

APACHE CANADA LIMITED  
HAMBURG 2-6 COMPRESSOR  
STATION

HAMBURG, ALBERTA

LSD: 02-06-097-11 W6M

DATE: SEPTEMBER, 2000

**S.O.#: 99420**

OPERATING MANUAL  
VOLUME 3

**PROPAK COPY**  
**Do Not Remove From Propak**  
**Premises**



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PROPAK COPY

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**PROPAK SYSTEMS LTD.**

INSTRUMENT LIST - PROPAK SO# 99420

W1380 6HOS-3 STOCK COMPRESSOR

LSD:TBA

REV	1	2	
DATE	99/12/28	MAY 25/00	

DATA SHEET	REV #	TAG #	MFS #	RANGE	ENG UNIT	SET POINT	INSTRUMENT TYPE	MANUFACTURER	MODEL #	COMMENTS	AREA #
							<b>PROCESS</b>				
YES	2	ESDV	101	100-04	kPag		Emergency Shutdown Valve	Fisher	357-40	33mm NPT connect, 19.1mm Port, WCC body, NACE MR-0175 certified	152
YES	2	I/P	100	100-04	4-20 / 6-30	MA/PSI	Transducer	Fisher	546	C/W PCV-100	152
YES	2	LC	100	100-04			kPag 241 Level Controller	Fisher	2680-268T	1st Stage Scrubber NACE MR-01-75, 60mm NPT, 48 x 305mm Displacer, vert. Mount	152
YES	2	LC	110	100-04			kPag 241 Level Controller	Fisher	2680-268T	2nd Stage Scrubber NACE MR-01-75, 60mm NPT, 48 x 305mm Displacer, vert. Mount	152
YES	2	LC	120	100-04			kPag 241 Level Controller	Fisher	2680-268T	3rd Stage Scrubber, NACE MR-01-75, 60mm NPT, 48 x 305mm Displacer vert. Mount	152
YES	2	LCV	100	100-04	0-241		kPag Level Control Valve	Fisher	128-PQC	1st Stage Dump Valve, NACE MR-10-75, 33mm NPT connect, 9.5mm Port, fail closed	152
YES	2	LCV	110	100-04	0-241		kPag Level Control Valve	Fisher	128-PQC	2nd Stage Dump Valve, NACE MR-10-75, 33mm NPT connect, 9.5mm Port, fail closed	152
YES	2	LCV	120	100-04	0-241		kPag Level Control Valve	Fisher	128-PQC	3rd Stage Dump Valve, NACE MR-10-75, 33mm NPT connect, 9.5mm Port, fail closed	152
YES	2	LG	100	100-04	321	mm	Level Gauge	Penberthy	1RL9	NACE MR-01-75, c/w 330J cocks, 100/110: 4516 KPAG @ 149°C; 120: 9067 KPAG @ 149°C	152
YES	2	LG	110	100-04	321	mm	Level Gauge	Penberthy	1RL9	NACE MR-01-75, c/w 330J cocks, 100/110: 4516 KPAG @ 149°C; 120: 9067 KPAG @ 149°C	152
YES	2	LG	120	100-04	321	mm	Level Gauge	Penberthy	1RL9	NACE MR-01-75, c/w 330J cocks, 100/110: 4516 KPAG @ 149°C; 120: 9067 KPAG @ 149°C	152
YES	2	LS	100	100-04	138-4516	kPag	Level Switch - High	Murphy	1100-SS	1st Stage Scrubber, NACE MR-01-75, 48mm NPT connect, 1.0 specific gravity, sour water	152
YES	2	LS	110	100-04	961-4516	kPag	Level Switch - High	Murphy	1100-SS	2nd Stage Scrubber, NACE MR-01-75, 48mm NPT connect, 1.0 specific gravity, sour water	152
YES	2	LS	120	100-04	2976-9067	kPag	Level Switch - High	Murphy	1100-SS	3rd Stage Scrubber, NACE MR-01-75, 48mm NPT connect, 1.0 specific gravity, sour water	152
YES	2	PCV	100	100-04	41-207	kPag	Pressure Control Valve	Fisher	357-40	33mm NPT connect, 9.5mm Port, WCC body, c/w 546 Transducer	152
	2	PRV	220	100-04	241 - 414	kPag	276 Pressure Regulator	Fisher	67 CFR	4-20MA input, 6-30 PSIG output, nace MR-0175	152
										<b>OPTIONAL</b>	
YES	2	PSV	200	100-04		kPag	3412 Pressure Safety Valve	Crosby	2 H 3 JOS 35 J	60mm 300# RF inlet x 89mm 150# RF outlet, 506.45mm Orifice, Nace MR-1075	152
YES	2	PSV	202	100-04		kPag	8727 Pressure Safety Valve	Crosby	1-1/2 F 2 JOS 45 J	48mm 600# RF inlet x 60mm 150# RF outlet, 198.064mm Orifice, Nace MR-1075	152
YES	2	PSV	203	100-04		kPag	11377 Pressure Safety Valve	Crosby	1-1/2 F 2-1/2 JOS 55 J	48mm 900# RTJ inlet x 73mm 300# RF outlet, 198.064mm Orifice, Nace MR-1075	152
YES	2	PT	100	100-04	0-2068	kPag	Pressure Transmitter	Wika	892.23.520	4-20 MA output, 24 VDC power, class 1 div. 2 group D, Nace c/w 21mm NPT bushing	152
YES	2	PT	210	100-04	0-6895	kPag	Pressure Transmitter	Wika	892.23.520	4-20 MA output, 24 VDC power, class 1 div. 2 group D, Nace c/w 21mm NPT bushing	152
YES	2	PT	211	100-04	0-13790	kPag	Pressure Transmitter	Wika	892.23.520	4-20 MA output, 24 VDC power, class 1 div. 2 group D, Nace c/w 21mm NPT bushing	152
YES	2	PT	212	100-04	0-13790	kPag	Pressure Transmitter	Wika	892.23.520	4-20 MA output, 24 VDC power, class 1 div. 2 group D, Nace c/w 21mm NPT bushing	152

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LSD:TBA

	REV	1	2									
	DATE	99/12/28	MAY 25/00									
DATA SHEET	REV #	TAG #	MFS #	RANGE	ENG UNIT	SET POINT	INSTRUMENT TYPE	MANUFACTURER	MODEL #	COMMENTS	AREA #	
	2	RO	121	100-04			Orifice	Daniel	Orifice Plate	219mm 300#, c/w 7.981" bore	152	
	2	RO	123	100-04			Orifice	Daniel	Orifice Plate	168mm 600#, c/w 6.065" bore	152	
	2	RO	124	100-04			Orifice	Daniel	Orifice Plate	114mm 600#, c/w 3.826" bore	152	
YES	2	SOV	101	100-04			Solenoid Valve	ASCO	EF8320G202	3-Way, 24 VDC, XP, CSA approved, instrument gas service	152	
	2	TC	210	100-04	-34 - 204	°C	49	Temperature Controller	Kimray	HT 12T	c/w 316SS thermowell, separable socket model 3/4" SS-12-SS and 3PG valve	152
	2	TC	211	100-04	-34 - 204	°C	49	Temperature Controller	Kimray	HT 12T	c/w 316SS thermowell, separable socket model 3/4" SS-12-SS and 3PG valve	152
	2	TC	212	100-04	-34 - 204	°C	49	Temperature Controller	Kimray	HT 12T	c/w 316SS thermowell, separable socket model 3/4" SS-12-SS and 3PG valve	152
YES	2	TE	100	100-04	0 - 1260	°C	35	Temperature Element	Thermo-Kenetics	K Type	Single Thermocouple, spring loaded c/w 27mm NPT, 304 SS, 55mm Insertion Thermowell	152
YES	2	TE	110	100-04	0 - 1260	°C	80	Temperature Element	Thermo-Kenetics	K Type	102mm Insertion Thermowell	152
YES	2	TE	120	100-04	0 - 1260	°C	80	Temperature Element	Thermo-Kenetics	K Type	Single Thermocouple, spring loaded c/w 27mm NPT, 304 SS, 63.5mm Insertion Thermowell	152
YES	2	TE	124	100-04	0 - 1260	°C	176	Temperature Element	Thermo-Kenetics	K Type	Single Thermocouple, spring loaded c/w 27mm NPT, 304 SS, 102mm Insertion Thermowell	152
YES	2	TE	126	100-04	0 - 1260	°C	176	Temperature Element	Thermo-Kenetics	K Type	Single Thermocouple, spring loaded c/w 27mm NPT, 304 SS, 63.5mm Insertion Thermowell	152
YES	2	TE	122A	100-04	0 - 1260	°C	176	Temperature Element	Thermo-Kenetics	K Type	Single Thermocouple, spring loaded c/w 27mm NPT, 304 SS, 102mm Insertion Thermowell	152
YES	2	TE	122B	100-04	0 - 1260	°C	176	Temperature Element	Thermo-Kenetics	K Type	Single Thermocouple, spring loaded c/w 27mm NPT, 304 SS, 102mm Insertion Thermowell	152
YES	2	TI	210	100-04	50-500/10-260	°F/°C		Temperature Indicator	Trend	33040-A-0-06-G-4	Dual Scale, 3" dial, 4" stem, 1/2" NPT c/w 304 SS Thermowell, 3/4" NPTM X 1/2" NPTF	152
YES	2	TI	211	100-04	50-500/10-260	°F/°C		Temperature Indicator	Trend	33040-A-0-06-G-4	Dual Scale, 3" dial, 4" stem, 1/2" NPT c/w 304 SS Thermowell, 3/4" NPTM X 1/2" NPTF	152
YES	2	TI	212	100-04	50-500/10-260	°F/°C		Temperature Indicator	Trend	33025-A-0-06-G-4	Dual Scale, 3" dial, 2.5" stem, 1/2" NPT c/w 304 SS Thermowell, 3/4" NPTM x 1/2" NPTF	152
<b>ENGINE FUEL / START GAS SYSTEM</b>												
YES	2	FCV	223	100-05		kPag	21	Flow Control Valve	Murphy	M5180-P	Fuel Gas Valve, semi-automatic, 552 KPA MAWP, 2" NPT	152
N/A	2	FCV	227	100-05				Flow Control Valve	Ingersol Rand	SRV-150	1-1/2" NPT	152
N/A	2	I/P	219	100-05	34 - 241	kPa		Transducer	Fisher	546	4-20 mA Input , 3-15 psig output, XP c/w 67 AFR 5-35 PSIG, c/w 1/4" NPT tapped bonnet	152
YES	2	PI	222	100-05	0-1103	kPag	207	Pressure Gauge	Wika	233.53	Engine fuel gas, 2-1/2" dial, 1/4" NPT bottom connect	152
YES	2	PI	227	100-05	0-1103	kPag	689	Pressure Gauge	Wika	233.53	Starter gas, 2-1/2" dial, 1/4" npt bottom connect	152
YES	2	PRV	221	100-05	103-276	kPag	172	Pressure Regulator	Fisher	627	33 mm NPT, 9.5 mm Port, sweet natural gas	152
YES	2	PRV	225	100-05	69-414	kPag	241	Pressure Regulator	Fisher	1805-1	33 mm NPT, Cast Iron c/w NPT tapped closing cap, sweet natural gas	152
N/A	2	SOV	223	100-05				Solenoid Valve	ASCO	EF8320G202-24	3-way, 24 VDC, CSA Approved Class 1, Division 1, Groups C & D	152
N/A	2	SOV	227	100-05				Solenoid Valve	ASCO	EF8320G202-24	3-way, 24 VDC, CSA Approved Class 1, Division 1, Groups C & D	152
	2	SOV	228	100-05				Solenoid Valve	ASCO	EF8320G202	3-way, 24 VDC, CSA Approved Class 1, Division 1, Groups C & D	152
N/A	2	SS	229	100-05		RPM		Speed Switch	Dynalco	M204	c/w cable assembly for M204, 30 feet long p/n C101-30	152

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DATA SHEET	REV #	TAG #	MFS #	RANGE	ENG UNIT	SET POINT	INSTRUMENT TYPE	MANUFACTURER	MODEL #	COMMENTS	AREA #
	2	STR	227	100-05		RPM	Starter	TDI	T1112-60001-B1R	c/w 3" FNPT, 90° Elbor (52-26947), starter relay valve (RLVA 25683-001-2-01)	152
	2	TE	225	100-05			Thermocouple	ATS Alltemp	AI-8113-U-14-180-K-10	c/w 27mm NPT 304SS Thermowell	152



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DATE	99/12/28	MAY 25/00	

DATA SHEET	REV #	TAG #	MFS #	RANGE	ENG UNIT	SET POINT	INSTRUMENT TYPE	MANUFACTURER	MODEL #	COMMENTS	AREA #
<b>GLYCOL COOLING SYSTEM</b>											
YES	2	LG	235A	100-06			Level Gauge	Penberthy	Tubular	Jacket Water Surge Tank, c/w (1) set N7A gauge cocks and glass guards	152
YES	2	LG	235B	100-06			Level Gauge	Penberthy	Tubular	Aux Water Surge Tank, c/w (1) set N7A gauge cocks and glass guards	152
YES	2	LSL	235A	100-06			Level Switch-Low	Murphy	L1111	Jacket Water Tank, 1-1/2" (48mm) NPT, 1.0 SG Float, Class 1, Div. 1, Horizontal fits 1/2 CPLG	152
YES	2	LSL	235B	100-06			Level Switch-Low	Murphy	L1111	Aux Water Tank, 1-1/2" (48mm) NPT, 1.0 SG Float, Class 1, Div. 1, Horizontal fits 1/2 CPLG	152
N/A	2	RC	235A	100-06	103	kPag	Radiator Cap	Kenco	1794	2" NPT F, 7 psig	152
N/A	2	RC	235B	100-06	103	kPag	Radiator Cap	Kenco	1794	2" NPT F, 7 psig	152
	2	TI	230	100-06	0-250/-20-120	°F/°C	Temperature Indicator	Trend	33025-A-0-06-G-4	Dual scale 3" dial, 1/2" NPT c/w 3/4" NPTM, x 1/2" NPTF, 304 SST, 2.5" insert Thermowell	152
YES	2	TI	231	100-06	0-250/-20-120	°F/°C	Temperature Indicator	Trend	33025-A-0-06-G-4	Dual scale 3" dial, 1/2" NPT c/w 3/4" NPTM, x 1/2" NPTF, 304 SST, 2.5" insert Thermowell	152
	2	TI	235	100-06	0-250/-20-120	°F/°C	Temperature Indicator	Trend	33025-A-0-06-G-4	Dual scale 3" dial, 1/2" NPT c/w 3/4" NPTM, x 1/2" NPTF, 304 SST, 2.5" insert Thermowell	152
	2	TI	236	100-06	0-250/-20-120	°F/°C	Temperature Indicator	Trend	33028-A-0-06-G-4	Dual scale, 3" dial, 1/2" NPT c/w 3/4" MNPT x 1/2" FNPT, 304SS, 2.5" insert Thermowell	152
<b>ENGINE LUBE OIL SYSTEM</b>											
YES	2	DPI	253	100-07	0-103	kPag	Differential Pressure Indicator	Midwest	120-AA-10-50-30	c/w 3-way manifold valve and mounting bracket, liquid filled	152
YES	2	LG	260	100-07		mm	Level Gauge	Penberthy	Tubular	Lube Oil Supply Tank, c/w (1) Set N7A gauge valves	152
							Level Indicator /Controller /Switch - Low	KENCO	LCE-27	SPDT, XP, CSA approved, Class 1, Div. 1, Group C & D, 1/2" NPT Inlet, 1/4" thick Pyrex Sight Glass c/w shutdown switch	
YES	2	LI/LC/LSL	262	100-07							152
YES	2	PI	259	100-07	0-1103	kPag	690 Pressure Indicator	Wika	233.53	Lube Oil, 2-1/2" dial, 1/4" NPT bottom connect	152
	2	PRV	200	100-07		kPag	Pressure Regulator	Waukesha		c/w KD-200 model L7042GL	
YES	2	PT	257	100-07	0-690	kPag	Pressure Transmitter	Wika	892.13.500	1/2" MNPT, 4-20mA signal output c/w 21mm NPT bushing, sweet lub oil service	152
	2	SV	258	100-07			3 Way Ball Valve	Whitey	42XS4	6.4mm Swagelok connections, SS construction	152
	2	TCV	200	100-07		°c	Temperature Control Valve	Amot		c/w KD-200 model L7042GL	
	2	TE	205	100-07	0 - 1260	kPa	70 Temperature Element	Thermo-Kenetics	K-Type	Single thermocouple, c/w 27mm NPT, 63,5mm insert 304SS thermowell	152
YES	2	TI	256	100-07	0-250/-20-120	°F/°C	75°C Temperature Indicator	Trend	33025-A-0-06-G-4	Dual scale, 3" dial, 2.5" stem 1/2" NPT c/w 304SS thermowell, 3/4" NPTM x 1/2" NPTF	152
	2	TI	258	100-07	0-250/-20-120	°F/°C	Temperature Indicator	Trend	33025-A-0-06-G-4	Dual Scale, 3" dial, 2.5" stem, 1/2" NPT c/w 304 SS Thermowell, 3/4" NPTM x 1/2" NPTF	152
N/A	2	VT	205	100-07	-40 - 100	°C	Vibration Transmitter	Metrix	5484C-123	non-indicating, 1/4" NPT w/ 1/2" bushing, 4-20 mA output, 5-1500 HZ, 24 VDC, 50 OHM load resist, Class 1, Div 1, Groups C&D, hazardous loc.	152
<b>COMPRESSOR LUBE OIL SYSTEM</b>											
YES	2	LG	270	100-08		mm	Level Gauge	Penberthy	Tubular	Lube Oil Supply Tank, c/w (1) Set N7A gauge valves	152
YES	2	LG	284	100-08		mm	Level Gauge	Penberthy	Tubular	Waste Oil Tank, c/w (1) Set N7A gauge valves	152

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**W1380 6HOS-3 STOCK COMPRESSOR**  
**LSD:TBA**

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		DATE	99/12/28	MAY 25/00								
DATA SHEET	REV #	TAG #	MFS #	RANGE	ENG UNIT	SET POINT	INSTRUMENT TYPE	MANUFACTURER	MODEL #	COMMENTS	AREA #	
YES	2	LI/LC/LSL	270	100-08			Level Indicator /Controller /Switch - Low	KENCO	LCE-9	SPDT, XP, CSA approved, Class 1, Div. 1, Group C & D, 1/2" NPT Inlet x 3/4" NPT Outlet c/w shutdown switch	152	
YES	2	PT	281	100-08	0 - 690	kPa	Pressure Transmitter	Wika	892.13.500	1/2" MNPT, 4-20 mA signal output c/w 21mm NPT bushing, sweet lubricating oil service	152	
N/A	2	SOV	276	100-08			Solenoid Valve	ASCO	EF8320G202	3-Way, CSA approved, XP, 24 VDC	152	
	2	SV	276	100-08	34 - 103	kPa	3 Way Valve	Amot	4057CT	BUNA-N Seals, spring return	152	
YES	2	TE	282	100-08	0 - 1260	°C	82	Temperature Element	Thermo-Kenetics	K-Type	Single thermocouple, c/w 27mm NPT, 63.5mm insert 304SS thermowell	152
YES	2	TI	275	100-08	0-250/-20-120	°F/°C		Temperature Indicator	Trend	33025-A-0-06-G-4	Dual scale, 3" dial, 2.5" stem 1/2" NPT c/w 304SS thermowell, 3/4" NPTM x 1/2" NPTF	152
	1	TI	275EP	100-08				Thermocouple	ATS Alltemp	DPYH-4320-U-K-10	Suitable for "K" style thermocouples	152
YES	2	TI	280	100-08	0-250/-20-120	°F/°C		Temperature Indicator	Trend	33025-A-0-06-G-4	Dual scale, 3" dial, 2.5" stem 1/2" NPT c/w 304SS thermowell, 3/4" NPTM x 1/2" NPTF	152
N/A	2	VT	288	100-08	-40 - 100	°C		Vibration Transmitter	Metrix	5484C-123	non-indicating, 1/4" NPT w/ 1/2" bushing, 4-20 mA output, 5-1500 HZ, 24 VDC, 50 OHM load resist, Class 1, Div 1, Groups C&D, hazardous loc.	152
<b>COMPRESSOR PACKING VENT &amp; DRAINS</b>												
	2	DPS	288	100-09	14 - 490	kPag	70	Differential Pressure Switch	CCS	646DZE2	Falling, class 1 div 2 Groups C & D, NACE	152
NO	2	FI	286	100-09	0-60	SCFH		Flow Indicator	Zimco	7510-3-3-2A-11	1/4" NPT, ss inlet and outlet, sweet natural gas 0.65 SG, Vertical mount	152
NO	2	FI	287	100-09	0-60	SCFH		Flow Indicator	Zimco	7510-3-3-2A-11	1/4" NPT, ss inlet and outlet, sweet natural gas 0.65 SG, Vertical mount	152
	2	FSL	289	100-09								
YES	2	LG	130	100-09				Level Gauge	Penberthy	Tubular	c/w (1) set N7A gauge valves	152
YES	2	PI	286	100-09	0-103	kPag	41	Pressure Indicator	Wika	233.53	Packing Vent, 2-1/2" dial, 1/4" NPT bottom connect	152
YES	2	PI	287	100-09	0-414	kPag	172	Pressure Indicator	Wika	233.53	Packing Vent, 2-1/2" dial, 1/4" NPT bottom connect	152
YES	2	PRV	130	100-09	34-241	kPag	100	Pressure Regulator	Fisher	98H	48mm NPT, WCB steel body, for sour service	152
YES	2	PRV	286	100-09	34-241	kPag	41	Pressure Regulator	Fisher	67-AFR	13mm FNPT, 2000#, Nace, ventable bonnet	152
YES	2	PRV	287	100-09	34-241	kPag	172	Pressure Regulator	Fisher	67-AFR	13mm FNPT, 2000#, Nace, ventable bonnets	152
YES	2	PSH	130	100-09	21-83	kPag	69	Pressure Switch	CCS	6900GZE12	3/4" NPTM, 1/4" FNPT, CSA-Class 1 Div 1 group C&D, sour service	152
<b>DRIVE TRAIN EQUIPMENT</b>												
N/A	2	VSH	230	100-10				Vibration Switch - High	Murphy	VS-2 EX	CSA Approved, XP, Contacts Open on HI	238
<b>BUILDING UTILITIES</b>												
	2	PRV	240A	100-11					CATADYNE		VENDOR SUPPLIED	
	2	PRV	240B	100-11					CATADYNE		VENDOR SUPPLIED	
	2	PRV	240C	100-11					CATADYNE		VENDOR SUPPLIED	

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# M2582, M5081, and M5180 Series Electromechanical and Pneumatic, Fuel Gas Shut-off Valves Installation and Operation Instructions



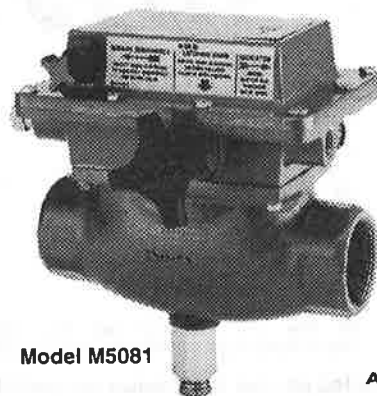
Please read the following instructions before installing. A visual inspection of this product for damage during shipping is recommended before mounting. It is your responsibility to have a qualified person install the unit and make sure installation conforms with NEC and local codes.

## 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 M5081



Approved\*

### M2582 and M5081 Series

#### Tripping Power From Engine Ignition System or Battery (Models available for magneto, CD ignition or 12/24 V battery)

These fuel shut-off valves are semi-automatic devices for shutdown of natural gas fueled engines. The standard valve opens by manual operation of the reset handle. A latch in the upper body of the valve will set and hold the valve open. At this point no electric power is used. The electromagnetic coil is de-energized, the snap-switch(es) is SET.

If a SWICHGAGE® contact closes, a circuit is completed from power through the snap-switch and coil. Now energized, the electromagnet trips the latch, (latch can be tripped manually), the valve closes, and the snap-switch resets. Power switches from the coil circuit to your choice of an open line, an electrical ground, or an alarm. After tripping, the vent seal opens, and on the M50 models, the open/close indicator (green button) retracts to indicate that the valve is closed.

Valve body is sandcast aluminum. Optional cast steel for M5081 models.

### M2582-P, M5180-P and M5180-V

#### MURPHY-NUMATIC™ Pneumatic Version for Pressure or Vacuum

Pneumatically controlled valves are designed to open and close automatically or semi-automatically (the supply can be air, oil or gas). M5180 models can operate from vacuum or pressure (pressure fittings can be swapped for vacuum control). The M2582-P is not available for vacuum.

**NOTE:** If using oil as a pressure source, use a lightweight oil.

These valves will open on rising control pressure and close on decreasing control pressure. M2582-P and M5180-P automatically open at 2 psi (14 kPa) [0.14 bar] and fully open at 3 psi (21 kPa) [0.21 bar].

All models include a built-in lever to aid in opening the valve manually. The M2582-P can be manually opened against inlet pressure of 80 psi (552 kPa) [5.52 bar]. The M5180-P valve can be opened against inlet pressure of 100 psi (689 kPa) [6.89 bar].

Standard models include an escape vent for gas trapped forward in the line after shut-off.

### M5081FS

#### Normally Energized Circuit

The M5081FS is manually opened, electrically latched open and tripped by interrupting the coil power circuit.

#### Magnetic Switch Adapter

As ignition systems wear from usage, their power output becomes less and less. Ignition may not have the capacity to reliably trip the Fuel Valve. Therefore, the use of a Magnetic Switch Adapter for *CD ignition systems* is recommended. The Magnetic Switch Adapter is a device that stores energy from the CD ignition to trip the Fuel Valve. Three models are available:

**65020126:** For Negative Ground CD Ignitions up to 240 VDC

**65020127:** For Positive Ground CD Ignitions up to 450 VDC

**65020155:** For Negative Ground CD Ignitions up to 450 VDC

#### 100 ohm, 2 watt Resistor

For Capacitor Discharge Ignitions that are specified to be grounded when the valve closes, and a Magnetic Switch Adapter is in use. The resistor must be connected in the system to prevent damage to the snap-switches in the fuel shut-off valve (see typical wiring diagrams).

A 100 ohm, 2 watt resistor is supplied on page 11, for your convenience.

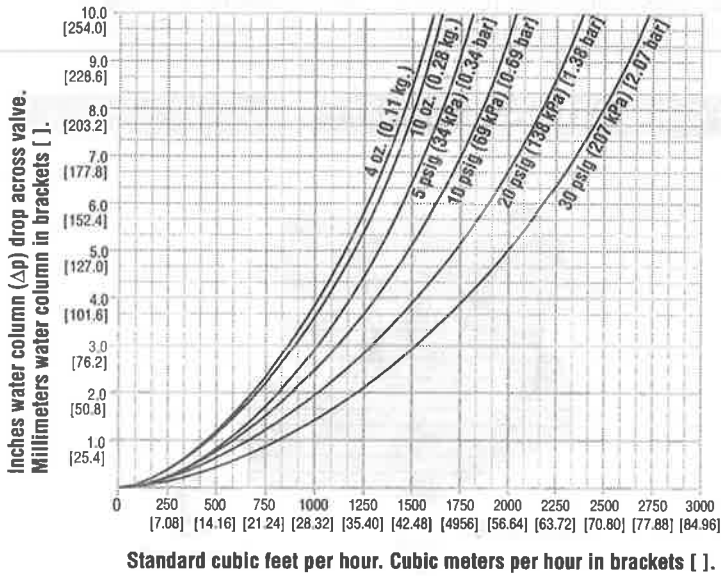
#### Diode Package

The Murphy diode package (65010065) is designed to allow the fuel shut-off valve to be used with dual Magneto Ignition systems.

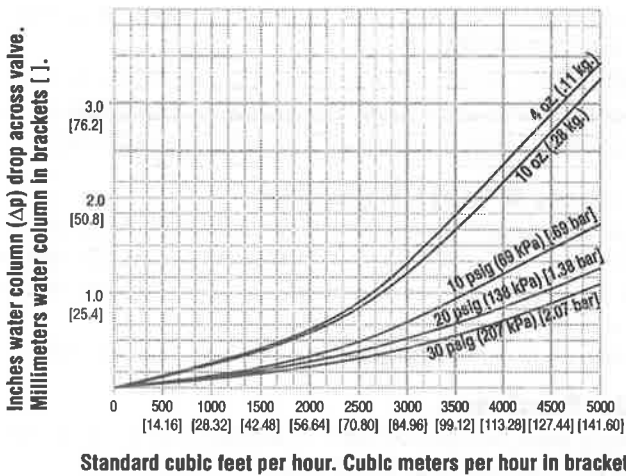
\* M5081 model is CSA approved for Class I, Division I, Groups C and D. See Specifications on page 12.

## FLOW CHARACTERISTICS

### M2582 Series



### M5081 Series



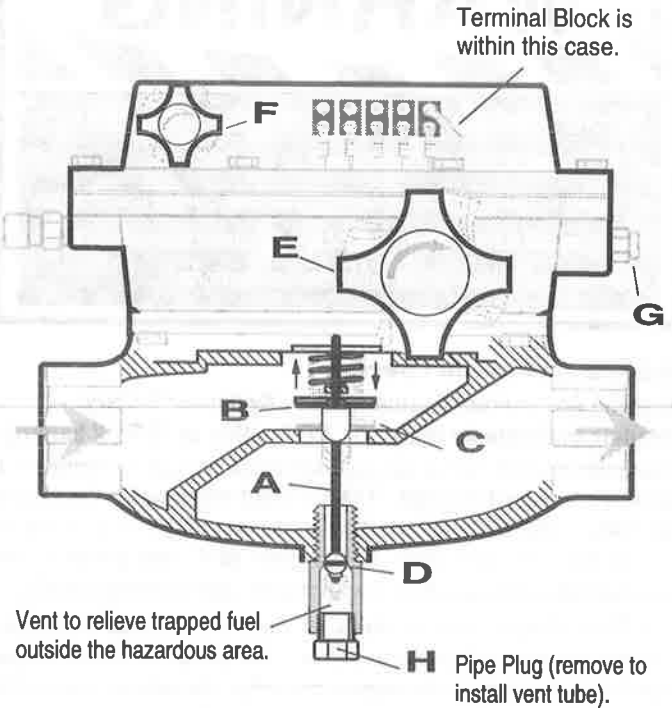
## VALVE CUT-OUT

### Understanding the Basic Operation of the Fuel Shut-off Valve

The valve below is shown in the run (open) position. Pressure is equalized, seat (B) is open, allowing the fuel to flow. When valve is in the tripped position (closed), seat closes (C).

The vent (D) opens to relieve trapped downstream fuel to vent to a non-hazardous area.

TYPICAL MODEL (M5081) SHOWN



- A. Main Stem
- B. Pressure Disc/seal (in run/open)
- C. Pressure Disc/seal (in trip/closed)
- D. Vent Seal Gland
- E. Reset Knob (latches valve open)
- F. Manual Trip Knob (not available for M5081FS)
- G. Indicator Button (out with valve open)
- H. Pipe Plug

**NOTE:** If the vent-after-tripping feature is not used, remove O-ring (D), to avoid condensation accumulation that can hamper trip action.

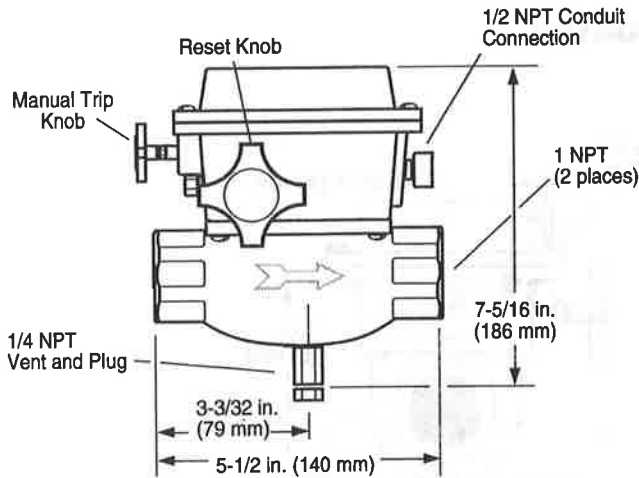
**Be sure** to replace Pipe Plug (H) and to clean vent periodically.

## DIMENSIONS

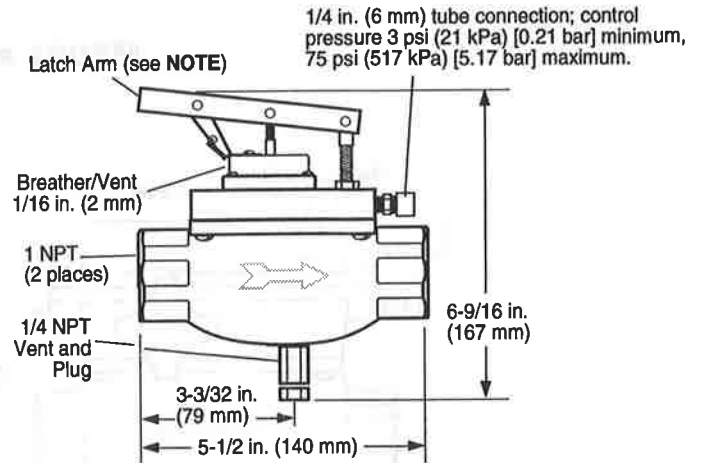


**CAUTION:** THE ARROW ON THE SIDE OF THE FUEL VALVE **MUST** POINT TO THE CORRECT DIRECTION OF THE FLOW, FROM FUEL SOURCE TO THE ENGINE. APPLY PIPE DOPE **ONLY** TO FUEL PIPE, **NOT** TO THE FUEL VALVE.

### M2582

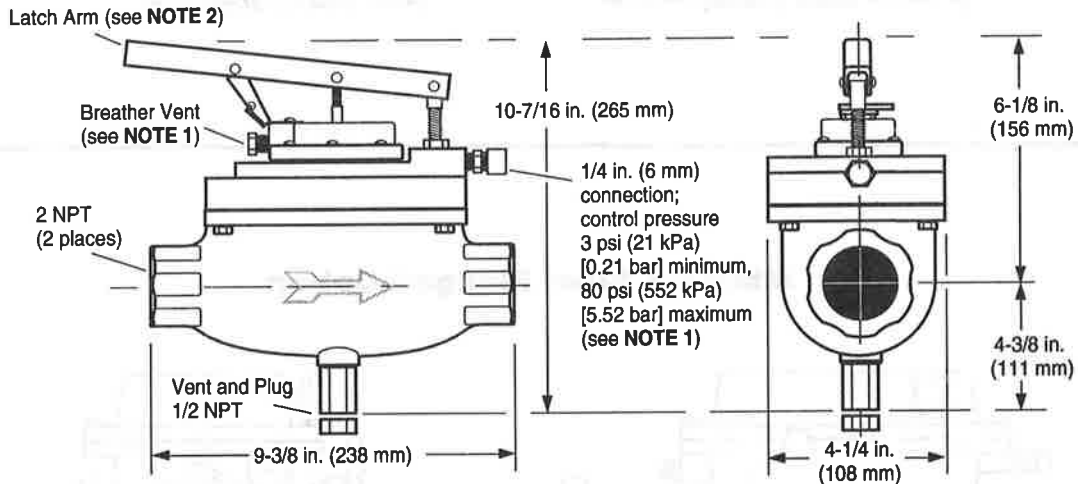


### M2582-P



**NOTE:** Thumb operated opening latch (2.5 psi [17 kPa] [0.17 bar] required to release cocking latch)

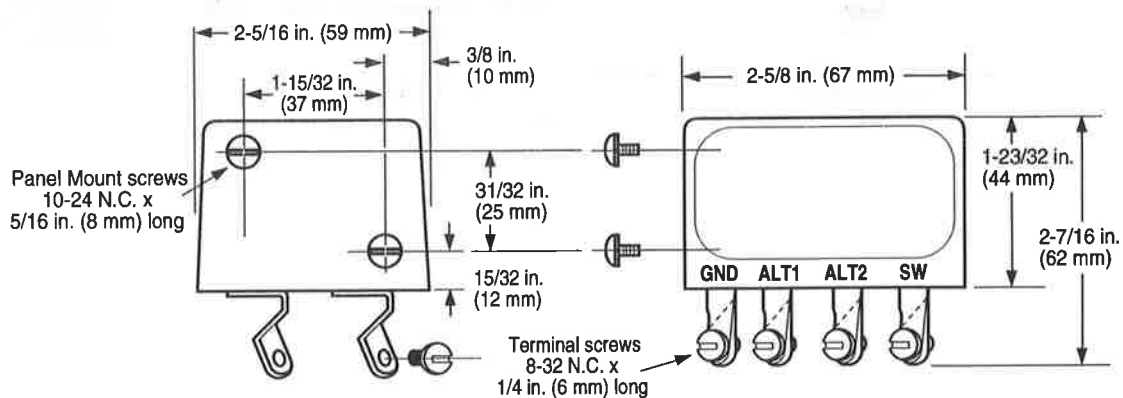
### M5180-P and M5180-V



**NOTE 1:** Control pressure connection fitting and breather vent fitting can be swapped to convert to vacuum control.

**NOTE 2:** Thumb operated opening latch (2.5 psi [17 kPa] [0.17 bar] required to release cocking latch).

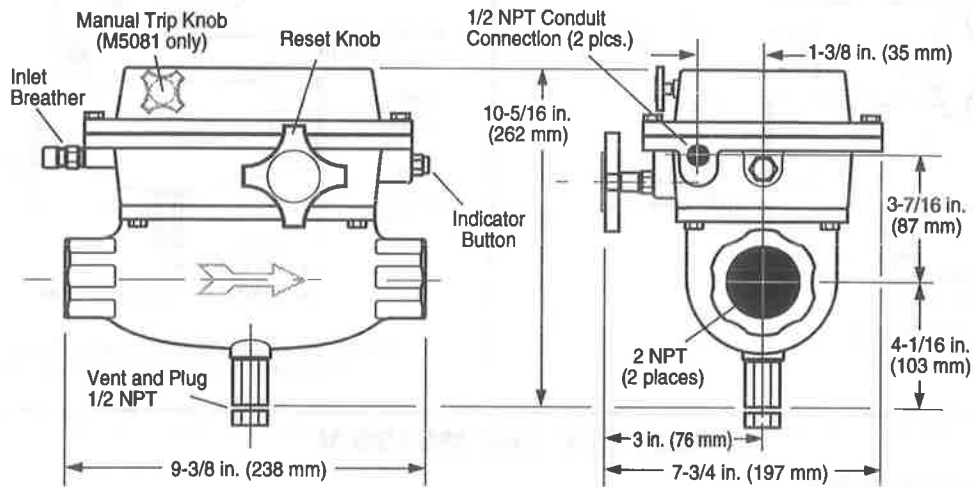
### Magnetic Switch Adapters 65020126, 65020127 and 65020155



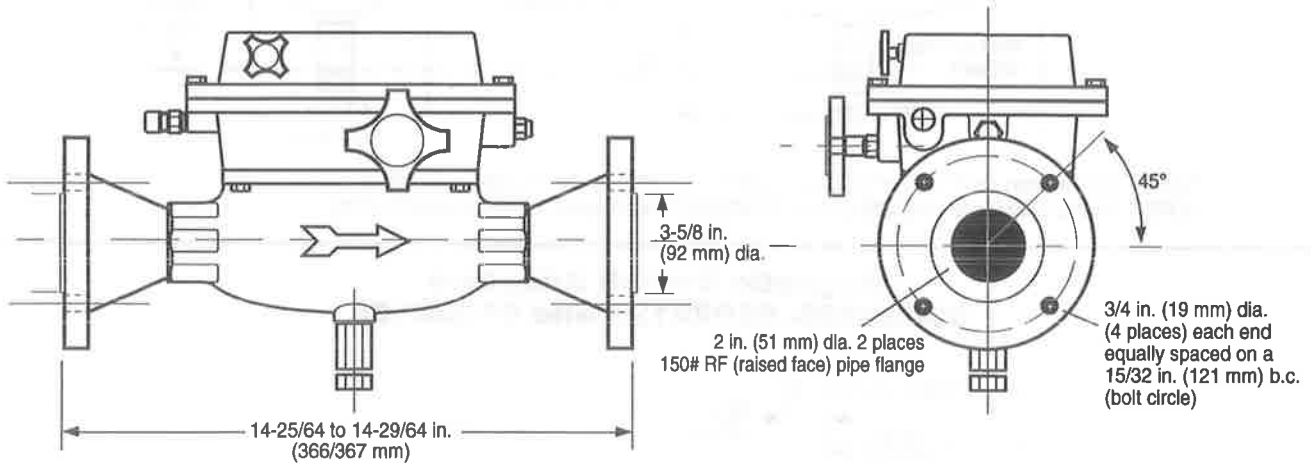


**CAUTION:** THE ARROW ON THE SIDE OF THE FUEL VALVE **MUST** POINT TO THE CORRECT DIRECTION OF THE FLOW, FROM FUEL SOURCE TO THE ENGINE. APPLY PIPE DOPE **ONLY** TO FUEL PIPE, **NOT** TO THE FUEL VALVE.

**M5081 and M5081FS**



**M5081-3 Steel Flanged Option**





## INSTALLATION



**WARNING:** STOP THE ENGINE AND DISCONNECT ALL ELECTRICAL POWER BEFORE BEGINNING INSTALLATION. BEGIN THE INSTALLATION BY SECURING AREA OF ANY HAZARDOUS CONDITIONS. SHUTOFF THE FUEL GAS SUPPLY. FOR HAZARDOUS APPLICATIONS REFER TO NATIONAL ELECTRICAL CODE SPECIFICATIONS.

### Connecting the Fuel Shut-off Valve

1. Before connecting the unit, apply pipe dope to plumbing male threads that will be inserted into the valve. Do **not** apply pipe dope to the valve.
2. Make sure that the arrow on the side of the valve indicates the correct direction of the flow.
3. Fuel shut-off valves can be installed in all three planes. However, mounting the valve horizontally (with vent pointing down) is recommended. Do **not** install valve with top down. (Refer to *Figure 1*.)
4. Hold valve in position, (use a tool on valve wrench flats) and tighten plumbing into inlet and outlet ends. (Refer to *dimensions on pages 3-4*.)



