11836	18539	30376	47406	77722	110997	172294	217406						
1100	6764	12053	18879	30932	48273	79144	113028	175445	221382						
1120	6885	12269	19218	31487	49140	80566	115058	178597							
1140	7007	12486	19557	32043	50008	81987	117089	181749							
1160	7129	12702	19896	32599	50875	83409	119119	184900							
1180	7250	12919	20235	33154	51742	84831	121149	188052							
1200	7372	13135	20574	33710	52609	86252	123180	191204							
1220	7493	13352	20913	34266	53476	87674	125210	194355							
1240	7615	13568	21252	34821	54343	89096	127241	197507							
1260	7736	13785	21592	35377	55211	90518	129271	200659							
1280	7858	14001	21931	35932	56078	91939	131301	203810							
1300	7979	14218	22270	36488	56945	93361	133332	206962							
1320	8101	14434	22609	37044	57812	94783	135362	210113							
1340	8222	14651	22948	37599	58679	96204	137392	213265							
1360	8342	14868	23287	38155	59546	97625	139422	216417							
1380	8463	15084	23626	38711	60413	99046	141452	219569							
1400	8584	15300	23965	39267	61280	100467	143482	222721							
1420	8705	15516	24304	39823	62147	101888	145512	225873							
1440	8826	15732	24643	40379	63014	103309	147542	229025							
1460	8947	15948	24982	40935	63881	104730	149572	232177							
1480	9068	16164	25321	41491	64748	106151	151602	235329							
1500	9189	16380	25660	42047	65615	107572	153632	238481							
1520	9310	16596	26000	42603	66482	109003	155662								
1540	9431	16812	26340	43159	67349	110434	157692								
1560	9552	17028	26679	43715	68216	111865	159722								
1580	9673	17244	27019	44271	69083	113296	161752								
1600	9794	17460	27358	44827	69950	114727	163782								
1620	9915	17676	27698	45383	70817	116158	165812								
1640	10036	17892	28038	45939	71684	117589	167842								
1660	10157	18108	28378	46495	72551	119020	169872								
1680	10278	18324	28717	47051	73418	120451	171902								
1700	10399	18540	29057	47607	74285	121882	173932								



# Saturated Steam Capacities Unfired Pressure Vessel Service Styles JOS and JBS

Capacity in pounds per hour of steam at 10% overpressure. Valve discharging to atmospheric pressure.

**Set Pressures** **USCS UNITS**  
1720-2900 psig (United States Customary System)

Capacities certified by the National Board of Boiler and Pressure Vessel Inspectors and in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII.

Set Pressure (psig)	ORIFICE LETTER DESIGNATION AND EFFECTIVE AREA, sq. in.															
	D	E	F	G	H	J	K	L	M	N	P	Q	R	T	T2	
	0.110	0.196	0.307	0.503	0.785	1.287	1.838	2.853	3.60	4.34	6.38	11.05	16.0	26.0	27.872	
1 psi Incr.	6.0	10.8	16.9	27.7	43.3	71.0	101	157	198	239	352	610	883	1436	1539	
5 psi Incr.	30.3	54.1	84.7	138	216	355	507	787	994	1198	1761	3051	4418	7180	7697	
1720	10744	19143	29985	49129	76673	125705	179523									
1740	10884	19394	30377	49771	77674	127347	181868									
1760	11025	19645	30770	50416	78681	128996	184223									
1780	11167	19897	31166	51063	79691	130654	186590									
1800	11309	20151	31563	51714	80707	132319	188968									
1820	11452	20406	31962	52368	81728	133992	191358									
1840	11596	20662	32363	53025	82753	135674	193759									
1860	11740	20919	32766	53686	83784	137364	196173									
1880	11885	21178	33172	54350	84821	139063	198600									
1900	12031	21438	33579	55017	85862	140771	201039									
1920	12178	21699	33989	55688	86910	142488	203491									
1940	12326	21962	34400	56363	87963	144215	205957									
1960	12474	22227	34815	57042	89022	145951										
1980	12623	22493	35231	57725	90087	147698										
2000	12773	22760	35650	58411	91159	149454										
2020	12924	23029	36072	59102	92237	151222										
2040	13076	23300	36496	59797	93321	153000										
2060	13229	23573	36923	60496	94413	154789										
2080	13383	23847	37352	61200	95511	156590										
2100	13538	24123	37785	61908	96617	158402										
2120	13694	24401	38220	62621	97730	160227										
2140	13851	24681	38658	63340	98850	162064										
2160	14009	24962	39100	64063	99979	163915										
2180	14169	25246	39544	64791	101115	165778										
2200	14329	25532	39992	65525	102260	167655										
2220	14491	25820	40443	66264	103414	169546										
2240	14654	26110	40898	67008	104576	171452										
2260	14818	26403	41356	67759	105747	173372										
2280	14983	26698	41818	68516	106928	175308										
2300	15150	26995	42283	69279	108119	177260										
2320	15318	27295	42753	70048	109319	179229										
2340	15488	27597	43226	70824	110530	181214										
2360	15659	27902	43704	71606	111752	183217										
2380	15832	28210	44186	72396	112985	185237										
2400	16006	28520	44673	73193	114229	187277										
2420	16182	28834	45164	73998	115484	189336										
2440	16360	29151	45660	74811	116752	191415										
2460	16539	29470	46160	75631	118033											
2480	16720	29793	46666	76460	119327											
2500	16904	30120	47177	77298												
2520	17089	30450	47694	78144												
2540	17276	30783	48217	79000												
2560	17465	31120	48745	79866												
2580	17657	31461	49279	80741												
2600	17850	31807	49820	81627												
2620	18046	32156	50367	82523												
2640	18245	32510	50921	83431												
2660	18446	32868	51482	84351												
2680	18650	33231	52051	85282												
2700	18856	33599	52627	86226												
2720	19066	33972	53211	87183												
2740	19278	34350	53803	88154												
2760	19493	34734	54405	89139												
2780	19712	35123	55015	90138												
2800	19934	35519	55634	91153												
2820	20159	35921	56264	92185												
2840	20388	36329	56903	93233												
2860	20621	36744	57553	94298												
2880	20858	37166	58215	95382												
2900	21100	37596	58888	96485												

# Equivalents and Conversion Factors

This table may be used in two ways

- (1) Multiply the unit under column A by the figure under column B, the result is the unit under column C.
- (2) Divide the unit under column C by the figure under column B, the result is then the unit under column A.

A MULTIPLY	B BY	C TO OBTAIN	A MULTIPLY	B BY	C TO OBTAIN
Atmospheres	14.70	Pounds per square inch	Inches of water	0.03613	Pounds per sq. in.
Atmospheres	1.033	Kilograms per sq. cm	Inches of water	0.07355	Inches of mercury
Atmospheres	29.92	Inches of mercury	Kilograms	2.205	Pounds
Atmospheres	760.0	Millimeters of mercury	Kilograms	0.001102	Short tons (2000 lbs.)
Atmospheres	407.2	Inches of water	Kilograms	35.27	Ounces
Atmospheres	33.93	Feet of water	Kilograms per minute	132.3	Pounds per hour
Atmospheres	1.013	Bars	Kilograms per sq. cm	14.22	Pounds per sq. in.
Atmospheres	101.3	KiloPascals	Kilograms per sq. cm	0.9678	Atmospheres
Barrels	42.00	Gallons (U.S.)	Kilograms per sq. cm	28.96	Inches of mercury
Bars	14.50	Pounds per square inch	Kilograms per cubic meter	16.018	Pounds per cubic foot
Bars	1.020	Kilograms per sq. cm	KiloPascals	0.1450	Pounds per sq. in.
Bars	100.0	KiloPascals	KiloPascals	0.0100	Bars
Centimeters	0.3937	Inches	KiloPascals	0.01020	Kilograms per sq. cm
Centimeters	0.03281	Feet	Liters	0.03532	Cubic feet
Centimeters	0.010	Meters	Liters	1000.	Cubic centimeters
Centimeters	0.01094	Yards	Liters	0.2642	Gallons
Cubic centimeters	0.06102	Cubic inches	Liters per hour	0.004403	Gallons per minute
Cubic feet	7.481	Gallons	Meters	3.281	Feet
Cubic feet	0.1781	Barrels	Meters	1.094	Yards
Cubic feet per minute	0.02832	Cubic meters per minute	Meters	100.0	Centimeters
Cubic feet per second	448.8	Gallons per minute	Meters	39.37	Inches
Cubic inches	16.39	Cubic centimeters	Pounds	0.1199	Gallons H <sub>2</sub> O @ 60F (U.S.)
Cubic inches	0.004329	Gallons	Pounds	453.6	Grams
Cubic meters	264.2	Gallons	Pounds	0.0005	Short tons (2000 lbs.)
Cubic meters per hour	4.403	Gallons per minute	Pounds	0.4536	Kilograms
Cubic meters per minute	35.31	Cubic feet per minute	Pounds	0.0004536	Metric tons
Standard cubic feet per min.	60.00	Standard cubic ft. per hr	Pounds	16.00	Ounces
Standard cubic feet per min.	1440.	Standard cubic ft. per day	Pounds per hour	6.323/M.W.	Cubic feet per minute
Standard cubic feet per min.	0.02716	Nm <sup>3</sup> /min.	Pounds per hour	.4536	Kilograms per hour
Standard cubic feet per min.	1.630	Nm <sup>3</sup> /hr.	Pounds per hour liquid	0.002/Sp.Gr.	Gallons per minute liquid (at 60F)
Standard cubic feet per min.	39.11	Nm <sup>3</sup> /day	Pounds per sq. inch	27.68	Inches of water
Standard cubic feet per min.	0.02832	Sm <sup>3</sup> /min.	Pounds per sq. inch	2.307	Feet of water
Standard cubic feet per min.	1.699	Sm <sup>3</sup> /hr.	Pounds per sq. inch	2.036	Inches of mercury
Standard cubic feet per min.	40.78	Sm <sup>3</sup> /day	Pounds per sq. inch	0.07031	Kilograms per sq. cm
Feet	0.3048	Meters	Pounds per sq. inch	0.0680	Atmospheres
Feet	0.3333	Yards	Pounds per sq. inch	51.71	Millimeters of mercury
Feet	30.48	Centimeters	Pounds per sq. inch	0.7032	Meters of water
Feet of water	0.8818	Inches of mercury	Pounds per sq. inch	0.06895	Bar
Feet of water	0.4335	Pounds per square inch	Pounds per sq. inch	6.895	KiloPascals
Gallons(U.S.)	3785.	Cubic centimeters	Specific gravity (of gas or vapors)	28.97	Molecular weight (of gas or vapors)
Gallons(U.S.)	0.1337	Cubic feet	Square centimeter	0.1550	Square inch
Gallons(U.S.)	231.0	Cubic inches	Square inch	6.4516	Square centimeter
Gallons(Imperial)	277.4	Cubic inches	Square inch	645.16	Square millimeter
Gallons(U.S.)	0.8327	Gallons (Imperial)	SSU	0.2205 x SG	Centipoise
Gallons(U.S.)	3.785	Liters	SSU	0.2162	Centistoke
Gallons of water	8.337	Pounds (at 60F)	Water (cubic feet)	62.4	Pounds (at 60F)
Gallons of liquid per minute	500 x Sp. Gr.	Pounds per hour liquid (at 60F)	Temperature:		
Gallons per minute	0.002228	Cubic feet per second	Centigrade	=	5/9 (Fahrenheit - 32)
Gallons per minute	227.0 x SG	Kilograms per hour	Kelvin	=	Centigrade + 273
Gallons per minute	.06309	Liters per second	Fahrenheit	=	9/5 (Centigrade)+32
Gallons per minute	3.785	Liters per minute	Fahrenheit +460	=	Rankine
Gallons per minute	.2271	M <sup>3</sup> /hr.	Fahrenheit (F+460) 5/9	=	Kelvin
Grams	.03527	Ounces			
Inches	2.540	Centimeters			
Inches	0.08333	Feet			
Inches	0.0254	Meters			
Inches	0.02778	Yards			
Inches of mercury	1.133	Feet of water			
Inches of mercury	0.4912	Pounds per square inch			
Inches of mercury	0.03342	Atmospheres			
Inches of mercury	0.03453	Kilograms per sq. cm			

# Air Capacities Styles JOS and JBS

Capacity in standard cubic meters of air per minute at 16C and 10% overpressure.†  
Valve discharging to atmospheric pressure.

**Set Pressures**  
**0.35-88 barg**

**METRIC UNITS**

Shaded values are JOS only

Capacities certified by the National Board of Boiler and Pressure Vessel Inspectors and in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII.

Set Pressure (barg)	ORIFICE LETTER DESIGNATION AND EFFECTIVE AREA, sq mm															Set Pressure (kPag)
	D 71.0	E 126	F 198	G 325	H 506	J 830	K 1186	L 1841	M 2323	N 2800	P 4116	Q 7129	R 10323	T 16774	T2 17981	
1 bar incr.	0.8	1.5	2.4	4.0	6.3	10.3	14.8	23.0	29.0	35.0	51.5	89.2	129	209	225	100 kPa incr.
5 bar incr.	4.4	7.9	12.3	20.3	31.6	51.9	74.2	115	145	175	257	446	646	1049	1125	500 kPa incr.
0.35			3.4	5.6	8.8	14.5	20.7					124				35
0.40			3.6	5.9	9.2	15.1	21.6					129				40
0.45			3.7	6.1	9.5	15.6	22.3	34.7				134				45
0.50			3.8	6.3	9.8	16.1	23.1	35.8			80.2	139				50
0.55		2.5	3.9	6.5	10.1	16.6	23.8	37.0	46.6	56.2	82.7	143	207	337	361	55
0.60		2.6	4.0	6.7	10.4	17.1	24.5	38.0	48.0	57.9	85.1	147	213	347	372	60
0.65		2.6	4.2	6.9	10.7	17.6	25.2	39.1	49.4	59.5	87.6	151	219	357	382	65
0.70	1.5	2.7	4.3	7.0	11.0	18.1	25.9	40.2	50.7	61.1	89.9	155	225	366	392	70
0.75	1.5	2.8	4.4	7.2	11.3	18.6	26.5	41.2	52.0	62.7	92.2	159	231	376	403	75
0.80	1.6	2.9	4.5	7.4	11.6	19.0	27.2	42.3	53.3	64.3	94.6	163	237	385	413	80
0.85	1.6	2.9	4.6	7.6	11.9	19.5	27.9	43.3	54.7	65.9	96.9	167	243	395	423	85
0.90	1.7	3.0	4.7	7.8	12.2	20.0	28.6	44.4	56.0	67.5	99.3	172	249	404	433	90
0.95	1.7	3.1	4.8	8.0	12.5	20.5	29.2	45.4	57.3	69.1	101	176	254	414	444	95
1	1.7	3.1	5.0	8.1	12.7	20.9	29.9	46.5	58.6	70.7	104	180	260	423	454	100
2	2.6	4.6	7.2	11.8	18.5	30.4	43.4	67.4	85.1	102	150	261	378	614	658	200
4	4.3	7.7	12.2	19.9	31.1	51.1	73.0	113	143	172	253	439	635	1033	1107	400
6	6.1	10.9	17.1	28.1	43.8	71.9	102	159	201	242	356	617	894	1453	1557	600
8	7.9	14.1	22.1	36.2	56.5	92.7	132	205	259	312	459	796	1152	1873	2008	800
10	9.7	17.2	27.0	44.3	69.2	113	162	251	317	382	562	974	1411	2293	2458	1000
12	11.4	20.4	32.0	52.4	81.9	134	191	297	375	452	665	1153	1669	2713	2908	1200
14	13.2	23.6	36.9	60.6	94.5	155	221	343	433	522	768	1331	1928	3133	3358	1400
16	15.0	26.7	41.9	68.7	107	175	251	389	491	593	871	1510	2186	3552	3808	1600
18	16.8	29.9	46.9	76.8	119	196	280	435	550	663	974	1688	2444	3972	4258	1800
20	18.5	33.1	51.8	84.9	132	217	310	482	608	733	1077	1866	2703	4392	4709	2000
22	20.3	36.2	56.8	93.1	145	238	340	528	666	803	1180	2045				2200
24	22.1	39.4	61.7	101	157	259	369	574	724	873	1284	2223				2400
26	23.9	42.6	66.7	109	170	279	399	620	782	943	1387	2402				2600
28	25.6	45.7	71.7	117	183	300	429	666	840	1013	1490	2580				2800
30	27.4	48.9	76.6	125	196	321	458	712	898	1083	1593	2759				3000
32	29.2	52.1	81.6	133	208	342	488	758	957	1153	1696	2937				3200
34	31.0	55.2	86.5	141	221	362	518	804	1015	1223	1799	3116				3400
36	32.7	58.4	91.5	149	234	383	548	850	1073	1294	1902	3294				3600
38	34.5	61.6	96.4	158	246	404	577	896	1131	1364	2005	3473				3800
40	36.3	64.7	101	166	259	425	607	942	1189	1434	2108	3651				4000
42	38.1	67.9	106	174	272	446	637	988	1247	1504	2211					4200
44	39.9	71.1	111	182	284	466	666	1034	1305	1574	2314					4400
46	41.6	74.2	116	190	297	487	696	1081	1364	1644	2417					4600
48	43.4	77.4	121	198	310	508	726	1127	1422	1714	2520					4800
50	45.2	80.6	126	206	322	529	755	1173	1480	1784	2623					5000
52	47.0	83.7	131	214	335	550	785	1219	1538	1854	2726					5200
54	48.7	86.9	136	223	348	570	815	1265	1596	1924	2829					5400
56	50.5	90.0	141	231	360	591	844	1311	1654	1995	2932					5600
58	52.3	93.2	146	239	373	612	874	1357	1713	2065	3035					5800
60	54.1	96.4	151	247	386	633	904	1403	1771	2135	3138					6000
62	55.8	99.5	155	255	398	653	933	1449	1829	2205	3241					6200
64	57.6	102	160	263	411	674	963	1495	1887	2275	3344					6400
66	59.4	105	165	271	424	695	993	1541	1945	2345	3448					6600
68	61.2	109	170	279	436	716	1023	1587	2003	2415	3551					6800
70	63.0	112	175	288	449	737	1052	1634	2061							7000
72	64.7	115	180	296	462	757	1082	1680	2120							7200
74	66.5	118	185	304	474	778	1112	1726	2178							7400
76	68.3	121	190	312	487	799	1141	1772								7600
78	70.1	124	195	320	500	820	1171	1818								7800
80	71.8	128	200	328	512	841	1201	1864								8000
82	73.6	131	205	336	525	861	1230	1910								8200
84	75.4	134	210	344	538	882	1260	1956								8400
86	77.2	137	215	353	551	903	1290	2002								8600
88	78.9	140	220	361	563	924	1319	2048								8800

†Capacities below 2.0 bar set pressure are calculated at 0.2 bar overpressure.

# Air Capacities Styles JOS and JBS

Capacity in standard cubic meters of air per minute at 16C and 10% overpressure. Valve discharging to atmospheric pressure.

Set Pressures  
90-410 barg

METRIC UNITS

Capacities certified by the National Board of Boiler and Pressure Vessel Inspectors and in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII.

Set Pressure (barg)	ORIFICE LETTER DESIGNATION AND EFFECTIVE AREA, sq mm														Set Pressure (kPag)	
	D 71.0	E 126	F 198	G 325	H 506	J 830	K 1186	L 1841	M 2323	N 2800	P 4116	Q 7129	R 10323	T 16774		T2 17981
1 bar incr.	0.8	1.5	2.4	4.0	6.3	10.3	14.8	23.0	29.0	35.0	51.5	89.2	129	209	225	100 kPa incr.
5 bar incr.	4.4	7.9	12.3	20.3	31.6	51.9	74.2	115	145	175	257	446	646	1049	1125	500 kPa incr.
90	80.7	143	225	369	576	944	1349	2094								9000
92	82.5	147	230	377	589	965	1379	2140								9200
94	84.3	150	235	385	601	986	1408	2186								9400
96	86.0	153	240	393	614	1007	1438	2233								9600
98	87.8	156	245	401	627	1028	1468	2279								9800
100	89.6	159	250	409	639	1048	1497	2325								10000
102	91.4	162	255	418	652	1069	1527	2371								10200
104	93.2	166	260	426	665	1090	1557									10400
106	94.9	169	265	434	677	1111	1587									10600
108	96.7	172	270	442	690	1132	1616									10800
110	98.5	175	275	450	703	1152	1646									11000
112	100	178	279	458	715	1173	1676									11200
114	102	181	284	466	728	1194	1705									11400
116	103	185	289	474	741	1215	1735									11600
118	105	188	294	483	753	1236	1765									11800
120	107	191	299	491	766	1256	1794									12000
122	109	194	304	499	779	1277	1824									12200
124	110	197	309	507	791	1298	1854									12400
126	112	200	314	515	804	1319	1883									12600
128	114	204	319	523	817	1339	1913									12800
130	116	207	324	531	829	1360	1943									13000
132	118	210	329	539	842	1381	1972									13200
134	119	213	334	548	855	1402	2002									13400
136	121	216	339	556	868	1423	2032									13600
138	123	219	344	564	880	1443	2062									13800
140	125	223	349	572	893	1464	2091									14000
142	126	226	354	580	906	1485	2121									14200
144	128	229	359	588	918	1506	2151									14400
146	130	232	364	596	931	1527	2180									14600
148	132	235	369	604	944	1547	2210									14800
150	134	238	374	613	956	1568	2240									15000
160	142	254	398	653	1020	1672										16000
170	151	270	423	694	1083	1776										17000
180	160	286	448	734	1146	1880										18000
190	169	302	473	775	1210											19000
200	178	318	498	816												20000
210	187	333	522	856												21000
220	196	349	547	897												22000
230	205	365	572	938												23000
240	214	381	597	978												24000
250	222	397	622	1019												25000
260	231	412	646													26000
270	240	428	671													27000
280	249	444	696													28000
290	258	460	721													29000
300	267	476	746													30000
310	276	492	770													31000
320	285	507	795													32000
330	293	523	820													33000
340	302	539	845													34000
350	311	555														35000
360	320	571														36000
370	329	587														37000
380	338	602														38000
390	347	618														39000
400	356	634														40000
410	365	650														41000

# Water Capacities Styles JLT-JOS and JLT-JBS

Capacity in liters per minute of  
water at 21C and 10%  
overpressure.

Differential Pressures  $\Delta P^*$

1-80 bar<sup>†</sup>

METRIC UNITS

Capacities certified by the National Board of  
Boiler and Pressure Vessel Inspectors and  
in accordance with the ASME Boiler and  
Pressure Vessel Code, Section VIII.

Diff. * Pressure $\Delta P$ (bar)	ORIFICE LETTER DESIGNATION AND EFFECTIVE AREA, sq. mm.														Diff. * Pressure $\Delta P$ (kPa)
	D 71.0	E 126	F 198	G 325	H 506	J 830	K 1186	L 1841	M 2323	N 2800	P 4116	Q 7129	R 10323	T 16774	
1	44.6	79.5	124	204	318	522	745	1157	1460	1760	2588	4482	6490	10547	100
2	63.1	112	176	288	450	738	1054	1636	2065	2489	3660	6339	9179	14916	200
3	77.2	137	215	353	551	904	1291	2004	2529	3049	4482	7764	11242	18268	300
4	89.2	159	249	408	636	1044	1491	2314	2920	3521	5176	8965	12981	21094	400
5	99.7	177	278	456	712	1167	1667	2587	3265	3936	5787	10023	14513	23584	500
6	109	194	305	499	780	1278	1826	2834	3577	4312	6339	10980	15898	25835	600
7	118	210	329	539	842	1381	1972	3062	3863	4658	6847	11859	17172	27905	700
8	126	224	352	577	900	1476	2108	3273	4130	4979	7320	12678	18358	29832	800
9	133	238	373	612	955	1566	2236	3472	4381	5281	7764	13447	19471	31641	900
10	141	251	393	645	1007	1651	2357	3659	4618	5567	8184	14175	20525	33353	1000
11	147	263	413	676	1056	1731	2472	3838	4843	5839	8583	14867	21527	34981	1100
12	154	275	431	706	1103	1808	2582	4009	5058	6098	8965	15528	22484	36536	1200
13	160	286	449	735	1148	1882	2688	4172	5265	6347	9331	16162	23402	38028	1300
14	166	297	465	763	1191	1953	2789	4330	5464	6587	9683	16772	24285	39464	1400
15	172	307	482	790	1233	2022	2887	4482	5656	6818	10023	17361	25138	40849	1500
16	178	318	498	816	1273	2088	2982	4629	5841	7042	10352	17930	25962	42189	1600
17	183	327	513	841	1312	2152	3074	4771	6021	7259	10671	18482	26761	43487	1700
18	189	337	528	865	1351	2215	3163	4910	6195	7469	10980	19018	27537	44748	1800
19	194	346	542	889	1388	2275	3250	5044	6365	7674	11281	19539	28292	45974	1900
20	199	355	556	912	1424	2334	3334	5175	6531	7873	11574	20046	29027	47169	2000
21	204	364	570	935	1459	2392	3416	5303	6692	8068	11860	20541	29743	48333	2100
22	209	372	584	957	1493	2448	3497	5428	6849	8257	12139	21025	30443	49471	2200
23	214	381	597	978	1527	2503	3575	5550	7003	8443	12412	21497	31128	50583	2300
24	218	389	610	999	1560	2557	3652	5669	7154	8625	12679	21960			2400
25	223	397	622	1020	1592	2610	3728	5786	7301	8802	12940	22413			2500
26	227	405	635	1040	1623	2662	3801	5901	7446	8977	13197	22856			2600
27	231	413	647	1060	1654	2712	3874	6013	7588	9148	13448	23292			2700
28	236	420	659	1079	1685	2762	3945	6124	7727	9316	13695	23719			2800
29	240	428	670	1098	1714	2811	4015	6232	7864	9481	13937	24139			2900
30	244	435	682	1117	1744	2859	4083	6339	7998	9643	14175	24552			3000
31	248	442	693	1136	1773	2906	4151	6443	8131	9802	14410	24958			3100
32	252	449	704	1154	1801	2953	4217	6547	8261	9959	14640	25357			3200
33	256	456	715	1172	1829	2999	4283	6648	8389	10113	14867	25750			3300
34	260	463	726	1189	1856	3044	4347	6748	8515	10265	15091	26137			3400
35	263	470	736	1207	1883	3088	4411	6847	8639	10415	15311	26519			3500
36	267	477	747	1224	1910	3132	4473	6944	8762	10563	15528	26895			3600
37	271	483	757	1241	1937	3175	4535	7039	8883	10709	15743	27266			3700
38	275	490	767	1257	1963	3218	4596	7134	9002	10853	15954	27632			3800
39	278	496	777	1274	1988	3260	4656	7227	9120	10994	16162	27993			3900
40	282	502	787	1290	2014	3302	4715	7319	9236	11134	16368	28350			4000
41	285	509	797	1306	2039	3343	4774	7410	9351	11273	16572	28702			4100
42	289	515	807	1322	2063	3383	4832	7500	9464	11409	16773	29050			4200
43	292	521	816	1338	2088	3423	4889	7589	9576	11544	16971	29394			4300
44	295	527	826	1353	2112	3463	4945	7677	9687	11678	17167	29734			4400
45	299	533	835	1368	2136	3502	5001	7763	9796	11810	17361				4500
46	302	539	844	1383	2159	3541	5057	7849	9904	11940	17553				4600
47	305	545	853	1398	2183	3579	5111	7934	10011	12070	17743				4700
48	309	550	862	1413	2206	3617	5165	8018	10117	12197	17931				4800
49	312	556	871	1428	2229	3654	5219	8101	10222	12324	18117				4900
50	315	562	880	1442	2251	3691	5272	8183	10326	12449	18300				5000
52	321	573	898	1471	2296	3764	5376	8345	10531	12695	18663				5200
54	327	584	915	1499	2340	3836	5479	8504	10731	12937	19018				5400
56	333	595	931	1526	2383	3906	5579	8660	10928	13175	19367				5600
58	339	605	948	1553	2425	3976	5678	8814	11122	13408	19710				5800
60	345	615	964	1580	2466	4044	5775	8964	11312	13637	20047				6000
62	351	626	980	1606	2507	4110	5870	9113	11499	13862	20379				6200
64	356	636	996	1632	2547	4176	5964	9258	11683	14084	20705				6400
66	362	645	1011	1657	2587	4241	6057	9402	11864	14303	21026				6600
68	367	655	1026	1682	2625	4305	6148	9543	12042	14518	21342				6800
70	373	665	1041	1707	2664	4368	6238	9683	12218	14730	21654				7000
72	378	674	1056	1731	2702	4430	6326	9820	12391	14939	21961				7200
74	383	683	1071	1755	2739	4491	6414	9956	12562	15145	22264				7400
76	389	693	1085	1778	2776	4551	6500	10089	12731						7600
78	394	702	1099	1802	2812	4610	6585	10221	12897						7800
80	399	711	1113	1825	2848	4669	6668	10351	13062						8000

\*Differential Pressure ( $\Delta P$ ) equals Inlet pressure (set pressure plus overpressure) at flowing conditions minus back pressure.

†See pages 14 to 43 for Minimum and Maximum Set Pressure Limits.

# Water Capacities Styles JLT-JOS and JLT-JBS

Capacity in liters per minute of water at 21C and 10% overpressure.

Differential Pressures  $\Delta P^*$   
82-455 bar†

METRIC UNITS

Capacities certified by the National Board of Boiler and Pressure Vessel Inspectors and in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII.

Differential Pressure $\Delta P$ (bar)	ORIFICE LETTER DESIGNATION AND EFFECTIVE AREA, sq. mm.														Differential Pressure $\Delta P$ (kPa)
	D	E	F	G	H	J	K	L	M	N	P	Q	R	T	
82	404	719	1127	1847	2883	4727	6751	10480	13224						8200
84	408	728	1141	1870	2918	4785	6833	10607	13384						8400
86	413	737	1154	1892	2953	4841	6914	10732							8600
88	418	745	1168	1914	2987	4897	6994	10857							8800
90	423	754	1181	1935	3021	4953	7073	10979							9000
92	428	762	1194	1957	3054	5007	7151	11101							9200
94	432	770	1207	1978	3087	5061	7228	11221							9400
96	437	779	1220	1999	3120	5115	7305	11339							9600
98	441	787	1232	2019	3152	5168	7381	11457							9800
100	446	795	1245	2040	3184	5220	7456	11573							10000
102	450	803	1257	2060	3216	5272	7530	11688							10200
104	455	810	1270	2080	3247	5324	7603	11802							10400
106	459	818	1282	2100	3278	5375	7676	11915							10600
108	463	826	1294	2120	3309	5425	7748	12027							10800
110	468	833	1306	2140	3339	5475	7820	12138							11000
112	472	841	1318	2159	3370	5525	7890	12248							11200
114	476	848	1329	2178	3400	5574	7960	12357							11400
116	480	856	1341	2197	3429	5623	8030								11600
118	484	863	1352	2216	3459	5671	8099								11800
120	488	870	1364	2235	3488	5719	8167								12000
122	492	878	1375	2253	3517	5766	8235								12200
124	496	885	1386	2272	3546	5813	8302								12400
126	500	892	1397	2290	3574	5860	8369								12600
128	504	899	1409	2308	3602	5906	8435								12800
130	508	906	1419	2326	3630	5952	8501								13000
132	512	913	1430	2344	3658	5998	8566								13200
134	516	920	1441	2362	3686	6043	8631								13400
136	520	927	1452	2379	3713	6088	8695								13600
138	524	934	1463	2397	3740	6133	8758								13800
140	527	940	1473	2414	3767	6177	8822								14000
142	531	947	1484	2431	3794	6221	8885								14200
144	535	954	1494	2448	3821	6265	8947								14400
146	539	960	1504	2465	3847	6308	9009								14600
148	542	967	1515	2482	3874	6351	9070								14800
150	546	973	1525	2499	3900	6394	9131								15000
160	564	1005	1575	2581	4028	6604	9431								16000
170	581	1036	1623	2660	4152	6807									17000
180	598	1066	1670	2737	4272	7004									18000
190	615	1095	1716	2812	4389	7196									19000
200	631	1124	1761	2885	4503	7383									20000
210	646	1152	1804	2956											21000
220	661	1179	1847	3026											22000
230	676	1205	1888	3094											23000
240	691	1231	1929	3161											24000
250	705	1257	1969	3226											25000
260	719	1282	2008	3290											26000
270	733	1306	2046	3352											27000
280	746	1330	2083	3414											28000
290	759	1354	2120												29000
300	772	1377	2157												30000
310	785	1399	2192												31000
320	798	1422	2227												32000
330	810	1444	2262												33000
340	822	1466	2296												34000
350	834	1487	2329												35000
360	846	1508	2362												36000
370	858	1529	2395												37000
380	869	1549													38000
390	881	1570													39000
400	892	1590													40000
410	903	1609													41000
420	914	1629													42000
430	925	1648													43000
440	936	1667													44000
450	946	1686													45000
455	951	1696													45500

\*Differential Pressure ( $\Delta P$ ) equals inlet pressure (set pressure plus overpressure) at flowing conditions minus back pressure.

†See pages 14 to 43 for Minimum and Maximum Set Pressure Limits.

# Saturated Steam Capacities Unfired Pressure Vessel Service Styles JOS and JBS

Capacity in kilograms per hour of steam at 10% overpressure.† Valve discharging to atmospheric pressure.

Capacities certified by the National Board of Boiler and Pressure Vessel Inspectors and in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII.

Set Pressures  
0.35-76 barg

**METRIC UNITS**

Shaded values are JOS only

Set Pressure (barg)	ORIFICE LETTER DESIGNATION AND EFFECTIVE AREA, sq. mm.															Set Pressure (kPag)
	D 71.0	E 126	F 198	G 325	H 506	J 830	K 1186	L 1841	M 2323	N 2800	P 4116	Q 7129	R 10323	T 16774	T2 17981	
*0.1 bar incr.	3.9	7.1	11.1	18.2	28.5	46.7	66.7	103	130	157	231	401	581	944	1012	10 kPa incr.
-0.5 bar incr.	19.9	35.6	55.7	91.3	142	233	333	518	654	788	1159	2007	2906	4723	5063	50 kPa incr.
0.35			155	255	398	652	932					5606				35
0.40			162	266	415	680	972					5843				40
0.45			168	275	430	705	1007	1563				6054				45
0.50			173	284	444	728	1040	1614			3611	6254				50
0.55		114	179	293	458	751	1072	1665	2101	2533	3723	6449	9338	15174	16267	55
0.60		117	184	302	471	773	1104	1713	2162	2607	3832	6638	9611	15618	16743	60
0.65		121	189	310	485	795	1135	1762	2224	2681	3941	6827	9885	16063	17220	65
0.70	69.7	124	194	319	497	816	1165	1809	2283	2753	4047	7009	10149	16493	17680	70
0.75	71.5	127	199	327	510	837	1196	1856	2343	2824	4152	7192	10414	16922	18141	75
0.80	73.4	130	204	335	523	858	1226	1904	2402	2896	4257	7374	10678	17352	18601	80
0.85	75.2	134	209	344	536	880	1257	1951	2462	2968	4363	7557	10942	17781	19061	85
0.90	77.0	137	215	352	549	901	1287	1998	2521	3039	4468	7739	11206	18211	19522	90
0.95	78.8	140	220	360	562	922	1317	2045	2580	3111	4574	7922	11471	18640	19982	95
1	80.6	143	225	368	575	943	1348	2092	2640	3183	4679	8104	11735	19069	20442	100
2	117	208	326	535	835	1369	1955	3034	3829	4616	6786	11754	17020	27658	29649	200
3	156	279	437	716	1118	1833	2618	4065	5129	6183	9090	15744	22798	37046	39714	300
4	196	350	548	899	1403	2301	3286	5101	6437	7760	11408	19759	28611	46494	49841	400
5	236	421	660	1082	1688	2769	3954	6138	7745	9337	13727	23775	34425	55941	59969	500
6	276	492	772	1265	1974	3236	4622	7175	9053	10914	16045	27790	40239	65388	70096	600
7	316	564	883	1447	2259	3704	5290	8211	10361	12491	18363	31805	46052	74835	80224	700
8	356	635	995	1630	2544	4172	5958	9248	11669	14068	20681	35820	51866	84283	90351	800
9	396	706	1106	1813	2829	4639	6626	10285	12978	15645	23000	39835	57680	93730	100479	900
10	436	777	1218	1996	3115	5107	7293	11321	14286	17222	25318	43850	63494	103177	110606	1000
11	476	849	1329	2178	3400	5574	7961	12358	15594	18799	27636	47865	69307	112625	120734	1100
12	516	920	1441	2361	3685	6042	8629	13395	16902	20376	29954	51880	75121	122072	130861	1200
13	556	991	1552	2544	3970	6510	9297	14431	18210	21953	32272	55895	80935	131519	140989	1300
14	596	1062	1664	2727	4256	6977	9965	15468	19518	23530	34591	59910	86748	140966	151116	1400
15	636	1133	1776	2909	4541	7445	10633	16505	20826	25107	36909	63926	92562	150414	161244	1500
16	676	1205	1887	3092	4826	7913	11300	17541	22134	26684	39227	67941	98376	159861	171371	1600
17	716	1276	1999	3275	5111	8380	11968	18578	23442	28261	41545	71956	104190	169308	181499	1700
18	756	1347	2110	3458	5397	8848	12636	19615	24750	29838	43863	75971	110003	178756	191626	1800
19	796	1418	2222	3641	5682	9316	13304	20651	26058	31415	46182	79986	115817	188203	201754	1900
20	836	1489	2333	3823	5967	9783	13972	21688	27367	32992	48500	84001	121631	197650	211881	2000
22	916	1632	2556	4189	6538	10718	15308	23761	29983	36146	53136	92031				2200
24	996	1774	2780	4554	7108	11654	16643	25834	32599	39300	57773	100061				2400
26	1076	1917	3003	4920	7678	12589	17979	27908	35215	42454	62409	108092				2600
28	1155	2059	3226	5285	8249	13524	19315	29981	37831	45608	67046	116122				2800
30	1235	2202	3449	5651	8819	14460	20650	32054	40447	48762	71682	124152				3000
32	1315	2344	3672	6017	9390	15395	21986	34128	43064	51916	76319	132182				3200
34	1395	2487	3895	6382	9960	16330	23322	36201	45680	55070	80955	140212				3400
36	1475	2629	4118	6748	10531	17265	24657	38274	48296	58223	85591	148243				3600
38	1555	2771	4341	7113	11101	18201	25993	40348	50912	61377	90228	156273				3800
40	1635	2914	4564	7479	11672	19136	27329	42421	53528	64531	94864	164303				4000
42	1715	3056	4787	7844	12242	20071	28665	44494	56144	67685	99501					4200
44	1795	3199	5011	8210	12813	21007	30000	46568	58761	70839	104137					4400
46	1875	3341	5234	8575	13383	21942	31336	48641	61377	73993	108774					4600
48	1955	3484	5457	8941	13954	22877	32672	50714	63993	77147	113410					4800
50	2035	3626	5680	9306	14524	23812	34007	52788	66609	80301	118046					5000
52	2115	3768	5903	9672	15095	24748	35343	54861	69225	83455	122683					5200
54	2195	3911	6126	10037	15665	25683	36679	56934	71841	86609	127319					5400
56	2275	4053	6349	10403	16236	26618	38014	59008	74458	89763	131956					5600
58	2355	4196	6572	10768	16806	27554	39350	61081	77074	92917	136592					5800
60	2434	4338	6795	11134	17376	28489	40686	63154	79690	96071	141229					6000
62	2514	4481	7018	11500	17947	29424	42022	65227	82306	99225	145865					6200
64	2594	4623	7242	11865	18517	30359	43357	67301	84922	102379	150502					6400
66	2674	4766	7465	12231	19088	31295	44693	69374	87538	105533	155138					6600
68	2754	4908	7688	12596	19658	32230	46029	71447	90155	108687	159774					6800
70	2834	5050	7911	12962	20229	33165	47364	73521	92771							7000
72	2914	5193	8134	13327	20799	34101	48700	75594	95387							7200
74	2994	5335	8357	13693	21370	35036	50036	77667	98003							7400
76	3074	5478	8580	14058	21940	35971	51372	79741								7600

† Capacities below 2.0 bar set pressure are calculated at 0.2 bar overpressure.

\* Not valid below 2.0 bar set pressure.

# Saturated Steam Capacities Unfired Pressure Vessel Service Styles JOS and JBS

Capacity in kilograms per hour of steam at 10% over-pressure. Valve discharging to atmospheric pressure.

Set Pressures  
78-200 barg

METRIC UNITS

Capacities certified by the National Board of Boiler and Pressure Vessel Inspectors and in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII.

Set Pressure (barg)	ORIFICE LETTER DESIGNATION AND EFFECTIVE AREA, sq. mm.															Set Pressure (tPeg) 10 kPa barg 50 kPa met.
	D 71.0	E 126	F 198	G 325	H 506	J 830	K 1186	L 1841	M 2323	N 2800	P 4116	Q 7129	R 10323	T 16774	U 17961	
0.1 bar incr. 0.5 bar met.	19.9	35.6	55.7	81.3	142	233	333	518	654	788	1159	2007	2906	4723	5063	
78	3154	5620	8803	14424	22511	36906	52707	81814								7800
80	3234	5763	9026	14789	23081	37842	54043	83887								8000
82	3314	5905	9249	15155	23652	38777	55379	85961								8200
84	3394	6047	9473	15520	24222	39712	56714	88034								8400
86	3474	6190	9696	15886	24793	40647	58050	90107								8600
88	3554	6332	9919	16252	25363	41583	59386	92181								8800
90	3634	6475	10142	16617	25934	42518	60721	94254								9000
92	3714	6617	10365	16983	26504	43453	62057	96327								9200
94	3780	6736	10550	17286	26978	44230	63167	98050								9400
96	3866	6889	10791	17681	27593	45240	64608	100287								9600
98	3953	7044	11033	18077	28212	46254	66056	102535								9800
100	4040	7199	11276	18475	28834	47273	67512	104794								10000
102	4127	7355	11520	18876	29458	48297	68975	107065								10200
104	4215	7512	11766	19278	30086	49327	70445									10400
106	4304	7669	12013	19683	30718	50362	71923									10600
108	4393	7828	12261	20089	31353	51402	73410									10800
110	4482	7987	12511	20498	31991	52449	74904									11000
112	4572	8147	12762	20910	32633	53502	76408									11200
114	4663	8309	13015	21324	33279	54561	77920									11400
116	4754	8471	13269	21740	33929	55626	79442									11600
118	4846	8634	13524	22159	34583	56698	80973									11800
120	4938	8799	13782	22581	35241	57778	82514									12000
122	5031	8964	14041	23006	35904	58864	84065									12200
124	5124	9131	14302	23433	36571	59958	85628									12400
126	5218	9298	14565	23864	37243	61059	87201									12600
128	5313	9467	14829	24297	37919	62169	88785									12800
130	5409	9638	15096	24734	38601	63287	90382									13000
132	5505	9809	15365	25175	39289	64414	91991									13200
134	5602	9982	15636	25618	39981	65549										13400
136	5700	10157	15909	26066	40680	66694										13600
138	5799	10332	16184	26517	41384	67849										13800
140	5898	10510	16462	26972	42094	69013										14000
142	5999	10689	16742	27432	42811	70189										14200
144	6100	10869	17025	27895	43535	71375										14400
146	6202	11052	17311	28363	44265	72572										14600
148	6306	11236	17599	28836	45003	73782										14800
150	6410	11422	17891	29314	45748	75004										15000
152	6516	11610	18186	29796	46501	76239										15200
154	6622	11800	18483	30284	47263	77487										15400
156	6730	11992	18784	30777	48033	78749										15600
158	6839	12187	19089	31277	48812	80027										15800
160	6950	12384	19397	31782	49600	81319										16000
162	7062	12583	19710	32293	50399	82628										16200
164	7175	12785	20026	32812	51207	83954										16400
166	7290	12990	20346	33337	52027	85298										16600
168	7406	13197	20671	33869	52858	86660										16800
170	7525	13408	21001	34409	53701											17000
172	7644	13621	21336	34957												17200
174	7766	13838	21675	35514												17400
176	7890	14059	22021	36080												17600
178	8016	14283	22372	36655												17800
180	8143	14511	22728	37239												18000
182	8274	14743	23092	37835												18200
184	8406	14979	23462	38441												18400
186	8541	15220	23839	39059												18600
188	8679	15465	24224	39690												18800
190	8820	15716	24617	40334												19000
192	8964	15973	25018	40991												19200
196	9262	16503	25849	42352												19600
200	9574	17059	26721	43781												20000



# Pressure Relief Valves - Custom Designed by Crosby Engineering

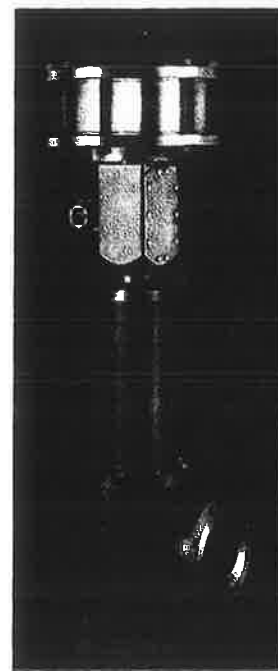
***Crosby can design and manufacture pressure relief valves to meet your unique requirements.***

## **Application:**

- ◆ Emergency depressurizing system for overpressure protection and protection in the event of a fire or runaway exothermic reaction.

## **Solution:**

- ◆ Crosby® Style JBS pressure relief valve with special axial pneumatic actuator custom designed by Crosby Engineering.
- ◆ Standard direct operating pressure relief valve which can also be opened pneumatically.
- ◆ Pneumatic operation as a result of remote sensing of pressure, temperature or other process variables.
- ◆ Direct in line loading of valve spindle without the use of levers or cams.
- ◆ Full lift of valve disc with zero pressure at the inlet port.
- ◆ Remote valve lift indication.



**To find out more about this unique pressure relief valve with special axial pneumatic actuator, or for information about how Crosby can provide you with a special valve designed to meet your needs, contact the Crosby Factory or your local Crosby Representative.**

## Crosby Block Body Pressure Relief Valves

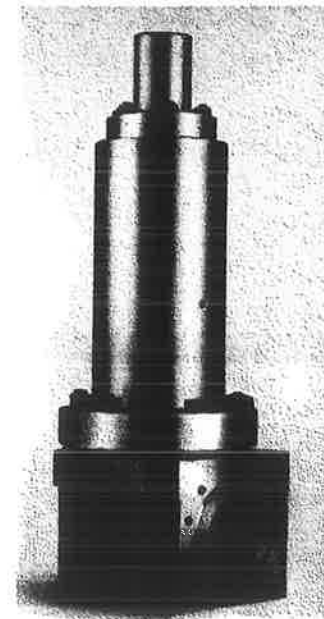
***With today's process systems requiring greater and larger throughputs at ever increasing pressure, Crosby's Block Body Pressure Relief Valves provide the solution to applications involving very high set and back pressures that exceed standard ranges.***

**One single Crosby Block Body Pressure Relief Valve installation can handle the capacity of multiple API-526 standard valves with:**

- ◆ Fewer potential leak paths
- ◆ Less down time and maintenance
- ◆ Fewer spare parts required
- ◆ Cost savings on inlet and outlet piping

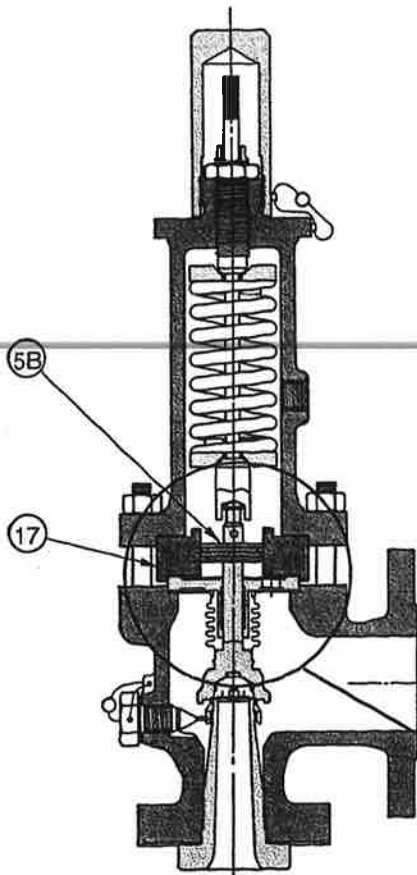
## **Design Details:**

- ◆ Full nozzle design for maximum tightness
- ◆ Geometrically designed valve block body and bonnet for weight savings
- ◆ Dissimilar materials are used for guiding surfaces to eliminate galling
- ◆ Interference fitted inlet studs provided
- ◆ Available in orifice sizes from "D" through "T2"
- ◆ Materials of construction available for special process applications
- ◆ Available in Crosby Styles JOS, JBS and JLT valve designs



**For more information, contact the Factory or your local Crosby Representative.**

# Crosby Styles JBS and JLT-JBS balanced bellows valves with supplementary back pressure balancing piston



**Styles JBS-BP  
and JLT-JBS-BP**

Styles JBS-BP and JLT-JBS-BP are a modification to the Crosby bellows pressure relief valve designed and tested in collaboration with engineers of one of the world's leading petroleum companies. This adaptation provides additional assurance of safe performance in the event of bellows failure on installations having discharge manifold systems where back pressures (constant or variable) are present.

The Crosby bellows pressure relief valve (Styles JBS and JLT-JBS) was especially developed for service under back pressure conditions. The balanced area bellows counteracts back pressure effects. However, in case of a broken or ruptured bellows, the valve would perform in the manner of a standard valve without bellows. Introduction of the Supplementary Back Pressure Balancing Piston guarantees full performance characteristics of the valve until necessary replacement of the bellows can be made. This design, illustrated at the left, thus affords double protection.

Unless compensated for, the effects of back pressure may cause (1) a change in the opening pressure, (2) a decrease in valve capacity, and (3) valve performance to become unstable at higher back pressure. Use of the bellows valve with supplementary balancing piston maintains the balancing effect even after bellows failure and in such event would allow the valve to function in essentially the same manner as with the bellows intact. However, the bonnet of the valve must be vented in order to insure proper functioning of the valve. The vent also serves for a tell-tale in case of a ruptured or broken bellows.

### Design

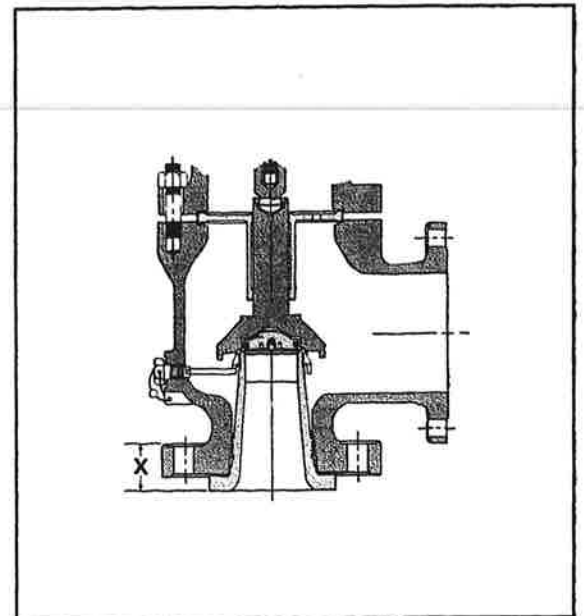
The auxiliary balancing piston is incorporated in the basic bellows valve, modified to include the piston (5B) and the cylinder (17) which is part of the disc holder. The guiding clearances are held to a minimum and, in addition, grooves in the piston form a labyrinth seal to reduce flow between the piston and cylinder. Thus, in the event of a bellows failure, the leakage of fluid to atmosphere is kept to a minimum.

## Flanges and Flange Facing

Dimensions of flanges conform to current ANSI standards. On full nozzle valve inlets, however, the thicknesses are greater than the minimum required by ANSI standards. Dimension X shown at right should be used to determine bolt length. Dimension X remains the same for raised face or ring joint flanges and is found on pages 14 through 42.

All flange facings are spiral serrated finish or concentric serrated finish. Optional finishes are available. Drilling of inlet and outlet flange holes straddle the valve center line. Inlet and outlet flanges are spot faced on back for stud nuts. Center-to-face dimensions are subject to tolerance of  $\pm 1/16"$  (1.5mm) for valves through 4" inlet size and  $\pm 1/8"$  (3.17mm) for valves with inlet size larger than 4".

In addition to standard raised face or ring joint flanges, tongue and groove or other flange facings are available as options.



## Crosby JBS and JLT-JBS Balanced Bellows Pressure Relief Valves for Sour Gas Service per NACE MR0175

**Level 1** - For applications where compliance with NACE MR0175 is required for wetted parts in the primary (upstream) pressure zone of the pressure relief valve.

**Level 2** - For applications where compliance with NACE MR0175 is required for wetted parts in the primary (upstream) and secondary (downstream) pressure zones of the pressure relief valve.

The stainless steel or Inconel bellows isolates the valve spring and other critical components above it from the process fluid.

While the materials recommended for the Crosby Style JBS and JLT-JBS sour gas valves are suitable for average service conditions, optional materials are available to provide additional resistance to corrosion beyond the minimum requirements of the standard.

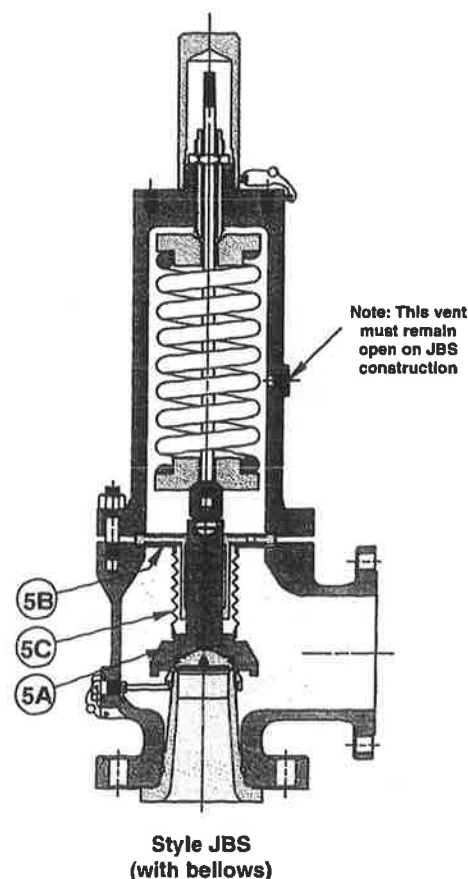
Ref. No.	Part Name	Standard NACE Material	
		Level 1	Level 2
1	Body	Carbon Steel SA-216 Gr. WCB	Carbon Steel SA-216 Gr. WCB
2	Nozzle	316 St.St.	316 St.St.
3	Nozzle Ring	316 St.St.	316 St.St.
4	Set Screw	416 St.St.	316 St.St.
5A	Disc Holder	316L St.St.	316L St.St.
5B	Bellows Top Flange	316L St.St.	Inconel (Note 2)
5C	Bellows	316L St.St.	Inconel
6	Disc Insert	316 St.St.	316 St.St.
8	Guide	St.St. ASTM A 297 Gr. HE	St.St. ASTM A 297 Gr. HE
9	Spindle	416 St.St.	416 St.St.
10	Spring	Carbon Steel	Carbon Steel Aluminum Metallized
11	Spring Washer	Steel	Steel
12	Bonnet	Carbon Steel SA-216 Gr. WCB	Carbon Steel SA-216 Gr. WCB
13	Bonnet Stud	Alloy Steel	Note 1
14	Bonnet Nut	Steel	Note 1
15	Adjusting Bolt	416 St.St.	416 St.St.
16	Adj. Bolt Nut	Steel	Steel
20	Set Screw Gasket	*	*
21	Guide Gasket	*	*
22	Seal & Wire	Lead & St.St.	Lead & St.St.
23	Seal Clip	St.St.	St.St.
24	Type J Cap	Steel	Steel
25	Cap Gasket	*	*

Note: Shaded materials indicate variation from standard.

\*Organic Fiber Non-Asbestos

**Note 1** - Standard bolting material is furnished for NACE MR0175 Class III applications where bolting is not directly exposed to sour environments and is not buried, insulated, equipped with flange protectors, or otherwise denied direct atmospheric exposure. If Class I or II bolting is required, bolts will be ASME A193 Grade B7M HRC-22 maximum and nuts will be ASME A194 Class 2HM HRC-22 maximum.

**Note 2** - Top flange on D and E orifice bellows is 316 stainless steel.

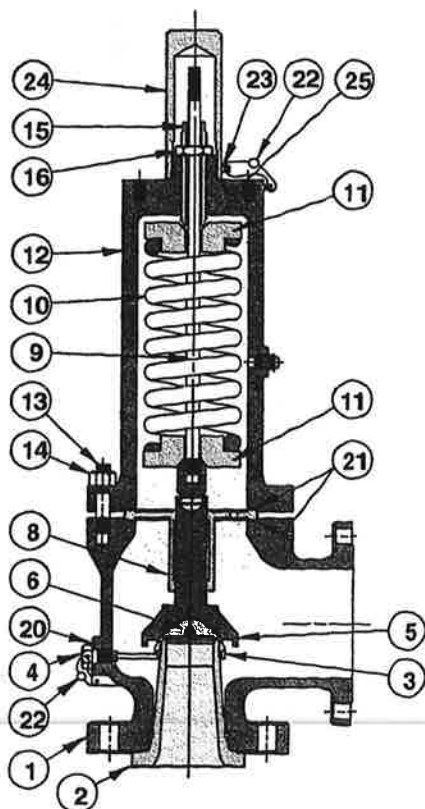


## Crosby JOS and JLT-JOS Pressure Relief Valves for Sour Gas Service per NACE MR0175

**Level 1** - For applications where compliance with NACE MR0175 is required for wetted parts in the primary (upstream) pressure zone of the pressure relief valve.

**Level 2** - For applications where compliance with NACE MR0175 is required for wetted parts in the primary (upstream) and secondary (downstream) pressure zones of the pressure relief valve.

While the materials recommended for the Crosby Style JOS and JLT-JOS sour gas valves are suitable for average service conditions, optional materials are available to provide additional resistance to corrosion beyond the minimum requirements of the standard.



**Style JOS**

Ref. No.	Part Name	Standard NACE Material	
		Level 1	Level 2
1	Body	Carbon Steel SA-216 Gr. WCB	Carbon Steel SA-216 Gr. WCB
2	Nozzle	316 St.St.	316 St.St.
3	Nozzle Ring	316 St.St.	316 St.St.
4	Set Screw	416 St.St.	316 St.St.
5	Disc Holder	316L St.St.	316L St.St.
6	Disc Insert	316 St.St.	316 St.St.
8	Guide	St.St. ASTM A 297 Gr. HE	St.St. ASTM A 297 Gr. HE
9	Spindle	416 St.St.	316 St.St.
10	Spring	Carbon Steel	Inconel X750
11	Spring Washer	Steel	316 St.St.
12	Bonnet	Carbon Steel SA-216 Gr. WCB	Carbon Steel SA-216 Gr. WCB
13	Bonnet Stud	Alloy Steel	Note 1
14	Bonnet Nut	Steel	Note 1
15	Adjusting Bolt	416 St.St.	316 St.St.
16	Adj. Bolt Nut	Steel	316 St.St.
20	Set Screw Gasket	*	*
21	Guide Gasket	*	*
22	Seal & Wire	Lead & St.St.	Lead & St.St.
23	Seal Clip	St.St.	St.St.
24	Type J Cap	Steel	Steel
25	Cap Gasket	*	*

Note: Shaded materials indicate variation from standard.

\*Organic Fiber Non-Asbestos

**Note 1** - Standard bolting material is furnished for NACE MR0175 Class III applications where bolting is not directly exposed to sour environments and is not buried, insulated, equipped with flange protectors, or otherwise denied direct atmospheric exposure. If Class I or II bolting is required, bolts will be ASME A193 Grade B7M HRC-22 maximum and nuts will be ASME A194 Class 2HM HRC-22 maximum.

# Pressure Relief Valve Seat Tightness

## Metal-to-Metal Seats and Soft Seats

As system pressure approaches the valve set pressure, the differential force tending to hold the seats in contact is diminished. Consequently, to obtain an acceptable degree of tightness capability, the valve must be designed and built with a high level of quality.

Crosby pressure relief valves are carefully engineered and manufactured to provide those features essential for good valve performance and continuous long term protection. The inherent high degree of seat tightness found in Crosby pressure relief valves is possible due to the following design features:

1. Positive alignment of the seats through generous guiding and ball joints.
2. Minimum distortion as a result of full nozzle construction and thermally balanced disc design.
3. Excellent flatness and surface finish of the seating surfaces by precision machining and custom lapping.

Cleanliness of the system and proper installation of the valve are also essential for good seat tightness.

### Definition

Ambiguous terms such as "bubble tight," "drop tight," "zero leakage" and "commercial tightness" have been used in the past. Since these terms were used without uniform definition, they lacked true practical meaning.

Now with the adoption of a standard that defines the terminology used to describe pressure relief devices (ASME Performance Test Code PTC-25.3), and the adoption of a standard describing a method of determining seat tightness of relief valves (API Standard 527), there should exist a degree of uniformity throughout the industry.

### "Commercial" Seat Tightness Standard (API Standard 527)

The following API Standard of "commercial" tightness has been adopted by industry and users in order to clarify testing methods and tightness standards for the sake of uniformity. It applies to pressure relief valves.

The API Standard is as follows:

#### Scope:

This standard describes a method of determining seat tightness of pressure relief valves as covered in *API Standard 527 Seat Tightness of Pressure Relief Valves*. The maximum acceptable leakage rates are defined for commercial pressure relief valves with metal-to-metal and soft seats for set pressures up to 6000 psig (414 barg). If greater tightness is required, it can be supplied but must be specified on the purchase order or inquiry. See page 9 for Crosby soft seat pressure-temperature limits.

#### Test Apparatus

A typical test arrangement for determining seat tightness for pressure relief valves is shown in Fig. 1. Leakage measurement shall be made with use of a 5/16 in. (7.93 mm) OD tubing with 0.035 in. (.88 mm) wall. The tube end shall be cut square and smooth. It shall be parallel to and 1/2 in. (127 mm) below the surface of the water. A clamp type seat leak apparatus is available from Crosby. Contact the factory.

#### Procedure

With the valve mounted vertically, as shown in Fig. 1, the leakage rate in bubbles per minute shall be determined with pressure at the valve inlet held at 90 percent of the cold differential test pressure, except for valves set at 50 psig (3.44 barg) or below, in which case the pressure shall be held at 5 psig (.34 barg) below the cold differential test pressure. The test pressure shall be applied for a minimum of 1 minute for valves of inlet sizes through 2 in. (50.8 mm); 2 minutes for sizes 2-1/2, 3 and 4 in. (63.5, 76.2 and 101.6 mm); 5 minutes for sizes 6 in. and 8 in. (152.4 and 203.2 mm). Air at approximately atmospheric temperature shall be used as the pressure medium.

### Tightness Standard

The leakage rate in bubbles per minute shall not exceed the values indicated in Table I below. For soft seated valves there shall be no leakage for one minute (zero bubbles for one minute).

Table I

Set Pressure psig (barg)	Effective Orifice Sizes 0.307 in. <sup>2</sup> and Smaller			Effective Orifice Sizes Larger Than 0.307 in. <sup>2</sup>		
	Max Bubbles Per Minute	Approximate Leakage Rate Per 24 Hours		Max Bubbles Per Minute	Approximate Leakage Rate Per 24 Hours	
		Standard Cubic Feet	Standard Cubic Meters		Standard Cubic Feet	Standard Cubic Meters
15-1000 (1.03-68.9)	40	0.60	0.017	20	0.30	0.0085
1500(103.4)	60	0.90	0.026	30	0.45	0.013
2000(137.9)	80	1.20	0.034	40	0.60	0.017
2500(172.4)	100	1.50	0.043	50	0.75	0.021
3000(206.8)	100	1.50	0.043	60	0.90	0.026
4000(275.8)	100	1.50	0.043	80	1.20	0.034
5000(344.8)	100	1.50	0.043	100	1.50	0.043
6000(413.7)	100	1.50	0.043	100	1.50	0.043

### Maximum Seat Leakage Rate Metal Seated Pressure Relief Valves

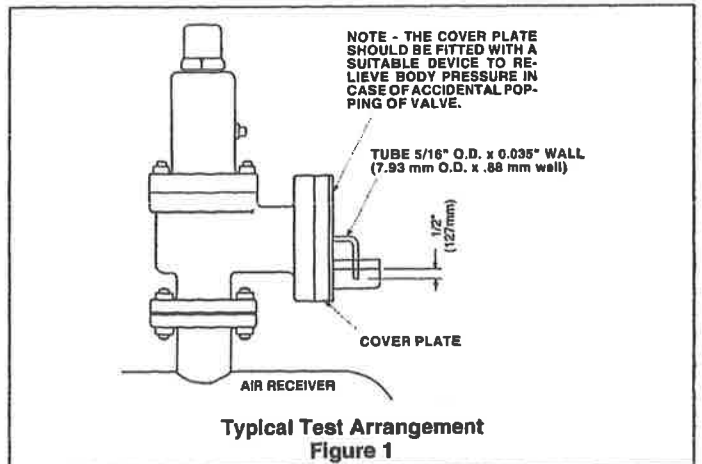
### Crosby Seat Tightness Standard - Water Service Valves (Style JLT)

Crosby pressure relief valves are checked for seat tightness by a quantitative seat leakage test. All of the test fluid passing through an assembled valve is collected and measured under the following test conditions:

1. The inlet pressure is adjusted to a test pressure which is 90% of the "Cold Differential Test Pressure." Valves set below 50 psig (3.44 barg) are tested at 5 psig (.34 barg) below the cold differential test pressure.
2. The seat leak pressure is maintained for a period of not less than ten minutes.

### Allowable Leak Rate

The maximum allowable leakage rate should not exceed 10 cubic centimeters per hour per inch of diameter of nominal valve inlet size. For nominal valve sizes of 1 inch (25.4 mm) or less, the leakage rate shall not exceed 10 cubic centimeters per hour. For soft seated valves there shall be no leakage for one minute.



# Ordering Information

The primary purpose of Style JOS/JBS/JLT pressure relief valves is to protect lives and property. In order to select the proper valve for your application, please provide the information listed below. Details of the process fluid and conditions are especially important. If there is any doubt as to selection or application of valves or parts, please contact your local Crosby Sales Office or Representative.

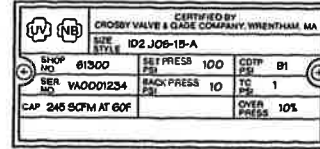
## Ordering Information

<b>Quantity</b>	<b>Example</b>
Nominal valve size (inlet x orifice x outlet)	5
Valve style	4 x L x 6
Inlet connection rating and facing	JOS-45
Outlet connection rating and facing	600 RF
Service (liquid, gas or vapor)	150 RF
Set pressure (psig)	Air
Back pressure (psig) if any, and whether constant or variable	800 psig
Maximum service temperature (°F)	Atmosphere
Cap or lifting lever type	Ambient 60F
Valve materials	Type C
Seat material	Standard
Code requirements	Metal-to-metal standard
Required capacity	ASME Unfired
Accumulation (allowable overpressure)	Pressure Vessel Code Section VIII
Molecular weight - vapor	45433 SCFM
Specific gravity - gases and liquids	10%
Viscosity - liquids	1.0
	-
	-

## Parts

To order parts, the following information should be included:

1. Quantity
2. Part name, i.e., disc insert
3. Size, style and valve number
4. Assembly number (from valve nameplate)
5. Serial number (from valve nameplate)
6. Original purchase order number (if assembly number has been destroyed).



**Sample Nameplate**

(Figures shown are for illustrative purposes only.)

Crosby provides special "fast response" delivery service of spare parts to satisfy unplanned parts requirements. Fast response delivery service can be initiated by contacting your local Crosby representative. Emergency delivery service is available direct from the factory, 24 hours a day, 7 days a week by calling (508) 384-3121.

## Springs with Washers

To order springs with washers, in addition to the other information included for "Parts," the required valve set pressure must also be specified. If the spring is for a non-bellows valve, and there is a constant back pressure condition, that too should be specified. Also specify spring material and coating if other than standard.

## Replacement Valves

To replace a valve in service, the assembly number, serial number, set pressure and previous order number should be specified.

## WARRANTY

Crosby Valve & Gage Company, Crosby Valve and Engineering Company, Limited, Crosby Services International Ltd., Crosby Valve Pte. Ltd., Crosby Valve Ltd. or Crosby Valve Corporation (collectively "Crosby") hereby warrant, for a period of one year from the date of shipment by Crosby, that its product or products ("Product") shall be free from defects in workmanship and material. This Warranty shall extend only to original purchasers of Product (the "Purchaser") and shall be exclusive of the effects of corrosion, erosion, normal wear and tear as well as defects due to improper application, handling, storage, installation or maintenance or where Purchaser has failed to comply with Crosby's warnings. This Warranty also does not apply to any repairs, assembly or test work done on the Product by parties other than Crosby. Crosby does not warrant that its Product will perform in any specific or designated application. The use of replacement parts, components, products or services not manufactured by Crosby may, in the sole discretion of Crosby, void this Warranty.

Under no circumstances shall Crosby be liable for special, incidental or consequential damages including, but not limited to, claims for economic loss. Moreover, in no event shall Crosby's total liability exceed the original purchase price of the Product.

CROSBY MAKES NO OTHER WARRANTY WITH RESPECT TO THE PRODUCT AND PURCHASER ACKNOWLEDGES THAT CROSBY EXPRESSLY DISCLAIMS ANY WARRANTY OR REPRESENTATION OF ANY KIND, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE PERFORMANCE, MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE, OR WITH RESPECT TO PATENT OR TRADEMARK INFRINGEMENT.

Within this one year warranty period, any Product which Purchaser believes to be defective may be returned to Crosby after written notification to and authorization by Crosby. If Crosby determines that such Product is, in fact, defective, Crosby shall, at its option, either repair or replace the Product free of charge to the Purchaser. If the Product is not covered by this Warranty, any repair and shipping charges will be the responsibility of the Purchaser. These remedies are Purchaser's sole and exclusive remedies.

Should any portion of this Warranty be found to be invalid or unenforceable, such finding shall not affect the other terms of the Warranty which shall be construed as if such portion had never been contained herein.

## WARNING

The Product is a safety related component intended for use in critical applications. The improper application, installation or maintenance of the Product or the use of parts or components not manufactured by Crosby may result in a failure of the Product. The advice of a qualified engineer should be sought prior to any use of the Product.

Any installation, maintenance, adjustment, repair or test performed on the Product must be done in accordance with the requirements of all applicable Codes and Standards.

The information, specifications and technical data (the "Specifications") contained in this document are subject to change without notice. Crosby does not warrant that the Specifications are current and assumes no responsibility for the use or misuse thereof. The Purchaser should verify that there have been no changes to the Specifications prior to use.

**WARNING:** The information contained in this catalog is for informational purposes only. See also Crosby's Engineering Handbook and computer program, CROSBY-SIZE. The actual selection of valve products is dependent upon numerous factors and should be made only after consultation with applicable Crosby personnel. Crosby assumes no responsibility for the actual selection of such products and hereby expressly disclaims liability for any and all claims and damages which may result from the use or application of this information or from any consultation with Crosby personnel.

# Full Spectrum Services

Crosby's product service program is designed to save you money after the valves are installed and operational. Whether or not your organization performs its own repair and maintenance, the Crosby product service organization offers the spare parts, field service, repair and training required to keep your shutdowns short and maintenance investment at a minimum.



## CROSBY FULL SPECTRUM SERVICES

### Replacement Parts

Spare parts for Crosby valves are on the shelf and special material parts are readily available when you need them. Recommended spare parts lists, parts interchangeability and documentation information on Crosby valves in your plant are also available on request.

### Valve Repair

Crosby's valve repair centers at Wrentham, Massachusetts and in England, Scotland, Singapore, Brazil and India, are staffed by highly trained technicians to refurbish and test your valves, providing around-the-clock repair of safety valves during power plant shutdown and fast routine repair of process safety relief and relief valves. Crosby also has Designated Repair Centers worldwide; for the location of the center nearest you, consult your local Crosby representative or Crosby's Worldwide Directory.

### Testing

Crosby has the capability to evaluate pressure relief valve operability either in the field or at various Crosby facilities. Special nuclear qualifications can also be accomplished.

### Contract Management

Crosby will combine a group of services to satisfy your special maintenance needs.

### Field Service

A fully trained staff of technicians is based at strategic locations to provide scheduled or emergency maintenance of Crosby pressure relief valves. Backed by an around-the-clock emergency repair facility, a complete line of specialized portable on-site repair tooling and instructional materials, Crosby's service can mean thorough maintenance and testing at minimum cost.

### Training

Maintenance training seminars are conducted on fossil power, process and nuclear pressure relief valves and related equipment. Seminars are held at Wrentham, MA, Houston, Texas or on-site if required. Contact Crosby Wrentham Product Service for details. Seminars are also conducted through our operations in Market Harborough, England, Aberdeen, Scotland and Singapore.

# Crosby Products

- ◆ Pressure Relief Valves for Air, Steam, Vapor and Liquid Service -- Spring Loaded and Pilot Operated
- ◆ Safety Valves for Fossil and Nuclear Power Plants
- ◆ Pressure/Vacuum Relief Valves for Sanitary, Beverage, Food and Pharmaceutical Industries
- ◆ Valves for Chlorine, Bromine, Fluorine and other corrosive services
- ◆ Valve Test Benches and Silencers
- ◆ Comprehensive Test Facilities for Air, Steam and Water
- ◆ Valve Field Service, Repair and Reconditioning, and Training
- ◆ Set Pressure Verification Device (SPVD) and Valve Position Indication (VPI) Systems

Ask for Crosby's Condensed Catalog



Quality is assured at Crosby

For additional information in the selection and installation of Crosby's pressure relief valves, Crosby's computer sizing program, "CROSBY-SIZE," Crosby's "Engineering Handbook" and Instruction No. IS-V3137A, "Installation, Maintenance and Adjustment Instruction for Crosby Style JOS/JBS/JLT Valves" are available on request. In addition, Instruction Sheet No. IS-V3137, "Installing and Adjusting Crosby Nozzle Type Pressure Relief Valves Styles JOS, JBS, JLT" is attached to every Style JOS, JBS and JLT valve shipped from Crosby.

## Crosby Valve & Gage Company



### USA Operations and Executive Offices

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Tlx: (851) 34431 CROSBYG  
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Tel: (905) 681-2310  
Fax: (905) 681-1884

### Singapore (Asia Pacific Operations)

#### Crosby Valve Pte. Ltd.

510 Thomson Road  
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Singapore 1129  
Tel: (65) 353-8879  
Tlx: RS25621 CROSBY  
Fax: (65) 353-6092

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# Pressure Transmitters

**Intrinsically Safe or Non-Incendive - Flush Diaphragm**

Ranges 50 INWC to 300 PSI • Model 892.13.520

Ranges 400 PSI to 8,000 PSI • Model 892.23.520

## Tronic

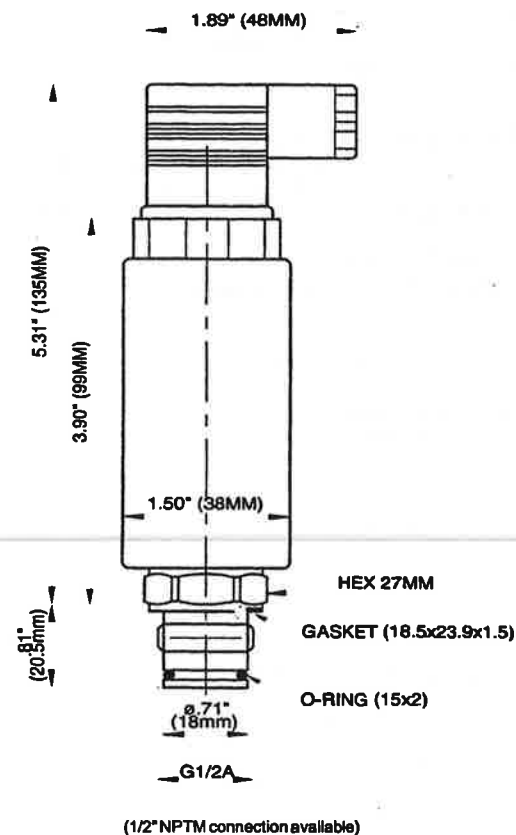
Flush diaphragm intrinsically safe pressure transmitters are engineered for applications requiring Class I, Division I protection in hazardous environments. Each unit undergoes extensive quality control testing and calibration to achieve an accuracy of 0.25% B.F.S.L. The printed circuit board uses state-of-the-art surface mount technology and is potted in epoxy casting resin for protection against vibration, shock and humidity. Units are temperature compensated to assure accuracy and long term stability under severe ambient temperature variations.

Flush diaphragm transmitters are designed for the measurement of viscous fluids or media containing solids. The diaphragm size is dependent upon the pressure range. The compact design provides a rugged transmitter particularly suited for applications in water and wastewater treatment, pulp and paper stock measurement, tank level measurement, test equipment and other monitoring and process control operations in hazardous environments.



### STANDARD RANGES

Model	RANGE	MAXIMUM*	BURST**
892.13.520	30 "Hg VAC	70 PSI	70 PSI
	30"-0-30 PSIG	250 PSI	250 PSI
	30"-0-60 PSIG	500 PSI	500 PSI
	30"-0-100 PSIG	500 PSI	500 PSI
	30"-0-160 PSIG	500 PSI	500 PSI
	30"-0-200 PSIG	1100 PSI	1100 PSI
	0-50 INWC	30 PSI	30 PSI
	0-100 INWC	30 PSI	30 PSI
	0-5 PSIG	30 PSI	30 PSI
	0-10 PSIG	60 PSI	60 PSI
	0-15 PSIG(A)	70 PSI	70 PSI
	0-25 PSIG(A)	145 PSI	145 PSI
	0-30 PSIG	145 PSI	145 PSI
	0-50 PSIG(A)	250 PSI	250 PSI
	0-60 PSIG	250 PSI	250 PSI
	0-100 PSIG(A)	500 PSI	500 PSI
	0-160 PSIG	500 PSI	500 PSI
	0-200 PSIG	500 PSI	500 PSI
	0-250 PSIG(A)	1100 PSI	1100 PSI
	0-300 PSIG	1100 PSI	1100 PSI
892.23.520	0-400 PSIG	725 PSI	3600 PSI
	0-500 PSIG(A)	1100 PSI	5800 PSI
	0-600 PSIG	1100 PSI	5800 PSI
	0-750 PSIG	1100 PSI	5800 PSI
	0-1000 PSIG	1750 PSI	8000 PSI
	0-1500 PSIG	2900 PSI	11,600 PSI
	0-2000 PSIG	4600 PSI	14,500 PSI
	0-3000 PSIG	4600 PSI	14,500 PSI
	0-5000 PSIG	11,600 PSI	25,000 PSI
	0-8000 PSIG	17,400 PSI	35,000 PSI
	0-10,000 PSIG	17,400 PSI	35,000 PSI
	0-15,000 PSIG	21,750 PSI	43,500 PSI



**Notes:**

\* Maximum pressure, causing no permanent changes in specifications but may lead to adjustable zero and span shifts.

\*\* Burst pressure, leading to permanent, non-adjustable changes in specifications (i.e. zero offsets) or destruction of transmitter.



## Specifications

**Input**  
10-28 VDC

**Output & load limitations**  
4-20mA 2-wire  $R_{(max)} = (V_s - 10V) / 0.02 A$

**Accuracy**  
Linearity (B.F.S.L.)  $\leq 0.25\%$  of span  
Hysteresis  $\leq 0.1\%$  of span  
Repeatability  $\leq 0.05\%$  of span  
1 yr. stability  $\leq 0.2\%$  of span  
Response time  $\leq 1$  ms  
( 10-90% full scale )  
Zero & span adjustment  $\pm 5.0\%$  full span maximum

**Temperature**  
Effective temperature compensation (+32°F to 175°F) (0°C to 80°C)  
Media (-25°F to 212°F) (-20°C to 100°C)  
Ambient (-5°F to 175°F) (-20°C to 80°C)  
Storage (-40°F to 212°F) (-20°C to 80°C)

**Temperature error** (reference temperature 70 °F)  
On zero (% of span/18 °F)  $\leq 0.2$   
On span (% of span/18 °F)  $\leq 0.2$

**Process connection**  
Instrument span 50 INWC to 30 PSI G1A Flush  
Instrument span 50 PSI to 8000 PSI G1/2A Flush  
Weld inserts available for all spans

**Electrical connection**  
DIN 43650 solderless screw terminal  
(IP 65 / NEMA 5)

**Material**  
Wetted parts 316 stainless steel  
(Optional: -Hastelloy C flush diaphragm)  
(-Teflon PFA coated flush diaphragm)  
Body material 304 stainless steel

**Transmitting liquid**  
Silicone oil, other options available

**Electrical protection**  
Protected against reverse polarity

**Vibration protection**  
Internal electronics 100% potted in epoxy casting resin

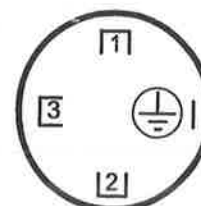
### Wiring

#### 2-Wire Current Loop

SIGNAL	DIN PLUG
Supply +	Pin 1
Signal -	Pin 2

\* All WIKA transmitters are calibrated at the factory. In the event calibration is required as a maintenance procedure, please use the following steps:

1. Remove cap
2. Set zero pot
3. Test zero
4. Set span pot
5. Test span
6. Replace cap



Use pin 4 or blue wire for shield

### Approval authority (Certification)

CENELEC/BASEEFA/BVS (European)

CANADIAN STANDARD ASSOCIATION Intrinsically safe  
Class I, Division 1 Group A, B, C, D  
 $V_{max} = 28v$   $C_i = 33 nF$   
 $I_{max} = 220 mA$   $L_i = 80 \mu H$   
Nonincendive for Class I, Division 2, Group A, B, C, & D  
(Barrier not required)

FACTORY MUTUAL intrinsically safe with entity approval for:  
Class I, Division 1, Groups A, B, C, D  
Class II, Division 1, Groups E, F, G  
Class III, Division 1  
hazardous location per WIKA dwg. 1354612  
nonincendive for Class I, Div 2, Groups A, B, C, D

$V_{max} = 28 V$   $C_i = 20 nF$   
 $I_{max} = 660 mA$   $L_i = 0 \mu H$

### Codes compliance

EN 50014/50020 relating to intrinsically safe products  
FM-3610 intrinsic standard  
CSA standard C22.2  
NACE MR-01-75 Certificate available  
Contact the factory for other worldwide approvals

### Conformity specifications

Power supply  
Short circuit Rating  
Power Rating  
Operating Temperature

### E Ex ia II C T5

10...28 VDC  
660mA  
(1.75W)  
-5°/150 °F(-5°/165 °F)

### E Ex ia II C T6

10...28 VDC  
660mA  
(1.75W)  
-5°/120 °F(-5°/140 °F)

**NOTE:** Power supply may be by means of common zener barriers or equivalent certified devices if the transmitters are operated within above temperature limits. The temperatures in parentheses are applicable if the output of the power supply is limited to the power rating values given in parentheses.

### Ordering Information:

State computer part number (if available) / model number / range / output / connections required. See price sheet for special options.

**WIKA reserves the right to make design changes without prior notice.**

### WIKA Instrument Head Office

WIKA Instruments Canada Ltd.  
9220 - 25 Avenue, Edmonton, Alberta T6N 1E1  
TEL (780) 438-6662 FAX (780) 437-0889

### WIKA Branch Office

1535 Meyerside Drive, Unit #6  
Mississauga, Ontario L5T 1M9  
TEL (905) 795-1677 Fax (905) 795-1669  
<http://www.wika.ca>



# Pressure Transmitters

Intrinsically Safe or Non-Incendive Safe  
Piezoresistive • Model 892.13.500  
Thin Film • Model 892.23.510

## Tronic

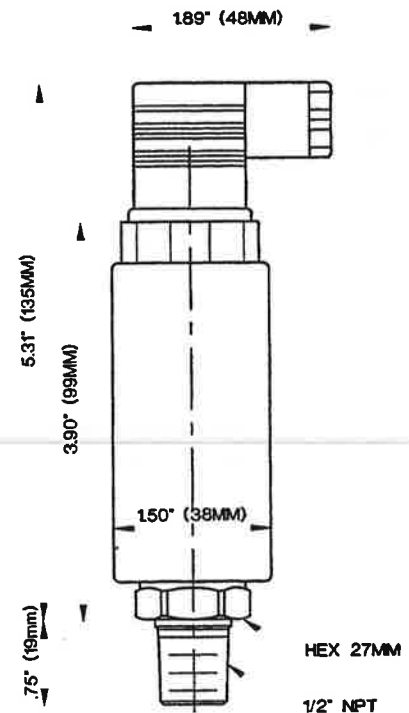
Intrinsically safe pressure transmitters are engineered for applications requiring Class I, Division I protection in hazardous environments. Each unit undergoes extensive quality control testing and calibration to achieve an accuracy of 0.25% full scale. The printed circuit board uses state-of-the-art surface mount technology and is potted in epoxy casting resin for protection against vibration, shock and humidity. Units are temperature compensated to assure accuracy and long term stability under severe ambient temperature variations.

The compact design provides a rugged transmitter suitable for various applications in hydraulics & pneumatics, vacuum, test stands, tank level measurement and other monitoring and control applications in hazardous environments.



## STANDARD RANGES

Model	RANGE	MAXIMUM*	BURST**
892.13.500	30 "Hg VAC	70 PSI	70 PSI
	30"-0-30 PSIG	250 PSI	250 PSI
	30"-0-60 PSIG	500 PSI	500 PSI
	30"-0-100 PSIG	500 PSI	500 PSI
	30"-0-160 PSIG	500 PSI	500 PSI
	30"-0-200 PSIG	1100 PSI	1100 PSI
	0-50 INWC	30 PSI	30 PSI
	0-100 INWC	30 PSI	30 PSI
	0-5 PSIG	30 PSI	30 PSI
	0-10 PSIG	60 PSI	60 PSI
	0-15 PSIG(A)	70 PSI	70 PSI
	0-25 PSIG(A)	145 PSI	145 PSI
	0-30 PSIG	145 PSI	145 PSI
	0-50 PSIG(A)	250 PSI	250 PSI
	0-60 PSIG	250 PSI	250 PSI
	0-100 PSIG(A)	500 PSI	500 PSI
	0-160 PSIG	500 PSI	500 PSI
	0-200 PSIG	500 PSI	500 PSI
	0-250 PSIG(A)	1100 PSI	1100 PSI
	0-300 PSIG	1100 PSI	1100 PSI
892.23.510	0-400 PSIG	725 PSI	3600 PSI
	0-500 PSIG(A)	1100 PSI	5800 PSI
	0-600 PSIG	1100 PSI	5800 PSI
	0-750 PSIG	1100 PSI	5800 PSI
	0-1000 PSIG	1750 PSI	8000 PSI
	0-1500 PSIG	2900 PSI	11,600 PSI
	0-2000 PSIG	4600 PSI	14,500 PSI
	0-3000 PSIG	4600 PSI	14,500 PSI
	0-5000 PSIG	11,600 PSI	25,000 PSI
	0-8000 PSIG	17,400 PSI	35,000 PSI
	0-10,000 PSIG	17,400 PSI	35,000 PSI
	0-15,000 PSIG	21,750 PSI	43,500 PSI



### Notes:

\* Maximum pressure, causing no permanent changes in specifications but may lead to adjustable zero and span shifts.

\*\* Burst pressure, leading to permanent, non-adjustable changes in specifications (i.e. zero offsets) or destruction of transmitter.

(A) Ranges available with absolute pressure reference.

## Specifications

### Input

10-28 VDC

### Output & load limitations

4-20mA 2-wire  $R_{(max)} = (V_s - 10V)/0.02 A$

### Accuracy

Linearity (B.F.S.L.)  $\leq 0.25\%$  of span  
 Hysteresis  $\leq 0.1\%$  of span  
 Repeatability  $\leq 0.05\%$  of span  
 1 yr. stability  $\leq 0.2\%$  of span  
 Response time  $\leq 1$  ms  
 ( 10-90% full scale )  
 Zero & span adjustments  $\pm 1.0\%$  full scale

### Temperature

Effective temperature compensation  $+32$  °F to  $175$  °F  
 Media  $-25$  °F to  $212$  °F  
 Ambient  $-5$  °F to  $175$  °F  
 Storage  $-40$  °F to  $212$  °F

### Temperature error

On zero (% of span/18 °F)  $\leq 0.2$   
 On span (% of span/18 °F)  $\leq 0.2$

### Process connection

1/2" NPTM  
 Other options available

### Electrical connection

DIN 43650 solderless screw terminal  
 ( IP 65 / NEMA 5 )

### Material

Wetted parts 316 stainless steel  
 Body material 304 stainless steel

### Transmitting liquid

Silicone oil  
 Fluorocarbon oil for O<sub>2</sub> service

### Electrical protection

Protected against reverse polarity

### Vibration protection

Internal electronics 100% potted in epoxy casting resin

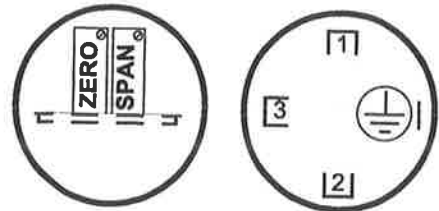
### Wiring

#### 2-Wire Current Loop

SIGNAL	DIN PLUG
Supply +	Pin 1
Signal -	Pin 2

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1. Remove cap
2. Set zero pot
3. Test zero
4. Set span pot
5. Test span
6. Replace cap



Use pin 4 or blue wire for shield



### Approval authority

CANADIAN STANDARDS ASSOCIATION

Class I, Division 1, Group A, B, C & D

V<sub>max</sub> = 28v Ci = 33nF

I<sub>max</sub> = 220 mA Li = 80 μH

GENELEC/BASEEFA/BVS (European)

FACTORY MUTUAL intrinsically safe with entity approval for:

Class I, Division 1, Groups A, B, C, D

Class II, Groups E, F, G

Class III

hazardous location per WIKA dwg. 1354612

nonincendive for Class I, Div 2, Groups A, B, C, D

V<sub>max</sub> = 28 V

Ci = 20 nF

I<sub>max</sub> = 660 mA

Li = 0 μH

### Codes compliance

EN 50014/50020 relating to intrinsically safe products

FM-3610 intrinsic standard

CSA Standard C22.2

### Conformity specifications

Power supply  
 Short circuit Rating  
 Power Rating  
 Operating Temperature

### E Ex ia II C T5

10...28 VDC  
 660mA  
 (1.75W)  
 -5°/150 °F (-5°/165 °F)

### E Ex ia II C T6

10...28 VDC  
 660mA  
 (1.75W)  
 -5°/120 °F (-5°/140 °F)

**NOTE:** Power supply may be by means of common zener barriers or equivalent certified devices if the transmitters are operated within above temperature limits. The temperatures in parentheses are applicable if the output of the power supply is limited to the power rating values given in parentheses.

### Ordering Information:

State computer part number (if available) / model number / range / output / connections required. See price sheet for special options.

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<http://www.wika.ca>



<b>PROPAK SYSTEMS LTD</b> POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3	<b>ORIFICE PLATES AND FLANGES</b>	SHEET _____ OF _____ SPEC NO _____ FILE 14.11.F JOB # 99404							
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : RESTRICTION ORIFICES	NO	BY	DATE	REVISION	DATE	REQ.	BY	CHK'D	APPR.
	1	CG	06/23/00	ISSUED TO DRAFTING					
	2	SW	07/04/00	REV'D RATING AND PLATE THK					
	3	GWW	11/01/00	REVISE MAX. FLOW					
	4	GWW	11/03/00	REV'D FOR ACOUSTICAL ANAL					

ORIFICE PLATES

1. CONCENTRIC  OTHER \_\_\_\_\_

2. ISA STANDARD  OTHER \_\_\_\_\_

3. BORE : MAXIMUM RATE  NEAREST 3.2 mm \_\_\_\_\_

4. MATERIAL: 304SS \_\_\_\_\_ 316SS  OTHER \_\_\_\_\_

5. RING MATERIAL & TYPE \_\_\_\_\_

6. OTHER \_\_\_\_\_

ORIFICE FLANGES

7. TAPS: FLANGE \_\_\_\_\_ VENA CONTRACTA \_\_\_\_\_ PIPE \_\_\_\_\_

OTHER \_\_\_\_\_

8. TAP SIZE: 21 mm \_\_\_\_\_ OTHER \_\_\_\_\_

9. TYPE: WELD NECK \_\_\_\_\_ SLIP ON \_\_\_\_\_ THREAD \_\_\_\_\_

10. MATERIAL : SA-105 \_\_\_\_\_ SA-350-LF2 \_\_\_\_\_ OTHER \_\_\_\_\_

11. FLANGES INCLUDED \_\_\_\_\_ BY OTHERS \_\_\_\_\_

12. FLANGE RATING \_\_\_\_\_

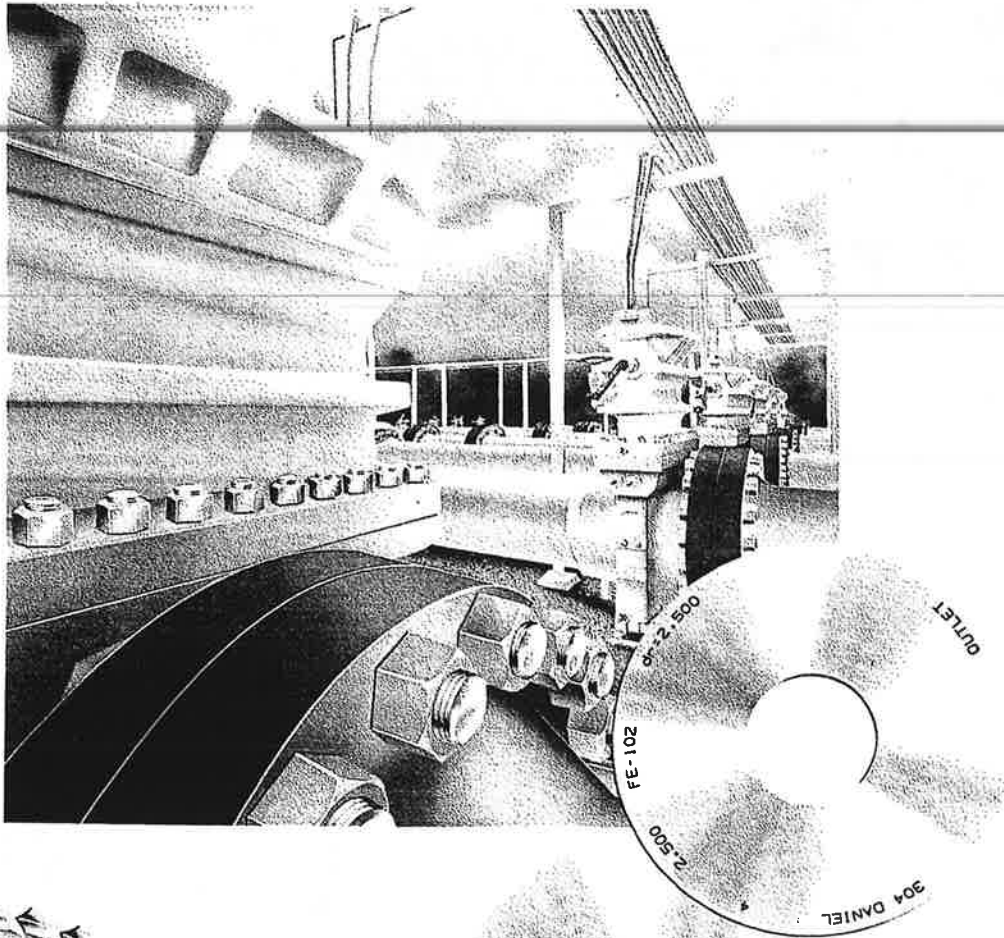
	TAG NO.	RO-121	RO-123	RO-124
14	SERVICE	1ST STAGE SUCTION BOTTLE	2ND STAGE SUCTION BOTTLE	2ND STAGE DISCHARGE BOTTLE
15	LINE NO.	P-002-BS-219	P-005-BS-168	P-006-CS-114
16	FLUID	NATURAL GAS	NATURAL GAS	NATURAL GAS
17	FLUID STATE	GAS	GAS	GAS
18	MAX. FLOW	11.80 MMSCFD $\Delta$	11.80 MMSCFD $\Delta$	11.80 MMSCFD $\Delta$
19	NOR. FLOW			
20	PRESSURE kPa (g)	413	1360	3742
21	TEMPERATURE °C	20	48	48
22	SPECIFIC GRAVITY AT BASE			
23	OPER. SP. GR.			
24	SUPERCOMP. FACTOR			
25	MOL WEIGHT CP / CV	18.8	18.8	18.8
26	OPER. VISC. cP			
27	QUALITY % OR SUPERHEAT			
28	BASE PRESS. BASE TEMP			
29	TYPE OF METER			
30	DIFF. RANGE - DRY			
31	SEAL SP. GR. AT 15°C			
32	STAT PRESS. RANGE kPa			
33	SEAL SP. GR. AT 15°C			
34	CHART MULTIPLIER			
	VANES REQD VANE MATERIAL			
	GOVT. APPROVED METER RUN			
35	BETA = d / D	1	1	1
36	ORIFICE BORE DIAMETER	114.3 $\Delta$ mm	88.9 $\Delta$ mm	53.975 $\Delta$ mm
37	LINE I.D. PIPE SCHED	202.717 mm SCHED 40	154.051 mm SCHED 40	97.1804 mm SCHED 80
38	NOM IPE OD RATING	219 mm 300#	168 mm 300# $\Delta$	114 mm 600#
39	VENT OR DRAIN HOLE			
40	PLATE THICKNESS mm	3 $\Delta$	3 $\Delta$	3 $\Delta$
41	FLANGE MATL TRIM			
42	MFR	DANIEL	DANIEL	DANIEL
43	MODEL NO.	ORIFICE PLATE	ORIFICE PLATE	ORIFICE PLATE
44	P. O. NUMBER			

NOTES:

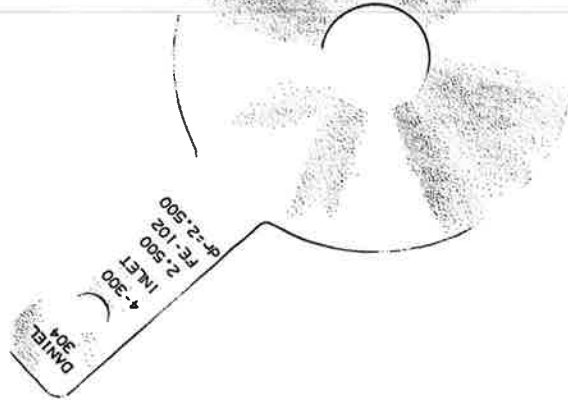
AREA UNIT #:

# Orifice Plates and Plate Sealing Units

CATALOG 500

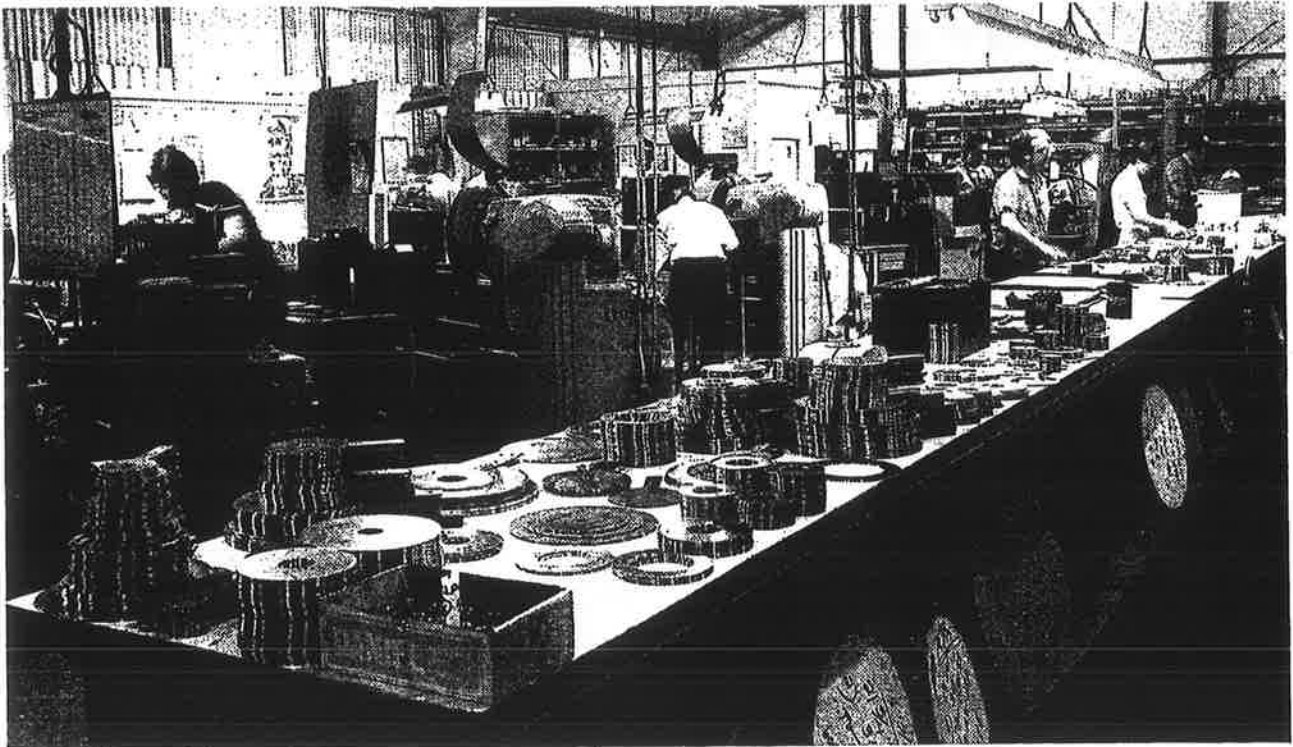


CERTIFICATE QSR-16  
1730 OLD KATY ROAD  
HOUSTON, TEXAS 77056 USA



# DANIEL

# Manufacturing Techniques



Orifice plate manufacture at Daniel is quality-controlled from selection of raw material to packaging of the finished product:

**Special Stainless Steel Sheets:**

Stretcher-leveled, stainless steel sheets are used. Following careful shearing, squares of sheets are machined/laser cut to circular discs. Other methods such as stamping or burning the plate banks are relatively inaccurate.

**Special Plate Boring Jigs:**

Daniel machinists use special jigs and fixtures designed only for orifice plate work. Plates are never chucked in a lathe for this sets up metal stresses. Special clamps are used to apply only face pressure to hold the plate for boring. Flatness is assured by use of a heavy back-up plate.

**Uniformly Smooth Surface Finish:**

Daniel plates are finished to 15-30 micro-inch roughness, applied by special sanding machines designed to preserve the flatness of each plate. No knives, honing stones or other devices are used for plate finishing. Daniel methods avoid procedures which may damage the bore accuracy or the plate finish.

**Plate Identification:**

Plates are lightly stamped to show the following information:

#520	#500
Material	Material
Line size	Line size
Rating	Outlet (on downstream side)
Inlet (on upstream side)	Bore (specified or calculated)
Bore (specified or calculated)	$d_r$ (Bore corrected to 68°F)
$d_r$ (Bore corrected to 68°F)	Tag # (if required)
Tag # (if required)	

**Protective Packaging:**

Each Daniel Orifice Plate is packaged in clear polyethylene plastic bags which protect the plate surface and bore edge, and keep the plate clean until ready for use. The plate identification can be read through the plastic bag.



Two basic styles of Orifice Plates are available. Catalog No. 500 Universal Size for use in Orifice Fittings and Ring-Joint Plate Holders, and Catalog No. 520 Paddle Type for use in Orifice Flanges. Specific tolerances which apply to all Daniel Orifice Plates are as follows:

**Edges:**

Square and sharp, will not reflect a beam of light when viewed without magnification.

**Finish:**

15-30 micro-inch roughness.

**Flatness:**

Flat within 0.010 inches, per inch of dam height. (Dam height = pipe diameter minus orifice diameter, divided by 2.)

**Bore:**

Orifice bore tolerance in strict accordance with A.P.I. Chapter 14, Section 3, A.G.A. Gas Measurement Committee Report No. 3, A.S.M.E., I.S.O., I.S.A., and with other societies' recommendations.

**Material:**

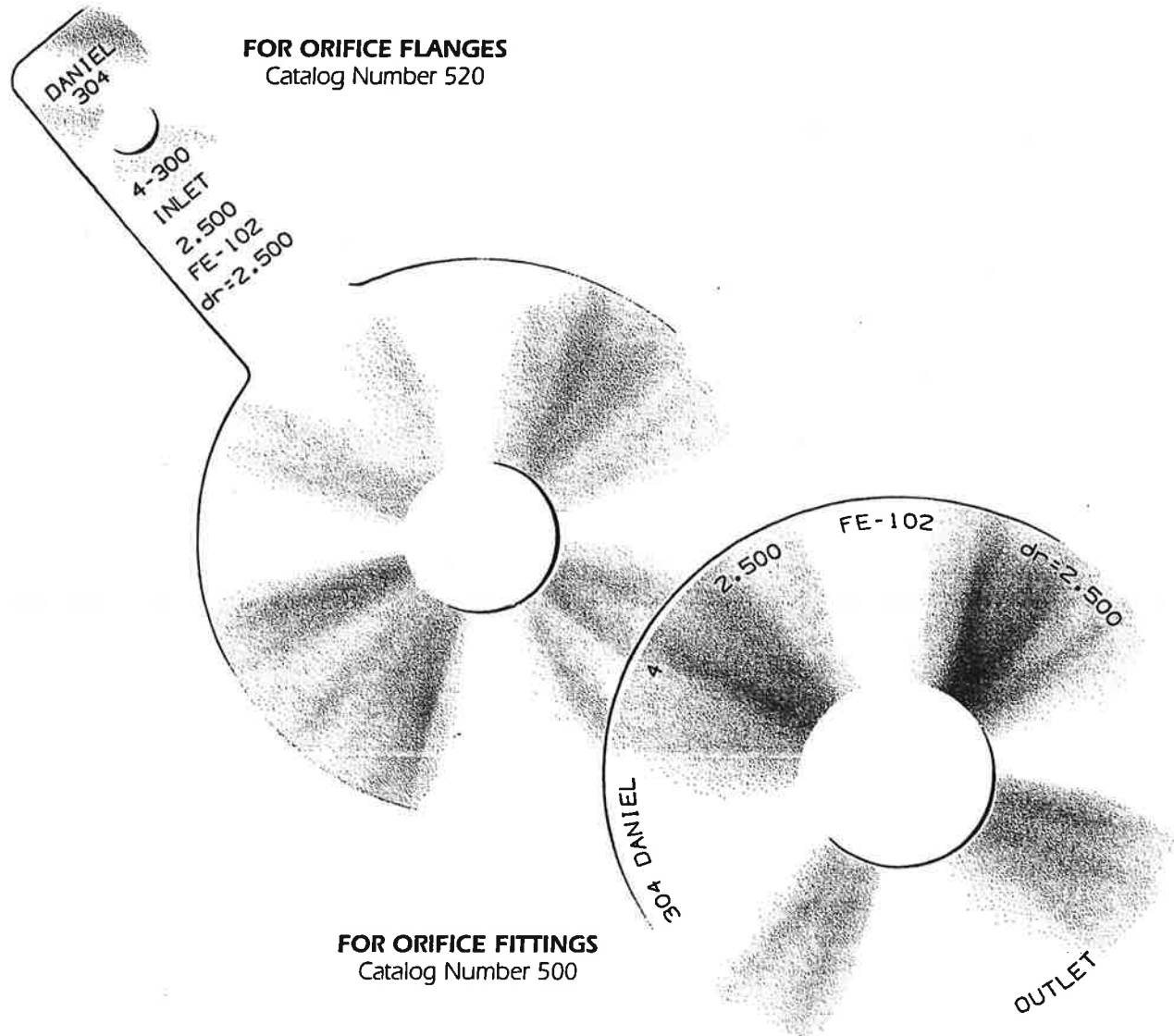
Stock materials are 304 and 316 Stainless Steel, Monel and Hastelloy. Other materials furnished on request.

**Design:**

Normal stocked items are the standard design used in all industries. Special designs are available on request.

**Sizes:**

Daniel Orifice Plates have been furnished in line sizes from 1/4 inch to 60 inches.



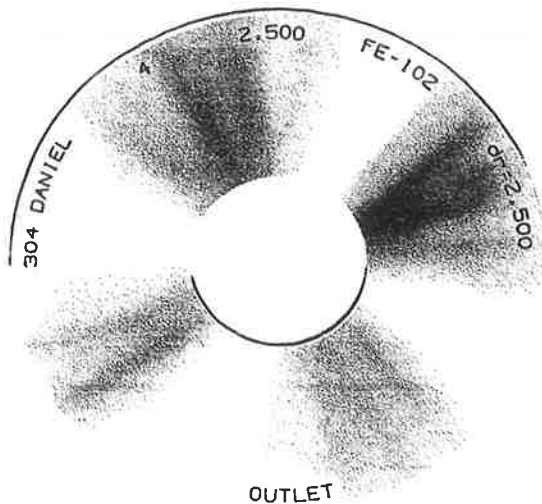


# Orifice Fitting Plates

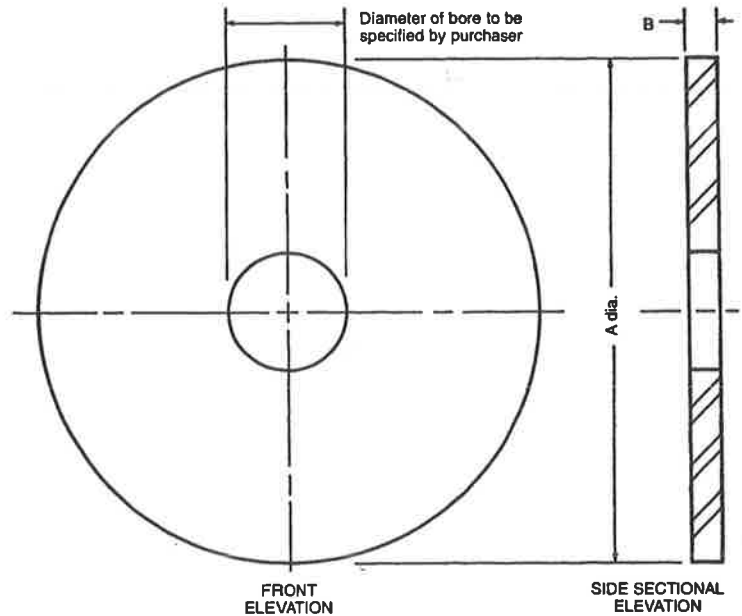
## CATALOG NO. 500

Universal Size Orifice Plates, originated by Daniel, are the standard used in many industries. They can be used interchangeably in all Daniel Orifice Fittings and Plate Holders. The Universal Size is the most economical style of plate available because of low initial cost, less maintenance, less storage space required, and the necessity of stocking plates for various pressure ranges is eliminated.

Four types of sealing units are available for use with Daniel Catalog No. 500 orifice plates. These are the "DSC" Dual Seal, which is removable up through 10" size; the "TSC" Teflon Seal, available to 16" size; the "Snap Seal", available through 16" size; and the "MSC" Metal Seal, available to 12" size. All the above units are removable.



CATALOG NUMBER 500  
ORIFICE PLATES



Line Size (Inches)	Plate O.D. A	Plate Thickness B (Inches)	Blank WT. (Lbs.)	Line Size (Inches)	Plate O.D. A	Plate Thickness B (Inches)	Blank WT. (Lbs.)
3/4	1.125	1/8	.06	14*	14.563	1/4	11.91
1	1.312	1/8	.06	16*	16.563	3/8	22.69
1 1/2	2.000	1/8	.11	18*	18.563	3/8	28.72
2	2.437	1/8	.17	20*	20.563	3/8	35.24
2 1/2	2.812	1/8	.25	24*	24.500	3/8	50.03
3	3.437	1/8	.34	26*	26.750	3/8	59.64
4	4.406	1/8	.55	30*	30.750	1/2	105.08
6	6.437	1/8	1.18	34*	35.228	1/2	137.91
8	8.437	1/8	2.03	36*	38.000	1/2	160.47
10	10.687	1/4	6.41	42*	44.000	3/4	322.73
12*	13.079	1/4	9.61				

\*See Page 8 for "A" dimensions of 12-inch and larger Universal type plates which may be used in Ring-type Joint Plate Holders. "TS" (TEFLON) seals, Snap Seals, and "MS" (METAL) seals.

## CATALOG NO. 510 "3DVS"\*\*\*

Universal size 12" and larger orifice fitting plates include a synthetic rubber sealing unit ("3DVS") bonded to both sides of the plate for a nonmetallic seal in the orifice fitting body seats. "A" dimension shown above for these sizes includes the 3DVS Seal. The "3DVS" is the standard plate for most applications in these sizes. Other type seals, shown on the next page, are also available for use with Catalog 500 plates in these sizes.

## WHEN ORDERING, PLEASE SPECIFY:

- CATALOG NUMBER
- LINE SIZE
- DIMENSION "A", IF NOT AS LISTED
- MATERIAL
- QUANTITY
- REQUIRED ORIFICE SIZE
- TYPE SEAL UNIT (Units shown on Page 3)

All Daniel Orifice Plate Sealing Units are interchangeable in 1 1/2 - 10" sizes.

## "DSC" DUAL SEAL\*



"DSC" in 2" - 8", "DS" in 10"

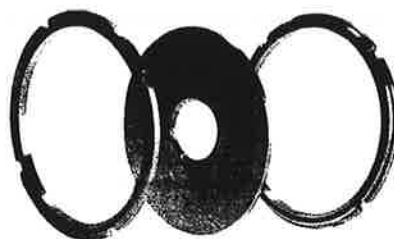
The Daniel Dual Seal is the most simple and practical orifice plate sealing device for normal flowing streams. It is precision molded from 70-80 Shore nitrile synthetic rubber\*\* and provides four rubber-to-metal sealing surfaces 360° around the plate. The units positively seal against both outer faces of the plate and against both seats of the orifice fitting to prevent leakage.

On request, a special metallic-oxide lubricant coated "DSC" seal is available. In 1-1/2" to 10" sizes, the "DSC" is interchangeable with Daniel "TSC" and "MSC" seal units. In 12" sizes and up, the seal is bonded from 80-90 shore rubber directly to the outer edge of the orifice plate at the factory. If damaged, the "DVSC" seal and plate may be returned to the factory for revulcanizing. The "DSC" and "DVSC" seals are used in pressure ratings to 600 lbs. ANSI, in temperatures from -20°F to +275°F.

\*US Patent #5085250

\*\*Also available in Viton®

## "SSR" SNAP SEAL RING\*



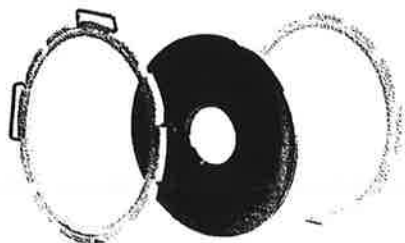
"SSRC" in 2" - 8", "SSR" in 10" & up  
\*U.S. Patent 4,478,251

The Daniel Snap Seal Ring is a removable orifice plate holder designed for use in services where elastomer seal swelling is a problem. Certain media, such as ethylene or carbon dioxide may cause seal swelling when other type holders are removed from high-pressure service.

The Snap Seal Ring unit consists of two symmetrical metal rings, each one having an O-ring on both sides for a positive seal on the plate side and the fitting side of the ring. These rings center and secure the orifice plate between them. The assembled unit provides a full 360° rubber-to-metal seal around both sides of the orifice plate, even in the absence of any pressure differential. No special tools are required for assembly or disassembly.

The Snap Seal Ring is designed for service temperatures ranging from -20°F to +257°F (standard O-rings) to -67°F to +437°F (Viton® O-rings). It is available for line sizes of 2" through 16". When ordering, please specify nominal line size, schedule, plate thickness, and flowing media or material choice. The unit is available in 316 stainless steel and cadmium-plated carbon steel.

## "TSC" TEFLON SEAL



"TSC" in 2" - 8", "TS" in 10" & up

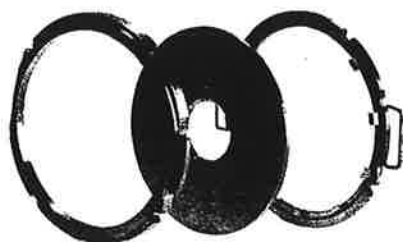
The Daniel Teflon Seal is a superior orifice plate sealing unit for difficult, corrosive flows and for higher temperatures than the "DSC" unit can handle. The "TSC" has proven effective in such flows as dilute sulphuric acid, fuming nitric acid, hydrazine, liquid oxygen and other unusual fluids, from -65°F to +500°F.