**CAUTION:** DO NOT TWIST THE VALVE BODY HOUSING.

5. To mount flanged models, follow the appropriate installation codes and ordinances for the application. (For *dimensions* see page 4.)
6. A vent line (to allow gas trapped forward between fuel valve and the carburetor to escape) should be attached to the vent connection at the bottom of the valve housing. Remove the plug and install the line. (Refer to *Figure 1*.)

### Connecting Pneumatic Models M2582-P, M5180-P and M5180-V

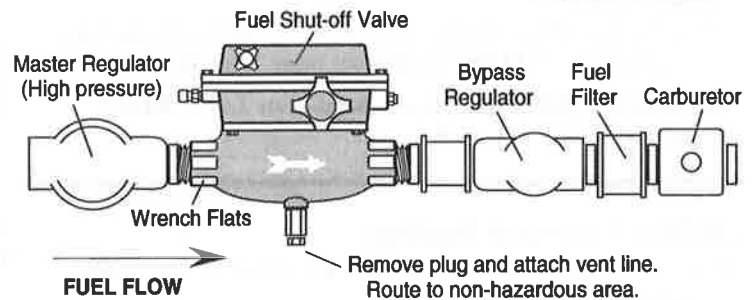
1. Repeat the steps above (1 thru 5), and observe the necessary cautions.
2. A lever/arm (handle) and a cocking latch are provided to allow manual opening of the valve. The thumb-operated latch can be locked in place to hold the lever/arm latched. The cocking latch will be released when pilot pressure reaches 2.5 psi (17 kPa) [0.17 bar]. M2582-P and M5180-P automatically open at 2 psi (14 kPa) [0.14 bar], and fully open at 3 psi (21 kPa) [0.21 bar]. See Specifications, page 12 for maximum control pressure.



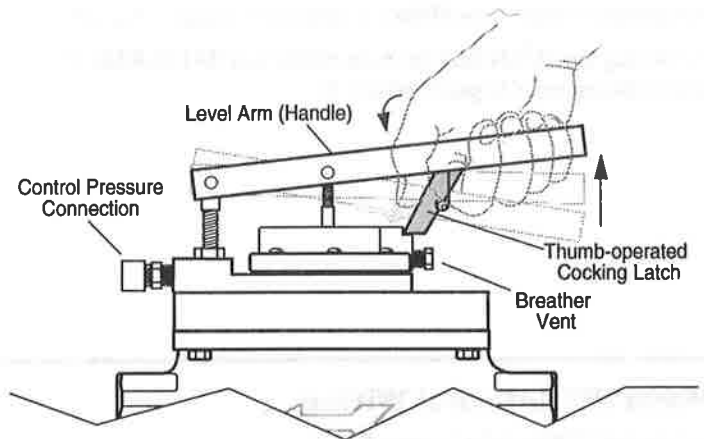
**CAUTION:** BE SURE PNEUMATIC SOURCE RELEASES THE MECHANICAL LATCH WHEN RUNNING.

3. If vacuum control is desired, swap the Control Pressure connection fitting and the Breather Vent fitting on your M5180-P model (see *Fig. 2*).

**Figure 1**  
**Physical Location and Plumbing (typical)**



**Figure 2**  
**Pull the lever up, and press the latch down into ridge with thumb.**



## WIRING INFORMATION



**WARNING: PERFORM THE WIRING OPERATION WITH THE POWER SOURCE "OFF" AND THE AREA MADE NON-HAZARDOUS. MAKE SURE THE VOLTAGE AND CURRENT REQUIREMENTS ARE WITHIN THE FUEL SHUT-OFF VALVE RATINGS. HARD CONDUIT WITH APPROVED SEALS IS REQUIRED BY THE NEC FOR HAZARDOUS AREA INSTALLATIONS.**

### M2582 Internal Wiring

Wiring shown in normal mode of operation (seat open). The 18 AWG (1.0 mm<sup>2</sup>) wire is color coded to the coil:

- For CD ignitions:* White and Orange
- For Magneto ignitions:* White and Green
- For Battery:* White and Blue

#### Conduit Installation

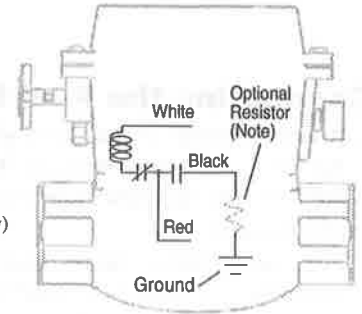
Install a 1/2 NPT conduit from the M2582 conduit connection to the power source. See M2582 Dimensions (page 3) for location.

For wiring the M2582 fuel valve to Solid-State TATTLETALE<sup>®</sup> annunciators, refer to page 9.

### Internal Wiring for M2582

#### NOTE:

For grounding the ignition (CD models only) through the fuel valve snap-switch, use a Magnetic Switch Adapter (see Magnetic Switch Adapter, below) and install a 100 ohm; 2 watt resistor (included on page 11).



### M5081 Internal Wiring

Wiring shown in normal mode of operation (seat open). The 18 AWG (1.0 mm<sup>2</sup>) wire is color coded to the coil:

- For CD Ignitions:* White and Orange
- For Magneto Ignitions:* White and Green
- For Battery:* White and Blue

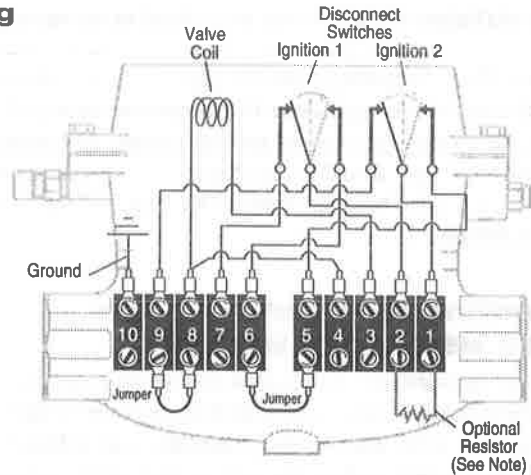
#### Conduit Installation

Install a 1/2 NPT conduit from the M5081 conduit connection to the power source. Refer to Dimensions (on page 4) for location.

For typical wiring of the M5081 models refer to pages 7 and 8.

For wiring the M5081 fuel valves to Solid-State TATTLETALE<sup>®</sup> annunciators, refer to pages 10 and 11.

### M5081 Internal Wiring

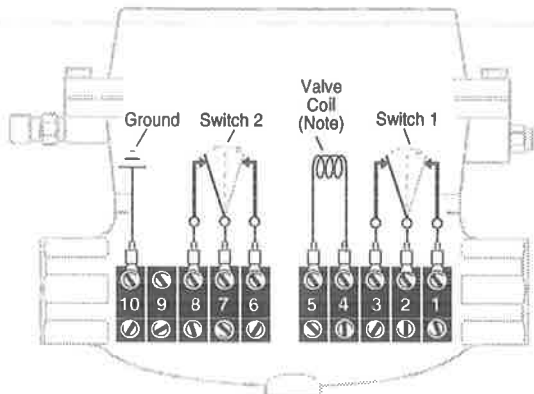


**NOTE:** For grounding the ignition (CD models only) through the fuel valve snap-switches, use a Magnetic Switch Adapter (see Magnetic Switch Adapter, below) and install a 100 ohm; 2 watt resistor (included in page 11).

### M5081FS Internal Wiring

For typical Wiring refer to page 8.

For wiring the M5081FS to MARK IV 12/24 refer to page 11.



**NOTE:** Wiring shown in normal mode of operation (seat open). The 18 AWG (1.0 mm<sup>2</sup>) wire is red color for both options: 12 VDC and 24 VDC.

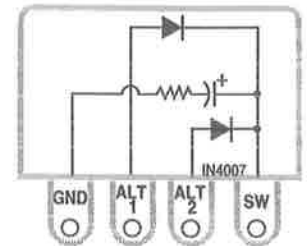
### Magnetic Switch Adapters for Use with Capacitor Discharge Ignitions

Connect the Magnetic Switch Adapter between the fuel Valve terminal 1 and the CD Ignition. See wiring diagrams on pages 7, 9, 10.

65020155: For use with negative ground ignitions up to 450 VDC.

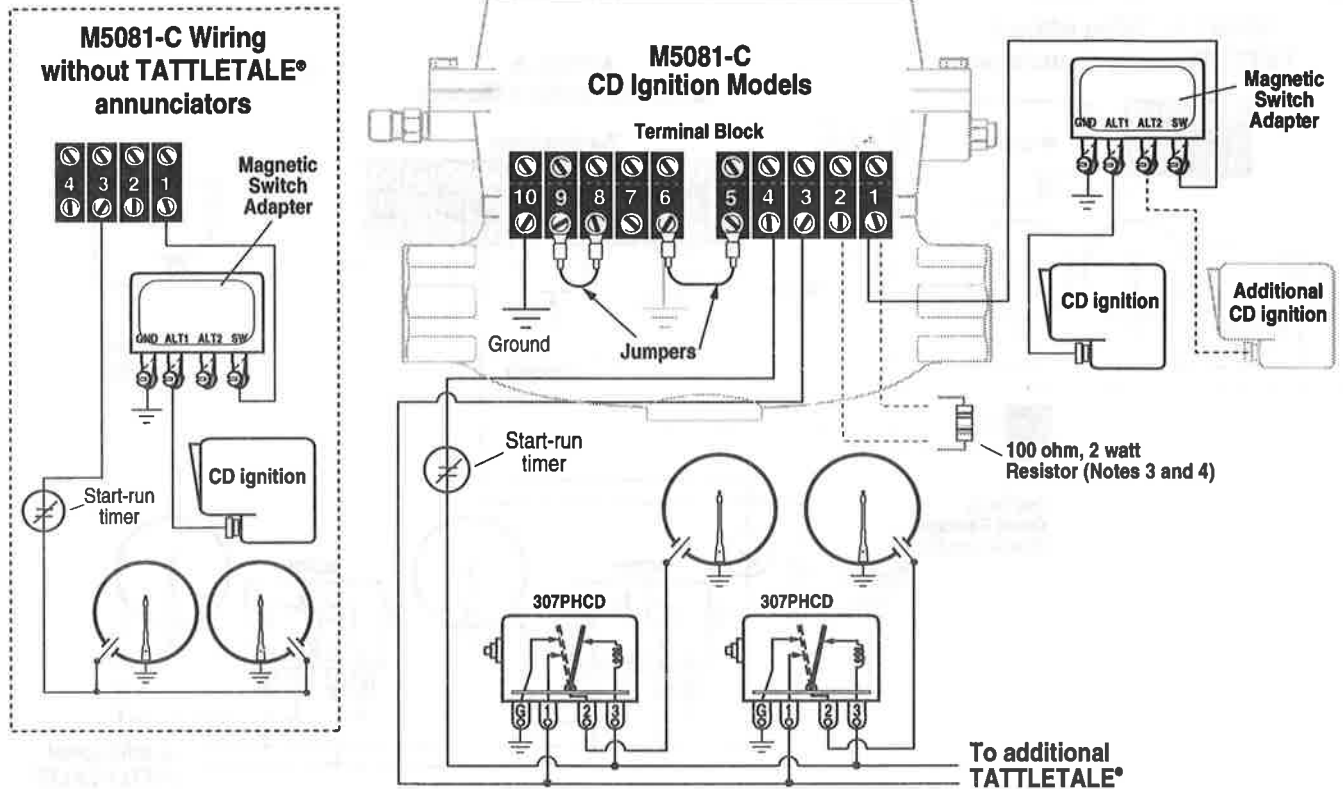
65020127: For use with positive ground ignitions up to 450 VDC.

65020126: For use with negative ground ignitions up to 240 VDC.



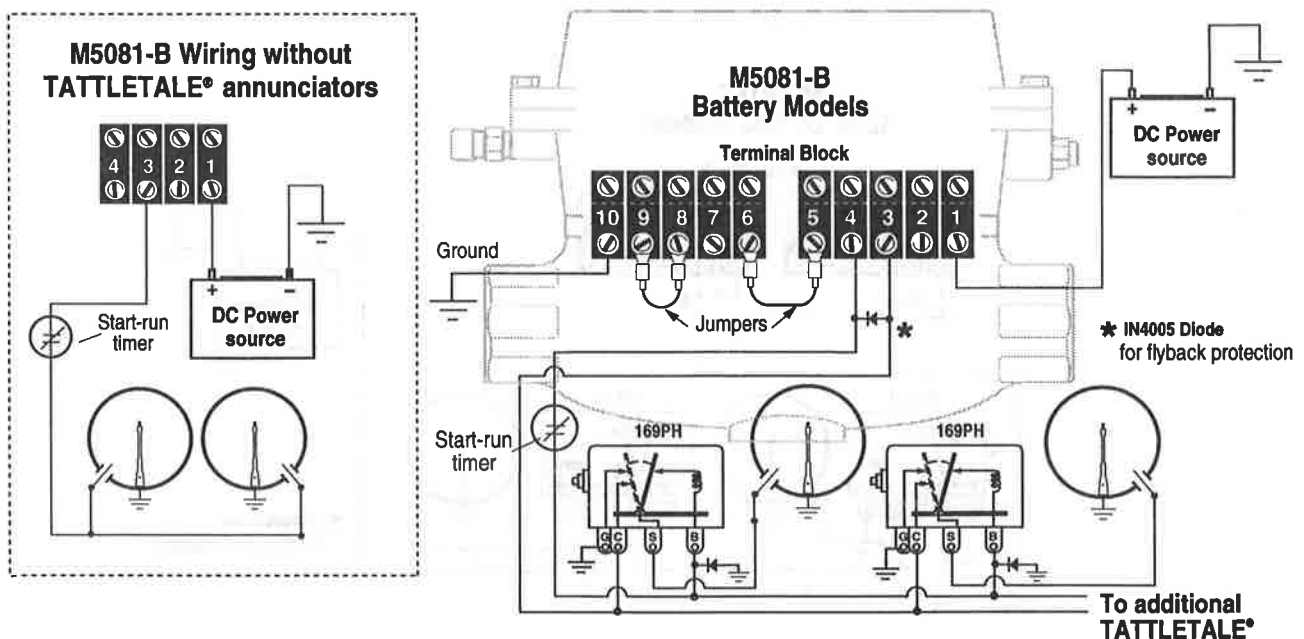
Negative ground  
Magnetic Switch Adapter shown

## TYPICAL WIRING for M5081-C (CD IGNITION MODELS)

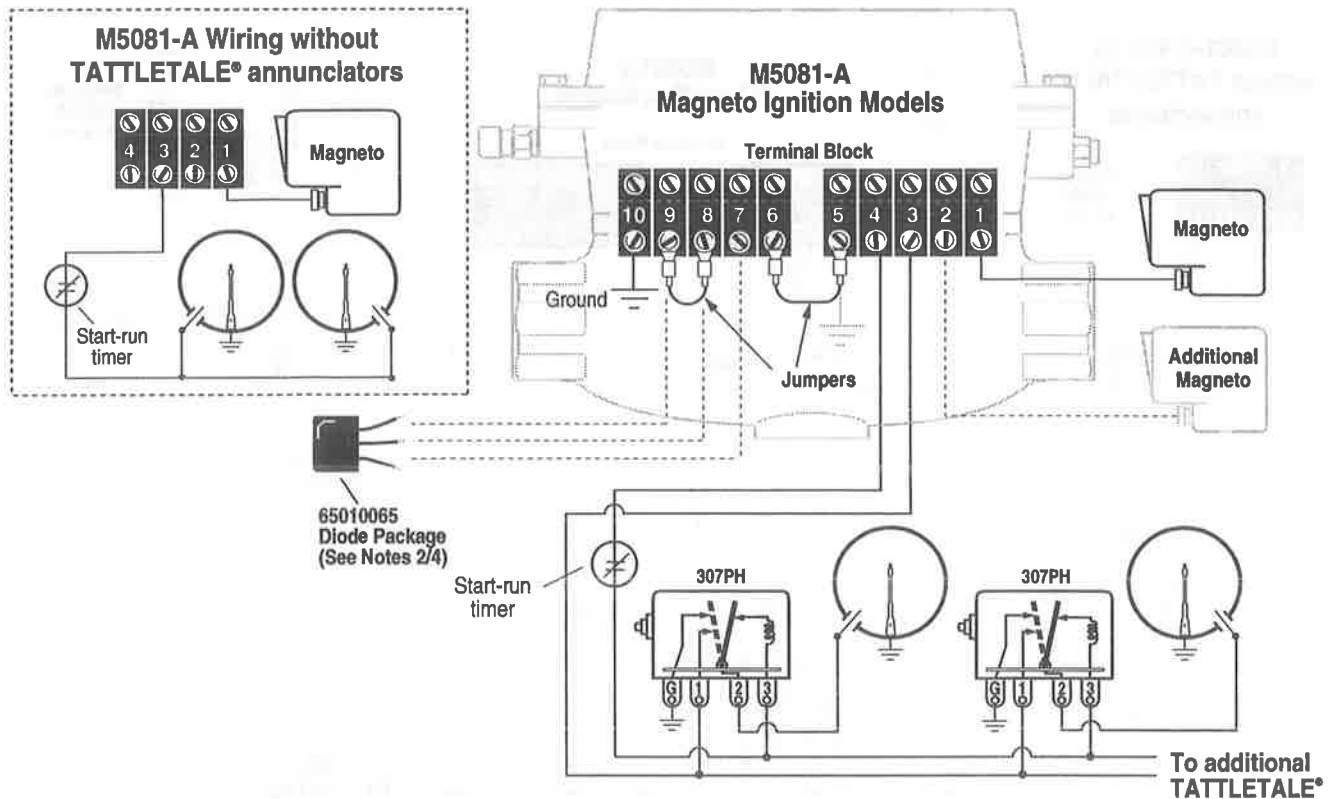


- NOTE 1:** To CLOSE FUEL VALVE—NOT GROUNDING THE IGNITION (Single CD Ignition Systems) Remove the factory-installed jumper on terminals 6-5. Do NOT ground terminal 6.
- NOTE 2:** To CLOSE FUEL VALVE—NOT GROUNDING THE IGNITIONS (Dual CD Ignition Systems) Remove the jumper on terminals 6-5. Connect second ignition to Magnetic Switch Adapter terminal ALT2.
- NOTE 3:** To CLOSE FUEL VALVE and GROUND THE IGNITION (Single CD Ignition Systems) Remove the jumper on terminals 6-5. Connect a 100 ohm, 2 watt resistor between valve terminals 1-2. Ground terminal 6.
- NOTE 4:** To CLOSE FUEL VALVE and GROUND THE IGNITION (Dual CD Ignition Systems) Remove the jumper on terminals 6-5. Connect a 100 ohm, 2 watt resistor between valve terminals 1-2. Ground terminal 6. Connect second ignition to Magnetic Switch Adapter terminal ALT2.

## TYPICAL WIRING for M5081-B (BATTERY IGNITION MODELS)

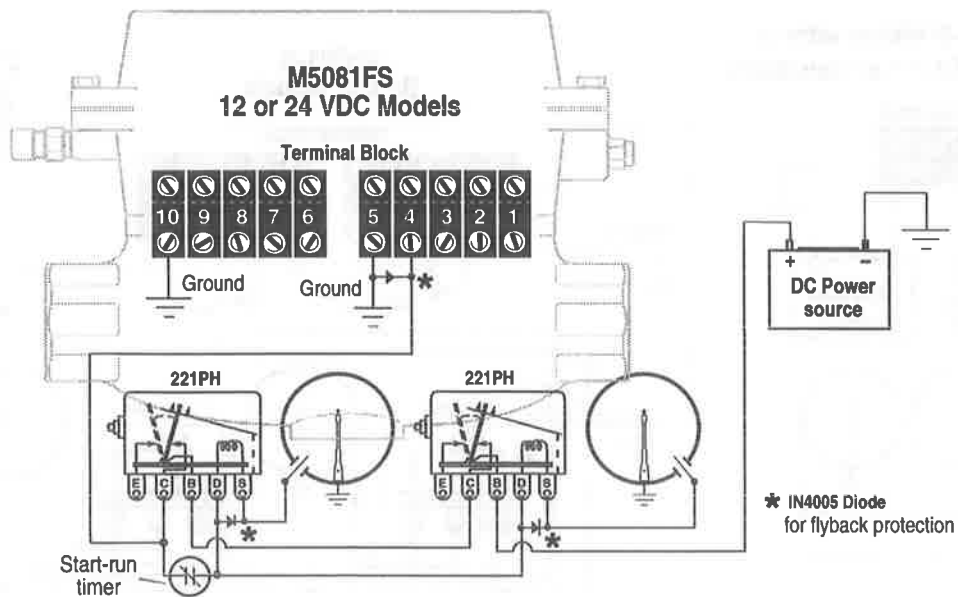


## TYPICAL WIRING for M5081-A (MAGNETO IGNITION MODELS)



- NOTE 1:** To CLOSE FUEL VALVE—NOT GROUNDING THE IGNITION (Single Magneto Systems) Remove the factory-installed jumper on terminals 6-5. Do NOT ground terminal 5.
- NOTE 2:** To CLOSE FUEL VALVE—NOT GROUNDING THE IGNITIONS (Dual Magneto Systems) Remove the factory-installed jumpers on terminals 6-5 and 9-8. Add 65010065 diode package as shown. Do NOT ground terminals.
- NOTE 3:** To CLOSE FUEL VALVE and GROUND THE IGNITION (Single Magneto Systems) The factory-installed jumpers (6-5 and 9-8) must be in place. Add ground wire to terminal 5.
- NOTE 4:** To CLOSE FUEL VALVE and GROUND THE IGNITION (Dual Magneto Systems) Remove the jumper on terminals 9-8. Add 65010065 diode package as shown. Add ground wire to terminal 5.

## TYPICAL WIRING for M5081FS (NORMALLY ENERGIZED MODELS)

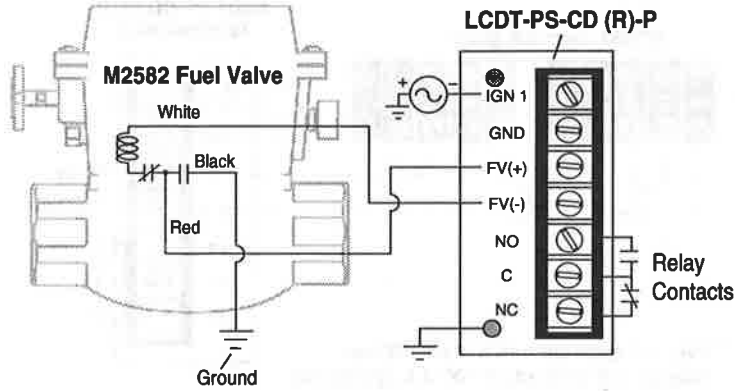


# TYPICAL WIRING for M2582 to SOLID-STATE TATTLETALE®



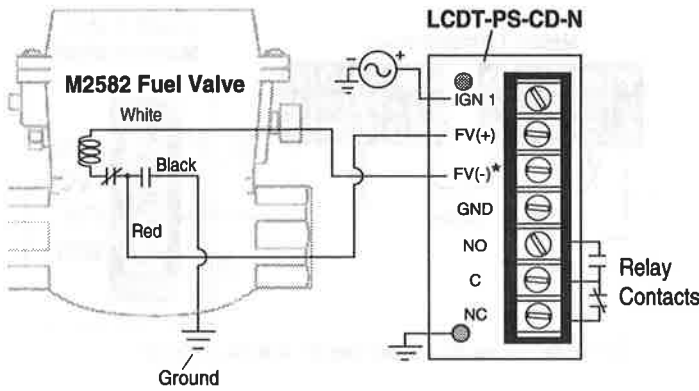
**WARNING:** PERFORM THE WIRING OPERATION WITH THE POWER SOURCE "OFF" AND THE AREA MADE NON-HAZARDOUS. MAKE SURE THE VOLTAGE AND CURRENT REQUIREMENTS ARE WITHIN THE FUEL SHUT-OFF VALVE RATINGS. HARD CONDUIT WITH APPROVED SEALS IS REQUIRED BY THE NEC FOR HAZARDOUS AREA INSTALLATIONS.

## M2582 to LCDT-PS-CD (R)-P (positive ground)



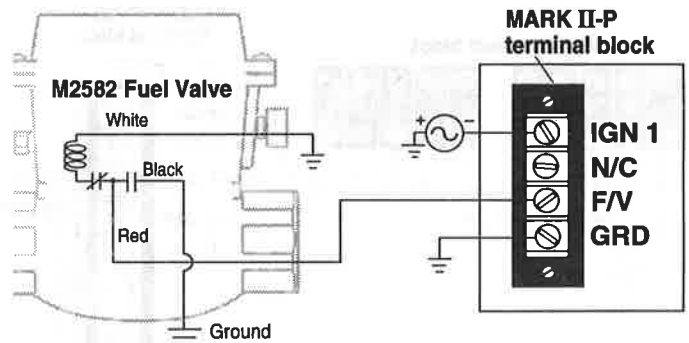
Relay contacts rated: 3 A, 30 VDC, 4 A, 125/250 VAC

## M2582 to LCDT-PS-CD-N (negative ground)



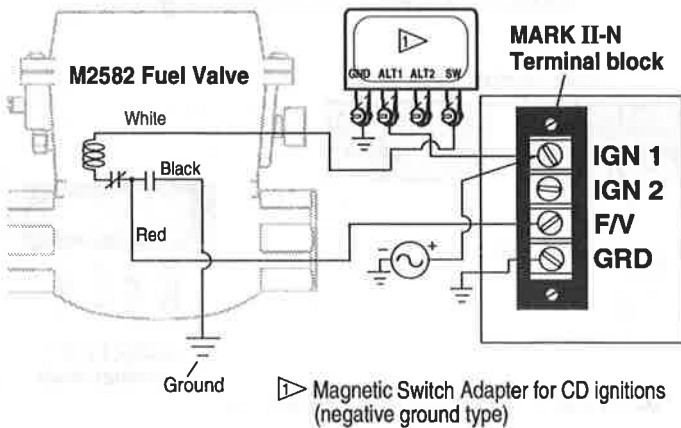
\* Relay contacts rated: 3 A, 30 VDC, 4 A, 125/250 VAC

## M2582 to MARK II-P (positive ground)



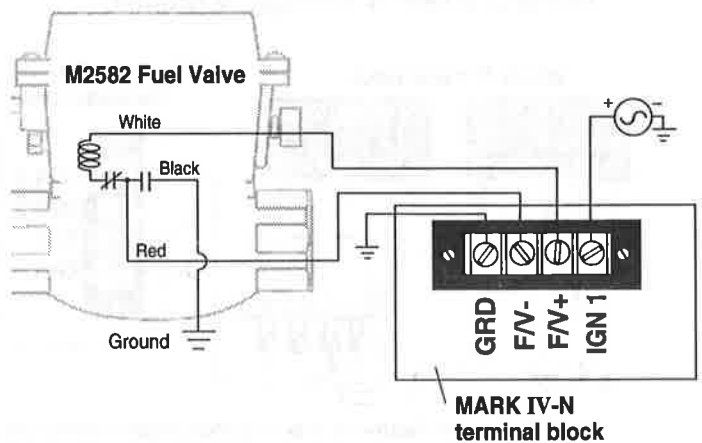
FET output rated: 0.5 A @ 250 VDC max.

## M2582 to MARK II-N (negative ground)



▶ Magnetic Switch Adapter for CD ignitions (negative ground type)

## M2582 to MARK IV-N (negative ground)

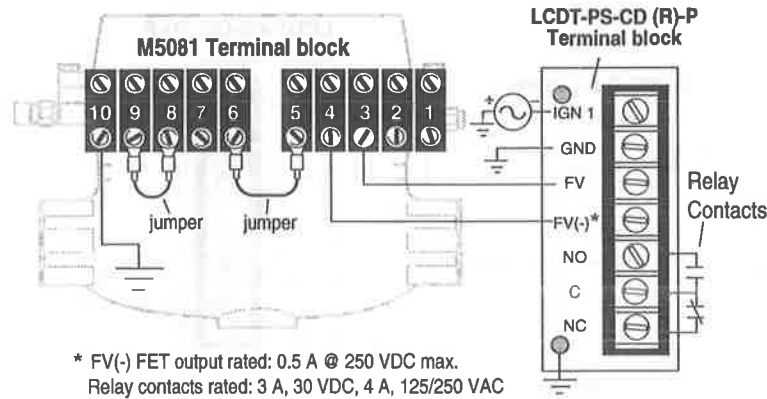


# TYPICAL WIRING for M50 to SOLID-STATE TATTLETALE<sup>SM</sup>

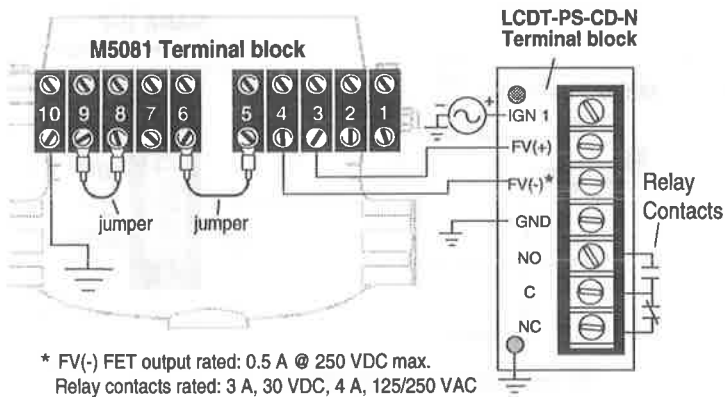


**WARNING:** PERFORM THE WIRING OPERATION WITH THE POWER SOURCE "OFF" AND THE AREA MADE NON-HAZARDOUS. MAKE SURE THE VOLTAGE AND CURRENT REQUIREMENTS ARE WITHIN THE FUEL SHUT-OFF VALVE RATINGS. HARD CONDUIT WITH APPROVED SEALS IS REQUIRED BY THE NEC FOR HAZARDOUS AREA INSTALLATIONS.

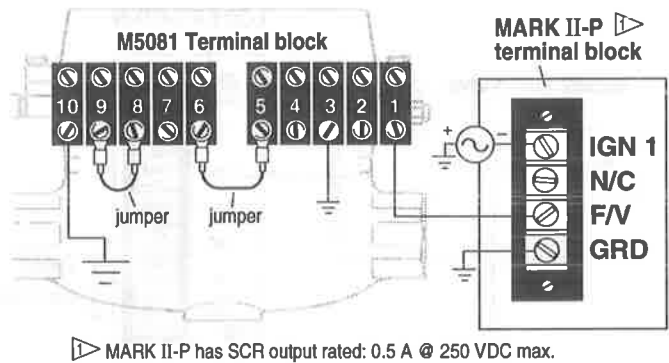
## M50 to LCDT-PS-CD (R)-P (positive ground)



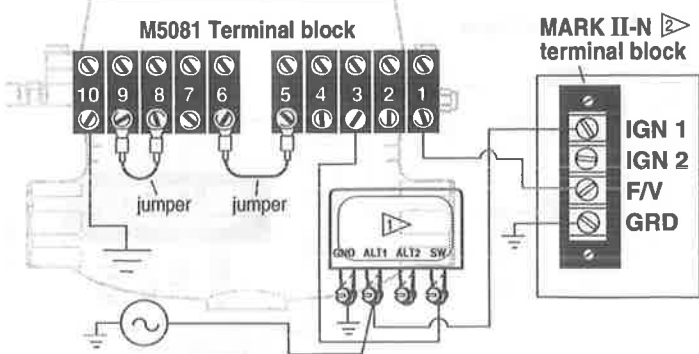
## M50 to LCDT-PS-CD-N (negative ground)



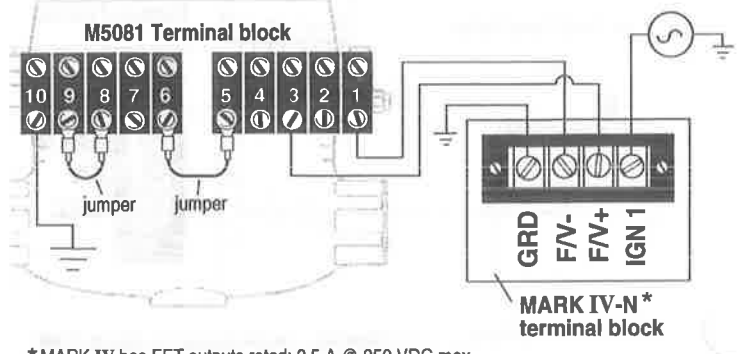
## M50 to MARK II-P (positive ground)



## M50 to MARK II-N (negative ground)



## M50 to MARK IV-N (negative ground)

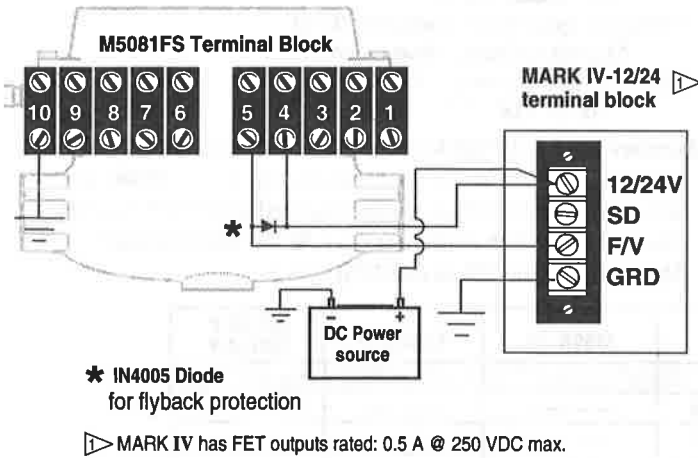


# TYPICAL WIRING for M50 to SOLID-STATE TATTLETALE<sup>®</sup> *continued*

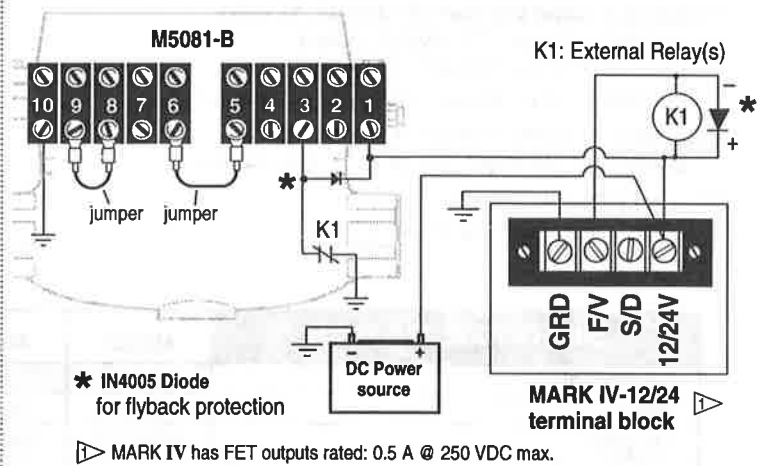


**WARNING:** PERFORM THE WIRING OPERATION WITH THE POWER SOURCE "OFF" AND THE AREA MADE NON-HAZARDOUS. MAKE SURE THE VOLTAGE AND CURRENT REQUIREMENTS ARE WITHIN THE FUEL SHUT-OFF VALVE RATINGS. HARD CONDUIT WITH APPROVED SEALS IS REQUIRED BY THE NEC FOR HAZARDOUS AREA INSTALLATIONS.

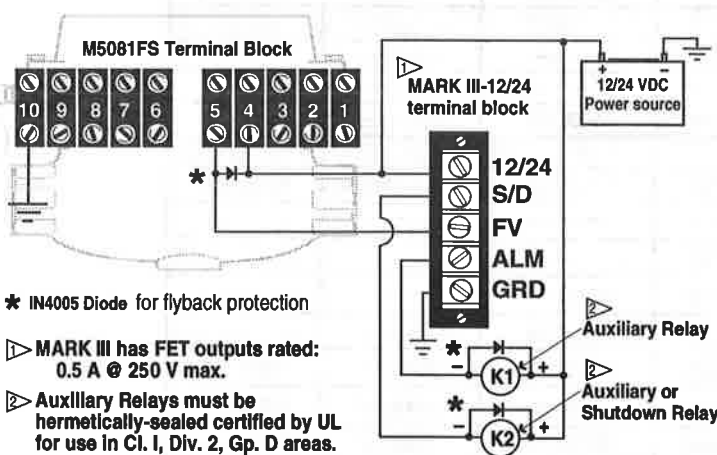
## M5081FS to MARK IV-12/24



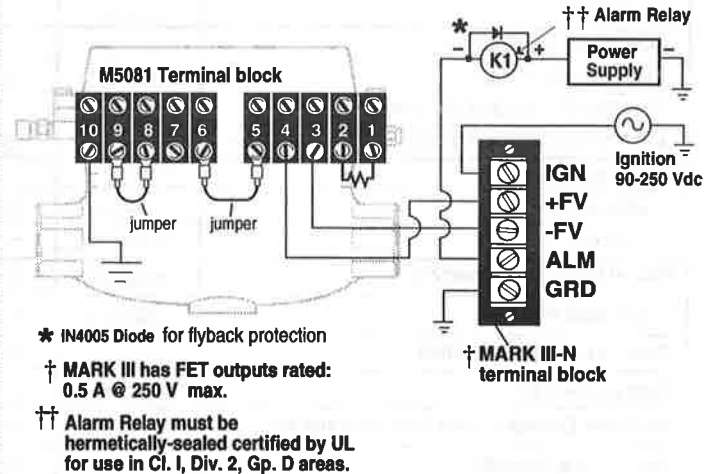
## M5081-B to MARK IV-12/24



## M5081FS to MARK III-12/24



## M5081 to MARK III-N



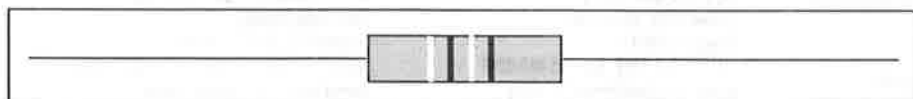
## TO CLOSE FUEL VALVE AND GROUND THE IGNITION

When *Capacitor Discharge Ignition Systems* are specified to be *grounded* when the *fuel gas valve closes*, and a *Magnetic Switch Adapter* is in use, a resistor must be used in the system to prevent damage to the valve snap-switches.

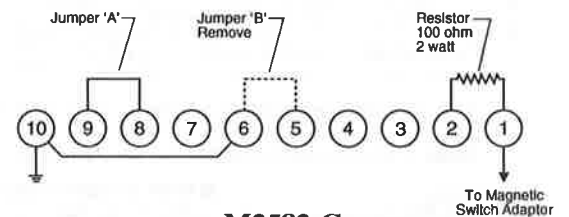
**M5081-C:** Place the 100 ohm, 2 watt resistor between valve terminals 1 and 2 as shown. Remove jumper "B" from terminals 5 and 6. Place a ground wire to terminal 6 only. **Do not** ground terminal 5 or damage will occur.

**M2582-C:** Place the 100 ohm, 2 watt resistor in the black wire and ground as shown. All other input and output wiring shown in bulletins, or other specific wiring diagrams, remain the same.

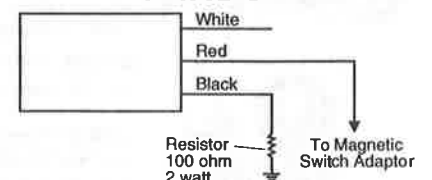
**A 100 ohm, 2 watt resistor for your convenience.**



### M5081-C



### M2582-C



## SPECIFICATIONS

**Valve Body:** Sandcast aluminum, painted red (corrosion resistance);  
*Optional cast steel available for M5081 and M5081FS models only.*

**Valve Seat:** Buna-N

**Maximum Valve Inlet Pressure:**

- M2582/M2582-P: 80 psi (552 kPa) [5.52 bar]
- M5081/M5081FS/ M5180-P: 100 psi (689 kPa) [6.89]

**Maximum Control Pressure (Pneumatic Models):**

- M2582-P: 75 psi (517 kPa) [5.17 bar]
- M5180-P: 80 psi (552 kPa) [5.52 bar]
- M5180-V: 30 in. Hg vac. (-100 kPa) [-1.00 bar]

**Snap-switch:** M2582: One SPDT, 5 A @ 480 VAC  
 M5081, and M5081FS: Two SPDT, 5 A @ 480 VAC

**Wiring:** M2582: Wire leads  
 M5081, and M5081FS: Terminal blocks

**Coil Rating:** Intermittent duty; coil type must match power source;

- CD ignition coil resistance: 72 Ω  
 CD ignition primary voltage: 1.38 to 3.8 A
- M5081FS model: Energized to Run (continuous-duty coil)  
 coil resistance:  
 12 V model: 33 Ω;  
 24 V model: 136 Ω
- Magneto ignition coil resistance: 0.5 Ω  
 Magneto primary voltage: 1 to 5 A
- Battery coil resistance : 7 Ω  
 12 or 24 VDC: 1.2 to 2.4 A

**Laboratory Approval:** CSA listed for Class I, Groups C and D Hazardous Locations. 5 amps maximum; intermittent duty; models M5081 and M5081-CD engine ignition powered, and model M5081-B, 12 or 24 VAC or VDC; switch contacts rated 5 A @ 480 VAC maximum. Maximum pressure 100 psi (689 kPa) [6.89 bar]

SERVICE PARTS	M2582	M5081	M5081FS	M2582-P	M5180-P M5180-V
<b>Coil Assembly</b>					
Battery	55000128	55000126	-----	-----	-----
CD Ignition	55000129	55000127	-----	-----	-----
Magneto Ignition	55000094	55000080	-----	-----	-----
<b>M5081FS Coil Assembly</b>					
12 VDC	-----	-----	55000158	-----	-----
24 VDC	-----	-----	55000159	-----	-----
<b>Latch Block Assembly</b>					
Latch block assembly	55000095	55000074	-----	-----	-----
Latch block switch and coil assembly	-----	-----	-----	-----	-----
Latch block switch and mounting bracket assembly	-----	55000118	55000196	-----	-----
<b>Handle and Latch Kit</b>					
Handle and latch kit	-----	55000102	55000102	5500148	55000154
Handle kit	55000096	-----	-----	-----	-----
<b>Manual Disconnect Assembly</b>	55000097	55000137	-----	-----	-----
<b>Snap Switch Assembly</b>	55000098	55000072	55000160	-----	-----
<b>Close/Open Indicator Assembly</b>	-----	55000138	55000138	-----	-----
<b>Stem and Seat Kit</b>	55000093	55000075	55000135	55000147	55000135
<b>Top Works Complete Valve Less Body and Vent</b>	55000146	55000131	55000161	55000150	55000155
<b>Vent Bushing Assembly</b>	55000143	55000132	55000132	55000143	55000132
<b>Diaphragm Assembly</b>	-----	-----	-----	55000184	55000153
<b>Pilot Diaphragm</b>	-----	-----	-----	00007908	55050420
<b>Diode Package for Dual Magneto Ignitions</b>	-----	65010065	-----	-----	-----
<b>Magnetic Switch Adapter for CD Ignitions</b>					
Single/Dual ign. – negative ground up to 240 VDC	65020126	65020126	-----	-----	-----
Single/Dual ign. – positive ground up to 450 VDC	65020127	65020127	-----	-----	-----
Single/Dual ign. – negative ground up to 450 VDC	65020155	65020155	-----	-----	-----

*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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# Limited Warranty

## MURPHY SWICHGAGE® and MURPHYMATIC® CONTROL SYSTEMS

This Murphy supplied product is warranted to be of good quality materials and workmanship. This limited warranty is for a period of TWO years. Any unit suspected of a quality flaw, verified by Murphy, will be either repaired or replaced, at our option, when returned to our factory, transportation charges paid. If a customer is requesting on-site service assistance for a MURPHYMATIC® control system, we will engage the proper resources to repair, adjust or replace the MURPHYMATIC® control system in accordance with our Service Philosophy and Limited Warranty. We are not responsible for damage caused by improper installation, neglect or abuse and are limited under warranty to repairing or replacing the item only and are not liable for equipment on which this product is installed.

Murphy SWICHGAGE® control instruments, MURPHYMATIC® control systems, or their parts, and supplied product shall be of kind and quality described in the

specifications as supplied and no other warranty except of title shall be implied. All other warranties, express or implied, including but not limited to warranties of merchantability or fitness for a particular purpose, are explicitly disclaimed. The liability of the company shall not in any case exceed the cost of correcting defects in the supplied product; and upon the expiration of above mentioned two years, all such liability shall terminate. The company shall not in any event be liable for indirect or consequential damages.

You have purchased dependable instrumentation and with normal care, it will provide long and faithful service, and enhance the preventive maintenance program on your valuable equipment. Any claim for shortage or damage of this shipment must be accompanied by this Packing Slip within 15 days of receipt or invoice date, whichever is later.

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This Murphy supplied control device is warranted to be of good quality materials and workmanship. Murphy warrants this quality for a period of TWO FULL YEARS. (Parts and systems are code dated.) This is only a time limit extension of the standard warranty; all other statements in the Murphy Limited Warranty remain in effect.

As with any monitoring and/or control system, the purchase, installation and use of SWICHGAGE® control instruments and other Murphy Systems is NOT AN INSURANCE POLICY. It is, however, the simplest means of adding inexpensive, reliable protection—protection that is as sound as the instruments, installation, and follow-up preventive maintenance program that is applied to these instruments and to the equipment they help protect. SWICHGAGE® control instruments, properly installed and maintained, are important and effective tools in any preventive maintenance program.

All "work machines" have life signs such as pressures, temperatures, levels, and overspeed conditions. Each of these vital signs can be monitored by a SWICHGAGE® capable of accurate indication and reliable limit switching. Teamed with Murphy electrical and SELECTRONIC® components, SWICHGAGE® control instruments can constantly monitor pressures, levels, temperatures, vibration, and overspeed conditions and activate alarm and/or shutdown when preset limits are reached. As these vital signs are constantly monitored, the SWICHGAGE® control instruments and their related components must be periodically inspected,

both visually and physically. Look for frozen pointers, bad contacts, kinked or broken pressure tubing or capillaries. Check floats on Level SWICHGAGE® control instruments visually and, if possible, mechanically. Test electric circuits and move limit contacts into the operating range to see that the proper sequence of events occurs when the contacts meet.

If a SWICHGAGE®, TATTLETALE® or other component fails the visual, physical, or electrical check, then repair or replace the unit or its parts as necessary to bring it back to proper operation. When a question exists on warranty, the questionable part should be returned to the factory or affiliate company for warranty inspection. If within the warranty period the unit is found to operate improperly and it appears to be related to material quality or workmanship, Murphy will repair or replace the product. (See Warranty above.)

Murphy SWICHGAGE® control instruments, MURPHYMATIC® panels and SELECTRONIC® systems are not a substitute for, but can be important tools in, a routine preventive maintenance program. Since 1939 we have been building our worldwide reputation as the source for simple, reliable monitoring and protection, featuring simplicity of maintenance. Please refer any questions regarding tests, repair or replacement parts to the factory, your nearest affiliate company, or your authorized servicing dealer.

# Garantía Limitada

## INSTRUMENTOS MURPHY SWICHGAGE® Y SISTEMAS DE CONTROL MURPHYMATIC®

Los instrumentos Murphy SWICHGAGE® y los sistemas de control MURPHYMATIC® son garantizados por su buena calidad en los materiales de fabricación y la mano de obra. Esta garantía es limitada por DOS años, con la excepción de aquellos artículos manufacturados por terceros pero vendidos por Murphy, que cuentan con la garantía original del fabricante.

Murphy se reserva la opción de reparar o reemplazar cualquier unidad considerada de calidad inferior, siempre y cuando ésta ha sido regrezada a nuestra planta con cargos de envío pagados. No somos responsables de daños causados por la inadecuada instalación del producto, el mal trato o el abuso, todas las partes fabricadas en Murphy son de garantía limitada para su reparación o su reemplazo y no se responsabilizan por ningún equipo en el cual nuestros controles han sido instalados.

Los instrumentos Murphy SWICHGAGE® y los sistemas de control MURPHYMATIC®, así como cada una de sus partes deben ser de la misma

calidad y la misma fabricación a las descritas en las especificaciones suministradas con cada producto, y ninguna otra garantía a excepción del título es implícita. La responsabilidad de la compañía bajo ninguna circunstancia debe exceder el costo de reparación del desperfecto en los sistemas Murphy, instrumentos SWICHGAGE® o sus componentes, una vez cumplida la garantía descrita, por dos años, toda responsabilidad es nula. La compañía por ninguna razón se hace responsable de daños consecuentes o indirectos.

Usted ha adquirido instrumentación confiable, y bajo cuidado normal le proporcionará buen servicio a largo plazo, mejorando el mantenimiento preventivo para su valioso equipo.

Cualquier reclamación de piezas faltantes o daños del envío debe estar acompañada por esta garantía, y formulada en 15 días subsiguientes a la fecha de entrega o de la fecha de facturación.

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Todos los instrumentos de control Murphy SWICHGAGE®, paneles MURPHYMATIC® y sistemas SELECTRONIC® están garantizados en sus materiales de fabricación y su mano de obra. Murphy garantiza esta calidad por DOS AÑOS o la garantía del fabricante original para con nosotros. (Todas las partes y los sistemas están fechados en código.) Esta es solo una extensión del tiempo límite en la garantía estándar; todas las otras cláusulas de la garantía permanecen efectivas.

Como cualquier otro sistema de control y/o monitoreo, la compra, instalación y uso de los instrumentos de control SWICHGAGE® y otros sistemas Murphy NO ES UNA POLIZA DE SEGURO. Pero es, la forma más económica y confiable de dar protección—protección que es tan firme como los productos mismos, instalación y un constante programa de mantenimiento preventivo se aplica a estos instrumentos y a los equipos que estos ayudan a proteger. Instrumentos SWICHGAGE® adecuadamente instalados y mantenidos, son herramientas efectivas e importantes en cualquier programa de mantenimiento preventivo.

Todas las máquinas de trabajo, tienen signos vitales como: presión, temperatura, nivel, velocidad y cada uno de estos puede ser monitoreado por un SWICHGAGE® capaz de dar lecturas de precisión y señales de interrupción. En combinación con componentes eléctricos Murphy SELECTRONIC®, el SWICHGAGE® puede monitorear continuamente la presión, el nivel, la temperatura, y activar alarmas y/o el paro cuando el límite del interruptor es activado. Así como los signos vitales son constantemente monitoreados, los SWICHGAGE® y sus partes deben ser inspeccionados periódicamente tanto visual como físicamente.

Asegúrese que la aguja indicadora no esté congelada, que no tenga malos contactos, que las mangueras de presión o los capilares de temperatura no estén torcidos o perforados. Cheque mecánicamente y de ser posible visualmente los flotadores de los SWICHGAGE® de nivel. Pruebe los circuitos y manualmente opere los interruptores para verificar que trabajan en secuencia cuando el contacto se activa.

Si un instrumento SWICHGAGE®, un anunciador TATTLETALE® o cualquier otro instrumento presenta anomalías al chequearse, visual, física o eléctricamente, repare o reemplace la unidad o sus partes como sea necesario para reestablecer su operación normal. Si hay alguna duda en la garantía, la parte en cuestión debe ser regresada a la fábrica o a nuestro distribuidor para una inspección apropiada. Si durante su año de garantía la unidad se ha encontrado defectuosa y todo determina que es debido a mala calidad de sus componentes o durante el ensamblado, regrese la unidad a Murphy para inspeccionarla y posiblemente repararla o reemplazarla por otra bajo nuestra garantía. (Vea la garantía en la parte superior).

Los SWICHGAGE®, MURPHYMATIC®, SELECTRONIC®, no son un sustituto de, pero pueden ser una herramienta importante en el rutinario programa de mantenimiento preventivo. Desde 1939 hemos creado nuestra reputación alrededor del mundo como proveedores de monitoreo y protección simple pero confiable con un mantenimiento mínimo. Por favor dirija sus preguntas referentes a la prueba, reparación o reemplazo de cualquier parte a nuestras fábricas u oficinas o distribuidor autorizado Murphy.

# INSTALLATION AND MAINTENANCE MANUAL

## for

### NO. SRV100, SRV125, SRV150 OR SRV150SS

### STARTER RELAY VALVE



#### ▲ WARNING

**IMPORTANT SAFETY INFORMATION ENCLOSED.  
READ THIS MANUAL BEFORE OPERATING TOOL.**

**FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.  
IT IS THE RESPONSIBILITY OF THE EMPLOYER TO PLACE THE INFORMATION  
IN THIS MANUAL INTO THE HANDS OF THE OPERATOR.**

- Always bleed off the air pressure before attempting to unscrew the Starter Relay Valve from the Receiver or before attempting to perform any maintenance on the Starter Relay Valve.
  - Never attempt to remove the Retaining Ring (12) from the bottom side of the Starter Relay Valve until after the air pressure has been bled off. If the Retaining Ring is removed while there is pressure in the Receiver, internal parts of the Starter Relay Valve will be blown out with considerable force.
2. Apply No. SMB-441 Ingersoll-Rand Sealant to the male thread on the nipple, and install the nipple in the Receiver. Tighten the connection so that it is airtight.
  3. Note that one of the tapped inlets on the Relay Valve is marked "IN". Thread this inlet onto the nipple and tighten the connection so that it is airtight.
  4. Apply Ingersoll-Rand Sealant to the male threads on the air line that goes to the Starter, and thread this line into the tapped outlet on the Relay Valve that is marked "OUT". Make certain the connection is airtight.
  5. Attach the air hose from the outlet side of a 3-way normally vented Control Valve to the small tapped hole in the top of the Relay Valve. Use Ingersoll-Rand Sealant on the male thread.

#### NOTICE

This Starter Relay Valve is specially designed and manufactured by Ingersoll-Rand for use on Starter installations. Install it in accordance with the following instructions.

#### Installation of the Starter Relay Valve

1. Use a short pipe nipple between the Receiver and the Relay Valve. Use a 1" nipple with the SRV100, 1-1/4" nipple with the SRV125, and a 1-1/2" nipple with the SRV150 or SRV150SS.

#### NOTICE

The use of other than genuine Ingersoll-Rand replacement parts may result in safety hazards, decreased starter relay valve performance and increased maintenance, and may invalidate all warranties.

Ingersoll-Rand is not responsible for customer modification of valve for applications on which Ingersoll-Rand was not consulted.

Repairs should be made only by authorized, trained personnel. Consult your nearest Ingersoll-Rand Authorized Servicenter.

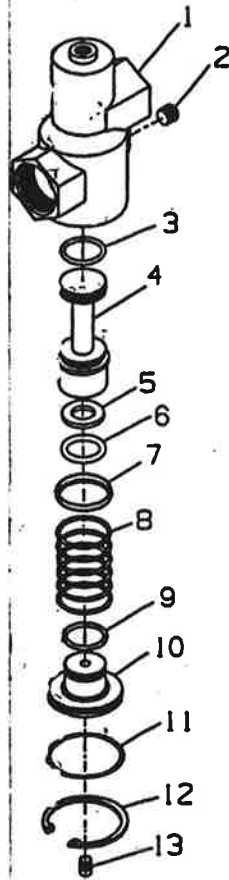
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**INGERSOLL-RAND®**  
**ENGINE STARTING SYSTEMS**

# MAINTENANCE SECTION



(Dwg. TPD1731)

**PART NUMBER FOR ORDERING**

**PART NUMBER FOR ORDERING**

1	Valve Housing		10	End Plug	
	for SRV100 .....	SRV100-40		for SRV100, SRV125	
	for SRV125 .....	SRV125-40		and SRV150 .....	SRV150-338
	for SRV150 .....	SRV150-40		for SRV150SS .....	SRV150SS-338
	for SRV150SS .....	SRV150SS-40	◆ 11	End Plug Seal O-ring .....	Y327-143
	2 Pipe Plug .....	HSPPS-2	◆ 12	Retaining Ring .....	SRV150-340
◆ 3	Upper Piston O-ring .....	SRV150-210	13	Pipe Plug (for SRV150SS only)	SRV150-368
◆ 4	Piston .....	SRV150-246	*	Tune-up Kit (includes illustrated	
◆ 5	Bumper .....	SRV150-339		parts 3, 5, 6, 7, 9, 11, 12 and	
◆ 6	Piston O-ring .....	SRV150-211		non-illustrated Part	
◆ 7	O-ring Retainer .....	SRV150-33		No. SRV-GR55 Grease) .....	SRV150-TK3
◆ 8	Spring .....	SRV150-250			
◆ 9	End Plug O-ring .....	SRV150-67			

◆ Indicates Tune-up Kit part.

## MAINTENANCE SECTION

### ▲ WARNING

Always wear eye protection when lubricating or performing maintenance on the Starter Relay Valve. Always bleed off the air pressure before lubricating or performing any maintenance on the Starter Relay Valve.

### LUBRICATION

Periodically lubricate the Starter Relay Valve as follows:

1. Bleed off the air pressure.
2. Disconnect the No. 4 Hose from the tank at the control air supply port near the bottom of the valve opposite the air inlet. In some installations, this 1/4" N. P. T. will be plugged.
3. Remove the plug. Squirt about 1 ounce (30 cc) of 10W oil into the valve through the hose or plug opening.
4. Reconnect the hose or reinstall the plug.

### NOTICE

No. SRV150-TK3 Tune-up Kit is available for maintaining the Starter Relay Valve. This Tune-up Kit includes all O-rings, Bumper and End Plug Retaining Ring.

### INSTALLATION OF THE TUNE-UP KIT

#### Disassembly of the Starter Relay Valve

1. Bleed off the air pressure.
2. Clamp the Relay Valve in a vise with the Retaining Ring (12) up.

3. Carefully remove the Retaining Ring. The End Plug (10) should spring out. If it does not, tap the Valve Housing (1) lightly with a soft hammer until the End Plug springs out.
4. Remove the End Plug, Spring (8), and Piston Assembly (4).
5. Remove and discard all used O-rings and Bumper (5).
6. Clean all other parts in a clean, suitable cleaning solution in a well ventilated area.

#### Assembly of the Starter Relay Valve

1. Using o-ring lubricant, lubricate and install the new Piston O-ring (6) and the new Upper Piston O-ring (3) on the Piston.

### NOTICE

The Upper Piston O-ring is slightly larger in diameter than the End Plug O-ring (9).

2. Turn the Piston over and insert the new Bumper (5).
3. Using o-ring lubricant, lubricate and install the new End Plug Seal O-ring (11) and the new End Plug O-ring (9) on the End Plug (10).
4. Lubricate the lower small bore of the Valve Housing (1) with o-ring lubricant.
5. Insert the Piston Assembly into the Valve Housing. Push on the Piston until the Piston O-ring (6) seats against the beveled face.
6. Install the O-ring Retainer (7) with the large opening over the Piston O-ring.
7. Place the Piston Spring (8) on the Piston.
8. Place the End Plug Assembly on the Piston Spring.
9. Using a press to hold down the End Plug Assembly, install the End Plug Retaining Ring (12).

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3				CONTROL VALVES				SHEET 1 OF 1	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : LEVEL CONTROL VALVES				NO	BY	DATE	REVISION	JOB #	99420
				0	TK	01/27/00	FOR PURCHASE	DATE	
								REQ.	
								BY	CHK'D
				DCP	GWW				
G	1	TAG NO.	LCV-100	LCV-110	LCV-120				
E	2	SERVICE	1ST STAGE DUMP VALVE	2ND STAGE DUMP VALVE	3RD STAGE DUMP VALVE				
N	3	LINE NO. / VESSEL NO.	V-100	V-110	V-120				
E	4	LINE SIZE / SCHED. NO.	33 mm SCH. 160	33 mm SCH. 160	33 mm SCH. 160				
	5	TYPE OF BODY	GLOBE	GLOBE	GLOBE				
	6	BODY SIZE	33 mm	33 mm	33 mm				
	7	PORT SIZE	9.5 mm	9.5 mm	9.5 mm				
	8	GUIDING	TOP	TOP	TOP				
	9	NO. OF PORTS	ONE	ONE	ONE				
B	10	END CONN. & RATING	33 mm FNPT, 6000#	33 mm FNPT, 6000#	33 mm FNPT, 6000#				
O	11	BODY MATERIAL	WCB STEEL (NACE)	WCB STEEL (NACE)	WCB STEEL (NACE)				
D	12	PACKING MATERIAL	NITRILE / COTTON	NITRILE / COTTON	NITRILE / COTTON				
Y	13	LUBRICATOR							
	14	ISOLAT. VALVE							
	15	BONNET TYPE	BOLTED	BOLTED	BOLTED				
	16	TRIM FORM	QUICK OPENING	QUICK OPENING	QUICK OPENING				
	17	TRIM MATERIAL SEAT / PLUG	NIT 50	NIT 50	NIT 50				
	18	SHAFT / MAT'L	316 SS	316 SS	316 SS				
	19	REQUIRED SEAT TIGHTNESS	CLASS IV	CLASS IV	CLASS IV				
	20	MAX ALLOW SOUND LEV. dBA	85	85	85				
A	21	MODEL NO. & SIZE	MFR. STANDARD (128)	MFR. STANDARD (128)	MFR. STANDARD (128)				
C	22	TYPE OF ACTUATOR	SPRING AND DIAPHRAGM	SPRING AND DIAPHRAGM	SPRING AND DIAPHRAGM				
T	23	CLOSE AT	0 kPa	241 kPa	0 kPa	241 kPa	0 kPa	241 kPa	
U	24	OPEN AT							
A	25	FLOW ACTION TO	CLOSE	CLOSE	CLOSE				
T	26	FAIL POSITION	CLOSE	CLOSE	CLOSE				
P	27	HANDWHEEL & LOCATION							
O	28	MFR. & MODEL NO.							
S	29	FILT REG   GAGES   BYPASS							
I	30	INPUT SIGNAL							
T	31	OUTPUT SIGNAL							
T	32	AIR SUPPLY PRESS		kPa		kPa		kPa	
R	33	MFR. & MODEL NO.							
N	34	INPUT SIGNAL							
O	35	OUTPUT SIGNAL							
P	36								
T	37								
S	38	FLOW UNITS	SCFH	SCFH	SCFH				
E	39	FLUID	SOUR HC'S AND WATER	SOUR HC'S AND WATER	SOUR HC'S AND WATER				
R	40	QUANT. MAX.	SMALL	SMALL	SMALL				
V	41	MAX Cv							
I	42	QUANT. OPER.							
C	43	OPER Cv							
E	44	VALVE Cv	3.13	3.13	3.13				
	45	VALVE FL							
	46	NORM IN PRES	483 kPa(g)	449 kPa	1302 kPa(g)	1268 kPa	3608 kPa(g)	3574 kPa	
	47	NORM DELTA P							
	48	MAX INLET PRESS.	4516 kPa	4516 kPa	4516 kPa	4516 kPa	8720 kPa	8720 kPa	
	49	MAX SHUT OFF	4516 kPa(g)	4516 kPa	4516 kPa(g)	4516 kPa	8720 kPa(g)	8720 kPa	
	50	MAX DELTA P							
	51	TEMP. MAX.	149 °C	16 °C	149 °C	49 °C	149 °C	49 °C	
	52	OPER. TEMP							
	53	OPER. SP. GR.	1.00	1.00	1.00	1.00			
	54	MOL. WT.							
	55	OPER. VISC.							
	56	% FLASH							
	57	% SUPERHEAT							
	58	% SOLIDS							
	59	VAPOR PRESS	kPa(g)	kPa(g)	kPa(g)	kPa(g)	kPa(g)	kPa(g)	
	60	CRIT PRESS							
	61	PREDICTED SOUND LEVEL dBA							
	62	MANUFACTURER	FISHER	FISHER	FISHER				
	63	MODEL NO.	128-PQC	128-PQC	128-PQC				
	64	P. O. NUMBER							

NOTES:

1. NACE COMPLIANCE REQUIRED

AREA UNIT #: 152

# Type 128-PQC Control Valves

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## Introduction

### Scope of Manual

This manual provides installation, maintenance, and parts information for the Type 128-PQC control valve. Instructions and parts lists for Fisher Controls pneumatic instrumentation and other equipment used with this control valve are found in separate manuals.

Only personnel qualified through training or experience should install, operate, or maintain the Type 128-PQC control valve. If you have any questions concerning the instructions in this manual, please contact your Fisher Controls sales office or sales representative before proceeding.

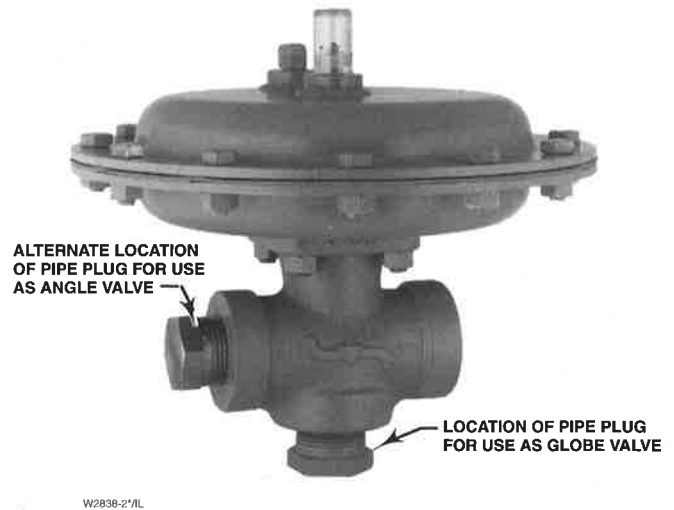


Figure 1. Type 128-PQC Control Valve

## Description

The Type 128-PQC control valve provides on-off dump valve service for such oil production applications as separators, scrubbers, and treaters, even under sour gas conditions. It also may be used in general on-off high-pressure control of a wide variety of liquids and gases, including those which are sticky or gritty and erosive. The Type 128-PQC valve is a 1-inch combination control valve with a pipe plug in the bottom connection for straight-through globe valve flow as shown in figure 1. However, the pipe plug may be field-changed to the left-hand end connection as shown in figure 3 for angle flow.

## Specifications

Table 1 lists specifications for the Type 128-PQC control valve. Some of the specifications for a given control valve as it originally comes from the factory are stamped on a nameplate, shown in figure 2, located on the upper diaphragm casing flange.



Table 1. Specifications

<p><b>Available Configurations</b></p> <p><b>Type 128 Actuator:</b> Yokeless, on-off spring-and-diaphragm actuator with action field-reversible between</p> <ul style="list-style-type: none"> <li>■ spring-open and</li> <li>■ spring-close</li> </ul> <p><b>Design PQC Valve:</b> See table 2</p> <p><b>Valve Sizes and End Connection Styles</b></p> <p>See table 2</p> <p><b>Maximum Inlet Pressures and Temperatures<sup>(1)</sup></b></p> <p>3600 psig from -20 to 100°F, 3550 psig at 150°F, and 3520 psig at 180°F (248 bar from -29 to 38°C, 245 bar at 66°C, and 243 bar at 82°C)</p> <p><b>Maximum Pressure Drops<sup>(1)</sup></b></p> <p>See table 3</p> <p><b>Actuator Input Signal</b></p> <p>0 or 20 psig (0 or 1.4 bar) or 0 or 35 psig (0 or 2.4 bar)</p> <p><b>Maximum Actuator Casing Pressure</b></p> <p>100 psig (6.9 bar)</p> <p><b>Shutoff Classifications</b></p> <p><b>Metal Seats:</b> ANSI Class IV ANSI/FCI 70-2 <b>Soft Seats:</b> ANSI Class VI ANSI/FCI 70-2</p>	<p><b>Material Temperature Capabilities<sup>(1)</sup></b></p> <p><b>Metal Seat:</b> -20 to 180°F (-29 to 82°C) <b>Soft Seat:</b> -20 to 150°F (-29 to 66°C) <b>LCC Valve Body:</b> -50 to 180°F (-46 to 82°C)</p> <p><b>Flow Characteristic</b></p> <p>Quick-opening with 45-degree taper valve plug</p> <p><b>Flow Direction</b></p> <p>Either way</p> <p><b>Port Diameters</b></p> <p>See table 2</p> <p><b>Maximum Travel</b></p> <p>3/8-inch (10 mm)</p> <p><b>Actuator Diaphragm Effective Area</b></p> <p>33 inches<sup>2</sup> (213 cm<sup>2</sup>)</p> <p><b>Actuator Pressure Connections</b></p> <p>1/4 inch NPT female</p> <p><b>Valve Travel Indication</b></p> <p>Scale divisions for each 25% of travel are provided on plastic travel indicator cover</p> <p><b>Approximate Weight</b></p> <p>17 lb (7.7 kg)</p>
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1. The pressure and temperature limitations in this manual, and any applicable code limitation, should not be exceeded.

Table 2. End Connections and Port Diameters

DESIGN		PQC	
<b>VALVE STYLE</b>		Combination globe and angle valve body; common end and bottom connections and pipe plug allow conversion between globe and angle styles	
<b>END CONNECTIONS</b>		1 inch NPT female	
<b>SEATING</b>		Metal	Soft
<b>PORT DIAMETERS</b>	Inch	1/4, 3/8, 1/2	1/4, 3/8, 1/2, 3/4 <sup>(1)</sup>
	mm	6.4, 9.5, 12.7	6.4, 9.5, 12.7, 19.1 <sup>(1)</sup>
<b>C<sub>v</sub> AT MAX TRAVEL FOR LARGEST PORT WITH FLOW TENDING TO CLOSE VALVE</b>		8.32 (angle-style valve body)	

1. Cageless construction with seat cut into valve body for soft seat only.



Table 3. Maximum Allowable Shutoff Pressure Drops

SEATING	ACTUATOR ACTION	FLOWING PRESSURE DROP TENDS TO:	PORT DIAMETER		CADMIUM COLORED MAIN SPRING 14A8831X012				RED MAIN SPRING 14A9077X012			
			Inches	mm	0 to 20 Psig (0 or 1.4 Bar) Actuator Input Signal (2 Springs Required)		0 to 35 Psig (0 or 2.4 Bar) Actuator Input Signal (4 Springs Required)		0 to 20 Psig (0 or 1.4 Bar) Actuator Input Signal (2 Springs Required)		0 to 35 Psig (0 or 2.4 Bar) Actuator Input Signal (4 Springs Required)	
					Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar
Metal	Spring closes valve	Open valve	1/4	6.4	1510	104	3370	232	3380	233	3600	248
			3/8	9.5	520	36	1340	92	1340	92	3120	215
			1/2	12.7	220	15	690	47	700	48	1720	118
			3/4	19.1	30	2.1	240	16	240	16	710	49
		Close valve	1/4	6.4	940	65	1860	128	1370	94	2920	201
			3/8	9.5	1130	78	2450	169	1540	106	3300	227
	Spring opens valve	Close valve	1/2	12.7	1330	92	2920	201	1710	118	3600	248
			3/4	19.1	2030	140	3600	248	2320	160	3600	248
			1/4	6.4	170	12	350	24	Valve will not shut off with this combination of spring and application			
			3/8	9.5	530	36	610	42				
		Close valve	1/2	12.7	540	37	1150	79	Valve will not shut off with this combination of spring and application			
			3/4	19.1	1400	96	2910	200				
Soft	Spring closes valve	Open valve	1/4	6.4	1000	69	1000	69	1000	69	1000	69
			3/8	9.5	710	49	1000	69	1000	69	1000	69
			1/2	12.7	400	28	830	57	830	57	1000	69
			3/4	19.1	160	11	350	24	360	25	790	54
		Close valve	1/4	6.4	940	65	1000	69	1000	69	1000	69
			3/8	9.5	1000	69	1000	69	1000	69	1000	69
			1/2	12.7	1000	69	1000	69	1000	69	1000	69
			3/4	19.1	1000	69	1000	69	1000	69	1000	69
	Spring opens valve	Close valve	1/4	6.4	560	39	660	45	Valve will not shut off with this combination of spring and application			
			3/8	9.5	480	33	960	66				
			1/2	12.7	540	37	1000	69				
			3/4	19.1	1000	69	1000	69				
		Close valve	1/4	6.4	560	39	660	45	Valve will not shut off with this combination of spring and application			
			3/8	9.5	480	33	960	66				

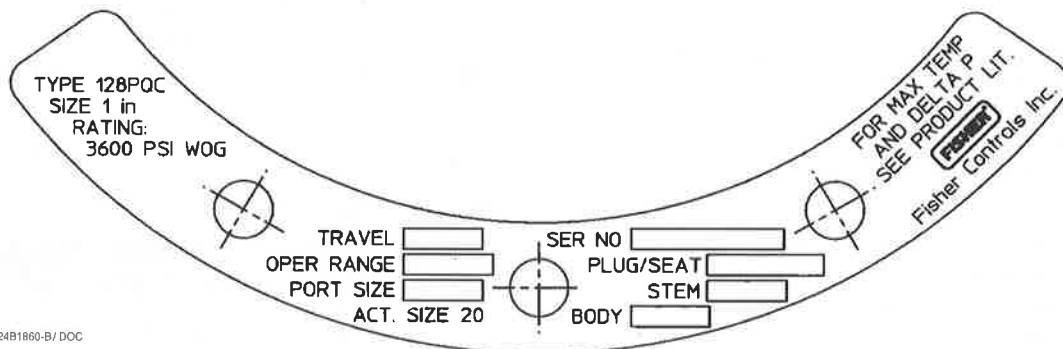


Figure 2. Typical Nameplate

## Installation

### WARNING

To avoid personal injury or property damage resulting from the sudden release of pressure, do not install the valve assembly where service conditions could exceed the limits given in this manual or on the appropriate nameplates. The leakoff and spring case vents must be kept open. Avoid danger

of fire or explosion from venting of flammable or otherwise hazardous fluid into a closed or poorly vented location by providing adequate ventilation.

1. Before installing the valve, inspect the valve body and associated equipment for any damage and for any foreign material.
2. The control valve may be installed in any orientation. However, the normal method is with the actuator above the valve, especially for an angle configuration.

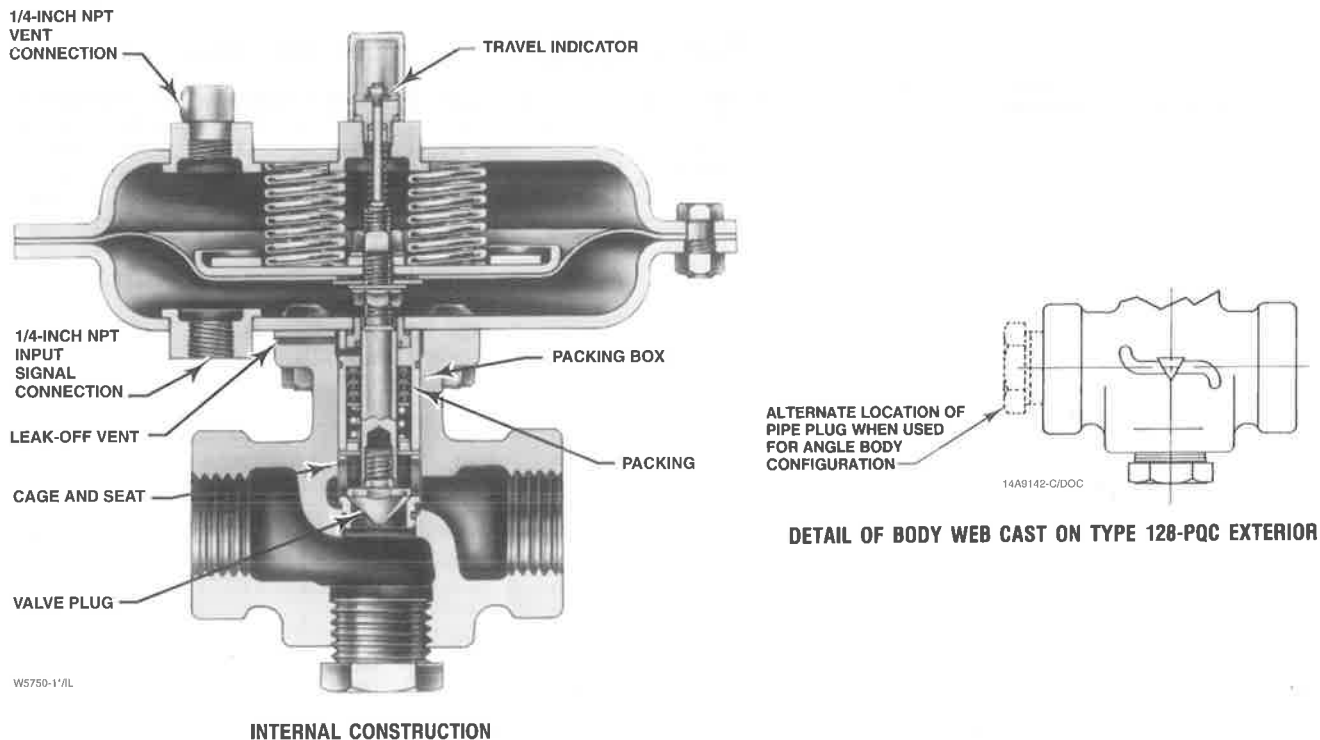


Figure 3. Type 128-PQC Control Valve with Spring-Close Action

3. Make sure that the valve is oriented so that flow is in the desired direction. If angle flow is desired, switch the pipe plug to the left-hand end connection as shown in figure 3.
4. Install the valve following local and national piping codes when they apply to the application. Use a good grade pipe compound on all male threads. If continuous operation is required during inspection and maintenance, install a three-valve bypass around the control valve.
5. Refer to figure 3. Connect the input signal line to the 1/4-inch NPT connection in the lower diaphragm casing of a spring-close control valve or in the upper diaphragm casing of a spring-open control valve.

## Principle of Operation

The Type 128-PQC control valve has push-down-to-close valve plug action, as shown in figure 3. With a metal seat, the valve uses a caged construction and the valve plug shuts off against the integral seat ring in the cage. In the cageless soft-seat construction, the valve plug shuts off against the seat cut into the web of the valve body.

A nylon insert in the valve plug thread is used to help keep the valve plug from rotating.

A leakoff vent passes through the packing box and out the valve body. This permits any process leakage through the packing to escape before passing along the stem into the actuator. It also permits loading pressure leakage from the lower diaphragm case to escape before passing along the stem into the valve body.

## Maintenance

### WARNING

**Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:**

- **Disconnect any operating lines providing air pressure 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 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.

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing and trim maintenance, changing the main spring range, reversing the action, and replacing actuator parts.

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

All maintenance operations can be performed with the valve in the line.

## Replacing Packing and Trim

Perform these procedures either when using a complete replacement packing and trim assembly or when replacing individual packing and trim parts. Replacement packing and trim assembly part numbers are listed in the *Parts List*. Packing and trim assembly key numbers are referenced in figure 5. Control valve assembly key numbers are shown in figure 7 for the valve body and in figure 8 for the actuator except where indicated. Most packing and trim assembly key numbers are duplicated in both figure 5 and figure 7.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Also shut-off all pressure lines to the actuator and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

If the valve is equipped with an optional handjack, be sure the handjack assembly is not restricting the valve from closing. Rotate the handles or handjack body (key 48 or 47 in figure 9), if necessary, to allow the main springs (key 19) to close the valve.

2. Remove the four nuts (key 14) from the integral screws of the lower diaphragm casing. Disconnect the input signal line, and lift the actuator and attached trim parts out of the valve body. Cleaning or other necessary maintenance may be performed on any accessible areas. The actuator and attached trim parts may be turned over and the valve body used to hold them as an aid in further maintenance.

3. To disassemble trim and gain access to packing parts or seal O-rings, unscrew the valve plug (key 3A) and remove the packing box washer (key 4).

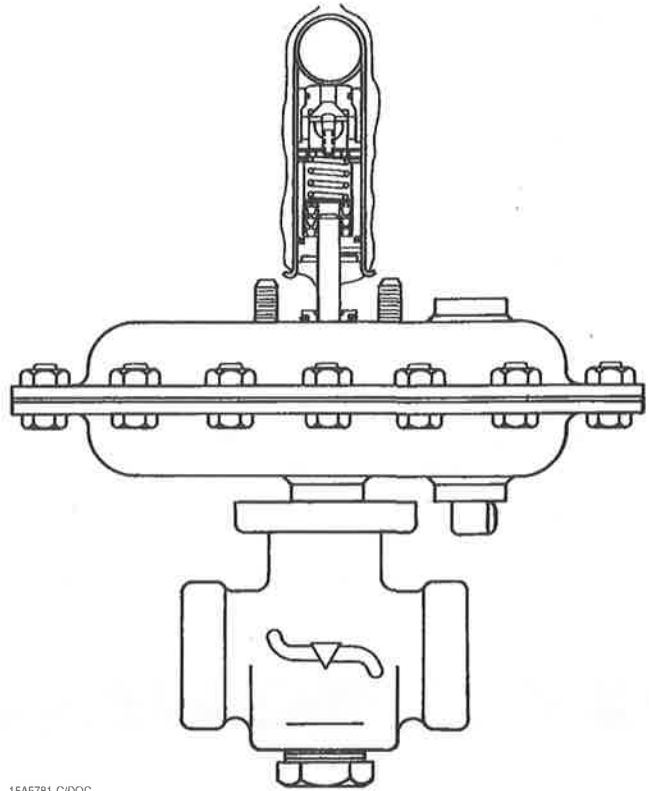


Figure 4. Installing Replacement Packing and Trim Assembly on Valve Stem

4. Pull the packing box (key 9), O-ring retainer (key 39), O-ring (key 11), and diaphragm casing O-ring (key 35) off the stem.

5. Install the packing and trim assembly or individual parts over the stem as shown in figure 4. With a packing and trim assembly, remove the assembly from the tube (key 42), but do not remove the web sleeve (key 43) from the assembly. The sleeve helps to keep the assembly parts in place during installation; roll back the sleeve as necessary during installation of the assembly.

If installing nitrile/cotton packing, lubricate the packing rings (key 8) with Dow-Corning No. 3 silicon-base lubricant or equivalent.

6. If installing a packing and trim assembly, continue pushing the assembly onto the stem until the stem pushes the valve plug and cage (key 2) away from the packing box washer (key 4). Roll the sleeve back just past the packing box (key 9).

7. Push the packing box all the way onto the stem until the packing box, the O-ring (key 11), the O-ring retainer (key 39), and the diaphragm casing O-ring (key 35) are sealed against the diaphragm casing. Make sure the O-rings are positioned properly so that they will not be cut when the other parts are com-

pressed against them. Then, push the packing spring washer (key 6), packing spring (key 7), other packing spring washer, wiper ring, and packing box washer (key 4) down on the stem.

8. If installing a packing and trim assembly, remove the sleeve, cage puller (key 44, if included in the assembly), cage, and spring clip (key 38, if included in the assembly) from the valve plug.

9. Install the valve plug into the stem.

### Note

**Rotate the valve plug until the shoulder on the plug contacts the stem snugly. Further tightening is not needed.**

To replace the cage (if used) or to gain access to the O-ring (key 12), use the cage puller (key 44) or a wire hook to remove the cage from the valve body (key 1). Then, install replacement parts as necessary.



**Use care performing the installation in the next step to avoid damaging the O-ring.**

10. Install the actuator and attached trim parts back into the valve body (key 1), and secure with the four nuts (key 14) attached to the lower diaphragm casing assembly screws. Tighten the nuts to 15 lbf•ft. (20 N•m).

11. Connect the input signal line to the 1/4-inch NPT connection of the appropriate diaphragm casing.

## Changing Main Spring Range

Key numbers used in this procedure are shown in figure 8 unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Also shut-off all pressure lines to the actuator and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

If the valve is equipped with an optional handjack, be sure the handjack assembly is not restricting the valve from closing. Rotate the handles or handjack body (key 48 or 47 in figure 9), if necessary, to allow the main springs (key 19) to close the valve. Unscrew the handles or pipe plugs and remove the indicator cover (key 41 in figure 9). Drive out the groove pin (key 50 in

figure 9) and remove the stem nut and thrust washer (keys 49 and 51 in figure 9).

2. Disconnect the input signal line, if necessary, and remove the diaphragm casing nuts (key 14), cap screws (key 21), and upper diaphragm casing (key 20).

3. With spring-close action, remove the existing main springs (key 19) and install replacement springs of the correct quantity and description as listed in table 3. Make sure that the springs rest in the spring plate holes and will not ride on the upper diaphragm casing vent boss.

### Note

**Do not loosen the stem nut (key 14). Disturbing its position in the following step may keep the valve either from shutting off or from opening completely at the correct input signal pressure, thus requiring complete reassembly of the stem and diaphragm assembly.**

4. With spring-open action, remove the locknut (key 46), flat washer (key 15), diaphragm (key 16), diaphragm plate (key 17), spring plate (key 18), and main springs (key 19). Install replacement springs of the correct quantity and description as listed in table 3. Re-install the removed parts (keys 18, 17, 16, 15, and 46) so that the lower ends of the main springs rest over the weld stud heads of the lower diaphragm casing and the spring plate holes fit over the upper ends of the springs. Tighten the locknut (key 46) to 12 lbf•ft (20 N•m).