The two-piece unit consists of an inlet ring which fits around the plate outer diameter, and a downstream ring fitted with metal clips for assembling the unit. A special lip on this ring plus an annular groove\* provide compression to effectively seal off the plate. The "TSC" unit can be assembled or taken apart by hand and is interchangeable in 1-1/2" to 10" sizes with Daniel "DSC" and "MSC" seal units.

The Teflon Seal is recommended for services with pressure ratings of 900 lbs. ANSI to 2500 lbs. ANSI or lower pressure services where rubber seals may not be satisfactory. Size 14" and larger now have graphite added for lubricity and ease of movement.

\*This groove should be spread by inserting a blunt object such as a screw driver and rotating 360° to reengage the spring lip after each use.

## "MSC" METAL SEAL



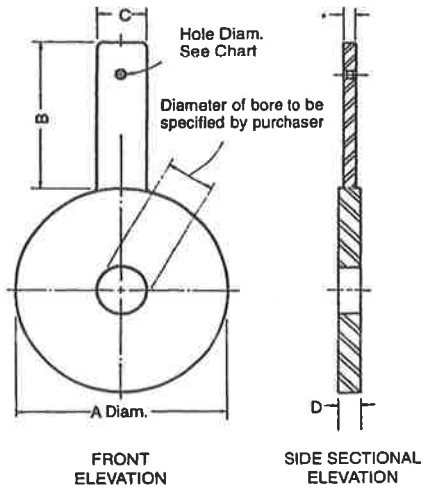
"MSC" in 2" - 8", "MS" in 10" & up

The Daniel Metal Seal is a stainless or cadmium-plated carbon steel clip-ring assembly recommended for high pressures and for temperatures to 1200°F. The assembly consists of an upstream and a downstream ring. The upstream ring has recessed groove into which a thin leaf-spring is inserted. When the plate is clamped between the rings, the spring provides the necessary compression to seat the plate against the downstream ring and effect a seal.

"MSC" Seal Units of cadmium-plated carbon steel are recommended for services to +600°F, standard 316 stainless steel units, to +1000°F, and 316 stainless steel units with an inconel spring to +1200°F. The "MSC" seal unit can be assembled or taken apart by hand, and is interchangeable in 1-1/2" to 12" sizes with Daniel "DSC" and "TSC" seal units.

# Orifice Flange Plates

## PADDLE-TYPE, CATALOG NO. 520



Daniel Paddle-Type Orifice Plates are used with Orifice Flange Unions. All outer diameters of the plates are machined/laser cut providing a uniformly circular disc. This results in a high degree of concentricity of the orifice bore and the plate outer diameter. Next, handles are carefully welded on. The plates are then sanded in special machines to a prescribed finish. Blank plates and plates with popular bore sizes are stocked continuously. Each plate is stamped on its handle with line size, flange rating, orifice bore and plate material. Daniel maintains a stock in Types 304 and 316 Stainless Steels in standard thickness. Other sizes and materials are available on request.

Diameters of holes in Paddle Plate Handles are as follows:

Plate Size	Hole Diameter
1/2" thru 2"	1/8
2 1/2" thru 12"	3/8
14" thru 12"	1/2
26" and larger	3/4

\*1/8" for sizes through 24", 1/4" for 30" & larger

## DIMENSIONS (In inches)

Line Size	125 Lbs. and 150 Lbs. ANSI	250 Lbs. and 300 Lbs. ANSI	400 Lbs. ANSI	600 Lbs. ANSI	900 Lbs. ANSI	1500 Lbs. ANSI	2500 Lbs. ANSI	For All Pressure Ratings 125-2500 Lbs. ANSI		
	A	A	A	A	A	A	A	B	C	D
1/2	1 7/8	2 1/8	2 1/8	2 1/8	2 1/2	2 1/2	2 3/4	4	1	1/8
3/4	2 1/4	2 5/8	2 5/8	2 5/8	2 3/4	2 3/4	3	4	1	1/8
1	2 5/8	2 7/8	2 7/8	2 7/8	3 1/8	3 1/8	3 3/8	4	1	1/8
1 1/4	3	3 1/4	3 1/4	3 1/4	3 1/2	3 1/2	4 1/8	4	1	1/8
1 1/2	3 3/8	3 3/4	3 3/4	3 3/4	3 7/8	3 7/8	4 5/8	4	1	1/8
2	4 1/8	4 3/8	4 3/8	4 3/8	5 5/8	5 5/8	5 3/4	4	1	1/8
2 1/2	4 7/8	5 1/8	5 1/8	5 1/8	6 1/2	6 1/2	6 5/8	4	1 1/4	1/8
3	5 3/8	5 7/8	5 7/8	5 7/8	6 5/8	6 7/8	7 3/4	4	1 1/4	1/8
4	6 7/8	7 1/8	7	7 5/8	8 1/8	8 1/4	9 1/4	4	1 1/4	1/8
5	7 3/4	8 1/2	8 3/8	9 1/2	9 3/4	10	11	5	1 1/2	1/8
6	8 3/4	9 7/8	9 3/4	10 1/2	11 3/8	11 1/8	12 1/2	5	1 1/2	1/8
8	11	12 1/8	12	12 5/8	14 1/8	13 7/8	15 1/4	5	1 1/2	1/8
10	13 3/8	14 1/4	14 1/8	15 3/4	17 1/8	17 1/8	18 3/4	6	1 1/2	1/4
12	16 1/8	16 5/8	16 1/2	18	19 5/8	20 1/2	21 5/8	6	1 1/2	1/4
14	17 3/4	19 1/8	19	19 3/8	20 1/2	22 3/4	—	6	1 1/2	1/4
16	20 1/4	21 1/4	21 1/8	22 1/4	22 5/8	25 1/4	—	6	1 1/2	3/8
18	21 1/2	23 3/8	23 1/4	24	25	27 5/8	—	6	1 1/2	3/8
20	23 3/4	25 5/8	25 3/8	26 3/4	27 3/8	29 5/8	—	6	1 1/2	3/8
22	26	27 3/4	27 1/2	28 7/8	—	—	—	6	1 1/2	3/8
24	28 1/8	30 3/8	30 1/8	31	32 7/8	35 1/2	—	6	1 1/2	3/8
30	34 5/8	37 3/8	37 1/4	38 1/8	—	—	—	6	1 1/2	1/2
36	41 1/8	43 7/8	43 7/8	44 3/8	—	—	—	6	1 1/2	1/2

## BLANK PLATE WEIGHTS (In Pounds)

Line Size (Inches)	ANSI CLASS 125 & 150	ANSI CLASS 250 & 300	ANSI CLASS 600	ANSI CLASS 900	Plate Thickness (Inches)
1/2	.09	.12	.12	.12	1/8
3/4	.16	.21	.21	.21	1/8
1	.31	.36	.36	.42	1/8
1 1/2	.43	.52	.52	.56	1/8
2	.59	.66	.66	1.03	1/8
3	.93	1.10	1.10	1.37	1/8
4	1.46	1.57	1.78	2.01	1/8
6	2.34	2.94	3.33	3.87	1/8
8	3.61	4.36	4.73	5.89	1/8
10	10.37	11.73	14.25	16.79	1/4
12	14.92	15.84	18.52	21.95	1/4
14	18.01	20.86	21.40	23.92	1/4
16	35.03	38.52	42.18	43.61	3/8
18	35.60	47.37	49.95	54.20	3/8
20	48.81	56.81	61.88	64.86	3/8
24	68.21	79.59	82.89	93.90	3/8

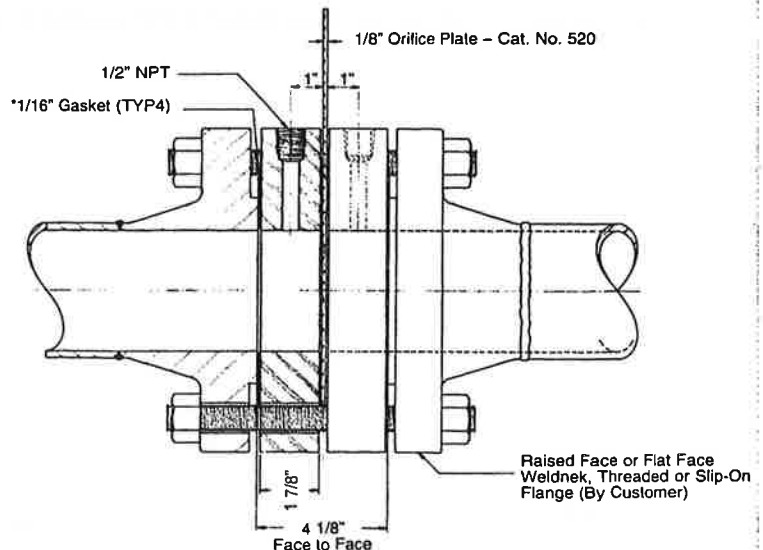
### WHEN ORDERING, PLEASE SPECIFY:

1. CATALOG NUMBER
2. SIZE, FLANGE ANSI RATING
3. DIMENSION "A", IF NOT AS LISTED
4. MATERIAL
5. QUANTITY
6. REQUIRED ORIFICE SIZE

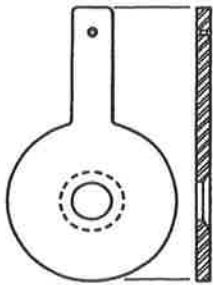
## Orifice Holding Blocks

Daniel manufactures orifice holding blocks in Teflon, PVC and other materials suitable for use in severe or caustic applications. Line sizes offered are from 1" up to 12", and these orifice holding blocks are used between 150 lbs. ANSI rated flanges. Flange taps are standard in all sizes, and the tap hole I.D. depends on line size.

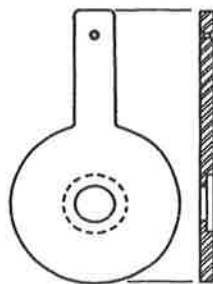
For additional information or prices, contact Daniel's Sales Department. When ordering please specify: nominal line size, line I.D., and material desired.



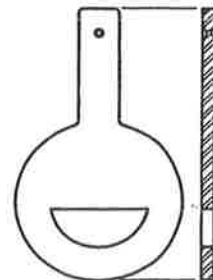
\*Taps are located for use with 1/16" thick gaskets. If other thickness gaskets are to be used, specify so that tap holes can be properly located.

**BORE AND BEVEL**

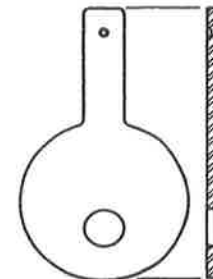
The Bore and Bevel is the standard method of limiting the plate edge thickness. The bevel is machined on a 45° angle to the desired edge thickness. Unless otherwise specified, plates will be beveled to 1/50 of the line I.D. or 1/8 of the orifice bore, minimum governing.

**BORE AND COUNTERBORE**

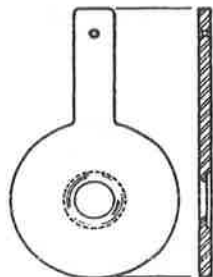
The Bore and Counterbore is a special method to limit the plate edge thickness. Instead of beveling at the normal 45 degrees, the plate is counterbored to the desired edge thickness.

**SEGMENTAL**

Segmentally bored orifice plates are provided for measurements where solids are entrained in a gas or liquid flow stream. The circular portion of the bore is inscribed within a circle which is normally 98% of the pipe diameter. The segmental opening may be placed either at the top or bottom of the pipe. Industries using these bores include sewage treatment, steel, chemical, water conditioning, paper, and petrochemical.

**ECCENTRIC**

Eccentrically bored plates are plates with the orifice off-center, or eccentric, as opposed to concentric. The bore of the eccentric orifice normally is inscribed in a circle which is 98% of the pipe diameter, so that solids or slurries may pass through. Eccentric orifice plates are used in many industries including heavy and light chemicals, steel, paper, atomic and petrochemicals.

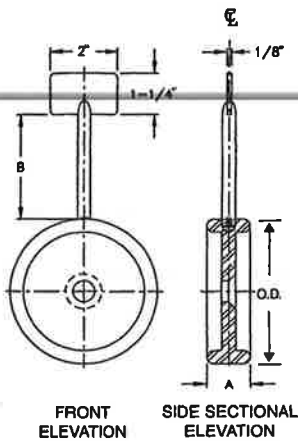
**QUARTER-ROUND**

The Quarter-Round, or Quadrant bore, is an orifice with the inlet edge rounded. The radius of the quarter-circle bore is a function of the orifice-to-pipe ratio ( $d/D$ ). Thickness at the throat is equal to the radius. Overall plate thickness is frequently greater than for standard plates. This bore is specifically designed for fluids of high viscosity, such as heavy crudes, syrups, and slurries. Quarter-Round bores are recommended for viscous flows having Reynolds Numbers below 4,000.

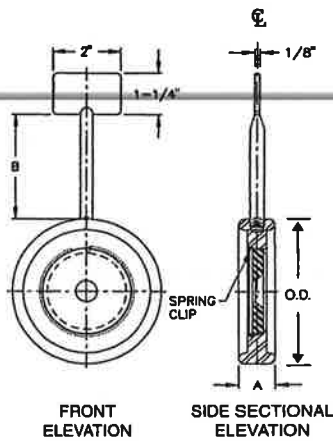
# Handle-Type Ring-Joint Orifice Plate Holders

Daniel Ring-Joint Orifice Plate Holders are fitted with Catalog No. 500 Orifice Plates and are used with Ring-Joint Orifice Flanges. The Oval Form is standard. Catalog No. 580 Plate Holders are equipped with a monel snap-ring which clamps the orifice plate snugly in place. Catalog No. 590 Plate Holders have hold-down screws to keep the plate in the holder. Both 580 and 590 styles have a gasket between the plate

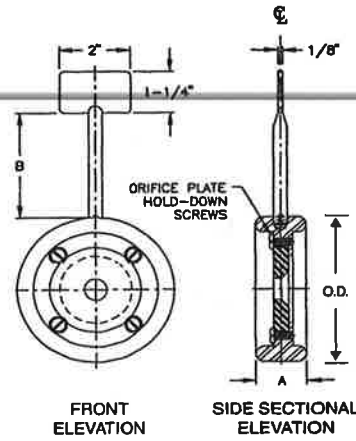
and holder. Orifice Plates are not included and must be ordered separately. Catalog 580 and 590 Plate Holders are available in cadmium plated mild steel and Type 304 and Type 316 Stainless Steel in most sizes and ratings. Catalog No. 560 Plate Holders are a one-piece integral plate seal. Catalog No. 560 Plate Holders are available in all sizes in Type 304 and 316 Stainless Steel.



**CATALOG NO. 560**  
Integral Plate Seal



**CATALOG NO. 580**  
With Snap-Ring Clip



**CATALOG NO. 590**  
With Hold-Down Screws

## DIMENSIONS (In inches) AND A.P.I. RING NUMBERS

Line Size	ANSI Class 300-600					ANSI Class 900				
	A.P.I. Ring Nos.	A†	B	Approx. Gap*	Ring O.D.	A.P.I. Ring Nos.	A†	B	Approx. Gap*	Ring O.D.
1/2	R-11	29/32	4 1/4	19/32	1.593	R-12	1	4 1/4	19/32	1.875
3/4	R-13	1	4 1/4	19/32	2.000	R-14	1	4 1/4	19/32	2.063
1	R-16	1	4 1/4	19/32	2.313	R-16	1	4 1/4	19/32	2.313
1 1/2	R-20	1	4 1/4	19/32	3.000	R-20	1	4 1/4	19/32	3.000
†2	R-23	1 1/16	4 1/4	19/32	3.688	R-24	1 1/16	5 1/4	17/32	4.188
†2 1/2	R-26	1 1/16	5 1/4	19/32	4.438	R-27	1 1/16	5 1/4	17/32	4.688
†3	R-31	1 1/16	5 1/4	19/32	5.313	R-31	1 1/16	5 1/4	17/32	5.313
†3 1/2	R-34	1 1/16	4 1/4	19/32	5.625	—	—	—	—	—
†4	R-37	1 1/16	5 1/4	19/32	6.313	R-37	1 1/16	5 1/4	17/32	6.313
†5	R-41	1 1/16	6 1/4	19/32	7.563	R-41	1 1/16	6 1/4	17/32	7.563
†6	R-45	1 1/16	6 1/4	19/32	8.750	R-45	1 1/16	6 1/4	17/32	8.750
†8	R-49	1 1/16	6 1/4	19/32	10.063	R-49	1 1/16	6 1/4	17/32	11.063
†10	R-53	1 3/16	7 1/4	23/32	13.188	R-53	1 3/16	7 1/4	21/32	13.188
†12	R-57	1 3/16	7 1/4	23/32	15.438	R-57	1 3/16	7 1/4	21/32	15.438
†14	R-61	1 3/16	7 1/4	23/32	16.938	R-62	1 7/16	7 1/4	23/32	17.125
†16	R-65	1 5/16	7 1/4	27/32	18.938	R-66	1 9/16	7 1/4	27/32	19.125
†18	R-69	1 5/16	7 1/4	27/32	21.438	R-70	1 11/16	7 1/4	7/8	21.750
†20	R-73	1 3/8	7 1/4	23/32	23.500	R-74	1 9/16	7 1/4	3/4	23.750
†24	R-77	1 7/16	7 1/4	13/16	27.875	R-78	1 7/8	9 1/4	25/32	28.250

NOTE: Catalog No. 560 Plate Holders are available in all sizes and Ring Numbers. Catalog No. 580 Plate Holders are available in all A.P.I. Ring Numbers from 1-1/2" and up. Catalog 590 Plate Holders are available in 2" size and up in all Ring Numbers. Except 2" R-23 and 2-1/2", R-26.

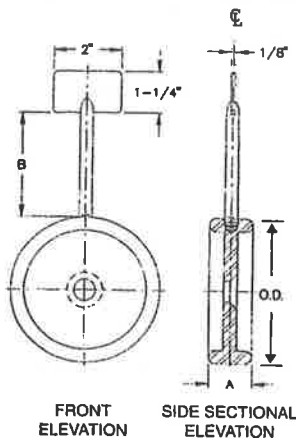
Other sizes, materials, ANSI and special flange ratings are available on special order. When ordering, please specify:  
1. Catalog No. 2. Size 3. Ring No. or ANSI Flange Pressure Rating. 4. Material. 5. Quantity. 6. Required orifice size.

\*Approximate distance between flanges.

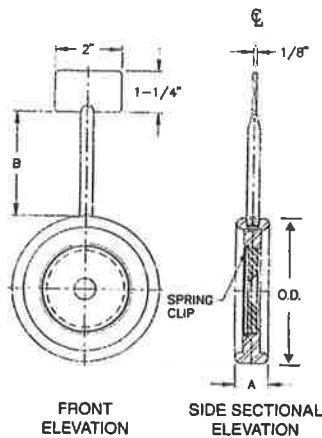
Standard plate thickness for above holders (except 2-8" 560) are as follows:  
1/2" - 8" = 1/8  
10" - 14" = 1/4  
16" - 24" = 3/8

†Catalog 560 Holders in 2" through 8" sizes have 1/4" thick plates as standard. Add 1/8" to 'A' and 'Approx. Gap' dimensions for 560 Holders in these sizes.

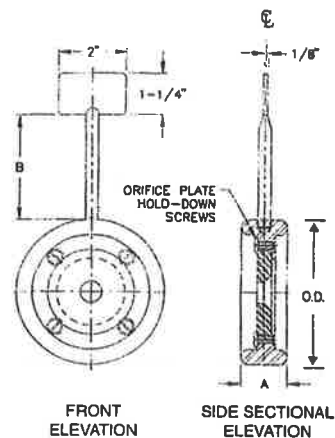
# Handle-Type Ring-Joint Orifice Plate Holders



**CATALOG NO. 560**  
Integral Plate Seal



**CATALOG NO. 580**  
With Snap-Ring Clip



**CATALOG NO. 590**  
With Hold-Down Screws

## DIMENSIONS (In inches) AND A.P.I. RING NUMBERS

Line Size	ANSI Class 1500					ANSI Class 2500				
	A.P.I. Ring Nos.	A†	B	Approx. Gap*	Ring O.D.	A.P.I. Ring Nos.	A†	B	Approx. Gap*	Ring O.D.
1/2	R-12	1	4 1/4	19/32	1.875	R-13	1	4 1/4	19/32	2.000
3/4	R-14	1	4 1/4	19/32	2.063	R-16	1	4 1/4	19/32	2.313
1	R-16	1	4 1/4	19/32	2.313	R-18	1	4 1/4	19/32	2.688
1 1/2	R-20	1	4 1/4	19/32	3.000	R-23	1 1/16	5 1/4	1/2	3.688
†2	R-24	1 1/16	5 1/4	1/2	4.188	R-26	1 1/16	5 1/4	1/2	4.438
†2 1/2	R-27	1 1/16	5 1/4	1/2	4.688	R-28	1 3/16	5 1/4	9/16	4.825
†3	R-35	1 1/16	5 1/4	1/2	5.813	R-32	1 3/16	6 1/4	9/16	5.500
†3 1/2	—	—	—	—	—	—	—	—	—	—
†4	R-39	1 1/16	5 1/4	1/2	6.813	R-38	1 5/16	6 1/4	19/32	6.813
†5	R-44	1 1/16	6 1/4	1/2	8.063	R-42	1 7/16	7 1/4	19/32	8.250
†6	R-46	1 3/16	6 1/4	9/16	8.813	R-47	1 7/16	7 1/4	19/32	9.750
†8	R-50	1 5/16	6 1/4	19/32	11.250	R-51	1 9/16	8 1/4	5/8	11.875
10	R-54	1 7/16	7 1/4	23/32	13.375	R-55	2	8 1/4	13/16	14.625
12	R-58	1 11/16	8 1/4	3/4	15.875	R-60	2 1/8	9 1/4	7/8	17.250
14	R-63	1 7/8	8 1/4	25/32	17.500	—	—	—	—	—
16	R-67	2 1/8	9 1/4	1	19.625	—	—	—	—	—
18	R-71	2 1/8	9 1/4	1	22.125	—	—	—	—	—
20	R-75	2 1/8	10 1/4	7/8	24.250	—	—	—	—	—
24	R-79	2 5/16	10 1/4	1	28.625	—	—	—	—	—

NOTE: Catalog No. 560 Plate Holders are available in all sizes and Ring Numbers. Catalog No. 580 Plate Holders are available in all A.P.I. Ring Numbers from 1-1/2" and up. Catalog 590 Plate Holders are available in 2" size and up in all Ring Numbers. Except 2" R-23 and 2-1/2", R-26.

Other sizes, materials, ANSI and special flange ratings are available on special order. When ordering, please specify: 1. Catalog No. 2. Size 3. Ring No. or ANSI Flange Pressure Rating. 4. Material. 5. Quantity. 6. Required orifice size.

\*Approximate distance between flanges.

†Catalog 560 Holders in 2" through 8" sizes have 1/4" thick plates as standard. Add 1/8" to 'A' and 'Approx. Gap' dimensions for 560 Holders in these sizes.

Universal Plates for use in RTJ Holders (no seal units included) Dimensions (Inches)**		
Line Size	Plate O.D. A	Plate Thickness B
12	12.593	1/4
14	14.000	1/4
16	16.000	3/8
18	18.000	3/8
20	20.000	3/8
24	24.000	3/8
26	26.000	3/8
30	30.000	1/2

\*\*Dimensions for 10" size and below on Page 2

Plate Type    520 Paddle     500 Universal     Other \_\_\_\_\_  
                   Concentric     Other \_\_\_\_\_  
 Material:    316     304     Other \_\_\_\_\_  
 Bore:        Maximum Rate     Nearest 1/8"   
 Tap Location: Flange     Corner   
                   Other \_\_\_\_\_    Up \_\_\_\_\_    Down \_\_\_\_\_  
 Flange Rating: \_\_\_\_\_

<b>G E N E R A L</b>	Tag No.				
	Line No.				
	Fluid				
	Flow Temperature °F				
	Flow Pressure PSIG				
	Actual Orifice I.D. Ins.				
	Line Flange I.D. Ins.				
	Meter Type (Mercury or Dry)				
	S.G. of Seal @ Ambient T.				
	Diff. Range Ins. H <sub>2</sub> O				
	Static Range PSIG				
	Chart or Scale Range				
	Chart Multiplier				
<b>L I Q U I D S</b>	Flow Units				
	Maximum Flow				
	Normal Flow				
	Specific Gravity @ 60°F				
	Specific Gravity @ Flowing Cond.				
	Viscosity cp @ Flowing Cond.				
<b>V A P O R / G A S</b>	Flow Units				
	Maximum Flow				
	Normal Flow				
	Specific Gravity				
	Molecular Weight				
	Flowing Density lbs./ft <sup>3</sup> -γ <sub>f</sub>				
	Barometric Pressure or Elev. at Plant Site (approx.)				
	Pressure Base				
	Temperature Base				
	Supercom. Factor @ Flowing T. & P.				
Viscosity-cp @ Flowing T. & P.					
<b>S T E A M</b>	Flow Units				
	Maximum Flow				
	Quality % or Superheat °F				

## Orifice Bore Calculations

The Daniel Orifice Calculation Department is a separate engineering branch responsible for the fast and accurate calculation of orifice plate bores. The computerized department utilizes the latest published trade statistics to figure and verify calculations. Their calculations are recorded on a

reproducible data sheet from which a copy is made and sent to the customer. The original is kept on file for 5 years. To insure prompt calculations, the above information relative to either gas, liquid or steam flow should be furnished.



**DANIEL**

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# 3 WAY DIRECT ACTING General Service Solenoid Valves

Brass or Stainless Steel Bodies • 1/8" and 1/4" N.P.T.

Additional constructions are available. The Optional Electrical Features Section, page 22, contains descriptions and ordering information for: Open Frame Solenoids • Junction Box Enclosures • Panel Mount Constructions.

**Electrical:** Standard Voltages: 12, 24, 120, 240, 480 volts, AC, 60 Hz (or 110, 220 volts, AC, 50 Hz)  
6, 12, 24, 120, 240 volts, DC

Other voltages are available when required.

**Coil:** Continuous duty molded Class F.

**Nominal Ambient Temperature Ranges:** AC Construction: 32°F. to 125°F.

DC Construction: 32°F. to 104°F. Refer to Engineering Section for details.

**Valve Parts in Contact with Fluid:**

Body — Brass or 303 s.s., as listed  
Seals and Discs — Buna "N"

Core Tube — 305 s.s.  
Core and Plugnut — 430F s.s.  
Core Springs — 302 s.s.  
Shading Coil — Copper (brass body); Silver (stainless steel body)  
Disc Holder — Acetal  
Core Guide — Acetal (10.1 and 17.1 watt only)

**Approvals:** CSA certified. Refer to Engineering Section for details.

**Ordering Information:**  
*Important:* We must have catalog number, voltage and Hertz, operating pressure and fluid handled. Use strainers with solenoid valves.

**FOR NAMUR INTERFACE CONSULT FACTORY**

**ELECTRICAL INFORMATION**

Standard Coil and Class of Insulation	Watt Rating and Power Consumption			
	DC Watts	AC		
		Watts	VA Holding	VA Inrush
F	11.6	10.1	25	50
F	22.6	17.1	40	70

**Specifications**

**Solenoid Enclosures:** Valves listed in this series have Red-Hat II molded epoxy solenoids, are identified by the change letter "G" in their catalog numbers, e.g., 8320G130, and are shown in red.

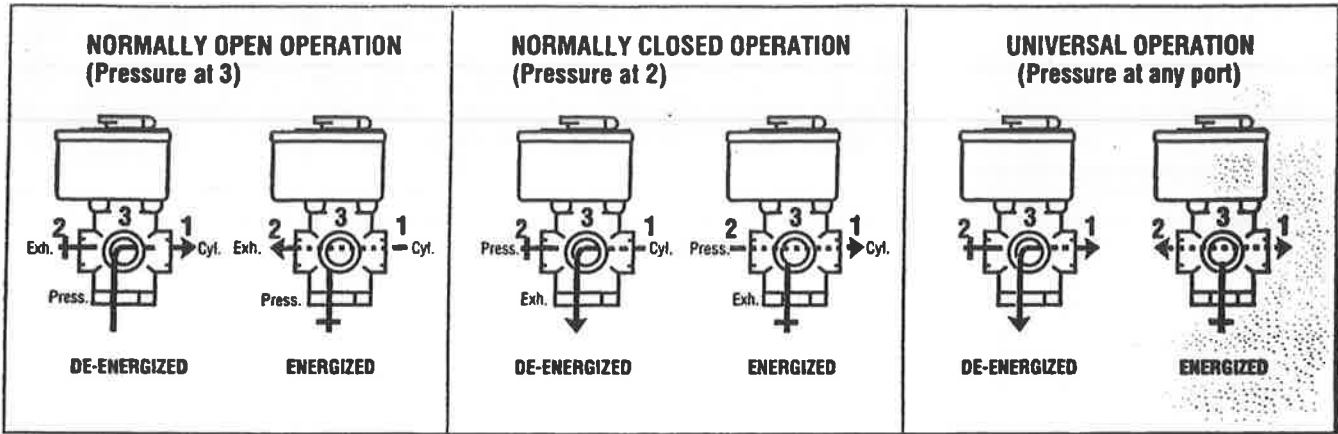
**Standard Enclosures:**  
Red-Hat II — Types 1, 2, 3, 3S, 4 and 4X Combination General Purpose and Watertight.

**Optional Enclosures:**  
Red-Hat II — Types 3, 3S, 4, 4X, 6, 6P, 7 and 9 Combination Explosionproof and Watertight.

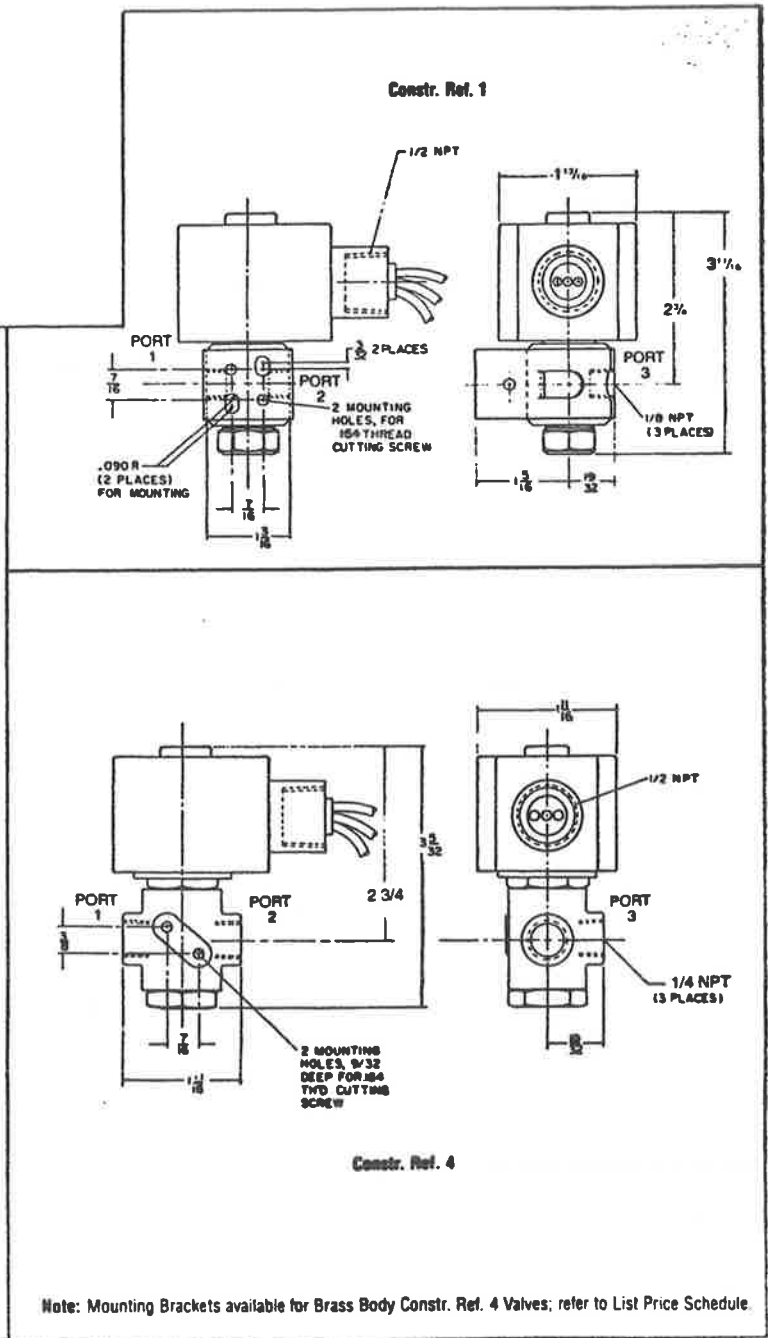
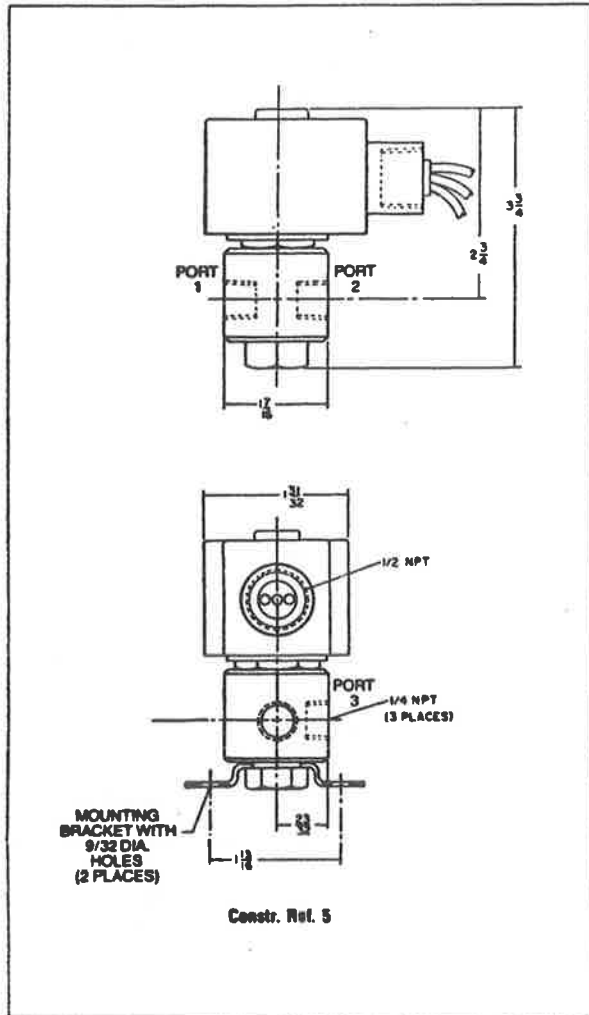
To order, add prefix "EF" to catalog number.

**SPECIFICATIONS**

Pipe Size (In.)	Orifice Size (In.)	Cv Flow Factor	Operating Pressure Differential (psi)									Standard Solenoid Enclosures Red-Hat II-Types 1, 2, 3, 3S, 4 and 4X				Watt Rating/ Class of Coil Insulation ①	
			Max. AC			Max. DC			Max. Fluid Temp. °F.		Brass Body		S. S. Body				
			Air-Inert Gas	Water	LI. Oil @ 300 SSU	Air-Inert Gas	Water	LI. Oil @ 300 SSU			AC	DC	Catalog Number	Constr. Ref. No.	Catalog Number		
<b>UNIVERSAL OPERATION (Pressure at any port)</b>																	
1/8	1/16	.09	175	175	175	125	125	125	180	120	8320G212	1	8320G221	1	17.1/F	22.6/F	
1/8	3/32	.12	100	100	100	60	60	60	180	120	8320G213	1	8320G222	1	17.1/F	11.6/F	
1/8	1/8	.21	50	50	50	25	25	25	180	120	8320G214	1	8320G223	1	17.1/F	11.6/F	
1/4	1/16	.09	125	130	130	75	75	75	200	150	8320G172	4	—	—	10.1/F	11.6/F	
1/4	1/16	.09	175	175	175	125	125	125	200	150	—	—	8320G230	5	17.1/F	22.6/F	
1/4	3/32	.12	100	100	100	60	60	60	200	150	8320G174	4	8320G200	5	17.1/F	11.6/F	
1/4	1/8	.25	50	50	50	25	25	25	200	150	8320G176	4	8320G201	5	17.1/F	11.6/F	
1/4	11/64	.35	20	20	20	12	12	12	200	150	8320G178	4	—	—	10.1/F	11.6/F	
<b>NORMALLY CLOSED (Closed when de-energized)</b>																	
1/8	1/16	.09	210	225	225	160	160	160	180	120	8320G215	1	8320G224	1	17.1/F	11.6/F	
1/8	3/32	.12	150	150	150	115	115	115	180	120	8320G216	1	8320G225	1	10.1/F	11.6/F	
1/8	1/8	.21	85	85	85	60	60	60	180	120	8320G217	1	8320G226	1	10.1/F	11.6/F	
1/4	1/16	.09	210	225	225	160	160	160	200	150	8320G182	4	8320G231	5	17.1/F	11.6/F	
1/4	3/32	.12	150	150	150	115	115	115	200	150	8320G184	4	8320G202	5	10.1/F	11.6/F	
1/4	1/8	.25	85	85	85	60	60	60	200	150	8320G186	4	8320G203	5	10.1/F	11.6/F	
1/4	11/64	.35	45	45	45	25	25	25	200	150	8320G188	4	—	—	10.1/F	11.6/F	
<b>NORMALLY OPEN (Open when de-energized)</b>																	
1/8	1/16	.09	235	250	250	160	160	160	180	120	8320G218	1	8320G227	1	17.1/F	11.6/F	
1/8	3/32	.12	150	150	150	100	100	100	180	120	8320G219	1	8320G228	1	10.1/F	11.6/F	
1/8	1/8	.21	70	70	70	55	55	55	180	120	8320G220	1	8320G229	1	10.1/F	11.6/F	
1/4	1/16	.09	235	250	250	160	160	160	200	150	8320G190	4	8320G232	5	17.1/F	11.6/F	
1/4	3/32	.12	150	140	140	100	100	100	200	150	8320G194	4	8320G214	5	10.1/F	11.6/F	
1/4	1/8	.25	70	70	70	55	55	55	200	150	8320G198	4	8320G205	5	10.1/F	11.6/F	
1/4	11/64	.35	40	40	40	30	30	30	200	150	8320G196	4	—	—	10.1/F	11.6/F	



DIMENSIONS (in inches)



# INSTALLATION AND MAINTENANCE INSTRUCTIONS

3 way solenoid operated valves normally closed, normally open and universal operation

# ASCO

Bulletin

8320

Form no. V32001

### DESCRIPTION

Bulletin 8320 valves are 3 way solenoid operated valves with all connections located in the body. Valves are brass or stainless steel with 1/8 or 1/4 inch NPT process connections.

Standard valves have an epoxy encapsulated solenoid coil for Type 1,2,3,3S, and 4 combination general purpose and watertight installations. Valves with "EP" prefixes in the catalogue number have encapsulated solenoids suitable for Type 3,3S,4,6, and 7(A,B,C,&D) explosion proof Class I, Group A,B,C,&D and Type 9(F,F,&G)-Dust-Ignition Proof Class II Groups E,F,&G.

### OPERATION

**Normally Closed:** Applies pressure when solenoid is energized; exhausts pressure when solenoid is de-energized. When the solenoid is energized flow is from connection "2" to connection "1". Connection "3" is closed. When solenoid is de-energized flow is from connection "1" to connection "3". Connection "2" is closed.

**Normally Open:** Applies pressure when solenoid is de-energized; exhausts pressure when solenoid is energized. When the solenoid is energized flow is from connection "1" to connection "2". Connection "3" is closed. When solenoid is de-energized flow is from connection "3" to connection "1". Connection "2" is closed.

**Universal:** For normally closed or normally open operation, selection or diversion of pressure can be applied to connection "1", "2" or "3".

NOTE: To change from normally closed to normally open or universal operation, consult factory.

### Positioning

This valve is designed to perform properly when mounted in any position. For optimum performance and life, the solenoid should be mounted vertical and upright.

### Mounting

Valves may be pipe mounted, direct mounted with self tapping screws in the case of forged brass bodies, or mounted with optional factory supplied mounting brackets.

### Piping

Connect pipe or tubing to valve according to markings on the valve body. Refer to flow diagrams above. Apply pipe compound or teflon tape sparingly to male pipe threads only. When tightening connections do not use the valve body or solenoid as a lever. Locate wrenches as close as possible to the connection point.

**IMPORTANT:** For protection of the solenoid valve, install a strainer or filter suitable for the service involved in the inlet side as close to the valve as possible. Periodic cleaning is required depending on service conditions.

### Wiring

Wiring must comply with local and national codes. Solenoids are provided with 1/2" conduit hubs or other optional connection methods as illustrated in Fig.2,3. The solenoid may be rotated to facilitate electrical connection.

NOTE: Alternating current and direct current solenoids are built differently. To convert one to the other it is necessary to change the complete solenoid assembly including core tube, bonnet, and core assembly.

### MAINTENANCE

NOTE: It is not necessary to remove the valve from the pipeline for repairs.

**WARNING:** Turn off electrical power supply and de-pressurize valve before making repairs.

### Cleaning

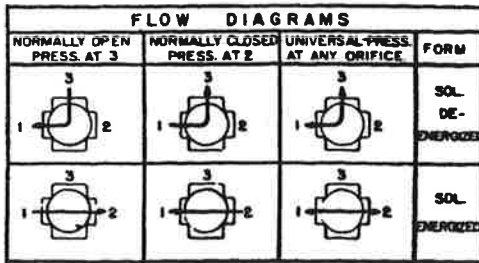
All solenoid valves should be cleaned periodically. The time between cleanings will vary depending on the fluid and service conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive noise, or leakage will indicate that cleaning is required. Clean valve strainer or filter when cleaning the valve.

### Preventive Maintenance

1. Keep the fluid flowing through the valve as free from dirt and foreign material as possible.
2. While in service, the valve should be operated at least once a month to insure proper opening and closing.
3. Depending on the fluid and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace worn or damaged parts with an ASCO rebuild kit.

### Causes of Improper Operation

1. **Faulty Control Circuits:** Check the electrical system by energizing the solenoid. A metallic "click" signifies that the solenoid is operating. Absence of the "click" indicates loss of power supply. Check for loose or blown fuses, open circuited or grounded coil, broken lead wires or splice connections.
2. **Burned-Out Coil:** Check for open-circuited coil. Replace coils as necessary. Check supply voltage; it must be the same as specified on coil.
3. **Low voltage:** Check voltage across the coil lead. Voltage must be at least 85% of coil rating.
4. **Incorrect Pressure:** Check valve pressure. Pressure to valve must be within range specified on nameplate.
5. **Excessive Leakage:** Disassemble valve and clean all parts. Replace worn or damaged parts with an ASCO Rebuild Kit.



### TEMPERATURE LIMITATIONS

For maximum valve ambient and fluid temperatures, refer to chart below. Check catalogue number prefixes and watt ratings to determine maximum temperatures.

TEMPERATURE LIMITATIONS 8320Q, CAT. 32C				
WATT RATING	CATALOGUE PREFIX	MAX. AMBIENT TEMP. F.	MAX. FLUID TEMP. F.	
			1/8 NPT	1/4 NPT
10.1 & 17.1	NONE, FB, KF, KP, SC, SD, SF, SP	125	180	200
10.1 & 17.1	HB, HT, KB, KN, SB, ST, SU	140	180	200
11.6 & 22.6	NONE, KB, KF, KP, SC, SD, SF, SP	104	120	150
11.6 & 22.6	HP, HT, KB, KN, SB, ST, SU, SV	104	120	150

\* MINIMUM AMBIENT TEMPERATURE - 40 F.

### INSTALLATION

Check nameplate for correct catalogue number, pressure, fluid and electrical service.

**ASCO ELECTRIC limited**

P.O. Box 160, Brantford, Ontario N3T 5M8

(519)758-2700 fax (519)758-5540

# ASCO

Printed in Canada

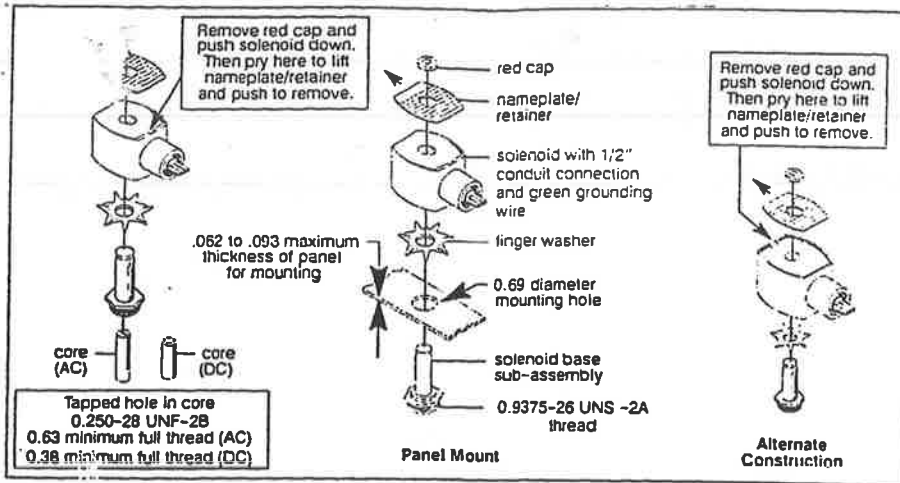


Figure 1. Series 8003G solenoids

Torque Chart

Part Name	Torque Value in Inch-Pounds	Torque Value in Newton-Meters
terminal block screws	10 ± 2	1,1 ± 0,2
socket head screw	15 - 20	1,7 - 2,3
center screw	5 ± 1	0,6 ± 0,1

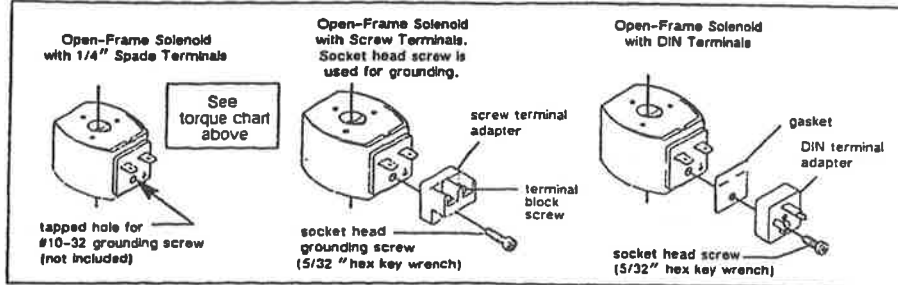


Figure 2. Open-frame solenoids

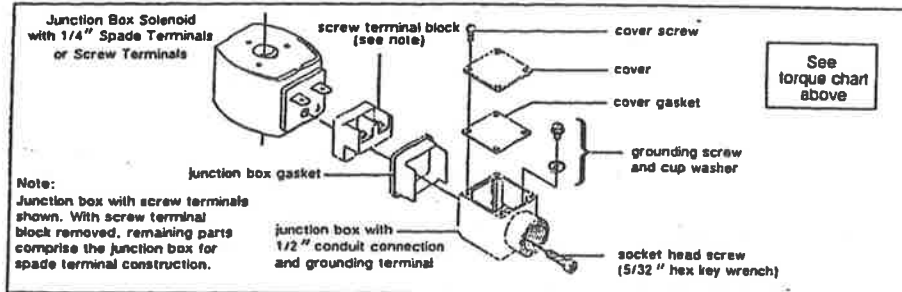


Figure 3. Junction box (optional feature)

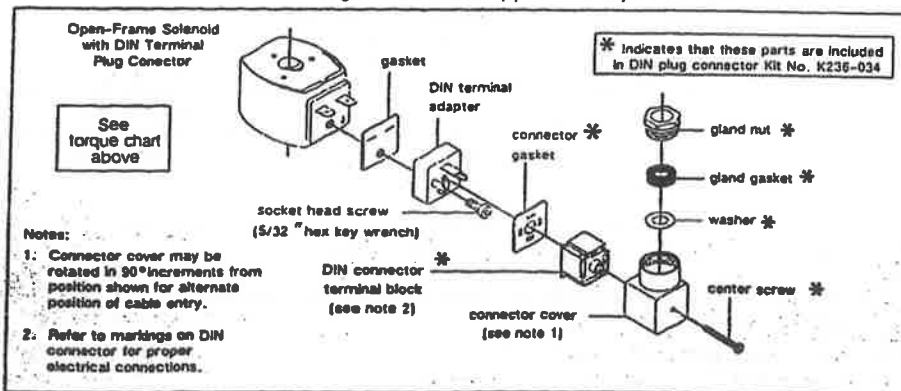


Figure 4. DIN plug connector kit No. K236-034 (optional feature)

**COIL REPLACEMENT (REF. FIG. 1)**

Turn off electrical power, disconnect coil lead wires and proceed as follows:

1. Remove red cap, and nameplate.
2. Slip coil off solenoid base sub-assembly
3. Reassemble in reverse order of disassembly.

**VALVE DISASSEMBLY AND REASSEMBLY (REF. FIG. 1)**

Turn off electrical power supply and de-pressure valve.

1. Remove retaining cap and slip entire solenoid off solenoid base sub-assembly.
2. Unscrew bonnet or solenoid base sub-assembly. Remove core assembly, core spring and body gasket.
3. Remove end cap, body gasket, disc spring, disc holder, disc or disc holder assembly.
4. All parts are now accessible for cleaning or replacement. Replace worn or damaged parts with a complete Spare Parts Kit for best results.
5. Reassemble in reverse order of disassembly paying careful attention to exploded view provided.

**ORDERING INFORMATION FOR SPARE PARTS KITS**  
When Ordering Spare Parts Kits or Coils Specify Valve Catalog Number, Serial Number and Voltage.

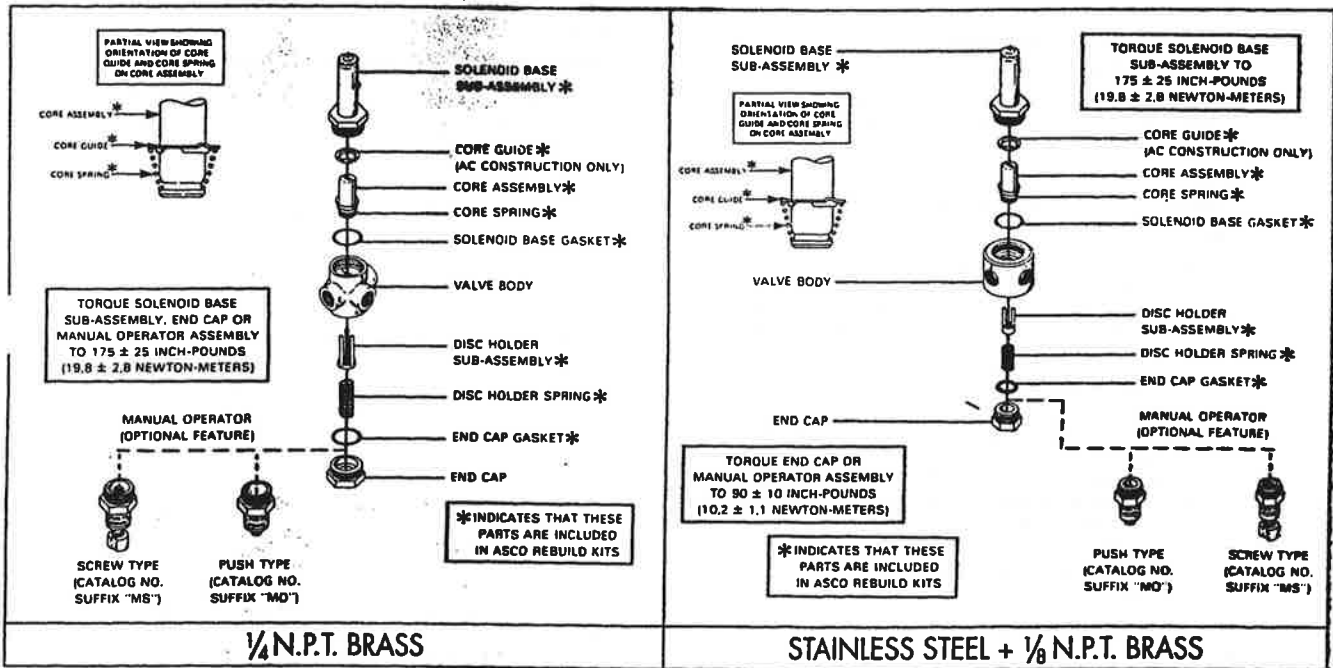


Fig. 5 Series 8320G Valves

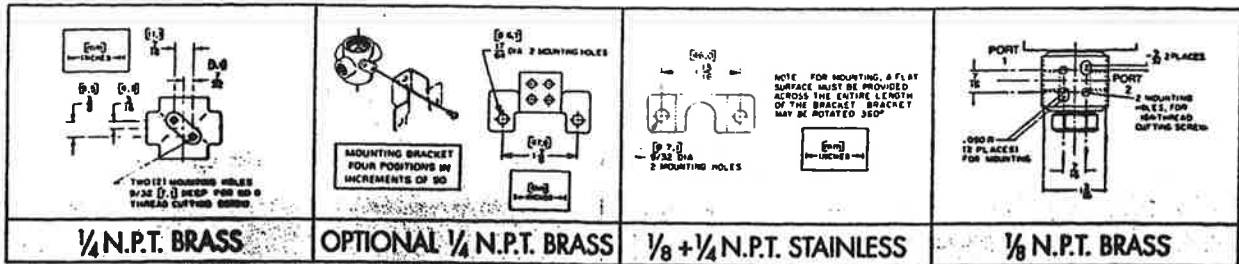


Fig. 6 Mounting

# INSTRUCTIONS DE MONTAGE ET D'ENTRETIEN

## DESCRIPTION

Les instructions suivantes sont incluses pour vous donner des informations générales pour l'installation de nos pièces de rechange. Ces instructions sont très générales et couvrent plusieurs types de soupapes, telle que soupapes à commande par solénoïde, à commande par pilote externe, etc.. Pour une information plus exacte au sujet d'une soupape particulière, voir les pages d'instructions qui sont incluses avec la soupape en question.

## FONCTIONNEMENT

Référez au dessin d'assemblage.

## INSTALLATION

Vérifiez la plaque d'identification pour vous assurer que le numéro de catalogue, le voltage, la pression et le service sont tels que requis.

## MISE EN PLACE

Référez aux dessins d'assemblage.

## TUYOTAGE

Couplez les conduits à la soupape selon les indications données sur le châssis de la soupape. Appliquez la pâte pour conduits généralement sur les pas de vis du conduit mâle seulement: si on l'applique sur le pas de vis de la soupape même, il y a danger que la pâte pénètre dans la soupape et cause des difficultés de fonctionnement.

- important - Pour meilleure opération, il est recommandé qu'un filtre approprié au service soit installé au plus près de la soupape que possible, et que ce filtre soit nettoyé périodiquement.

- avertissement - Évitez de trop serrer les tuyaux. Appliquez les clés le plus près possible du point de raccordement du tuyau et du corps de la soupape. N'utilisez pas la soupape comme levier.

## PRESSION DIFFÉRENTIELLE DE FONCTIONNEMENT (Minimum)

Pour toutes soupapes qui exigent une pression différentielle minimum, il est critique que les lignes de pression et d'échappement ne soient pas réduites. La pression minimum tel qu'indiqué sur la plaque d'identification doit être maintenue.

## CABLAGE

Le câblage doit être conforme aux règlements des Codes Électriques soit Nationaux, soit de l'endroit où l'installation est effectuée.

## ENTRETIEN

- ATTENTION - Débranchez l'alimentation électrique (ou pression auxiliaire) ainsi que la pression avant d'effectuer aucune réparation.

## NETTOYAGE

Un nettoyage périodique de toutes les soupapes et accessoires est recommandé. L'intervalle entre nettoyages variera selon les conditions de service.

## ENTRETIEN PREVENTIF

1. Assurez-vous que la matière circulant dans la soupape est aussi propre que possible.
2. Pendant son service, opérez la soupape au moins une fois par mois pour assurer l'opération normale de la soupape.
3. L'inspection périodique (selon les conditions de service) des parties internes de la soupape est recommandée afin d'observer si il y a endommagement ou usure excessive. Nettoyez la soupape au complet et installez les nouvelles pièces de rechange.

## FONCTIONNEMENT FAUTIF

1. **Defaut du circuit de contrôle:** Vérifiez le système électrique en mettant le solénoïde sous tension. Un dé clic métallique signifie que le solénoïde fonctionne normalement. L'absence d'un dé clic métallique indique une perte d'alimentation du courant. Vérifiez la présence de fusibles fondus, d'une bobine avec un circuit ouvert ou mise à terre, d'un fil ou d'une éprisure brisée.
2. **Basse tension:** Vérifiez le niveau de tension. La tension doit être au moins à 85% du niveau indiqué sur la plaque d'identification.
3. **Pression inadéquate:** Vérifiez que la pression et le service conforme à celle indiquée sur la plaque d'identification de la soupape.
4. **Fuite de pression:** Démontez la soupape et nettoyez toutes les pièces. Installez les pièces de rechange si nécessaire. Vérifiez qu'il n'y a pas d'objets étrangers qui bloquent ou causent la fuite de pression.  
- important - Certaines soupapes, à cause de leurs sièges non-élastiques sont allouées une fuite de pression minime. Consultez le bureau de vente Asco.

## ENSEMBLES DE PIÈCES DE RECHANGE

Pour commander les ensembles de pièces de rechange et les bobines pour les soupapes ASCO, spécifiez le numéro de catalogue, le voltage, la pression et le service en question.

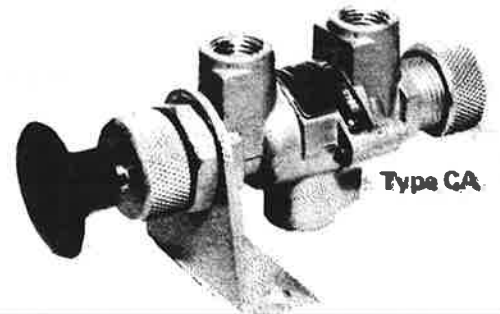
- à noter - Les pièces indiquées avec (\*) sur le dessin d'assemblage sont incluses dans l'ensemble de pièces de rechange.