5. Install the upper diaphragm casing cap screws and casing nuts. To avoid crushing the diaphragm, tighten the cap screws and nuts evenly in a crisscross pattern to 15 lbf•ft (20 N•m).

6. Connect the input signal line to the 1/4-inch NPT connection of the upper diaphragm casing.

7. If an optional handjack is used, reinstall the handjack parts. Be sure to secure the stem nut (key 49 in figure 9) with the groove pin (key 50 in figure 9).

## Reversing Action or Replacing Actuator Parts

Key numbers used in this procedure are shown in figure 8 unless otherwise indicated.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Also shut-off all pressure lines to the actuator and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

If the valve is equipped with an optional handjack, be sure the handjack assembly is not restricting the valve from closing. Rotate the handles or handjack body (key 48 or 47 in figure 9), if necessary, to allow the main springs (key 19) to close the valve. Unscrew the handles or pipe plugs and remove the indicator cover (key 41 in figure 9). Drive out the groove pin (key 50 in figure 9) and remove the stem nut and thrust washer (keys 49 and 51 in figure 9).

The optional handjack is used only with spring-close valves. If changing the action of a spring-close valve with a handjack to spring-open action, the only function the handjack performs is to restrict the valve from closing.

2. Disconnect the input signal line and remove the diaphragm casing nuts (key 14), cap screws (key 21), and upper diaphragm casing (key 20).

3. Remove the main springs (key 19), stem nut (key 14), locknut (key 46), lock washer (key 29), spring plate (key 18), diaphragm plate (key 17), diaphragm (key 16), and flat washer (key 15).

4. Remove the four nuts (key 14) from the integral screws of the lower diaphragm casing. Lift the casing and attached trim parts off of the valve body.

5. Unscrew the valve plug (key 3A) and remove the packing box washer (key 4).

6. Pull the packing box (key 9), O-ring retainer (key 39), O-ring (key 11), and diaphragm casing O-ring (key 35) off the stem.

7. Remove the stem (key 3B), and replace it, the bottom stem nut (key 14), or the locknut (key 46) as necessary.

8. When reinstalling the stem nut (key 14) or locknut (key 46), make sure the distance between the bottom shoulder of the nut and the plug end of the stem is equal to dimension A in figure 6.

9. Begin the following procedure as appropriate, depending on whether the desired control valve action is spring-close or spring-open.

**For spring-close action**, install the flat washer (key 15), diaphragm (key 16), diaphragm plate (key 17), spring plate (key 18), lock washer (key 29), and stem nut (key 14). Tighten the stem nut to 12 lbf•ft (16 N•m).

**For spring-open action**, install the lock washer (key 29), spring plate (key 18), diaphragm plate (key 17), diaphragm (key 16), flat washer (key 15), and locknut (key 46). Tighten the locknut to 12 lbf•ft (16 N•m).

10. For spring-open action only, install the main springs (key 19) into the lower diaphragm casing so

that the lower ends of the springs rest over the weld stud heads of the lower diaphragm casing.

11. Install the stem and diaphragm assembly into the lower diaphragm casing. For spring-open action, make sure that the assembly is oriented so that the spring plate holes fit over the upper ends of the springs.

12. Secure the stem by installing the packing and trim parts according to steps 5 through 9 of the *Replacing Packing and Trim* section.

13. If reversing action from what it was previously, remove the vent assembly (key 31), and install it in the 1/4-inch NPT connection of the lower diaphragm casing for spring-open action or the upper diaphragm casing for spring-close action.

14. For spring-close action only, install the main springs, making sure they rest in the spring plate holes and will not ride on the upper diaphragm casing vent boss.

15. Install the upper diaphragm casing, cap screws, and casing nuts. To avoid crushing the diaphragm, tighten the cap screws and nuts evenly in a crisscross pattern to 15 lbf•ft (20 N•m).

16. Install the actuator and attached trim parts back into the valve body (key 1), and secure with the four nuts (key 14) attached to the lower diaphragm casing assembly screws. Tighten the nuts to 15 lbf•ft (20 N•m).

17. Connect the input signal line to the 1/4-inch NPT connection of the appropriate diaphragm casing.

18. If an optional handjack is used, reinstall the handjack parts. Be sure to secure the stem nut (key 49 in figure 9) with the groove pin (key 50 in figure 9).

## Parts Ordering

The Type 128-PQC control valve is assigned a serial number which can be found on the nameplate. A typical nameplate is shown in figure 2. Refer to the serial number when contacting your Fisher Controls representative or sales office for assistance. When ordering replacement parts, refer to the serial number and to the 11-character part number from the following *Parts List*.

## Parts Kits

Key	Description	Part Number
	Type 128-PQC Repair Kits (soft parts only.)	
	Kit includes key 5, 8, 10, 11, 12, and 35)	
	w/PTFE V-ring packing	RPQCX000012
	w/Nitrile/cotton packing	RPQCX000022

For additional kit information, see the *Replacement Packing and Trim Assembly Part Number* table.

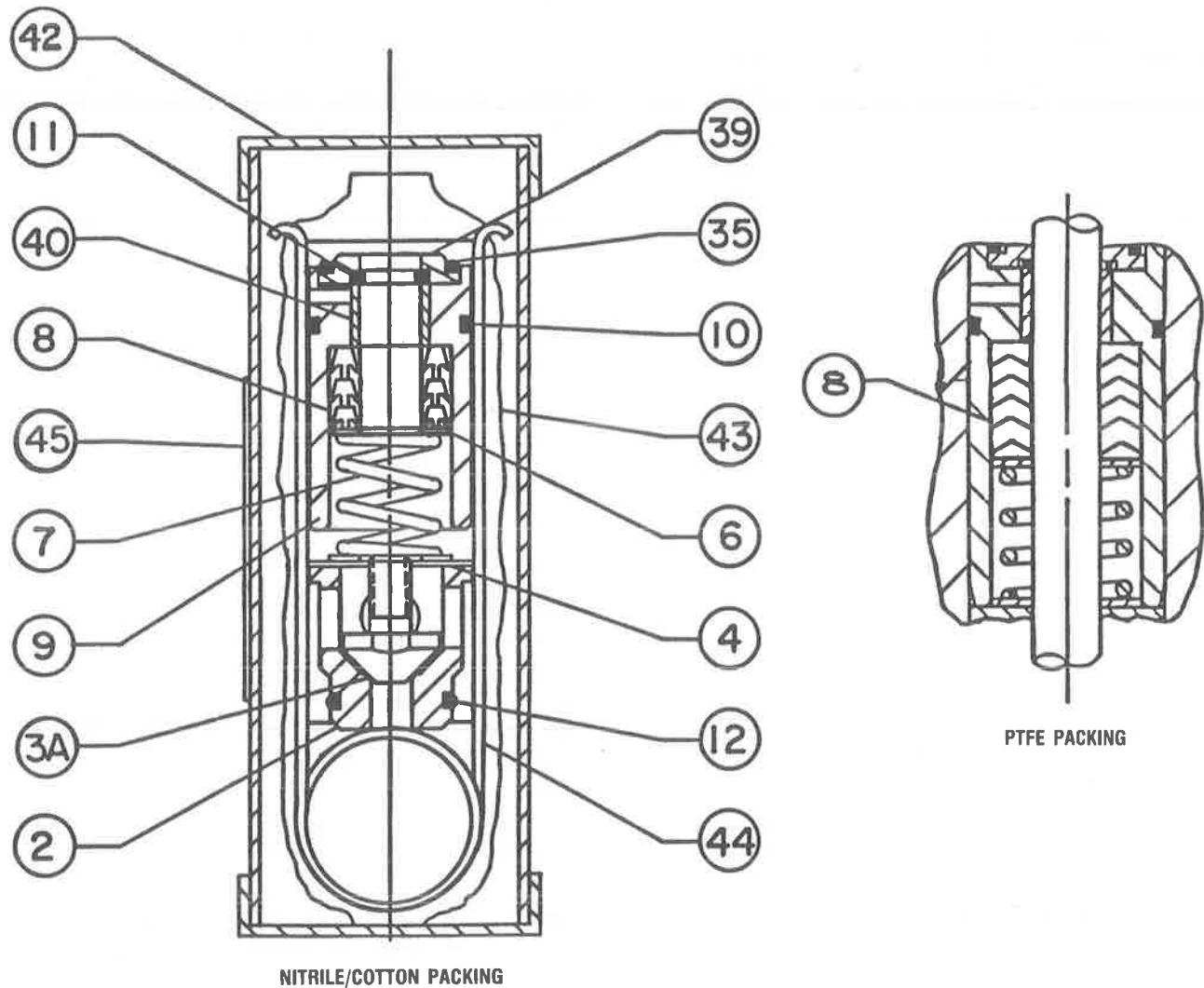


Figure 5. Replacement Packing and Trim Assemblies for Metal-Seated Construction

Key	Description	Part Number	Key	Description	Part Number
	<b>Parts List</b>				
	Travel Indicator Assembly	35A1588X0A2	3A*	Valve Plug	
1	Valve Body, 1-inch NPT	24A8802X012		Metal Seat,	
2*	Cage			1/4 & 3/8 inch ports	
	440C stainless steel, heat-treated <sup>(1,2)</sup>			440C stainless steel, heat treated <sup>(1)</sup>	16A2087X012
	1/4 inch port	14A8823X022		Nitronic 50 stainless steel <sup>(1)</sup>	16A2087X022
	3/8 inch port	14A8805X022		Carbide seating surface <sup>(2)</sup>	15A6804X012
	1/2 inch port	14A7157X022		1/2 inch (12.7 mm) port	
	Nitronic 50 <sup>(1)</sup> stainless steel			440C stainless steel, heat-treated <sup>(1)</sup>	14A6618X012
	1/4 inch port	14A8823X032		Nitronic 50 stainless steel <sup>(1)</sup>	14A6618X022
	3/8 inch port	14A8805X032		Soft Seat	
	1/2 inch port	14A7157X032		3/4 inch port	
	Carbide seating surface <sup>(1,2)</sup>			Austenitic stainless steel/nitrile	15A3197X022
	1/4 inch port	15A6800X012		Austenitic stainless steel/polyethylene	15A3197X012
	3/8 inch port	15A6801X012	3B*	Stem, 316 stainless steel <sup>(2)</sup>	
				w/o handjack	14A8806X012
				w/handjack	26A1765X012

1. May also be ordered from the Replacement Packing and Trim Assembly Part Numbers table.

2. May also be ordered as part of the cage/plug/stem assembly (key 52).

\*Recommended spare parts

Key	Description	Part Number
4	Packing Box Washer, stainless steel <sup>(1)</sup> 1/2 inch and smaller ports 3/4 inch port	14A6617X012 14A8807X012
6	Washer, stainless steel <sup>(1)</sup> (2 req'd)	14A8808X012
7	Packing Spring, 17-7PH stainless steel <sup>(1)</sup> Inconel X750	10B7429X012 10B7430X012
8*	Packing Set, PTFE V-Ring <sup>(1)</sup>	10B7279X012
8*	Packing Ring, nitrile/cotton (6 req'd)	14A9057X012
9	Packing Box, stainless steel <sup>(1)</sup>	10B7278X022
10*	O-Ring, fluoroelastomer <sup>(1)</sup>	1U841806382
11*	O-Ring, nitrile <sup>(1)</sup>	1P420706992
12*	O-Ring, fluoroelastomer <sup>(1)</sup>	11A8741X012
13	Lower Diaphragm Casing, steel	24A8810X012
14	Hex Nut, zn pl steel (17 req'd)	1A346524122
15	Flat Washer, zn pl steel	14A9770X012
16*	Diaphragm, neoprene w/nitrile insert	14A8813X012
17	Diaphragm Plate, zn pl steel	14A8814X012
18	Spring Plate, zn pl steel	14A8819X012
19	Main Spring, pl steel	See table 3
20	Upper Diaphragm Casing, steel w/o handjack w/handjack	24A8816X012 26A1770X012
21	Cap Screw, pl steel (12 req'd)	1E760324052

**Note**

Key numbers 22 through 27 are not req'd with a handjack. These parts are also included in the stem travel assembly, part number 35A1588X0A2, but are omitted when a handjack is used.

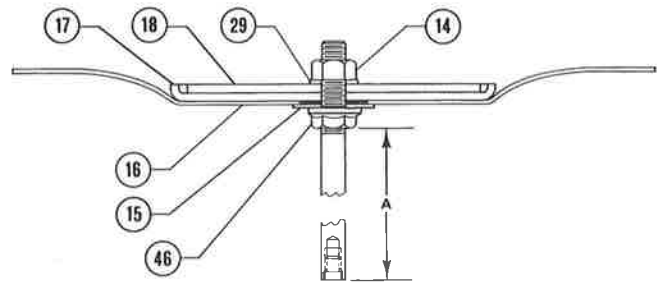
22	Travel Indicator Disk Nut, plastic	1F730506992
23	Indicator Fitting, stainless steel	15A0726X012
24	Indicator Bushing, 316 stainless steel	13A2323X012
25*	O-Ring, nitrile	1H292606992
26	Machine Screw, stainless steel	14A8818X012
27	Spring, stainless steel	16A0431X012
28	Pipe Plug, steel	1A794728992
29	Lock Washer, steel	1A742328992
31	Vent Assembly	
35*	Diaphragm Casing O-ring	13A1584X012
39*	O-Ring Retainer, polyethylene	14A9053X012
40*	Bushing, PTFE (used with metal seat only)	10B7431X012
41	Indicator Cover, plastic w/o handjack w/handjack	15A1580X012 26A1764X012
42	Paper Tube <sup>(1)</sup>	1M3227X0012
43	Web Sleeve <sup>(1)</sup>	1M3512X0012
44	Cage Puller, steel <sup>(1)</sup>	15A2525X012
45	Paper Label <sup>(1)</sup>	15A6827X012
46	Locknut, pl steel	15A7591X012

**Note**

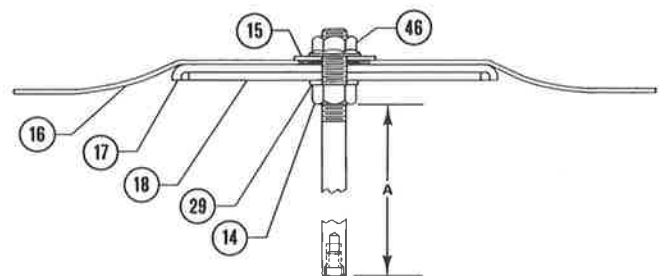
Key numbers 47 through 51 are handjack parts.

47	Handjack Body, steel	16A1769X012
48	Pipe Plug or Handle, steel (2 req'd) Pipe Plug Handle	1A500828992 16A1768X012

DIMENSION A			
Inches		mm	
Spring-Close Assembly	Spring-Open Assembly	Spring-Close Assembly	Spring-Open Assembly
2.46	2.72	62.5	69.1



**SPRING-CLOSE ASSEMBLY**



**SPRING-OPEN ASSEMBLY**

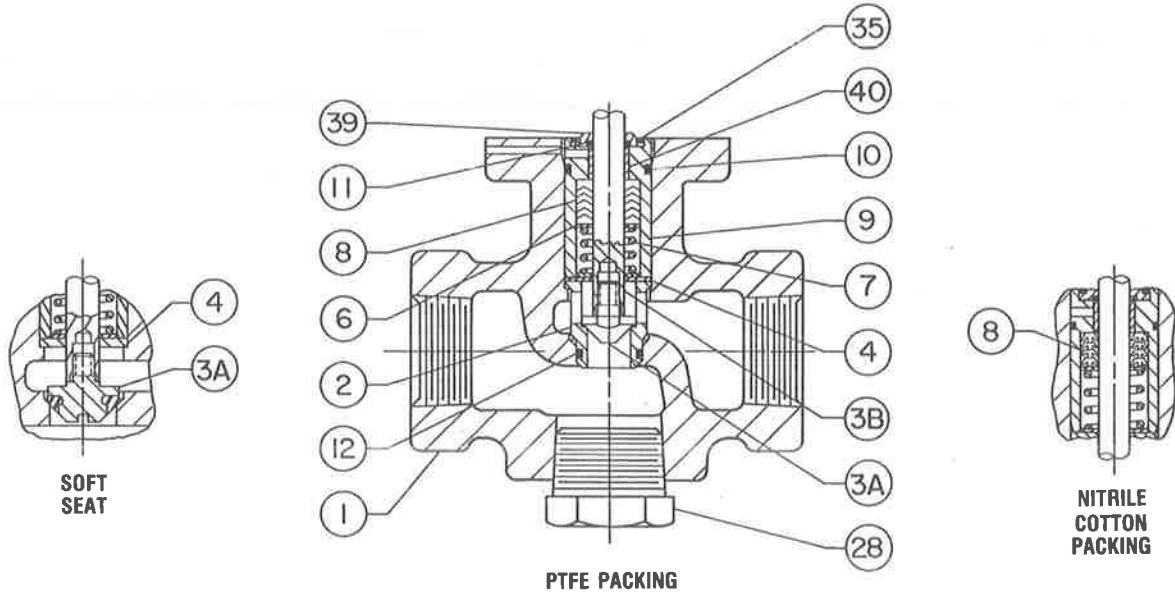
34A8839-G  
34A8836-G  
A2223-2/IL

Figure 6. Stem and Diaphragm Assembly Dimensions

Key	Description	Part Number
49	Stem Nut, pl steel	16A1763X012
50	Groove Pin, 316 stainless steel	1B599135072
51	Thrust Washer, steel	16A1508X012
52*	Cage/Plug/Stem Assembly, austenitic stainless steel w/carbide seating surface (not shown) (includes keys 2, 3A, and 3B) w/o handjack 1/4 inch port 3/8 inch port w/handjack 1/4 inch port 3/8 inch port	16A4601X012 16A4601X032 16A4601X022 16A4601X042
54	Nameplate	22B6762X0A2

1. May also be ordered from the Replacement Packing and Trim Assembly Part Numbers table.

\*Recommended spare parts



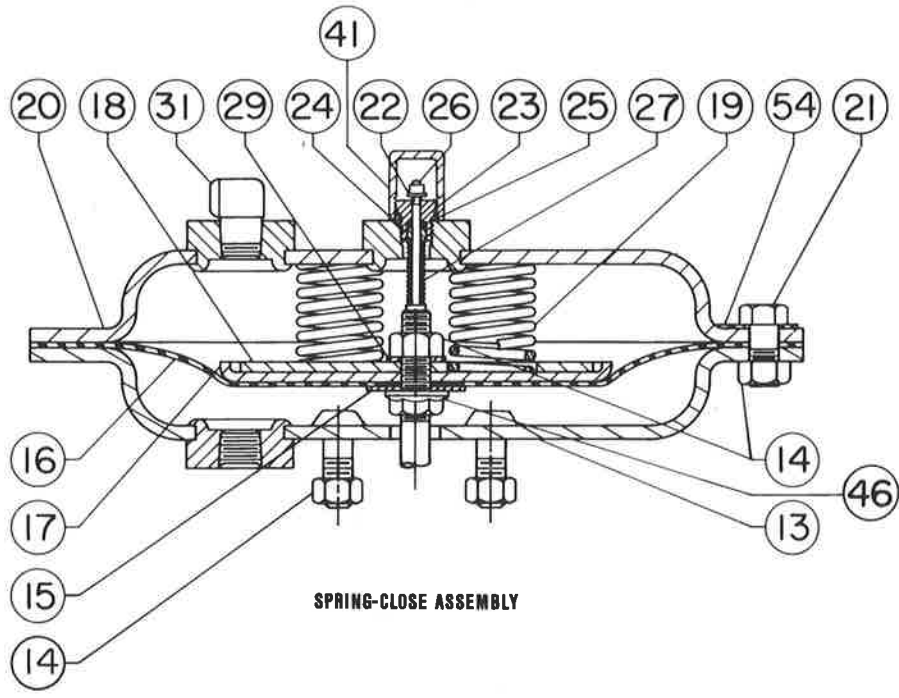
20B7894-A/DOC

Figure 7. Design PQC Valve Body Assembly

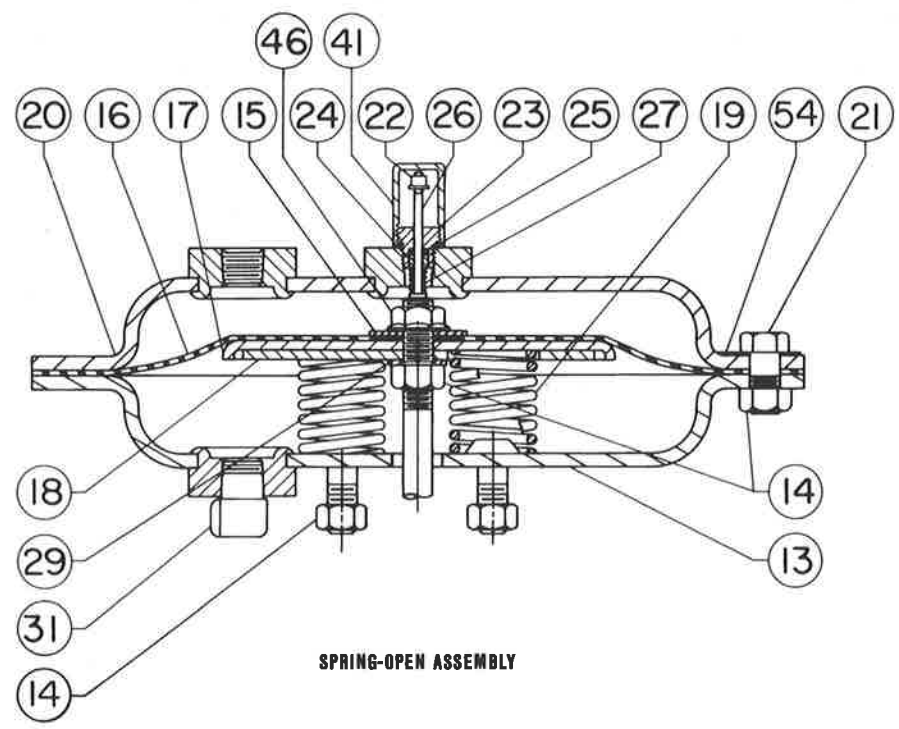
Replacement Packing and Trim Assembly Part Numbers

PORT DIAMETER		TFE V-RING PACKING, HEAT-TREATED 440C STAINLESS STEEL VALVE PLUG AND CAGE AND 17-7 PH STAINLESS STEEL PACKING SPRING	TFE V-RING PACKING, NITRONIC 50 STAINLESS STEEL VALVE PLUG AND CAGE AND INCONEL X750 PACKING SPRING
Inches	mm		
1/4	6.4	10B7899X012	10B7899X042
3/8	9.5	10B7899X022	10B7899X052
1/2	12.7	10B7899X032	10B7899X062
3/4	10.1		



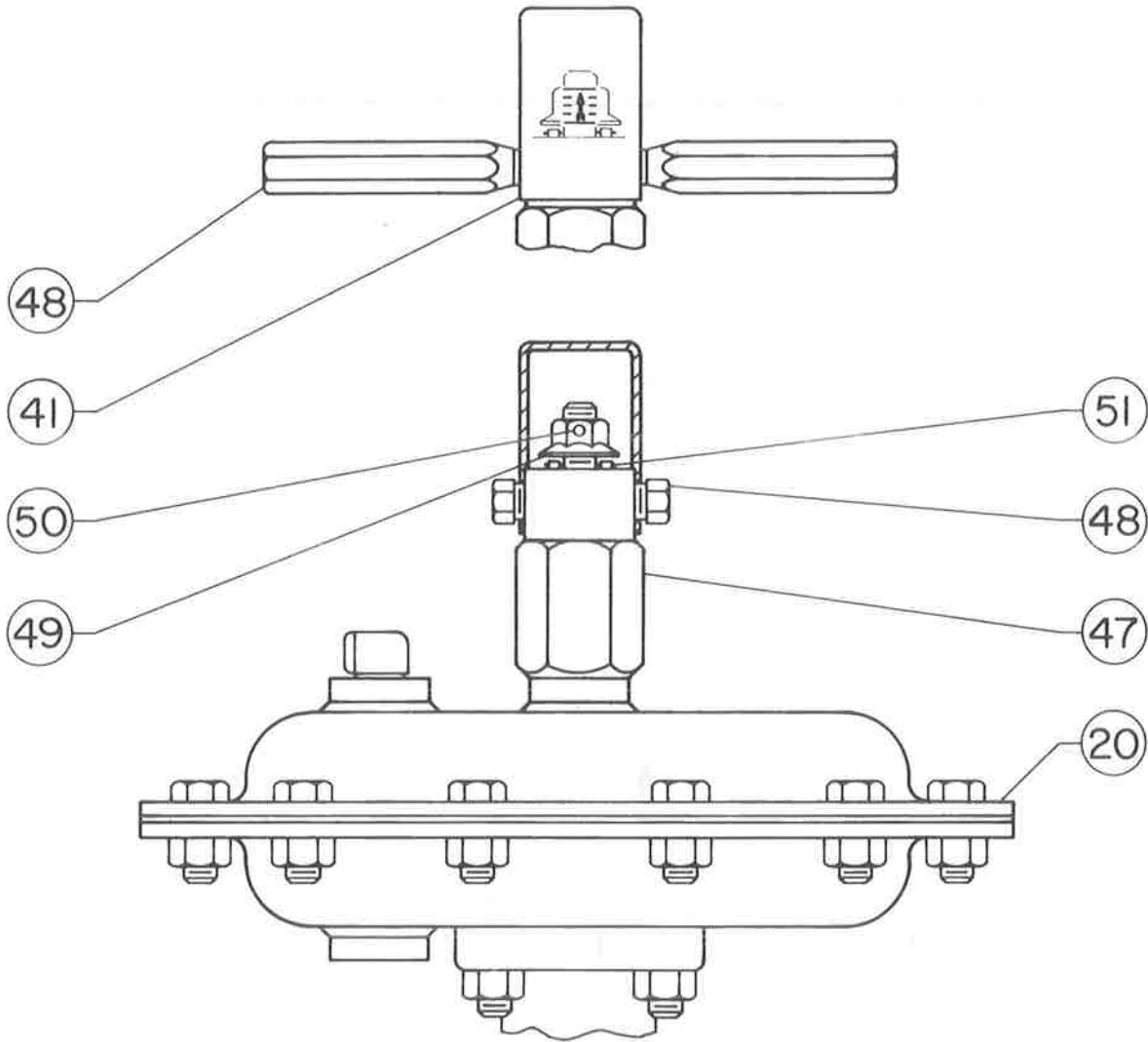


29A0341-A/DOC



29A0343-A/DOC

Figure 8. Type 128 Actuator



36A1772-A/DOC

Figure 9. Optional Handjack Assembly

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PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3				CONTROL VALVES				SHEET 1 OF 1	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478 HAMBURG COMPRESSOR LIMITED SERVICE : PRESSURE CONTROL VALVE				NO	BY	DATE	REVISION	SPEC NO	FILE 14.11
				0	TK	01/27/00	FOR PURCHASE	JOB #	99420
								DATE	
								REQ.	
				BY	CHK'D	APPR.			
G	1	TAG NO.	PCV-100						
E	2	SERVICE	COMPRESSOR MIN. FLOW						
N	3	LINE NO. / VESSEL NO.							
E	4	LINE SIZE / SCHED. NO.	89 mm SCH. 80						
	5	TYPE OF BODY	GLOBE						
	6	BODY SIZE	33 mm	19.1 mm	mm	mm	mm	mm	
	7	PORT SIZE	33 mm	19.1 mm	mm	mm	mm	mm	
	8	GUIDING	TOP	ONE					
	9	NO. OF PORTS	TOP	ONE					
B	10	END CONN. & RATING	33 mm FNPT, 6000#						
O	11	BODY MATERIAL	WCC STEEL (NACE)						
D	12	PACKING MATERIAL	TFE						
Y	13	LUBRICATOR	ISOLAT. VALVE						
	14	BONNET TYPE	HAMMER NUT						
	15	TRIM FORM	EQUAL PERCENTAGE						
	16	TRIM MATERIAL SEAT / PLUG	17-4 PH SST						
	17	SHAFT / MAT'L	NITRONIC 50						
	18	REQUIRED SEAT TIGHTNESS	CLASS IV						
	19	MAX. ALLOW SOUND LEV. dBA							
A	20	MODEL NO. & SIZE	357-40						
C	21	TYPE OF ACTUATOR	SPRING AND DIAPHRAGM						
T	22	CLOSE AT	41 kPa	207 kPa	kPa	kPa	kPa	kPa	
U	23	OPEN AT	41 kPa	207 kPa	kPa	kPa	kPa	kPa	
A	24	FLOW ACTION TO	OPEN						
T	25	FAIL POSITION	OPEN						
P	26	HANDWHEEL & LOCATION							
O	27	MFR. & MODEL NO.							
S	28	FILT REG   GAGES   BYPASS							
I	29	INPUT SIGNAL							
T	30	OUTPUT SIGNAL							
T	31	AIR SUPPLY PRESS	kPa	kPa	kPa	kPa	kPa	kPa	
R	32	MFR. & MODEL NO.	FISHER 546						
N	33	INPUT SIGNAL	4-20 MA						
O	34	OUTPUT SIGNAL	41-207 kPag						
P	35	FLOW UNITS	MMSCFD						
T	36	FLUID	SOUR HC VAPOR						
S	37	QUANT. MAX.	MAX. Cv						
E	38	QUANT. OPER.	OPER Cv	4.58	123.7				
R	39	VALVE Cv	VALVE C1	342					
V	40	NORM IN PRES	NORM DELTA P	8377 kPa(g)	7205 kPa	kPa(g)	kPa	kPa(g)	
I	41	MAX INLET PRESS		11377 kPa(g)	11377 kPa	kPa(g)	kPa	kPa(g)	
C	42	MAX SHUT OFF	MAX.DELTA P	11377 kPa(g)	11377 kPa	kPa(g)	kPa	kPa(g)	
E	43	TEMP. MAX.	OPER. TEMP	149 ° C	49 ° C	° C	° C	° C	
	44	OPER. SP. GR.	MOL. WT.		18.827				
	45	OPER. VISC.	% FLASH						
	46	% SUPERHEAT	% SOLIDS						
	47	VAPOR PRESS	CRIT PRESS	kPa(g)	kPa(g)	kPa(g)	kPa(g)	kPa(g)	
	48	PREDICTED SOUND LEVEL dBA							
	49	MANUFACTURER	FISHER						
	50	MODEL NO.	357-40						
	51	P. O. NUMBER							

NOTES:

- NACE COMPLIANCE REQUIRED
- VALVE IS TO BE USED INTERMITTENTLY - HIGH NOISE B55

AREA. UNIT #: 152



# 357 Series Control Valves

## Contents

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W58101L

Figure 1. 357 Series Control Valve

## Introduction

### Scope of Manual

This instruction manual provides installation, maintenance, and parts information for 357 Series control valves. Refer to separate manuals for instruction covering accessories used with the control valve.

### Description

The 357 Series control valves (figure 1) are designed for high-pressure on-off and throttling applications and are used as dump valves on oil and gas separators, scrubbers, and other field process equipment. They are also used for well-head applications where rugged

steel construction and easy maintenance are necessary. (The bonnet/body connection is covered by patent.)

Only personnel qualified through training or experience should install, operate, and maintain this control valve. If there are any questions concerning these instructions, contact your Fisher Controls sales office or sales representative before proceeding.

### Specifications

Table 1 lists specifications for the 357 Series control valves. Some of the specifications for the control valve, as it originally comes from the factory, are stamped on nameplates.



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Table 1. Specifications

<p><b>Available Configurations</b> See table 2</p> <p><b>Valve Body Sizes and End Connection Styles</b> See table 3</p> <p><b>Maximum Inlet Pressures and Temperatures<sup>(1)</sup></b> 4000 psig from -20 to 200°F (276 bar from -29 to 93°C), 4000 psig at -50°F (276 bar at -45°C), and 3880 psig at 300°F (268 bar at 149°C) unless limited by end connection rating</p> <p><b>Maximum Pressure Drops<sup>(1)</sup></b> <b>Metal Seats:</b> See tables 4 and 5</p> <p><b>Input Signal to Actuator</b> See tables 4 and 5</p> <p><b>Actuator Maximum Casing Pressure</b> Size 20: 50 psig (3.4 bar) Size 40: 50 psig (3.4 bar)</p> <p><b>Shutoff Classification</b> <b>Metal Seats:</b> ANSI Class IV per ANSI/FCI 70-2 <b>Soft Seats:</b> ANSI Class VI per ANSI/FCI 70-2</p> <p><b>Material Temperature Capabilities<sup>(1)(2)</sup></b> <b>With Nitrile O-Rings, Nylon Bushings, and WCC Valve Bodies:</b> -20 to 200°F (-29 to 93°C) <b>With Fluoroelastomer O-Rings, Ryton Bushings, and WCC Valve Bodies:</b> -10 to 300°F (-23 to 149°C)</p>	<p><b>With Nitrile<sup>(3)</sup> O-Rings, Nylon Bushings, and LCC Valve Bodies:</b> -50 to 180°F (-45 to 82°C)</p> <p><b>Flow Characteristic</b> <b>Metal or Ceramic Seats:</b> Equal percentage <b>Soft Seats:</b> Quick opening</p> <p><b>Flow Direction</b> May be in either direction as suits the application</p> <p><b>Port Diameters</b> ■ 1/4, ■ 3/8, ■ 1/2, ■ 3/4, ■ 1, or ■ 1-1/2 inch (6.4, 9.5, 12.7, 19.1, 25.4, or 38.1 mm) port diameters for both 1-inch and 2-inch valve bodies. See tables 4 and 5 for more information.</p> <p><b>Maximum Rated Valve Plug Travel</b> 3/4 inch (19 mm)</p> <p><b>Valve Plug Style</b> Micro-Form valve plug<sup>(4)</sup></p> <p><b>Actuator Diaphragm Effective Area</b> Size 20: 33 inches<sup>2</sup> (213 cm<sup>2</sup>) Size 40: 70 inches<sup>2</sup> (452 cm<sup>2</sup>)</p> <p><b>Actuator Spring Information</b> See table 6</p> <p><b>Actuator Pressure Connection Size</b> 1/4 inch NPT female</p> <p><b>Approximate Weight</b> See table 7</p>
--	---

1. The pressure or temperature limits in the referenced tables and any applicable ANSI code limitations should not be exceeded.  
 2. Process temperature should not go below -20°F (-29°C).  
 3. Low temperature material.  
 4. Contact your Fisher Controls sales office or sales representative for other valve plug requirements.

Table 2. Available Configurations

VALVE TYPE NUMBER AND FAIL ACTION	357, FAIL DOWN (SPRING CLOSSES—AIR OPENS)				357, FAIL UP (SPRING OPENS—AIR CLOSSES)			
	20		40		20		40	
Actuator Sizes								
Valve Configurations	Globe	Angle	Globe	Angle	Globe	Angle	Globe	Angle
Valve Size, Inches	1 and 2	1 and 2	1 and 2	1 and 2	1 and 2	1 and 2	1 and 2	1 and 2

Table 3. Valve Sizes and Connection Styles

VALVE SIZE, INCHES	SCREWED <sup>(1)</sup>	RAISED FACE (RF) FLANGED				RING TYPE JOINT (RTJ) FLANGED	
		Class 150	Class 300	Class 600	Class 1500	Class 600	Class 1500
1	X	X	X	X	---	X	---
2	X	X	X	X	X	X	X

X = Available construction.  
 1. The 1-inch screwed valve is a combination valve that uses a pipe plug in the unused connection to make either a globe or angle configuration (see figure 3).

Table 4. Maximum Allowable Shutoff Pressure Drops<sup>(1)</sup> for 357 Series Valves with Metal Seats (Fail Down, Spring Closes—Air Opens Configuration)

ACTUATOR SIZE	FLOW DIRECTION	PORT DIAMETER		INPUT SIGNAL TO ACTUATOR, SPRING PART NUMBER											
				3 to 15 Psig (0.2 to 1.0 Bar)		6 to 30 Psig (0.4 to 2.0 Bar)		10 to 50 Psig (0.7 to 3.4 Bar)		0 to 20 Psig (0 to 1.4 Bar)		0 to 35 Psig (0 to 2.4 Bar)		0 to 50 Psig (0 to 3.4 Bar)	
				16A9594X012		16A9595X012		16A9656X012		16A9594X012		16A9595X012		16A9656X012	
Inches	mm	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar
20	Up to Open	1/4	6.4	1700	117	4000	276	3720	257	3720	257	4000	276	4000	276
		3/8	9.5	610	42	2400	166	1510	104	1510	104	4000	276	4000	276
		1/2	12.7	260	18	1270	88	770	53	770	53	2280	157	2450	169
		3/4	19.1	40	3	490	34	270	19	270	19	940	65	1010	70
		1	25.4	---	---	240	17	110	8	110	8	490	34	530	37
		1-1/2	38.1	---	---	70	5	10	1	10	1	180	12	200	14
	Down to Close	1/4	6.4	960	66	1620	111	1620	111	1620	111	2700	186	3360	232
		3/8	9.5	1100	76	2590	178	2590	178	2590	178	4000	276	4000	276
		1/2	12.7	1270	87	3420	236	3580	247	1760	121	4000	276	4000	276
		3/4	19.1	450	31	1100	76	1490	103	1100	76	2050	141	2830	195
		1	25.4	180	12	460	32	620	43	460	32	850	54	1180	81
		1-1/2	38.1	---	---	170	12	230	16	170	12	320	22	440	30
40	Up to Open	1/4	6.4	4000	276	4000	276	4000	276	4000	276	4000	276	4000	276
		3/8	9.5	2920	201	4000	276	4000	276	4000	276	4000	276	4000	276
		1/2	12.7	1560	108	2270	157	2270	157	2630	181	4000	276	4000	276
		3/4	19.1	620	43	940	65	940	65	1100	76	1890	30	2520	174
		1	25.4	310	21	490	34	490	34	570	39	1020	70	1380	95
		1-1/2	38.1	100	7	180	12	180	12	220	15	420	29	570	39
	Down to Close	1/4	6.4	2300	159	4000	276	3720	257	3720	257	4000	276	4000	276
		3/8	9.5	3750	259	4000	276	4000	276	4000	276	4000	276	4000	276
		1/2	12.7	4000	276	4000	276	4000	276	4000	276	4000	276	4000	276
		3/4	19.1	1210	83	2640	182	3860	248	2640	182	4000	276	4000	276
		1	25.4	500	34	1100	76	1690	117	1100	76	2050	141	2760	190
		1-1/2	38.1	190	13	410	28	630	44	410	28	760	52	1030	71

1. For valves with soft seats, the maximum allowable pressure drop is limited to 1000 psig (69 bar) or to the values in the table, whichever is less.

# 357 Series

Table 5. Maximum Allowable Shutoff Pressure Drops<sup>(1)</sup> for 357 Series Valves with Metal Seats (Fail Up, Spring Opens—Air Closes Configuration)

ACTUATOR SIZE	FLOW DIRECTION <sup>(3)</sup>	PORT DIAMETER		INPUT SIGNAL TO ACTUATOR <sup>(2)</sup> , SPRING PART NUMBER					
				3 to 15 Psig (0.2 to 1.0 Bar)		6 to 30 Psig (0.4 to 2.0 Bar)		10 to 50 Psig (0.7 to 3.4 Bar)	
		Inches	mm	16A9594X012		16A9929X012		16A9595X012	
				Psi	Bar	Psi	Bar	Psi	Bar
20	Up to Open <sup>(2)</sup>	1/4	6.4	4000	276	4000	276	4000	276
		3/8	9.5	2210	152	4000	276	4000	276
		1/2	12.7	1160	80	2510	173	3960	273
		3/4	19.1	440	30	1040	72	1690	117
		1	25.4	210	14	540	37	910	63
		1-1/2	38.1	50	3	200	14	370	26
40	Up to Open <sup>(2)</sup>	1/4	6.4	3 to 15 Psig (0.2 to 1.0 Bar)		6 to 30 Psig (0.4 to 2.0 Bar)		10 to 50 Psig (0.7 to 3.4 Bar)	
				1F176727032		1F714327092		1E795627082	
				Psi	Bar	Psi	Bar	Psi	Bar
				4000	276	4000	276	4000	276
				4000	276	4000	276	4000	276
				2810	194	4000	276	4000	276
1/2	12.7	2810	194	4000	276	4000	276		
3/4	19.1	1250	86	2540	175	1730	119		
1	25.4	700	48	1390	96	930	64		
1-1/2	38.1	300	21	580	40	380	26		

1. For valves with soft seats, the maximum allowable pressure drop is limited to 1000 psig (69 bar) or to the values in the table, whichever is less.  
 2. Actual operating pressure includes an additional 3 psig (0.2 bar) input supply to the controller.  
 3. Consult your Fisher Controls sales office or sales representative for maximum allowable shutoff pressure drops of flow down to close valve configuration.

Table 6. Spring Part Number, Color Code, Spring Rate and Free Length

ACTUATOR SIZE	SPRING PART NUMBER	COLOR CODE	SPRING RATE		FREE LENGTH	
			Lb/in	N/mm	Inch	mm
20	16A9594X012	Aluminum	205	36	5.5	140
	16A9595X012	Light Green	571	100		
	16A9656X012	Yellow	912	160		
	16A9929X012	Black	380	67		
40	1E792427082	Light Green	1470	257	6.5	165
	1E793327082	Yellow	2100	367		
	1E795627082	White	2520	441		
	1F176727032	Dark Green	368	64		
	1F176827092	Aluminum	490	86		
	1F714327092	Aluminum/Dark Blue	830	145		
	1J258127092	Aluminum/Brown	1000	175		

Table 7. 357 Series Approximate Weights, Pounds (Kg)

Actuator Size	20				40			
	1		2		1		2	
Valve Size, Inches	1		2		1		2	
Valve Configuration	Globe	Angle	Globe	Angle	Globe	Angle	Globe	Angle
Screwed	47 (21) <sup>(1)</sup>	47 (21) <sup>(1)</sup>	61 (28)	51 (23)	64 (29) <sup>(1)</sup>	64 (29) <sup>(1)</sup>	78 (35)	68 (31)
Class 150	50 (23)	48 (22)	60 (27)	60 (27)	67 (30)	65 (29)	77 (35)	77 (35)
Class 300 & 600	57 (26)	57 (26)	82 (37)	77 (35)	74 (34)	74 (34)	99 (45)	94 (43)
Class 1500	---	---	122 (55)	126 (57)	---	---	139 (63)	143 (65)

1. The 1-inch screwed valve is a combination valve that uses a pipe plug in the unused connection to make either a globe or angle configuration (see figure 3).



## Installation

Some types of ceramic trim, including the VTC (very tough ceramic) variety, can create a spark under certain circumstances. When the edge of a ceramic part is struck against a second ceramic part with enough force, a spark can be created.

### WARNING

**Avoid personal injury and property damage from ignition of process fluid caused by sparks from ceramic trim.**

**Do not use ceramic trim where the process fluid is unstable or if it is an explosive mixture (such as ether and air).**

### WARNING

**To avoid personal injury or property damage caused by bursting of pressure-retaining parts or by uncontrolled process fluid, be certain the service conditions do not exceed the limits shown on the valve nameplate and in tables 1, 4, and 5.**

1. Before installing the control valve assembly, inspect it for any damage and for any foreign material that may have collected in the valve body.
2. Remove any pipe scale, welding slag, and other foreign material from the pipeline.
3. The control valve can be installed in any position, but normally the actuator is vertical above the valve. Install the valve so the flow direction arrow on the side of the valve indicates the direction of the process flow.
4. Install the valve following local and national piping codes when they apply to the application. For screwed connections, treat the male pipe threads with a good grade pipe compound. For flanged valves, use suitable gaskets between valve and pipeline flanges.
5. If continuous operation is required during maintenance and inspection, install a conventional three-valve bypass around the valve.
6. Connect loading pressure for the fail-up configuration to the 1/4-18 NPT connection in the spring case. The fail-down configuration loading pressure connection is in the lower casing assembly as shown in figure 3.

### CAUTION

**If a fail-up configuration is used, do not plug the 1/4-18 NPT connection in the lower casing. It acts as a vent for the lower casing, permitting air to move in and out of the lower casing cavity as the diaphragm moves up and down. If the vent is plugged, the actuator will not respond properly to loading pressure changes and may be incapable of completely opening or shutting off the valve.**

## Spring Adjustment

The spring supplied with the actuator has been selected to meet the requirements of the application as specified on the order. This pressure condition is stamped on the actuator nameplate.

The spring has a fixed pressure span over which loading pressure will stroke the valve. Adjustment of the spring compression shifts the span so that more or less loading pressure is required to start travel. Since the span does not change, there will be a corresponding increase or decrease in the pressure requirements at the end of the valve stroke.

If the actuator has been disassembled or pressure conditions have changed, the spring may need adjustment to make the valve travel coincide with the diaphragm pressure range. Make the adjustment in the following manner.

1. Loosen the adjusting screw nut (key 35, figure 3) on the fail-down configuration, or unscrew the spring case assembly (key 46, figure 2) on the fail-up configuration.
  2. Turn the fail-down adjusting screw (key 34, figure 3) or the fail-up adjusting stem nut (key 35, figure 2) clockwise to compress the spring or counterclockwise to decrease spring compression.
- Increased spring compression results in increased loading pressure necessary to start travel. Decreased spring compression results in less loading pressure required to start travel. With the fail-down configuration flow-to-open, increased spring compression will balance a higher line pressure or provide additional seating load. With the fail-up configuration flow-to-open, decreased spring compression may be necessary if the line pressure is increased or if more valve plug seating load is required from the input signal.
3. After adjustment, tighten the adjusting screw nut (fail-down configuration), or replace the spring case assembly (fail-up configuration).

The maximum pressure drop conditions are shown in tables 4 and 5. Note that the springs can be identified

# 357 Series

by the color code. Depending on how much conditions are changed, it may be necessary to change the actuator spring. If so, check the *Parts List* section to see if a different adjusting screw or adjusting stem assembly (key 34) is required.

## Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and maintenance depends on the severity of the service conditions.

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

### WARNING

**Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:**

- **Disconnect any operating lines providing air pressure, electric 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.**

Some types of ceramic trim, including the VTC (very tough ceramic) variety, can create a spark under certain circumstances. When the edge of a ceramic part is struck against a second ceramic part with enough force, a spark can be created.

### WARNING

**Avoid personal injury and property damage from ignition of process fluid caused by sparks from ceramic trim.**

**Do not use ceramic trim where the process fluid is unstable or if it is an explosive mixture (such as ether and air).**

The following describes the procedure for complete disassembly and assembly of the actuator-valve combination. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job. Key numbers refer to figure 2 for the fail-up configuration and figure 3 for the fail-down configuration.

## Disassembly

1. Remove the loading pressure tubing and any accessories that may hamper disassembly.
2. Unscrew the hammer nut (key 3). If the bonnet is stuck on the valve, continue to unscrew the hammer nut. The hammer nut will contact the spring pins (key 58) and will force the bonnet out of the valve. Carefully lift the actuator, bonnet, and valve plug assembly from the valve body.

If the bonnet is stuck on the valve, insert a large screwdriver or steel rod into the pry hole in the bonnet. Push down on the screwdriver or rod to loosen the bonnet.

### Note

**The spring pins must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.**

3. Remove the cage (key 5). For ceramic trim, remove the cage (key 60) and seat ring (key 61). Inspect the cage and bonnet O-rings (keys 6 and 11) for wear or damage.
4. To remove valve plug (key 7), drive out roll pin (key 9) and unscrew valve plug from stem (key 8).

If valve plug cannot be easily unscrewed from stem, disassemble actuator in accordance with steps 7 through 9. Hold wrench on hex nut (key 29) to prevent stem and diaphragm from rotating.

**CAUTION**

**Be careful to avoid damaging the seating surface on the valve plug or the cage as damage in these areas will allow excessive leakage at shutoff. Avoid damaging the highly polished valve stem surface. A damaged valve stem could cut the packing and allow process fluid to leak to the atmosphere.**

5. If packing parts (keys 12, 13, 14, 15 for PTFE V-ring and nitrile/cotton; keys 12, 13, 14, and 16 for PTFE/composition) are to be replaced with new parts, remove washer (key 10) and pull out old parts using a formed wire hook.

**Note**

**Save three flat washers (key 13) when removing packing.**

6. No further disassembly is necessary if only the trim and/or packing is being serviced. To reassemble the unit, proceed to the *Assembly* section step 1 and steps 7 through 15.

**WARNING**

**To avoid personal injury caused by sudden release of spring force, relieve all spring compression before continuing disassembly. Use step 7 to relieve spring compression.**

7. To relieve all spring compression,

**For fail-down configuration,** loosen adjusting screw nut (key 35, figure 3) and turn adjusting screw (key 34, figure 3) counterclockwise to remove all spring compression.

**For fail-up configuration,** unscrew spring case assembly (key 46, figure 2) and turn adjusting stem nut (key 35, figure 2) counterclockwise to remove all spring compression. Remove adjusting stem nut, spring seat, and spring.

8. Unscrew the casing cap screws and hex nuts (keys 36 and 37), and remove the upper casing assembly (key 23) from the lower casing (key 22).

9. For fail-up configuration, remove cotter pin (key 50, figure 2) and unscrew adjusting stem (key 34, figure 2) from stem.

10. Lift out the diaphragm, diaphragm plate, and stem assembly.

11. To replace the diaphragm (key 26), separate the diaphragm assembly by using a wrench on the hex nuts (key 29) to unscrew the assembly.

12. Separate the parts—diaphragm washer, actuator O-ring (keys 27 and 28), diaphragm, and diaphragm plate, (keys 26 and 24).

13. Inspect the diaphragm and the actuator O-ring for damage or deterioration, and replace if necessary. If the diaphragm is replaced, a new O-ring should also be installed.

14. Inspect stem O-ring (key 19) and bonnet bushing (key 20); replace if necessary. To inspect casing O-ring (key 18), remove cap screws (key 21) and lift off lower casing (key 22). Replace O-ring if necessary.

**Note**

**The stem O-ring and bonnet bushing (keys 19 and 20), when used in fail-down, seal against loading pressure. The stem O-ring and bonnet bushing in fail-up have atmospheric pressure on the actuator side.**

15. If the hammer nut needs to be removed from the bonnet, the spring pins (key 58) can be removed with locking pliers.

16. The travel indicator assembly on the fail-up configuration has an O-ring (key 44, figure 2) that may become worn and leak loading pressure. If this happens, replace with a new assembly (key 43).

17. Fail-up configuration has adjusting stem bushing and actuator stem O-ring (keys 48 and 49, figure 2) that seals against loading pressure around the adjusting stem.

**Assembly**

1. Before starting assembly, make sure all parts are clean and in good condition. There should be no burrs or sharp edges on any threads or surfaces that might cut or damage an O-ring, bushing, the packing, or the diaphragm. When replacing O-rings and bushings, be sure the O-ring or bushing groove is clean and undamaged. Using a general purpose lubricant, lubricate all O-rings and bushings and the threads of parts that have to pass through the O-rings and bushings.

**CAUTION**

**The threads on factory-produced valve stems have been specially machined to avoid O-ring, bushing, or packing damage during trim maintenance. Use of other than a factory-produced valve stem may result in early stem O-ring, bushing, and packing failure.**

# 357 Series

2. If the actuator being reassembled is a fail-up configuration, replace the O-ring and bushing (keys 49 and 48, figure 2).

3. Assemble the diaphragm and diaphragm plate assembly. Place the patterned side of the diaphragm (key 26) (size 40 only) against the diaphragm plate (key 24). Be sure to turn the diaphragm washer (key 27) so that the side that is beveled on the inside diameter is against the O-ring (key 28). Also, make sure that it is assembled for installation with the diaphragm on the loading pressure side and the lockwasher (key 30) and lower spring seat (key 31), if used, are on the spring side.

4. Place the hammer nut and spring pins on the bonnet, if removed. Install the casing O-ring (key 18), the stem O-ring (key 19), and the bonnet bushing (key 20); then bolt the lower casing to the bonnet.

## Note

**Spring pins must always be in place during valve operation, acting as a safeguard against injury when the unit is being disassembled.**

5. Fasten diaphragm and diaphragm plate assembly on the stem with hex nuts (key 29). Place the diaphragm and diaphragm plate, and stem assembly into the lower casing and bonnet.

6. For fail-up configuration, screw the adjusting stem (key 34) onto the stem (key 8) and secure with cotter pin (key 50). Make sure bushing (key 48) and O-ring (key 49) are in place in the upper casing.

7. Install packing parts (keys 12, 13, 14, 15, or 16). Install washer (key 10). Screw valve plug onto stem. Drive in roll pin.

8. Make sure the cage O-ring (key 6) is in the cage. Install the cage into the valve.

For ceramic trim, ensure the O-ring (key 6) is in the seat ring. Install the seat ring and cage into the valve.

9. Make sure bonnet O-ring (key 11) is on the bonnet.

10. Lubricate the threads on the valve body and hammer nut and on the contact surfaces of bonnet and hammer nut flange. Install bonnet with attached diaphragm and valve plug onto the valve body. Tighten hammer nut using a hammer until the nut stops turning. A few extra hammer blows will be required to ensure that the assembly is tight. To avoid overloading of the cage, do not use excessive force, which can be seen by deformation of the nut.



## CAUTION

**Over-tightening the diaphragm casing cap screws and nuts (keys 36 and 37) can damage the diaphragm. Do not exceed 20 lbf•ft (27 N•m) torque.**

11. If valve is a fail-up, position upper casing (key 23) on lower casing (key 22). Insert cap screws (key 36) and tighten hex nuts (key 37). Torque the casing cap screws evenly to 20 lbf•ft (27 N•m) using a crisscross pattern. Replace the spring, spring seat, (keys 32 and 33) and adjusting stem nut (key 35) over the adjusting stem (key 34). Replace the spring case assembly (key 46).

12. If the valve is fail-down, replace the spring (key 32) on the diaphragm plate (key 24). Replace upper spring seat (key 33). Position upper casing (key 23) on lower casing (key 22). Insert cap screws (key 36) and tighten hex nuts (key 37). Torque the casing cap screws evenly to 20 lbf•ft (27 N•m) using a crisscross pattern.

13. Install the travel indicator assembly.

14. Refer to the *Spring Adjustment* section.

15. Adjust the travel indicator nut (key 42).

## Parts Ordering

Each 357 Series control valve is assigned a serial number, which can be found on the nameplate. Refer to the number when contacting the Fisher Controls representative for assistance or when ordering replacement parts. When ordering replacement parts, also be sure to include the complete 11-character part number from the following parts list.

## Parts Kits

### Repair kits for the valve portion only.

PTFE V-Ring Packing Repair Kit (includes keys 6, 11, 12, and 15)	
Nitrile seal	R357XPTFE12
Fluoroelastomer seal	R357XPTFE22
Nitrile/Cotton Packing Repair Kit (includes 6, 11, 12, and 15)	
Nitrile seal	R357X00NC12
Fluoroelastomer seal	R357X00NC22
Ceramic Trim Package (includes keys 7, 9, 60, and 61)	
1/4-inch (6.4 mm) port diameter	R357XVTC012
3/8-inch (9.5 mm) port diameter	R357XVTC022
1/2-inch (12.7 mm) port diameter	R357XVTC032
3/4-inch (19.1 mm) port diameter	R357XVTC042
1-inch (25.4 mm) port diameter	R357XVTC052
1-1/2 inch (38.1 mm) port diameter	R357XVTC062

### Repair kits for the valve and actuator assembly.

Diaphragm is not included and must be ordered separately by appropriate part number.

PTFE V-Ring Packing Repair Kit (includes keys 6, 11, 12, 15, 18, 19, 20, 28, 44, 48, and 49)	
Nitrile seal	R357X000012
Fluoroelastomer seal	R357X000032
Nitrile/Cotton Packing Repair Kit (includes 6, 11, 12, 15, 18, 19, 20, 28, 44, 48, and 49)	
Nitrile seal	R357X000022
Fluoroelastomer seal	R357X000042

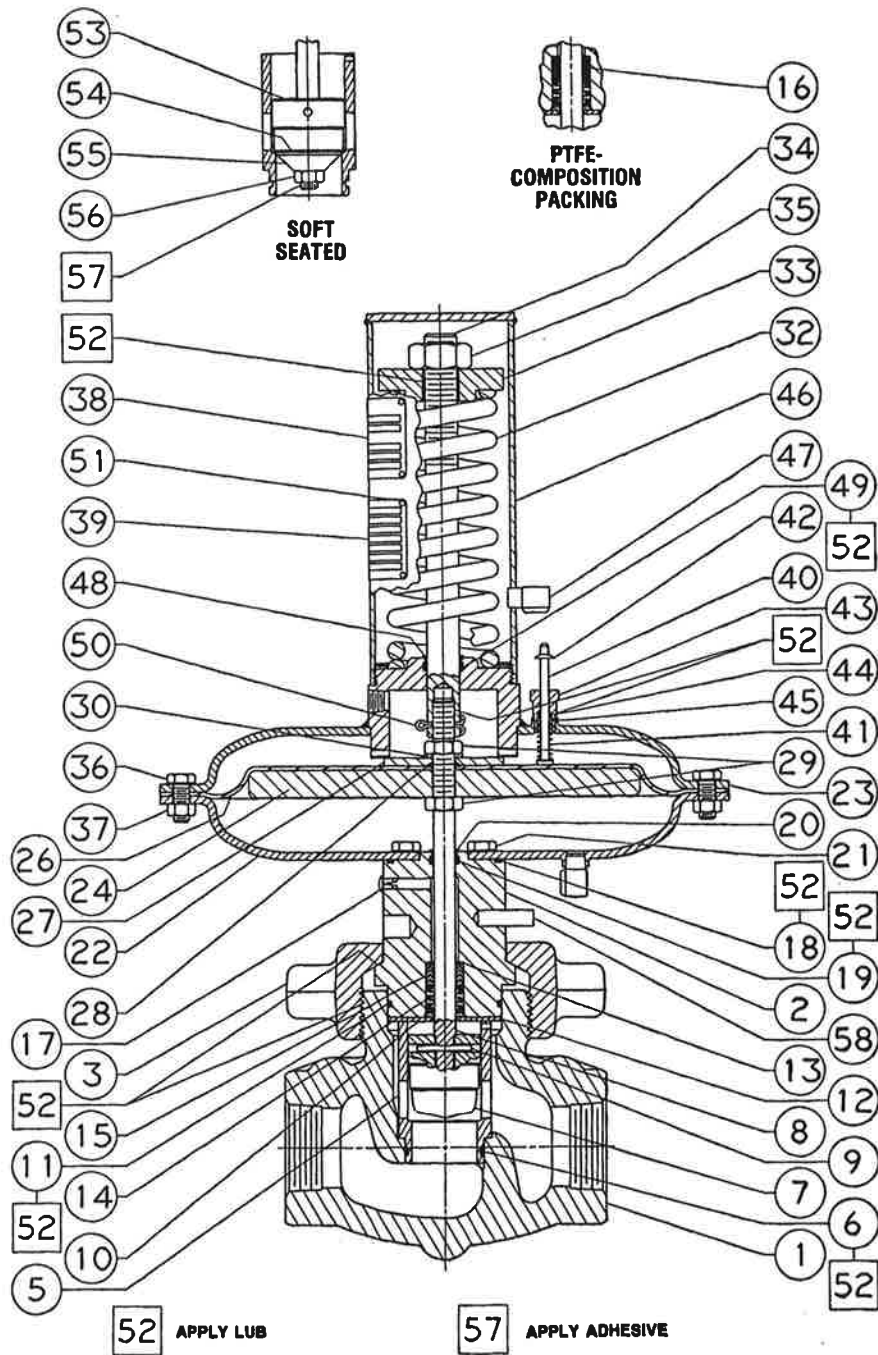
## Parts List

Key	Description	Part Number
2	Bonnet	
	For WCC (steel) valve & NACE, SA-105 steel	32B3485X012
	For LCC (steel) valve & NACE, SA-350 steel	32B3485X022
3	Hammer Nut	
	Size 1 & 2, Class 150 through 600 flanged and screwed	
	For WCC valve & NACE, SA-105 steel	22B3483X012
	For LCC valve & NACE, SA-350 steel	22B3483X022
	Size 2, Class 1500	
	For WCC (steel) valve & NACE, SA-105 steel	22B3549X012
	For LCC (steel) valve & NACE, SA-350 steel	22B3549X022
4	Pipe Plug (1-inch screwed valve only)	
	For WCC valve & NACE, SA-105 steel	1A794728992
	For LCC valve & NACE, S31600 (316 SST)	1A7947X00A2

Key	Description	Part Number
5*	Cage w/Integral Seat Ring	
	Metal Seat	
	17-4PH stainless steel H1075	
	1/4-inch (6.4 mm) port diameter	32B3486X012
	3/8-inch (9.5 mm) port diameter	32B3487X012
	1/2-inch (12.7 mm) port diameter	32B3488X012
	3/4-inch (19.1 mm) port diameter	32B3489X012
	1-inch (25.4 mm) port diameter	32B3490X012
	1-1/2 inch (38.1 mm) port diameter	32B3491X012
	17-4PH stainless steel DH1150 (NACE)	
	1/4-inch (6.4 mm) port diameter	32B3486X022
	3/8-inch (9.5 mm) port diameter	32B3487X022
	1/2-inch (12.7 mm) port diameter	32B3488X022
	3/4-inch (19.1 mm) port diameter	32B3489X022
	1-inch (25.4 mm) port diameter	32B3490X022
	1-1/2 inch (38.1 mm) port diameter	32B3491X022
5*	Cage w/Integral Seat Ring (Continued)	
	Soft Seat	
	17-4PH stainless steel H1075	
	1/2-inch (12.7 mm) port diameter	32B3488X012
	3/4-inch (19.1 mm) port diameter	32B3489X012
	1-inch (25.4 mm) port diameter	32B3490X012
	1-1/2 inch (38.1 mm) port diameter	32B3491X012
	17-4PH stainless steel DH1150 (NACE)	
	1/2-inch (12.7 mm) port diameter	32B3488X022
	3/4-inch (19.1 mm) port diameter	32B3489X022
	1-inch (25.4 mm) port diameter	32B3490X022
	1-1/2 inch (38.1 mm) port diameter	32B3491X022
6*	Cage O-Ring	See following table
7*	Valve Plug	
	Taper Plug (all port diameters)	
	416 stainless steel	22B3498X012
	17-4PH stainless steel DH1150 (NACE)	22B3498X022
	Micro-Form Plug	
	416 stainless steel	
	1/4-inch (6.4 mm) port diameter	22B3492X012
	3/8-inch (9.5 mm) port diameter	22B3493X012
	1/2-inch (12.7 mm) port diameter	22B3494X012
	3/4-inch (19.1 mm) port diameter	22B3495X012
	1-inch (25.4 mm) port diameter	22B3496X012
	1-1/2 inch (38.1 mm) port diameter	22B3497X012
	17-4PH stainless steel DH1150 (NACE)	
	1/4-inch (6.4 mm) port diameter	22B3492X022
	3/8-inch (9.5 mm) port diameter	22B3493X022
	1/2-inch (12.7 mm) port diameter	22B3494X022
	3/4-inch (19.1 mm) port diameter	22B3495X022
	1-inch (25.4 mm) port diameter	22B3496X022
	1-1/2 inch (38.1 mm) port diameter	22B3497X022
7*	Valve Plug (continued)	
	VTC (ceramic) (standard or NACE)	
	1/4-inch (6.4 mm) port diameter	22B8922X012
	3/8-inch (9.5 mm) port diameter	22B8923X012
	1/2-inch (12.7 mm) port diameter	22B8924X012
	3/4-inch (19.1 mm) port diameter	22B8925X012
	1-inch (25.4 mm) port diameter	22B8926X012
	1-1/2 inch (38.1 mm) port diameter	22B8927X012
8*	Valve Stem	
	S31600 (316 stainless steel)	22B3516X012
	S20910 (Nitronic 50) (NACE)	22B3516X032
9*	Roll Pin, 18-8 stainless steel	1U5972X0012
9*	Pin, 17-4PH SST (DH1150) (NACE)	12B3507X022
10	Cage/Packing Washer, 304 stainless steel	12B3519X012
11*	Bonnet O-Ring	See following table
12*	Packing Wiper, PTFE	15A9637X012
13	Packing Washer, SST (3 req'd)	1H981836042
14	Packing Spring, N07750 (Inconel)	15A3183X012

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Key	Description	Part Number	Key	Description	Part Number
15*	Packing Set PTFE V-ring Nitrile/cotton	12A9016X012 19A5772X012	36	Cap Screw, pl steel Size 20 (12 req'd) Size 40 (16 req'd)	1E760324052 1E760324052
16*	Packing Ring, PTFE comp (3 req'd)	1P390501042	37	Hex Nut, pl steel Size 20 (12 req'd) Size 40 (16 req'd)	1A346524122 1A346524122
17	Leak-off Plug	15A0983X012	38	Actuator Nameplate	14B2028X0A2
18*	Casing O-Ring	See following table	40	Indicator Rod (included in key 43 assembly)	
19*	Stem O-Ring	See following table	41	Indicator Spring (included in key 43 assembly)	
20*	Bonnet Bearing	See following table	42	Indicator Nut (included in key 43 assembly)	
21	Cap Screw, pl steel (4 req'd)	1D529824052	43	Indicator Assembly Fail up (includes keys 40, 41, 42, 43, 44, and 45) -20 to 300°F (-29 to 149°C) -50 to 180°F (-45 to 82°C)	22B3524X022 22B3524X032
22	Lower Casing, pl (plated) steel Fail up or fail down Size 20 Size 40	32B3499X012 42B3500X012	44	Indicator O-Ring (included in key 43 assembly) (fail up only)	22B3523X022
23	Upper Casing Assy, pl steel Size 20 Fail up Fail down Size 40 Fail up Fail down	22B3503X012 32B3501X012 22B3510X012 32B3508X012	45	Indicator Bushing (included in key 43 assembly)	23A2349X012
24	Diaphragm Plate, steel Size 20 Size 40	22B3514X012 24B1785X012	46	Spring Case Assembly, steel (for fail up)	27A5516X012
26*	Diaphragm (O-Ring, key 28 should be ordered with diaphragm) Size 20 Nitrile/nylon Fluoroelastomer Size 40 Neoprene/nylon Fluoroelastomer	32B3520X012 32B3520X022 22B3521X012 22B3521X032	47	Vent Assy, SST (2 req'd) (for fail up)	17A4059X012
27	Diaphragm Washer, pl steel	12B3517X012	48*	Adjusting Stem Bushing, nylon (for fail up)	See following table
28*	Actuator O-Ring	See following table	49*	Actuator Stem O-Ring (for fail up)	See following table
29	Hex Nut, pl steel (2 req'd)	1A353724122	50*	Cotter Pin, S30200 (302 stainless steel) (for fail up)	1C608035022 1A368228982
30	Lockwasher, pl steel	1A353828982	51	Drive Screw, SST (8 req'd)	---
31	Lower Spring Seat, pl steel (for fail down only)	12B3518X012	52	Lubricant, Lubriplate Mag-1 Not included with control valve	
32	Actuator Spring See tables 4, 5, and 6		53*	Plug, Disk Holder, S17400 D1150 1/2-inch (12.7 mm) port diameter 3/4-inch (19.1 mm) port diameter 1-inch (25.4 mm) port diameter 1-1/2 inch (38.1 mm) port diameter	22B3533X012 22B3532X012 22B3531X012 22B3530X012
33	Upper Spring Seat, pl steel Fail up (size 20 or 40 actuator) Fail down Size 20 actuator Size 40 actuator	13A2343X012 16A9460X012 17A3513X012	54*	Disk, Plug Seat, UHMWPE <sup>(1)</sup> 1/2-inch (12.7 mm) port diameter 3/4-inch (19.1 mm) port diameter 1-inch (25.4 mm) port diameter 1-1/2 inch (38.1 mm) port diameter	15A3584X012 13A7446X012 13A7450X012 13A7463X012
34	Adjusting Screw, pl steel Fail down Size 20 flow-up-to-open 3 to 15 psig (0.2 to 1.0 bar) signal range All other ranges Size 40 flow-up-to-open 3 to 15 psig (0.2 to 1.0 bar) signal range All other ranges	1D336628982 1A6441X0012 17A3515X012 1V360928982	55*	Disk Retainer, S31600 1/2-inch (12.7 mm) port diameter 3/4-inch (19.1 mm) port diameter 1-inch (25.4 mm) port diameter 1-1/2 inch (38.1 mm) port diameter	15A3583X022 13A7447X012 13A7451X012 12B3529X012
34	Adjusting Stem, S31600 (316 stainless steel) For fail up	22B3512X012	56	Hex Nut, S31600 3/4-inch (19.1 mm) port diameter 1-inch (25.4 mm) port diameter 1-1/2 (38.1 mm) port diameter	1A391535072 1A3753X0282 1A3753X0282
35	Adjusting screw nut, pl steel (fail down)	1A352424122	57	Adhesive, Loctite No. 262	T13060T0012
35	Adjusting stem nut, pl steel (fail up)	1A599324122	58	Spring Pin, Pl carbon steel, (2 req'd)	12B9011X012
			60*	Cage for Ceramic Trim S17400 D1150 (std or NACE) all port dia	22B8912X012
			61*	Seat Ring for Ceramic Trim S17400 D1150 (std or NACE) 1/4 inch (6.4 mm) port diameter 3/8 inch (9.5 mm) port diameter 1/2 inch (12.7 mm) port diameter 3/4 inch (19.1 mm) port diameter 1-inch (25.4 mm) port diameter Ceramic (std or NACE) 1-1/2 inch (38.1 mm) port diameter	17B1949X012 17B1950X012 17B1951X012 17B9680X012 17B9681X012 32B8918X012



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Figure 2. 2-Inch 357 Series Valve—Fail-Up

# 357 Series

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PCV/IP-100

# Type 546, 546S, and 546NS

## Type 546, 546S, and 546NS Electro-Pneumatic Transducers

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<b>Operating Information</b> .....	5	<b>Introduction</b>	
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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 (mA <sub>dc</sub> ) input signal and transmits a proportional pneumatic output pressure to a final control element. The Type 546S transducer receives a current (mA <sub>dc</sub> ) 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

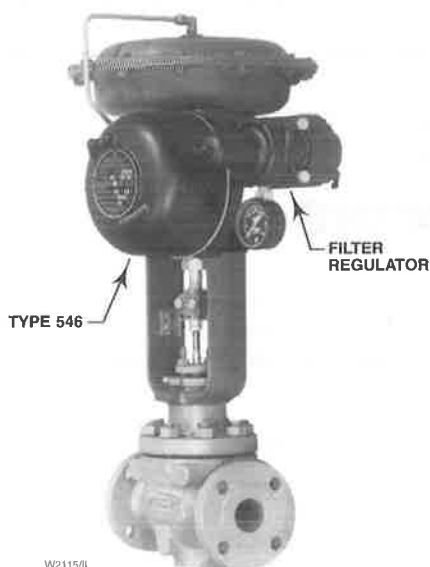
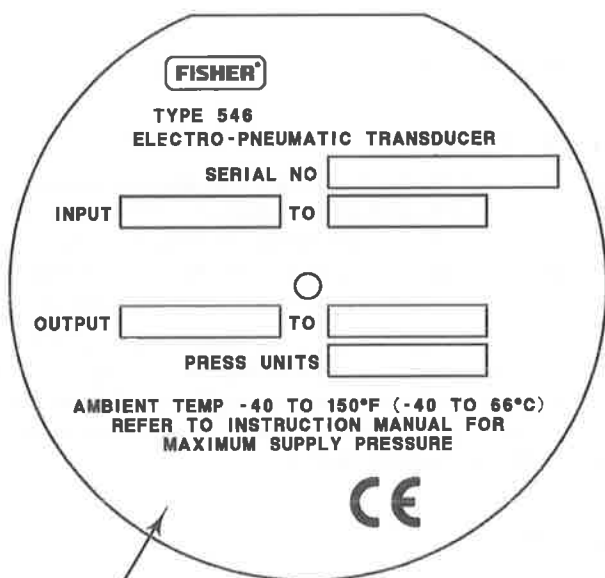


Figure 1. Type 546 Mounted on a Type 657 Pneumatic Diaphragm Actuator



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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.

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.

## 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

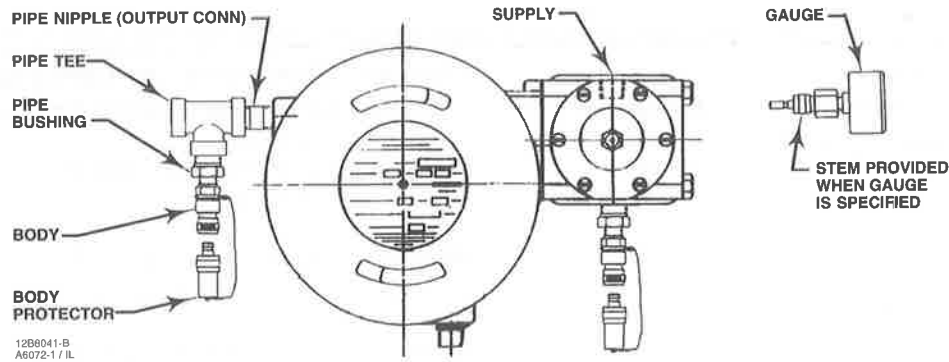


Figure 3. Diagnostic Connections

## Pressure Connections

### Note

The supply source must be clean, dry, oil-free,<sup>(1)</sup> non-corrosive air or gas at an unfailing 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

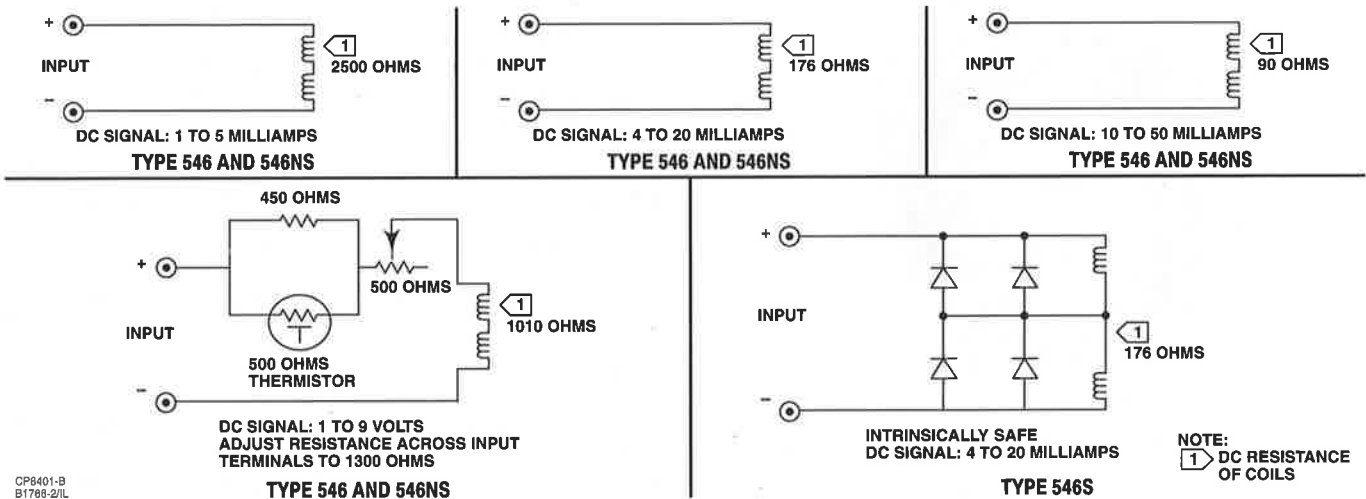


Figure 4. Typical Circuit Drawings

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

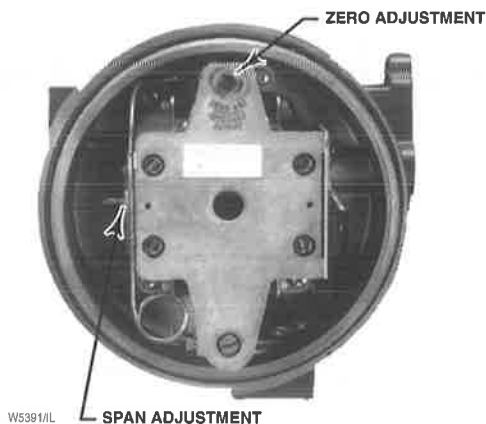


Figure 5. Zero and Span Adjustments (Cover Removed)

## 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	ACTUAL OUTPUT PRESSURE		TARGET OUTPUT PRESSURE	
	mA dc	Psig	Bar	Psig
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 mA dc 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 mA dc.

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 mA dc 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 mA dc and 20.00 mA dc, 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

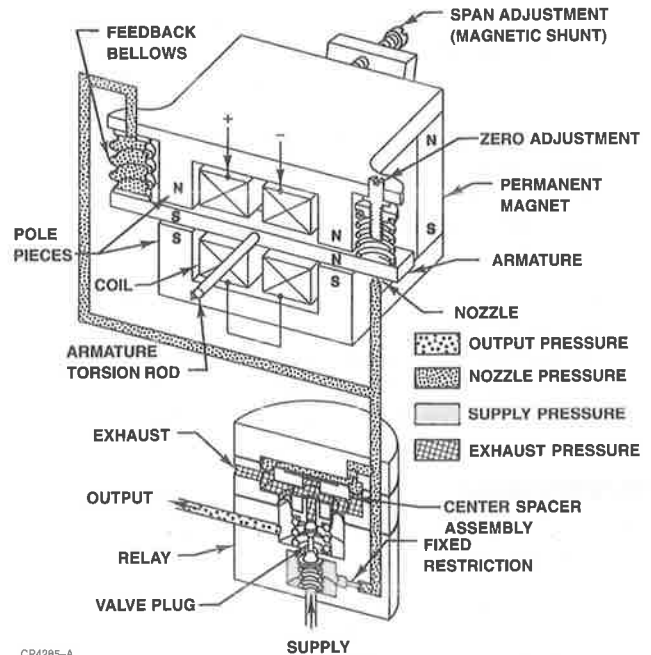
1. Temperature compensated circuit.  
2. Not appropriate for split range applications because of the high resistance of 1 to 5 mA dc coils. If split range operation is desired, consult your Fisher Controls sales office or sales representative.

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, relay, and feedback bellows. The relay diaphragm assembly moves upward, and the exhaust port opens to bleed the output pressure to atmosphere.



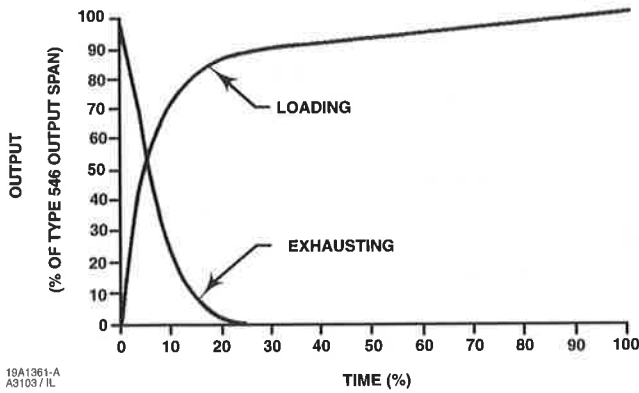


Figure 7. Output-Time Relationship for Type 546, 546S, and 546NS Transducers

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 dripwell. 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	R82X000022
<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

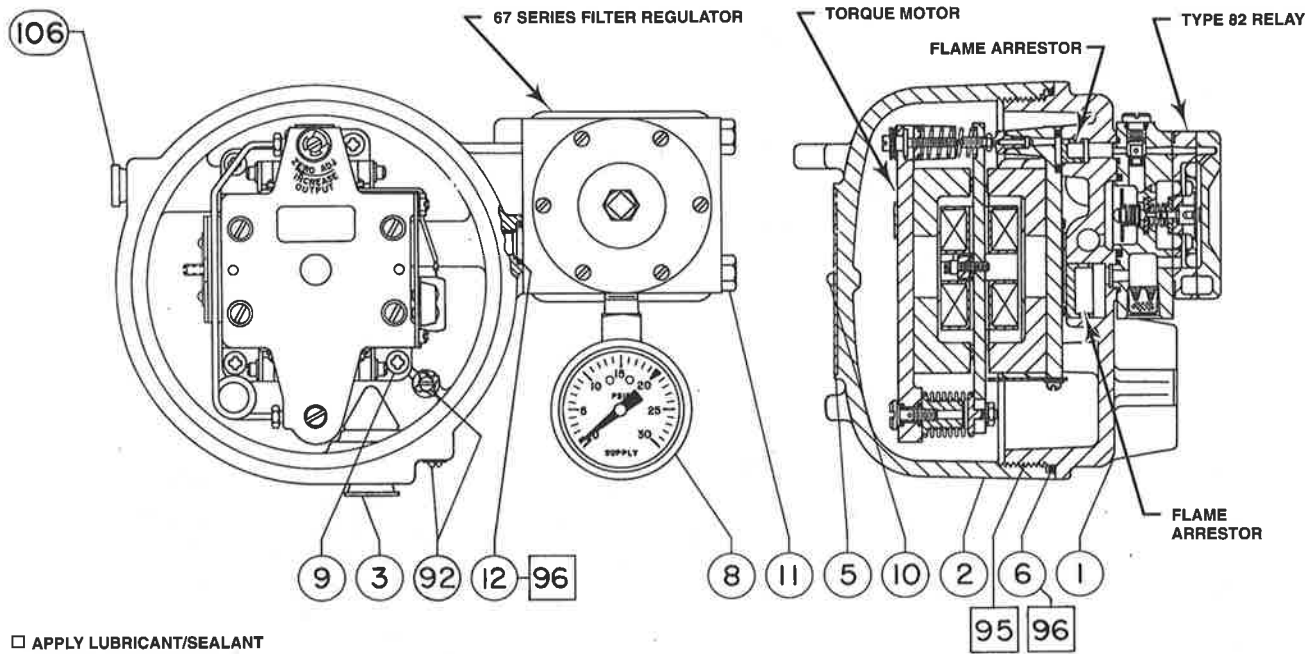


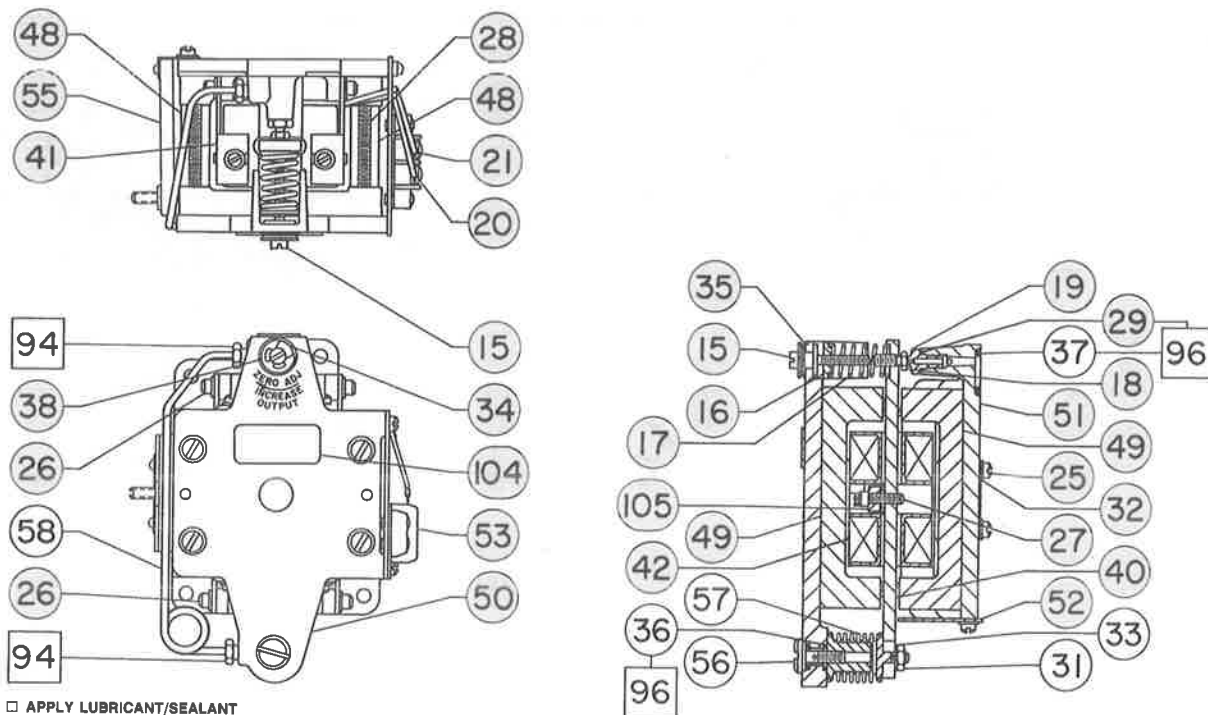
Figure 8. Type 546 Transducer Assembly

□ APPLY LUBRICANT/SEALANT  
NOTE: KEY 4 NOT SHOWN  
30A8595-L  
B1769-37/IL

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 For Type 546NS, EPDM Duro 80A	1D444806992 14B7744X012	15 <sup>(2)</sup>	Adjusting Screw	----
8*	Pressure Gauge Triple scale 0-30 psig/0-.2 MPa/0-2 bar 0-60 psig/0-.4 MPa/0-4 bar Dual scale 0-30 psig/0-2 Kg/cm <sup>2</sup> 0-60 psig/0-4 Kg/cm <sup>2</sup>	11B8582X012 11B8582X022 11B8582X042 11B8579X072	16 <sup>(2)</sup>	Spring Seat	----
9	Machine Screw, brass pl (4 req'd)	17B0404X012	17 <sup>(2)</sup>	Spring-Zero Adjustment For Type 546 & 546S, For Type 546NS, SST	----
10	Screw, steel pl	1P426928982	18 <sup>(2)</sup>	Baffle	----
11	Cap Screw, steel pl (2 req'd) use with integrally mounted filter regulator only	1C197024052	19 <sup>(2)</sup>	Nozzle	----
12*	O-Ring, use with integrally mounted filter regulator only For Type 546 and 546S, nitrile For Type 546NS, EPDM Duro 80A	1E591406992 14B7748X012	20 <sup>(2)</sup>	Hook-Up Wire Ass'y	----
13	Pipe Nipple, steel pl, For filter regulator only (not shown)	1C678926232	21 <sup>(2)</sup>	Hook-Up Wire Ass'y	----
92	Wire Retainer, steel pl (2 req'd)	17B7757X012	22 <sup>(2)</sup>	Hook-Up Wire (not shown)	----
95	Lubricant, For 546 and 546S use Lubriplate Mag 1 (not furnished with unit) For 546NS use Molykote 33 (not furnished with unit)		25 <sup>(2)</sup>	Machine Screw	----
			26 <sup>(2)</sup>	Cap Screw	----
			27 <sup>(2)</sup>	Cap Screw	----
			28 <sup>(2)</sup>	Machine Screw	----
			29 <sup>(2)</sup>	O-Ring For Type 546 & 546S, nitrile For Type 546NS, EPDM Duro 80A	----
			31	Hex Nut, brass pl	1N107318992
			32 <sup>(2)</sup>	Washer	----
			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 For Type 546NS, EPDM Duro 80A	1D687506992 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

## Type 82 Relay (figure 10)

### Note

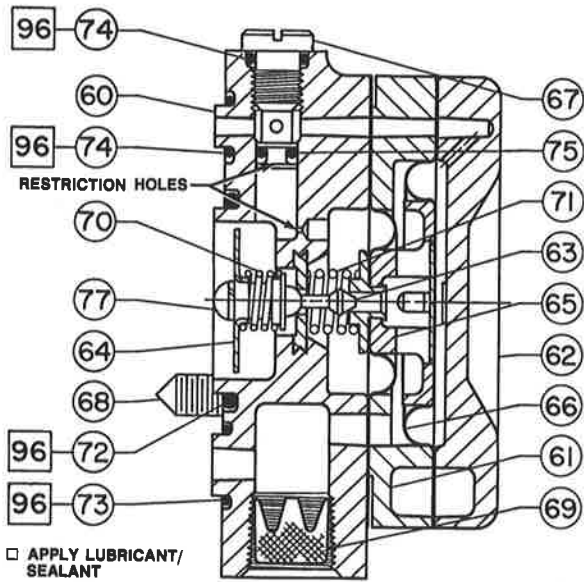
The following parts are for repairing the Type 546 and 546S relays only. The Type 546NS relay is not repairable. If the relay is defective, order a Type 82 Relay Replacement Assembly for a Type 546NS transducer.