# Amot® MODEL 4057 3-WAY VALVES



Type CA

## FEATURES

- BALANCED FORCE DESIGN-  
PRESSURE CAN BE APPLIED  
TO ANY PORT.
- BUBBLE-TIGHT SEAL
- CENTER DEAD SPOT-STD.
- PORT OVERLAP-OPTIONAL
- ARRANGED FOR PANEL OR  
BRACKET MOUNTING

## HOW TO ORDER

When ordering please specify the following:

1. Amot Model 4057D
2. Valve Type (see table).
3. Any of the following special features if required:
  - a. Viton Seals (instead of Buna N).
  - b. Gulfproofed (corrosion protection for seacoast atmospheres).
  - c. Valve Port Overlap (instead of center dead spot - uses aluminum piston).
  - d. BSP Parallel Port Threads (instead of NPT). Available from UK factory only.
  - e. Part No. 5186 Bracket if required. Furnished standard with Types CF, CT and C2 only.
  - f. Satin chrome Nut Part No. 3496L001 for front of panel mounting. Not available for Types CF, CS, CT or C2.
  - g. Part No. 681L001 Red Knob if required for Types CA, CB, CD, or CE.

This unit may be ordered using the full description as shown above or by constructing a Model Number using the Model Code System. The complete Model Number for a standard Type CA unit with NPT port threads, standard finish, spool with center dead spot, Buna N seals and no bracket is 4057D001A1.



Type CP

AMOT Model 4057 3-Way Valves were developed for use in manual and automatic hydraulic or pneumatic control systems. They offer versatility in operating requirements and allowable pressure limits. For a 1/4" size control valve, they offer exceptional flow capacity.

These valves are suitable for use on clean air, natural gas, L.P. gases, petroleum-base lubricants and hydraulic oils as well as many other fluids. Viton seals are also available for use with oils and other fluids which are harmful to Buna N.

Each valve is carefully assembled, tested, and inspected to ensure that high quality standards are met. Valves are made from precision cast and machined aluminum parts. The unique porting arrangement eliminates seal ring cutting, and permits pressure inlet at any port without danger of seal "blow out". Standard construction permits valve pressures to 125 psi. For similar valves in stainless steel, refer to AMOT's 4457 Series.

Certain of these valves are completely unique in the industry. For example, the 4057 Type CP has a manual reset latch which automatically will drop out on introduction of pilot pressure, and permits return stroke on loss of pilot pressure.

These valves make use of AMOT's patented "Tad-Pole" seal which provides for lower friction and longer cycle life than conventional O-rings. (U.S. Pat. No. 3,926,444)

**INSTALLATION**

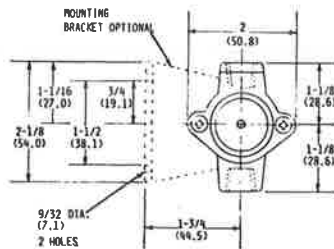
All connections on 4057 Valves are made with 1/4" pipe thread fittings. Apply a quality thread sealant such as Loctite Pipe Sealant to pipe thread connections but do not permit it to enter the valve passages. Teflon thread sealing tape may be used but must be applied so that shreds of the tape do not enter the valve.

Avoid overtightening fittings on the valve port bosses as they may be cracked, especially when Teflon thread sealing tape is used.

All valves may be bracket mounted; most are also suitable for panel mounting. A Satin Chrome Nut, Part No. 3496L001, is available as an option for most types. It substitutes for standard Nut (8) to improve the appearance for front of panel mountings. A red Knob, Part No. 681L001, is available for Types CA, CB, CD or CE if desired as a substitute for standard Knob (11).

**DIMENSIONS**

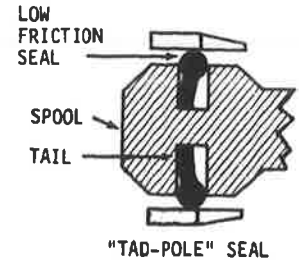
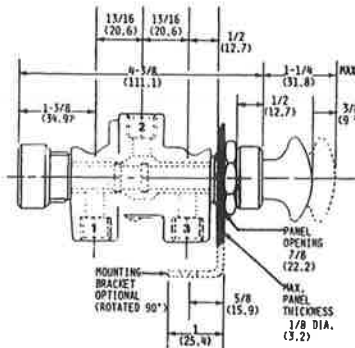
Dimensions in Inches  
Millimetres in ( )



**SPECIFICATIONS**

Body Material . . . . . precision cast aluminum  
 Standard Spool Material . . . glass reinforced Ryton  
 Standard Seal Material . . . . . Buna N  
 Maximum Temperature - with Buna N seals 180°F (82°C)  
 - with Viton seals 250°F (120°C)  
 Flow Coefficient (equivalent to 9/32 dia. port)  $C_v = 1.2$   
 Maximum Pressure at Ports 1, 2 or 3 \*125 psi (860 kPa)  
 Maximum Pressure at Ports A or B 150 psi (1034 kPa)  
 Maximum Pressure at Port C (Types CT & SB) \*\*125 psi (860 kPa)  
 Net Weight . . . . . 0.6 to 2.0 lbs (0.3 to 0.9 kg)

\* 150 psi (1034 kPa) if a slight increase in operating force and pressures is acceptable.  
 \*\* 350 psi (2411 kPa) if a suitable orifice is used to prevent damage to valve components from sudden application of pressure.

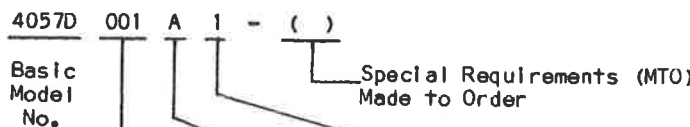


**OPERATION**

AMOT Model 4057 3-Way Valves feature modular construction and incorporate a sliding spool. The standard spool has a small center dead spot position and no valve port overlap. With the spool fully to the left (rest position) as shown in the diagrams, Port 2 is open to Port 3 and Port 1 is closed. With

the spool moved to the right (actuated position), Port 2 is open to Port 1 and Port 3 is closed. The valves are available with a variety of manual and pressure operators and with manual, pressure or spring returns. See the Valve Type Description Table for the standard variations which are available.

**MODEL CODE SYSTEM**



Valve Type	Table A Operator, Finish & Thread Code No.				Table B Seal Material Code No.		Table C Spool Code No.		
	Standard NPT	Gulf-proofed NPT	Standard *BSP (PL)	Gulf-proofed *BSP (PL)	Buna N	Viton	Standard	Valve Port Overlap	Type C1 only has 3 Seal Rings, not 4
CA	001	019	073	091	A	F	1	2	-
CB	002	020	074	092	A	F	1	2	-
CD	004	022	076	094	C	H	1	2	-
CE	005	023	077	095	C	H	1	2	-
CP	007	025	079	097	E	K	5	6	-
SB	009	027	081	099	A	F	1	2	-
CS	010	028	082	100	E	K	1	2	-
CT	011	029	083	101	C	H	1	2	-
CG	013	031	085	103	D	J	1	2	-
CF	014	032	086	104	D	J	1	2	-
C2	017	035	089	107	D	J	1	2	-
C1	018	036	090	108	B	G	-	-	3

\* Available from U.K. Factory only.

NOTE: Letters or numbers in the MTO space, other than nothing, AI or AA, indicate the unit is built to special requirements and some of the other code numbers may not be valid. Check with the factory for full specification of such models.

AMOT designs and tests all its products to ensure that high quality standards are met. For good product life, carefully follow AMOT's installation and maintenance instructions; failure to do so could result in damage to the equipment being protected or controlled.

VALVE TYPE DESCRIPTION TABLE

**TYPE CA**

Manual Operated  
5 lbs Force Required

**TYPE CF**

Double Pilot Operated  
10 psi Pressure Required

**TYPE CB**

Manual Pull  
Spring Return  
15 lbs Force Required

**TYPE CG**

Pressure Operated,  
Spring Return  
26 psi Pressure Required

**TYPE CD**

Manual or  
Pressure Operated  
Manual Return  
10 psi Pressure or  
6 lbs Force Required

**TYPE C1**

Normally Open  
Pressure Operated  
Internal Pressure Return

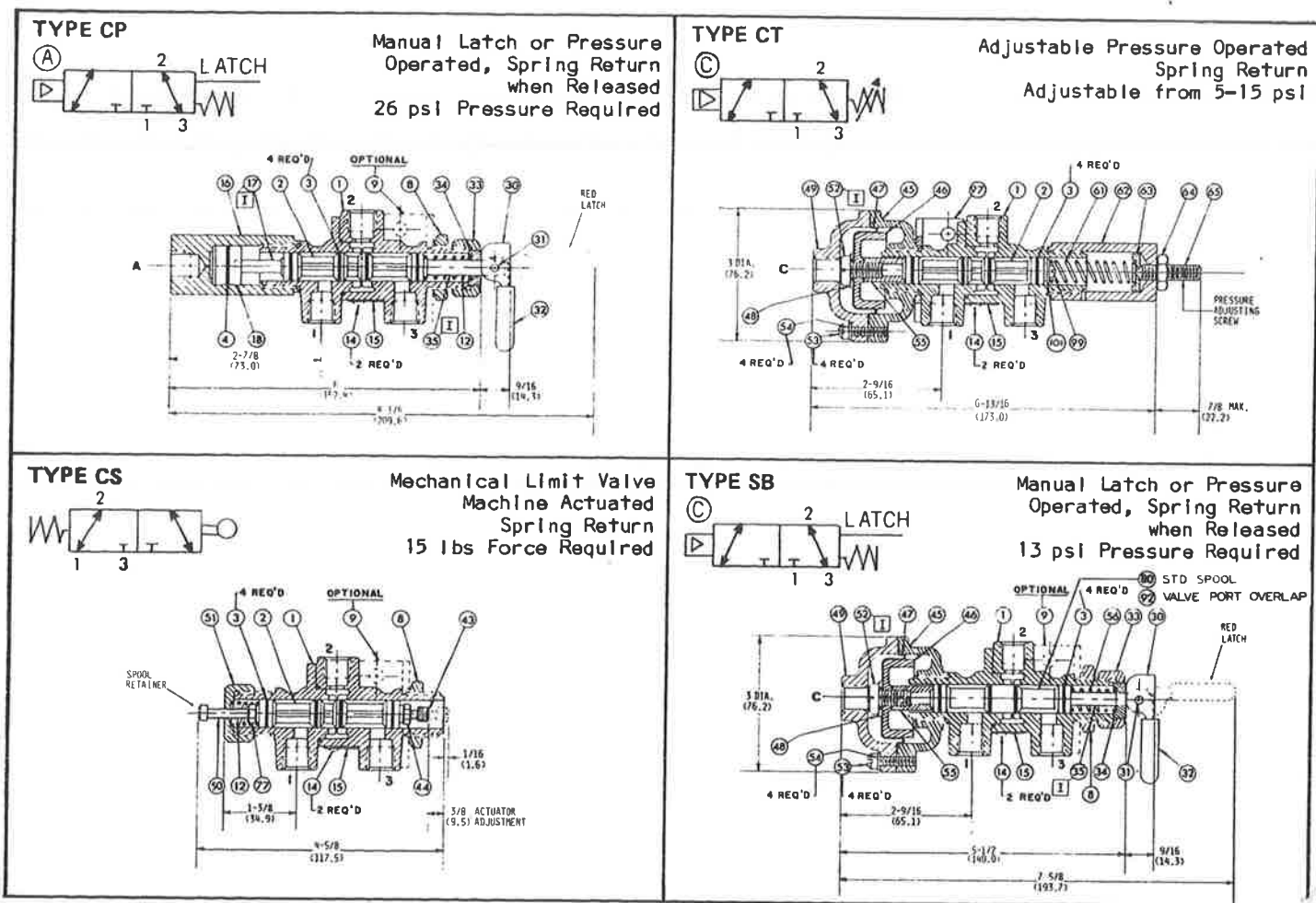
**TYPE CE**

Manual or  
Pressure Operated  
Spring Return  
26 psi Pressure or  
16 lbs Force Required

**TYPE C2**

Double Pilot Operated  
Spring Return in One  
Direction, 10 psi  
and 26 psi required

Note: The symbol does not designate a detent, but indicates that the valve has a memory and that the piston will remain in position until moved.



### MAINTENANCE

AMOT 4057 Valves make use of AMOT's "Tad Pole" rubber seals to provide low operating forces and high cycle life. Wear can be observed by checking for leakage which will increase as there is more wear.

To check the seal rings, the valve spool can be removed. This is done on most versions by simply removing the end cap and pulling out the spool. Spools on panel mounted valves can be removed from in front of the panel without disconnecting any piping.

To replace seal rings, remove the spool, take off the old rings, thoroughly clean the grooves, and fill the grooves with Dow Corning No. 33 grease (AMOT Part No. 911L001). Lightly coat the new rings with grease and install them, first inserting the thin tail section of the ring into one side of the groove. Work around the ring until it is uniformly positioned. Remove excess grease and reinstall the piston.

When these valves are used in safety control systems, it is recommended that the system be checked monthly for proper functioning.

When communicating with AMOT regarding operation of a control, always give the Model No. and Serial No. If ordering service parts, also include the Description, Part No., and quantity desired. If any parts are ordered by Reference No. only, please include the Form No., Revision No., and date of this brochure.

### SERVICE KITS

Ref No.	Part No.	Qty	Description
for all Types except CT & SB (Buna N) Kit 9113X			
3	7896L001	4	Seal Ring, Buna N
4	7898L001	2	Seal Ring, Buna N

Service Kit 9113X may contain extra parts when used for some valve types.

for Types CT & SB (Buna N)			Kit 9128X
3	7896L001	4	Seal Ring, Buna N
47	2254	1	Diaphragm, Buna N
48	714L004	1	Thread Seal

### SERVICE PARTS

Ref No.	Part No.	Qty	Description
3	7896L001		Seal Ring, Buna N
3	7896L002		Seal Ring, Viton
4	7898L001		Seal Ring, Buna N
4	7898L002		Seal Ring, Viton
47	2254		Diaphragm, Buna N for Types CT & SB
47	2254L002		Diaphragm, Viton, for Types CT & SB
48	714L004		Thread Seal

These Parts Lists effective with Valve Serial No. C



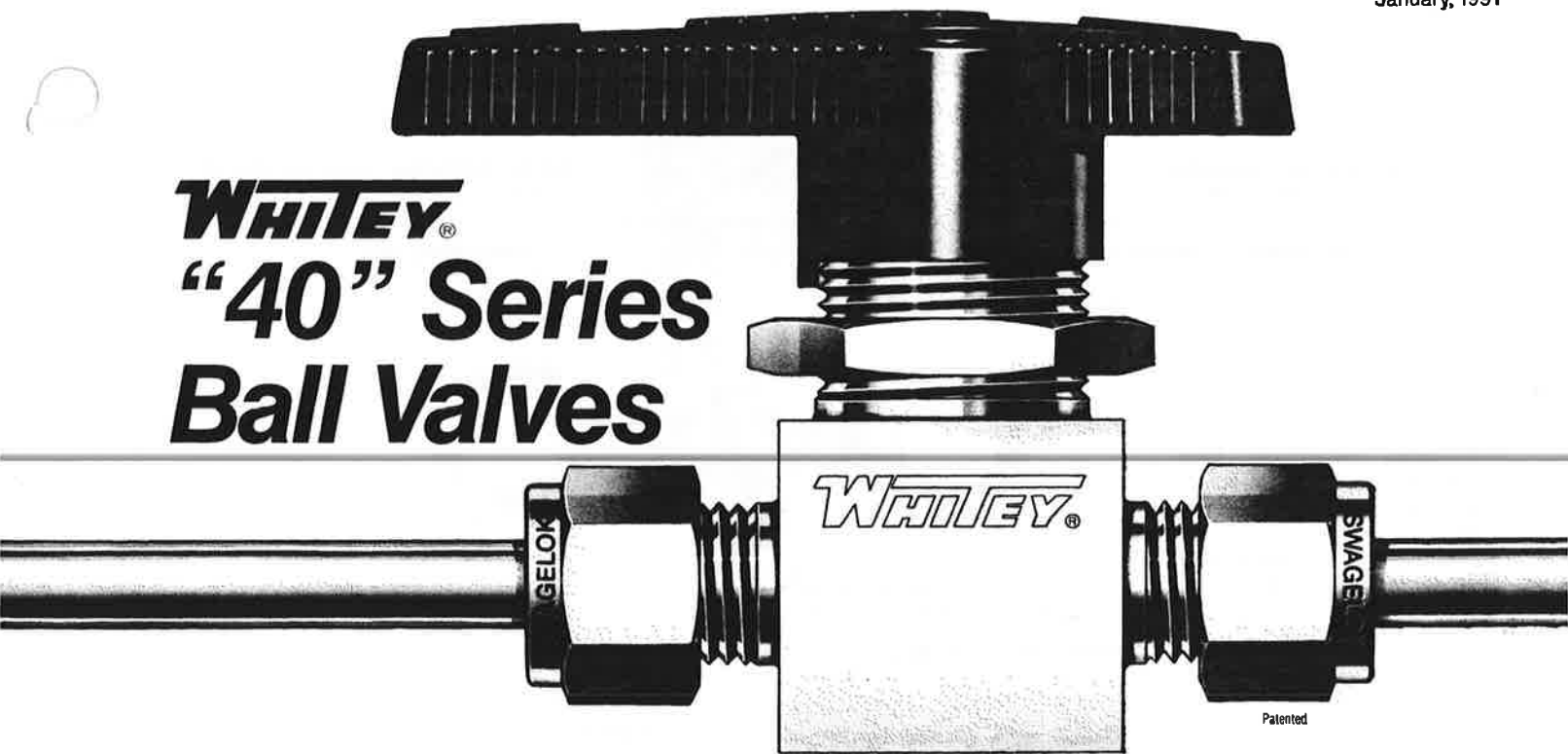
AMOT Controls Corporation  
P.O. Box 1312  
First Street & Nevin Avenue  
Richmond, CA 94802  
U.S.A.  
Tel: (415) 236-8300  
Tlx: 33-5442  
Fax: (415) 234-9950

AMOT Controls Ltd.  
Western Way  
Bury St. Edmunds IP33 3SZ  
England  
Tel: (0284) 62 222  
Tlx: 81 283  
Fax: (0284) 60 256

AMOT Controls S.A.  
Chemin de la Tavallaz 25  
CH-1816 Chailly (Montreux)  
Switzerland  
Tel: (021) 64 11 41  
Tlx: 452 109  
Fax: (021) 64 46 84

FORM 747  
REV. 7  
12-81

# WHITEY® "40" Series Ball Valves

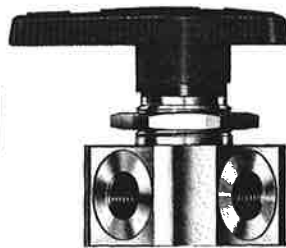


2-WAY

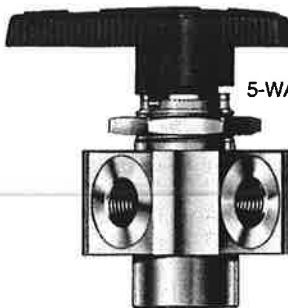
*WHITEY Instrument  
Ball Valves feature  
a compact maximum  
flow design in sizes  
from 1/16" to 3/4"*



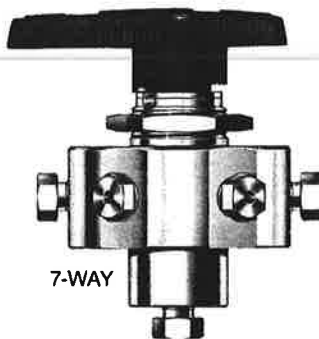
3-WAY



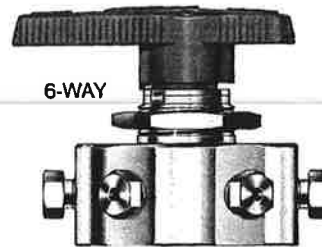
4-WAY



5-WAY



7-WAY



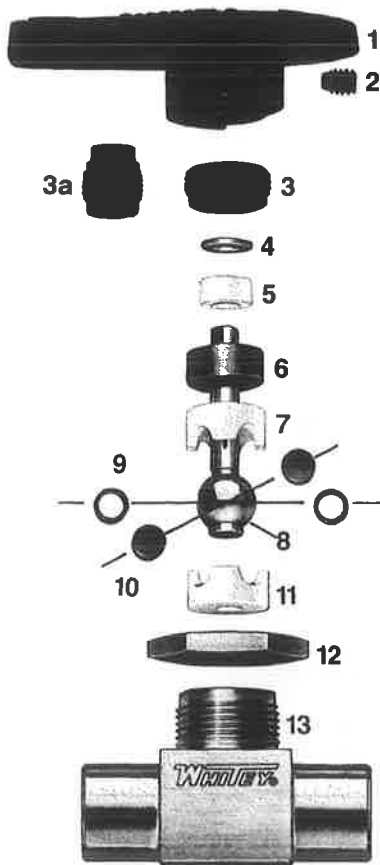
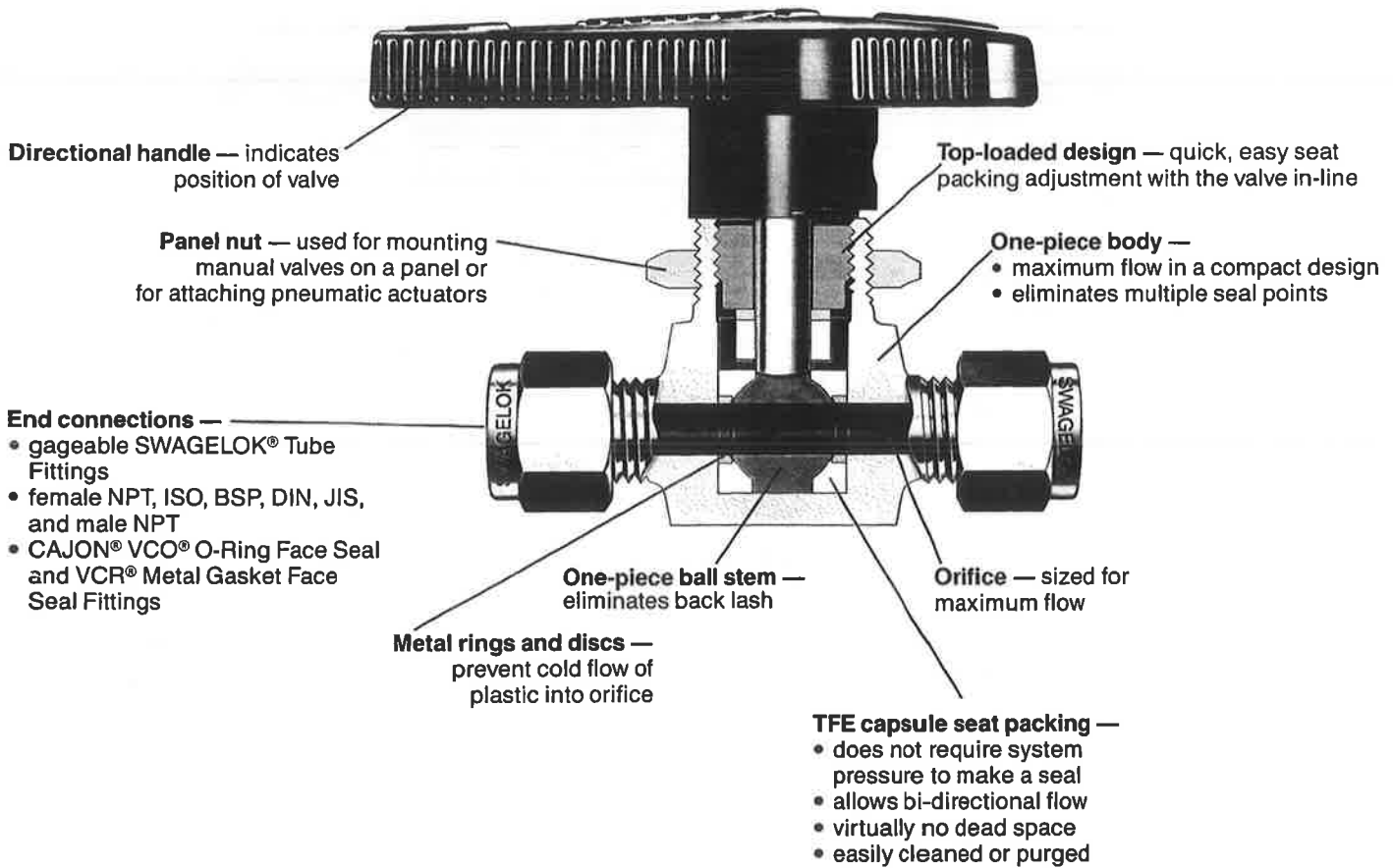
6-WAY



A SWAGELOK® COMPANY

WHITEY Co.  
318 Bishop Road  
Highland Heights, OH 44143

# THE WHITEY "40" SERIES DESIGN



## Testing

Standard Production Test — Each valve is 100% tested with nitrogen @ 1000 PSI (6800 kPa) for leakage at the seats and seals. Each test is performed to a maximum allowable leak rate of 0.1 scc/min. Other optional tests are available. Consult your Authorized Sales and Service Representative.

## Materials of Construction

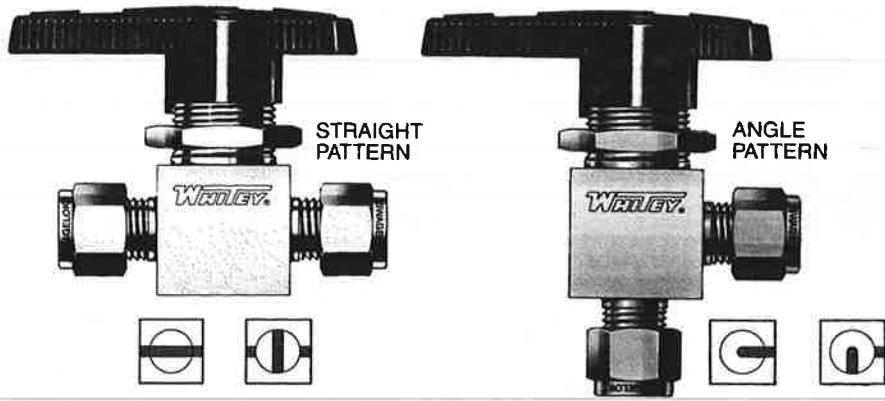
	VALVE BODY MATERIALS		
	316 STAINLESS STEEL	BRASS	ALLOY 400
	GRADE/ASTM SPECIFICATION		
1 Handle	Black Nylon (Bronze insert)		
2 Set Screw	17-4PH/A564		
3 Packing Bolt (43)	Stainless Steel	Brass	Stainless Steel
3a Packing Bolt (41, 42, 44, 45)			
4 Upper Gland	Stainless Steel		Alloy 400
5 Bushing	TFE/D1710*		
6 Lower Gland	Stainless Steel	Brass	Alloy 400
7 Upper Packing	TFE/D1710*		
8 Stem	316SS/A276	Brass/B16	Alloy 400/B164
9 Side Rings	Stainless Steel	Brass	Alloy 400
10 Side Discs			
11 Lower Packing	TFE/D1710*		
12 Panel Nut	Stainless Steel	Brass/B16	Stainless Steel
13 Body	316SS/A479		Alloy 400/B164

\* Optional UHMW Polyethylene/D4020 available.

Wetted parts numbered in RED

Lubrication: Silicone base lubricant

# ON-OFF VALVES — 2 WAY



## Technical Data

These ratings are for a standard valve with TFE or UHMW Polyethylene seat packings.

VALVE SERIES	PRESSURE RATING ●	TEMPERATURE RATING
41, 42 41A, 42A, 43A	2500 PSI (17,200 kPa)	50°F to 150°F (10°C to 65°C)
43	3000 PSI (20,600 kPa)	
44, 45	2500 PSI (17,200 kPa)	
44A, 45A	1500 PSI (10,300 kPa)	

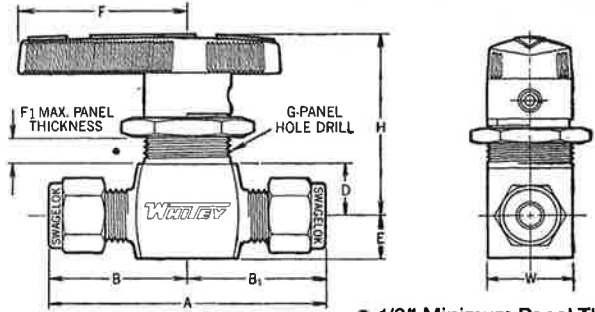
● Valves are adjusted for 1000 PSI (6800 kPa) service at 70°F (21°C). For use in other pressure applications, the valve packing must be adjusted.

## Flow Data

Orifice	C <sub>v</sub>	FLOW RATE					
		Pressure Drop To Atmosphere (ΔP) PSI					
		SCFM of Air @ 70°F (21°C)			GPM of Water @ 70°F (21°C)		
0.093	0.2	10	50	100	10	50	100
		2.7	7.6	14.0	0.6	1.4	2.0
0.125	0.5 0.6	10	50	100	10	50	100
		6.9 8.3	19.0 23.0	34.0 41.0	1.5 1.9	3.5 4.2	5.0 6.0
0.187	0.9 1.2 1.5 1.6 2.4	10	50	100	10	50	100
		12.0	34.0	61.0	2.8	6.3	9.0
		17.0	46.0	81.0	3.7	8.4	12.0
		21.0	57.0	100.0	4.7	11.0	15.0
0.281	2.6 3.0 6.0	10	50	100	10	50	100
		36.0	99.0	180.0	8.2	18.0	26.0
		42.0	110.0	200.0	9.4	21.0	30.0
		83.0	230.0	410.0	19.0	42.0	60.0
0.406	6.3 6.4 12.0	10	50	100	10	50	100
		87.0	240.0	430.0	20.0	45.0	63.0
		170.0	460.0	810.0	38.0	85.0	120.0

NOTE: Angle pattern valves have the same flow capacity and B1 dimension as the 3-way Switching Valves.

To determine the flow capacity of the valve, match the orifice size and C<sub>v</sub> in the Table of Dimensions with the orifice size and C<sub>v</sub> in the Flow Data chart.



● 1/8" Minimum Panel Thickness

## Table of Dimensions

BASIC ORDERING NUMBER	ORIFICE		C <sub>v</sub>	CONNECTION / SIZE		DIMENSIONS												
	in.	mm		Inlet	Outlet	A	B	B1	D	E	F	F1	G	H	W			
-41S3MM	.093	2.4	0.2	3mm SWAGELOK		2	1	1	1 1/32	3/32	1 1/8	1/4	1 1/32	1 1/32				
-41S2			0.2	1/8 SWAGELOK														
-42F2	.125	3.2	0.5	1/8 Female NPT		1 1/8	1 3/16	1 3/16	1 1/32	3/32	1 1/8	1/4	1 1/32	1 1/32				
-42S6MM			0.6	6mm SWAGELOK		2 3/16	1 3/32	1 3/32										
-42S4			0.6	1/4 SWAGELOK		1 1/4	7/8	7/8										
-42VCO4			0.6	1/4 Male VCO											7/16	3/8	3/16	2 5/32
-42VCR4			0.6	1/4 Male VCR		2 1/8	1 1/16	1 1/16										
-43F2			1.2	1/8 Female NPT		2	1	1										
-43F4	0.9	1/4 Female NPT		2 1/16	1 1/32	1 1/32												
-43F4RT	0.9	1/4 ISO Female Tapered																
-43M4	1.2	1/4 Male NPT					2	1	1									
-43M4-S4	1.6	1/4 Male NPT	1/4 SWAGELOK	2 3/16	1	1 1/16	7/16	3/8	1 17/32	3/16	2 5/32	1 1/16	2 5/32					
-43S6MM	2.4	6mm SWAGELOK		2 3/8	1 1/16	1 1/16												
-43S4	2.4	1/4 SWAGELOK		2 3/8	1 1/16	1 1/16												
-43S8MM	1.5	8mm SWAGELOK		2 7/16	1 1/32	1 1/32												
-43S6	1.5	3/8 SWAGELOK		2 7/16	1 1/32	1 1/32												
-43VCO4	2.4	1/4 Male VCO		1 7/8	1 5/16	1 5/16												
-43VCR4	2.4	1/4 Male VCR		2 1/8	1 1/16	1 1/16												
-44F4	.281	7.1	3.0	1/4 Female NPT		2 1/2	1 1/4	1 1/4	3/16	3/16	2	3/8	1 1/8	2 1/16	1 1/8			
-44F6			2.6	3/8 Female NPT														
-44F6RT			2.6	3/8 ISO Female Tapered														
-44S6			6.0	3/8 SWAGELOK												3 1/8	1 17/32	1 17/32
-44S10MM			6.0	10mm SWAGELOK														
-45F8			.406	10.3	6.3											1/2 Female NPT		3 3/8
-45F8RT	6.3	1/2 ISO Female Tapered																
-45S12MM	12.0	12mm SWAGELOK																
-45S8	12.0	1/2 SWAGELOK			3 5/16	1 3/32	1 3/32											
-45S12	6.4	3/4 SWAGELOK																
-45VCR8	12.0	1/2 Male VCR			3 3/8	1 1/16	1 1/16											

Dimensions shown with SWAGELOK nuts finger-tight, where applicable. All dimensions are in inches — for reference only, subject to change.

## Ordering Information

### Materials:

To order, use **SS** for 316 stainless steel, **B** for brass, or **M** for alloy 400 as a prefix to the Basic Ordering Number.

Example: **SS-42F2**

### Vent Port:

The vent port allows venting to atmosphere through a side port in the valve body. Straight pattern valves vent downstream; angle pattern valves vent to the bottom port. For valves with an optional vent, the pressure rating is reduced to 500 PSI (3400 kPa). To order, insert **V** after the valve series.

Example: **SS-43VF4**

### Patterns:

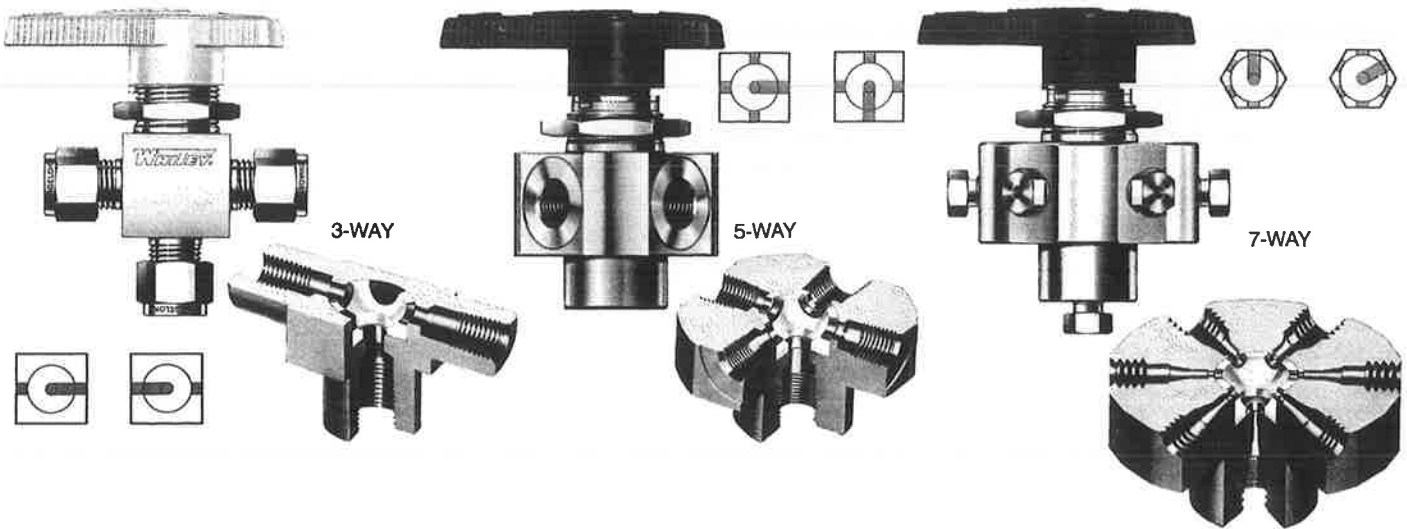
To order an angle pattern valve, use **-A** as a suffix to the Valve Ordering Number.

Example: **SS-45F8-A**

### Seat Packings:

For optional UHMW Polyethylene seat packings, use **-P** as a suffix to the Valve Ordering Number. Example: **SS-43F4-P**

# SWITCHING VALVES — 3-WAY, 5-WAY and 7-WAY



## Features

- Unique, top-loaded TFE capsule packing allows reliable switching in the most compact design
- Switches single inlet to multiple outlets or multiple inlets to common outlet
- 3-way design has center-off position
- 5 and 7-way designs have spring loaded detent for exact port positioning
- Optional ball drillings available for special applications (See Technical Bulletin No. 25)

## Technical Data

These ratings are for a standard valve with TFE or UHMW Polyethylene seat packings.

VALVE SERIES	DESIGN	PRESSURE RATING ●	TEMPERATURE RATING
41X, 42X 43X	3-WAY	2500 PSI (17,200 kPa)	50°F to 150°F (10°C to 65°C)
44X, 45X		1500 PSI (10,300 kPa)	
43Z	5-WAY	2500 PSI (17,200 kPa)	
43Z6	7-WAY	500 PSI (3,400 kPa)	

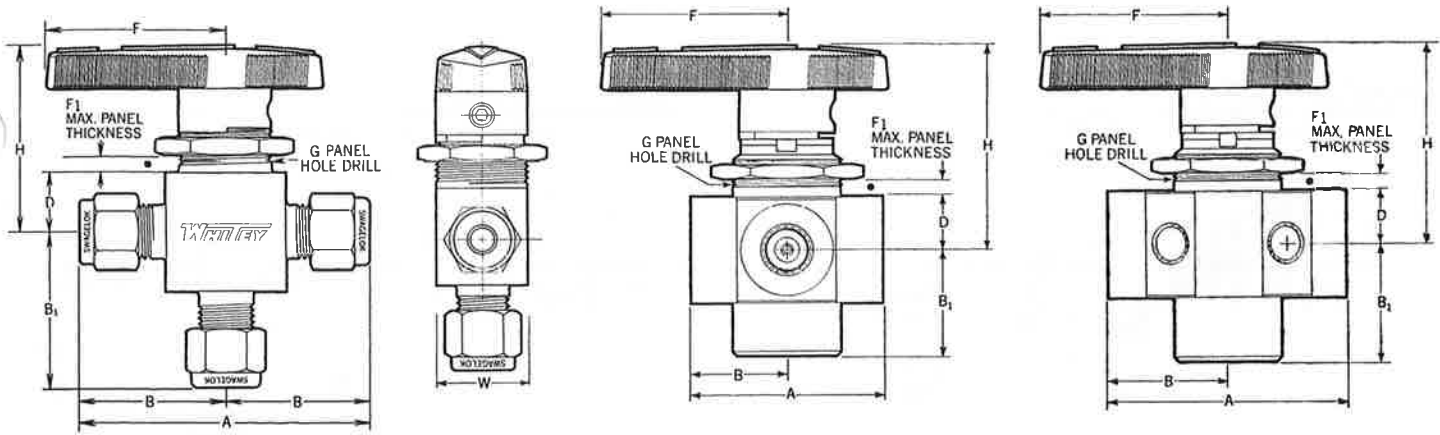
- Valves are adjusted for 1000 PSI (6800 kPa) service at 70°F (21°C). "43Z6" valves are adjusted for 500 PSI (3400 kPa) service at 70°F (21°C). For use in other pressure applications, the valve packing *must* be adjusted.

## Flow Data

		FLOW RATE					
		Pressure Drop To Atmosphere ( $\Delta P$ ) PSI					
		SCFM of Air @ 70°F (21°C)			GPM of Water @ 70°F (21°C)		
Orifice	C <sub>v</sub>	10	50	100	10	50	100
<b>3-Way Design</b>							
0.093	0.15	2.0	5.7	10.1	0.4	1.0	1.5
0.125	0.30	4.1	11.0	20.0	0.9	2.1	3.0
	0.35	4.8	13.0	24.0	1.1	2.4	3.5
0.187	0.75	10.0	29.0	51.0	2.3	5.3	7.5
	0.80	11.0	31.0	54.0	2.5	5.6	8.0
0.281	0.90	12.0	34.0	61.0	2.8	6.3	9.0
	1.5	21.0	57.0	100.0	4.7	11.0	15.0
0.406	1.7	24.0	65.0	110.0	5.3	12.0	17.0
	2.0	28.0	77.0	140.0	6.3	14.0	20.0
0.406	3.5	48.0	130.0	240.0	11.0	25.0	35.0
	3.8	53.0	140.0	260.0	12.0	27.0	38.0
0.406	4.6	64.0	180.0	310.0	15.0	33.0	46.0
	<b>5-Way Design</b>						
0.062	0.07	0.9	2.6	4.7	0.2	0.4	0.7
<b>7-Way Design</b>							
0.052	0.05	0.6	1.9	3.3	0.1	0.3	0.5
0.062	0.07	0.9	2.6	4.7	0.2	0.4	0.7

To determine the flow capacity of the valve, match the orifice size and C<sub>v</sub> in the Table of Dimensions with the orifice size and C<sub>v</sub> in the Flow Data chart.





**Table of Dimensions**

● 1/8" Minimum Panel Thickness

BASIC ORDERING NUMBER	ORIFICE		Cv	CONNECTION / SIZE		DIMENSIONS													
	in.	mm		SIDE PORTS	BOTTOM PORT	A	B	B1	D	F	F1	G	H	W					
-41XS3MM	.093	2.4	0.15	3mm SWAGELOK		2	1	3/32	11/32	1 1/8	1/4	19/32	1 11/32	19/32					
-41XS2			0.15	1/8 SWAGELOK															
-42XF2	.125	3.2	0.30	1/8 Female NPT		1 5/8	1 3/16	1 3/16	11/32	1 1/8	1/4	19/32	1 11/32	19/32					
-42XS6MM			0.35	6mm SWAGELOK		2 3/16	1 3/32	1 1/16											
-42XS4			0.35	1/4 SWAGELOK		2 1/8	1 1/16	1 3/32							7/16	3/16	25/32	1 1/16	25/32
-42XVCR4			0.35	1/4 Male VCR															
-43XF4	.187	4.8	0.75	1/4 Female NPT		2 7/16	1 1/32	1 1/32	7/16	1 17/32	3/16	25/32	1 9/16	25/32					
-43XF4RT			0.75	1/4 ISO Female Tapered															
-43XS6MM			0.90	6mm SWAGELOK															
-43XS4			0.90	1/4 SWAGELOK															
-43XS4-S4-M4			0.80	1/4 SWAGELOK	1/4 Male NPT														
-43XS8MM			0.80	8mm SWAGELOK															
-43XVCR4			0.90	1/4 Male VCR															
-44XF4	.281	7.1	1.7	1/4 Female NPT		2 1/2	1 1/4	1 1/4	9/16	2	3/8	1 1/8	2 1/16	1 1/8					
-44XF6			1.5	3/8 Female NPT															
-44XF6RT			1.5	3/8 ISO Female Tapered															
-44XS6			2.0	3/8 SWAGELOK															
-44XS10MM			2.0	10mm SWAGELOK															
-45XF8	.406	10.3	3.5	1/2 Female NPT		3 1/8	1 9/16	1 9/16	11/16	3	3/8	1 1/2	2 7/16	1 1/2					
-45XF8RT			3.5	1/2 ISO Female Tapered															
-45XS12MM			4.6	12mm SWAGELOK															
-45XS8			4.6	1/2 SWAGELOK															
-45XS12			3.8	3/4 SWAGELOK															
-43ZF2	.062*	1.6	0.07	1/8 Female NPT		1 9/16	25/32	7/8	7/16	1 17/32	5/32	29/32	1 1/16	—					
-43ZFS2			0.07	1/8 Female SWAGELOK															
-43Z6FS1	.052*	1.3	0.05	1/16 Female SWAGELOK		1 15/16	31/32	31/32	7/16	1 17/32	5/32	29/32	—						
-43Z6FS2	.062*	1.6	0.07	1/8 Female SWAGELOK															

\* This orifice has been designed for typical applications. Some cross port flow can occur during switching. For applications where cross port flow is unacceptable during switching, specify a .049" ball orifice. Example: SS-43ZF2-049. Dimensions shown with SWAGELOK nuts finger-tight, where applicable. All dimensions are in inches — for reference only, subject to change.

**Ordering Information**

**Materials:**

To order, prefix **SS** for 316 stainless steel, **B** for brass, or **M** for alloy 400 to the Basic Ordering Number. Example: **SS-43XS4**

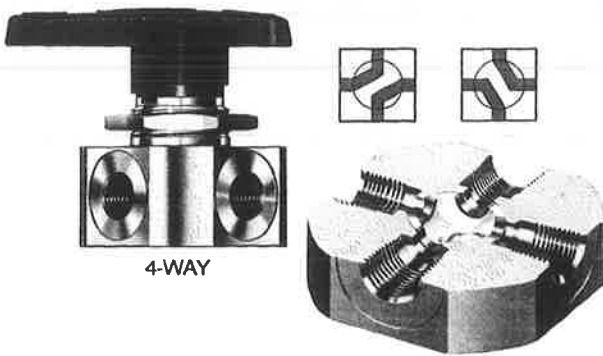
**3-Way Vent:**

Allows venting of the bottom port to atmosphere through a side port in the valve body. For valves with an optional vent, the pressure rating is reduced to 500 PSI (3400 kPa). To order, insert **V** after the valve series. Example: **SS-44XFV6**.

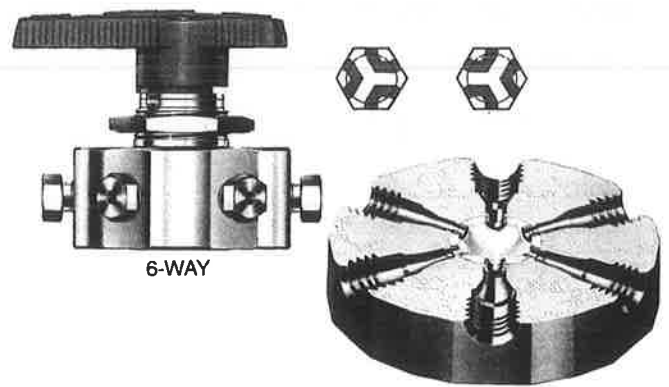
**Seat Packings:**

For optional UHMW Polyethylene seat packings, suffix **-P** to the Ordering Number. Example: **SS-45XF8-P**

# CROSSOVER VALVES — 4-WAY and 6-WAY



4-WAY



6-WAY

## Features

- TFE capsule packing allows crossover of 2 or 3 streams in a compact design
- Machined stops provide positive, exact port positioning

## Technical Data

These ratings are for a standard valve with TFE or UHMW Polyethylene seat packings.

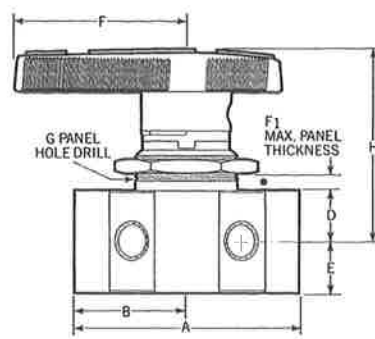
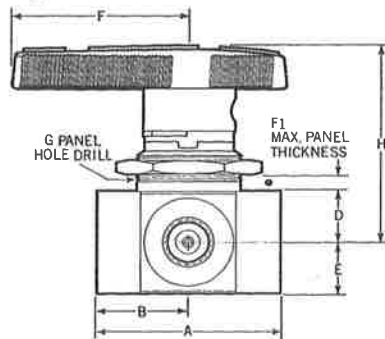
VALVE SERIES	DESIGN	PRESSURE RATING ●	TEMPERATURE RATING
43Y	4-WAY	2500 PSI (17,200 kPa)	50°F to 150°F (10°C to 65°C)
45Y		1500 PSI (10,300 kPa)	
43Y6	6-WAY	500 PSI (3,400 kPa)	

● Valves are adjusted for 1000 PSI (6800 kPa) service at 70°F (21°C). "43Y6" valves are adjusted for 500 PSI (3400 kPa) service at 70°F (21°C). For use in other pressure applications, the valve packing must be adjusted.

## Flow Data

		FLOW RATE					
		Pressure Drop To Atmosphere (Δ P) PSI					
		SCFM of Air @ 70°F (21°C)			GPM of Water @ 70°F (21°C)		
Orifice	C <sub>v</sub>	10	50	100	10	50	100
<b>4-Way Design</b>							
0.052	0.06	0.8	2.2	4.0	0.1	0.4	0.6
0.062	0.08	1.1	3.0	5.4	0.2	0.5	0.8
0.281	1.6	22.0	61.0	110.0	5.0	11.0	16.0
<b>6-Way Design</b>							
0.052	0.06	0.8	2.2	4.0	0.1	0.4	0.6
0.062	0.08	1.1	3.0	5.4	0.2	0.5	0.8

To determine the flow capacity of the valve, match the orifice size and C<sub>v</sub> in the Table of Dimensions with the orifice size and C<sub>v</sub> in the Flow Data chart.



## Table of Dimensions

● 1/8" Minimum Panel Thickness

BASIC ORDERING NUMBER	ORIFICE		C <sub>v</sub>	CONNECTION / SIZE		DIMENSIONS						
	in.	mm		INLET	OUTLET	A	B	D	E	F	F1	G
-43YF2	.062*	1.6	0.08	1/8 Female NPT	1 <sup>9</sup> / <sub>16</sub>	2 <sup>5</sup> / <sub>32</sub>	7/ <sub>16</sub>	7/ <sub>16</sub>	1 <sup>17</sup> / <sub>32</sub>	5/ <sub>32</sub>	2 <sup>9</sup> / <sub>32</sub>	1 <sup>11</sup> / <sub>16</sub>
-43YFS1	.052*	1.3	0.06	1/16 Female SWAGELOK								
-43YFS2	.062*	1.6	0.08	1/8 Female SWAGELOK	1 <sup>15</sup> / <sub>16</sub>	3 <sup>1</sup> / <sub>32</sub>	1 <sup>1</sup> / <sub>16</sub>	1 <sup>1</sup> / <sub>16</sub>	3	3/ <sub>8</sub>	1 <sup>1</sup> / <sub>2</sub>	2 <sup>7</sup> / <sub>16</sub>
-45YF8	.281**	7.1	1.6	1/2 Female NPT								
-43Y6FS1	.052	1.3	0.06	1/16 Female SWAGELOK	1 <sup>15</sup> / <sub>16</sub>	3 <sup>1</sup> / <sub>32</sub>	7/ <sub>16</sub>	7/ <sub>16</sub>	1 <sup>17</sup> / <sub>32</sub>	5/ <sub>32</sub>	2 <sup>9</sup> / <sub>32</sub>	1 <sup>11</sup> / <sub>16</sub>
-43Y6FS2	.062	1.6	0.08	1/8 Female SWAGELOK								

\* This orifice has been designed for typical applications. Some cross port flow can occur during switching. For applications where cross port flow is unacceptable during switching, specify a .049" ball orifice.  
Example: SS-43YF2-049.  
For an orifice designed for maximum flow, specify a .125" ball orifice.  
Example: SS-43YFS2-125.

\*\* This orifice has been designed for maximum flow. As a result, cross port flow occurs during switching. For applications where cross port flow is unacceptable during switching, specify a .093" ball orifice.  
Example: SS-45YF8-093  
All dimensions are in inches — for reference only, subject to change.

## Ordering Information

### Materials:

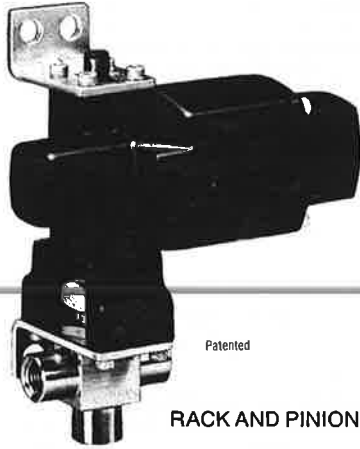
To order a 4-Way or 6-Way Ball Valve, use **SS** for 316 stainless steel or **B** for brass as a prefix to the Basic Ordering Number.  
Example: SS-43YF2

### Seat Packings:

For optional UHMW Polyethylene seat packings, use **-P** as a suffix to the Valve Ordering Number. Example: SS-43YF2-P

# PNEUMATIC ACTUATORS

WHITEY "40" Series Ball Valves can be mounted to either Double Acting or Spring Return pneumatic actuators. A rack and pinion actuator ("130" and "150" Series) is available. These pneumatic actuators can be actuated with standard shop air supply or bottled gas. For additional information on pneumatic actuators, refer to *WHITEY technical bulletin no. 37*.



RACK AND PINION

## Minimum Actuator Pressure (PSI) Required at maximum rated valve pressure

PNEUMATIC ACTUATOR MODEL	DESIGNATOR	VALVE SERIES	ACTUATION MODES			
			Double Acting (D)		Spring Return (S)	
			Single	Dual	Single	Dual
-131 (90°)	-31	41, 41A, 42, 42A	20	35	60	70
		43, 43A, 43Y	40	70	70	80
-151 (180°)	-51	41X, 42X	20	35	60	70
		43X	40	70	70	NR
-133 (90°)	-33	44, 44A	25	50	70	80
		45, 45A, 45Y	60	100	80	100
-153 (180°)	-53	44X	25	50	70	80
		45X	60	100	80	NR

NR = Not Recommended

## Ordering Instructions

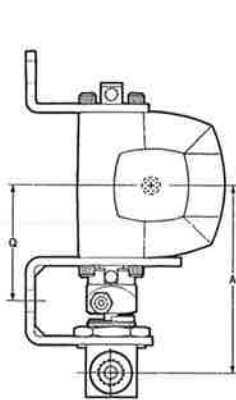
VALVE SERIES	PNEUMATIC ACTUATOR MODEL	MOUNTING KIT
41, 41A, 42, 42A	-131	MS-MB-41
41X, 42X	-151	
43, 43A	-131	MS-MB-43
43X	-151	
43Y	-131	MS-MB-43Y
44, 44A	-133	MS-MB-44
44X	-153	
45, 45A	-133	MS-MB-45
45X	-153	
45Y	-133	MS-MB-45Y

### To order Pneumatic Actuators for field assembly

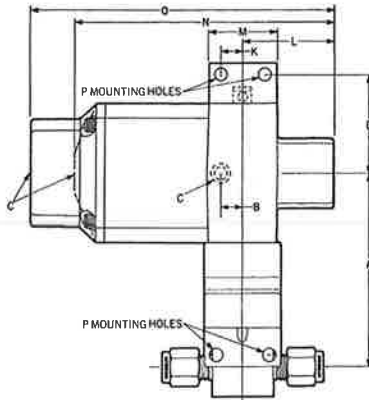
- Select the pneumatic actuator model from the chart according to the valve series to be actuated. Example: -131 (for a "43" series valve).
  - Complete the pneumatic actuator model Ordering Number by:
    - Using **MS** as a prefix to the model number.
    - Using the model number with **-DA** for double acting or **-SR** for spring return as a suffix. Example: **MS-131-SR** (spring return pneumatic actuator for a "43" series valve).
  - Select the mounting kit from the chart according to the valve series being used. Example: **MS-MB-43** (mounting kit for a "43" series valve).
- NOTE:** "42" Series Valves with CAJON® VCO® or VCR® ends, order MS-MB-43 Mounting Kit and SS-7-42-1 Panel Nut.

### To order Valves with Pneumatic Actuators factory assembled

- Determine the Valve Ordering Number. Example SS-43F4
- Select the appropriate pneumatic actuator model number from the chart. Delete the first numeral 1 in the number, and use this designator as a suffix to the Valve Ordering Number. Example: SS-43F4-31
- Select one of the following actuation modes and use the designator as a suffix to the Valve Ordering Number. **D** Double Acting, **C** Normally Closed, **O** Normally Open, **S** Spring Return (3-Way & 4-Way) — Example: SS-43F4-31D
- For dual mounted assemblies (two valves mounted to one pneumatic actuator), use **DM** as a suffix to the Valve Ordering Number. Example: SS-43F4-31DDM



"131" & "151" PNEUMATIC ACTUATORS



"133" & "153" PNEUMATIC ACTUATORS

## Table of Dimensions

PNEUMATIC ACTUATOR MODEL NUMBER		VALVE SERIES	DIMENSIONS															
90°	180°		A	B	C	D	E	F	G	H	J	K	L	M (S)	N (D)	O (S)	P*	Q
-131	-151	41, 42	2 <sup>13</sup> / <sub>16</sub>	1 <sup>1</sup> / <sub>32</sub>	1/8 NPT	1 <sup>3</sup> / <sub>4</sub>	3 <sup>1</sup> / <sub>32</sub>	1 <sup>23</sup> / <sub>32</sub>	1 <sup>5</sup> / <sub>16</sub>	1 <sup>9</sup> / <sub>32</sub>	1 <sup>7</sup> / <sub>32</sub>	5/16	1 <sup>15</sup> / <sub>32</sub>	1 <sup>1</sup> / <sub>4</sub>	4 <sup>3</sup> / <sub>32</sub>	4 <sup>29</sup> / <sub>32</sub>	1 <sup>1</sup> / <sub>32</sub>	1 <sup>13</sup> / <sub>16</sub>
		43	2 <sup>29</sup> / <sub>32</sub>															
133	-153	44	4 <sup>1</sup> / <sub>8</sub>	1 <sup>5</sup> / <sub>32</sub>	1/8 NPT	2 <sup>5</sup> / <sub>16</sub>	4 <sup>1</sup> / <sub>16</sub>	2 <sup>5</sup> / <sub>16</sub>	1 <sup>3</sup> / <sub>4</sub>	3/4	1 <sup>3</sup> / <sub>16</sub>	7/16	2 <sup>5</sup> / <sub>32</sub>	1 <sup>9</sup> / <sub>16</sub>	5 <sup>7</sup> / <sub>8</sub>	7 <sup>27</sup> / <sub>32</sub>	1 <sup>1</sup> / <sub>32</sub>	4 <sup>3</sup> / <sub>16</sub>
		45	4 <sup>1</sup> / <sub>4</sub>															

\*"41", "42", and "43" Series Ball Valves — The distance between mounting holes is 2 inches. "44" and "45" Series Ball Valves — The distance between mounting holes is 7/8"

(D) = Double Acting (S) = Spring Return

All dimensions are in inches — for reference only, subject to change.

# ACCESSORIES / ORDERING INFORMATION

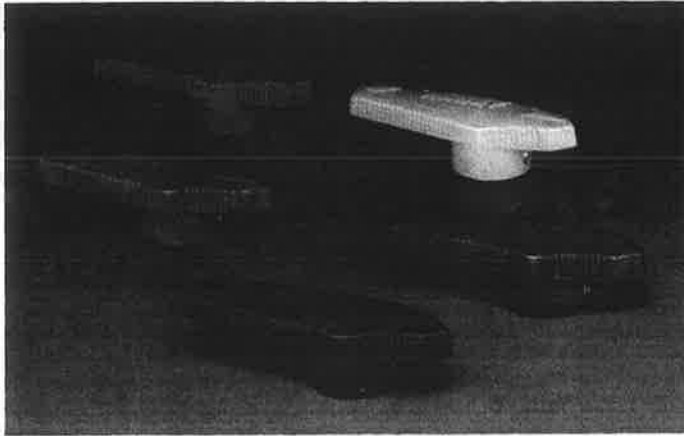
## Handles

### Factory Assembled to Valve

WHITEY "40" Series Ball Valves are standard with a black (-BK) nylon handle with a bronze insert. To order valves factory assembled with these handles in colors other than black, suffix the designator code listed below to the valve Ordering Number.

Example: SS-43S4-RD

RED (-RD), BLUE (-BL), GREEN (-GR), YELLOW (-YW), ORANGE (-OG)



To order WHITEY "40" Series Ball Valves with a stainless steel handle, suffix -SH to the valve Ordering Number.  
Example: SS-43F4-SH



To order WHITEY "40" Series Ball Valves with an aluminum bar handle, suffix -BKB to the valve Ordering Number.  
Example: SS-45XS8-BKB.



To order WHITEY "40" Series 2-Way, 3-Way, and 4-Way Ball Valves factory assembled with an oval handle, use -K as a suffix to the Valve Ordering Number. Example: SS-45F8-K



Oval handles are not available as separate items.

## Directional Name Plates

Directional name plates show the position of the valve at all times. A matte surface accepts ink, labels, or decals.

To order name plates as spare parts, refer to *Technical Bulletin No. 25*.

## Safe Valve Selection

When selecting a valve, the total system design must be considered to ensure safe, trouble-free performance. Valve function, materials compatibility, adequate ratings, proper installation, operation, and maintenance are the responsibility of the system designer and user.



Your Local Authorized Sales & Service Representative:

## Handles

### As Spare Parts

To order handles as spare parts, refer to the chart below. Kits contain: Handle and set screw.

VALVE SERIES	BLACK NYLON HANDLE WITH BRONZE INSERT*	STAINLESS STEEL BAR HANDLE	ALUMINUM BAR HANDLE
41, 42	BZ-5K-42-BK	SS-5S-42B	A-5S-42B-BK
43	BZ-5K-43-BK	SS-5S-43B	A-5S-43B-BK
44	BZ-5K-44-BK	SS-5S-44B	A-5S-44B-BK
45	BZ-5K-45-BK	SS-5S-45B	A-5S-45B-BK

\*To order handles in colors other than black, replace BK in the Ordering Number with the appropriate color designator: Red (-RD), Blue (-BL), Green (-GR), Yellow (-YW), Orange (-OG).  
Example: BZ-5K-42-RD

## Packing Adjustment

### IMPORTANT READ PACKING TORQUE ADJUSTMENT INFORMATION IN THIS SECTION

**These valves are factory adjusted for 1000 PSI\***

All standard WHITEY "40" Series Ball Valves are factory adjusted for 1000 PSI (6800 kPa) service at 70°F (21°C). **For use in other pressure applications, the valve packing must be adjusted.** This can be done while the valve is in the system by removing the handle and tightening the packing bolt clockwise in 1/16 turn increments until a leak-tight seal is achieved at the stem and ports. For a valve mounted to a pneumatic or electric actuator, remove the lock nut and coupling pin. Loosen and lift the panel nut from the valve. Separate the valve from the mounting bracket and tighten the packing bolt clockwise in 1/16 turn increments until a leak-tight seal is achieved at the stem and ports. Reassemble by reversing the previous steps. Be certain the valve stem flat and the coupling pin hole are aligned. Also, position coupling pin flat toward (against) the valve stem flat.

Valves exposed to changing temperature conditions before installation may lose their initial packing load. Always verify proper operation upon installation by either checking the packing torque or checking the valve for leakage at the stem and ports.

### "40" SERIES PACKING ADJUSTMENT CHART

VALVE SERIES	ORIFICE		NOMINAL PACKING BOLT TORQUE FOR 1000 PSI SERVICE		HANDLE HEX KEY SIZE (in.)	PACKING BOLT OR HEX ADAPTER WRENCH SIZE (in.)
	in.	mm	(in.-lbs.)	n. m.		
41, 41A, 41X	.093	2.4	15	1.7	1/16	5/16
42, 42A, 42X	.125	3.2	15	1.7	1/16	5/16
43, 43A, 43X	.187	4.8	40	4.5	3/32	9/16
43Y, 43Z	.062	1.6	40	4.5	3/32	9/16
44, 44A, 44X	.281	7.1	90	10.2	3/32	1/2
45Y	.281	7.1	180	20.3	1/8	5/8
45, 45A, 45X	.406	10.3	180	20.3	1/8	5/8

**NOTE:** Torque values given are for 1000 PSI (6800 kPa) service at 70°F (21°C) — except when the valve pressure rating is less than 1000 PSI (6800 kPa). **For other pressure applications, adjust packing in 1/16 turn increments until a leak-tight seal is achieved at the stem and ports.** Excessive tightening may shorten valve life and increase operating torque.

\*NOTE: All "43Y6," "43Z6," and "40V" Series Ball Valves are factory adjusted for 500 PSI (3400 kPa) service.

• The "43" Series Ball Valves are assembled with a special packing bolt. A special hex adapter tool (Reference Ordering Number MS-WK-43) is available for packing adjustment.

• For all other WHITEY "40" Series Ball Valves, packing adjustments can be made with standard wrenches. Wrench sizes and nominal torque values are shown above.

SWAGELOK — TM Crawford Fitting Company  
CAJON, VCO, VCR — TM Cajon Company  
17-4PH-TM Armaco Steel

Printed in U.S.A.  
SWG-0851-C  
11-91-MI  
MS-01-60

# Type 546, 546S, and 546NS

## Type 546, 546S, and 546NS Electro-Pneumatic Transducers

### Contents

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<b>Operating Information</b> .....	5	<b>Introduction</b>	
Adjustments .....	6	<b>Scope of Manual</b>	
Calibration .....	6	This instruction manual provides installation, operation, maintenance, and parts ordering information for the Type 546, 546S, and 546NS transducers and Type 82 relay. Refer to separate manuals for instructions covering equipment used with the transducer.	
Equipment Required .....	6	Only personnel qualified through training or experience should install, operate, and maintain this transducer. If there are any questions concerning these instructions, contact your Fisher Controls sales office or sales representative before proceeding.	
Calibration Procedure .....	6	<b>Description</b>	
Recalibration .....	7	The Type 546 or 546NS transducer (figure 1) receives either a voltage (Vdc) or a current (mAdc) input signal and transmits a proportional pneumatic output pressure to a final control element. The Type 546S transducer receives a current (mAdc) input signal and transmits a proportional pneumatic output pressure. A typical application is in electronic control loops where the final control element, generally a control valve, is pneumatically operated. The input signal, output pressure range, and electrical classification, if approved, of each transducer is indicated on the nameplate attached to the cover (figure 2).	
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# Type 546, 546S, and 546NS

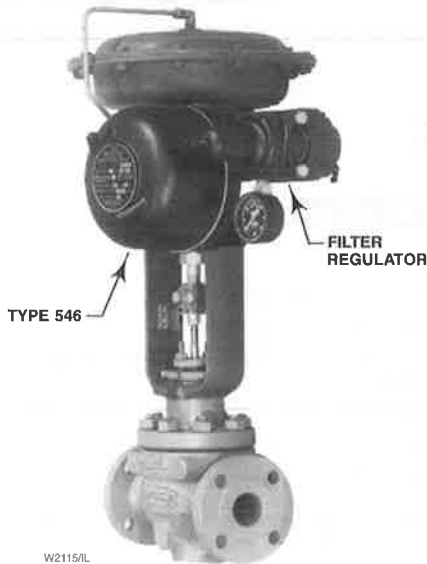


Figure 1. Type 546 Mounted on a Type 657 Pneumatic Diaphragm Actuator

The O-rings are EPDM (ethylene propylene) and the diaphragms are EPDM/Nomex. EPDM<sup>(1)</sup> demonstrates superior temperature capability and shelf life over nitrile. The Nomex diaphragm fabric demonstrates improved strength retention at elevated temperature and radiation conditions.

In addition, the Type 546NS transducer is qualified "commercial grade dedicated" under Fisher's 10CFR50, Appendix B, quality assurance program. These can be supplied as 10CFR, Part 21 items.

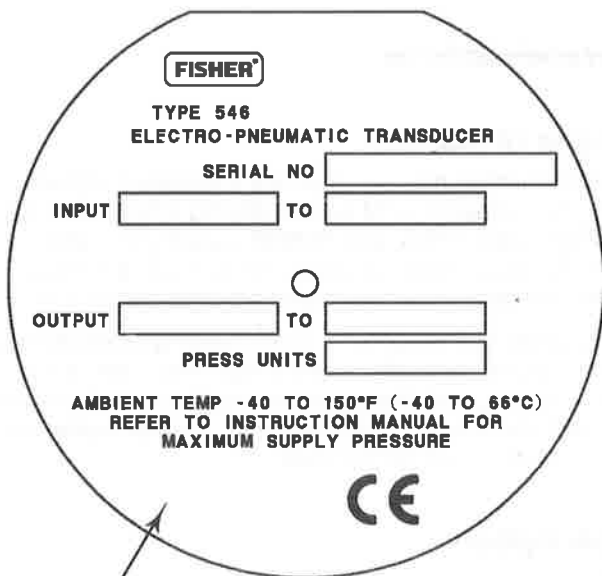
## Specifications

Specifications for the Type 546, 546S, and 546NS are listed in table 1.

## Installation

### WARNING

If a flammable or hazardous gas is being used as the supply pressure medium and the transducer is in an enclosed area, personal injury or property damage might result from fire or explosion of accumulated gas. To avoid such injury or damage, provide adequate ventilation.



11A0050-G SHT B  
A3102-2 / L

INFORMATION IN THIS PORTION OF THE NAMEPLATE IDENTIFIES THE HAZARDOUS AREA CLASSIFICATION AND APPROVALS FOR THE PRODUCT SPECIFIED ON THE EQUIPMENT ORDER.

Figure 2. Typical Nameplate

The Type 546S transducer is approved as being intrinsically safe when used with certain barrier systems. Refer to the Loop Schematics section of this manual.

The Type 546NS transducer meets typical requirements of the nuclear power industry. The Type 546NS construction includes materials that provide superior performance in elevated temperature and radiation environments.

## Mounting

When a Type 546, 546S, or 546NS transducer is ordered as part of a control valve assembly, the factory mounts the transducer on the actuator and connects the necessary tubing, then adjusts the transducer as specified on the order.

Transducers also can be ordered separately for mounting on a control valve assembly already in service. The transducer may be ordered with or without mounting parts. Mounting parts include the appropriate bracket and bolts for attaching the unit to an actuator boss (with tapped holes) or for attaching it to the diaphragm casing. If preferred, mounting parts are available for mounting the transducer on a 2-inch (51 mm) diameter pipestand, a flat surface, or a bulkhead.

Tubing is not included if the transducer is not factory mounted. Use 3/8-inch (9.5 mm) outside diameter tubing for all supply and output connections. Tubing length between the transducer output and the final control element should be as short as possible to minimize its effect on control loop stability.

1. Use a clean, dry, oil-free air supply with instruments containing EPDM components. EPDM is subject to degradation when exposed to petroleum-based lubricants.

# Type 546, 546S, and 546NS

Table 1. Specifications

## Available Configurations

**Type 546:** Electro-pneumatic signal transducer with explosion-proof case and cover

**Type 546S:** Similar to Type 546 except designed for intrinsically safe, non-incendive, or dust-ignition applications

**Type 546NS:** Similar to Type 546 except provided with EPDM elastomers for use in elevated temperature and radiation environments

All transducer types can be ordered with or without a 67 Series filter regulator. A 2 inch (51 mm) circular supply pressure gauge may be mounted on the regulator

## Input Signals<sup>(1)</sup>

**Type 546 and 546NS:** 1 to 5 mAdc, 4 to 20 mAdc, 10 to 50 mAdc, 1 to 9 Vdc, or two-way split range using any half of one of the standard input signal spans

**Type 546S:** ■ 4 to 20 mAdc, or ■ For Factory Mutual only, a two-way split range using either half of the 16 mAdc span. Signal must not exceed 30 Vdc, 20 mAdc

## Internal Resistance of Torque Motor

**1 to 5 mAdc Input Signal:** 2500 ±120 ohms (standard) or 12,000 ±50 ohms (temperature-compensated circuit)

**4 to 20 mAdc Input Signal:** 176 ±10 ohms

**10 to 50 mAdc Input Signal:** 90 ±10 ohms

**1 to 9 Vdc Input Signal:** 1300 ±50 ohms (temperature-compensated circuit)

## Output Signals<sup>(1)</sup>

### Ranges:<sup>(1)</sup>

*For 546 and 546NS:* 3 to 15 psig (0.2 to 1.0 bar), 6 to 30 psig (0.4 to 2.0 bar), 3 to 27 psig (0.2 to 1.9 bar), 0 to 18 psig (0 to 1.2 bar), or 0 to 33 psig (0 to 2.3 bar)

*For 546S:* 3 to 15 psig (0.2 to 1.0 bar), 6 to 30 psig (0.4 to 2.0 bar), 3 to 27 psig (0.2 to 1.9 bar), or 0 to 33 psig (0 to 2.3 bar)

**Action:** Type 546 and 546NS are field-reversible between direct and reverse action. The Type 546S is available with either direct or reverse action but cannot be reversed in the field.

## Supply Pressure<sup>(1)</sup>

**Recommended:** 5 psig (0.3 bar) higher than upper range limit of output signal

**Maximum:** 50 psig (3.5 bar)

## Maximum Steady-State Air Consumption<sup>(1,2)</sup>

**At 20 psig (1.4 bar) Supply Pressure:** 0.35 scfm (0.6 normal m<sup>3</sup>/hr)

**At 35 psig (2.4 bar) Supply Pressure:** 0.50 scfm (0.8 normal m<sup>3</sup>/hr)

## Maximum Output Air Capacity<sup>(2)</sup>

**At 20 psig (1.4 bar) Supply Pressure:** 8.0 scfm (13.4 normal m<sup>3</sup>/hr)

**At 35 psig (2.4 bar) Supply Pressure:** 11.5 scfm (19.3 normal m<sup>3</sup>/hr)

## Performance<sup>(3)</sup>

**Actuator Loading Time:** See figure 7

**Reference Accuracy:** ±0.75% of output signal span

**Independent Linearity:<sup>(1)</sup>** ±0.50% of output signal span

**Open Loop Gain:<sup>(1)</sup>** 26

**Frequency Response:<sup>(1)</sup>** Gain is attenuated 3 dB at 20 Hz with transducer output signal piped to a typical instrument bellows with 12 inches (305 mm) of 1/4 inch tubing

## Operative Ambient Temperature Limits<sup>(1)</sup>

−40 to +150°F (−40 to 66°C)

## Electrical and Enclosure Classification

Refer to the Hazardous Area Classification bulletins and the transducer nameplate (see figure 2)

**Housing:** NEMA 3R and CSA ENC 3 rating (NEMA 3R mounting orientation requires vent location to be below horizontal. Vent is shown in figure 10, key 69)

## Adjustments

**Zero and Span Adjustments:** Screwdriver adjustments located inside case (see figure 5)

## Connections

**Supply Pressure:** 1/4-inch NPT female located on side of case, (or located on the Type 67 AFR filter-regulator if mounted)

**Output Pressure:** 1/4-inch NPT female located on side of case

**Vent:** 1/4-inch NPT female with screen located on relay

**Electrical:** 1/2-inch NPT female located on bottom of case

## Approximate Weight (Transducer Only)

9 pounds (4.1 kg)

1. These terms are defined in ISA Standard S51.1-1979.

2. Scfm—Standard cubic feet per minute (60°F and 14.7 psia). Normal m<sup>3</sup>/hr—Normal cubic meters per hour (0°C and 1.01325 bar absolute).

3. Performance values are obtained using a Type 546 or Type 546S transducer with a 4 to 20 mAdc input signal and a 3 to 15 psig (0.2 to 1 bar) or a 6 to 30 psig (0.4 to 2 bar) output signal. Ambient temperature is 73°F (24°C). A transducer with other input or output signals might exceed these values. Reference accuracies of ±3.5% can be expected with output ranges starting near zero psig.

# Type 546, 546S, and 546NS

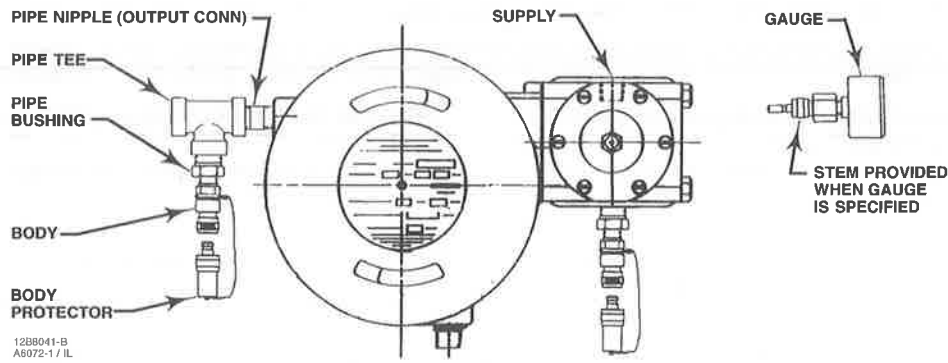


Figure 3. Diagnostic Connections

## Pressure Connections

### Note

The supply source must be clean, dry, oil-free,<sup>(1)</sup> non-corrosive air or gas at an unfailling pressure at least 5 psig (0.3 bar) higher than the upper limit of the transducer output pressure range. This means that for an output pressure range of 3 to 15 psig (0.2 to 1.0 bar) the supply pressure should be at least 20 psig (1.4 bar); for a 6 to 30 psig (0.4 to 2.0 bar) range, the supply pressure should be at least 35 psig (2.4 bar). The supply pressure to the filter regulator should not be more than 250 psig (17.3 bar) at a maximum temperature of 150°F (66°C).

If specified, the filter regulator is mounted on the transducer case. A pressure gauge on the regulator shows the supply pressure to the transducer.

1. Connect a supply pressure source to the 1/4-inch NPT IN connection on the filter regulator (if furnished) or to the 1/4-inch NPT SUPPLY connection on the transducer case (if a regulator is not furnished).

2. Run 3/8-inch (9.5 mm) outside diameter tubing from the 1/4-inch NPT OUTPUT connection on the transducer case to the input connection on the pneumatic actuator or valve positioner. This connection is made at the factory if the unit is shipped mounted on an actuator as shown in figure 1.

## Diagnostic Connections

To support diagnostic testing of valve/actuator/positioner packages, special connectors and hardware are available. Typical connector installations are shown in figure 3. The hardware used includes a 1/4-inch NPT pipe nipple and pipe tee with a 1/8-inch NPT pipe

bushing for the connector. The connector consists of 1/8-inch NPT body and body protector.

### Note

If the transducer is used in a valve assembly with a positioner, no connections for diagnostic testing are required for the transducer. Install the connections for diagnostic testing at the positioner.

Install the connectors and hardware between the transducer and the actuator.

1. Before assembling the pipe nipple, pipe tee, pipe bushings, actuator piping, and connector body, apply sealant to all threads.
2. Turn the pipe tee to position the connector body and body protector for easy access when doing diagnostic testing.

## Electrical Connections

### WARNING

For explosion-proof applications, disconnect power before removing the transducer cover.

For explosion-proof applications, install rigid metal conduit and a conduit seal no more than 18 inches (457 mm) from the transducer. Personal injury or property damage may result from explosion if the seal is not installed.

For intrinsically safe installations, refer to factory drawings or to instructions provided by the barrier manufacturer for proper wiring and installation.



# Type 546, 546S, and 546NS

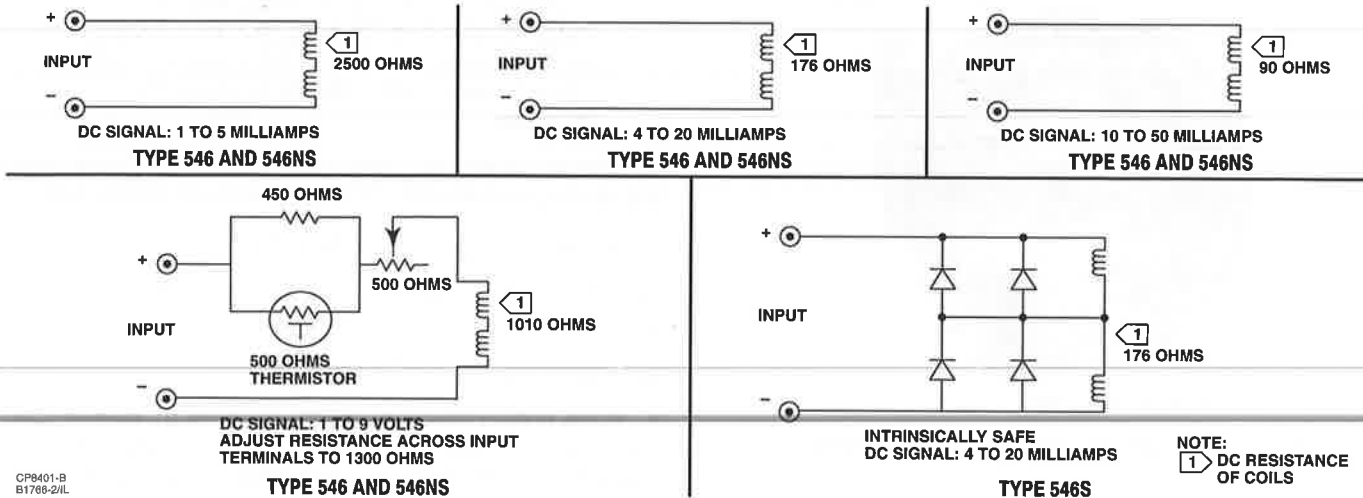


Figure 4. Typical Circuit Drawings

The electrical connections are made in the transducer case. A 1/2-inch NPT conduit connection is provided in the bottom of the case. Use a suitable conduit seal for hazardous locations. The wires that carry the input signal from the control device are connected to the terminal mounting bracket assembly (key 53, figure 9).

## Note

Use a lubricant (key 95, figure 8) on the case-cover threads to prevent thread damage.

## Operating Information

### WARNING

To avoid personal injury or equipment damage, do not reverse the action of a Type 546S transducer in the field. Diodes in the input circuit (see figure 4) will short if a reversed input signal is applied. If the diodes are shorted, they are capable of producing a spark which might ignite a hazardous atmosphere causing a fire or explosion. A Type 546S transducer must be ordered from the factory as either direct or reverse acting.

For a direct-acting unit (i.e., increasing current produces an increasing output pressure), connect the positive wire from the control device to the positive terminal of the transducer and the negative wire to the negative terminal. For a reverse-acting unit (i.e., increasing current produces a decreasing output pressure), connect the positive wire from the control device to the negative terminal and the negative wire to the positive terminal. Typical circuits are shown in figure 4.

### WARNING

Personal injury or property damage may result from fire or explosion if power is applied to the transducer with the cover removed in a hazardous area.

If the transducer is installed in an application where explosion-proof classification is required, perform the following steps when any procedure in this section requires removal of the cover:

- Disconnect the electrical signal from the transducer.
- Remove the transducer to a non-hazardous area.
- Perform procedures as described in this section.
- Reinstall the transducer, and ensure the cover is secured before turning on the electrical signal.

For intrinsically safe areas, current monitoring during operation must be with a meter approved for use in hazardous areas.

# Type 546, 546S, and 546NS

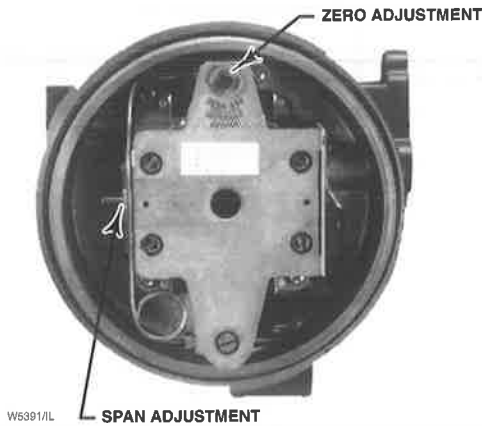


Figure 5. Zero and Span Adjustments (Cover Removed)

## Adjustments

Adjust the filter regulator to provide the proper supply pressure to the transducer, then adjust the transducer span and zero (see figures 5 and 6) to match the application requirements and be within specifications.

The zero adjustment is used to set the output pressure so that it corresponds to the proper value of the input signal. For example, if the output range is 3 to 15 psig (0.2 to 1.0 bar) and the input range is 1 to 5 mAdc and the unit is direct-acting, use the zero adjustment to set the output pressure at 3 psig (0.2 bar) when the input signal is 1 mAdc. Use the span adjustment to set the output pressure span so that full output pressure change results for a full change in the input signal. In this example, the output pressure change would be 12 psi (0.8 bar). Thus, the output pressure should start at 3 psig and increase to 15 psig (1.0 bar) as the input signal is changed from 1 to 5 mAdc.

A span adjustment will affect the zero. Therefore, follow any span adjustment with a zero adjustment. Provide a suitable gauge to measure the pressure.

## Calibration

### Equipment Required

Choose a current or voltage source that is capable, without switching ranges, of driving the transducer through its entire input range. Switching ranges on a current or voltage source will produce spikes or mid-scale reverses in the input signal presented to the transducer, causing errors.

### Calibration Procedure

#### Note

The following calibration procedure is for a Type 546, 546S, or 546NS transducer

er with a 4 to 20 mAdc input signal range and a 3 to 15 psig (0.2 to 1.0 bar) output range. Calibrate transducers with other inputs and outputs in a similar manner.

1. Check the supply pressure to ensure it agrees with the minimum pressure on the transducer nameplate.
2. Adjust the input current to 4.00 mAdc.
3. Turn the zero screw until the output pressure is  $3.00 \pm 0.09$  psig ( $0.2 \pm 0.006$  bar).
4. Adjust the input to 20.00 mAdc.
5. If the output pressure is less than 14.91 psig (1.028 bar), turn the span screw clockwise to increase the span. If the output pressure is greater than 15.09 psig (1.040 bar), turn the span screw counterclockwise to decrease the span.

#### Note

**Do not watch the output gauge while turning the span screw because the change in output is not a good indication of the change in span. While turning the span adjustment screw, the output pressure may move in the opposite direction than expected. For example, while turning the span screw in the INCREASING SPAN direction, the output pressure might decrease. This should be disregarded since even though the output pressure decreases, the output span is increasing.**

6. Repeat steps 2 through 5 until the output pressure is within one-third of the accuracy limits at 4 and 20 mAdc. One-third of the accuracy limits for a 3 to 15 psig (0.2 to 1.0 bar) output range is  $\frac{1}{3} \times (\pm 0.0075) \times (15.00 - 3.00) = \pm 0.03$  psig ( $\pm 2$  mbar). Calibrate for maximum accuracy at the target end points [3.00 and 15.00 psig (0.20 and 1.00 bar)]. This allows for error at other calibration points in between.
7. Run the transducer through three calibration cycles before recording data. The cycles should be run from exactly 4.00 to 20.00 mAdc in a slow ramping fashion (no large step inputs).
8. After returning from 20.00 mAdc during the last exercise cycle, move back upscale to the midpoint (12.00 mAdc) and record the first data point. Table 2 is an example of recorded data.
9. Record at the other calibration points desired by moving upscale to 20.00 mAdc then down scale to 4.00 mAdc, then back upscale to 12.00 mAdc. Refer to table 2 for common calibration points.

# Type 546, 546S, and 546NS

Table 2. Typical Calibration Data

TRANSDUCER INPUT mA dc	ACTUAL OUTPUT PRESSURE		TARGET OUTPUT PRESSURE	
	Psig	Bar	Psig	Bar
12.00	8.89	0.612	9.00	0.620
16.00	11.95	0.823	12.00	0.826
20.00	15.02	1.035	15.00	1.033
16.00	12.02	0.828	12.00	0.826
12.00	8.96	0.617	9.00	0.620
8.00	6.00	0.413	6.00	0.413
4.00	3.01	0.207	3.00	0.206
8.00	5.95	0.409	6.00	0.413
12.00	8.97	0.618	9.00	0.620

## Note

**During the calibration cycle, use care to avoid overshoot. In other words, if data is to be recorded at an 8.00 mAdc input while moving upscale and you accidentally pass 8.00 to some higher value, run the test again starting at step 7 with the three exercise cycles. Do not reverse direction and move down scale to 8.00 mAdc.**

10. After completing the calibration cycle and recording data, verify that all data is within  $\pm 0.75\%$  accuracy limits. If not, the transducer may need to be recalibrated to move the end points slightly to bring the entire calibration curve within the accuracy limits.

## Recalibration

Table 2 shows typical recorded data where recalibration is necessary.

The 8.89 psig (0.612 bar) value at 12.00 mAdc is outside the accuracy limit of  $\pm 0.09$  from the target value. This data point can be raised by recalibrating the transducer and raising the end points enough to bring this low value within  $-0.09$  psig ( $-0.6$  mbar) of 9.00 psig (0.62 bar). A reasonable recalibration would be 3.05 and 15.05 psig (0.21 and 1.04 bar) at 4.00 mAdc and 20.00 mAdc, respectively. Recalibrate the instrument and recheck the calibration data as described in steps 7 through 10.

If the transducer remains outside of accuracy specifications after altering the calibration end points as much as possible, return the transducer to the factory or consult your Fisher Controls sales office or sales representative.

For transducers inaccurate to less than 5 percent of output span, relay repair or replacement may correct the problem. Refer to the alignment procedures in the Troubleshooting section to correct the operation of a faulty transducer. Also check for air leaks at the tubing, nozzle, relay, and bellows.

If the accuracy error is greater than 5 percent of output span, check the clearance between the armature and the coils. These parts are referenced as key 40

and key 42, respectively, in the Parts List section. The armature and the white plastic coil bobbin should be approximately 1/64 inch (0.4 mm) apart. If the parts are in contact, loosen the machine screws that hold the bobbin and reposition the bobbin.

## Changing Output Pressure Range

Changing the output pressure range from 3 to 15 psig (0.2 to 1.0 bar) to 6 to 30 psig (0.4 to 2.0 bar) or vice versa requires changing the feedback bellows (key 57, figure 9). To do this, refer to the replacing the feedback bellows assembly procedures in the Maintenance section.

## Reversing the Action

Reversing the action of a Type 546 or 546NS transducer requires no special parts. The direction of armature rotation is dependent upon the direction of the current flow. Therefore, simply reverse the input current leads to the transducer to obtain the opposite action. Whenever the action is changed, readjust the zero of the transducer as outlined in the adjustments procedures.

## WARNING

**To avoid personal injury or equipment damage, do not reverse the action of a Type 546S transducer in the field. Diodes in the input circuit (see figure 4) will short if a reversed input signal is applied. If the diodes are shorted, they are capable of producing a spark which might ignite a hazardous atmosphere causing a fire or explosion. A Type 546S transducer must be ordered from the factory as either direct or reverse acting.**

## Split Range Operation

Type 546, 546S, and 546NS transducers are suitable for two-way split range operation. In a two-way split

# Type 546, 546S, and 546NS

Table 3. Feedback Bellows Output Pressure Range

OPERATION	INPUT SIGNAL, DC	BELLOWS SIZE					
		Full		Half		Quarter	
		Psig	Bar	Psig	Bar	Psig	Bar
Full Range	1 to 9 V <sup>(1)</sup> 1 to 5 mA <sup>(2)</sup> 4 to 20 mA 10 to 50 mA	3 to 15	0.2 to 1.0	6 to 30	0.4 to 2.0	---	---
Split Range	4 to 12 mA or 12 to 20 mA 10 to 30 mA or 30 to 50 mA 1 to 5 Vdc or 5 to 9 Vdc	---	---	3 to 15	0.2 to 1.0	6 to 30	0.4 to 2.0

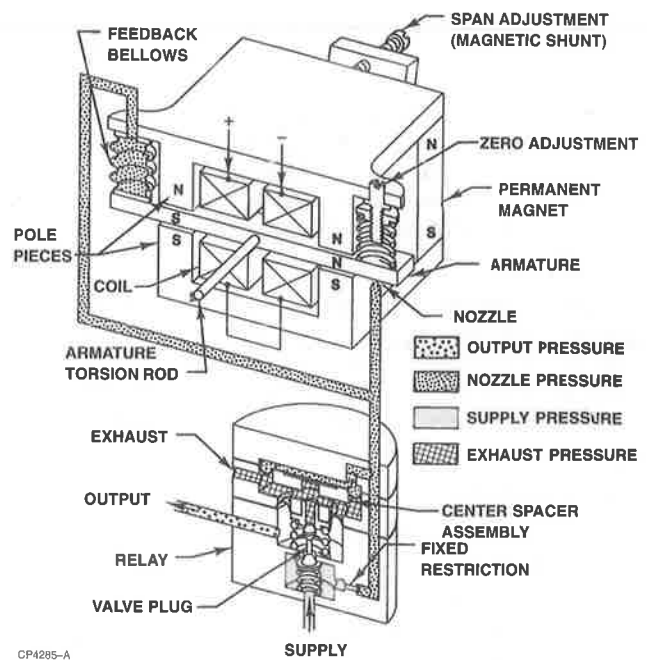
1. Temperature compensated circuit.  
2. Not appropriate for split range applications because of the high resistance of 1 to 5 mA dc coils. If split range operation is desired, consult your Fisher Controls sales office or sales representative.

the milliampere (mA) or voltage output signal of a single control device is split between two transducers electrically connected in series. Although each transducer receives the full signal, it is calibrated to provide a full output pressure range of 3 to 15 psig (0.2 to 1.0 bar) or 6 to 30 psig (0.4 to 2.0 bar) to the control valve with one-half the input signal. Since the transducer operates on only one-half of the normal input span, the feedback bellows must be changed to compensate for the shorter span. Change the bellows as described in the replacing feedback bellows assembly procedure in the Maintenance section. Table 3 indicates which bellows is required for your conditions. Reset the span and zero adjustments to the split range values. Note that these transducers cannot provide a three-way split range.

## Principle of Operation

Refer to the schematic drawing in figure 6. Assume that the transducer is direct-acting. An increase in the dc signal to the coils increases the magnetic field around the coils. This field increases the magnetic strength in the armature and the magnetic attraction across the air gap between the armature and the pole pieces.

The pole pieces are already polarized by the permanent magnet. The armature polarity is as shown in the schematic. The magnetic attraction will therefore be downward at the nozzle end and upward at the feedback bellows end, resulting in a torque that rotates the armature about the fixed torsion rod to cover the nozzle. The resulting restriction produces an increased pressure in the nozzle, in the upper chamber of the relay, and in the feedback bellows. The relay responds to the increase in nozzle pressure to increase the output pressure to the actuator and control valve. The increased pressure in the feedback bellows creates a force that acts on the armature to move it back to an equilibrium position. In this way, the new nozzle pressure is compared to the input current by the force-balance principle.



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Figure 6. Transducer Schematic

The relay operates in the following manner. The nozzle pressure acts on the large top diaphragm to force the center spacer assembly (mounted between the two diaphragms) downward against the valve plug, closing the exhaust port and opening the supply port. Supply air then flows through the open port to the output load. The output pressure continues to increase until the relay diaphragm assembly is pushed back to its original position by the force of the pressure acting on the small diaphragm. When this occurs, the valve plug is closed again.

When a decreasing dc signal is received, the magnetic attraction across the air gap is reduced. The armature rotates to uncover the nozzle and decrease the pressure in the nozzle, relay, and feedback bellows. The relay diaphragm assembly moves upward, and the exhaust port opens to bleed the output pressure to atmosphere.

# Type 546, 546S, and 546NS

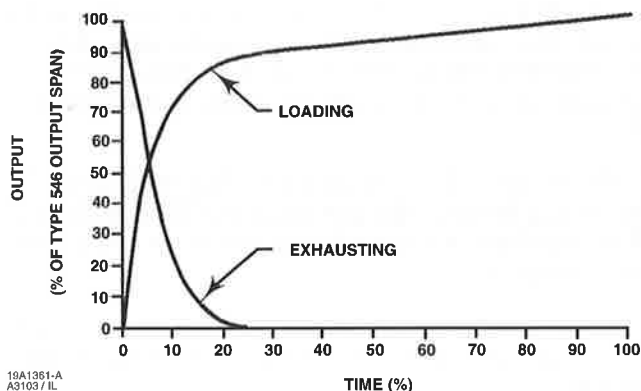


Figure 7. Output-Time Relationship for Type 546, 546S, and 546NS Transducers

The output decreases until the diaphragm assembly is forced back to its original position and the exhaust port is closed again. The reduced pressure in the feedback bellows diminishes the force to return the armature to the equilibrium position.

Figure 7 shows output-time relationship curves for loading and exhausting an actuator. Exhausting times are nominally 25 percent of the loading times.

Reverse-acting transducers operate in a similar manner except that when the dc input signal increases, the output pressure from the relay decreases. Conversely, a decreasing input signal increases the output pressure.

## Maintenance

### WARNING

For explosion proof applications, disconnect power before opening the transducer cover. Personal injury or property damage may result if power is not disconnected.

### CAUTION

The presence of Fisher Controls personnel and also approval agency personnel may be required if you service (other than normal, routine maintenance, such as calibration) or replace components on a transducer that carries a third-party approval. When you replace components, use only components specified by the factory. Substitution with other

components may void the third-party approval. Also, always use proper component replacement techniques, as presented in this manual. Improper techniques can cause poor quality repairs and impair the safety features of the device.

Maintenance of the transducer consists of relay repair or replacement, and replacement of the feedback bellows. These procedures are described at the end of this section. Due to the care Fisher Controls takes in meeting all manufacturing requirements (heat treating, dimensional tolerance, etc.), use only replacement parts manufactured or furnished by Fisher Controls International.

Figure 9 shows the torque motor and associated parts. Shaded key numbers indicate parts that should not be disassembled from the torque motor because the magnetism in the torque motor magnets will decrease permanently.

Certain troubleshooting and alignment procedures are described in the following steps. These may serve as a guide to correct some problems. Improper supply pressure and mechanical defects in pneumatic and electrical connections should be apparent upon inspection and repaired as appropriate.

### CAUTION

Never disassemble the torque motor assembly because the magnetism in the torque motor magnets will decrease permanently. Shaded key numbers indicate parts that should not be disassembled from the torque motor (see figure 9). If troubleshooting or alignment attempts indicate either a faulty torque motor or the necessity of disassembling the torque motor, return the entire transducer to the factory, or consult your Fisher Controls sales office or sales representative.

## Troubleshooting

This section contains some checks for operational difficulties that may be encountered. If correcting the difficulties is not possible, contact your Fisher Controls sales office, service center, or sales representative.

### Electrical

1. Check the output of the control device. Make sure that it is reaching the transducer.
2. Check the dc input signal. It should be the same as the range stamped on the transducer nameplate.

# Type 546, 546S, and 546NS

3. Check the resistance of the transducer circuit to see that it coincides with the value listed on the circuit identification tag located on the torque motor.
4. Check the terminal lugs for proper connections. If reverse action of the transducer is observed, simply reverse the input leads as indicated in the Reversing the Action procedures in the Operating Information section.

## Pneumatic



### CAUTION

**Do not attempt to remove the nozzle (key 19, figure 9) for any reason. Nozzle removal requires disassembling the torque motor. Disassembling the torque motor will permanently reduce the strength of the magnets, causing improper operation. Also, do not adjust the baffle (key 18, figure 9). The spacing between the baffle and nozzle is preset and locked at the factory to obtain optimum performance of the transducer.**

1. Connect supply pressure and a pressure gauge to monitor the output. Check the operation of the transducer as follows:
  - a. Force the baffle (key 18, figure 9) against the nozzle. The output pressure should build up to approximately the supply pressure. If it does not, check for a leak in the pneumatic system or a burr on the nozzle.
  - b. Force the baffle away from the nozzle. The output pressure should drop to less than 1 psig (0.07 bar). If it does not, check the flame arrestors in the transducer case (see figure 8). If the flame arrestors require cleaning, first remove the torque motor assembly from the case by removing four machine screws (key 9, figure 8). Then, clean the flame arrestors by blowing them out with air pressure.
2. Check zero and span adjustment for proper setting. Refer to the adjustments procedure.
3. Check the supply pressure. It should be at least 5 psig (0.3 bar) above the upper limit of the output pressure range.
4. Check the filter regulator for moisture in the drip-well. Drain off any moisture, and clean the filter element if necessary.
5. If the transducer cycles, be sure there are no sharp bends in the copper capillary feedback tubing (key 56, figure 9) and that the tubing is not plugged.
6. Check the nozzle. If it is clogged, remove the entire torque motor assembly from the case by removing four machine screws (key 9, figure 8). Run a wire through the nozzle from the underside of the assembly.
7. Erratic operation may be caused by metal chips in the air gap between the armature and the pole pieces. Blow any chips out of the torque motor assembly with low pressure air.
8. If a problem persists, check the relay as described in the Type 82 Relay Maintenance procedures in this section.

## Alignment

The following alignment procedures can be used in conjunction with troubleshooting procedures to correct the operation of a faulty transducer.

## Span Adjustment

Refer to figure 9 for key number locations, unless otherwise directed.

If setting the required span is not possible, additional span adjustment can be obtained by shifting the entire span adjustment assembly (key 55) at the flexure pivot end. The alignment procedure is as follows:

1. Shut off the dc input signal and supply pressure to the transducer.
2. Disconnect the external lead wires from the terminal mounting bracket assembly (key 53).
3. Loosen the four machine screws (key 9, figure 8) that hold the torque motor assembly to the case. Remove the entire torque motor assembly from the case.
4. Loosen the two flexure pivot screws (key 25) that hold the flexure pivot to the torque motor assembly base.
5. Slide the span adjustment assembly in or out as required. Sliding it in toward the base decreases the span; sliding it out away from the base increases the span.
6. Tighten the flexure pivot screws. Replace the torque motor assembly, and tighten the screws (key 9, figure 8). Make sure that the O-ring (key 37) is in place. Connect the external lead wires, and turn on the air supply.
7. Make final adjustment of the span with the span adjustment screw.

## Torque Motor Frame

The top pole piece plate (key 50, figure 9) of the torque motor can become twisted with respect to the bottom pole piece plate (key 51, figure 9). If this happens, return the transducer to the factory, service center, or contact your Fisher Controls sales office or sales representative.

## Armature Travel Stop

The armature travel stop (key 52, figure 9) must be in place to prevent overstressing the armature and coil support (key 41, figure 9) due to over-travel. The clearance between the armature and travel stop should be 0.005 inches (0.13 mm).

The two screws at the base of the travel stop can be loosened if an alignment is necessary.

## Coil

The coil assembly (key 42, figure 9) consists of a nylon bobbin wound with wire. The coils are not attached to the armature itself, and therefore, they must not touch the armature, or armature movements will be restricted. If this problem exists, loosen the two screws that attach each coil assembly to the armature and coil support. Sight down the armature and realign the coil assemblies for clearance with the armature. Tighten the screws.

## WARNING

**The following maintenance procedures require that the transducer be taken out of service. This requires that certain precautions be taken to avoid personal injury or equipment damage caused by sudden release of pressure or explosion of accumulated gas. Prior to maintenance:**

- **Disconnect electrical power before removing the transducer cover (especially in explosion proof or hazardous applications).**
- **Shut off or disconnect pressure lines to the transducer.**
- **Disconnect any operating lines providing air pressure, electrical power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**

- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.**

- **Vent the power actuator loading pressure and relieve any actuator spring precompression.**

- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**

## Type 82 Relay Removal and Replacement

Use the following procedure when removing and replacing a relay assembly. Refer to figure 10 for key number locations, unless otherwise directed.

1. Loosen the two mounting screws (key 68), and remove the relay assembly from the transducer case (key 1, figure 8).
2. To install the replacement relay assembly, install the two relay mounting screws (key 68) into the relay assembly. Apply lubricant (key 96) to the O-rings, and make sure the O-rings (keys 72, 73, and 74) are in place on the relay assembly.
3. Install the relay assembly on the transducer case. Tighten the mounting screws.
4. With the torque motor installed, apply supply pressure to the transducer case, and check the relay assembly for leaks with a soap solution.

## Type 82 Relay Maintenance

Use the procedure below to repair the relay assembly. Refer to figure 10 for key number locations.

Obtain the relay repair kit listed in the parts list. This kit provides the parts, alignment tool, and an instruction sheet used when repairing the relay assembly.

1. Remove the two screws (key 77), valve plug spring seat (key 64), valve plug spring (key 70) and valve plug (key 63).
2. Remove the six screws (key 76, not shown) and separate the relay body (key 60), casing spacer (key 61), and relay casing (key 62) by inserting a screwdriver between the external casting lugs. Twist the screwdriver to separate parts.
3. Remove the upper diaphragm (key 66), lower diaphragm assembly (key 65), and relay spring (key 71). Clean and inspect relay parts before replacing them.
4. Remove the restriction assembly (key 67) and replace the O-rings (keys 74 and 75). Apply lubricant (key 96) to the O-rings before installing the restriction assembly into the relay body.

# Type 546, 546S, and 546NS

5. The restriction hole (see figure 10) in the restriction assembly is 0.016 inches (0.41 mm) in diameter. Clean the hole with solvent and blow dry with compressed air. If the hole is plugged, insert a wire in the hole. Then, clean with solvent and blow dry with compressed air. Do not enlarge the hole. Reinstall the restriction assembly in the relay body. Do not overtighten.
6. The restriction hole in the relay body is 0.020 inches (0.51 mm) in diameter. If the hole is plugged, insert a wire into the hole and clean it out. Do not enlarge the hole.
7. Insert the new lower diaphragm assembly through the casing spacer, replace the relay spring, and position the parts on the relay body. Position the new upper diaphragm on the relay casing and position the relay casing on the upper diaphragm. Ensure that the exterior casting lugs on the relay body, casing spacer, and relay casing are aligned.
8. Invert the relay and install the six screws (key 76), but do not tighten.
9. Insert the alignment tool through the brass supply seat in the relay body, and into the exhaust seat of the lower diaphragm assembly to align the parts.
10. Ensure the diaphragms are flat between the relay body, casing spacer, and relay casing. Tighten the six screws (key 76).
11. Remove the alignment tool, and reassemble the valve plug, valve plug spring, valve plug spring seat and the two screws (key 77).
12. Install the two relay mounting screws (key 68) into the relay assembly. Apply lubricant (key 96) to the O-rings, and make sure the O-rings (keys 72, 73, and 74) are in place on the relay assembly.
13. Install the relay assembly on the transducer case. Tighten the mounting screws.
14. With the torque motor installed, apply supply pressure to the transducer case, and check the relay assembly for leaks with a soap solution.

## Replacing the Feedback Bellows Assembly

Refer to figure 9 for key number locations.

1. Loosen the hex nut (key 31).
2. Remove the bellows screw (key 56) and O-ring (key 36) under the head of the bellows screw.
3. Pull the bellows assembly (key 57) out. The armature is slotted to allow removal of the bellows assembly.
4. Inspect and, if necessary, replace the two O-rings (key 36). Make sure the O-rings under the bellows assembly are in place.
5. Choose the correct bellows assembly as outlined in table 3. Install the new bellows assembly. Make sure that the O-ring (key 36) is in place.
6. Install the bellows screw and O-ring, and tighten the screw. Be sure the bellows assembly is not distorted in any direction. Tighten the hex nut (key 31).
7. Refer to the adjusting zero and span procedures in the Adjustments section.

## Parts Ordering

Whenever corresponding with the sales office or sales representative about this equipment, mention the serial number of the unit. This serial number can be found on the nameplate (figure 2). When ordering replacement parts, also state the complete 11-character part number of each part needed as found in the following parts list.

### Note

**In the torque motor assembly drawing (figure 9), there are many shaded key numbers. The shading indicates that these parts should not be disassembled and that they are not available as individual items. Consequently, no part numbers are shown for these parts in the list below.**

## Parts List

### Repair Kits for Type 546, 546S, and 546NS Transducers

Description	Part Number
<b>Type 546 and 546S Transducer Repair Kit</b> Kit includes keys 6, 12, 36, 37, and 58	R546X000022
<b>Type 546NS Transducer Repair Kit</b> Kit includes keys 6, 12, 36, 37, and 58	R546X000032
<b>Type 82 Relay Repair Kit</b> (for Type 546 and 546S only) This kit includes keys 63, 65, 66, 69, 70, 72, 73, 74, 75. Kit also includes instruction sheet and alignment tool	R82X0000022
<b>Type 82 Relay Replacement Assembly</b> (for Type 546 and 546S) Assembly includes two mounting screws (Key 68)	10A8593X082
<b>Type 82 Relay Replacement Assembly</b> (for Type 546NS) Assembly includes two mounting screws (key 68)	10A8593X142



# Type 546, 546S, and 546NS

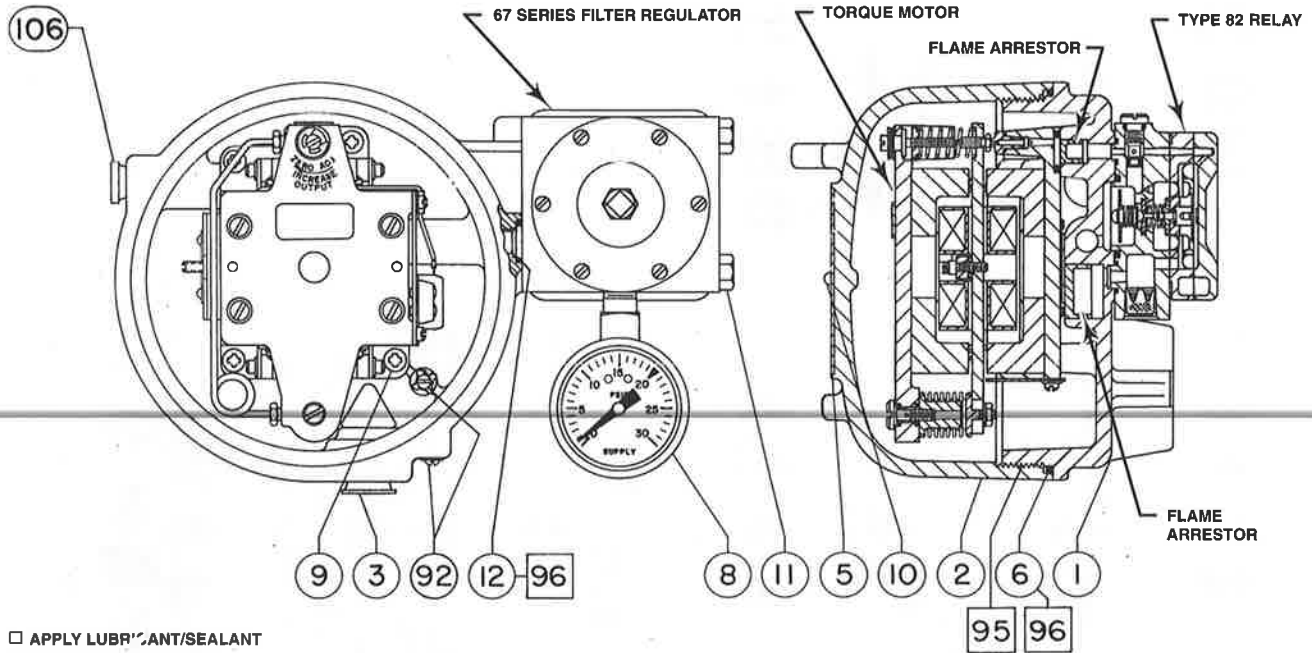
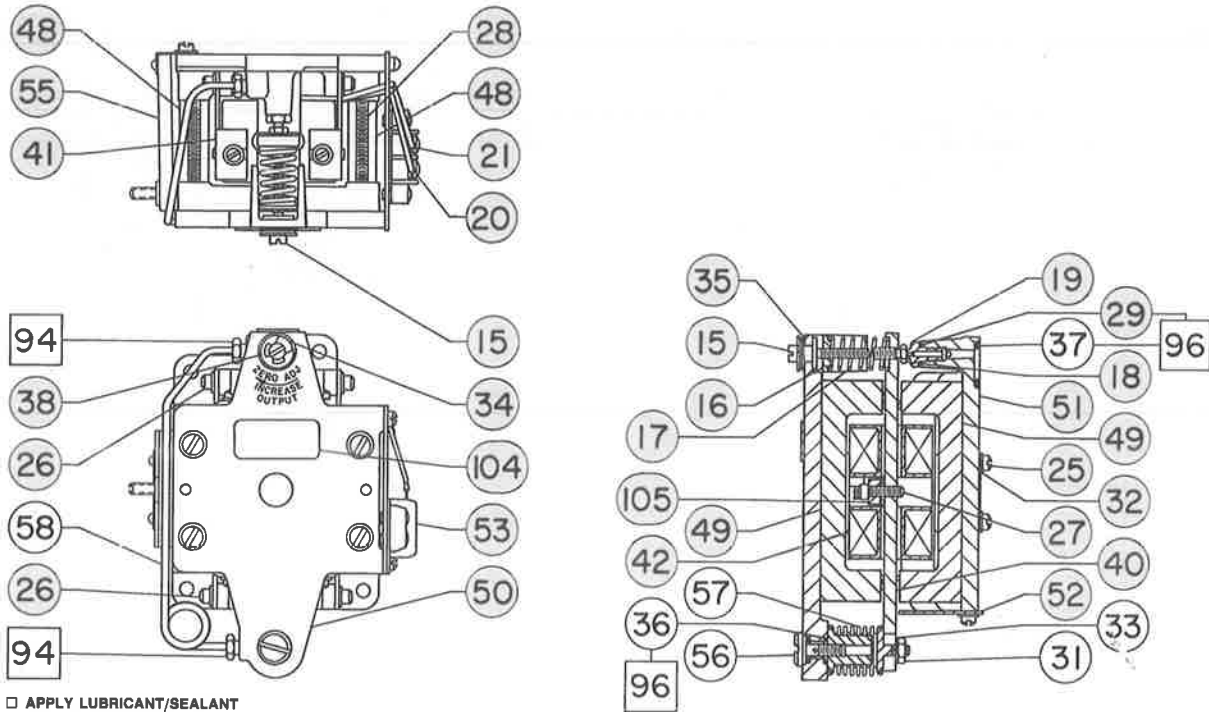


Figure 8. Type 546 Transducer Assembly

Key	Description	Part Number	Key	Description	Part Number
<b>Type 546, 546S, &amp; 546NS Transducers (figure 8)</b>					
1	Transducer Case Ass'y, aluminum	1P4210000A2	96	Lubricant, Molykote 33 (not furnished with unit)	
2	Case Cover, aluminum	3P4213000A2	106	Protective plug, polyethylene (2 req'd)	1E878406992
3	Protective Plug, plastic	1M3590X0012	107	Street Elbow, use with integrally mounted filter regulator w/0-60 dual scale gauge	1A913221992
4	Tagging Plate (optional) Stainless steel (SST)	13B6776X012	108	Pipe Plug, steel For regulator w/o gauge	1A767524662
5	Nameplate, Standard, SST		<b>Torque Motor (figure 9)</b>		
6*	O-Ring For Type 546 and 546S, nitrile	1D444806992	15 <sup>(2)</sup>	Adjusting Screw	---
	For Type 546NS, EPDM Duro 80A	14B7744X012	16 <sup>(2)</sup>	Spring Seat	---
8*	Pressure Gauge Triple scale		17 <sup>(2)</sup>	Spring-Zero Adjustment For Type 546 & 546S, For Type 546NS, SST	---
	0-30 psig/0-2 MPa/0-2 bar	11B8582X012	18 <sup>(2)</sup>	Baffle	---
	0-60 psig/0-4 MPa/0-4 bar	11B8582X022	19 <sup>(2)</sup>	Nozzle	---
	Dual scale		20 <sup>(2)</sup>	Hook-Up Wire Ass'y	---
	0-30 psig/0-2 Kg/cm <sup>2</sup>	11B8582X042	21 <sup>(2)</sup>	Hook-Up Wire Ass'y	---
	0-60 psig/0-4 Kg/cm <sup>2</sup>	11B8579X072	22 <sup>(2)</sup>	Hook-Up Wire (not shown)	---
9	Machine Screw, brass pl (4 req'd)	17B0404X012	25 <sup>(2)</sup>	Machine Screw	---
10	Screw, steel pl	1P426928982	26 <sup>(2)</sup>	Cap Screw	---
11	Cap Screw, steel pl (2 req'd) use with integrally mounted filter regulator only	1C197024052	27 <sup>(2)</sup>	Cap Screw	---
12*	O-Ring, use with integrally mounted filter regulator only		28 <sup>(2)</sup>	Machine Screw	---
	For Type 546 and 546S, nitrile	1E591406992	29 <sup>(2)</sup>	O-Ring For Type 546 & 546S, nitrile	---
	For Type 546NS, EPDM Duro 80A	14B7748X012		For Type 546NS, EPDM Duro 80A	---
13	Pipe Nipple, steel pl, For filter regulator only (not shown)	1C678926232	31	Hex Nut, brass pl	1N107318992
92	Wire Retainer, steel pl (2 req'd)	17B7757X012	32 <sup>(2)</sup>	Washer	---
95	Lubricant, For 546 and 546S use Lubriplate Mag 1 (not furnished with unit) For 546NS use Molykote 33 (not furnished with unit)		33	Washer, brass pl	1P425315052
			34 <sup>(2)</sup>	Washer	---
			35 <sup>(2)</sup>	Washer	---
			36*	O-Ring (2 req'd) For Type 546 and 546S, nitrile	1D687506992
				For Type 546NS, EPDM Duro 80A	14B7743X012

\*Recommended spare parts  
 2. Parts are not field repairable. The torque motor assembly should never be disassembled because the magnetism in the torque motor will decrease permanently. Shaded key numbers shown in figure 9 indicate parts that should not be disassembled.