Key	Description	Part Number
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

A1504-1 / IL

Figure 10. Type 82 Relay.

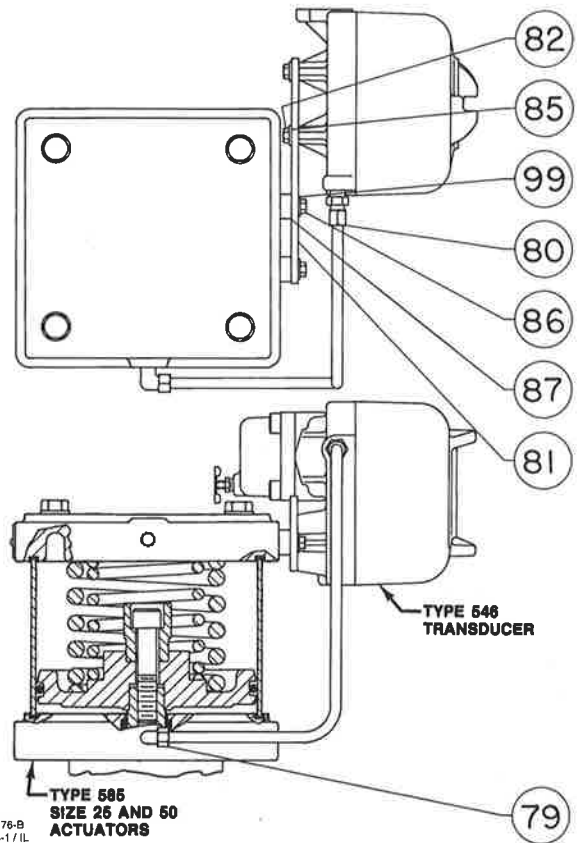


Figure 11. Typical Actuator Mounting

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 all sizes	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

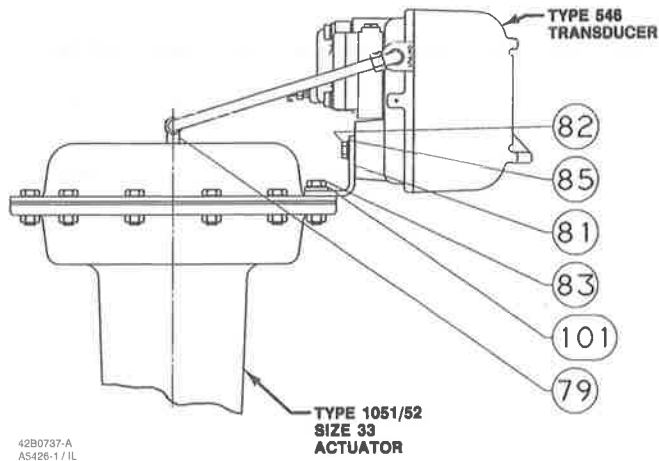


Figure 12. Typical Casing Mounting

42B0797-A  
A5426-1/IL

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
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	1K766824092 1R801924092 1F906724092 1V102624052 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

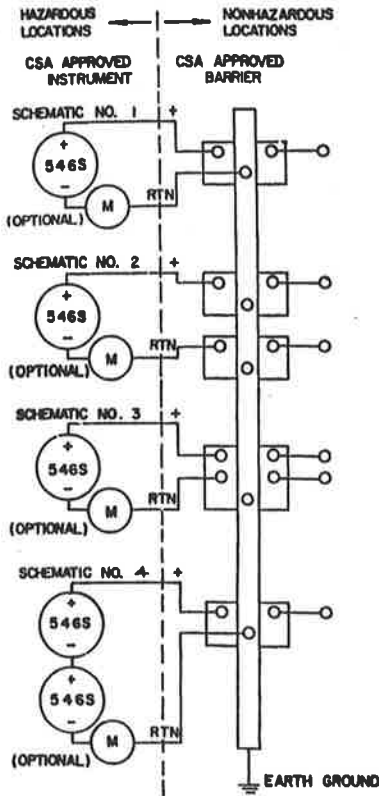


# Type 546, 546S, and 546NS

## 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,	346 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	18-21E600	1	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	25.75V, 350 OHMS
TAYLOR	5851FL84100	18-21E600	1	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	25.75V, 350 OHMS
TAYLOR	1130FG21000	18-17E211	1	43M/44M	CLASS I, DIV 1, GROUPS C,D	30V, 206 OHMS
TAYLOR	1135FG21000	18-17E212	1	43M/44M	CLASS I, DIV 1, GROUPS C,D	30V, 206 OHMS
TAYLOR	1150FZ81010	18-17E220	1	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	26V, 342 OHMS
FOXBORO	2A0-V21-CGB	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	2A0-V31-CGB	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	2A0-V51-CGB	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	2A0-VA1-CGB	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	3A2-D21 CS-E/CGB-A	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	3A2-D31-CS-E/CGB-A	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	
FOXBORO	2A5-131-CGB	MI 200-255	3	43M/44M	CLASS I, DIV 1, GROUPS A,B,C,D	

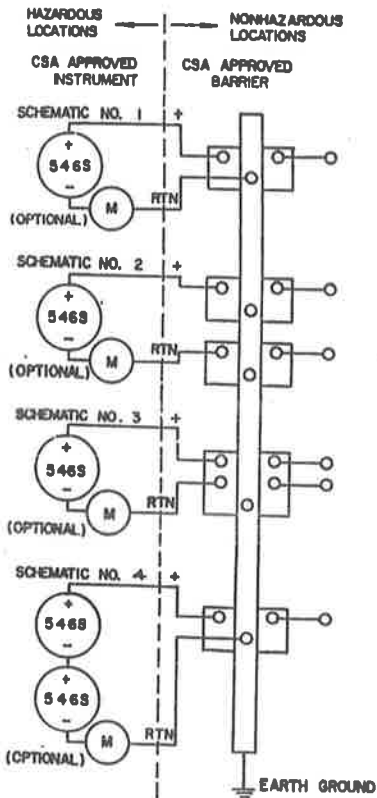
THE LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.

FOR GUIDANCE ON INSTALLATION, SEE ANSI/ISA RP12.6.

W8-10/ 10

# 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	128+	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 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	766610AAV1	4576K16-034	3	NONE	CLASS I, DIV 1, GROUPS C,D	27V, 345 OHMS 10V, 40 OHMS
HONEYWELL	38545-0000-0110-113-C5D5	5 385-22	1	43M 44M	CLASS I, DIV 1, GROUPS A,B,C,D	20V, 150 OHMS
HONEYWELL	38545-000-0110-111-C5D5	5 385-22	1	43M 44M	CLASS I, DIV 1, GROUPS C,D	28V, 200 OHMS
HONEYWELL	38545-000-0110-111-C5D5	5 385-22	2	43M 44M	CLASS I, DIV 1, GROUPS C,D	28V, 200 OHMS
	38545-0000-0110-112-C5D5					28V, 200 OHMS

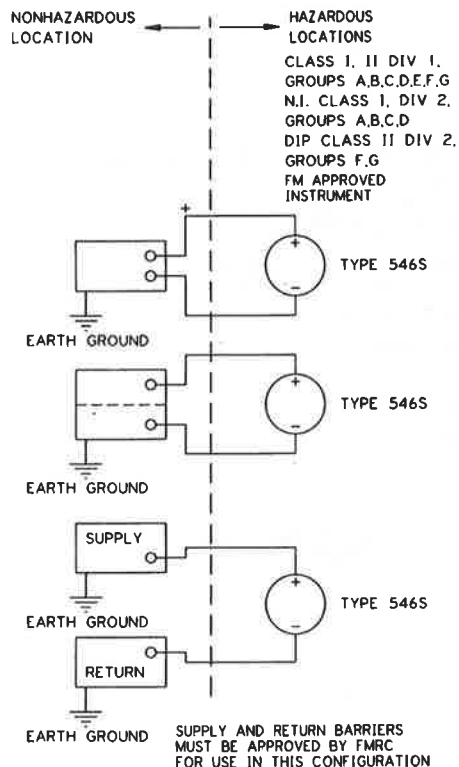
THE LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.

FOR GUIDANCE ON INSTALLATION, SEE ANSI/ISA RP12.6.

WB-10/ 10

# Type 546, 546S, and 546NS

## FM Schematics



TYPE 546S ENTITY PARAMETERS  
 $V_{max} = 33.3Vdc$      $I_{max} = 175mA$      $C_i = 0$      $L_i = 0$

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  $250 V_{rms}$

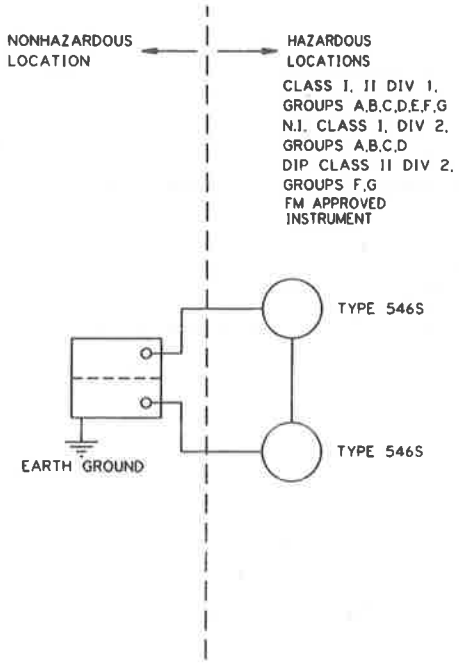
-RESISTANCE BETWEEN BARRIER GROUND AND EARTH GROUND MUST BE LESS THAN ONE OHM

-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

$V_{max} = 33.3Vdc$   $I_{max} = 175mA$   $C_i = 0$   $L_i = 0$

- 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  $250 V_{rms}$
  - 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

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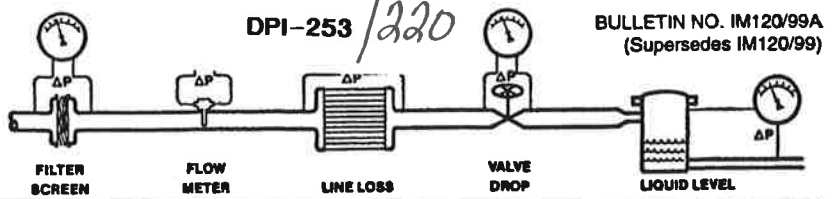
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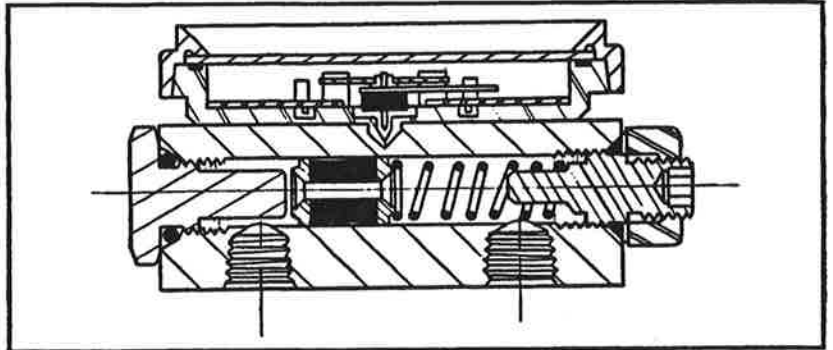
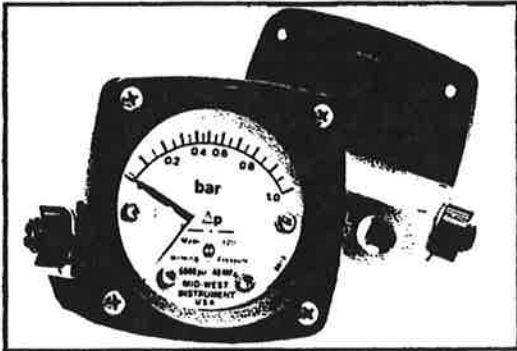








## Model 120 Series "Filter Minder"<sup>®</sup> Installation and Operating Instructions



### INSPECTION

Before installation check the nameplate on each instrument against the receiving paperwork and the intended application for correct part number, materials of construction, working pressure, dial range, etc. If equipped with switches, check electrical rating, type of enclosure, etc. Inspect for shipping damage and, if damaged, report it immediately.

**NOTE - Before attempting repairs contact your local Mid-West Representative or our factory. Failure to do so will void any warranty.**

### PRODUCT DESCRIPTION

The Model 120 Series "Filter Minder"<sup>®</sup> is a rugged, medium-range differential pressure instrument available as a switch, a gauge, or both. See "Part Numbering System". (Fig. 4) for available options.

Differential pressure is sensed by the movement of a floating piston magnet against a calibrated spring. The magnetically coupled gauge pointer outside the pressure housing follows the movement of the piston magnet and indicates differential pressure on the dial scale.

When equipped with switches, a contact is made or broken by the magnetic field of the piston magnet. See Bulletin ELECIM120/latest for gauges with switches.

The unit provides full over-range protection to the rated working pressure of the housing in either direction.

The precise piston/bore fit allows minimal leakage from high to low sides. This leakage is only 5 to 15 SCFH air at ambient conditions and a pressure differential of 100 PSID.

### INSTALLATION

Model 120 Series "Filter Minder"<sup>®</sup> is calibrated and tested prior to shipment and is ready for immediate installation. Use of the following installation procedures should eliminate potential damage and provide optimum trouble-free operation.

#### 1. CONNECTIONS

1/4" FNPT are provided as standard but check paperwork for connections ordered. There are two connections on the housing identified as "hi" and "lo" for high pressure and low pressure (Fig. 2). Be sure these get plumbed to the proper connections on your system. Improper connection will not damage the instrument, but it will not function properly. Flexible tubing is recommended to minimize the effect of any vibration that may exist.

#### 2. INSTRUMENT LOCATION

On liquid service the instrument should be mounted **below** the process connections to facilitate self-bleeding. On gas service it should be located **above** the process connections to promote self-draining. If the process contains particulates, a "pigtail" loop or drop leg (manometer "U-tube" configuration) in the tubing will minimize the possibility of it migrating into the instrument.

### 3. PANEL MOUNTING

Gauges with 2-1/2" dials can only be mounted through the rear of the panel. Make the proper panel cutout as indicated in (Fig.1). Remove the (4) bezel screws. Insert the gauge front through the rear of the panel and reinstall the bezel screws through the front of the panel and into the gauge bezel. Tighten the screws securely, alternating in a diagonal pattern.

Gauges with 3-1/2" dial should be mounted from the front of the panel. Contact factory for mounting information and dimensional data.

Gauges with 4-1/2" dial should be mounted from the front of the panel. Make the cutout as indicated in (Fig. 1). Insert the (4) panel mounting studs, finger tight, into the metal inserts located in the rear of the bezel. Insert the gauge through the panel, aligning the panel mounting studs with the holes in the panel. Install the (4) #8-32 nuts onto the studs and tighten securely.

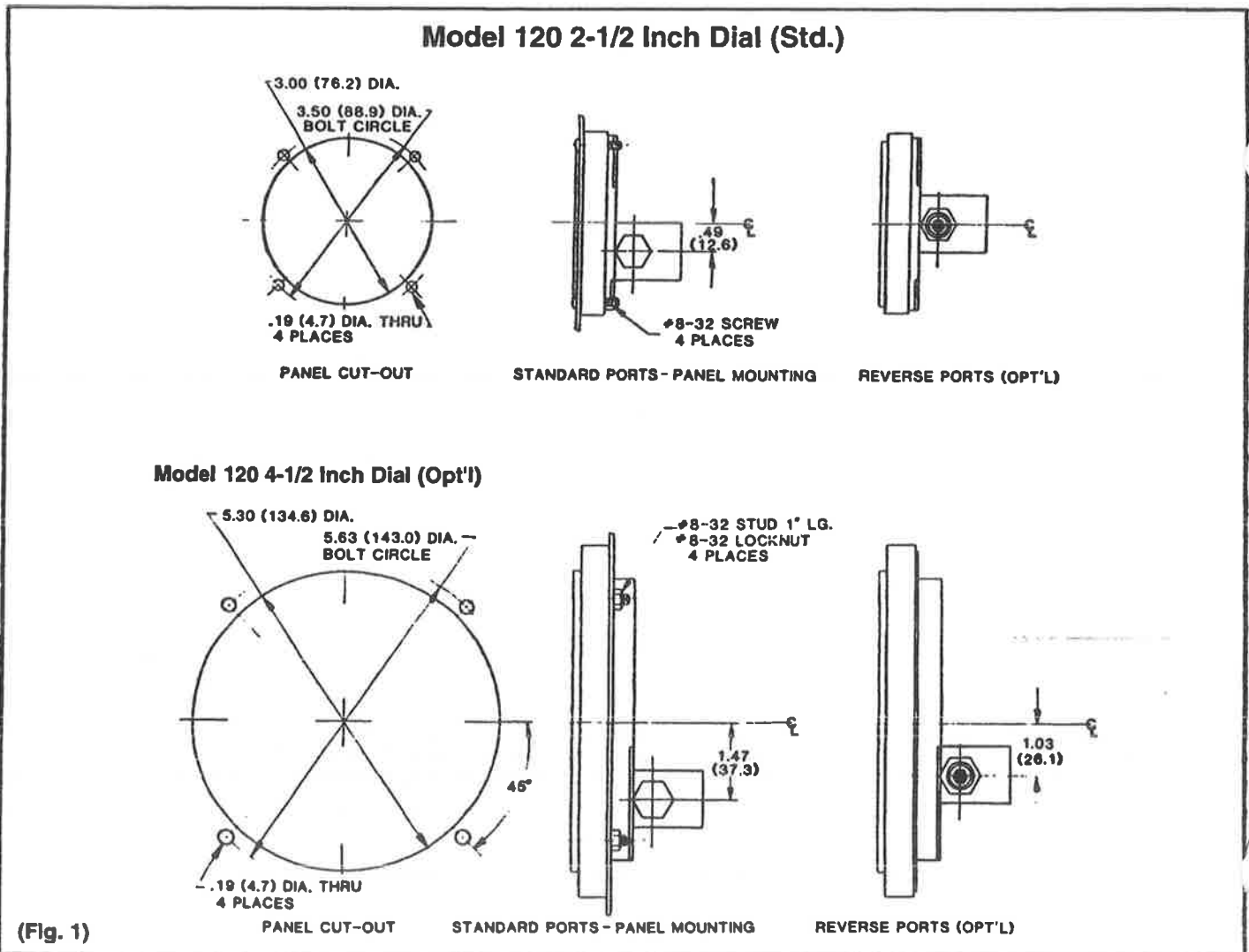
### 4. PIPE MOUNTING

An optional pipe mounting kit is available for mounting the gauge to a 2" vertical or horizontal pipe (Fig. 3).

### TROUBLE SHOOTING

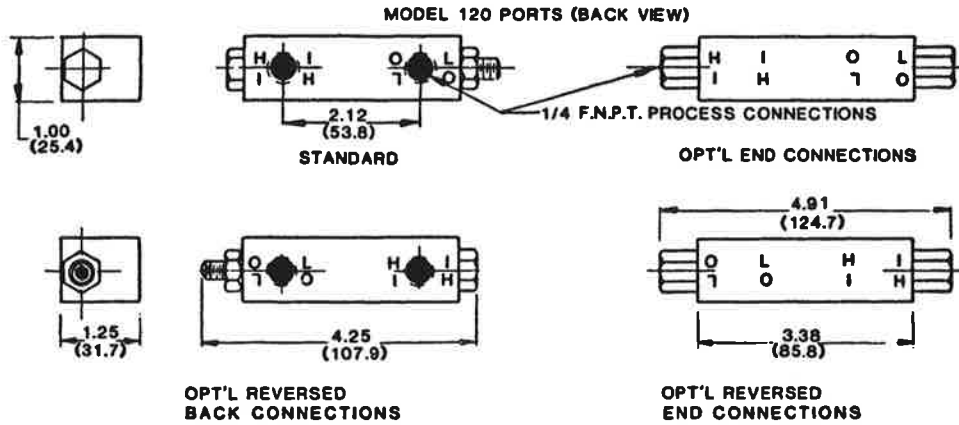
#### 1. Gauge does not indicate differential.

- A. Check for proper hook up, high to "hi" and low to "lo".
- B. Make certain block valves are open and, if using a 3-valve manifold, that the equalizer (balance) valve is closed.
- C. If A & B check out correctly, loosen or disconnect the high pressure line to determine if there is pressure to the instrument.
- D. If there is pressure to the instrument, check to determine that there is differential across the unit being monitored. If so, contact the factory for assistance and/or an "RGA" (return goods authorization) number to return the instrument for repair or replacement.





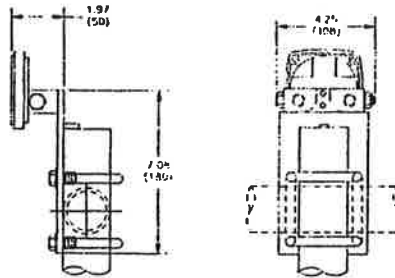
# Supplementary 120 Dimensional/Mounting Data



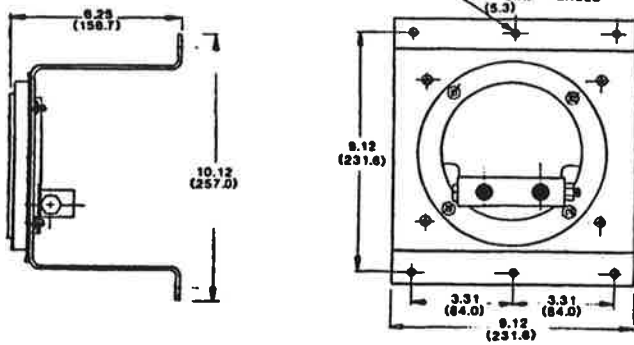
(Fig. 2)

## TYPICAL 2" PPE MOUNTING (BACK CONNECTIONS ONLY)

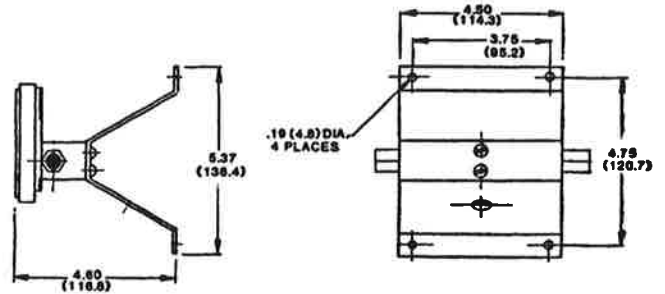
3.75 (95) FOR 2-1/2 INCH DIAL  
4.18 (106.1) FOR 4-1/2 INCH DIAL



## TYPICAL WALL MOUNTING 4-1/2 INCH DIAL (BACK OR END CONNECTIONS)



## TYPICAL WALL MOUNTING 2-1/2 INCH DIAL (END CONNECTION OPTION ONLY)



(Fig. 3)

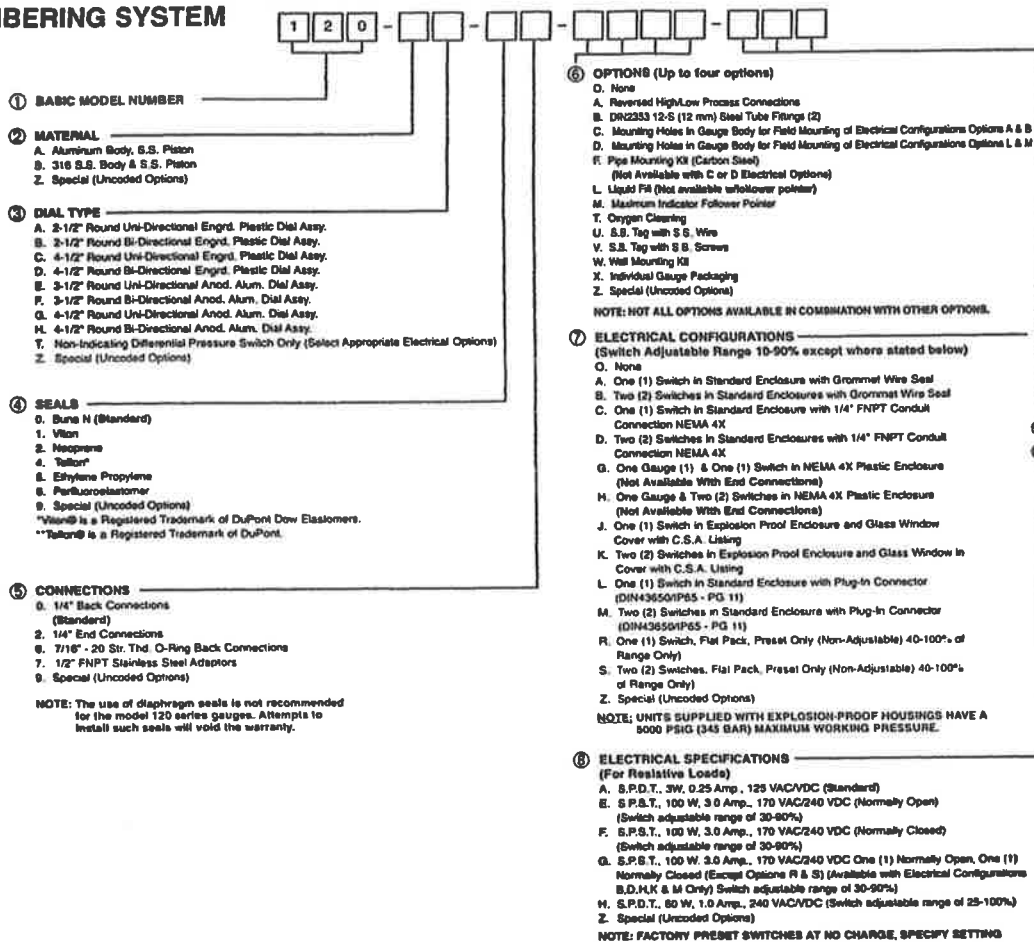
- NOTES:**
1. Drawings show standard gauge nominal dimensions. (not to scale)
  2. Dimensions shown in parentheses are in millimeters.
  3. Manufacturer reserves the right to change specifications without prior notice.

# STANDARD MODEL SPECIFICATIONS

## 120-AA-00-00

6000 P.S.I.G. Working Pressure Aluminum Body, Stainless Steel Piston, Ceramic Magnets, Buna N Seals, 2-1/2" Engineering Plastic Case with Shatter-Resistant Lens. 1/4" FNPT Back Connections. Accuracy  $\pm 3-2-3\%$  Full Scale (Ascending).

### PART NUMBERING SYSTEM



Manufacturer reserves the right to change specifications without prior notice.

**PROOF PRESSURE:** 12,000 PSI.

**TEMPERATURE LIMITS:** -40°F (-40°C) to +200°F (+93°C) - These limits are based on the entire instrument being saturated to these temperatures. System (process) temperatures may exceed these limitations with proper installation. Contact our customer service representative for details.

**STANDARDS:** All Model 120 Series differential pressure gauges either conform to and/or are designed to the requirements of the following standards:

ASME B1.20.1	NACE MR0175
ASME B40.1	NEMA Std. No. 250
CSA-C22.2 No. 14.25 and 30	SAE J514i
EN-61010-1	UL Std. No. 50,508 and 1203

REPRESENTED BY:

# Mid-West® Instrument

6500 Dobry Dr. □ Sterling Heights, MI 48314  
 (810) 254-6500 □ FAX (810) 254-6509  
 E-mail: sales@midwestinstrument.com  
 Website: www.midwestinstrument.com

Printed in U.S.A.



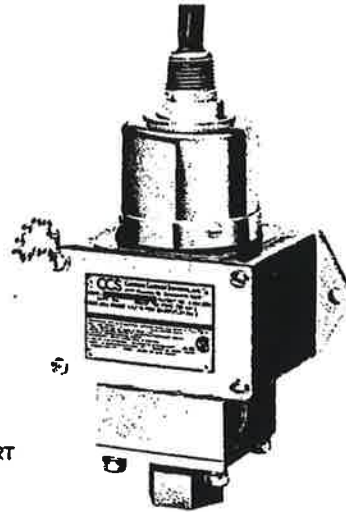
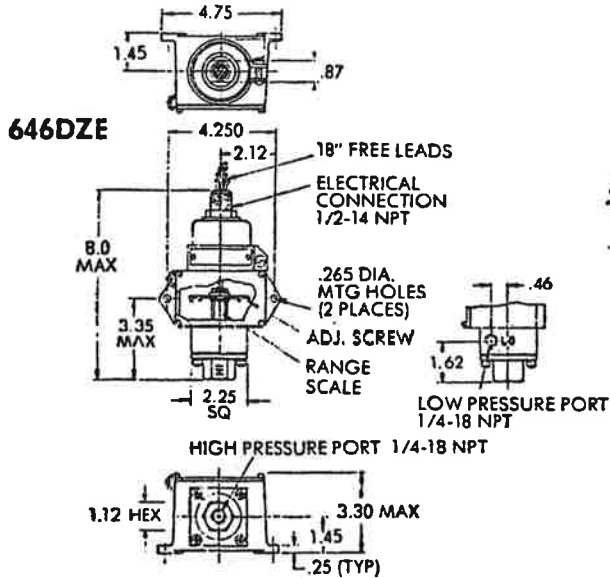
# EXTERNAL ADJUSTMENT

LOW/MID RANGE  
DIAPHRAGM  
SS PORT

**DIFFERENTIAL**

**DPS-288**

## INSTALLATION DRAWING



SHIPPING WT.  
APPROX. 60 OZ.  
(1700 GRAMS)

Diff. .4 to 75 psid

## SERIES: 646DZE

### Standard Features:

- U.L./CSA — See Note
- Explosion Proof: Div. 1, 2
- NEMA: 4, 7, 9, 13
- Fire Resistant
- Steel Body

### AMBIENT TEMP. RANGE

- 30° to 160° F
- 34° to 71° C

## OPERATING AND ORDERING DATA:

Maximum System Pressure psi		Proof (Test) Pressure psi		Adjustable Set-Point Range		Approx. Dead band psi	Model Number and Wetted Parts			
High Press. Port	Low Press. Port	Both Ports Simultaneous	High Over Low	Low Over High	On Increasing Pressure psid		On Decreasing Pressure psid	MODEL SPDT-Std.	MODEL DPDT "M"	Wetted Parts
400		750	750	400	1.2 to 18	.4 to 17.2	.8	646DZE1	646DZEM1	300 SS Polyimide Viton
					6 to 75	2 to 71	4	646DZE2	646DZEM2	

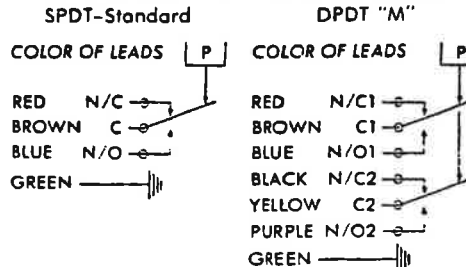
1/4" STAINLESS STEEL  
• PRESSURE PORTS AND POLYIMIDE DIAPHRAGM

## ELECTRICAL CHARACTERISTICS:

### Rating of Switch Element

VOLTS	AMPERES	
	SPDT Res.	DPDT "M" Res.
125 AC-50 60 Hz	15	5
250 AC-50 60 Hz	15	5
480 AC-50 60 Hz	15	—
125 DC	.4	.5

### SCHEMATIC AND WIRING CODE



### NOTE:

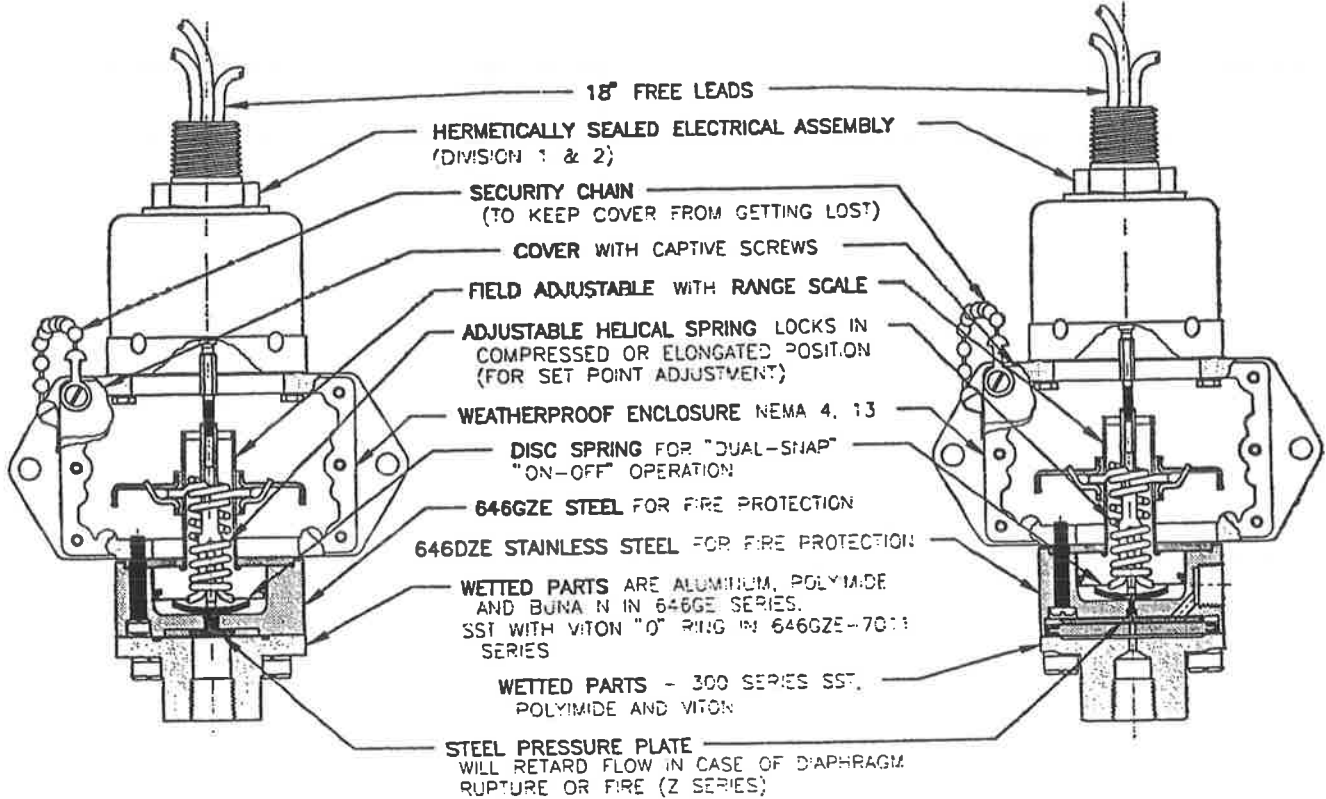
Div. 1 explosion-proof and hermetically sealed electrical assembly Part No. 17-51 (17-73 for "M" model option) listed by both Underwriters' Laboratories, Inc. (File No. E32961) and CSA Testing Laboratories (File No. 22921) for hazardous locations, Class 1, Groups A, B, C, and D; Class 2, Groups E, F, and G.

## HOW TO ORDER:

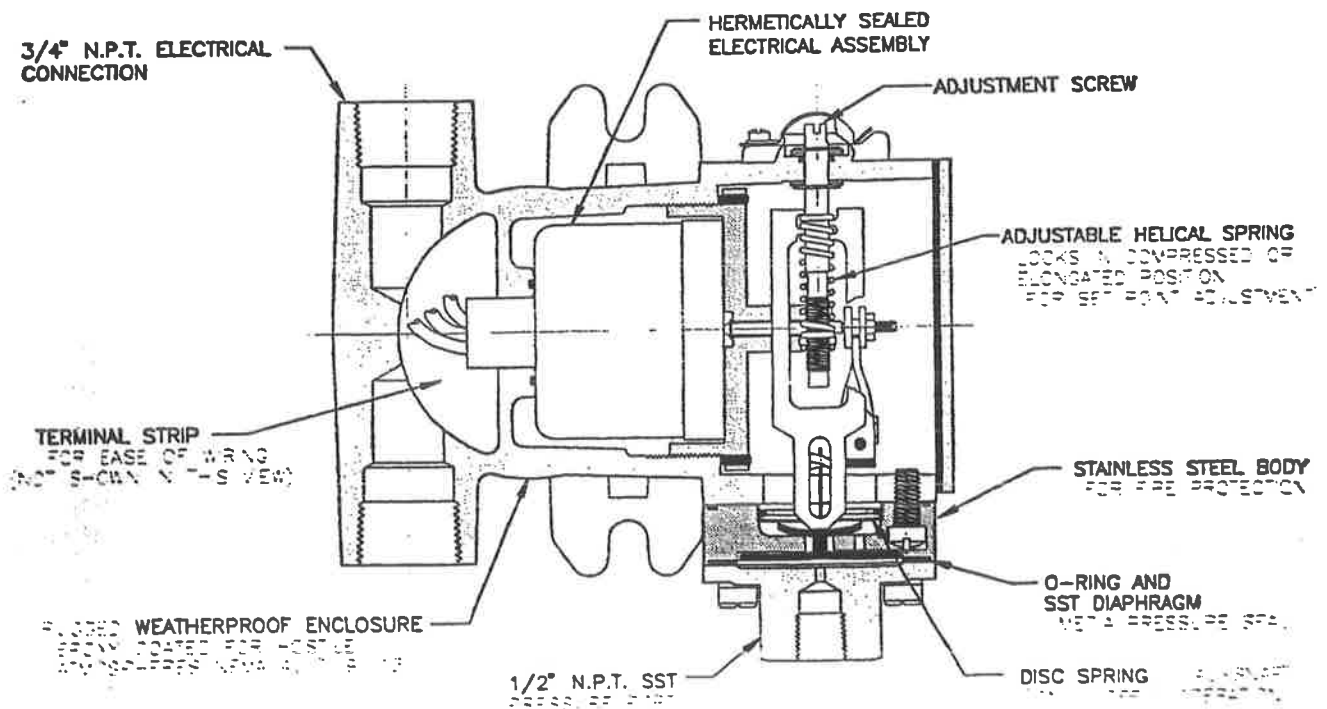
1. Specify model number.