# Type 546, 546S, and 546NS



□ APPLY LUBRICANT/SEALANT

**NOTES:**

1. SHADED KEY NUMBERS INDICATE PARTS THAT SHOULD NOT BE DISASSEMBLED FROM TORQUE MOTOR.
2. KEY NUMBERS 22 AND 103 ARE NOT SHOWN.

30A8594-K  
B1767-3

Figure 9. Torque Motor Assembly

Key	Description	Part Number
37*	O-Ring For Type 546 and 546S, nitrile For Type 546NS, EPDM Duro 80A	1C782206992 14B7747X012
38 <sup>(2)</sup>	E-Ring	---
40 <sup>(2)</sup>	Armature	---
41 <sup>(2)</sup>	Coil Support	---
42 <sup>(2)</sup>	Coil Ass'y	---
48 <sup>(2)</sup>	Magnet	---
49 <sup>(2)</sup>	Pole Piece	---
50 <sup>(2)</sup>	Top Pole Piece Plate	---
51 <sup>(2)</sup>	Bottom Pole Piece Plate	---
52 <sup>(2)</sup>	Travel Stop	---
53 <sup>(2)</sup>	Terminal Mounting Bracket Ass'y	---
55 <sup>(2)</sup>	Span Adjustment Ass'y <sup>(3)</sup>	---
56	Bellows Screw, brass	12B2577X012
57*	Bellows Ass'y, brass Full Size, 27/32 inch (21 mm) O.D. Half Size, 1/2 inch (13 mm) O.D. Quarter Size, 3/8 inch (9.5 mm) O.D.	1U3958000A2 1U3975000A2 1R6521000A2
58	Tubing Ass'y, brass/copper	1P4242000A2
94	Sealant, Zink Plate 770 (not furnished with unit)	
96	Lubricant, Molykote 33 (not furnished with unit)	
103	Set Screw, SST/nylon (not shown)	11B2218X012
105 <sup>(2)</sup>	Spacer	---

Key	Description	Part Number
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## Type 82 Relay (figure 10)

**Note**

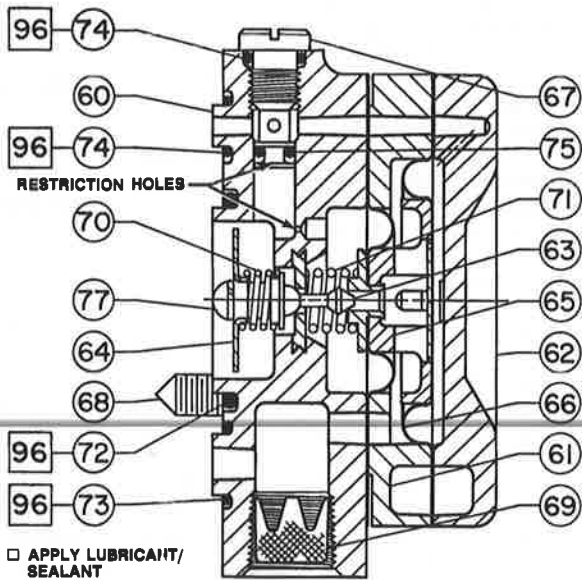
The following parts are for repairing the Type 546 and 546S relays only. The Type 546NS relay is not repairable. If the relay is defective, order a Type 82 Relay Replacement Assembly for a Type 546NS transducer.

60	Relay Body, aluminum/brass	3P4192X0022
61	Casing Spacer, aluminum	2P419347052
62	Relay Casing, aluminum	2P419447052
63*	Valve Plug, brass	1P419514012
64	Spring Seat, brass	1P419615102
65*	Lower Diaphragm Ass'y	1P4197X0032
66*	Upper Diaphragm, nitrile	26A5657X012
67	Restriction Ass'y	1U8160X0012
68	Relay Mounting Screw, steel pl (2 req'd)	1P420324102
69*	Screen, Monel	0L078343062
70*	Valve Plug Spring, SST	1P420437022
71	Relay Spring, steel pl	15A3181X012
72*	O-Ring nitrile	1P420606992
73*	O-Ring, nitrile (2 req'd)	1P420706992
74*	O-Ring, nitrile (2 req'd)	1D687506992
75*	O-Ring, nitrile	1D134606992

\*Recommended spare parts

3. The span adjustment assembly for the Type 546NS uses a bronze passive lock, rather than nylon, and a locking hex nut.

# Type 546, 546S, and 546NS



NOTE:  
KEY 76 IS NOT SHOWN

A1604-1/IL

Figure 10. Type 82 Relay.

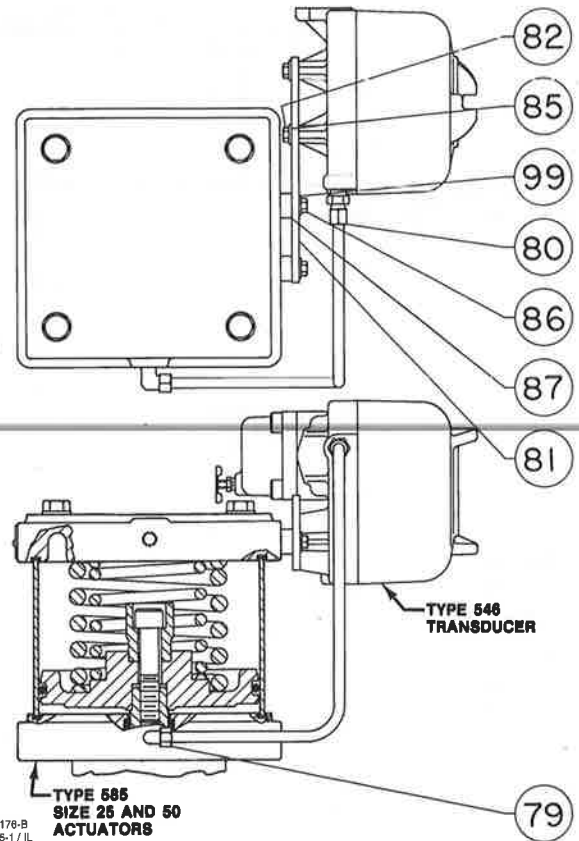


Figure 11. Typical Actuator Mounting

Key	Description	Part Number
76	Machine Screw, steel pl (6 req'd) (not shown)	10B6513X012
77	Machine Screw, steel pl (2 req'd)	59061140X22
96	Lubricant, Molykote 33 (not furnished with unit)	

## Diagnostic Connections

FlowScanner™ diagnostic system hook-up includes pipe tee, pipe nipple, pipe bushings, connector body, and body protector. See figure 3 for part identification. Also, part number provides correct quantities of each item.

### Note

**If the transducer is used in a valve assembly with a positioner, no hook-up for diagnostic testing is required for the transducer. The hook-up for diagnostic testing should be installed at the positioner.**

For units with gauges	
SST fittings	12B8041X012
Brass fittings	12B8041X022
For units without gauges	
SST fittings	12B8041X032
Brass fittings	12B8041X042

## Mounting Parts (figures 11 & 12)

79	Elbow, brass Yoke mounting, Types 513, 657, 1051, 1052, 1061 all sizes	15A6002X162
	Yoke mounting (2 req'd) Type 470, 480, 585, 585C, 667 all sizes	15A6002X162

Key	Description	Part Number
79	Elbow, brass (cont'd) Yoke mounting, Types 513, 657, 1051, 1052, 1061 all sizes	15A6002X162
	Casing mounting Type 1250, 657, 667 1051, 1052 all sizes	15A6002X162
80	Connector, brass Yoke mounting Type 513, 657, 1051, 1052, 1061 all sizes	15A6002X202
	Casing mounting 1250, 657, 667, 1051, 1052	15A6002X202
81	Mounting Plate, steel Yoke mounting Type 470, 480, 513, 585, 585C, 656, 657, 667, all sizes Type 1051 size 33 all positions, size 40 and 60 position 1, Type 1052 size 33 all positions, sizes 40 thru 70 position 1 Type 1061 size 30 all positions, sizes 40 thru 100 position 1 Type 1250 and 1250R Type 1051 size 40 and 60 position 3 Type 1052 sizes 40 thru 70 position 3 Type 1061 sizes 40 thru 100 position 3 Type 657, 657NS, 667, 667NS, all sizes for seismic mounting of 546NS	3P426825022 30B1265X022 2R1552X0022 35A4153X012

# Type 546, 546S, and 546NS

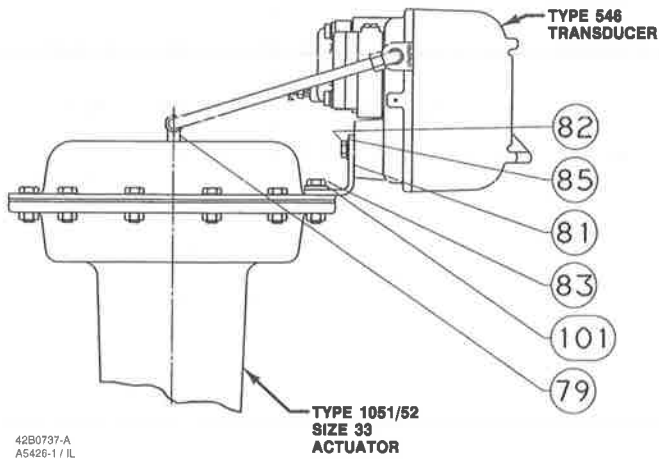


Figure 12. Typical Casing Mounting

Key	Description	Part Number
81	Mounting Plate, steel (cont'd) Casing mounting Type 657 & 667, all sizes except size 80 Type 1051, 1052, all sizes, all positions Pipestand mounting Surface mounting Bulkhead mounting	1F401225072 3P426825022 2R100125022 22A7618X012
82	Cap Screw, steel pl Yoke mounting (4 req'd) Type 470 size 23 thru 40, 63 & 64 Type 480 all sizes Type 513 all sizes Type 656 size 40 thru 60 Type 657 & 667 size 30 thru 80 Type 1051 size 40 & 60 all positions Type 1052 sizes 40 thru 70 all positions Type 1061 all sizes all positions Yoke mounting (2 req'd) Type 470, size 60 thru 130, except 63 & 64 Type 585, sizes 25 & 50 Type 585C, all sizes Type 656, size 30 Type 657NS & 667NS, sizes 70 & 80 Type 1250 & 1250R Type 1051 size 33 all positions Type 1052 size 33 all positions Casing mounting (2 req'd) All types, all sizes Pipestand mounting (2 req'd) Surface mounting (2 req'd) Bulkhead mounting (2 req'd)	1A381624052 1A381624052 1A381624052 1A381624052

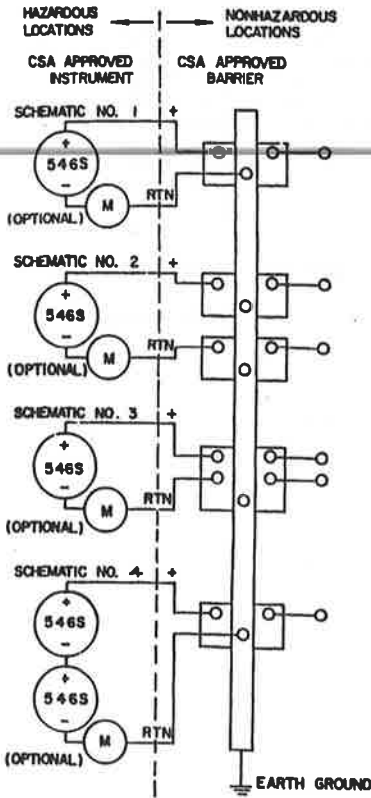
Key	Description	Part Number
83	Cap Screw Casing mounting (2 req'd) Type 1051, 1052, all sizes, all positions	1A582824052
85	Washer, steel pl Yoke mounting (4 req'd) All types, all sizes, except Type 1250 & 1250R Casing mounting (2 req'd) Pipestand mounting (4 req'd) Yoke mounting Type 1250 & 1250R, none required	1B865928982
86	Cap Screw, steel pl (2 req'd) Yoke mounting Type 470, Sizes 60 through 130 Type 490, all sizes Type 657NS & 667NS, Sizes 70, 80 Type 1051 & 1052, size 33, positions 1 & 3 Type 480, all sizes Type 585 & 585C, Sizes 25 & 50 Type 656, Size 30 Type 1051 & 1052, size 33, positions 2 & 4 Casing mounting Type 657 & 667, Sizes 30 through 60 Type 657 & 667, Size 70	1C870224052 1C5958X0022 1A352624052 1B989624052 1K747624052 1A582824052 1A368324052
87	Spacer, steel (2 req'd) Yoke mounting Type 470, Sizes 60 through 130 Type 490, all sizes Type 657NS & 667NS, Sizes 70, 80 Type 656, Sizes 30 Type 585, Sizes 25 & 50 Type 1051 & 1052, size 33, positions 1 & 3 Type 1051 & 1052, size 33, positions 2 & 4 Surface mounting	K766824092 1P801924092 1F06724092 1V10624052 1L200624092 18A1696X012
88	Mounting Bracket, steel Yoke mounting Type 480, all sizes	3L276725092
89	Hex Nut, steel pl (2 req'd) Yoke mounting Type 480, all sizes	1A352724122
90	Pipe Clamp, steel pl Pipestand mounting	1P427028982
97	U-Bolt, steel pl (2 req'd) Type 1250 & 1250R, all sizes	19A7930X012
98	Hex Nut, steel pl (4 req'd) Type 1250 & 1250R, all sizes	19A4838X022
99	Lock washer, SST Yoke mounting (4 req'd) Type 585C, size 25 & 50 Type 1250 & 1250R, all sizes Yoke mounting (2 req'd) Type 1051 & 1052, size 33, all positions	1C225728982 10B6610X012 1C225728982
101	Washer (2 req'd) Casing mounting Type 1051, 1052, all sizes, all positions	1H723125072

# Type 546, 546S, and 546NS

## Loop Schematics

This section includes loop schematics required for wiring of intrinsically safe installations. If you have any questions, contact your Fisher Controls sales representative or sales office.

## CSA Schematics



### TYPE 546S: CSA PARAMETRIC RATINGS

GROUP A,B,C,D	CSA RATING 33V MAX, 581 OHM MIN.	SINGLE INSTRUMENT
GROUP A,B,C,D	CSA RATING 30V MAX, 411 OHM MIN.	SINGLE INSTRUMENT
GROUP A,B,C,D	CSA RATING 28V MAX, 345 OHM MIN.	SINGLE INSTRUMENT
GROUP A,B,C,D	CSA RATING 26V MAX, 342 OHM MIN.	SINGLE INSTRUMENT
GROUP A,B,C,D	CSA RATING 22V MAX, 150 OHM MIN.	SINGLE INSTRUMENT
GROUP C,D	CSA RATING 30V MAX, 150 OHM MIN.	SINGLE INSTRUMENT
GROUP C,D	CSA RATING 33V MAX, 150 OHM MIN.	SINGLE INSTRUMENT OR SPLIT RANGE

APPROVED BARRIER	BARRIER TYPE	MANUF. INST. MANUAL	SCHEM NO.	METER OPTION	APPLICABLE HAZARDOUS LOCATIONS	CSA BARRIER RATING
TAYLOR	5850FL84100	IB-21E600	1	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	25.75V, 350 OHMS
TAYLOR	5851FL84100	IB-21E600	1	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	25.75V, 350 OHMS
TAYLOR	1130FG21000	IB-17E211	1	43M/44M	CLASS I, DIV 1, GROUPS C,D	30V, 206 OHMS
TAYLOR	1135FG21000	IB-17E212	1	43M/44M	CLASS I, DIV 1, GROUPS C,D	30V, 266 OHMS
TAYLOR	1150FZ81010	IB-17E220	1	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	26V, 342 OHMS
FOXBORO	2A0-V2I-CGB	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	2A0-V3I-CGB	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	2A0-V5I-CGB	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	2A0-V4I-CGB	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	3A2-D2I-CS-E/CGB-A	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	3A2-D3I-CS-E/CGB-A	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	2A5-13I-CGB	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	

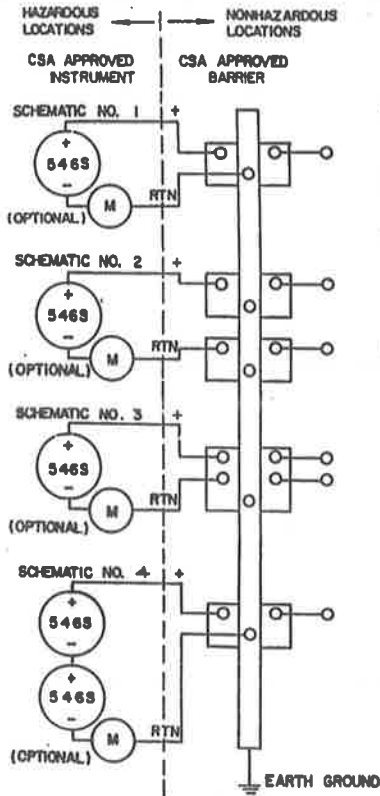
THE LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.

FOR GUIDANCE ON INSTALLATION, SEE ANSI/ISA RP12.6.

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# Type 546, 546S, and 546NS

## CSA Schematics (Continued)



APPROVED BARRIER	BARRIER TYPE	MANUF. INST. MANUAL	SCHEM NO.	METER OPTION	APPLICABLE HAZARDOUS LOCATIONS	CSA BARRIER RATING
STAHL	8903/51-200/050/7	89 036 01 31 0	2	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	20.41V, 300 OHMS
STAHL	8901/33-293/000/7	89 016 03 31 0				28.1V, 470 OHMS
STAHL	8901/31-199/100/7	89 016 03 31 0	1,4	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	19V, 220 OHMS
STAHL	8903/31-200/050/7	89 036 01 31 0	1,4	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	19.95V, 286.7 OHMS
STAHL	8903/31-263/050/7	89 036 01 31 0	1	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	26.5V 386 OHMS
STAHL	8901/31-280-165/8	89 016 03 31 0	2	43M/44M	CLASS I, DIV 1, GROUPS C,D	27.3V, 179 OHMS
STAHL	8901/33-293/000/7	89 016 03 31 0				28.1V, 470 OHMS
MTL	187+	PS-300-13	3	43M/44M	CLASS I, DIV 1, GROUPS C,D	28V, 300 OHMS; 30V (DIODE)
MTL	120+	PS-300-13	1	43M/44M	CLASS I, DIV 1, GROUPS C,D	28V, 300 OHMS
MTL	122+	PS-300-13	1	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	22V, 150 OHMS
MTL	787+	PS-700-2	3	43M/44M	CLASS I, DIV 1, GROUPS C,D	28V, 300 OHMS; 28V (DIODE)
MTL	728+	PS-700-2	1	43M/44M	CLASS I, DIV 1, GROUPS C,D	28V, 300 OHMS
MTL	722+	PS-700-2	1	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	22V, 150 OHMS
BAILEY	766610AAA1	4576K16-034	3	NONE	CLASS I, DIV 1, GROUPS C,D	27V, 345 OHMS 10V, 40 OHMS
HONEYWELL	38545-0000-0110-113-C505	S 385-22	1	43M 44M	CLASS I, DIV 1, GROUPS A,B,C,D	20V, 150 OHMS
HONEYWELL	38545-000-0110-111-C505	S 385-22	1	43M 44M	CLASS I, DIV 1, GROUPS C,D	28V, 200 OHMS
HONEYWELL	38545-000-0110-111-C505	S 385-22	2	43M 44M	CLASS I, DIV 1, GROUPS C,D	28V, 200 OHMS
	38545-0000-0110-112-C505					28V, 200 OHMS

THE LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.

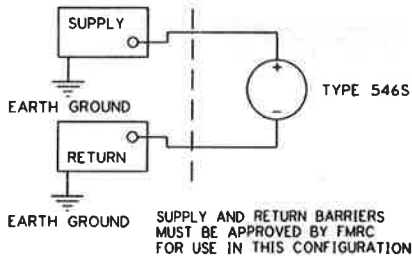
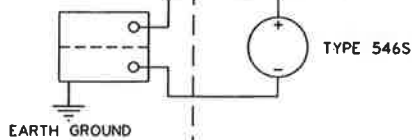
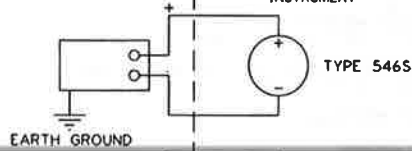
FOR GUIDANCE ON INSTALLATION, SEE ANSI/ISA RP12.6.

WB-10/ 10

# Type 546, 546S, and 546NS

## FM Schematics

NONHAZARDOUS LOCATION ← → HAZARDOUS LOCATIONS  
 CLASS I, II DIV 1, GROUPS A,B,C,D,E,F,G  
 N.I. CLASS I, DIV 2, GROUPS A,B,C,D  
 DIP CLASS II DIV 2, GROUPS F,G  
 FM APPROVED INSTRUMENT



SUPPLY AND RETURN BARRIERS MUST BE APPROVED BY FMRC FOR USE IN THIS CONFIGURATION

TYPE 546S ENTITY PARAMETERS  
 $V_{max} = 33.3V_{dr}$   $I_{max} = 175mA$   $C_i = 0$   $L_i = 0$

NOTES:  
 -LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURERS INSTRUCTION  
 -SEE ANSI/ISA RP12.6 FOR GUIDANCE IN INSTALLATION

-BARRIER PARAMETERS MUST MEET THE FOLLOWING REQUIREMENTS:  
 $V_{oc}$  OR  $V_T \leq V_{max}$   $I_{sc}$  OR  $I_T \leq I_{max}$   $C_o(\mu F) > 0.0$   $L_o(mH) > 0.0$

-THE  $C_o$  AND  $L_o$  PARAMETERS FOR THE BARRIER MUST BE GREATER THAN THE SUM OF THE CONNECTING CABLE PARAMETERS AND  $C_i$  AND  $L_i$  OF THE I.S. APPARATUS

-MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED  $250 \cdot V_{rms}$

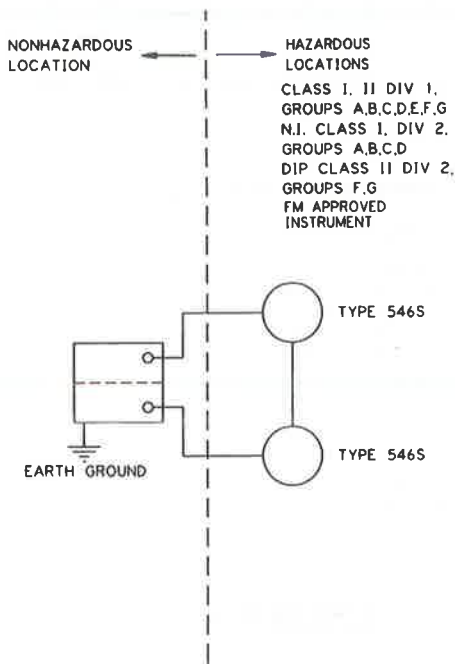
-RESISTANCE BETWEEN BARRIER GROUND AND EARTH GROUND MUST BE LESS THAN ONE OHM

-CL I, DIV 2 APPLICATIONS MUST BE INSTALLED AS SPECIFIED IN NEC SECTION 501-4 (b) WHEN BARRIERS ARE NOT USED

NORMAL OPERATING CONDITIONS 30 VDC, 20 mADC

NO CHANGE IN PART OR VENDOR OF PART ALLOWED WITHOUT PRIOR APPROVAL OF FM

# Type 546, 546S, and 546NS



TYPE 546S

ENTITY PARAMETERS

$$V_{max} = 33.3Vdc \quad I_{max} = 175mA \quad C_i = 0 \quad L_i = 0$$

NOTES:

-LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURERS INSTRUCTION

-SEE ANSI/ISA RP12.6 FOR GUIDANCE IN INSTALLATION

-BARRIER PARAMETERS MUST MEET THE FOLLOWING REQUIREMENTS:

$$V_{oc} \text{ OR } V_T \leq V_{max} \quad I_{sc} \text{ OR } I_T \leq I_{max} \quad C_o (\mu F) > 0.0 \quad L_o (mH) > 0.0$$

-THE  $C_o$  AND  $L_o$  PARAMETERS FOR THE BARRIER MUST BE GREATER THAN THE SUM OF THE CONNECTING CABLE PARAMETERS AND  $C_i$  AND  $L_i$  OF THE I.S. APPARATUS

-MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED  $250 V_{rms}$

-RESISTANCE BETWEEN BARRIER GROUND AND EARTH GROUND MUST BE LESS THAN ONE OHM

-CL I, DIV 2 APPLICATIONS MUST BE INSTALLED AS SPECIFIED IN NEC SECTION 501-4 (b) WHEN BARRIERS ARE NOT USED

NORMAL OPERATING CONDITIONS 30 VDC, 20 mADC

NO CHANGE IN PART OR VENDOR OF PART ALLOWED WITHOUT PRIOR APPROVAL OF: FM

SUPPLY AND RETURN BARRIERS MUST BE APPROVED BY FMRC FOR USE IN THIS CONFIGURATION

28A5036-H Sheet 2 of 2



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Cernay 68700 France

Sao Paulo 05424 Brazil

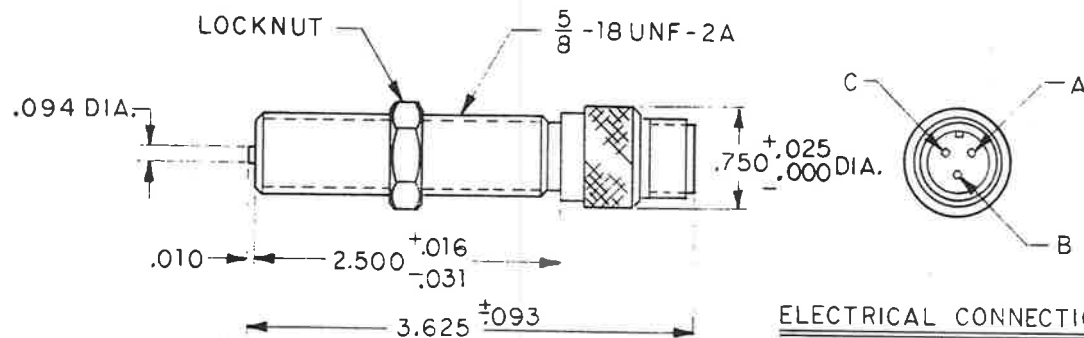
Singapore 128461







DATE	BY	REVISION RECORD	AUTH	DR.	CK.



**ELECTRICAL CONNECTIONS**

PIN A	+POWER SUPPLY
PIN B	OUTPUT
PIN C	COMMON

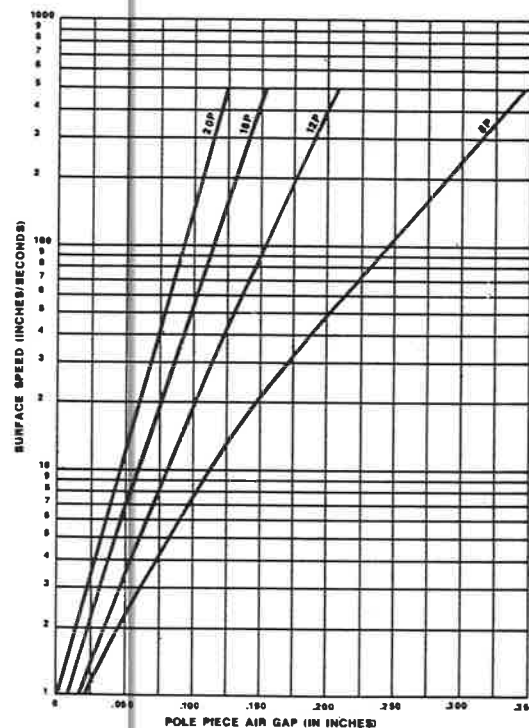
**SPECIFICATIONS**

POWER SUPPLY: 5 TO 15VDC.  
 OPERATING TEMPERATURE: -40°F TO +250°F  
 OUTPUT VOLTAGE: TTL COMPATIBLE, 50 ±10% DUTY CYCLE.  
 LOGIC 0: +0.6V PEAK MAX. WITH 50 ma SINK CURRENT.

LOGIC 1:  $\frac{R_L \times E_S}{R_L + 2K\Omega}$

OUTPUT IMPEDANCE: 2K OHMS  
 POWER SUPPLY CURRENT: 10 ma. TYPICAL WITH 10 VDC POWER SUPPLY.  
 HOUSING: 303 STAINLESS STEEL.  
 OUTPUT CONNECTOR: MATES WITH MS 3106A-10 SL-3S.  
 INSULATION RESISTANCE: 100 MΩ MIN. @ 50 VDC (PIN "A" TO HOUSING).

**WARNING:** INCORRECT WIRING MAY CAUSE PERMANENT DAMAGE TO PICKUP.



MINIMUM SPEED CHART

MATERIAL:	TOLERANCES (EXCEPT AS NOTED)	DYNALCO CONTROLS DIVISION		
	DECIMAL			SCALE
FINISH:	± .005	DATE	DRAWING NUMBER	APPROVED BY <i>hc 7/27/86</i>
	FRACTIONAL			TITLE
	± 1/64			DIGITAL OUTPUT PICKUP M928
	ANGULAR	7-28-86	B 8000928	REV.
	± 1/2°			

55-229



PROPAK SYSTEMS LTD POSTAL BAG #2, AIRDRIE, ALBERTA, CANADA T4B 2C3			TEMPERATURE CONTROLLERS				SHEET 1 OF 1
							SPEC NO _____ FILE 14.11.T
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : TEMPERATURE CONTROLLER			NO	BY	DATE	REVISION	JOB # 99404
			0	PC	5/23/00	ISSUED FOR PURCHASE	DATE _____
							REQ. _____
							BY _____ CHK'D _____ APPR. _____
1	TAG NO. TC- 210	DESCRIPTION: AC-210 COMPRESSOR 1ST STAGE COOLER TEMPERATURE CONTROL					
GENERAL INFORMATION	2	FUNCTIONS	RECORD _____	INDICATE _____	CONTROL <input checked="" type="checkbox"/>	DLIND _____	TRANS. _____
	3	CASE	MFR STD <input checked="" type="checkbox"/>	NOM SIZE _____	COLOR: MFR STD <input checked="" type="checkbox"/>	OTHER _____	
	4	MOUNTING	FLUSH _____	SURFACE _____	YOKE _____	OTHER DIRECT _____	
	5	ENCLOSURE CLASS	GENERAL PURPOSE _____	WEATHERPROOF <input checked="" type="checkbox"/>	EXPLOSIONPROOF _____	CLASS 1, DIV 2 _____	
	6	POWER SUPPLY	117 V 60Hz _____	OTHER AC _____	DC _____	VOLTS _____	
	7	CHART	STRIP _____	ROLL _____	FOLD _____	CIRCULAR _____	TIME MARKS _____
	8	CHART DRIVE	SPEED _____			POWER _____	
	9	SCALES	TYPE _____				
			RANGE 1 _____	2 _____	3 _____	4 _____	
METER	10	TRANSMITTER OUTPUT	4 - 20 mA _____	10 - 50 mA _____	21 - 103 kPa(ga) _____	42 - 206 kPa (ga) _____	OTHER _____
			FOR RECEIVER SEE SPEC. SHEET _____				
CONTROL SETTINGS	11	CONTROL MODES	P = PROP ( GAIN ), I = INTEGRAL ( AUTO RESET ), D = DERIVATIVE ( RATE ), SUB: S = SLOW F = FAST				
			P _____	PI _____	PD _____	PID _____	IF _____ DF _____ IS _____ DS _____
	12	ACTION	ON MEAS. INCREASE OUTPUT:	INCREASES _____	DECREASES <input checked="" type="checkbox"/>		
	13	AUTO - MAN SWITCH	NONE <input checked="" type="checkbox"/>	MFR STD _____	OTHER _____		
	14	SET POINT ADJ.	MANUAL <input checked="" type="checkbox"/>	EXTERNAL _____	REMOTE _____	OTHER _____	
	15	MANUAL REG.	NONE <input checked="" type="checkbox"/>	MFR STD _____	OTHER _____		
METER RANGE	16	OUTPUT	4 - 20 mA _____	10 - 50 mA _____	21 - 103 kPa(ga) _____	42 - 206 kPa (ga) <input checked="" type="checkbox"/>	OTHER _____
	17	FILL	SAMA CLASS <u>IA</u>	COMPENSATION _____	FULL _____		
	18	PROCESS DATA	TEMP: NORMAL <u>49</u> ° C	MAX. <u>176/-28</u> ° C	MAX. PRESSURE <u>4447</u> kPa (ga)		
	19	RANGE	FIXED <u>-34 - 204</u> ° C	ADJ. RANGE _____	SET AT <u>49</u> ° C		
	20	BULB	OVERRRANGE PROTECTION TO _____				
			TYPE <u>STD</u>	MTL <u>SS</u>	EXTENSION: _____	LENGTH _____ mm	TYPE _____
METER TYPE	21	CAPILLARY	SIZE: DIAMETER <u>10</u> mm	LENGTH <u>305</u> mm	INSERTION _____ mm		
	22	WELL	CONN. _____	LOCATION _____ mm	ABOVE _____	BELOW _____	
			MFR. STD _____	LENGTH _____ mm	MTL _____	ARMOR _____	
			MTL. <u>304 SSL</u>	INSERTION _____ mm	LAG EXT. <u>NO</u>	CONN. <u>3/4" NPT</u>	
		CONST: DRILLED _____	BUILT - UP _____	OTHER _____			
ALARM	23	ALARM SWITCHES	QUANTITY _____	FORM _____	RATING _____		
	24	FUNCTION	TEMP _____	DEVIATION _____	CONTACTS TO _____	ON TEMP. INCREASE _____	
OPTIONS	25	OPTIONS	FILT - REG. _____	SUP. GAGE _____	OUTPUT GAGE _____	CHARTS _____	
			OTHER <u>SEPARABLE SOCKET (MODEL #: 3/4SS-12SS) REQUIRED</u>				
26	MFR. & MODEL NO.	<u>KIMRAY</u>					
27	MODEL NO.	<u>HT-12T C/W SEPARABLE SOCKET AND 3PG</u>					
28	P. O. NUMBER	_____					
NOTES:							
1. SWEET INSTRUMENT GAS SUPPLY.							
AREA. UNIT #:							

PROPAK SYSTEMS LTD POSTAL BAG #2, AIRDRIE, ALBERTA, CANADA T4B 2C3		TEMPERATURE CONTROLLERS				SHEET 1 OF 1
		NO	BY	DATE	REVISION	SPEC NO _____ FILE 14.11.T
CUSTOMER : APACHE CANADA LIMITED		0	PC	5/23/00	ISSUED FOR PURCHASE	JOB # 99404
PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE		1	CG	7/13/00	MODEL WAS HT-12T w/ 3PG	DATE _____
SERVICE : TEMPERATURE CONTROLLER						REQ. _____
						BY _____ CHK'D _____ APPR. _____
1	TAG NO. TC- 211	DESCRIPTION: AC-211 COMPRESSOR 2ND STAGE COOLER TEMPERATURE CONTROL				
2	FUNCTIONS	RECORD _____	INDICATE _____	CONTROL: <input checked="" type="checkbox"/>	BLIND _____	TRANS _____
3	CASE	MFR STD <input checked="" type="checkbox"/>	NOM SIZE _____	COLOR: MFR STD <input checked="" type="checkbox"/>	OTHER _____	
4	MOUNTING	FLUSH _____	SURFACE _____	YOKE _____	OTHER DIRECT _____	
5	ENCLOSURE CLASS	GENERAL PURPOSE _____	WEATHERPROOF <input checked="" type="checkbox"/>	EXPLOSIONPROOF _____	CLASS 1, DIV 2 _____	
6	POWER SUPPLY	117 V 60Hz _____	OTHER AC _____	DC _____	VOLTS _____	
7	CHART	STRIP _____	ROLL _____	FOLD _____	CIRCULAR _____	TIME MARKS _____
8	CHART DRIVE	SPEED _____ POWER _____				
9	SCALES	TYPE _____				
10	TRANSMITTER OUTPUT	4 - 20 mA _____	10 - 50 mA _____	21 - 103 kPa(ga) _____	42 - 206 kPa (ga) _____	OTHER _____
11	CONTROL MODES	P = PROP ( GAIN ), I = INTEGRAL ( AUTO RESET ), D = DERIVATIVE ( RATE ), SUB: S = SLOW F = FAST				
12	ACTION	P _____	PI _____	PD _____	PID _____	IF _____ DF _____ IS _____ DS _____
13	AUTO - MAN SWITCH	NONE _____	<input checked="" type="checkbox"/>	MFR STD _____	OTHER _____	
14	SET POINT ADJ.	MANUAL _____	<input checked="" type="checkbox"/>	EXTERNAL _____	REMOTE _____	OTHER _____
15	MANUAL REG.	NONE _____	<input checked="" type="checkbox"/>	MFR STD _____	OTHER _____	
16	OUTPUT	4 - 20 mA _____	10 - 50 mA _____	21 - 103 kPa(ga) _____	42 - 206 kPa (ga) <input checked="" type="checkbox"/>	OTHER _____
17	FILL	SAMA CLASS _____	IA _____	COMPENSATION _____	FULL _____	
18	PROCESS DATA	TEMP: NORMAL _____ ° C	MAX. _____ ° C	MAX. PRESSURE _____	kPa (ga) _____	
19	RANGE	FIXED _____ ° C	ADJ. RANGE _____	SET AT _____	° C _____	
20	BULB	OVERRANGE PROTECTION TO _____				
21	CAPILLARY	TYPE _____	STD _____	MTL. _____	SS _____	EXTENSION: _____
22	WELL	SIZE: DIAMETER _____	mm _____	LENGTH _____	mm _____	INSERTION _____
		CONN. _____	LOCATION _____	mm _____	ABOVE _____	BELOW _____
		MFR. STD _____	LENGTH _____	mm _____	MTL. _____	ARMOR _____
		MTL. _____	304 SSL _____	INSERTION _____	mm _____	LAG EXT. _____
		CONST: DRILLED _____	BUILT - UP _____	OTHER _____	CONN. 3/4" NPT _____	
23	ALARM SWITCHES	QUANTITY _____	FORM _____	RATING _____		
24	FUNCTION	TEMP _____	DEVIATION _____	CONTACTS TO _____	ON TEMP. INCREASE _____	
25	OPTIONS	FILT - REG. _____	SUP. GAGE _____	OUTPUT GAGE _____	CHARTS _____	
		OTHER SEPARABLE SOCKET (MODEL #: 3/4SS-12SS) REQUIRED				
26	MFR. & MODEL NO.	KIMRAY				
27	MODEL NO.	T-12 C/W SEPARABLE SOCKET				
28	P. O. NUMBER	_____				
NOTES: 1. SWEET INSTRUMENT GAS SUPPLY.						
AREA. UNIT # : _____						

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3				TEMPERATURE CONTROLLERS				SHEET 1 OF 1			
						SPEC NO		FILE 14.11.T			
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : TEMPERATURE CONTROLLER				NO		BY		DATE			
				0		PC		5/23/00		ISSUED FOR PURCHASE	
				1		CG		7/13/00		MODEL WAS HT-12T w/ 3PG	
						JOB #		99404			
						DATE					
						REQ.					
				BY		CHK'D		APPR.			
1 TAG NO. TC- 212 DESCRIPTION: AC-212 COMPRESSOR AFTERCOOLER TEMPERATURE CONTROL											
2 FUNCTIONS				RECORD _____ INDICATE _____ CONTROL <input checked="" type="checkbox"/> BLIND _____ TRANS. _____							
G 3 CASE				OTHER _____							
E 4 MOUNTING				MFR STD <input checked="" type="checkbox"/> NOM SIZE _____ COLOR : MFR STD <input checked="" type="checkbox"/> OTHER _____							
N 5 ENCLOSURE CLASS				FLUSH _____ SURFACE _____ YOKE _____ OTHER DIRECT _____							
R 6 POWER SUPPLY				GENERAL PURPOSE _____ WEATHERPROOF <input checked="" type="checkbox"/> EXPLOSIONPROOF _____ CLASS 1, DIV 2 _____							
A 7 CHART				FOR USE IN INTRINSICALLY SAFE SYSTEM _____ OTHER _____							
L 8 CHART DRIVE				117 V 60Hz _____ OTHER AC _____ DC _____ VOLTS _____							
9 SCALES				STRIP _____ ROLL _____ FOLD _____ CIRCULAR _____ TIME MARKS _____							
				SPEED _____ POWER _____							
				TYPE _____							
				RANGE 1 _____ 2 _____ 3 _____ 4 _____							
X 10 TRANSMITTER				4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(ga) _____ 42 - 206 kPa (ga) _____ OTHER _____							
M 11 CONTROL MODES				FOR RECEIVER SEE SPEC. SHEET _____							
C 12 ACTION				P = PROP ( GAIN ), I = INTEGRAL ( AUTO RESET ), D = DERIVATIVE ( RATE ),							
O 13 AUTO - MAN SWITCH				SUB : S = SLOW F = FAST							
N 14 SET POINT ADJ.				P _____ PI _____ PD _____ PID _____ IF _____ DF _____ IS _____ DS _____							
S 15 MANUAL REG.				OTHER _____							
T 16 OUTPUT				ON MEAS. INCREASE OUTPUT : INCREASES _____ DECREASES <input checked="" type="checkbox"/> _____							
				NONE <input checked="" type="checkbox"/> MFR STD _____ OTHER _____							
				MANUAL <input checked="" type="checkbox"/> EXTERNAL _____ REMOTE _____ OTHER _____							
				NONE <input checked="" type="checkbox"/> MFR STD _____ OTHER _____							
				4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(ga) _____ 42 - 206 kPa (ga) <input checked="" type="checkbox"/> OTHER _____							
E 17 FILL				SAMA CLASS _____ IA _____ COMPENSATION _____ FULL _____							
L 18 PROCESS DATA				TEMP: NORMAL _____ 49 * C MAX. 178/-28 * C MAX. PRESSURE 8908 kPa (ga)							
E 19 RANGE				FIXED -34 - 204 °C ADJ. RANGE _____ SET AT 49 ° C							
M 20 BULB				OVERRANGE PROTECTION TO _____							
E 21 CAPILLARY				TYPE _____ STD _____ MTL. _____ SS _____ EXTENSION: _____ LENGTH _____ mm TYPE _____							
N 22 WELL				SIZE: DIAMETER 10 mm LENGTH 305 mm INSERTION _____ mm							
				CONN. _____ LOCATION _____ mm ABOVE _____ BELOW _____							
				MFR. STD _____ LENGTH _____ mm MTL. _____ ARMOR _____							
				MTL. 304 SSL INSERTION _____ mm LAG EXT. _____ NO _____ CONN. 3/4" NPT							
				CONST: DRILLED _____ BUILT - UP _____ OTHER _____							
23 ALARM SWITCHES				QUANTITY _____ FORM _____ RATING _____							
24 FUNCTION				TEMP _____ DEVIATION _____ CONTACTS TO _____ ON TEMP. INCREASE _____							
25 OPTIONS				FILT - REG. _____ SUP. GAGE _____ OUTPUT GAGE _____ CHARTS _____							
				OTHER SEPARABLE SOCKET (MODEL #: 3/4SS-12SS) REQUIRED							
26 MFR. & MODEL NO.				KIMRAY							
27 MODEL NO.				T-12 C/W SEPARABLE SOCKET							
28 P. O. NUMBER				_____							
NOTES:											
1. SWEET INSTRUMENT GAS SUPPLY.											
AREA. UNIT # :											

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		TEMPERATURE INSTRUMENTS ( FILLED SYSTEM )				SHEET 1 OF 6	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : TEMPERATURE ELEMENT		NO	BY	DATE	REVISION	SPEC NO	FILE 14.11.T
		1	GWV	00.09.26	ISSUED FOR PURCHASE	JOB #	99404
						DATE	SEPTEMBER 26, 2000
						REQ.	
						BY	CHK'D APPR.
						GW	
1	TAG NO.: TE - 100	INLET SUCTION TEMPERATURE					
2	FUNCTIONS	RECORD	INDICATE	CONTROL	BLIND	TRANS.	
3	CASE	OTHER THERMOCOUPLE AT ALLTEMP SERIES 8000					
4	MOUNTING	MFR STD	NOM SIZE	21 mm MNPT PROBE, 27 mm FNPT ELECTRICAL		OTHER	
5	ENCLOSURE CLASS	FLUSH	SURFACE	YOKE	OTHER REMOTE		
6	POWER SUPPLY	GENERAL PURPOSE	WATERPROOF	EXPLOSIONPROOF	CLASS 1, DIV. 2, GR. C & D		
7	CHART	FOR USE IN INTRINSICALLY SAFE SYSTEM					OTHER
8	CHART DRIVE	117 V 60Hz	OTHER AC	DC	VOLTS		
9	SCALES	STRIP	ROLL	FOLD	CIRCULAR	TIME MARKS	
10	TRANSMITTER OUTPUT	SPEED	POWER				
11	CONTROL MODES	TYPE K-TYPE THERMOCOUPLE					
12	ACTION	RANGE 1	0 - 1260 C	2	3	4	
13	AUTO - MAN SWITC	4 - 20 mA	10 - 50 mA	21 - 103 kPa(g)	42 - 206 kPa (g)	OTHER	
14	SET POINT ADJ.	mV OUTPUT RANGE 0 - 54.5 mV					
15	MANUAL REG.	P = PROP ( GAIN ), I = INTEGRAL ( AUTO RESET ), D = DERIVATIVE ( RATE ), SUB : S = SLOW F = FAST					
16	OUTPUT	P	PI	PD	PID	IF	DF IS DS
17	FILL	OTHER					
18	PROCESS DATA	ON MEAS. INCREASE OUTPUT : INCREASES DECREASES					
19	RANGE	NONE	MFR STD	OTHER			
20	BULB	MANUAL	EXTERNAL	REMOTE	OTHER		
21	CAPILLARY	NONE	MFR STD	OTHER			
22	WELL	4 - 20 mA	10 - 50 mA	21 - 103 kPa(g)	42 - 206 kPa (g)	OTHER	
23	ALARM SWITCHES	SAMA CLASS COMPENSATION					
24	FUNCTION	TEMP: NORMAL	49 ° C	MAX. 149 ° C	MAX. PRESSURE	4516 kPa (g)	
25	OPTIONS	FIXED	0 - 1260 C	ADJ. RANGE	SET AT	° C	
26	MFR. & MODEL NO.	OVERRANGE PROTECTION TO					
27	MODEL NO.	TYPE SINGLE MTL. 304 SS EXTENSION: LENGTH mm TYPE K-THERMOCOUPLE					
28	THERMOWELL	SIZE: DIAMETER 6.35 mm "A"-LENGTH 139.7 mm INSERTION mm					
		CONN. 21 mm LOCATION mm ABOVE BELOW					
		MFR. STD X LENGTH 1524 mm MTL. ARMOR FLEXIBLE					
		MTL. 304 ss "U" LENGTH 152.4 mm "H" LENGTH 44.5 mm PROC. CON 21mm NPTF					
		CONST: STRAIGHT "B-STYLE" BUILT - UP OTHER x 27mm NPTM					
23	ALARM SWITCHES	QUANTITY	FORM	RATING			
24	FUNCTION	TEMP	DEVIATION	CONTACTS TO	ON TEMP. INCREASE		
25	OPTIONS	FILT - REG.	SUP. GAGE	OUTPUT GAGE	CHARTS		
26	MFR. & MODEL NO.	OTHER					
27	MODEL NO.	ATS ALLTEMP - SERIES 8000					
28	THERMOWELL	THERMOCOUPLE P/N: AI-8113-U-14-60"-K-10.50"					
		THERMOWELL P/N: B 34-1.75"-6.0"-0.25"-5.50"-0"-P/PL-0.26"-0.75"					

NOTES:

AREA, UNIT # : 152

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		TEMPERATURE INSTRUMENTS ( FILLED SYSTEM )				SHEET 2 OF 6	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : TEMPERATURE ELEMENT		NO	BY	DATE	REVISION	SPEC NO	FILE 14.11.T
		1	GW	00.09.26	ISSUED FOR PURCHASE	JOB #	99404
						DATE	SEPTEMBER 26, 2000
						REQ.	
				BY	CHK'D	APPR.	
				GW			
1	TAG NO.: TE - 110	STAGE 2 SUCTION TEMPERATURE					
2	FUNCTIONS	RECORD _____ INDICATE _____ CONTROL _____ BLIND _____ TRANS. _____ OTHER THERMOCOUPLE _____ ATS ALLTEMP SERIES 8000 _____					
3	CASE	MFR STD <u>X</u> NOM SIZE <u>21 mm MNPT PROBE, 27 mm FNPT ELECTRICAL</u> OTHER _____					
4	MOUNTING	FLUSH _____ SURFACE _____ YOKE _____ OTHER REMOTE _____					
5	ENCLOSURE CLASS	GENERAL PURPOSE _____ WATERPROOF _____ EXPLOSIONPROOF _____ CLASS <u>1, DIV. 2, GR. C &amp; D</u>					
6	POWER SUPPLY	FOR USE IN INTRINSICALLY SAFE SYSTEM _____ OTHER _____					
7	CHART	117 V 60Hz _____ OTHER AC _____ DC _____ VOLTS _____					
8	CHART DRIVE	STRIP _____ ROLL _____ FOLD _____ CIRCULAR _____ TIME MARKS _____					
9	SCALES	SPEED _____ POWER _____					
		TYPE <u>K-TYPE THERMOCOUPLE</u>					
		RANGE 1 <u>0 - 1260 C</u> 2 _____ 3 _____ 4 _____					
10	TRANSMITTER OUTPUT	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(g) _____ 42 - 206 kPa (g) _____ OTHER _____ mV OUTPUT RANGE <u>0 - 54.5 mV</u>					
11	CONTROL MODES	P = PROP ( GAIN ), I = INTEGRAL ( AUTO RESET ), D = DERIVATIVE ( RATE ), SUB : S = SLOW F = FAST P _____ PI _____ PD _____ PID _____ IF _____ DF _____ IS _____ DS _____ OTHER _____					
12	ACTION	ON MEAS. INCREASE OUTPUT :INCREASES _____ DECREASES _____					
13	AUTO - MAN SWITC	NONE _____ MFR STD _____ OTHER _____					
14	SET POINT ADJ.	MANUAL _____ EXTERNAL _____ REMOTE _____ OTHER _____					
15	MANUAL REG.	NONE _____ MFR STD _____ OTHER _____					
16	OUTPUT	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(g) _____ 42 - 206 kPa (g) _____ OTHER _____					
17	FILL	SAMA CLASS _____ COMPENSATION _____					
18	PROCESS DATA	TEMP: NORMAL <u>49</u> ° C MAX. <u>149</u> ° C MAX. PRESSURE <u>4516</u> kPa (g)					
19	RANGE	FIXED <u>0 - 1260 C</u> ADJ. RANGE _____ SET AT _____ ° C					
20	BULB	OVERRANGE PROTECTION TO _____ TYPE <u>SINGLE</u> MTL. <u>304 SS</u> EXTENSION: LENGTH _____ mm TYPE <u>K-THERMOCOUPLE</u> SIZE: DIAMETER <u>6.35</u> mm "A"-LENGTH <u>139.7</u> mm INSERTION _____ mm CONN. <u>21 mm</u> LOCATION _____ mm ABOVE _____ BELOW _____					
21	CAPILLARY	MFR. STD <u>X</u> LENGTH <u>1524</u> mm MTL. _____ ARMOR <u>FLEXIBLE</u>					
22	WELL	MTL. <u>304 ss</u> "U" LENGTH <u>101.6</u> mm "H" LENGTH <u>44.5</u> mm PROC. CON <u>21mm NPTF</u> CONST: STRAIGHT "B-STYLE" BUILT - UP _____ OTHER _____ x 27mm NPTM					
23	ALARM SWITCHES	QUANTITY _____ FORM _____ RATING _____					
24	FUNCTION	TEMP _____ DEVIATION _____ CONTACTS TO _____ ON TEMP. INCREASE _____					
25	OPTIONS	FILT - REG. _____ SUP. GAGE _____ OUTPUT GAGE _____ CHARTS _____ OTHER _____					
26	MFR. & MODEL NO.	<u>ATS ALLTEMP - SERIES 8000</u>					
27	MODEL NO.	<u>THERMOCOUPLE P/N: AI-8113-U-14-60"-K-8.50"</u>					
28	THERMOWELL	<u>THERMOWELL P/N: B 34-1.75"-4.0"-0.25"-5.50"-0"-P/PL-0.26"-0.75"</u>					

NOTES:

AREA. UNIT # : 152



PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		TEMPERATURE INSTRUMENTS ( FILLED SYSTEM )				SHEET 4 OF 6	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : TEMPERATURE ELEMENT		NO	BY	DATE	REVISION	SPEC NO	FILE 14.11.T
		1	GWV	00.09.26	ISSUED FOR PURCHASE	JOB #	99404
						DATE	SEPTEMBER 26, 2000
						REQ.	
						BY	CHK'D APPR.
						GW	
1	TAG NO.: TE - 120	STAGE 3 SUCTION TEMPERATURE					
2	FUNCTIONS	RECORD _____ INDICATE _____ CONTROL _____ BLIND _____ TRANS. _____ OTHER THERMOCOUPLE ATS ALLTEMP SERIES 8000					
3	CASE	MFR STD <u>X</u> NOM SIZE <u>21 mm MNPT PROBE, 27 mm FNPT ELECTRICAL</u> OTHER _____					
4	MOUNTING	FLUSH _____ SURFACE _____ YOKE _____ OTHER REMOTE _____					
5	ENCLOSURE CLASS	GENERAL PURPOSE _____ WATERPROOF _____ EXPLOSIONPROOF _____ CLASS <u>1, DIV. 2, GR. C &amp; D</u> FOR USE IN INTRINSICALLY SAFE SYSTEM _____ OTHER _____					
6	POWER SUPPLY	117 V 60Hz _____ OTHER AC _____ DC _____ VOLTS _____					
7	CHART	STRIP _____ ROLL _____ FOLD _____ CIRCULAR _____ TIME MARKS _____					
8	CHART DRIVE	SPEED _____ POWER _____					
9	SCALES	TYPE <u>K-TYPE THERMOCOUPLE</u> RANGE 1 <u>0 - 1260 C</u> 2 _____ 3 _____ 4 _____					
10	TRANSMITTER OUTPUT	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(g) _____ 42 - 206 kPa (g) _____ OTHER _____ mV OUTPUT RANGE <u>0 - 54.5 mV</u>					
11	CONTROL MODES	P = PROP ( GAIN ), I = INTEGRAL ( AUTO RESET ), D = DERIVATIVE ( RATE ), SUB : S = SLOW F = FAST P _____ PI _____ PD _____ PID _____ IF _____ DF _____ IS _____ DS _____ OTHER _____					
12	ACTION	ON MEAS. INCREASE OUTPUT : INCREASES _____ DECREASES _____					
13	AUTO - MAN SWITC	NONE _____ MFR STD _____ OTHER _____					
14	SET POINT ADJ.	MANUAL _____ EXTERNAL _____ REMOTE _____ OTHER _____					
15	MANUAL REG.	NONE _____ MFR STD _____ OTHER _____					
16	OUTPUT	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(g) _____ 42 - 206 kPa (g) _____ OTHER _____					
17	FILL	SAMA CLASS _____ COMPENSATION _____					
18	PROCESS DATA	TEMP: NORMAL <u>49</u> ° C MAX. <u>149</u> ° C MAX. PRESSURE <u>9067</u> kPa (g)					
19	RANGE	FIXED <u>0 - 1260 C</u> ADJ. RANGE _____ SET AT _____ ° C					
20	BULB	OVERRANGE PROTECTION TO _____ TYPE <u>SINGLE</u> MTL. <u>304 SS</u> EXTENSION: LENGTH _____ mm TYPE <u>K-THERMOCOUPLE</u> SIZE: DIAMETER <u>6.35</u> mm "A"-LENGTH <u>139.7</u> mm INSERTION _____ mm CONN. <u>21 mm</u> LOCATION _____ mm ABOVE _____ BELOW _____					
21	CAPILLARY	MFR. STD <u>X</u> LENGTH <u>1524</u> mm MTL. _____ ARMOR <u>FLEXIBLE</u>					
22	WELL	MTL. <u>304 ss</u> "U" LENGTH <u>63.5</u> mm "H" LENGTH <u>44.5</u> mm PROC. CON <u>21mm NPTF</u> CONST: STRAIGHT "B-STYLE" _____ BUILT - UP _____ OTHER _____ x 27mm NPTM					
23	ALARM SWITCHES	QUANTITY _____ FORM _____ RATING _____					
24	FUNCTION	TEMP _____ DEVIATION _____ CONTACTS TO _____ ON TEMP. INCREASE _____					
25	OPTIONS	FILT - REG. _____ SUP. GAGE _____ OUTPUT GAGE _____ CHARTS _____ OTHER _____					
26	MFR. & MODEL NO.	<u>ATS ALLTEMP - SERIES 8000</u>					
27	MODEL NO.	<u>THERMOCOUPLE P/N: AI-8113-U-14-60"-K-7.00"</u>					
28	THERMOWELL	<u>THERMOWELL P/N: B 34-1.75"-2.5"-0.25"-4.00"-0"-P/PL-0.26"-0.75"</u>					

NOTES:

AREA, UNIT # : 152

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		TEMPERATURE INSTRUMENTS ( FILLED SYSTEM )			SHEET 2 OF 6		
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : TEMPERATURE ELEMENT		NO	BY	DATE	REVISION	SPEC NO	
		1	GWV	00.09.26	ISSUED FOR PURCHASE	JOB # 99404	
							FILE 14.11.T
							DATE SEPTEMBER 26, 2000
					REQ.		
		BY	CHKD	APPR.			
		GW					
1	TAG NO.: TE - 122A/B	STAGE 1 DISCHARGE TEMPERATURE					
2	FUNCTIONS	RECORD _____ INDICATE _____ CONTROL _____ BLIND _____ TRANS. _____ OTHER THERMOCOUPLE _____ ATS ALLTEMP SERIES 8000 _____					
3	CASE	MFR STD <u>X</u> NOM SIZE <u>21 mm MNPT PROBE, 27 mm FNPT ELECTRICAL</u> OTHER _____					
4	MOUNTING	FLUSH _____ SURFACE _____ YOKE _____ OTHER REMOTE _____					
5	ENCLOSURE CLASS	GENERAL PURPOSE _____ WATERPROOF _____ EXPLOSIONPROOF _____ CLASS <u>1, DIV. 2, GR. C &amp; D</u>					
6	POWER SUPPLY	FOR USE IN INTRINSICALLY SAFE SYSTEM _____ OTHER _____					
7	CHART	117 V 60Hz _____ OTHER AC _____ DC _____ VOLTS _____					
8	CHART DRIVE	STRIP _____ ROLL _____ FOLD _____ CIRCULAR _____ TIME MARKS _____					
9	SCALES	SPEED _____ POWER _____					
10	TRANSMITTER OUTPUT	TYPE <u>K-TYPE THERMOCOUPLE</u> RANGE 1 <u>0 - 1260 C</u> 2 _____ 3 _____ 4 _____					
11	CONTROL MODES	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(g) _____ 42 - 206 kPa (g) _____ OTHER _____ mV OUTPUT RANGE <u>0 - 54.5 mV</u>					
12	ACTION	P = PROP ( GAIN ), I = INTEGRAL ( AUTO RESET ), D = DERIVATIVE ( RATE ), SUB : S = SLOW F = FAST P _____ PI _____ PD _____ PID _____ IF _____ DF _____ IS _____ DS _____ OTHER _____					
13	AUTO - MAN SWITC	ON MEAS. INCREASE OUTPUT :INCREASES _____ DECREASES _____					
14	SET POINT ADJ.	NONE _____ MFR STD _____ OTHER _____					
15	MANUAL REG.	MANUAL _____ EXTERNAL _____ REMOTE _____ OTHER _____					
16	OUTPUT	NONE _____ MFR STD _____ OTHER _____					
17	FILL	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(g) _____ 42 - 206 kPa (g) _____ OTHER _____					
18	PROCESS DATA	SAMA CLASS _____ COMPENSATION _____					
19	RANGE	TEMP: NORMAL <u>99</u> ° C MAX. <u>176</u> ° C MAX. PRESSURE <u>4447</u> kPa (g) FIXED <u>0 - 1260 C</u> ADJ. RANGE _____ SET AT _____ ° C					
20	BULB	OVERRANGE PROTECTION TO _____ TYPE <u>SINGLE</u> MTL. <u>304 SS</u> EXTENSION: LENGTH _____ mm TYPE <u>K-THERMOCOUPLE</u> SIZE: DIAMETER <u>6.35</u> mm "A"-LENGTH <u>139.7</u> mm INSERTION _____ mm CONN. <u>21 mm</u> LOCATION _____ mm ABOVE _____ BELOW _____					
21	CAPILLARY	MFR. STD <u>X</u> LENGTH <u>1524</u> mm MTL. _____ ARMOR <u>FLEXIBLE</u>					
22	WELL	MTL. <u>304 ss</u> "U" LENGTH <u>101.6</u> mm "H" LENGTH <u>44.5</u> mm PROC. CON <u>21mm NPTF</u> CONST: STRAIGHT "B-STYLE" _____ BUILT - UP _____ OTHER _____ x 27mm NPTM					
23	ALARM SWITCHES	QUANTITY _____ FORM _____ RATING _____					
24	FUNCTION	TEMP _____ DEVIATION _____ CONTACTS TO _____ ON TEMP. INCREASE _____					
25	OPTIONS	FILT - REG. _____ SUP. GAGE _____ OUTPUT GAGE _____ CHARTS _____ OTHER _____					
26	MFR. & MODEL NO.	<u>ATS ALLTEMP - SERIES 8000</u>					
27	MODEL NO.	<u>THERMOCOUPLE P/N: AI-8113-U-14-60"-K-8.50"</u>					
28	THERMOWELL	<u>THERMOWELL P/N: B 34-1.75"-4.0"-0.25"-5.50"-0"-P/PL-0.26"-0.75"</u>					

NOTES:

AREA. UNIT #: 152

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		TEMPERATURE INSTRUMENTS ( FILLED SYSTEM )			SHEET 2 OF 6 SPEC NO _____ FILE 14.11.T	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : TEMPERATURE ELEMENT		NO	BY	DATE	REVISION	JOB # 99404
		1	GWV	00.09.26	ISSUED FOR PURCHASE	DATE SEPTEMBER 26, 2000
						REQ.
						BY _____ CHK'D _____ APPR. _____
						GW
1	TAG NO.: TE - 124	STAGE 2 DISCHARGE TEMPERATURE				
G E N E R A L	2 FUNCTIONS	RECORD _____ INDICATE _____ CONTROL _____ BLIND _____ TRANS. _____				
	3 CASE	OTHER THERMOCOUPLE _____	ATS ALLTEMP SERIES 8000			
	4 MOUNTING	MFR STD <u>X</u> _____ NOM SIZE <u>21 mm MNPT PROBE, 27 mm FNPT ELECTRICAL</u> _____	OTHER _____			
	5 ENCLOSURE CLASS	FLUSH _____ SURFACE _____ YOKE _____ OTHER REMOTE _____				
	6 POWER SUPPLY	GENERAL PURPOSE _____ WATERPROOF _____ EXPLOSIONPROOF _____ CLASS <u>1, DIV. 2, GR. C &amp; D</u>				
	7 CHART	FOR USE IN INTRINSICALLY SAFE SYSTEM _____ OTHER _____				
	8 CHART DRIVE	117 V 60Hz _____ OTHER AC _____ DC _____ VOLTS _____				
	9 SCALES	STRIP _____ ROLL _____ FOLD _____ CIRCULAR _____ TIME MARKS _____				
			SPEED _____ POWER _____			
		TYPE <u>K-TYPE THERMOCOUPLE</u>				
		RANGE 1 <u>0 - 1260 C</u> 2 _____ 3 _____ 4 _____				
X M T	10 TRANSMITTER OUTPUT	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(g) _____ 42 - 206 kPa (g) _____ OTHER _____				
		mV OUTPUT RANGE <u>0 - 54.5 mV</u>				
C O N T R O L	11 CONTROL MODES	P = PROP ( GAIN ), I = INTEGRAL ( AUTO RESET ), D = DERIVATIVE ( RATE ), SUB : S = SLOW F = FAST P _____ PI _____ PD _____ PID _____ IF _____ DF _____ IS _____ DS _____ OTHER _____				
	12 ACTION	ON MEAS. INCREASE OUTPUT : INCREASES _____ DECREASES _____				
	13 AUTO - MAN SWITC	NONE _____ MFR STD _____ OTHER _____				
	14 SET POINT ADJ.	MANUAL _____ EXTERNAL _____ REMOTE _____ OTHER _____				
	15 MANUAL REG.	NONE _____ MFR STD _____ OTHER _____				
	16 OUTPUT	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(g) _____ 42 - 206 kPa (g) _____ OTHER _____				
E L E M E N T	17 FILL	SAMA CLASS _____ COMPENSATION _____				
	18 PROCESS DATA	TEMP: NORMAL <u>130</u> ° C MAX. <u>176</u> ° C MAX. PRESSURE <u>8908</u> kPa (g)				
	19 RANGE	FIXED <u>0 - 1260 C</u> ADJ. RANGE _____ SET AT _____ ° C				
	20 BULB	OVERRANGE PROTECTION TO _____				
		TYPE <u>SINGLE</u> MTL. <u>304 SS</u> EXTENSION: LENGTH _____ mm TYPE <u>K-THERMOCOUPLE</u>				
		SIZE: DIAMETER <u>6.35</u> mm "A"-LENGTH <u>139.7</u> mm INSERTION _____ mm				
		CONN. <u>21 mm</u> LOCATION _____ mm ABOVE _____ BELOW _____				
	21 CAPILLARY	MFR. STD <u>X</u> LENGTH <u>1524</u> mm MTL. _____ ARMOR <u>FLEXIBLE</u>				
22 WELL	MTL. <u>304 ss</u> "U" LENGTH <u>101.6</u> mm "H" LENGTH <u>44.5</u> mm PROC. CON <u>21mm NPTF</u>					
	CONST: STRAIGHT <u>"B-STYLE"</u> BUILT - UP _____ OTHER _____ x 27mm NPTM					
23 ALARM SWITCHES	QUANTITY _____ FORM _____ RATING _____					
24 FUNCTION	TEMP _____ DEVIATION _____ CONTACTS TO _____ ON TEMP. INCREASE _____					
25 OPTIONS	FILT - REG. _____ SUP. GAGE _____ OUTPUT GAGE _____ CHARTS _____					
	OTHER _____					
26 MFR. & MODEL NO.	<u>ATS ALLTEMP - SERIES 8000</u>					
27 MODEL NO.	<u>THERMOCOUPLE P/N: AI-8113-U-14-60"-K-8.50"</u>					
28 THERMOWELL	<u>THERMOWELL P/N: B 34-1.75"-4.0"-0.25"-5.50"-0"-P/PL-0.26"-0.75"</u>					

NOTES:

AREA. UNIT # : 152

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		TEMPERATURE INSTRUMENTS ( FILLED SYSTEM )			SHEET 4 OF 6 SPEC NO _____ FILE 14.11.T	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : TEMPERATURE ELEMENT		NO	BY	DATE	REVISION	JOB # 99404
		1	GWW	00.09.26	ISSUED FOR PURCHASE	DATE SEPTEMBER 26, 2000
						REQ.
						BY _____ CHK'D _____ APPR. _____
					GW _____	
1	TAG NO.: TE - 126	STAGE 3 DISCHARGE TEMPERATURE				
2	FUNCTIONS	RECORD _____ INDICATE _____ CONTROL _____ BLIND _____ TRANS. _____ OTHER THERMOCOUPLE _____ ATS ALLTEMP SERIES 8000 _____				
3	CASE	MFR STD X _____ NOM SIZE 21 mm MNPT PROBE, 27 mm FNPT ELECTRICAL _____ OTHER _____				
4	MOUNTING	FLUSH _____ SURFACE _____ YOKE _____ OTHER REMOTE _____				
5	ENCLOSURE CLASS	GENERAL PURPOSE _____ WATERPROOF _____ EXPLOSIONPROOF _____ CLASS 1, DIV. 2, GR. C & D FOR USE IN INTRINSICALLY SAFE SYSTEM _____ OTHER _____				
6	POWER SUPPLY	117 V 60Hz _____ OTHER AC _____ DC _____ VOLTS _____				
7	CHART	STRIP _____ ROLL _____ FOLD _____ CIRCULAR _____ TIME MARKS _____				
8	CHART DRIVE	SPEED _____ POWER _____				
9	SCALES	TYPE K-TYPE THERMOCOUPLE _____ RANGE 1 0 - 1260 C _____ 2 _____ 3 _____ 4 _____				
10	TRANSMITTER OUTPUT	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(g) _____ 42 - 206 kPa (g) _____ OTHER _____ mV OUTPUT RANGE 0 - 54.5 mV _____				
11	CONTROL MODES	P = PROP ( GAIN ), I = INTEGRAL ( AUTO RESET ), D = DERIVATIVE ( RATE ), SUB : S = SLOW F = FAST P _____ PI _____ PD _____ PID _____ IF _____ DF _____ IS _____ DS _____ OTHER _____				
12	ACTION	ON MEAS. INCREASE OUTPUT : INCREASES _____ DECREASES _____				
13	AUTO - MAN SWITC	NONE _____ MFR STD _____ OTHER _____				
14	SET POINT ADJ.	MANUAL _____ EXTERNAL _____ REMOTE _____ OTHER _____				
15	MANUAL REG.	NONE _____ MFR STD _____ OTHER _____				
16	OUTPUT	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(g) _____ 42 - 206 kPa (g) _____ OTHER _____				
17	FILL	SAMA CLASS _____ COMPENSATION _____				
18	PROCESS DATA	TEMP: NORMAL 116 ° C _____ MAX. 176 ° C _____ MAX. PRESSURE 11377 kPa (g) _____				
19	RANGE	FIXED 0 - 1260 C _____ ADJ. RANGE _____ SET AT _____ ° C				
20	BULB	OVERRANGE PROTECTION TO _____ TYPE SINGLE _____ MTL. 304 SS _____ EXTENSION: LENGTH _____ mm TYPE K-THERMOCOUPLE SIZE: DIAMETER 6.35 mm _____ "A"-LENGTH 139.7 mm _____ INSERTION _____ mm CONN. 21 mm _____ LOCATION _____ mm _____ ABOVE _____ BELOW _____				
21	CAPILLARY	MFR. STD X _____ LENGTH 1524 mm _____ MTL. _____ ARMOR FLEXIBLE _____				
22	WELL	MTL. 304 ss _____ "U" LENGTH 63.5 mm _____ "H" LENGTH 44.5 mm _____ PROC. CON 21mm NPTF CONST: STRAIGHT "B-STYLE" _____ BUILT - UP _____ OTHER _____ x 27mm NPTM				
23	ALARM SWITCHES	QUANTITY _____ FORM _____ RATING _____				
24	FUNCTION	TEMP _____ DEVIATION _____ CONTACTS TO _____ ON TEMP. INCREASE _____				
25	OPTIONS	FILT - REG. _____ SUP. GAGE _____ OUTPUT GAGE _____ CHARTS _____ OTHER _____				
26	MFR. & MODEL NO.	ATS ALLTEMP - SERIES 8000 _____				
27	MODEL NO.	THERMOCOUPLE P/N: AI-8113-U-14-60"-K-7.00" _____				
28	THERMOWELL	THERMOWELL P/N: B 34-1.75"-2.5"-0.25"-4.00"-0"-P/PL-0.26"-0.75" _____				
NOTES:						

AREA, UNIT # : 152

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		TEMPERATURE INSTRUMENTS ( FILLED SYSTEM )				SHEET 5 OF 6	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : TEMPERATURE ELEMENT		NO	BY	DATE	REVISION	SPEC NO	FILE 14.11.T
		1	GWW	00.09.26	ISSUED FOR PURCHASE	JOB #	99404
						DATE	SEPTEMBER 26, 2000
						REQ.	
					BY	CHK'D	APPR.
					GW		
1	TAG NO.: TE - 205	ENGINE REMOTE FILTER CRANKCASE LUBE OIL TEMPERATURE					
2	FUNCTIONS	RECORD _____ INDICATE _____ CONTROL _____ BLIND _____ TRANS. _____ OTHER THERMOCOUPLE _____ ATS ALLTEMP SERIES 8000 _____					
3	CASE	MFR STD <u>X</u> NOM SIZE <u>21 mm MNPT PROBE, 27 mm FNPT ELECTRICAL</u> OTHER _____					
4	MOUNTING	FLUSH _____ SURFACE _____ YOKE _____ OTHER REMOTE _____					
5	ENCLOSURE CLASS	GENERAL PURPOSE _____ WATERPROOF _____ EXPLOSIONPROOF _____ CLASS <u>1, DIV. 2, GR. C &amp; D</u>					
6	POWER SUPPLY	FOR USE IN INTRINSICALLY SAFE SYSTEM _____ OTHER _____					
7	CHART	117 V 60Hz _____ OTHER AC _____ DC _____ VOLTS _____					
8	CHART DRIVE	STRIP _____ ROLL _____ FOLD _____ CIRCULAR _____ TIME MARKS _____					
9	SCALES	SPEED _____ POWER _____					
		TYPE <u>K-TYPE THERMOCOUPLE</u>					
		RANGE 1 <u>0 - 1260 C</u> 2 _____ 3 _____ 4 _____					
X	10 TRANSMITTER OUTPUT	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(g) _____ 42 - 206 kPa (g) _____ OTHER _____					
		mV OUTPUT RANGE <u>0 - 54.5 mV</u>					
C	11 CONTROL MODES	P = PROP ( GAIN ), I = INTEGRAL ( AUTO RESET ), D = DERIVATIVE ( RATE ), SUB : S = SLOW F = FAST P _____ PI _____ PD _____ PID _____ IF _____ DF _____ IS _____ DS _____ OTHER _____					
R	12 ACTION	ON MEAS. INCREASE OUTPUT : INCREASES _____ DECREASES _____					
O	13 AUTO - MAN SWITC	NONE _____ MFR STD _____ OTHER _____					
L	14 SET POINT ADJ.	MANUAL _____ EXTERNAL _____ REMOTE _____ OTHER _____					
L	15 MANUAL REG.	NONE _____ MFR STD _____ OTHER _____					
E	16 OUTPUT	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(g) _____ 42 - 206 kPa (g) _____ OTHER _____					
R							
17	FILL	SAMA CLASS _____ COMPENSATION _____					
18	PROCESS DATA	TEMP: NORMAL <u>82</u> ° C MAX. <u>100</u> ° C MAX. PRESSURE <u>689</u> kPa (g)					
19	RANGE	FIXED <u>0 - 1260 C</u> ADJ. RANGE _____ SET AT <u>96</u> ° C					
20	BULB	OVERRANGE PROTECTION TO _____					
21	CAPILLARY	TYPE <u>SINGLE</u> MTL. <u>304 SS</u> EXTENSION: LENGTH _____ mm TYPE <u>K-THERMOCOUPLE</u> SIZE: DIAMETER <u>6.35</u> mm "A"-LENGTH <u>139.7</u> mm INSERTION _____ mm CONN. <u>21 mm</u> LOCATION _____ mm ABOVE _____ BELOW _____ MFR. STD <u>X</u> LENGTH <u>1524</u> mm MTL. _____ ARMOR <u>FLEXIBLE</u>					
22	WELL	MTL. <u>304 ss</u> "U" LENGTH <u>63.5</u> mm "H" LENGTH <u>44.5</u> mm PROC. CON <u>21mm NPTF</u> CONST: STRAIGHT "B-STYLE" _____ BUILT - UP _____ OTHER _____ x 27mm NPTM					
23	ALARM SWITCHES	QUANTITY _____ FORM _____ RATING _____					
24	FUNCTION	TEMP _____ DEVIATION _____ CONTACTS TO _____ ON TEMP INCRFASF _____					
25	OPTIONS	FILT - REG. _____ SUP. GAGE _____ OUTPUT GAGE _____ CHARTS _____ OTHER _____					
26	MFR. & MODEL NO.	<u>ATS ALLTEMP - SERIES 8000</u>					
27	MODEL NO.	<u>THERMOCOUPLE P/N: AI-8113-U-14-36"-K-7.00"</u>					
28	THERMOWELL	<u>THERMOWELL P/N: B 34-1.75"-2.5"-0.25"-4.00"-0"-P/PL-0.26"-0.75"</u>					
NOTES:							

AREA, UNIT # : 152

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIF, ALBERTA, CANADA T4B 2C3		TEMPERATURE INSTRUMENTS ( FILLED SYSTEM )			SHEET 5 OF 6 SPEC NO _____ FILE 14.11.T		
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : TEMPERATURE ELEMENT		NO	BY	DATE	REVISION	JOB # 99404	
		1	GWW	00.09.26	ISSUED FOR PURCHASE	DATE SEPTEMBER 26, 2000	
							REQ.
							BY _____ CHK'D _____ APPR. _____
1 TAG NO.: TE - 282		COMPRESSOR CRANKCASE LUBE OIL TEMPERATURE					
G E N E R A L	2 FUNCTIONS	RECORD _____ INDICATE _____ CONTROL _____ BLIND _____ TRANS. _____ OTHER _____ THERMOCOUPLE _____ ATS ALLTEMP SERIES 8000 _____					
	3 CASE	MFR. STD <u>X</u> _____ NOM. SIZE <u>21 mm MNPT PROBE, 27 mm FNPT ELECTRICAL</u> _____ OTHER _____					
	4 MOUNTING	FLUSH _____ SURFACE _____ YOKE _____ OTHER REMOTE _____					
	5 ENCLOSURE CLASS	GENERAL PURPOSE _____ WATERPROOF _____ EXPLOSIONPROOF _____ CLASS <u>1, DIV. 2, GR. C &amp; D</u> FOR USE IN INTRINSICALLY SAFE SYSTEM _____ OTHER _____					
	6 POWER SUPPLY	117 V 60Hz _____ OTHER AC _____ DC _____ VOLTS _____					
	7 CHART	STRIP _____ ROLL _____ FOLD _____ CIRCULAR _____ TIME MARKS _____					
	8 CHART DRIVE	SPEED _____ POWER _____					
	9 SCALES	TYPE <u>K-TYPE THERMOCOUPLE</u> RANGE 1 <u>0 - 1260 C</u> 2 _____ 3 _____ 4 _____					
	X M T	10 TRANSMITTER OUTPUT	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(g) _____ 42 - 206 kPa (g) _____ OTHER _____ mV OUTPUT RANGE <u>0 - 54.5 mV</u>				
11 CONTROL MODES		P = PROP ( GAIN ), I = INTEGRAL ( AUTO RESET ), D = DERIVATIVE ( RATE ), SUB : S = SLOW F = FAST P _____ PI _____ PD _____ PID _____ IF _____ DF _____ IS _____ DS _____ OTHER _____					
R O L L E R	12 ACTION	ON MEAS. INCREASE OUTPUT :INCREASES _____ DECREASES _____					
	13 AUTO - MAN SWITC	NONE _____ MFR. STD _____ OTHER _____					
	14 SET POINT ADJ.	MANUAL _____ EXTERNAL _____ REMOTE _____ OTHER _____					
	15 MANUAL REG.	NONE _____ MFR. STD _____ OTHER _____					
E M E N T	16 OUTPUT	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(g) _____ 42 - 206 kPa (g) _____ OTHER _____					
	17 FILL	SAMA CLASS _____ COMPENSATION _____					
	18 PROCESS DATA	TEMP: NORMAL <u>73</u> ° C MAX. <u>88</u> ° C MAX. PRESSURE <u>689</u> kPa(g) RANGE FIXED <u>0 - 1260 C</u> ADJ. RANGE _____ SET AT <u>82</u> ° C OVERRANGE PROTECTION TO _____					
	19 BULB	TYPE <u>SINGLE</u> MTL. <u>304 SS</u> EXTENSION: LENGTH _____ mm TYPE <u>K-THERMOCOUPLE</u> SIZE: DIAMETER <u>6.35</u> mm "A"-LENGTH <u>139.7</u> mm INSERTION _____ mm CONN. <u>21 mm</u> LOCATION _____ mm ABOVE _____ BELOW _____					
	20 CAPILLARY	MFR. STD <u>X</u> LENGTH <u>1524</u> mm MTL. _____ ARMOR <u>FLEXIBLE</u> 21 WELL MTL. <u>304 ss</u> "U" LENGTH <u>63.5</u> mm "H" LENGTH <u>44.5</u> mm PROC. CON <u>21mm NPTF</u> CONST: STRAIGHT <u>"B-STYLE"</u> BUILT - UP _____ OTHER _____ x 27mm NPTM					
23 24	ALARM SWITCHES	QUANTITY _____ FORM _____ RATING _____					
	FUNCTION	TEMP _____ DEVIATION _____ CONTACTS TO _____ ON TEMP. INCREASE _____					
25	OPTIONS	FILT - REG. _____ SUP. GAGE _____ OUTPUT GAGE _____ CHARTS _____ OTHER _____					
	26 MFR. & MODEL NO.	<u>ATS ALLTEMP - SERIES 8000</u>					
27 MODEL NO.	<u>THERMOCOUPLE P/N: AI-8113-U-14-36"-K-7.00"</u>						
28 THERMOWELL	<u>THERMOWELL P/N: B 34-1.75"-2.5"-0.25"-4.00"-0"-P/PL-0.26"-0.75"</u>						
NOTES:							

AREA. UNIT # : 152









PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		TEMPERATURE INSTRUMENTS ( FILLED SYSTEM )			SHEET _____ OF _____ SPEC NO _____ FILE 14.11.T	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : 1478HP COMPRESSOR PACKAGE		NO 0	BY GWW	DATE 00.10.02	REVISION FOR PURCHASE	JOB # 99404 DATE _____ REQ _____ BY _____ CHK'D _____ APPR. _____ GWW _____

1	TAG NO.	TIC/TE-225	AIR COOLER PLENUM TEMPERATURE			
2	FUNCTIONS	RECORD _____ INDICATE <input checked="" type="checkbox"/>	CONTROL <input checked="" type="checkbox"/>	BLIND _____	TRANS. _____	
3	CASE	MFR STD <input checked="" type="checkbox"/>	NOM SIZE _____	COLOR : MFR STD <input checked="" type="checkbox"/>	OTHER _____	
4	MOUNTING	FLUSH _____	SURFACE _____	YOKE _____	OTHER WALL MOUNT _____	
5	ENCLOSURE CLASS	GENERAL PURPOSE _____	WATERPROOF <input checked="" type="checkbox"/>	EXPLOSIONPROOF _____	CLASS _____	
6	POWER SUPPLY	FOR USE IN INTRINSICALLY SAFE SYSTEM _____	OTHER _____	DC _____	VOLTS _____	
7	CHART	STRIP _____	ROLL _____	FOLD _____	CIRCULAR _____	TIME MARKS _____
8	CHART DRIVE	SPEED _____			POWER _____	
9	SCALES	TYPE _____				
		RANGE 1 _____	2 _____	3 _____	4 _____	
10	TRANSMITTER OUTPUT	4 - 20 mA _____	10 - 50 mA _____	3 - 15 psi(g) _____	6 - 30 psi(g) _____	OTHER _____
		FOR RECEIVER SEE SPEC. SHEET _____				
11	CONTROL MODES	P = PROP (GAIN), I = INTEGRAL (AUTO RESET), D = DERIVATIVE (RATE), SUB: S = SLOW F = FAST P _____ PI <input checked="" type="checkbox"/> PD _____ PID _____ IF _____ DF _____ IS _____ DS _____ OTHER _____				
12	ACTION	ON MEAS. INCREASE OUTPUT :	INCREASES <input checked="" type="checkbox"/>	DECREASES _____		
13	AUTO - MAN SWITCH	NONE <input checked="" type="checkbox"/>	MFR STD _____	OTHER _____		
14	SET POINT ADJ.	MANUAL <input checked="" type="checkbox"/>	EXTERNAL _____	REMOTE _____	OTHER _____	
15	MANUAL REG.	NONE <input checked="" type="checkbox"/>	MFR STD _____	OTHER _____		
16	OUTPUT	4 - 20 mA _____	10 - 50 mA _____	3 - 15 psi(g) _____	6 - 30 psi(g) <input checked="" type="checkbox"/>	OTHER _____
17	FILL	SAMA CLASS _____	COMPENSATION _____			
18	PROCESS DATA	TEMP: NORMAL _____ ° F	MAX. 10-100 _____ ° F	MAX. PRESSURE ATM _____	psi(g) _____	
19	RANGE	FIXED _____ ° F	ADJ. RANGE _____	SET AT _____	° F _____	
20	BULB	TYPE _____	MTL. SS _____	EXTENSION: _____	LENGTH _____ in.	TYPE _____
		SIZE: DIAMETER _____ in.	LENGTH _____ in.	INSERTION _____	in.	
		CONN. _____	LOCATION _____ in.	ABOVE _____	BELOW _____	
21	CAPILLARY	MFR. STD <input checked="" type="checkbox"/>	LENGTH 180 _____ in.	MTL. SS _____	ARMOR <input checked="" type="checkbox"/>	
22	WELL	MTL. _____	INSERTION _____ in.	LAG EXT. _____ in.	CONN. _____	
		CONST: DRILLED _____	BUILT - UP _____	OTHER _____		
23	ALARM SWITCHES	QUANTITY _____	FORM _____	RATING _____		
24	FUNCTION	TEMP _____	DEVIATION _____	CONTACTS TO _____	ON TEMP. INCREASE _____	
25	OPTIONS	FILT - REG. _____	SUP. GAGE _____	OUTPUT GAGE _____	CHARTS _____	
		OTHER _____				
26	MFR. & MODEL NO.	FISHER _____				
27	MODEL NO.	4196BE _____				
28	P. O. NUMBER	_____				

NOTES:

AREA. UNIT # :

**ACTION:**

Indirect throttle; Pilot Output Pressure (Yellow) decreases with temperature rise.

**APPLICATION:**

For temperature control of indirect heaters, emulsion treaters, reboilers, steam generators, heat exchangers cooler shutter controllers, and salt bath heaters.

**WORKING PRESSURE (sensing element):**

p.s.i.g.	kg/cm <sup>2</sup>
500	35.15 max. without Separable Socket.
4000	281.23 max. with Separable Socket.
7000	492.15 max. with Special Separable Socket.

Separable Socket is an extra price item and must be ordered separately, if desired. To order Separable Sockets refer to Table of Contents.

**TEMPERATURE RANGE:**

T 12T, T 18T	-30°F minimum to 400°F maximum.
	-34°C minimum to 204°C maximum.
HT 12T, HT 18T	-30°F minimum to 750°F maximum.
	-34°C minimum to 399°C maximum.
HT 12T-S, HT 18T-S	-30°F minimum to 750°F maximum.
	-34°C minimum to 399°C maximum.

**OPERATION:**

These Thermostats each consist of a Base Assembly sending an indirect throttle signal to operate a 3 PG Pilot. The 3 PG Pilot is connected as a throttle pilot and amplifies this signal increasing the sensitivity of the Base Assembly.

Assume the set temperature of the Thermostat is above the temperature of the system being controlled and Output Pressure (Yellow) is being sent to a Pilot or Motor Valve.

As the system temperature rises, the STAINLESS TUBE increases in length to move the Thermostat Diaphragm (or Bellows) Assembly in a direction to first close the seat at BALL 1 (Violet to Orange) and open the seat at BALL 2 (Orange to Atmosphere). As Variable Pressure (Orange) decreases the 3 PG Pilot Diaphragm Assembly moves upward to close the seat at BALL 4 (Violet to Yellow) and open the seat at BALL 3 (Yellow to Atmosphere). Pilot Output Pressure (Yellow) is vented for the desired Pilot or Motor Valve action.

As the system temperature decreases, the action is reversed to increase Pilot Output Pressure (Yellow).

Due to the low modulating characteristic of a Motor Valve, the action of this controller will not be a true throttle action but will have a tendency to over ride the control point. The 112 SMT-T is the recommended Motor Valve for this thermostat configuration. Refer to "Burner Valves" in the Table of Contents for more information.

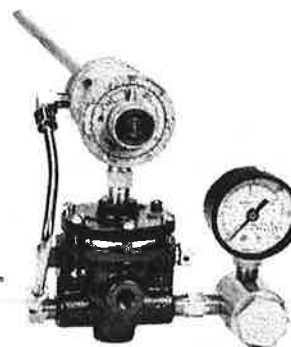
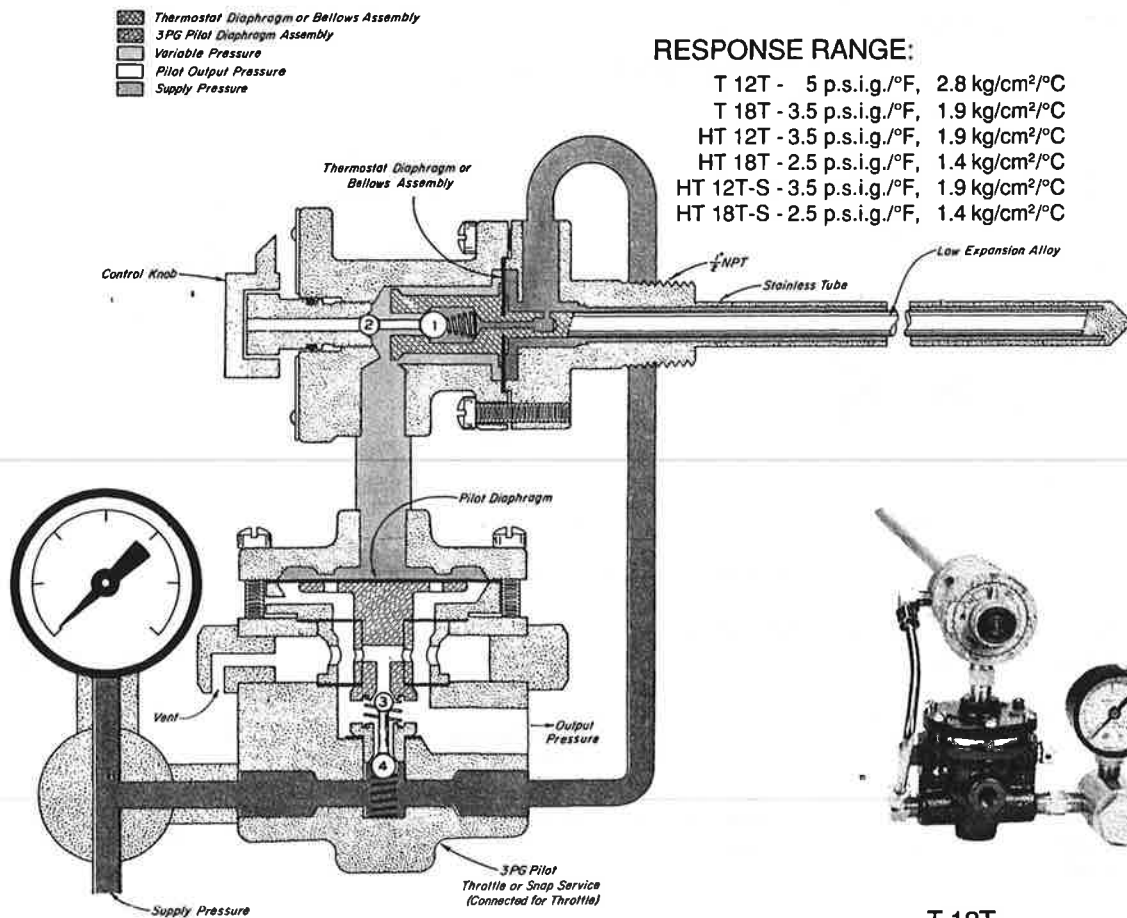
The 3 PG Pilot may be used for snap service when connected as a snapper pilot. For snap connection of the 3 PG Pilot refer to catalog section "Y".

**SUPPLY PRESSURE:**

5 to 30 p.s.i.g.
.35 to 2.11 kg/cm <sup>2</sup> .

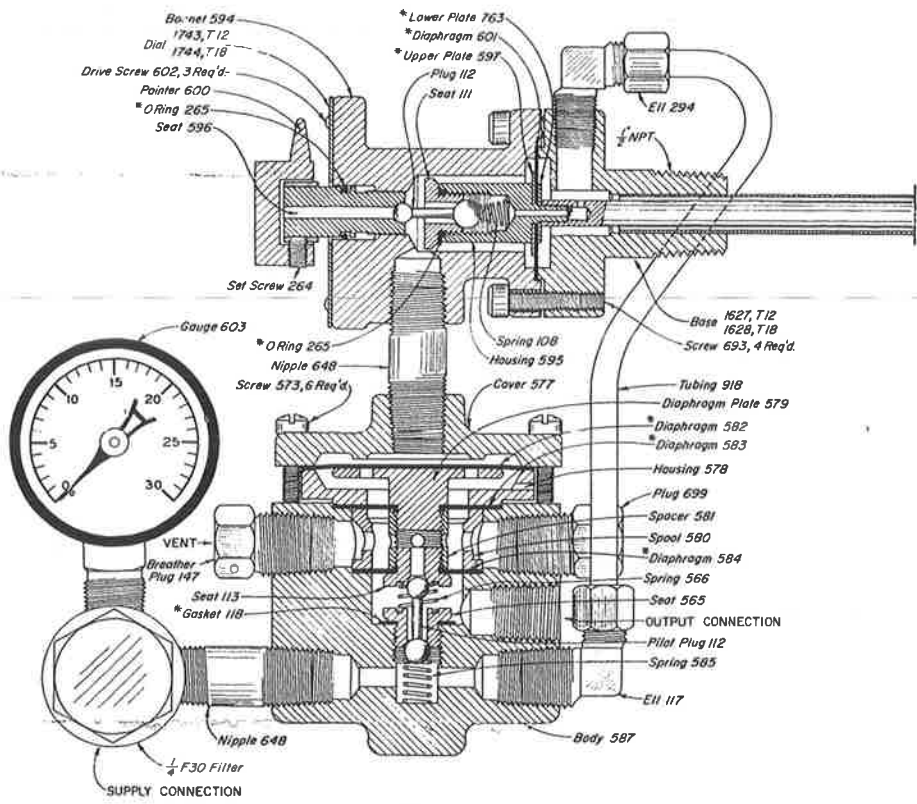
**RESPONSE RANGE:**

T 12T - 5 p.s.i.g./°F,	2.8 kg/cm <sup>2</sup> /°C
T 18T - 3.5 p.s.i.g./°F,	1.9 kg/cm <sup>2</sup> /°C
HT 12T - 3.5 p.s.i.g./°F,	1.9 kg/cm <sup>2</sup> /°C
HT 18T - 2.5 p.s.i.g./°F,	1.4 kg/cm <sup>2</sup> /°C
HT 12T-S - 3.5 p.s.i.g./°F,	1.9 kg/cm <sup>2</sup> /°C
HT 18T-S - 2.5 p.s.i.g./°F,	1.4 kg/cm <sup>2</sup> /°C

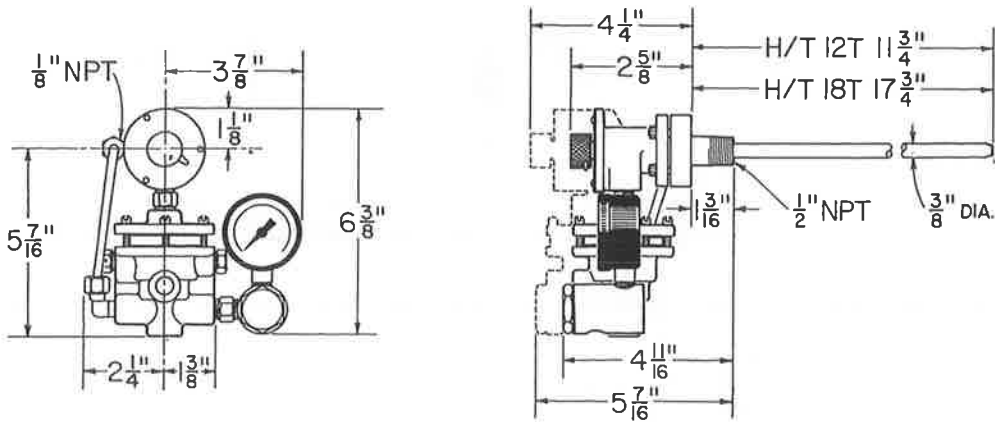


T 12T

T 12/18T  
 CAST IRON  
 500 lbs. W.P.  
 -30°F to 400°F, -34°C to 204°C



THERMOSTAT DIMENSIONS



ALL TAPPED OPENINGS ARE 1/4" NPT EXCEPT AS NOTED.

INDIRECT THROTTLE ACTION THERMOSTATS  
 AVAILABLE: CAST IRON, 500 lbs. W.P.

CAT. NO.	THERMOSTAT MODEL	MAX. TEMP. °F	MAX. TEMP. °C
HAI	T 12T	400	204
HAI	T 18T	400	204
HBI	HT 12T	750	399
HBJ	HT 18T	750	399

\*These are recommended spare parts and are stocked as repair kits. To order repair kit, specify; "T12 Repair Kit, RLA" or "HT 12 Repair Kit, RLR."

Separable Sockets are available at extra cost, refer to Table of Contents for ordering.

For HT 12T, HT 18T High Temperature Base Assembly parts, refer to "Base Assemblies" in Table of Contents.

TE-100/110/120/122A/B  
124/126/205/282

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# THERMO-KINETICS INDUSTRIAL THERMOCOUPLES

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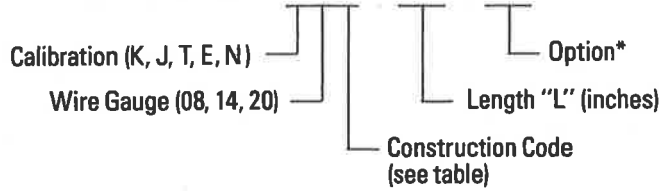
*Sensible Solutions to Temperature Measurement*



**THERMO-KINETICS**  
COMPANY LIMITED

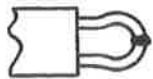
# THERMOCOUPLE ELEMENTS (Base Metal)

(Sample Configuration) **CATALOG NUMBER:** TK - K14B - 12.0 - X18



CONSTRUCTION CODE		DESCRIPTION	ILLUSTRATION
BUTT-WELD	TWIST-WELD		
A	H	Bare Element	
B	J	Oval, Double-Bore 3" long insulators	
C	K	Round, Double-Bore 3" long insulators	
D	L	Round, Single-Bore 1" long insulators	
E	M	Fish Spine Insulators	
F	N	Round, Four-Bore 3" long insulators	
G	P	Angle type, 3" long oval double bore with fish spine at bend	
S		Special (describe in detail)	<p>*OPTION for angle-type specify "X" length in inches eg: X18</p>

Standard construction is butt-weld with oval insulators (type B)



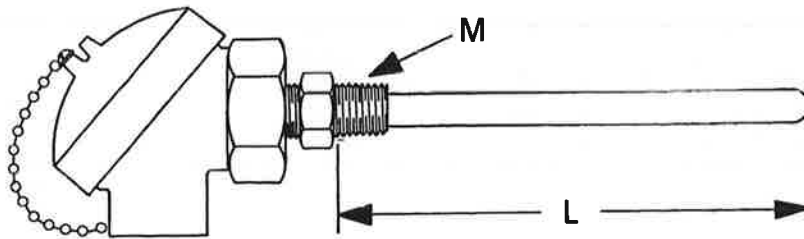
Butt-welded junction



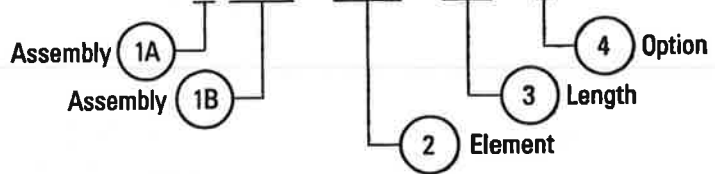
Twist-welded junction



# CERAMIC PROTECTION TUBES (Base Metal Thermocouples)



(Sample Configuration) **CATALOG NUMBER:** TA - A 5240 - J20B - 18.0 - 0



1A HEAD	
CODE	DESCRIPTION
A	Aluminum - G.P.
B	Aluminum - H.D.
C	Cast Iron - G.P.
D	Cast Iron - H.D.
G	GUAB
S	Special

2 ELEMENT
See details on page 2

3 LENGTH
Specify length "L" in inches.

Standard lengths: 12-48" in 6" increments

4A OPTIONS	
CODE	DESCRIPTION
0	None
*F	Adjustable flange
*W	Weatherproof cover
**M	Mounting sleeve (see 4B)
X	Special (describe in detail)

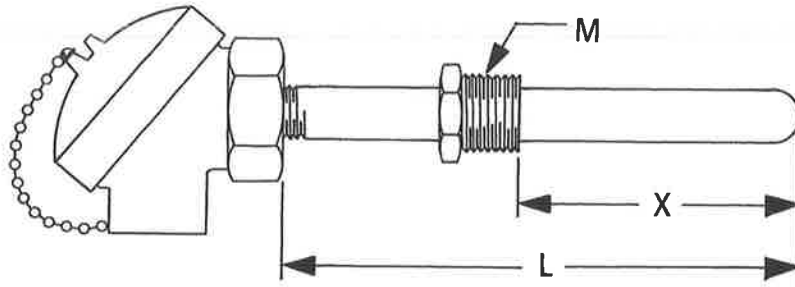
\*for Silicon Carbide tube only

\*\*for all except Silicon Carbide

1B PROTECTION TUBE			
CODE	MATERIAL (O.D. x I.D.)	"M"	REPLACEMENT P/N
5130	Mullite (3/8" x 1/4")	3/4" NPT	CP-0604-32-"L"
5230	Mullite (11/16" x 7/16")	3/4" NPT	CP-1107-32-"L"
5240	Mullite (11/16" x 7/16")	1" NPT	CP-1107-42-"L"
5350	Mullite (1" x 3/4")	1-1/4" NPT	CP-1612-53-"L"
6130	Alumina (3/8" x 1/4")	3/4" NPT	AP-0604-32-"L"
6230	Alumina (11/16" x 7/16")	3/4" NPT	AP-1107-32-"L"
6240	Alumina (11/16" x 7/16")	1" NPT	AP-1107-42-"L"
6350	Alumina (1" x 3/4")	1-1/4" NPT	AP-1612-53-"L"
7400	Silicon Carbide (1 3/4" x 1")	—	SP-2816-SC-"L"

4B MOUNTING SLEEVE DETAILS	

# METAL PROTECTION TUBES (Base Metal Thermocouples)



(Sample Configuration) **CATALOG NUMBER: TA - A 432 A - K14B - 24.0 - B 4S16**

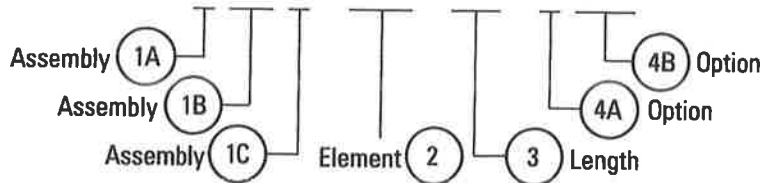
1A HEAD	
CODE	DESCRIPTION
A	Aluminum - G.P.
B	Aluminum - H.D.
C	Cast Iron - G.P.
D	Cast Iron - H.D.
G	GUAB
S	Special

1C JUNCTION	
CODE	DESCRIPTION
A	Grounded
B	Insulated
C	Exposed (open ended tube)

2 ELEMENT
See details on page 2

3 LENGTH
Specify length "L" in inches.

4A OPTIONS	
CODE	DESCRIPTION
O	None
A	Angle Type (see P. 5)
B	Welded Bushing
F	Adjustable Flange
P	Pipe Extension (see P. 5)
S	Special (describe in detail)



1B PROTECTION TUBE		
CODE	MATERIAL	REPLACEMENT P/N
421	1/2" C. Stl. Sch 40	MP-10040-08-"L"
422	1/2" 304 SS, Sch 40	MP-30440-08-"L"
423	1/2" 310 SS, Sch 40	MP-31040-08-"L"
424	1/2" 316 SS, Sch 40	MP-31640-08-"L"
425	1/2" 347 SS, Sch 40	MP-34740-08-"L"
426	1/2" 446 SS, Sch 40	MP-44640-08-"L"
427	1/2" INC 600, Sch 40	MP-60040-08-"L"
110	Cast Iron	MP-11097-00-"L"
210	LT-1 Metal Ceramic	MP-21075-03-"L"
320	Lava Coated Pipe	LP-3210-08-"L"
999	Unlisted — specify part, material, size etc.	

For Sch 80 pipe, change 1st digit from 4 to 8 (eg. 832 for Sch 80 304SS)  
 For 3/4" or 1" pipe, change 2nd digit from 2 to 3 or 4. (eg. 443 for 1" 304SS)  
 Also change 08 to 12 or 16 in replacement P/N

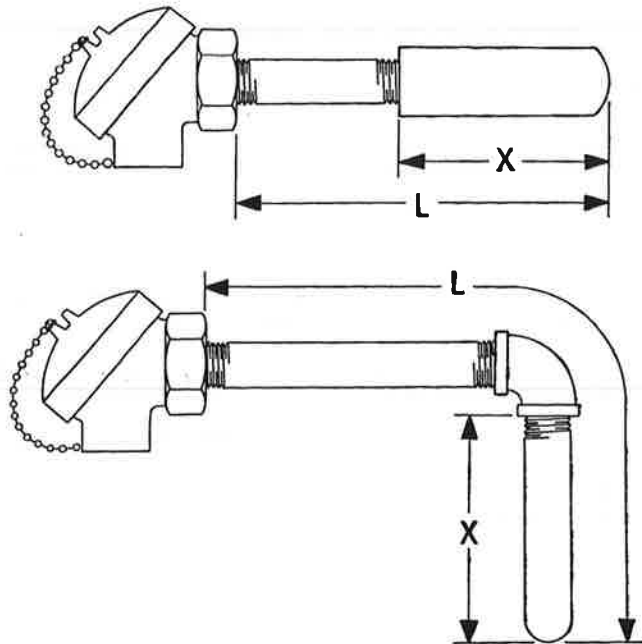
4B WELDED BUSHING DETAILS (for opt. B only)	
B 4 S 16	
"X" length in inches	
MATERIAL: C = Carbon Steel S = Stainless Steel	
THREAD SIZE: 2: 1/2" NPT 4: 1" NPT (M) 3: 3/4" NPT 5: 1-1/4" NPT	



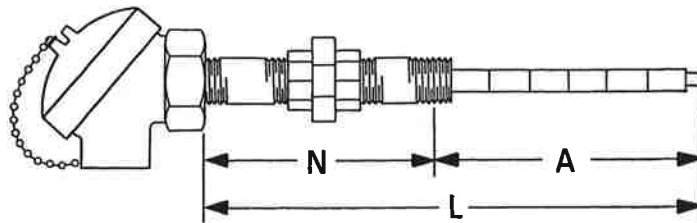
# PIPE & ANGLE EXTENSION ASSEMBLIES

- P C 12

"X" length (inches)  
 MATERIAL: C = Carbon steel  
 S = Stainless steel  
 P = Pipe Extension  
 A = Angle Type



# N & NUN ASSEMBLIES

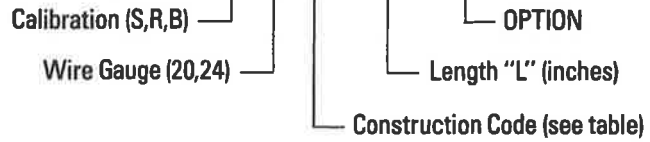


(Sample Configuration) **CATALOG NUMBER:** TA - A N 2 30 - ELEMENT - LENGTH - OPTION

Head (see table 1A page 4)  
 N: Nipple; U: Nipple-Union-Nipple  
 2: 1/2" NPT; 3: 3/4" NPT  
 "N" Length in inches  
 (eg. 30 = 3", 35 = 3.5")  
 See page 2  
 O: None  
 W: Assembled with T/W  
 (ordered separately)  
 S: Special - describe  
 Total length "L" (inches)

# THERMOCOUPLE ELEMENTS (Noble Metal)

(Sample Configuration) **CATALOG NUMBER:** TK - S 24 X - 24.0 - 0

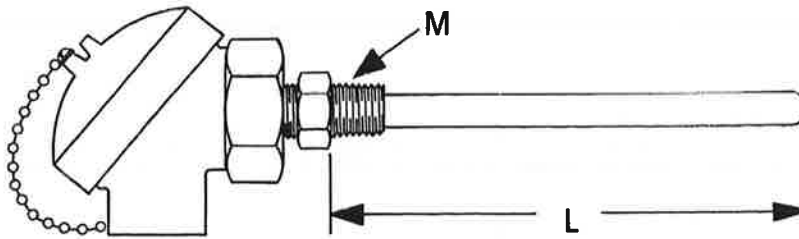


CONSTRUCTION CODE		
CODE	DESCRIPTION	ILLUSTRATION
T	Bare element	
U	Mullite, double bore full length insulator	
V	Alumina, double bore full length insulator	
W	Mullite, double bore full length insulate with collar	
X	Alumina, double bore full length insulator with collar	
Y	Mullite 4 bore full length insulator	
Z	Alumina 4 bore full length insulator	
S	Special (describe in detail)	

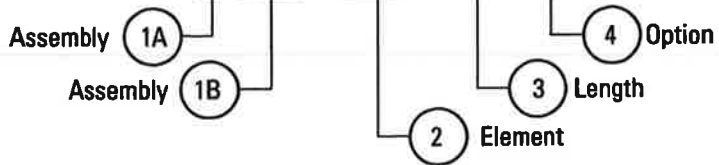
Codes U to Z include Copper sleeves attached to end of each head.

OPTIONS	
O	None
C	Delete copper sleeves (not required for type 'E' head)

# SINGLE PROTECTION TUBE (Noble Metal Thermocouples)



(Sample Configuration) **CATALOG NUMBER:** TA - A 5230 - R24X - 18.0 - 0



1A HEAD	
CODE	DESCRIPTION
A	Aluminum - G.P.
B	Aluminum - H.D.
C	Cast Iron - G.P.
D	Cast Iron - H.D.
G	GUAB
S	Special

2 ELEMENT
See details on page 6

3 LENGTH
Specify length "L" in inches.

Standard lengths: 12-48" in 6" increments

4A OPTIONS	
CODE	DESCRIPTION
0	None
M	Mounting Sleeve (see 4B)
X	Special (describe in detail)

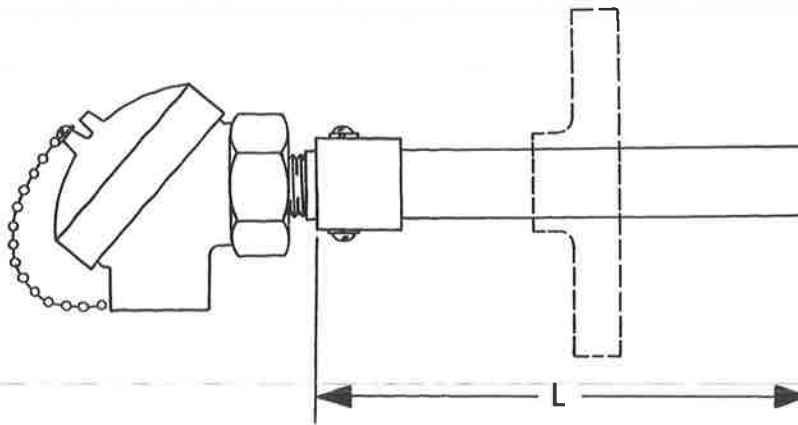
1B PROTECTION TUBE			
CODE	MATERIAL (O.D. x I.D.)	"M"	REPLACEMENT P/N
5130	Mullite (3/8" x 1/4")	3/4" NPT	CP-0604-32-"L"
5230	Mullite (11/16" x 7/16")	3/4" NPT	CP-1107-32-"L"
5240	Mullite (11/16" x 7/16")	1" NPT	CP-1107-42-"L"
5350	Mullite (1" x 3/4")	1-1/4" NPT	CP-1612-53-"L"
6130	Alumina (3/8" x 1/4")	3/4" NPT	AP-0604-32-"L"
6230	Alumina (11/16" x 7/16")	3/4" NPT	AP-1107-32-"L"
6240	Alumina (11/16" x 7/16")	1" NPT	AP-1107-42-"L"
6350	Alumina (1" x 3/4")	1-1/4" NPT	AP-1612-53-"L"

### 4B MOUNTING SLEEVE DETAILS

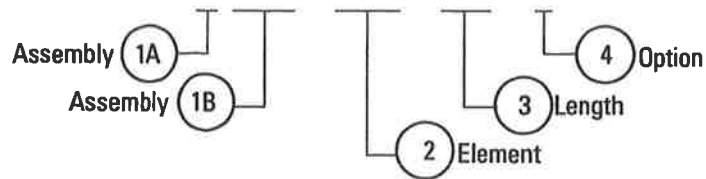
M S 4 F

- F = Adjustable Flange
- Sleeve length (X) in inches
- C = Carbon Steel
- S = Stainless Steel

# DOUBLE PROTECTION TUBE (Noble Metal Thermocouples)



(Sample Configuration) **CATALOG NUMBER: TA - A 524R - R24X - 24.0 - F**



1A HEAD	
CODE	DESCRIPTION
A	Aluminum - G.P.
B	Aluminum - H.D.
C	Cast Iron - G.P.
D	Cast Iron - H.D.
G	GUAB
S	Special

2 ELEMENT
See details on page 6

4 OPTIONS	
CODE	DESCRIPTION
0	None
**F	Adjustable flange
**W	Weatherproof cover

3 LENGTH
Specify length "L" in inches.

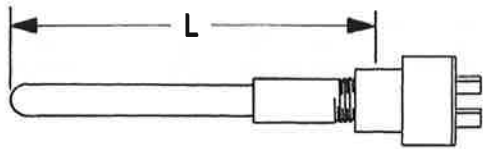
\*\*For SiC outer tube only

Standard lengths: 12-48" in 6" increments

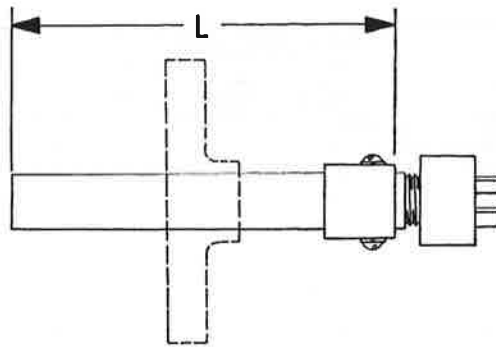
1B PROTECTION TUBES								
CODE	PRIMARY (INNER) TUBE				SECONDARY (OUTER) TUBE			
	MATERIAL	O.D.	I.D.	REPLACEMENT P/N	MATERIAL	O.D.	I.D.	REPLACEMENT P/N
513M	Mullite	3/8"	1/4"	CP-0604-00-"L"	Mullite	11/16"	7/16"	CP-1107-32-"L"
513R				CP-0604-00-"L"	Alumina	11/16"	7/16"	AP-1107-32-"L"
513S				CP-0604-42-"L"	SiC	1 3/4"	1"	SP-2816-SC-"L"
524M	Mullite	11/16"	7/16"	CP-1107-00-"L"	Mullite	1"	3/4"	CP-1612-53-"L"
524R				CP-1107-00-"L"	Alumina	1"	3/4"	AP-1612-53-"L"
524S				CP-1107-42-"L"	SiC	1 3/4"	1"	SP-2816-SC-"L"
613R	Alumina	3/8"	1/4"	AP-0604-00-"L"	Alumina	11/16"	7/16"	AP-1107-32-"L"
613S				AP-0604-42-"L"	SiC	1 3/4"	1"	SP-2816-SC-"L"
613I				AP-0604-00-"L"	Inconel	1/2" pipe		MP-60040-08-"L"
624R	Alumina	11/16"	7/16"	AP-1107-00-"L"	Alumina	1"	3/4"	AP-1612-53-"L"
624S				AP-1107-42-"L"	SiC	1 3/4"	1"	SP-2816-SC-"L"
624I				AP-1107-00-"L"	Inconel	3/4" pipe		MP-60040-12-"L"

Note: For mounting sleeve see details in chart 4B on page 7.