## SERIES 646GE

## SERIES 646DZE



## SERIES 6401GZE





PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3				CONTROL VALVES				SHEET 1 OF 1		
CUSTOMER : Apache Canada Limited PLANT : 1478HP Hamburg Compressor SERVICE : EMERGENCY SHUT DOWN VALVE				NO	BY	DATE	REVISION		SPEC NO	FILE 14,11
				0	TK	01/27/00	FOR PURCHASE		JOB #	99420
									DATE	
								REQ.		
								BY	CHKD	APPR.
G	1	TAG NO.	ESDV-101							
E	2	SERVICE	BLOW DOWN							
N	3	LINE NO. / VESSEL NO.								
E	4	LINE SIZE / SCHED. NO.	33 mm SCH. 160							
	5	TYPE OF BODY	GLOBE							
	6	BODY SIZE	PORT SIZE	33 mm	19.1 mm	mm	mm	mm	mm	mm
	7	GUIDING	NO. OF PORTS	TOP	ONE					
B	8	END CONN. & RATING	33 mm FNPT, 6000#							
O	9	BODY MATERIAL	WCC							
D	10	PACKING MATERIAL	TFE							
Y	11	LUBRICATOR	ISOLAT. VALVE							
	12	BONNET TYPE	HAMMER NUT							
	13	TRIM FORM	EQUAL PERCENTAGE							
	14	TRIM MATERIAL SEAT / PLUG	17-4 PH							
			SHAFT / MAT'L	NITRONIC 50						
	15	REQUIRED SEAT TIGHTNESS	CLASS IV							
	16	MAX. ALLOW SOUND LEV. dBA								
A	17	MODEL NO. & SIZE	357-40							
C	18	TYPE OF ACTUATOR	SPRING AND DIAPHRAGM							
T	19	CLOSE AT	OPEN AT	0 kPa	207 kPa	kPa	kPa	kPa	kPa	kPa
U	20	FLOW ACTION TO	OPEN							
A	21	FAIL POSITION	OPEN							
T	22	HANDWHEEL & LOCATION								
P	23	MFR. & MODEL NO.								
O	24	FILT REG   GAGES   BYPASS								
S	25	INPUT SIGNAL								
I	26	OUTPUT SIGNAL								
T	27	AIR SUPPLY PRESS	kPa		kPa	kPa	kPa	kPa	kPa	kPa
T	28	MFR. & MODEL NO.								
R	29	INPUT SIGNAL								
N	30	OUTPUT SIGNAL								
O	31									
P	32									
T	33									
	34	FLOW UNITS	SCFH							
	35	FLUID	SOUR HC VAPOUR							
	36	QUANT. MAX.	MAX. Cv							
S	37	QUANT. OPER.	OPER Cv							
E	38	VALVE Cv	VALVE C1	342						
R	39	NORM IN PRES	NORM DELTA P	8377 kPa(g)	8377 kPa	kPa(g)	kPa	kPa(g)	kPa	kPa(g)
V	40	MAX. INLET PRESS.	11377 kPa		kPa	kPa	kPa	kPa	kPa	kPa
I	41	MAX SHUT OFF	MAX.DELTA P	11377 kPa(g)	11377 kPa	kPa(g)	kPa	kPa(g)	kPa	kPa(g)
C	42	TEMP. MAX.	OPER. TEMP	149 °C	48 °C	°C	°C	°C	°C	°C
E	43	OPER. SP. GR.	MOL. WT.	18.827						
	44	OPER. VISC.	% FLASH							
	45	% SUPERHEAT	% SOLIDS							
	46	VAPOR PRESS	CRIT PRESS	kPa(g)	kPa(g)	kPa(g)	kPa(g)	kPa(g)	kPa(g)	kPa(g)
	47	PREDICTED SOUND LEVEL dBA								
	48	MANUFACTURER	FISHER							
	49	MODEL NO.	357-40							
	50	P. O. NUMBER								

NOTES:

1. NACE COMPLIANCE REQUIRED
2. VALVE TO BE USED INTERMITTANTLY - HIGH NOISE

AREA UNIT #: 152

# 357 Series Control Valves

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WS8107L

Figure 1. 357 Series Control Valve

## Introduction

### Scope of Manual

This instruction manual provides installation, maintenance, and parts information for 357 Series control valves. Refer to separate manuals for instruction covering accessories used with the control valve.

### Description

The 357 Series control valves (figure 1) are designed for high-pressure on-off and throttling applications and are used as dump valves on oil and gas separators, scrubbers, and other field process equipment. They are also used for well-head applications where rugged

steel construction and easy maintenance are necessary. (The bonnet/body connection is covered by patent.)

Only personnel qualified through training or experience should install, operate, and maintain this control valve. If you have any questions concerning these instructions, contact your Fisher Controls sales office or sales representative before proceeding.

### Specifications

Table 1 lists specifications for the 357 Series control valves. Some of the specifications for the control valve, as it originally comes from the factory, are stamped on nameplates.





# 357 Series

Table 1. Specifications

<p><b>Available Configurations</b> See table 2</p> <p><b>Valve Body Sizes and End Connection Styles</b> See table 3</p> <p><b>Maximum Inlet Pressures and Temperatures<sup>(1)</sup></b> 276 bar from -29 to 93°C (4000 psig from -20 to 200°F), 276 bar at -45°C (4000 psig at -50°F), and 268 bar at 149°C (3880 psig at 300°F) unless limited by end connection rating</p> <p><b>Maximum Pressure Drops<sup>(1)</sup></b> <b>Metal Seats:</b> See tables 4 and 5</p> <p><b>Input Signal to Actuator</b> See tables 4 and 5</p> <p><b>Actuator Maximum Casing Pressure</b> Size 20: 3.4 bar (50 psig) Size 40: 3.4 bar (50 psig)</p> <p><b>Shutoff Classification</b> <b>Metal Seats:</b> ANSI Class IV per ANSI/FCI 70-2 <b>Soft Seats:</b> ANSI Class VI per ANSI/FCI 70-2</p> <p><b>Material Temperature Capabilities<sup>(1)(2)</sup></b> <b>With Nitrile O-Rings, Nylon Bushings, and WCC Valve Bodies:</b> -29 to 93°C (-20 to 200°F) <b>With Fluoroelastomer O-Rings, Ryton Bushings, and WCC Valve Bodies:</b> -23 to 149°C (-10 to 300°F)</p>	<p><b>With Nitrile<sup>(3)</sup> O-Rings, Nylon Bushings, and LCC Valve Bodies:</b> -45 to 82°C (-50 to 180°F)</p> <p><b>Flow Characteristic</b> <b>Metal or Ceramic Seats:</b> Equal percentage <b>Soft Seats:</b> Quick opening</p> <p><b>Flow Direction</b> May be in either direction as suits the application</p> <p><b>Port Diameters</b> ■ 6.4, ■ 9.5, ■ 12.7, ■ 19.1, ■ 25.4, or ■ 38.1 mm (1/4, 3/8, 1/2, 3/4, 1, or 1-1/2 inch) port diameters for both 1-inch and 2-inch valve bodies. See tables 4 and 5 for more information.</p> <p><b>Maximum Rated Valve Plug Travel</b> 19 mm (3/4 inch)</p> <p><b>Valve Plug Style</b> Micro-Form valve plug<sup>(4)</sup></p> <p><b>Actuator Diaphragm Effective Area</b> Size 20: 213 cm<sup>2</sup> (33 inches<sup>2</sup>) Size 40: 452 cm<sup>2</sup> (70 inches<sup>2</sup>)</p> <p><b>Actuator Spring Information</b> See table 6</p> <p><b>Actuator Pressure Connection Size</b> 1/4 inch NPT female</p> <p><b>Approximate Weight</b> See table 7</p>
--	---

1. The pressure or temperature limits in the referenced tables and any applicable ANSI code limitations should not be exceeded.  
 2. Process temperature should not go below -29°C (-20°F).  
 3. Low temperature material.  
 4. Contact your Fisher Controls sales office or sales representative for other valve plug requirements.

Table 2. Available Configurations

VALVE TYPE NUMBER AND FAIL ACTION	357, FAIL DOWN (SPRING CLOSES—AIR OPENS)				357, FAIL UP (SPRING OPENS—AIR CLOSES)			
	20		40		20		40	
	Globe	Angle	Globe	Angle	Globe	Angle	Globe	Angle
Actuator Sizes								
Valve Configurations	Globe	Angle	Globe	Angle	Globe	Angle	Globe	Angle
Valve Size, Inches	1 and 2	1 and 2	1 and 2	1 and 2	1 and 2	1 and 2	1 and 2	1 and 2

Table 3. Valve Sizes and Connection Styles

VALVE SIZE, INCHES	SCREWED <sup>(1)</sup>	RAISED FACE (RF) FLANGED				RING TYPE JOINT (RTJ) FLANGED	
		Class 150	Class 300	Class 600	Class 1500	Class 600	Class 1500
1	X	X	X	X	---	X	---
2	X	X	X	X	X	X	X

X = Available construction.  
 1. The 1-inch screwed valve is a combination valve that uses a pipe plug in the unused connection to make either a globe or angle configuration (see figure 3).

Table 4. Maximum Allowable Shutoff Pressure Drops<sup>(1)</sup> for 357 Series Valves with Metal Seats (Fail Down, Spring Closes—Air Opens Configuration)

ACTUATOR SIZE	FLOW DIRECTION	PORT DIAMETER		INPUT SIGNAL TO ACTUATOR, SPRING PART NUMBER											
				0.2 to 1.0 Bar (3 to 15 Psig)		0.4 to 2.0 Bar (6 to 30 Psig)		0.7 to 3.4 Bar (10 to 50 Psig)		0 to 1.4 Bar (0 to 20 Psig)		0 to 2.4 Bar (0 to 35 Psig)		0 to 3.4 Bar (0 to 50 Psig)	
				16A9594X012		16A9595X012		16A9656X012		16A9594X012		16A9595X012		16A9656X012	
		mm	Inches	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi
20	Up to Open	6.4	1/4	117	1700	276	4000	257	3720	257	3720	276	4000	276	4000
		9.5	3/8	42	610	166	2400	104	1510	104	1510	276	4000	276	4000
		12.7	1/2	18	260	88	1270	53	770	53	770	157	2280	169	2450
		19.1	3/4	3	40	34	490	19	270	19	270	65	940	70	1010
		25.4	1	---	---	17	240	8	110	8	110	34	490	37	530
		38.1	1-1/2	---	---	5	70	1	10	1	10	12	180	14	200
	Down to Close	6.4	1/4	66	960	111	1620	111	1620	111	1620	186	2700	232	3360
		9.5	3/8	76	1100	178	2590	178	2590	178	2590	276	4000	276	4000
		12.7	1/2	87	1270	236	3420	247	3580	121	1760	276	4000	276	4000
		19.1	3/4	31	450	76	1100	103	1490	76	1100	141	2050	195	2830
		25.4	1	12	180	32	460	43	620	32	460	54	850	81	1180
		38.1	1-1/2	---	---	12	170	16	230	12	170	22	320	30	440
40	Up to Open	6.4	1/4	276	4000	276	4000	276	4000	276	4000	276	4000	276	4000
		9.5	3/8	201	2920	276	4000	276	4000	276	4000	276	4000	276	4000
		12.7	1/2	108	1560	157	2270	157	2270	181	2630	276	4000	276	4000
		19.1	3/4	43	620	65	940	65	940	76	1100	30	1890	174	2520
		25.4	1	21	310	34	490	34	490	39	570	70	1020	95	1380
		38.1	1-1/2	7	100	12	180	12	180	15	220	29	420	39	570
	Down to Close	6.4	1/4	159	2300	276	4000	257	3720	257	3720	276	4000	276	4000
		9.5	3/8	259	3750	276	4000	276	4000	276	4000	276	4000	276	4000
		12.7	1/2	276	4000	276	4000	276	4000	276	4000	276	4000	276	4000
		19.1	3/4	83	1210	182	2640	248	3860	182	2640	276	4000	276	4000
		25.4	1	34	500	76	1100	117	1690	76	1100	141	2050	190	2760
		38.1	1-1/2	13	190	28	410	44	630	28	410	52	760	71	1030

1. For valves with soft seats, the maximum allowable pressure drop is limited to 69 bar (1000 psig) or to the values in the table, whichever is less.

# 357 Series

Table 5. Maximum Allowable Shutoff Pressure Drops<sup>(1)</sup> for 357 Series Valves with Metal Seats (Fail Up, Spring Opens—Air Closes Configuration)

ACTUATOR SIZE	FLOW DIRECTION <sup>(3)</sup>	PORT DIAMETER		INPUT SIGNAL TO ACTUATOR <sup>(2)</sup> , SPRING PART NUMBER					
				0.2 to 1.0 Bar (3 to 15 Psig)		0.4 to 2.0 Bar (6 to 30 Psig)		0.7 to 3.4 Bar (10 to 50 Psig)	
		mm	Inches	16A9594X012		16A9929X012		16A9595X012	
				Bar	Psi	Bar	Psi	Bar	Psi
20	Up to Open <sup>(2)</sup>	6.4	1/4	276	4000	276	4000	276	4000
		9.5	3/8	152	2210	276	4000	276	4000
		12.7	1/2	80	1160	173	2510	273	3960
		19.1	3/4	30	440	72	1040	117	1690
		25.4	1	14	210	37	540	63	910
		38.1	1-1/2	3	50	14	200	26	370
40	Up to Open <sup>(2)</sup>	6.4	1/4	0.2 to 1.0 Bar (3 to 15 Psig)		0.4 to 2.0 Bar (6 to 30 Psig)		0.7 to 3.4 Bar (10 to 50 Psig)	
				1F176727032		1F714327092		1E795627082	
				Bar	Psi	Bar	Psi	Bar	Psi
				276	4000	276	4000	276	4000
				276	4000	276	4000	276	4000
				194	2810	276	4000	276	4000
				86	1250	175	2540	119	1730
48	700	96	1390	64	930				
		38.1	1-1/2	21	300	40	580	26	380

- For valves with soft seats, the maximum allowable pressure drop is limited to 69 bar (1000 psig) or to the values in the table, whichever is less.
- Actual operating pressure includes an additional 0.2 bar (3 psig) input supply to the controller.
- Consult your Fisher Controls sales office or sales representative for maximum allowable shutoff pressure drops of flow down to close valve configuration.

Table 6. Spring Part Number, Color Code, Spring Rate and Free Length

ACTUATOR SIZE	SPRING PART NUMBER	COLOR CODE	SPRING RATE		FREE LENGTH	
			N/mm	Lb/in	mm	Inch
20	16A9594X012	Aluminum	36	205	140	5.5
	16A9595X012	Light Green	100	571		
	16A9656X012	Yellow	160	912		
	16A9929X012	Black	67	380		
40	1E792427082	Light Green	257	1470	165	6.5
	1E793327082	Yellow	367	2100		
	1E795627082	White	441	2520		
	1F176727032	Dark Green	64	368		
	1F176827092	Aluminum	86	490		
	1F714327092	Aluminum/Dark Blue	145	830		
	1J258127092	Aluminum/Brown	175	1000		

Table 7. 357 Series Approximate Weights, Kg (Pounds)

Actuator Size	20				40			
	1		2		1		2	
	Globe	Angle	Globe	Angle	Globe	Angle	Globe	Angle
Screwed	21 (47) <sup>(1)</sup>	21 (47) <sup>(1)</sup>	28 (61)	23 (51)	29 (64) <sup>(1)</sup>	29 (64) <sup>(1)</sup>	35 (78)	31 (68)
Class 150	23 (50)	22 (48)	27 (60)	27 (60)	30 (67)	29 (65)	35 (77)	35 (77)
Class 300 & 600	26 (57)	26 (57)	37 (82)	35 (77)	34 (74)	34 (74)	45 (99)	43 (94)
Class 1500	---	---	55 (122)	57 (126)	---	---	63 (139)	65 (143)

- The 1-inch screwed valve is a combination valve that uses a pipe plug in the unused connection to make either a globe or angle configuration (see figure 3).

## Installation

Some types of ceramic trim, including the VTC (very tough ceramic) variety, can create a spark under certain circumstances. When the edge of a ceramic part is struck against a second ceramic part with enough force, a spark can be created.

### WARNING

Avoid personal injury and property damage from ignition of process fluid caused by sparks from ceramic trim.

Do not use ceramic trim where the process fluid is unstable or if it is an explosive mixture (such as ether and air).

### WARNING

To avoid personal injury or property damage caused by bursting of pressure-retaining parts or by uncontrolled process fluid, be certain the service conditions do not exceed the limits shown on the valve nameplate and in tables 1, 4, and 5.

1. Before installing the control valve assembly, inspect it for any damage and for any foreign material that may have collected in the valve body.
2. Remove any pipe scale, welding slag, and other foreign material from the pipeline.
3. The control valve can be installed in any position, but normally the actuator is vertical above the valve. Install the valve so the flow direction arrow on the side of the valve indicates the direction of the process flow.
4. Install the valve following local and national piping codes when they apply to the application. For screwed connections, treat the male pipe threads with a good grade pipe compound. For flanged valves, use suitable gaskets between valve and pipeline flanges.
5. If continuous operation is required during maintenance and inspection, install a conventional three-valve bypass around the valve.
6. Connect loading pressure for the fail-up configuration to the 1/4-18 NPT connection in the spring case. The fail-down configuration loading pressure connection is in the lower casing assembly as shown in figure 3.

## CAUTION

If a fail-up configuration is used, do not plug the 1/4-18 NPT connection in the lower casing. It acts as a vent for the lower casing, permitting air to move in and out of the lower casing cavity as the diaphragm moves up and down. If the vent is plugged, the actuator will not respond properly to loading pressure changes and may be incapable of completely opening or shutting off the valve.

## Spring Adjustment

The spring supplied with the actuator has been selected to meet the requirements of the application as specified on the order. This pressure condition is stamped on the actuator nameplate.

The spring has a fixed pressure span over which loading pressure will stroke the valve. Adjustment of the spring compression shifts the span so that more or less loading pressure is required to start travel. Since the span does not change, there will be a corresponding increase or decrease in the pressure requirements at the end of the valve stroke.

If the actuator has been disassembled or pressure conditions have changed, the spring may need adjustment to make the valve travel coincide with the diaphragm pressure range. Make the adjustment in the following manner.

1. Loosen the adjusting screw nut (key 35, figure 3) on the fail-down configuration, or unscrew the spring case assembly (key 46, figure 2) on the fail-up configuration.
2. Turn the fail-down adjusting screw (key 34, figure 3) or the fail-up adjusting stem nut (key 35, figure 2) clockwise to compress the spring or counterclockwise to decrease spring compression.

Increased spring compression results in increased loading pressure necessary to start travel. Decreased spring compression results in less loading pressure required to start travel. With the fail-down configuration flow-to-open, increased spring compression will balance a higher line pressure or provide additional seating load. With the fail-up configuration flow-to-open, decreased spring compression may be necessary if the line pressure is increased or if more valve plug seating load is required from the input signal.

3. After adjustment, tighten the adjusting screw nut (fail-down configuration), or replace the spring case assembly (fail-up configuration).

The maximum pressure drop conditions are shown in tables 4 and 5. Note that the springs can be identified

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by the color code. Depending on how much conditions are changed, it may be necessary to change the actuator spring. If so, check the *Parts List* section to see if a different adjusting screw or adjusting stem assembly (key 34) is required.

## Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and maintenance depends on the severity of the service conditions.

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



## WARNING

**Avoid personal injury from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:**

- **Disconnect any operating lines providing air pressure, electric 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.**

Some types of ceramic trim, including the VTC (very tough ceramic) variety, can create a spark under certain circumstances. When the edge of a ceramic part is struck against a second ceramic part with enough force, a spark can be created.



## WARNING

**Avoid personal injury and property damage from ignition of process fluid caused by sparks from ceramic trim.**

**Do not use ceramic trim where the process fluid is unstable or if it is an explosive mixture (such as ether and air).**

The following describes the procedure for complete disassembly and assembly of the actuator-valve combination. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job. Key numbers refer to figure 2 for the fail-up configuration and figure 3 for the fail-down configuration.

## Disassembly

1. Remove the loading pressure tubing and any accessories that may hamper disassembly.
2. Unscrew the hammer nut (key 3). If the bonnet is stuck on the valve, continue to unscrew the hammer nut. The hammer nut will contact the spring pins (key 58) and will force the bonnet out of the valve. Carefully lift the actuator, bonnet, and valve plug assembly from the valve body.

If the bonnet is stuck on the valve, insert a large screwdriver or steel rod into the pry hole in the bonnet. Push down on the screwdriver or rod to loosen the bonnet.

### Note

**The spring pins must always be in place during valve operation. They provide a safeguard against injury when the unit is being disassembled.**

3. Remove the cage (key 5). For ceramic trim, remove the cage (key 60) and seat ring (key 61). Inspect the cage and bonnet O-rings (keys 6 and 11) for wear or damage.
4. To remove valve plug (key 7), drive out roll pin (key 9) and unscrew valve plug from stem (key 8).

If valve plug cannot be easily unscrewed from stem, disassemble actuator in accordance with steps 7 through 9. Hold wrench on hex nut (key 29) to prevent stem and diaphragm from rotating.

**CAUTION**

**Be careful to avoid damaging the seating surface on the valve plug or the cage as damage in these areas will allow excessive leakage at shutoff. Avoid damaging the highly polished valve stem surface. A damaged valve stem could cut the packing and allow process fluid to leak to the atmosphere.**

5. If packing parts (keys 12, 13, 14, 15 for PTFE V-ring and nitrile/cotton; keys 12, 13, 14, and 16 for PTFE/composition) are to be replaced with new parts, remove washer (key 10) and pull out old parts using a formed wire hook.

**Note**

**Save three flat washers (key 13) when removing packing.**

6. No further disassembly is necessary if only the trim and/or packing is being serviced. To reassemble the unit, proceed to the *Assembly* section step 1 and steps 7 through 15.

**WARNING**

**To avoid personal injury caused by sudden release of spring force, relieve all spring compression before continuing disassembly. Use step 7 to relieve spring compression.**

7. To relieve all spring compression,

**For fail-down configuration,** loosen adjusting screw nut (key 35, figure 3) and turn adjusting screw (key 34, figure 3) counterclockwise to remove all spring compression.

**For fail-up configuration,** unscrew spring case assembly (key 46, figure 2) and turn adjusting stem nut (key 35, figure 2) counterclockwise to remove all spring compression. Remove adjusting stem nut, spring seat, and spring.

8. Unscrew the casing cap screws and hex nuts (keys 36 and 37), and remove the upper casing assembly (key 23) from the lower casing (key 22).

9. For fail-up configuration, remove cotter pin (key 50, figure 2) and unscrew adjusting stem (key 34, figure 2) from stem.

10. Lift out the diaphragm, diaphragm plate, and stem assembly.

11. To replace the diaphragm (key 26), separate the diaphragm assembly by using a wrench on the hex nuts (key 29) to unscrew the assembly.

12. Separate the parts—diaphragm washer, actuator O-ring (keys 27 and 28), diaphragm, and diaphragm plate, (keys 26 and 24).

13. Inspect the diaphragm and the actuator O-ring for damage or deterioration, and replace if necessary. If the diaphragm is replaced, a new O-ring should also be installed.

14. Inspect stem O-ring (key 19) and bonnet bushing (key 20); replace if necessary. To inspect casing O-ring (key 18), remove cap screws (key 21) and lift off lower casing (key 22). Replace O-ring if necessary.

**Note**

**The stem O-ring and bonnet bushing (keys 19 and 20), when used in fail-down, seal against loading pressure. The stem O-ring and bonnet bushing in fail-up have atmospheric pressure on the actuator side.**

15. If the hammer nut needs to be removed from the bonnet, the spring pins (key 58) can be removed with locking pliers.

16. The travel indicator assembly on the fail-up configuration has an O-ring (key 44, figure 2) that may become worn and leak loading pressure. If this happens, replace with a new assembly (key 43).

17. Fail-up configuration has adjusting stem bushing and actuator stem O-ring (keys 48 and 49, figure 2) that seals against loading pressure around the adjusting stem.

**Assembly**

1. Before starting assembly, make sure all parts are clean and in good condition. There should be no burrs or sharp edges on any threads or surfaces that might cut or damage an O-ring, bushing, the packing, or the diaphragm. When replacing O-rings and bushings, be sure the O-ring or bushing groove is clean and undamaged. Using a general purpose lubricant, lubricate all O-rings and bushings and the threads of parts that have to pass through the O-rings and bushings.

**CAUTION**

**The threads on factory-produced valve stems have been specially machined to avoid O-ring, bushing, or packing damage during trim maintenance. Use of other than a factory-produced valve stem may result in early stem O-ring, bushing, and packing failure.**

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2. If the actuator being reassembled is a fail-up configuration, replace the O-ring and bushing (keys 49 and 48, figure 2).
3. Assemble the diaphragm and diaphragm plate assembly. Place the patterned side of the diaphragm (key 26) (size 40 only) against the diaphragm plate (key 24). Be sure to turn the diaphragm washer (key 27) so that the side that is beveled on the inside diameter is against the O-ring (key 28). Also, make sure that it is assembled for installation with the diaphragm on the loading pressure side and the lockwasher (key 30) and lower spring seat (key 31), if used, are on the spring side.
4. Place the hammer nut and spring pins on the bonnet, if removed. Install the casing O-ring (key 18), the stem O-ring (key 19), and the bonnet bushing (key 20); then bolt the lower casing to the bonnet.

## Note

**Spring pins must always be in place during valve operation, acting as a safeguard against injury when the unit is being disassembled.**

5. Fasten diaphragm and diaphragm plate assembly on the stem with hex nuts (key 29). Place the diaphragm and diaphragm plate, and stem assembly into the lower casing and bonnet.
6. For fail-up configuration, screw the adjusting stem (key 34) onto the stem (key 8) and secure with cotter pin (key 50). Make sure bushing (key 48) and O-ring (key 49) are in place in the upper casing.
7. Install packing parts (keys 12, 13, 14, 15, or 16). Install washer (key 10). Screw valve plug onto stem. Drive in roll pin.
8. Make sure the cage O-ring (key 6) is in the cage. Install the cage into the valve.

For ceramic trim, ensure the O-ring (key 6) is in the seat ring. Install the seat ring and cage into the valve.

9. Make sure bonnet O-ring (key 11) is on the bonnet.
10. Lubricate the threads on the valve body and hammer nut and on the contact surfaces of bonnet and hammer nut flange. Install bonnet with attached diaphragm and valve plug onto the valve body. Tighten hammer nut using a hammer until the nut stops turning. A few extra hammer blows will be required to ensure that the assembly is tight. To avoid overloading of the cage, do not use excessive force, which can be seen by deformation of the nut.

## CAUTION

**Over-tightening the diaphragm casing cap screws and nuts (keys 36 and 37) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.**

11. If valve is a fail-up, position upper casing (key 23) on lower casing (key 22). Insert cap screws (key 36) and tighten hex nuts (key 37). Torque the casing cap screws evenly to 27 N•m (20 lbf•ft) using a crisscross pattern. Replace the spring, spring seat, (keys 32 and 33) and adjusting stem nut (key 35) over the adjusting stem (key 34). Replace the spring case assembly (key 46).
12. If the valve is fail-down, replace the spring (key 32) on the diaphragm plate (key 24). Replace upper spring seat (key 33). Position upper casing (key 23) on lower casing (key 22). Insert cap screws (key 36) and tighten hex nuts (key 37). Torque the casing cap screws evenly to 27 N•m (20 lbf•ft) using a crisscross pattern.
13. Install the travel indicator assembly.
14. Refer to the *Spring Adjustment* section.
15. Adjust the travel indicator nut (key 42).

## Parts Ordering

Each 357 Series control valve is assigned a serial number, which can be found on the nameplate. Refer to the number when contacting the Fisher Controls representative for assistance or when ordering replacement parts. When ordering replacement parts, also be sure to include the complete 11-character part number from the following parts list.

## Parts Kits

### Repair kits for the valve portion only.

PTFE V-Ring Packing Repair Kit (includes keys 6, 11, 12, and 15)	
Nitrile seal	R357XPTFE12
Fluoroelastomer seal	R357XPTFE22
Nitrile/Cotton Packing Repair Kit (includes 6, 11, 12, and 15)	
Nitrile seal	R357X00NC12
Fluoroelastomer seal	R357X00NC22
Ceramic Trim Package (includes keys 7, 9, 60, and 61)	
6.4 mm (1/4-inch) port diameter	R357XVTC012
9.5 mm (3/8-inch) port diameter	R357XVTC022
12.7 mm (1/2-inch) port diameter	R357XVTC032
19.1 mm (3/4-inch) port diameter	R357XVTC042
25.4 mm (1-inch) port diameter	R357XVTC052
38.1 mm (1-1/2 inch) port diameter	R357XVTC062

### Repair kits for the valve and actuator assembly.

Diaphragm is not included and must be ordered separately by appropriate part number.

PTFE V-Ring Packing Repair Kit (includes keys 6, 11, 12, 15, 18, 19, 20, 28, 44, 48, and 49)	
Nitrile seal	R357X000012
Fluoroelastomer seal	R357X000032
Nitrile/Cotton Packing Repair Kit (includes 6, 11, 12, 15, 18, 19, 20, 28, 44, 48, and 49)	
Nitrile seal	R357X000022
Fluoroelastomer seal	R357X000042

## Parts List

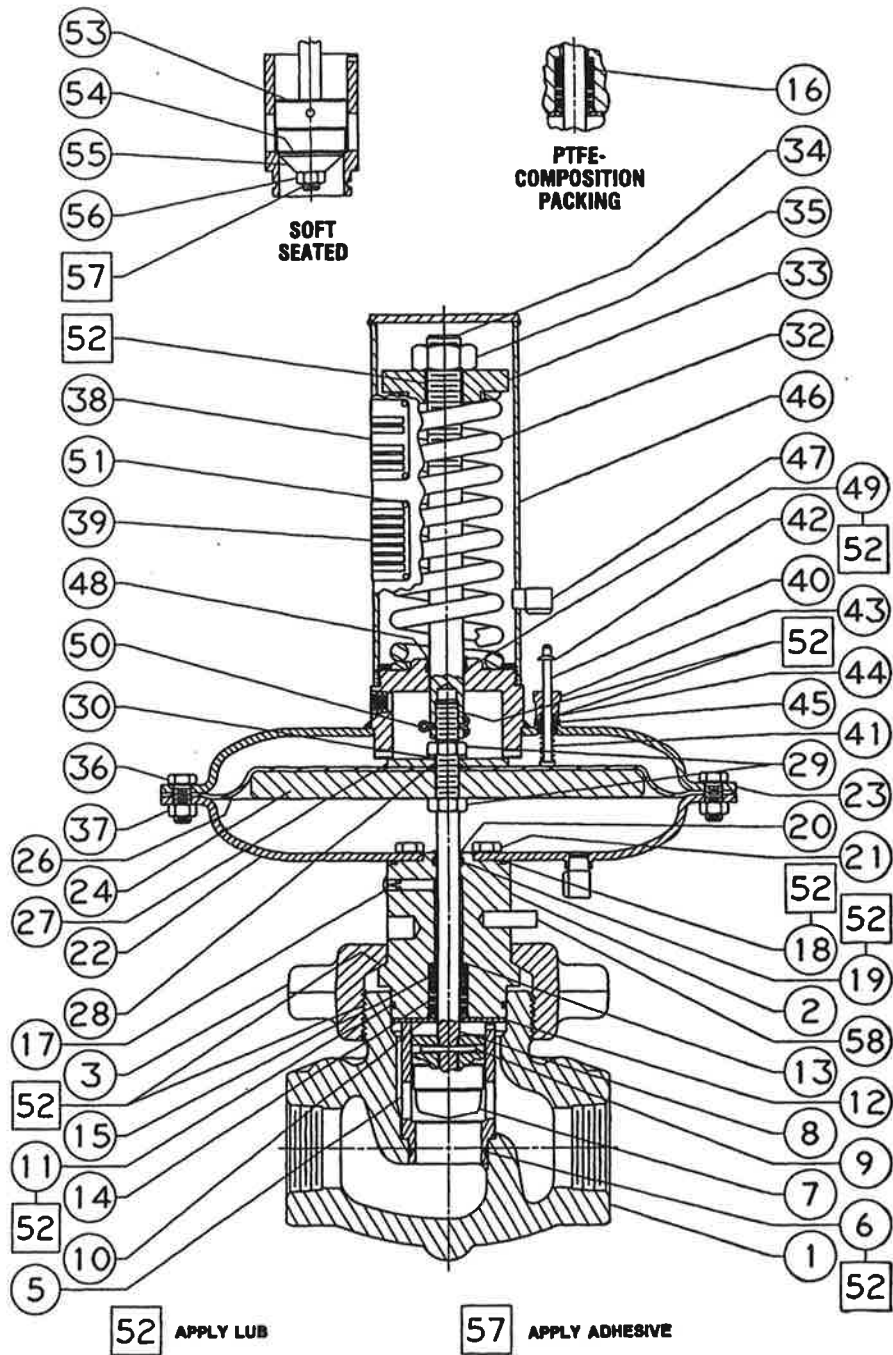
Key	Description	Part Number
2	Bonnet	
	For WCC (steel) valve & NACE, SA-105 steel	32B3485X012
	For LCC (steel) valve & NACE, SA-350 steel	32B3485X022
3	Hammer Nut	
	Size 1 & 2, Class 150 through 600 flanged and screwed	
	For WCC valve & NACE, SA-105 steel	22B3483X012
	For LCC valve & NACE, SA-350 steel	22B3483X022
	Size 2, Class 1500	
	For WCC (steel) valve & NACE, SA-105 steel	22B3549X012
	For LCC (steel) valve & NACE, SA-350 steel	22B3549X022
4	Pipe Plug (1-inch screwed valve only)	
	For WCC valve & NACE, SA-105 steel	1A794728992
	For LCC valve & NACE, S31600 (316 SST)	1A7947X00A2

Key	Description	Part Number
5*	Cage w/Integral Seat Ring	
	Metal Seat	
	17-4PH stainless steel H1075	
	6.4 mm (1/4-inch) port diameter	32B3486X012
	9.5 mm (3/8-inch) port diameter	32B3487X012
	12.7 mm (1/2-inch) port diameter	32B3488X012
	19.1 mm (3/4-inch) port diameter	32B3489X012
	25.4 mm (1-inch) port diameter	32B3490X012
	38.1 mm (1-1/2 inch) port diameter	32B3491X012
	17-4PH stainless steel DH1150 (NACE)	
	6.4 mm (1/4-inch) port diameter	32B3486X022
	9.5 mm (3/8-inch) port diameter	32B3487X022
	12.7 mm (1/2-inch) port diameter	32B3488X022
	19.1 mm (3/4-inch) port diameter	32B3489X022
	25.4 mm (1-inch) port diameter	32B3490X022
	38.1 mm (1-1/2 inch) port diameter	32B3491X022
	Soft Seat	
	17-4PH stainless steel H1075	
	12.7 mm (1/2-inch) port diameter	32B3488X012
	19.1 mm (3/4-inch) port diameter	32B3489X012
	25.4 mm (1-inch) port diameter	32B3490X012
	38.1 mm (1-1/2 inch) port diameter	32B3491X012
	17-4PH stainless steel DH1150 (NACE)	
	12.7 mm (1/2-inch) port diameter	32B3488X022
	19.1 mm (3/4-inch) port diameter	32B3489X022
	25.4 mm (1-inch) port diameter	32B3490X022
	38.1 mm (1-1/2 inch) port diameter	32B3491X022
6*	Cage O-Ring	See following table
7*	Valve Plug	
	Taper Plug (all port diameters)	
	416 stainless steel	22B3498X012
	17-4PH stainless steel DH1150 (NACE)	22B3498X022
	Micro-Form Plug	
	416 stainless steel	
	6.4 mm (1/4-inch) port diameter	22B3492X012
	9.5 mm (3/8-inch) port diameter	22B3493X012
	12.7 mm (1/2-inch) port diameter	22B3494X012
	19.1 mm (3/4-inch) port diameter	22B3495X012
	25.4 mm (1-inch) port diameter	22B3496X012
	38.1 mm (1-1/2 inch) port diameter	22B3497X012
	17-4PH stainless steel DH1150 (NACE)	
	6.4 mm (1/4-inch) port diameter	22B3492X022
	9.5 mm (3/8-inch) port diameter	22B3493X022
	12.7 mm (1/2-inch) port diameter	22B3494X022
	19.1 mm (3/4-inch) port diameter	22B3495X022
	25.4 mm (1-inch) port diameter	22B3496X022
	38.1 mm (1-1/2 inch) port diameter	22B3497X022
	VTC (ceramic) (standard or NACE)	
	6.4 mm (1/4-inch) port diameter	22B8922X012
	9.5 mm (3/8-inch) port diameter	22B8923X012
	12.7 mm (1/2-inch) port diameter	22B8924X012
	19.1 mm (3/4-inch) port diameter	22B8925X012
	25.4 mm (1-inch) port diameter	22B8926X012
	38.1 mm (1-1/2 inch) port diameter	22B8927X012
8*	Valve Stem	
	S31600 (316 stainless steel)	22B3516X012
	S20910 (Nitronic 50) (NACE)	22B3516X032
9*	Roll Pin, 18-8 stainless steel	1U5972X0012
9*	Pin, 17-4PH SST (DH1150) (NACE)	12B3507X022
10	Cage/Packing Washer, 304 stainless steel	12B3519X012
11*	Bonnet O-Ring	See following table
12*	Packing Wiper, PTFE	15A9637X012
13	Packing Washer, SST (3 req'd)	1H981836042
14	Packing Spring, N07750 (Inconel)	15A3183X012



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Key	Description	Part Number	Key	Description	Part Number
15*	Packing Set		36	Cap Screw, pl steel	
	PTFE V-ring	12A9016X012		Size 20 (12 req'd)	1E760324052
	Nitrile/cotton	19A5772X012		Size 40 (16 req'd)	1E760324052
16*	Packing Ring, PTFE comp (3 req'd)	1P390501042	37	Hex Nut, pl steel	
17	Leak-off Plug	15A0983X012		Size 20 (12 req'd)	1A346524122
18*	Casing O-Ring	See following table		Size 40 (16 req'd)	1A346524122
19*	Stem O-Ring	See following table	38	Actuator Nameplate	14B2028X0A2
20*	Bonnet Bearing	See following table	40	Indicator Rod (included in key 43 assembly)	
21	Cap Screw, pl steel (4 req'd)	1D529824052	41	Indicator Spring (included in key 43 assembly)	
22	Lower Casing, pl (plated) steel		42	Indicator Nut (included in key 43 assembly)	
	Fail up or fail down		43	Indicator Assembly	
	Size 20	32B3499X012		Fail up (includes keys 40, 41, 42, 43, 44, and 45)	
	Size 40	42B3500X012		-29 to 149°C (-20 to 300°F)	22B3524X022
23	Upper Casing Assy, pl steel			-45 to 82°C (-50 to 180°F)	22B3524X032
	Size 20			Fail down (includes keys 40, 41, 42, and 43)	22B3523X022
	Fail up	22B3503X012	44	Indicator O-Ring (included in key 43 assembly)	
	Fail down	32B3501X012		(fail up only)	
	Size 40		45	Indicator Bushing (included in key 43 assembly)	
	Fail up	22B3510X012	46	Spring Case Assembly, steel (for fail up)	23A2349X012
	Fail down	32B3508X012	47	Vent Assy, SST (2 req'd) (for fail up)	27A5516X012
24	Diaphragm Plate, steel		48*	Adjusting Stem Bushing, nylon (for fail up)	17A4059X012
	Size 20	22B3514X012	49*	Actuator Stem O-Ring (for fail up)	See following table
	Size 40	24B1785X012	50*	Cotter Pin, S30200 (302 stainless steel)	
26*	Diaphragm (O-Ring, key 28 should be ordered with diaphragm)			(for fail up)	1C608035022
	Size 20		51	Drive Screw, SST (8 req'd)	1A368228982
	Nitrile/nylon	32B3520X012	52	Lubricant, Lubriplate Mag-1	---
	Fluoroelastomer	32B3520X022		Not included with control valve	
	Size 40		53*	Plug, Disk Holder, S17400 D1150	
	Neoprene/nylon	22B3521X012		12.7 mm (1/2-inch) port diameter	22B3533X012
	Fluoroelastomer	22B3521X032		19.1 mm (3/4-inch) port diameter	22B3532X012
27	Diaphragm Washer, pl steel	12B3517X012		25.4 mm (1-inch) port diameter	22B3531X012
28*	Actuator O-Ring	See following table		38.1 mm (1-1/2 inch) port diameter	22B3530X012
29	Hex Nut, pl steel (2 req'd)	1A353724122	54*	Disk, Plug Seat, UHMWPE <sup>(1)</sup>	
30	Lockwasher, pl steel	1A353828982		12.7 mm (1/2-inch) port diameter	15A3584X012
31	Lower Spring Seat, pl steel (for fail down only)	12B3518X012		19.1 mm (3/4-inch) port diameter	13A7446X012
32	Actuator Spring See tables 4, 5, and 6			25.4 mm (1-inch) port diameter	13A7450X012
33	Upper Spring Seat, pl steel			38.1 mm (1-1/2 inch) port diameter	13A7463X012
	Fail up (size 20 or 40 actuator)	13A2343X012	55*	Disk Retainer, S31600	
	Fail down			12.7 mm (1/2-inch) port diameter	15A3583X022
	Size 20 actuator	16A9460X012		19.1 mm (3/4-inch) port diameter	13A7447X012
	Size 40 actuator	17A3513X012		25.4 mm (1-inch) port diameter	13A7451X012
34	Adjusting Screw, pl steel			38.1 mm (1-1/2 inch) port diameter	12B3529X012
	Fail down		56	Hex Nut, S31600	
	Size 20 flow-up-to-open			19.1 mm (3/4-inch) port diameter	1A391535072
	0.2 to 1.0 bar (3 to 15 psig) signal range	1D336628982		25.4 mm (1-inch) port diameter	1A3753X0282
	All other ranges	1A6441X0012		38.1 mm (1-1/2 inch) port diameter	1A3753X0282
	Size 40 flow-up-to-open		57	Adhesive, Loctite No. 262	T13060T0012
	0.2 to 1.0 bar (3 to 15 psig) signal range	17A3515X012	58	Spring Pin, Pl carbon steel, (2 req'd)	12B9011X012
	All other ranges	1V360928982	60*	Cage for Ceramic Trim	
34	Adjusting Stem, S31600 (316 stainless steel)			S17400 D1150 (std or NACE) all port dia	22B8912X012
	For fail up	22B3512X012	61*	Seat Ring for Ceramic Trim	
35	Adjusting screw nut, pl steel (fail down)	1A352424122		S17400 D1150 (std or NACE)	
35	Adjusting stem nut, pl steel (fail up)	1A599324122		6.4 mm (1/4 inch) port diameter	17B1949X012
				9.5 mm (3/8 inch) port diameter	17B1950X012
				12.7 mm (1/2 inch) port diameter	17B1951X012
				19.1 mm (3/4 inch) port diameter	17B9680X012
				25.4 mm (1-inch) port diameter	17B9681X012
				Ceramic (std or NACE)	
				38.1 mm (1-1/2 inch) port diameter	32B8918X012



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Figure 2. 2-Inch 357 Series Valve—Fail-Up

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Singapore 128461



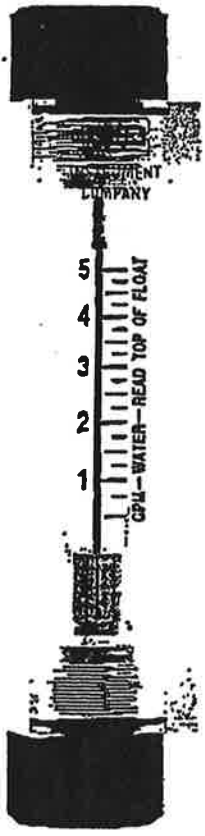
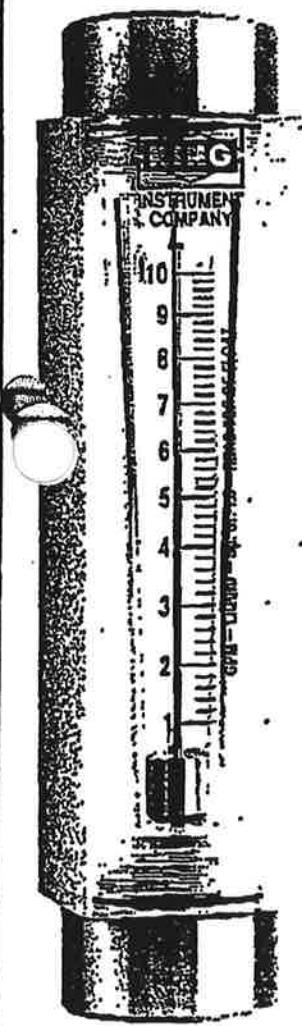


**7500**  
**SERIES**

**MACHINED CAST ACRYLIC, BLOCK TYPE,**

**7500 SERIES**

- All meter blocks are precision CNC machined from solid cast acrylic stock. (Cast material is the most durable of all Acrylic resins.)
- Direct reading scales for Water or Air are standard. (Special scales are available.)
- A uniform white back on all 7500 Series meters enhances scale readability.
- Factory certified calibration is available.