# OPEN STYLE HEAD (Noble Metal Thermocouples)

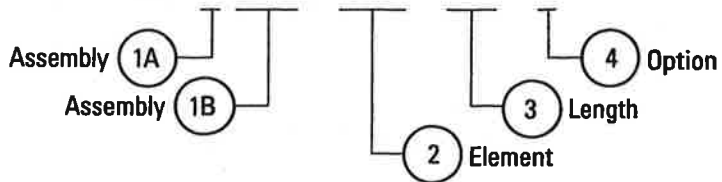


**SINGLE PROTECTION TUBE**



**DOUBLE PROTECTION TUBE**

(Sample Configuration) **CATALOG NUMBER: TA - E 5220 - R24X - 360 - 0**



1A HEAD	
CODE	DESCRIPTION
E	Open Style

2 ELEMENT
See details on page 6

3 LENGTH
Specify length "L" in inches.

Standard lengths: 12-48" in 6" increments

4 OPTIONS	
CODE	DESCRIPTION
0	None
F**	Adjustable flange

\*\*For SiC outer tube only

1B PROTECTION TUBE (single)		
CODE	MATERIAL (O.D. x I.D.)	REPLACEMENT P/N
5110	Mullite (3/8" x 1/4")	CP-0604-27-"L"
5210	Mullite (11/16" x 7/16")	CP-1107-27-"L"
6110	Alumina (3/8" x 1/4")	AP-0604-27-"L"
6210	Alumina (11/16" x 7/16")	AP-1107-27-"L"

1B PROTECTION TUBE (double)							
CODE	PRIMARY (INNER) TUBE*			SECONDARY (OUTER) TUBE			
	MATERIAL	OD	ID	MATERIAL	OD	ID	REPLACEMENT P/N
522S	Mullite	11/16"	7/16"	SiC	1-3/4"	1"	SP-2816-SC-"L"
622S	Alumina	11/16"	7/16"	SiC	1-3/4"	1"	SP-2816-SC-"L"

* REPLACEMENT P/N (Primary Tube)	
Mullite	CP-1107-27-"L"
Alumina	AP-1107-27-"L"

# REFERENCE DATA

THERMOCOUPLE WIRE RESISTANCE								
WIRE Ga	LOOP RESISTANCE ( $\Omega$ /FT @ 20°C)							
	J	K	T	E	N	S	R	B
*7	.021							
8	.022	.036	.019	.044				
14	.089	.147	.074	.176	.198			
16	.141	.232	.117	.277	.308			
18	.229	.377	.190	.450	.500	.112	.113	.139
20	.357	.588	.297	.702	.781	.175	.178	.218
24	.905	1.488	.754	1.778	1.98	.449	.453	.550
28	2.297	3.59	1.92	4.33	5.04	1.062	1.073	1.392
30	3.65	6.02	2.94	7.19	8.00	1.794	1.813	2.213

\*7 Ga Iron with 8 Ga Constantan

THERMOCOUPLE WIRE WEIGHT (ft/lb)										
WIRE Ga	TYPE J		TYPE K		TYPE T		TYPE E		TYPE N	
	Iron + JP	Constantan - JN	Chromel + KP	Alumel - KN	Copper + TP	Constantan - TN	Chromel + EP	Constantan - EN	Nicrosil	Nisil
7	18.0									
8	22.8	20.2	21	21	19.8	20.2	21	20.2	21	20.9
14	91.2	80.9	83	83	80.5	80.9	83	80.9	84	83.6
16	144	127	130	130	128	127	130	127	132	131
18	233	207	212	212	203	207	212	207	215	214
20	365	324	331	331	324	324	331	324	336	334
24	925	821	838	838	820	821	838	821	861	847
28	2353	2089	2130	2130	2062	2089	2130	2089	2170	2156
30	3736	3316	3370	3370	3294	3316	3370	3316	3445	3423

RESPONSE TIME (sec)		
WIRE O.D.	GRDED. JCT	INSUL. JCT
.040"	.08	.12
.063"	.1	.25
.125"	.35	1.5
.188"	.75	7.5
.250"	1.75	4.5
.375"	4.0	8.5

T/C WIRE SIZE	
GAUGE	DIAMETER (in)
7	0.1443
8	0.1285
14	0.0641
16	0.0508
18	0.0403
20	0.0320
22	0.0253
24	0.0201
28	0.0126
30	0.0100

# APPLICATION DATA

CALIBRATION	RECOMMENDED TEMP. RANGE	APPLICATION INFORMATION
J	0 to 760°C (32 to 1400°F)	Suitable for vacuum, reducing, or inert atmospheres; oxidizing atmospheres with reduced life. Iron oxidizes rapidly above 540°C (1000°F) so only heavy gauge wire is recommended for high temperature. Bare elements should not be exposed to sulphurous atmospheres above 540°C (1000°F).
K	0 to 1260°C (32 to 2300°F)	Recommended for continuous oxidizing or neutral atmospheres. Mostly used above 540°C (1000°F). Subject to failure if exposed to sulphur. Preferential oxidation of chromium in positive leg at certain low oxygen concentrations causes "green rot" and large negative calibration drifts; most serious in the 820–1040°C (1500–1900°F) range. Ventilation or inert sealing of the protection tube can prevent this.
T	– 185 to 370°C (– 300 to 700°F)	Useable in oxidizing, reducing, or inert atmospheres as well as vacuum. Not subject to corrosion in moist atmospheres. Limits of error published for sub-zero temperature ranges.
E	0 to 870°C (32 to 1600°F)	Recommended for continuously oxidizing or inert atmospheres. Sub-zero limits of error not established. Highest thermoelectric output of common calibrations.
N	0 to 1260°C (32 to 2300°F)	Can be used in applications where Type K elements have shorter life and stability problems due to oxidation and the development of "Green Rot".
R S	540 to 1480°C (1000 to 2700°F)	Recommended for high temperature. Must be protected with nonmetallic protection tube and ceramic insulators. Continued high temperature usages causes grain growth which can lead to mechanical failure. Negative calibration drift caused by rhodium diffusion to pure leg as well as from rhodium volatilization.
B	870 to 1700°C (1600 to 3100°F)	Same as R&S but output is lower. Also less susceptible to grain growth and drift. Can be used at higher temperature.

## LIMITS · OF · ERROR

TC TYPE	TEMPERATURE RANGE		LIMITS-OF-ERRORS*	
	°C	°F	STANDARD	SPECIAL
J	0 to 760°C	32-1400°F	±0.75% or 2.2°C (4°F)	±0.4% or 1.1°C (2°F)
K	0 to 1250°C	32 to 2300°F	±0.75% or 2.2°C (4°F)	±0.4% or 1.1°C (2°F)
	-200 to 0°C	-330 to 32°F	±2% or 2.2°C (4°F)	—
T	0 to 350°C	32 to 200°F	±0.75% or 2.2°C (4°F)	±0.4% or 1.1°C (2°F)
	-200 to 0°C	-330 to 32°F	1.5% or 1°C (1.8°F)	—
E	0 to 900°C	32 to 1100°F	±0.5% or 1.7°C (3°F)	±0.4% or 1.1°C (2°F)
	-200 to 0°C	-330 to 32°F	±1% or 1.7°C (3°F)	—
N	0 to 1250°C	32 to 2280°F	±0.75% or 2.2°C (4°F)	—
R	0 to 1400°C	32 to 2640°F	±0.25% or 1.5°C (2.7°F)	±0.1% or .6°C (1.1°F)
S	0 to 1400°C	32 to 2640°F	±0.25% or 1.5°C (2.7°F)	±0.1% or .6°C (1.1°F)
B	800 to 1700°C	1470 to 3080°F	±0.5%	

\*% of reading or fixed error, which ever is greater

## MAXIMUM TEMPERATURE LIMITS

TC TYPE	RECOMMENDED MAXIMUM TEMPERATURE LIMITS							
	8 GAUGE (.125")		14 GAUGE (.064")		20 GAUGE (.032")		24 GAUGE (.020")	
J	760°C	1400°F	595°C	1100°F	480°C	900°F	370°C	700°F
K	1260°C	2300°F	1070°C	2000°F	980°C	1800°F	870°C	1600°F
T	—	—	370°C	700°F	260°C	500°F	205°C	400°F
E	870°C	1600°F	650°C	1200°F	540°C	1000°F	430°C	800°F
N	—	—	1090°C	2000°F	980°C	1800°F	—	—
R	—	—	—	—	—	—	1480°C	2700°F
S	—	—	—	—	—	—	1480°C	2700°F
B	—	—	—	—	—	—	1700°C	3100°F



### THERMO-KINETICS COMPANY LIMITED

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We accept:



\*Effective March 1, 1989 our new telephone number will be (416) 670-2266.

All specifications subject to change without notice.

PRINTED IN CANADA





# Shock/Vibration Control Switches Installation Instructions

VSH-299

VS-7037N  
Revised 01-00  
Section 20  
(00-02-0185)

**Models: VS2, VS2C, VS2N, VS2EX, VS2EXR, VS2EXRB and VS94**



Please read the following instructions before installing. A visual inspection of this product for damage during shipping is recommended before mounting. It is your responsibility to have a qualified person install the unit, and make sure installation conforms with NEC and local codes.

## GENERAL INFORMATION

# WARNING

BEFORE BEGINNING INSTALLATION OF THIS MURPHY PRODUCT

- ✓ Disconnect all electrical power to the machine.
- ✓ Make sure the machine cannot operate during installation.
- ✓ Follow all safety warnings of the machine manufacturer.
- ✓ Read and follow all installation instructions.



Model VS2EX

### Description

The Murphy shock and vibration switches are available in a variety of models for applications on machinery or equipment where excessive vibration or shock can damage the equipment or otherwise poses a threat to safe operation. A set of contacts is held in a latched position through a mechanical latch and magnet mechanism. As the level of vibration or shock increases an inertia mass exerts force against the latch arm and forces it away from the magnetic latch causing the latch arm to operate the contacts. Sensitivity is obtained by adjusting the amount of the air gap between the magnet and the latch arm plate.

Applications include all types of rotating or reciprocating machinery such as cooling fans, engines, pumps, compressors, pump jacks, etc.

### Models

**VS2:** Base mount; non hazardous locations.

**VS2C:** C-clamp mount; non hazardous locations.

**VS2EX:** Explosion-proof; Class I, Div. 1, Groups C and D\*

**VS2EXR:** Explosion-proof with remote reset.

**VS2EXRB:** Explosion-proof; Class I, Div. 1, Group B\*; with remote reset.

**VS2N:** Pneumatic signal—no electrical contacts.

**VS94:** Base mount; non hazardous locations, NEMA 4.

### Remote Reset Option (VS2EXR, VS2EXRB and VS94 only)

Includes built-in electric solenoid which allows reset of tripped unit from a remote location. Standard on VS2EXR and VS2EXRB. Optional on VS94 (options listed below).

-R15: Remote reset for 115 VAC

-R24: Remote reset for 24 VDC

### Time Delay Option (VS94 only)

Overrides trip operation on start-up. For VS94 series models, the delay time is field-adjustable from 5 seconds up to 6-1/2 minutes with a 20-turn potentiometer (15 seconds per turn approximately). Options listed below:

-T15: Time delay for 115 VAC

-T24: Time delay for 24 VDC

### Space Heater Options (VS94 only)

This optional space heater board prevents moisture from condensing inside the VS94 Series case. Options listed below:

-H15: Space heater for 115 VAC

-H23: Space heater for 230 VAC

-H24: Space heater for 24 VDC

### Warranty

A two-year limited warranty on materials and workmanship is provided with this Murphy product. Details are available on request and are packed with each unit.

\* See *Specifications* section, on page 3, for listed models.

## Electric Models



**WARNING: STOP THE MACHINE AND DISCONNECT ALL ELECTRICAL POWER BEFORE BEGINNING INSTALLATION.**

1. Firmly secure the unit to the equipment using the base foot mount or C-Clamp if applicable. See *C-Clamp Installation* page 3.  
For oilwell pumpjacks attach the VS2 and VS94 Series to the Sampson post or walking beam. See *Typical Mounting Locations* page 5.
2. Make the necessary electrical connections to the vibration switch. See *Internal Switches*, page 6 for electrical terminal locations and page 7 for typical wiring diagrams. **DO NOT EXCEED VOLTAGE OR CURRENT RATINGS OF THE CONTACTS.** Follow appropriate electrical codes/methods when making electrical connections. Be sure that the run of electrical cable is secured to the machine and is well-insulated from electrical shorting. Use of conduit is recommended.

**NOTE: If the electrical cable crosses a pivot point such as at the pivot of the walking beam, be sure to allow enough slack in the cable so that no stress is placed on the cable when the beam moves.**

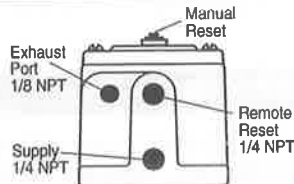
If conduit is not used for the entire length of wiring, conduit should be used from the electrical supply box to a height above ground level that prevents damage to the exposed cable from the elements, rodents, etc. or as otherwise required by applicable electrical codes. If conduit is not attached directly to the VS2 and VS94 Series switch, use a strain relief bushing and a weatherproof cap on the exposed end of the conduit. A "drip loop" should be provided in the cable to prevent moisture from draining down the cable into the conduit should the weathercap fail.

## Pneumatic Models (VS2N)



**WARNING: IF USED IN A HAZARDOUS AREA, EXPLOSIVE GASES MUST NOT BE VENTED INTO THE AREA.**

1. Mount the VS2N according to the same instructions as the electric models. However, note that although the VS2N is sensitive to shock/vibration in all three planes of motion, its most sensitive plane is perpendicular to its base.
2. Attach a pressure source of 20-80 psi (138-552 kPa) [1.37-5.51 bar] to the "Supply" port. Best operation is obtained with 60 psi (414 kPa) [4.13 bar]. Pressure medium must be clean, dry air or gas. Use a filter and pressure regulator as necessary.
3. Connect an exhaust line to the "Exhaust" port and to the equipment shutdown device to be operated.



## Sensitivity Adjustment

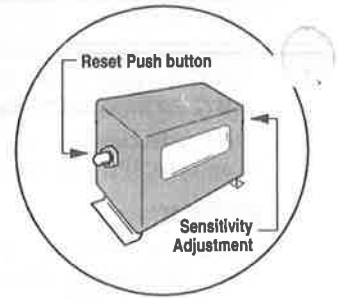


**WARNING: REMOVE ALL POWER BEFORE OPENING THE ENCLOSURE. IT IS YOUR RESPONSIBILITY TO HAVE A QUALIFIED PERSON PERFORM ADJUSTMENTS, AND MAKE SURE IT CONFORMS WITH NEC AND LOCAL CODES. DO NOT ADJUST SENSITIVITY WHILE THE MACHINE IS RUNNING. STAND CLEAR OF THE MACHINE AT ALL TIMES WHEN IT IS OPERATING.**

All models of the VS2 and VS94 Series cover a wide range of sensitivity. Each model is adjusted to the specific piece of machinery on which it is installed. After the switch has been installed in a satisfactory location (see page 5) the sensitivity adjustment will be increased or decreased so that the switch does not trip during start-up or under normal operating conditions. This is typically done as follows:

1. REPLACE ALL COVERS, LIDS, AND ELECTRICAL ENCLOSURES.
2. Press the reset push button to engage the magnetic latch. To be sure the magnetic latch has engaged, observe latch through the window on the VS2 and VS2C (see DETAIL "A"). On the VS2EX, VS2N, VS94 series the reset button will remain depressed meaning the magnetic latch has engaged.
3. Start the machine.
4. If the instrument trips on start-up, allow the machine to stop. Turn the sensitivity adjustment 1/4 turn clockwise, (adjustment for VS94 and VS2EXRB models is located within the box, see DETAIL "B").

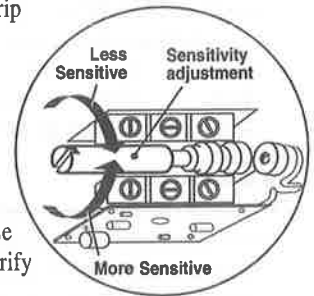
### DETAIL "A"



**WARNING: MAKE THE AREA NON-HAZARDOUS BEFORE OPENING THE EXPLOSION-PROOF (-EX) ENCLOSURES.**

Depress the reset button and restart the machine. Repeat this process until the unit does not trip on start-up.

### DETAIL "B"



5. If the instrument does NOT trip on start-up, stop the machine. Turn the sensitivity adjustment 1/4 turn counter-clockwise. Repeat the start-up/stop process until the instrument trips on start-up. Turn the sensitivity adjustment 1/4 turn clockwise (less sensitive). Restart the machine to verify that the instrument will not trip on start-up.
6. Verify that the unit will trip when abnormal shock/vibration exists.

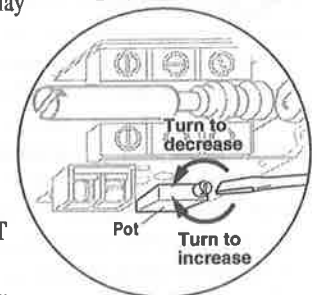
## VS94 Time Delay Adjustment



**WARNING: REMOVE ALL POWER BEFORE OPENING ACCESS DOOR. IT IS YOUR RESPONSIBILITY TO HAVE A QUALIFIED PERSON ADJUST THE UNIT, AND MAKE SURE IT CONFORMS WITH NEC AND LOCAL CODES.**

1. Apply power to the time delay circuit. (see page 7 for time delay circuit). The time delay function will be initiated.
2. Time the length of the delay with a watch. Let time delay expire. After it expires, the override circuit will de-energize the solenoid, allowing the latch arm to trip. A clicking noise is heard.
3. **TURN THE POWER OFF TO RESET THE TIME DELAY CIRCUIT.**

### DETAIL "C"



**NOTE: Allow 30 seconds bleed-time between turning the power "OFF" and "ON!"**

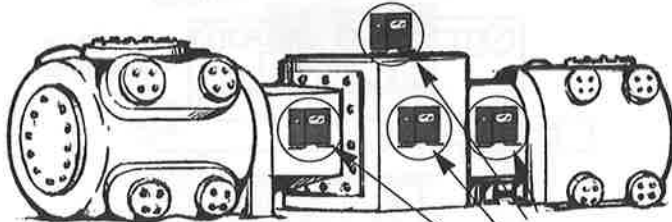
4. Locate the time adjustment pot (DETAIL "C"). The time is factory-set at the lowest setting (5 seconds approximately). To increase time, rotate the 20-turn pot clockwise as needed (15 seconds per turn approximately).
5. Repeat the above steps as necessary to obtain desired time delay.

**NOTE: An external time delay can be used with the remote reset feature of the VS2EXR series to provide a remote reset and override of the trip operation on start-up. Time delay must automatically disconnect after equipment start-up.**

## TYPICAL MOUNTING LOCATIONS

**NOTE:** These are typical mounting locations for best operation. Other mountings are possible. See *Installation* section on page 3.

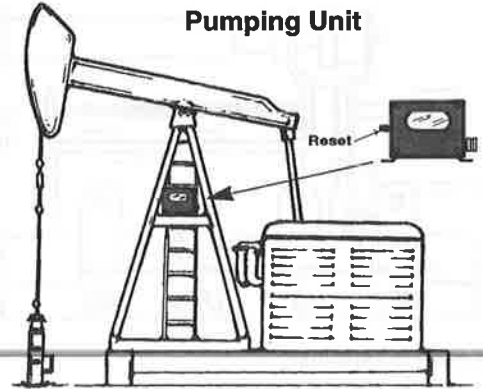
### 2-Throw Balance-Opposed Compressor



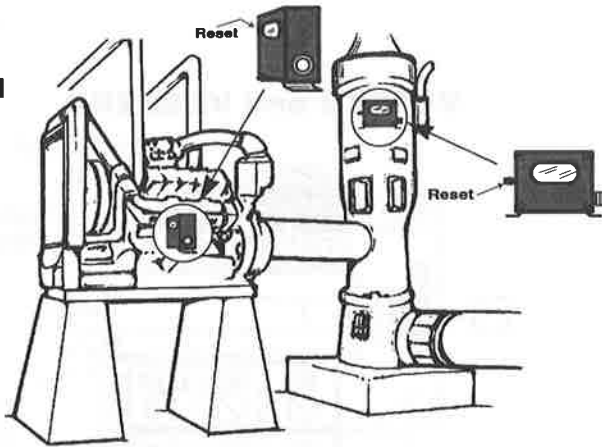
**NOTE:** If installing on cylinders, 2 vibration/shock switches are recommended- 1 for each cylinder.



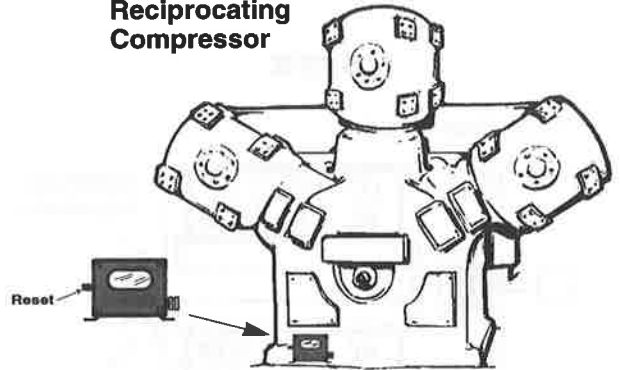
### Pumping Unit



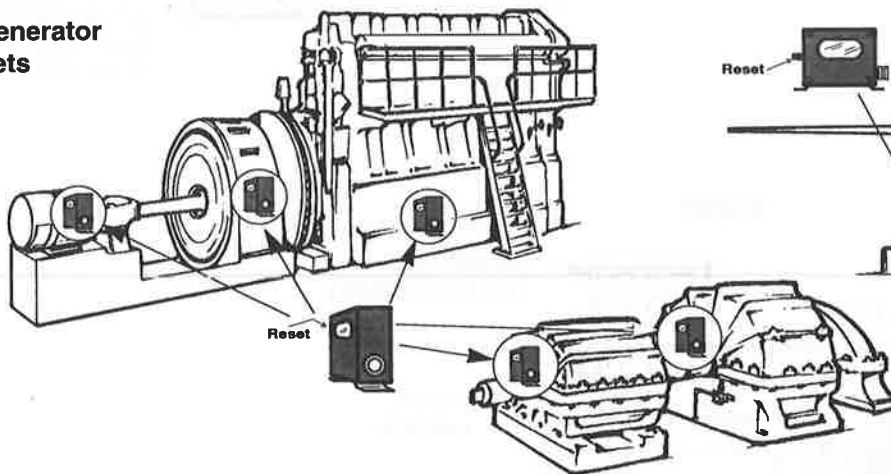
### Engine and Vertical Shaft Pump



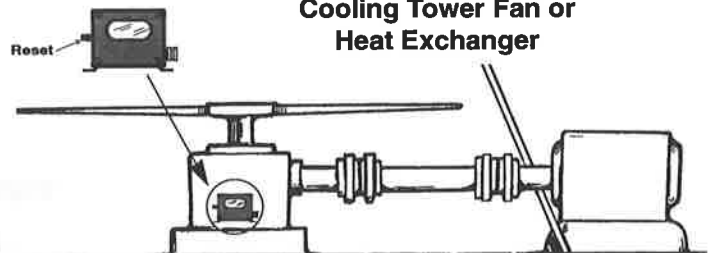
### "Y" Type Reciprocating Compressor



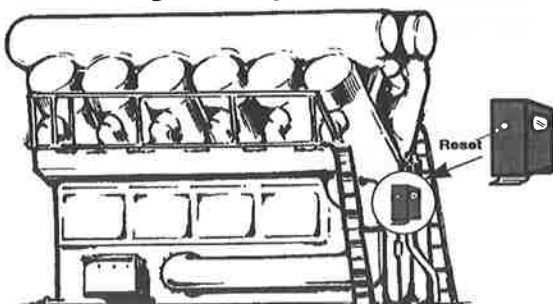
### Generator Sets



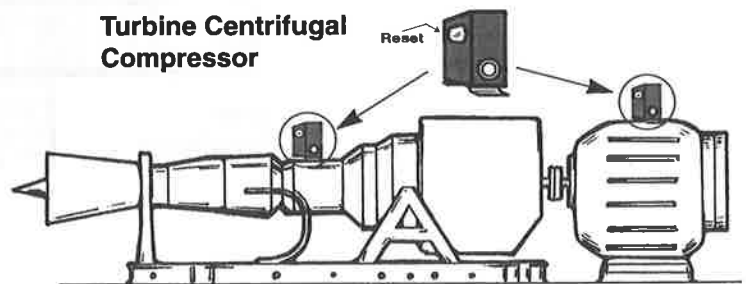
### Cooling Tower Fan or Heat Exchanger



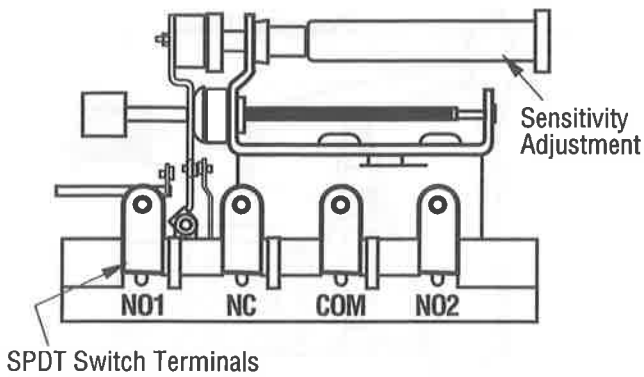
### Engine Compressor



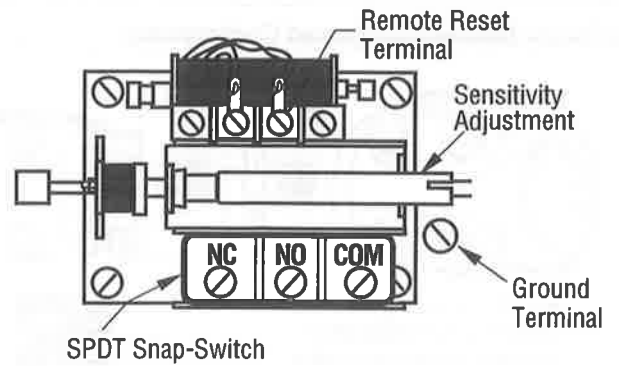
### Turbine Centrifugal Compressor



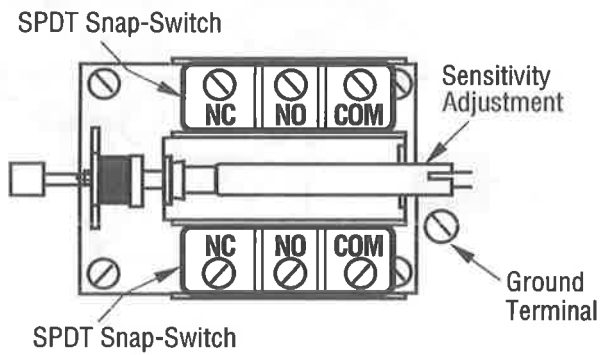
**VS2 and VS2C**



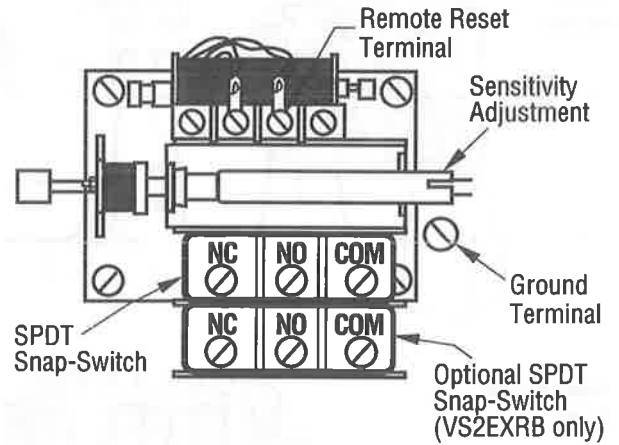
**VS2EXR**



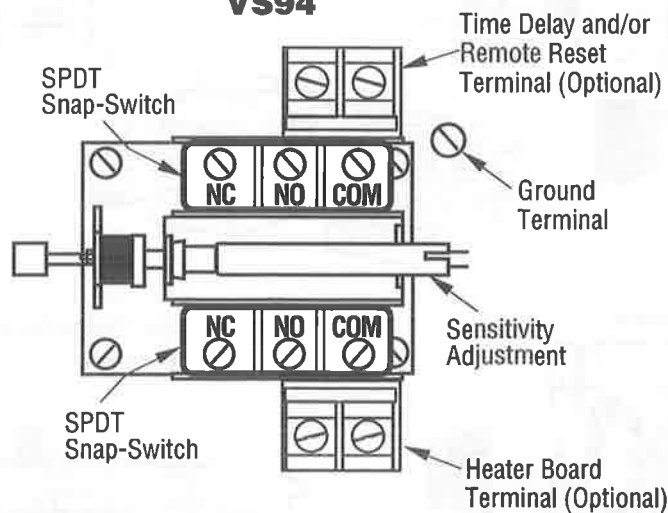
**VS2EX**



**VS2EXB and VS2EXRB**



**VS94**

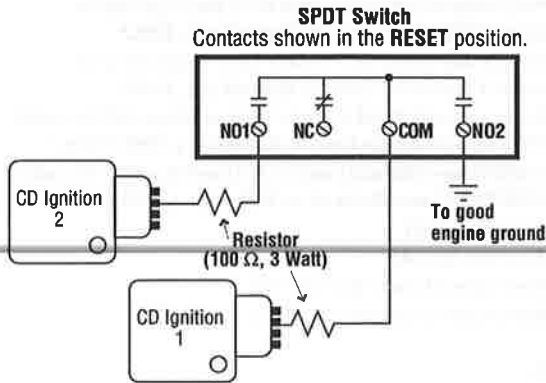


# ELECTRICAL

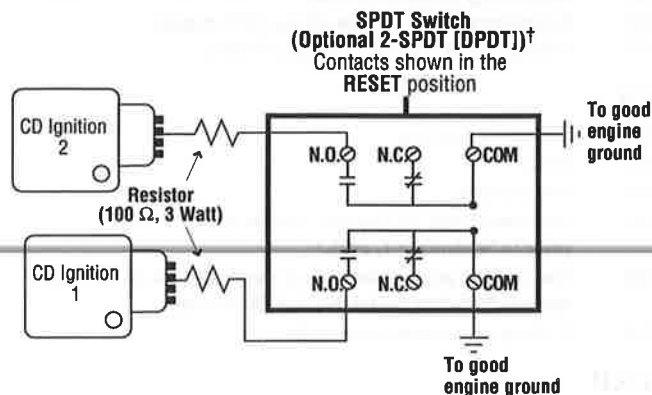


**WARNING: REMOVE POWER BEFORE OPENING THE UNIT (ACCESS DOOR). STOP THE MACHINE AND DISCONNECT ALL ELECTRICAL POWER BEFORE BEGINNING THE WIRING OPERATION. IT IS YOUR RESPONSIBILITY TO HAVE A QUALIFIED PERSON INSTALL AND WIRE THE UNIT, AND MAKE SURE IT CONFORMS WITH NEC AND APPLICABLE CODES.**

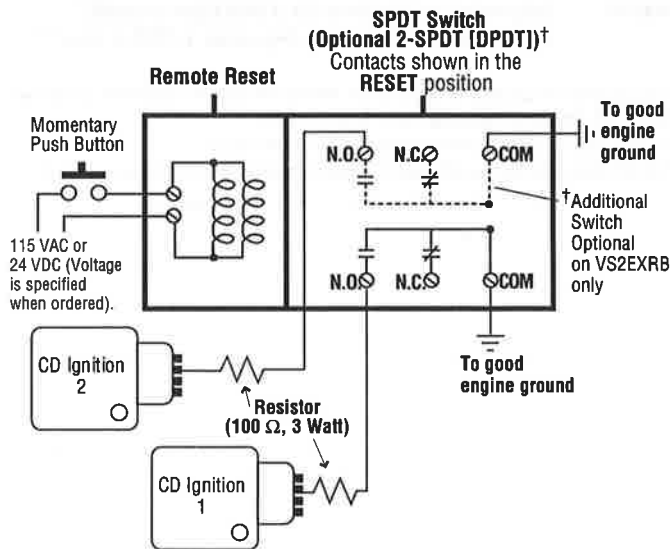
**VS2 and VS2C**  
**Typical Wiring Diagram for Single or Dual CD Ignition**



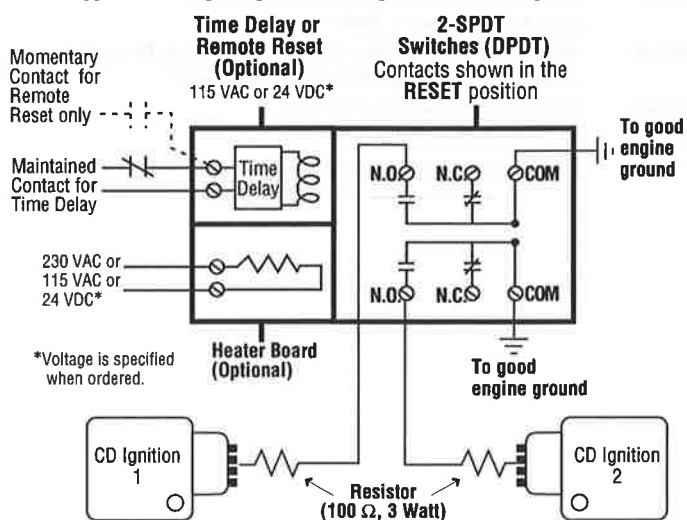
**VS2EX**  
**Typical Wiring Diagram for Single or Dual CD Ignitions**



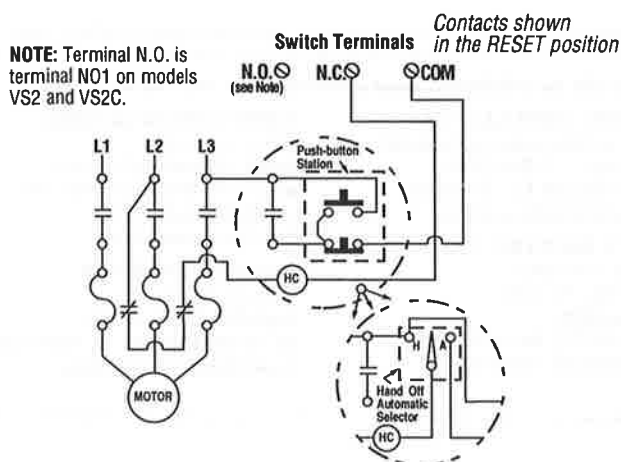
**VS2EXR and VS2EXRB**  
**Typical Wiring Diagram for Single or Dual CD Ignitions**



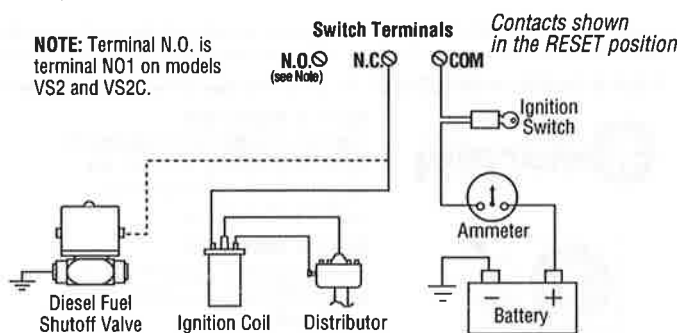
**VS94**  
**Typical Wiring Diagram for Single or Dual CD Ignitions**



**VS2, VS2C, VS2EX, VS2EXR, VS2EXRB and VS94**  
**Typical Wiring Diagram for Electric Motors**



**VS2, VS2C, VS2EX, VS2EXR, VS2EXRB and VS94**  
**Typical Wiring Diagram for Distributor Ignition or Diesel**



## SERVICE PARTS

### PART NO. DESCRIPTION

#### VS2 and VS2C

20000030	Movement assembly
20000031	Glass and gasket assembly
20000032	Reset push button assembly
20050021	Mounting clamp
00003292	Cable clamp assembly (1 each)
20050465	2-Conductor electrical cable, 45 feet (13.7 meters)
20000137	5 clamps and 45 feet (13.7 meters) of cable

#### VS2EX

20010091	Movement assembly
20050087	Cover
00000309	Cover gasket
20010090	Snap-switch and insulator kit (1 switch per kit) <b>prior to September 1, 1995.*</b>
20000288	<b>Snap-switch and insulator kit (1 switch per kit) for models manufactured on September 1, 1995 or later.*</b>
20000289	C-clamp conversion mounting kit

#### VS2EXR

20000262	Movement assembly
20050087	Cover
00000309	Cover gasket
20010090	Snap-switch and insulator kit (1 switch per kit) <b>prior to September 1, 1995.*</b>
20000288	<b>Snap-switch and insulator kit (1 switch per kit) for models manufactured on September 1, 1995 or later.*</b>
20000049	Reset solenoid assembly (115 VAC)
20000234	Reset solenoid assembly (24 VDC)
20000289	C-clamp conversion mounting kit

### PART NO. DESCRIPTION

#### VS2EXRB

20010090	Snap-switch and insulator kit (1 switch per kit) <b>prior to September 1, 1995.*</b>
20000288	<b>Snap-switch and insulator kit (1 switch per kit) for models manufactured on September 1, 1995 or later.*</b>
20000057	<i>Inside</i> snap-switch and insulator kit (1 switch per kit) for model VS2EXRB-D <b>prior to September 1, 1995.*</b>
20000058	<i>Outside</i> snap-switch and insulator kit (1 switch per kit) for model VS2EXRB-D <b>prior to September 1, 1995.*</b>
20000287	<b><i>Inside</i> snap-switch and insulator kit (1 switch per kit) for model VS2EXRB-D manufactured on September 1, 1995 or later.*</b>
20000290	<b><i>Outside</i> snap-switch and insulator kit (1 switch per kit) for model VS2EXRB-D manufactured on September 1, 1995 or later.*</b>
20050077	Adjustment shaft
20000262	Movement assembly
20000049	Reset solenoid assembly (115 VAC)
20000234	Reset solenoid assembly (24 VDC)

#### VS94 Series

25050506	Dust boot
00000232	Conduit fitting
20010090	Snap-switch and insulator kit (1 switch per assembly) <b>prior to September 1, 1995.**</b>
20000288	<b>Snap-switch and insulator kit (1 switch per assembly) for models manufactured on September 1, 1995 or later.**</b>

\* If no date code is found, refer to the old switch. Models with date 0895 and before use old switch.  
Dated 0995 after, use straight snap-switch arm, no rollers.

\*\* Models dated Q1 thru Q8 (formed snap-switch arm and rollers).

\*\*\*Models date coded Q9 thru Q12 and R1 thru R12 (straight snap-switch arm, no rollers).

*In order to consistently bring you the highest quality, full featured products, we reserve the right to change our specifications and designs at any time.*

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## MINIATURE 2 WIRE SEISMIC VIBRATION TRANSMITTER MODEL 5484C-1XX INSTALLATION INSTRUCTIONS



### INSTALLATION

**1. MOUNTING** IT IS IMPORTANT THAT THE TRANSMITTER HOUSING BE SOLIDLY MOUNTED TO THE MACHINE SURFACE. The preferred method is to drill and tap a 1/4 - 18 NPT hole in the machine case for direct installation of the housing. A 1/4" to 1/2" NPT bushing is provided for mounting the transmitter in existing 1/2" NPT holes. A minimum of five (5) threads of engagement should be made. A Model 7084 Flange Adapter can be installed between the transmitter mounting stud and the machine surface. The sensitive axis of the transmitter is in line with the mounting stud. The transmitter can be oriented in any position.



**2.A SAFE AREA INSTALLATION** Connect the field wiring in accordance with the appropriate diagram on page 2. The transmitter requires a minimum of 10 VDC for proper operation. The minimum loop power supply voltage required is 10VDC plus 1 volt for each 50 ohms of loop resistance.

Example: Signal wire resistance = 10 ohms  
Resistance of receiver = 250 ohms  
Total loop resistance = 260 ohms  
Minimum supply voltage = 260 (1V/50 ohms) + 10V = 15.2 VDC

The maximum loop power supply voltage that may be applied is 60VDC. The maximum loop resistance is calculated by the equation:

RI = 50 (VS - 10) ohms.  
Example: RI = 50 (24 - 10) = 700 ohms for 24 VDC loop supply.

### 2.B INTRINSICALLY SAFE INSTALLATION IN HAZARDOUS LOCATIONS EEx ia IIB T4

Connect the field wiring in accordance with Metrix drawing 8644. The leads must be terminated inside an enclosure that affords a degree of protection of at least IP20, as defined on drawing 8643. The transmitter requires a minimum of 10 VDC for proper operation. The voltage drop across the specified barriers with a 20 mA loop current is 8.1 VDC.


The minimum loop power supply voltage required is 18.1 VDC plus 1 volt for each 50 ohms of loop resistance. The maximum loop power supply voltage that may be applied to the safety barrier is 26 VDC. Therefore, the maximum loop resistance with a 26 VDC supply is 395 ohms.

Example: Signal wire resistance = 5 ohms  
Resistance of receiver = 250 ohms  
Total loop resistance = 255 ohms  
Minimum supply voltage = 255 (1V/50 ohms) + 18.1 V = 23.2 VDC

### 2.C EXPLOSION-PROOF INSTALLATION IN HAZARDOUS LOCATIONS 5484C transmitters are

CSA certified explosion-proof, Class I (B, C & D); Class II (E, F, G). Connect the field wiring in accordance with the appropriate diagram on page 2. Refer to paragraph 2.A for loop voltage and resistance requirements. All conduit and junction boxes used must be certified explosion-proof for the class, division and group required by the application. Installation of the transmitter must meet all of the explosion-proof installation requirements of the local governing agency.

### 3.0 ELECTROMAGNETIC COMPATIBILITY

In order to meet the requirements of  electromagnetic compatibility in areas of high electromagnetic interference, the field wiring must be:

1. shielded twisted pair cable enclosed in grounded metallic conduit, or
2. double shielded twisted pair cable with a metallic body cable gland fitting and with the outer shield grounded to earth



## CALIBRATION

The unit has been factory calibrated for the full scale vibration level marked on the label. If the calibration is in doubt the unit can be field calibrated as follows:

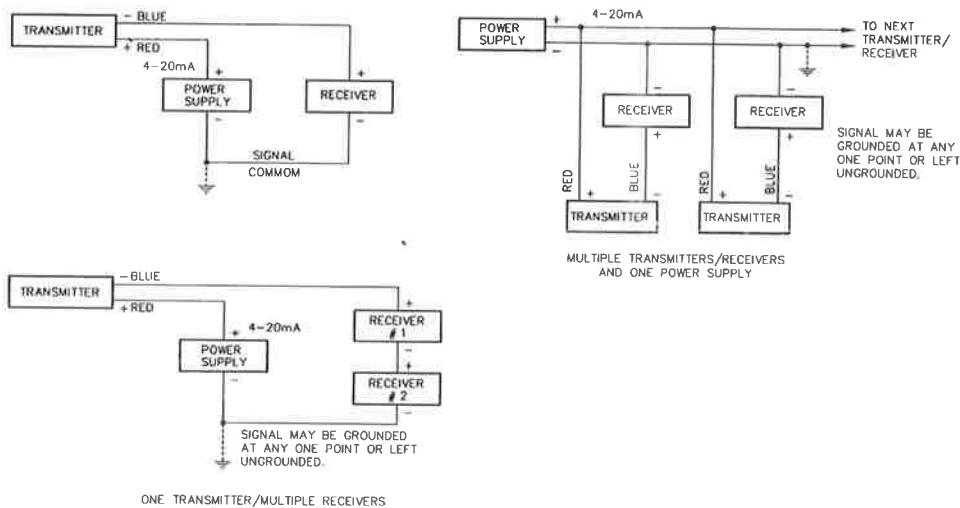
### 5484C VIBRATION TRANSMITTER

**1. Zero Adjustment** In the absence of vibration the output current should be  $4 \text{ mA} \pm 0.2 \text{ mA}$ . If the ambient vibration is more than 2% of full scale, the transmitter should be removed from the machine and taken to a vibration free area for this measurement. The adjustment potentiometers are covered with a thin layer of clear RTV. Dig through the RTV with a small screwdriver and adjust the ZERO (Z) control to obtain 4 mA output current in the absence of vibration.

**2. Span Adjustment** Subject the transmitter to a known vibration equal to the full scale marked on the label and adjust the SPAN (S) control to obtain an output of  $20 \text{ mA} \pm 0.2 \text{ mA}$ . Alternatively, the span can be calibrated by measuring the vibration level at the base of the unit with an independent vibration meter calibrated at the measuring frequency. If the output current is incorrect, adjust the span control to obtain agreement.

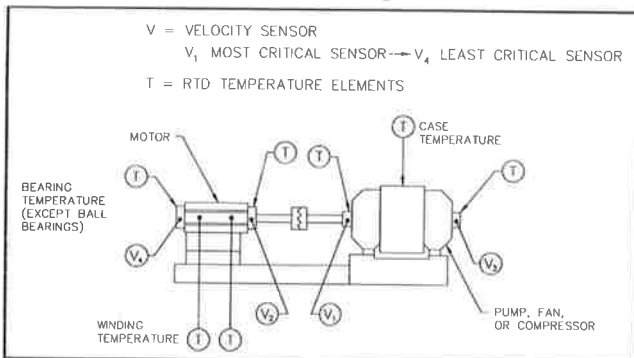
**NOTE:** If field calibration is performed, the potentiometer adjustment screws must be re-covered with RTV after calibration. The RTV is required to prevent moisture from reaching the adjustment screws. **Failure to re-cover the adjustment screws will void the warranty!**

### WIRING DIAGRAMS

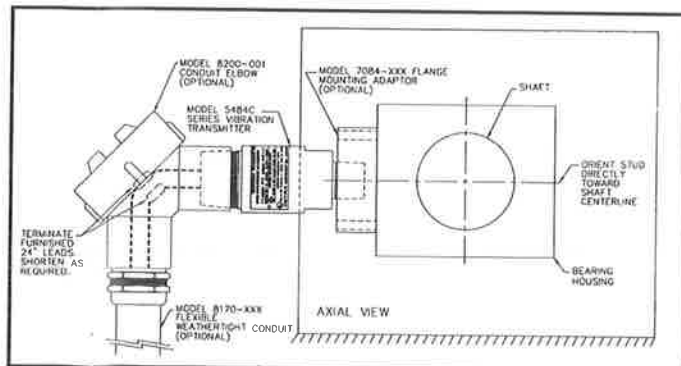


**Figure 1**

Typical Application and mounting Arrangement



**Figure 2**



**NOTES:** OTHER MOUNTING OPTIONS INCLUDE DRILLING AND TAPPING A 1/4"-18 NPT HOLE IN THE BEARING HOUSING OR BRAZING A 1/4" PIPE COUPLING TO THE BEARING HOUSING. FOR CASE MOUNTED TRANSDUCERS, HORIZONTAL SENSOR MOUNTING AS SHOWN IS RECOMMENDED. VIBRATION IS ALMOST EXCLUSIVELY GREATER SIDE TO SIDE RATHER THAN UP AND DOWN SINCE THE EQUIPMENT IS RESTRAINED (GROUTED) IN THE VERTICAL DIRECTION.

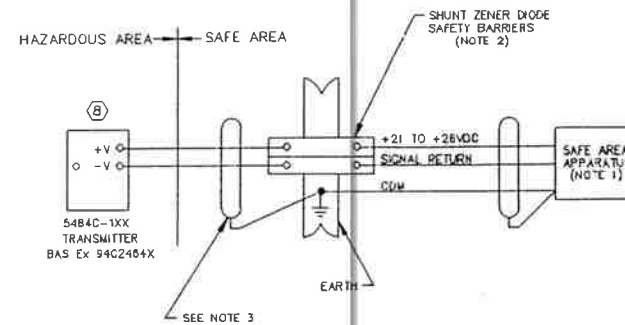
INTRINSICALLY SAFE INSTALLATION

NOTES:

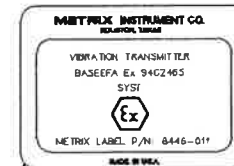
1. SAFE AREA APPARATUS IS NOT SPECIFIED EXCEPT THAT IT MUST NOT BE SUPPLIED FROM NOR CONTAIN IN NORMAL OR ABNORMAL CONDITIONS A SOURCE OF POTENTIAL WITH RESPECT TO EARTH IN EXCESS OF 250 VRMS OR 250 VDC.
2. THE SAFETY BARRIER MUST BE ONE OF THE FOLLOWING:
  - 2a. A 28V, 300 OHM AND A 28V D-ODE RETURN DUAL CHANNEL SHUNT ZENER DIODE SAFETY BARRIER TYPE MTL 787S CERTIFIED ON BASEEFA CERTIFICATE Ex.832452, OR STAHL TYPE 9002/13-280-093-00 CERTIFIED ON PTB CERTIFICATE Ex-91.C.2045X.
  - 2b. A TRANSFORMER ISOLATING BARRIER ELCON TYPE 1026-A-0-0242-AA CERTIFIED ON CESI CERTIFICATE Ex.-90.C.117X OR MTL TYPE 4041B CERTIFIED ON BASEEFA CERTIFICATE Ex.92C2003. NOTE 3. DOES NOT APPLY WHEN ISOLATING BARRIERS ARE USED.
3. CIRCUIT IN HAZARDOUS AREA MUST BE CAPABLE OF WITHSTANDING A VOLTAGE TEST OF 500 VRMS TO EARTH OR TO THE FRAME OF THE APPARATUS FOR ONE MINUTE.
4. THE CAPACITANCE AND EITHER THE INDUCTANCE OR INDUCTANCE TO RESISTANCE (L/R) RATIO OF THE INTERCONNECTING CABLE MUST NOT EXCEED THE VALUES IN TABLE 1. THE VALUES IN THE TABLE HAVE TAKEN ACCOUNT OF Ceq AND Leq.
5. THE HAZARDOUS AREA CABLE IS TO BE INSTALLED AS EITHER A SEPARATE CABLE OR A SEPARATE CIRCUIT WITHIN A "TYPE A" CABLE OR WITHIN A "TYPE B" CABLE AS DEFINED IN EN 50039 (1980). THE PEAK VOLTAGE OF ANY CIRCUIT IN THE "TYPE B" CABLE MUST NOT EXCEED 60V.
6. THE INSTALLATION MUST COMPLY WITH THE APPROPRIATE NATIONAL INSTALLATION REQUIREMENTS. EXAMPLE: UK, BS5345 PART 4 (1977)
- ⑦ SYSTEM LABEL METRIX P/N: 8446-011 SHOULD APPEAR ON OR ADJACENT TO THE PRINCIPAL ITEM OF THE ELECTRICAL APPARATUS IN THE SYSTEM OR AT THE INTERFACE BETWEEN THE INTRINSICALLY SAFE AND NON-INTRINSICALLY SAFE CIRCUIT.
- ⑧ REFER TO SPECIFICATION DRAWING 8643 FOR ADDITIONAL INSTALLATION AND WIRING DETAILS. MODEL 820D-001 CONDUIT ELBOW OR OTHER IP 20 RATED FITTING MUST BE EMPLOYED TO PROTECT THE ELECTRICAL CONNECTION. MATERIAL OF FITTING MUST CONTAIN LESS THAN 6% MAGNESIUM.

REVISIONS					
REV	EXP	BY	DATE	APPROVED	
*	6891H	RELEASE	AW	2-14-95	MCN
A	7917		AW	1C-23-96	RAW
B	7976		AW		

INSTALLATION -  
PROXIMITY SENSOR IN HAZARDOUS LOCATION  
CENELEC



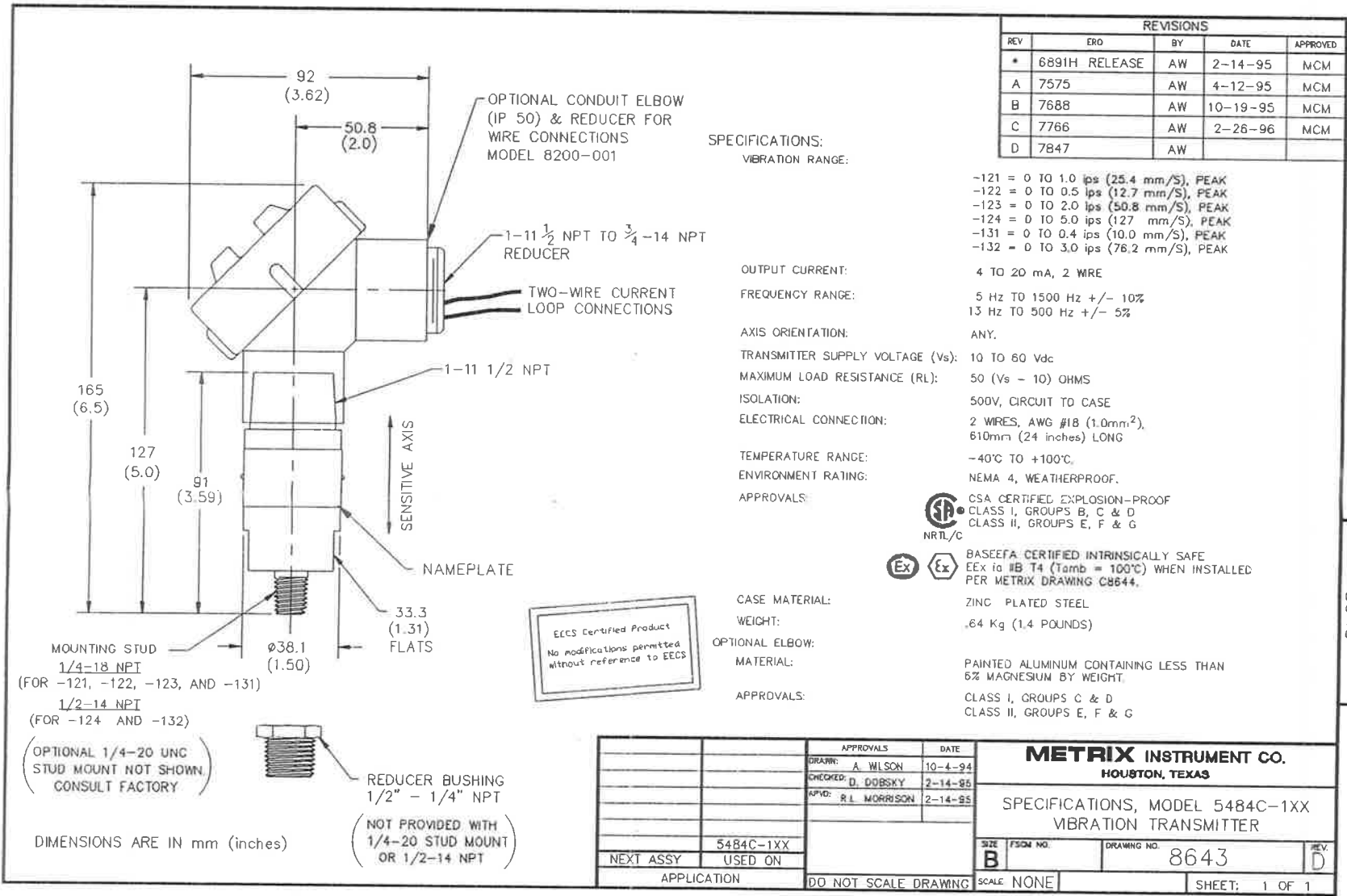
GROUP	CAPACITANCE uF	INDUCTANCE mH
IIB	0.21	12.6



ECCS Certified Product  
No modifications permitted  
without reference to ECCS

MATERIAL:	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:	APPROVED:	DATE:	<b>METRIX INSTRUMENT CO.</b> HOUSTON, TEXAS INSTALLATION (CENELEC) 5484C-1XX TRANSMITTER
FINISH:	FRACTIONS DECIMALS ANGLES 1/16 1/32 1/64 1/8 1/4 1/2 3/4 1 1 1/2 2 3 4 5 6 8 10 12 16 20 24 32 40 48 60 72 96 120 144 180 240 360	DRW: A. WILSON	20-08-94	
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8644



REVISIONS					
REV	ERO	BY	DATE	APPROVED	
*	6891H	RELEASE	AW	2-14-95	MCM
A	7575		AW	4-12-95	MCM
B	7688		AW	10-19-95	MCM
C	7766		AW	2-26-96	MCM
D	7847		AW		

SPECIFICATIONS:  
VIBRATION RANGE:

- 121 = 0 TO 1.0 ips (25.4 mm/S), PEAK
- 122 = 0 TO 0.5 ips (12.7 mm/S), PEAK
- 123 = 0 TO 2.0 ips (50.8 mm/S), PEAK
- 124 = 0 TO 5.0 ips (127 mm/S), PEAK
- 131 = 0 TO 0.4 ips (10.0 mm/S), PEAK
- 132 = 0 TO 3.0 ips (76.2 mm/S), PEAK

OUTPUT CURRENT: 4 TO 20 mA, 2 WIRE  
 FREQUENCY RANGE: 5 Hz TO 1500 Hz +/- 10%  
 13 Hz TO 500 Hz +/- 5%  
 AXIS ORIENTATION: ANY.

TRANSMITTER SUPPLY VOLTAGE (Vs): 10 TO 60 Vdc  
 MAXIMUM LOAD RESISTANCE (RL): 50 (Vs - 10) OHMS

ISOLATION: 500V, CIRCUIT TO CASE  
 ELECTRICAL CONNECTION: 2 WIRES, AWG #18 (1.0mm<sup>2</sup>), 610mm (24 inches) LONG

TEMPERATURE RANGE: -40°C TO +100°C  
 ENVIRONMENT RATING: NEMA 4, WEATHERPROOF.

APPROVALS:  
 CSA CERTIFIED EXPLOSION-PROOF CLASS I, GROUPS B, C & D CLASS II, GROUPS E, F & G

BASEEFA CERTIFIED INTRINSICALLY SAFE EEx ia IB T4 (Tamb = 100°C) WHEN INSTALLED PER METRIX DRAWING C8644.

CASE MATERIAL: ZINC PLATED STEEL  
 WEIGHT: .64 Kg (1.4 POUNDS)

OPTIONAL ELBOW: PAINTED ALUMINUM CONTAINING LESS THAN 5% MAGNESIUM BY WEIGHT.  
 MATERIAL: CLASS I, GROUPS C & D CLASS II, GROUPS E, F & G  
 APPROVALS:

EECS Certified Product  
 No modifications permitted without reference to EECS

APPROVALS		DATE	METRIX INSTRUMENT CO. HOUSTON, TEXAS	
DRAWN:	A WILSON	10-4-94	SPECIFICATIONS, MODEL 5484C-1XX VIBRATION TRANSMITTER	
CHECKED:	D DOBSKY	2-14-95		
APVD:	R L MORRISON	2-14-95		
NEXT ASSY USED ON		5484C-1XX	SIZE	B
APPLICATION		DO NOT SCALE DRAWING	FSON NO.	
			DRAWING NO.	8643
			SCALE	NONE
			REV	D
			SHEET:	1 OF 1

DRAWING NO. 8643