**7510 MODELS**

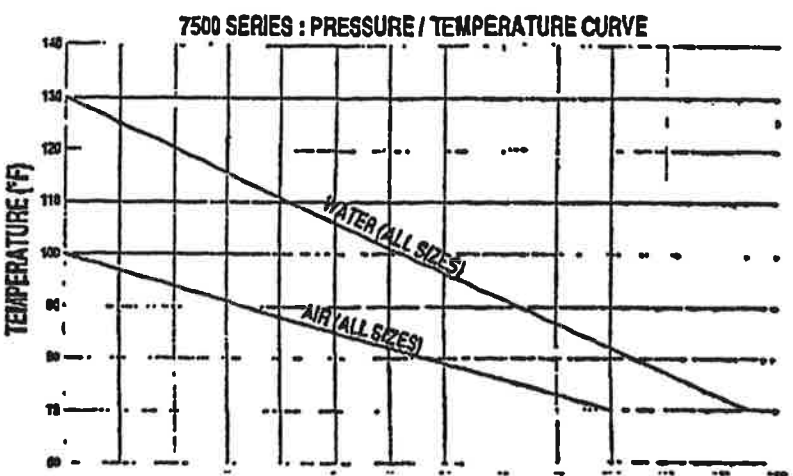
- Connections are in line (vertical) type.
- Scale lengths are 50mm (2"), 100mm (4"), 127mm (5") and 250mm (10").
- Fitting material is either PVC or Brass depending on model. (316 Stainless Steel is optional.)
- Threaded inserts for panel mounting are included.

**7511 MODELS**

- Large diameter taper and floats provide reduced pressure loss and add superior float stability.
- Same in line connections and panel mount capability as 7510 models.
- Choose from either 50mm (2") or 127mm (5") scale lengths.
- Seven flow ranges are available from 1 to 5 GPM—Water and 8 to 20 SCFM—Air.
- Connections are 1/2" FNPT.
- PVC fittings are standard. (Brass and 316 Stainless Steel are optional.)
- Panel mounting threaded inserts are included.

**METER CAPACITIES**  
7 GPH to 20 GPM—Water  
2 SCFH to 62 SCFM—Air

SCALE LENGTH	FULL SCALE ACCURACY (±)
50 mm (2")	6%
75 mm (3")	4%
100 mm (4")	4%
127 mm (5")	3%
250 mm (10")	2%



# 7500 SERIES

## 7510 AND 7511 MODELS, IN LINE TYPE

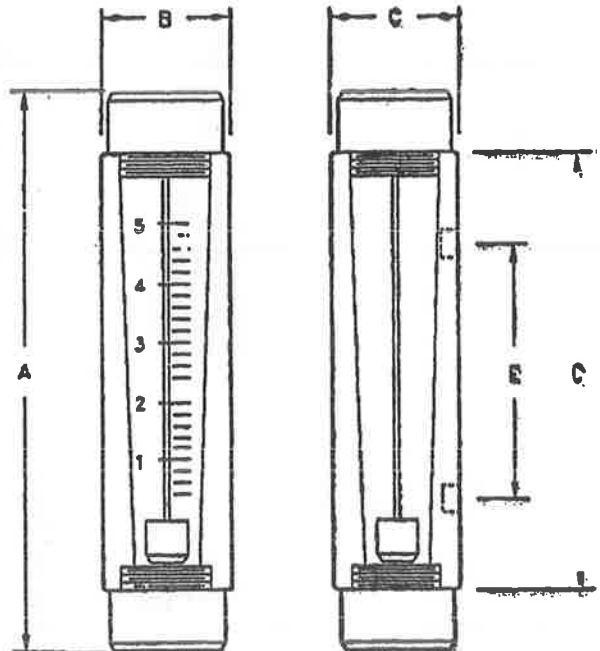
### FLOAT INFORMATION AND CAPACITY TABLES

ORDER NUMBER	FLOW WATER	ORDER NUMBER	FLOW AIR	ORDER NUMBER	FLOW WATER	ORDER NUMBER	FLOW AIR
<b>Block #2A, 50mm (2 Inch) Scale</b>				<b>BLOCK #5B, 127mm (5 Inch) Scale</b>			
		2A-01	2.8 SCFH	5B-02	1 GPM	5B-01	4.2 SCFM
		2A-03	5 SCFH	5B-04	2 GPM	5B-03	8.2 SCFM
		2A-05	10 SCFH	5B-06	3.5 GPM	5B-05	15 SCFM
		2A-07	20 SCFH	5B-08	5 GPM	5B-07	21 SCFM
		2A-09	30 SCFH	<b>BLOCK #6A, 100mm (4 Inch) Scale</b>			
2A-02	7 GPH	2A-11	60 SCFH	6A-02	10 GPM	6A-01	40 SCFM
2A-04	12 GPH	2A-13	100 SCFH	6A-04	15 GPM	6A-03	60 SCFM
2A-06	22 GPH	2A-15	180 SCFH	6A-06	20 GPM	—	—
2A-08	44 GPH	2A-17	4 SCFM	<b>BLOCK #7A, 250mm (10 Inch) Scale</b>			
2A-10	60 GPH	—	—	7A-02	2 GPM	7A-01	8 SCFM
2A-12	75 GPH	—	—	7A-04	3.5 GPM	7A-03	14.8 SCFM
<b>BLOCK #2B, 50mm (2 Inch) Scale</b>				7A-06	5 GPM	7A-05	20 SCFM
2B-02	1 GPM	2B-01	4 SCFM	7A-08	10 GPM	7A-07	40 SCFM
2B-04	2 GPM	2B-03	8 SCFM				
2B-06	3.6 GPM	2B-05	15 SCFM				
2B-08	5 GPM	2B-07	20 SCFM				

### DIMENSIONS

BLOCK NUMBER	DETAIL LETTER					CONNECTION SIZE
	A	B	C	D	E	
2A	4 3/4	1	1 1/8	3 1/2	1 1/2	1/4" FNPT*
2B	6 1/2	1 3/8	1 3/8	5	2 1/2	1/2" FNPT
5B	9 1/4	1 3/8	1 3/8	7 3/4	5 1/4	1/2" FNPT
6A	8 3/8	1 3/4	1 13/16	6 5/8	4	1" FNPT
7A	13 5/8	1 3/4	1 13/16	11 7/8	8	3/4" FNPT

\* Block 2A has 1/4" FNPT with Brass or Stainless Steel Fittings, 1/4" MNPT with PVC fittings.





# INSTRUCTION MANUAL

## **MODEL S106A**

Three Relay  
Smart Sensor for  
Combustible Gas Applications



**GENERAL MONITORS**

*Protection for life.*





GENERAL MONITORS

## MODEL S106A

Three Relay  
Smart Sensor for  
Combustible Gas Applications



The information and technical data disclosed in this document may be used and disseminated only for the purposes and to the extent specifically authorized in writing by General Monitors.

### INSTRUCTION MANUAL 05/99

General Monitors reserves the right to change published specifications and designs without prior notice.

Part No.  
Revision

MANS106A  
D/05-99



# GENERAL MONITORS

## Model S106A

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### Warranty

General Monitors warrants the *Model S106A* to be free from defects in workmanship or material under normal use and service within two (2) years from the date of shipment. General Monitors will repair or replace without charge any equipment found to be defective during the warranty period. Full determination of the nature of, and responsibility for, defective or damaged equipment will be made by General Monitors' personnel. Defective or damaged equipment must be shipped prepaid to General Monitors' plant or the representative from which shipment was made. In all cases this warranty is limited to the cost of the equipment supplied by General Monitors. The customer will assume all liability for the misuse of this equipment by its employees or other personnel.

All warranties are contingent upon proper use in the application for which the product was intended and do not cover products which have been modified or repaired without General Monitors' approval or which have been subjected to neglect, accident, improper installation or application, or on which the original identification marks have been removed or altered. Except for the express warranty stated above, General Monitors disclaims all warranties with regard to the products sold, including all implied warranties of merchantability and fitness and the express warranties stated herein are in lieu of all obligations or liabilities on the part of General Monitors for damages including, but not limited to, consequential damages arising out of/or in connection with the use or performance of the product.

### Warning

The Model S106A Combustible Gas Enhanced Smart Sensor Assembly contains components which can be damaged by static electricity. Special care must be taken when wiring the system to ensure that only the connection points are touched.



**GENERAL MONITORS**  
*Protection for life.*

## Customer Satisfaction Response Card

We greatly appreciate your interest in General Monitors products. To help us learn how to continuously improve to serve you better, please take a moment to complete and return the reply card below.

***Thank you for your ongoing consideration of General Monitors products.***



**GENERAL MONITORS**  
*Protection for life.*

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Lake Forest, California, 92630  
+1-949-581-4464  
Fax: +1-949-581-5241  
[www.generalmonitors.com](http://www.generalmonitors.com)

**Please rank our performance in providing the services described below.**

Ratings: 5 = Excellent 4 = Good 3 = Average 2 = Below average 1 = Poor

- General Monitors' product meets your specifications and performance requirements.
- General Monitors' product is reliably delivered to your request date.
- General Monitors' product reliability compared to our competition.
- General Monitors provides the customer service and technical support you require.
- General Monitors innovates new products which better meet your requirements.

Comment on above ratings: \_\_\_\_\_

\_\_\_\_\_

Are there any other areas we have not covered where General Monitors does well or could improve: \_\_\_\_\_

\_\_\_\_\_

Name \_\_\_\_\_ Company \_\_\_\_\_



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# GENERAL MONITORS

## Model S106A

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# GENERAL MONITORS

## Model S106A

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# GENERAL MONITORS

26776 Simpatica Circle  
Lake Forest, California 92630-8128  
Telephone: (714) 581-4464  
Fax: (714) 581-1151

## EC Declaration of Conformity in accordance with EC Directives

We, at General Monitors, Inc., 26776 Simpatica Circle, Lake Forest, California 92630, U.S.A., hereby declare that the equipment described below, both in its basic design and construction, and in the version or versions marketed by us, conforms to the relevant safety and health related requirements of the appropriate EC Directives, only as follows:

- a) Conforms with the protection requirements of Council Directive 89/336/EEC, +Amd 92/31/EEC, +Amd 93/68/EEC relating to Electro-magnetic Compatibility, by the application of;

A Technical Construction File No. GMI96008-1 and Competent Body Report No. 4473/1H5.

and

- b) Conforms with protection requirements of IEC 1010-1:1990 + Amd 1:1992 relating to the safety by the application of;

A Technical Construction File No. GMI96008-1 and Competent Body Report Nos. 96-0215 and 96-0383, issued by;

ERA Technology Ltd., Cleeve Road, Leatherhead, Surrey, KT22 7SA, England. Tel: +44-1372-367000


This declaration shall cease to be valid if modifications are made to the equipment without our approval.

PRODUCT: HC and H2S Smart Sensors

MODEL /S: S106A, S216A, S104, S214

It is ensured through internal measures and our ISO 9001:1994 certification, that series production units conform at all times to the requirements of these current EC Directives and relevant standards.

Responsible Person:

  
Robert J. Wek  
Chief Operating Officer

Date: 14 OCT 96

The signatory acts on behalf of company management, and with full power of attorney.



# GENERAL MONITORS

## Model S106A

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## 1.0 Introduction

### 1.1 General Description

The Model S106A is an enhanced Smart Sensor assembly that can be used for detecting combustible gases. The microprocessor based electronics process information at the sensor site within an explosion proof housing.

A digital display provides indications and display codes that can be viewed through a window in the cover. Relay contacts and an analog signal (4-20mA) provide remote and/or discrete indications of the sensor's operation.

The Model S106A enhanced Smart Sensor assembly is rated explosion proof for use in Class I, Division 1, Group B, C, and D hazardous areas.

### 1.2 Features and Benefits

**Microprocessor Based Electronics:** monitors nine individual fault conditions, processing input signals from the sensor and providing outputs in the form of display codes, relay contact activation, and an analog signal.

**One Person Calibration:** initiate the calibration sequence with a magnet, apply the gas, and wait for the display to indicate that the unit has completed the calibration. No tools or adjustments are required.

**2 Digit Display:** indicates gas concentrations, fault codes, calibration cues, and is used for selecting relay options.

**4 to 20 mA Output:** transmits fault, over range, calibration, and gas concentrations to a remote display, computer or other device.

**Relay Contacts (SPDT):** provides discrete relay contacts for Alarm, Warn and Fault indications to activate hazard prevention or safety control devices (such as fans, vacuum pumps, ventilation equipment, etc.).

### 1.3 Applications

This is a partial listing of applications:

- Drilling and Production Platforms
- Fuel Loading Facilities
- Compressor Stations
- Oil Well Logging
- LNG/LPG Processing and Storage
- Waste Water Treatment
- Gas Turbines
- Solvent Vapors
- Hydrogen Storage





# GENERAL MONITORS

## Model S106A

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## 2.0 Sensor Assembly

### 2.1 Sensor Signal Processing

Combustible material is found in many gases and vapors. General Monitors uses a low temperature catalytic bead to detect the presence of combustible gases and vapors. The catalytic bead converts the combustible materials to heat. A change in heat is then converted to a change in resistance, which can be measured.

By taking a matched pair of catalytic beads and coating one so that it does not respond to the presence of combustible gases, we can compare the change in resistance between the two beads. The bead that is coated is called the reference bead and the other is called the active bead (figure 1). Environmental factors can also influence the temperature of the catalytic beads. Because the beads are a matched pair, they will respond to changes in ambient temperature, humidity, and pressure equally.

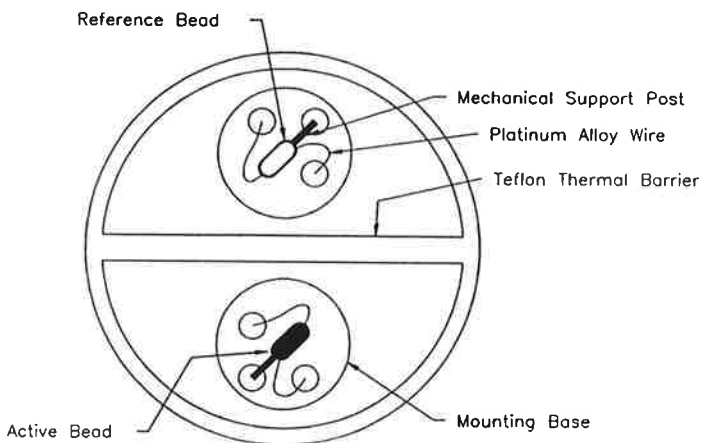


figure 1

By connecting one end of each catalytic bead together, a series circuit is formed. This circuit is supplied with a constant voltage. The voltage drop across each of the beads will be identical in the absence of combustible gases. As combustible material is converted to heat, the resistance of the active bead increases causing the voltage drop across each bead to be different. This difference is proportional to the amount of combustible gas that is present.

The voltage from the sensor is amplified and fed to an Analog to Digital (A/D) converter and then made available to the microprocessor (figure 2).

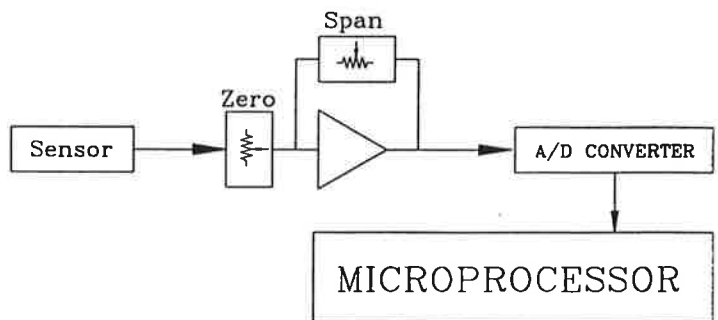


figure 2

The baseline and the gain for the amplifier are determined by digital potentiometers. They are adjusted by the microprocessor during calibration.



# GENERAL MONITORS

## Model S106A

## Sensor Assembly

### 2.2 Power Supply

The Model S106A operates from a +24 VDC (nominal) input. This unregulated source is fed to a converter board that produces voltages (see figure 3). These signals are the source for operating all of the circuitry on the control and the display boards, and supplying the sensor with power. Terminal connections inside of the housing have been provided for accepting the input power.

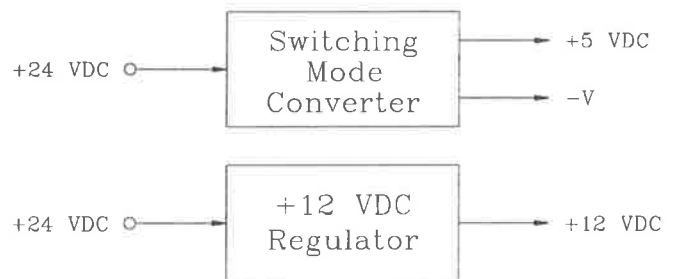


figure 3

### 2.3 Control Electronics

The control electronics are centered around an eight bit microprocessor (figure 4). The sensor signal, the CAL switch, the non-volatile memory (NOVRAM), and certain fault conditions are monitored as inputs. By processing these inputs, the following outputs are generated; 4-20mA output signal, relay contact states, digital display indications, and calibration values (NOVRAM).

As the microprocessor (MPU) receives and processes the inputs, it determines what value is output to the display, the 4-20mA current generator, and the state of the relay contacts.

When the CAL Switch is activated, the MPU allows the user to choose between the Calibration, the Calibration Check, or the Alarm Set Point and Relay Option Selection modes. While the unit is in the Calibration Check mode, the MPU will fix the 4-20mA output signal to 1.5mA. The 0mA option applies to the calibration mode, the alarm set point and relay option selection modes.

**Calibration Mode:** When the unit is placed in this mode, the MPU accepts a ZERO value and waits for the signal from the sensor to increase and then stabilize. It accepts this final value as a SPAN value. These values are stored in NOVRAM and are used in adjusting with the digital potentiometers associated with the Input Amplifier.

**Calibration Check Mode:** In this mode, the MPU will output the gas concentration to the display while inhibiting the Warn & Alarm outputs. When the gas concentration drops below 10% LEL, the unit will return to normal operation. The purpose of this mode is to check the response of the unit to a known level of gas and determine if calibration is necessary.

**Warn & Alarm Set Points and Relay Options Selection Mode:** The Alarm Set Point can be set in increments of 5% LEL, from 5 to 60 on the display for each set point (Warn & Alarm). The two Relay Options that are available are Energized/De-Energized and Latching/Non-Latching for the Warn & Alarm relays.



# GENERAL MONITORS

## Model S106A

### Sensor Assembly

Control Electronics (continued)

**NOTE: Once the Warn & Alarm Set Points and Relay Options have been selected, the unit will revert to the calibration sequence, and must be calibrated.**

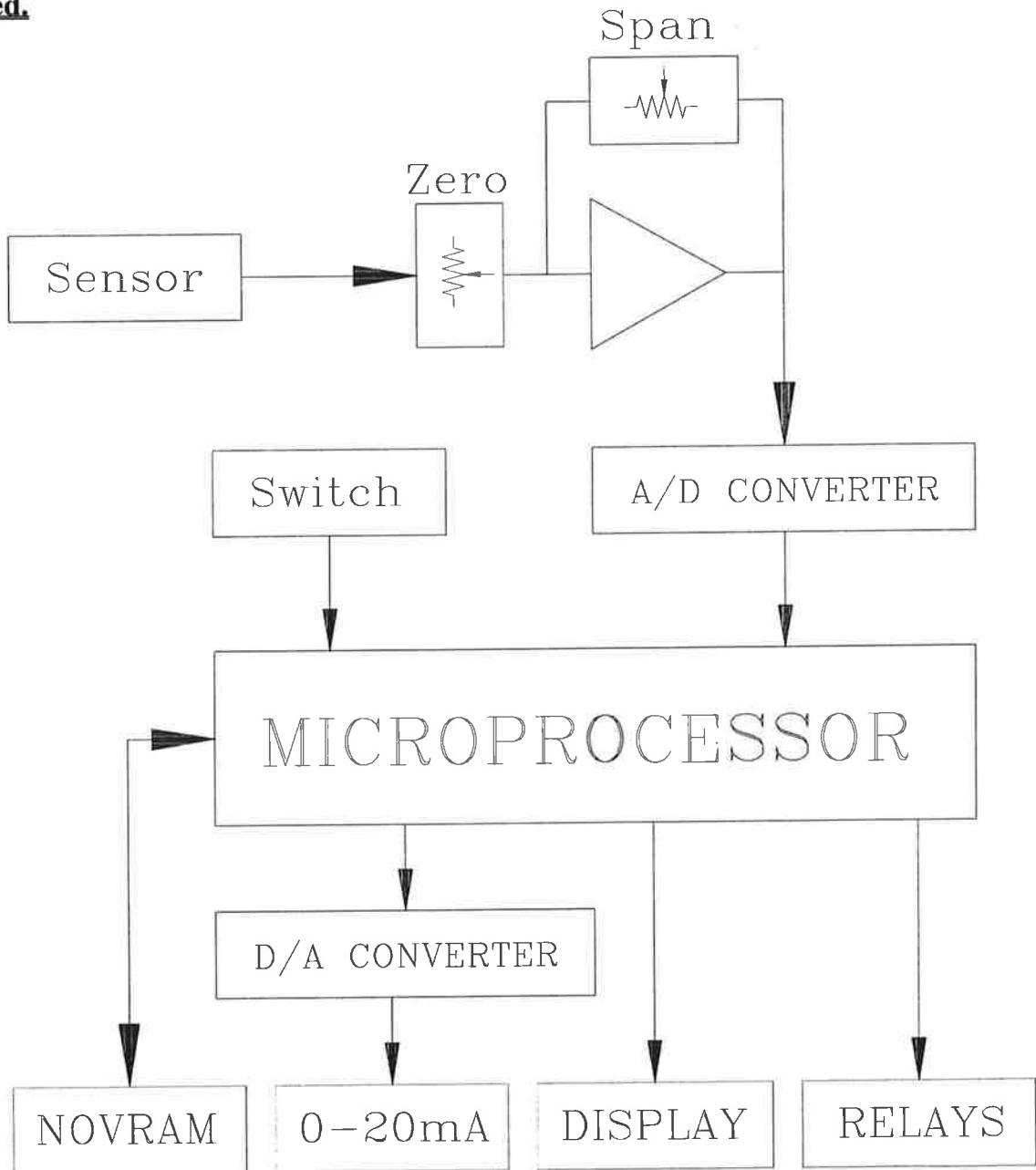


figure 4



# GENERAL MONITORS

## Model S106A

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# GENERAL MONITORS

## Model S106A

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### 3.0 Installation

#### 3.1 Receipt of Equipment

All equipment shipped by General Monitors is prepackaged in shock absorbing containers which provide considerable protection against physical damage. The contents should be carefully removed and checked against the packing slip. If any damage has occurred or if there is any discrepancy in the order, notify General Monitors as soon as possible. All subsequent correspondence with General Monitors must specify the equipment part and serial numbers.

Each Model S106A is completely checked by the factory. However, a complete check-out is necessary upon initial installation and start up to ensure system integrity.

#### 3.2 Sensor Location Considerations

There are no standard rules for sensor placement since the optimum sensor location is different for each application. The customer must evaluate conditions at the facility to make this determination. Generally, the Model S106A Enhanced Smart Sensor should be easily accessible for calibration checks.

- The sensor assembly should be mounted pointing down to prevent water build-up on the sensor head.
- The sensor assembly should not be placed where it may be coated by contaminating substances.
- Although the Model S106A is RFI resistant, it should not be mounted in close proximity to radio transmitters or similar equipment.

- Locate the Model S106A where prevailing air currents contain the maximum concentration of gas.
- Locate the Model S106A near possible sources of gas leaks.
- Observe the Model S106A's temperature specification and locate the unit away from concentrated sources of heat.
- Sensor Assemblies should be mounted in an area that is as free from wind, dust, water, shock, and vibration as possible. See Appendix, section 5.1.4 for the environmental specifications of the unit.

Sensors may be adversely affected by prolonged exposure to certain materials. Loss of sensitivity or corrosion may be gradual if such materials are present in low concentrations, or it may be rapid at high concentrations. The more important materials adversely affecting sensors are:

- Prolonged presence of Hydrogen Sulfide ( $H_2S$ ) gas
- Silicones (often contained in greases and aerosols)
- Halides . . . compounds containing Fluorine, Chlorine, Bromine and Iodine
- Heavy metals, e.g. Tetraethyl Lead

The presence of poisons and contaminants in an area does not necessarily preclude the use of a Model S106A Enhanced Smart Sensor. The feasibility of using a sensor in such areas must be determined by an analysis of the specific factors in each application and General Monitors should be consulted before attempting any such installation.



# GENERAL MONITORS

## Model S106A

### Installation

#### Sensor Location Considerations *(continued)*

Sensors used in these areas usually require more frequent calibration checks than normal, and typically have a shorter life. In many such applications the normal two year warranty would not apply.

**CAUTION: General Monitors discourages the painting of sensor assemblies. If the sensor head is painted over, the gas will not be able to diffuse into the sensor. If the assembly cover is painted over, the digital display cannot be read.**

#### Remoting the Sensor from the Electronics:

If it is necessary to remotely mount the sensor from the electronics and the housing, the maximum distance can be no greater than 100 feet, using 14 AWG wire. Sensors that are remotely mounted must be placed in a sensor housing (GMI P/N 10252) and the cable run must be contained in a conduit running from the sensor housing to the electronics. See Appendix, section 5.4 for FMRC approval requirements.

### 3.3 Installation Instructions

The overall and mounting dimensions for the Model S106A (figures 5 & 27) should be used when making installation determinations. A complete list of the mechanical specifications can be found in the Appendix (section 5.1.3).

To prevent possible corrosion due to moisture or condensation, it is recommended that the conduit connected to the Model S106A housing, be sealed or contain a drain loop (figure 6).

Each conduit run from a hazardous location to a non-hazardous location should be sealed so that gases, vapors, and/or flames can not pass beyond the seal. The purpose of seals in a Class I hazardous location is to prevent the passage of gases, vapors, or flames from one electrical installation to another through the conduit system.

It is not necessary to seal the Model S106A housing to maintain its explosion proof integrity, however, conduit runs containing wires attached to the Model S106A's relay contacts must be sealed (see section 5.4).

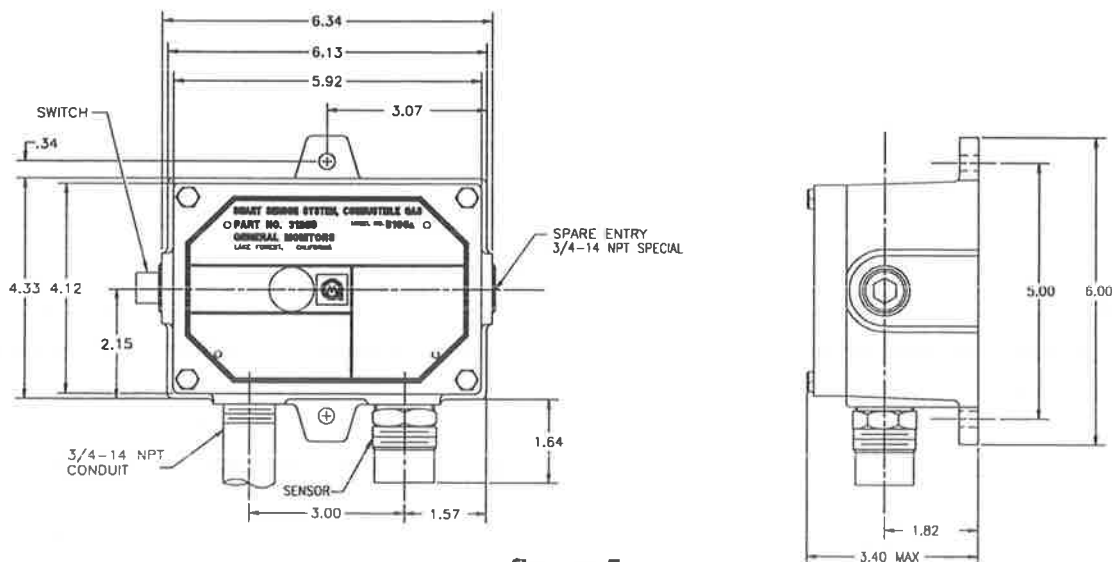


figure 5



# GENERAL MONITORS

## Model S106A

### Installation

#### Installation Instructions (continued)

Information on Class I location seals can be found in the NEC handbook, Article 501-5.

**NOTE: Acetic acid will cause damage to metal components, metal hardware, ceramic IC's, etc. If damage results from the use of a sealant that outgases acetic acid (RTV silicone), the warranty will be void.**

Once correctly installed, the Model S106A requires little or no maintenance other than periodic calibration checks to ensure system integrity. General Monitors recommends that a schedule be established and followed.

**NOTE: The system's full two year warranty will be voided if customer personnel or third parties damage the system during repair attempts.**

Sensor heads exposed to the elements may require the accessory mounting threads to be lubricated. Grease **must not** be used. As an alternate, PTFE (teflon) tape may be used on sensor accessory threads.

**NOTE: Do not use any material or substance on threads that contact the sensor housing.**

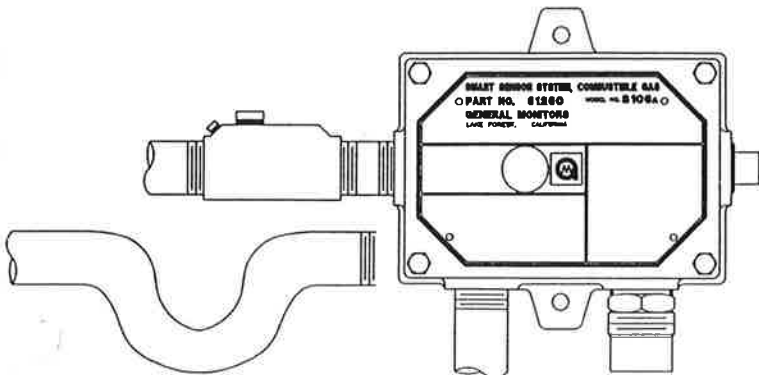


figure 6

The removal of particulate matter from sensor accessories may be done through the use of an appropriate halogen-free solvent. Water or ethanol are examples of suitable solvents. The accessories should be thoroughly dried, with compressed air if necessary, before refitting to the sensor body.

General Monitors recommends that the complete system, including all alarm circuitry, be tested at least annually. Some typical items to check during maintenance examinations are:

- The sensor mounting, to see it is secure.
- The sensor screen, to see it is clear of water, oil, dust or paint.
- The cable connections for tightness and possible damage.
- All sensor placements, to see that they are up to date with the layout of the plant (e.g. modifications to the plant).
- The complete system, to see it has a back up supply for the full prescribed time.

### 3.4 Terminal Connections

The terminal blocks (TB) are located inside of the housing and can be accessed by removing the cover (figure 7, CE Marked units see figure 28). TB3 contains the three sensor connections, White (W), Black (B), and Red (R).

SENSOR CONNECTIONS 1 ONLY.		TB3		TB2	
<b>DO NOT APPLY +24VDC</b>		W	B	R	
		SENSOR			
NOTE: RELAY CONTACT NORMALLY ENERGIZED		4-20mA OUT		TB1	
TB2 POS 1 - NO, POS 4 - NO		1	WHT	WC	5
TB2 POS 2 - C, POS 5 - C		COM	2	W2	6
TB2 POS 3 - NC, POS 6 - NC		RELAY RESET	3	F NC	7
NORMALLY DE-ENERGIZED		COM	4	BLK	F C
TB2 POS 1 - NC, POS 4 - NC				8	
TB2 POS 2 - C, POS 5 - C				RED	F NC
TB2 POS 3 - NO, POS 6 - NO					9

figure 7





# GENERAL MONITORS

## Model S106A

### Installation

#### Terminal Connections (*continued*)

TB1 contains the connections for Power, Relay Reset, and Output Signal (CE Marked units, see figure 28).

TB1 position	Function
1	0-20mA Output
2	Reset Common
3	Relay Reset
4	Common (Ground)
5	+24VDC Power

TB2 contains the connections for the Relay Contacts. The function for the Warn and Alarm Relay connections vary according to the normal state of the relay. Use the following as a guide for determining the Normally Open (NO) and the Normally Closed (NC) contact:

Alarm Relay - Normally Energized

TB2 position	Relay Contact
1	Normally Open
2	Common
3	Normally Closed

Alarm Relay - Normally De-Energized

TB2 position	Relay Contact
1	Normally Closed
2	Common
3	Normally Open

Warn Relay - Normally Energized

TB2 position	Relay Contact
4	Normally Open
5	Common
6	Normally Closed

Warn Relay - Normally De-Energized

TB2 position	Relay Contact
4	Normally Closed
5	Common
6	Normally Open

The Fault Relay contacts are always Normally Energized.

TB2 position	Relay Contact
7	Normally Open
8	Common
9	Normally Closed

Inductive loads (bells, buzzers, relays, etc.) on dry relay contacts must be clamped down (figures 8 and 9). Unclamped inductive loads can generate voltage spikes in excess of 1000 volts. Spikes of this magnitude may cause false alarms and contact damage.

**NOTE: Contact with PCB components should be avoided to prevent damage by static electricity. All wire connections are made to the Terminal Blocks.**

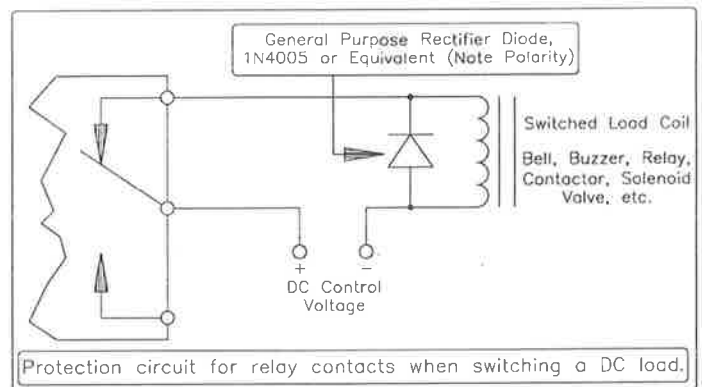


figure 8

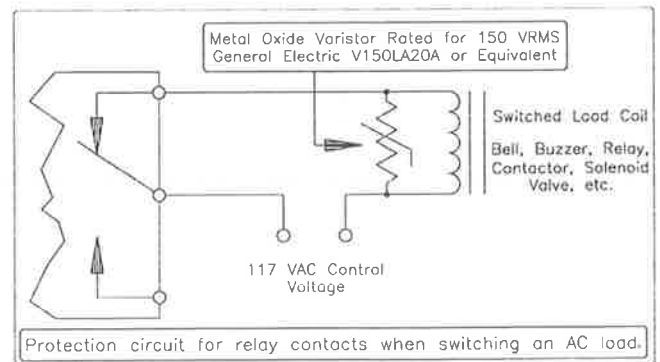


figure 9



# GENERAL MONITORS

## Model S106A

### Installation

#### Terminal Connections (continued)

It is recommended that a three wire (red, black, white) shielded cable be used for making power and output signal connections on the Model S106A. The terminal block accepts 16 AWG to 22 AWG stranded or solid wire. Each wire should be stripped before wiring the Model S106A Combustible Gas Enhanced Smart Sensor. To connect wiring to the terminal block, insert a screw driver into the orange tab and press down (figure 10), opening the terminal. Insert the wire into the terminal and release the orange tab, clamping the wire in the terminal. Check the hold of the wire by GENTLY tugging it to ensure it is locked in.

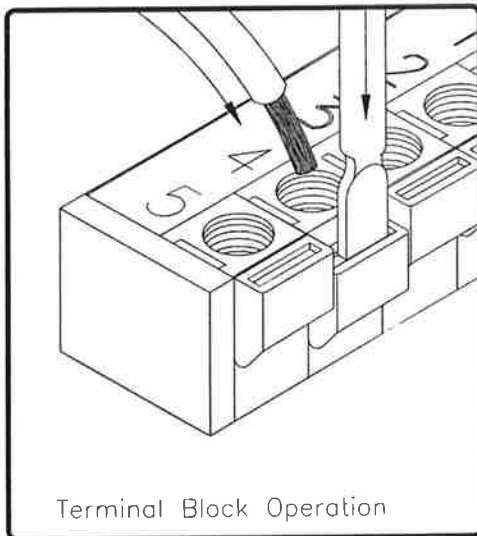
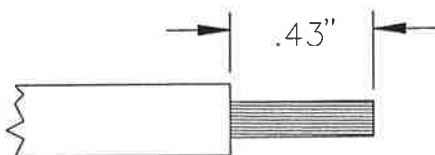


figure 10

**NOTE: up to 14 AWG wire can be used if it is carefully stripped (figure 11).**



Strip Length

figure 11

A 4 to 20mA output signal is provided by the Model S106A Combustible Gas Enhanced Smart Sensor and can be sent up to 9000 feet (2740 meters) to a General Monitors readout/relay display module, industrial analog to digital converter, computer based monitor, PLC, DCS, etc. The 4 to 20mA signal provides for control room or other locations remote to the Model S106A to display indications of operation and alarm conditions. To connect the 4 to 20mA output signal with another unit, connect the white wire into TB1, position 1, labeled 4-20 mA OUT (CE Marked units TB 4, position 1). For making output signal connections to display devices, refer to the specific manual for that device (figure 12).

FROM	TO				
MODEL S106A	MODEL DC100	MODEL DC110	MODEL DC120	MODEL DC130	MODEL TA102A
TB1 PIN 1 4-20 mA OUT	REAR PIN 3 ANALOG IN	REAR CH 1-8 4-20mA	REAR TB 1 PIN 8 or 9	REAR PIN 2 or 5 ANALOG IN	REAR PIN 26d,z

4 to 20mA Output Connections

figure 12

If a device other than a General Monitors readout/relay display module is being used, the commons, COM, of both systems must be connected together See Appendix, section 5.4. The Model S106A Combustible Gas Enhanced Smart Sensor operates on a nominal power of +24 VDC.



# GENERAL MONITORS

## Model S106A

### Installation

#### Terminal Connections (continued)

Primary DC power must be provided by the customer unless one of the following General Monitors Modules is being used with the Model S106A:

- DC100 Readout/Relay Display Module
- DC110 Readout/Relay Display Module with Power Supply & Relay Module
- DC130 Readout/Relay Display Module
- TA102A Trip Amplifier Module with a PS002

The following General Monitors Modules provide power connections for the Model S106A, but need a customer supplied DC source:

- DC110 Readout/Relay Display Module without a Power Supply & Relay Module
- DC120 Dual Channel Display Module
- TA102A Trip Amplifier Module without a PS002

Since the Model S106A is designed to operate continuously, a power switch is not included, in order to prevent accidental system shut-down.

**NOTE: Power must remain disconnected until all other wiring connections have been made.**

The maximum distance between the Model S106A and the power supply is 4500 feet or 1372 meters (each cable run should be as short as possible). See the Appendix (section 5.1.2) for cable length specifications. To connect +24VDC to the Model S106A, connect the red wire to TB1, position 5, labeled +24VDC (CE Marked units TB 4, position 3). Connect the black wire to TB1, position 4, labeled COM (CE Marked units TB 4, position 2). For making power connections to display devices see figure 13 (CE Marked units see figure 28).

### 3.5 Applying Power

Before applying power to the system for the first time, all wiring connections should be checked for correctness and the housing cover replaced. Upon first power-up the sensor may take up to fifteen minutes to stabilize.

At the initial application of power, or after a fault condition, the unit will enter a fifty second Start-Up mode. During this period the display will indicate an SU.

FROM		TO				
COMMON	MODEL S106A	MODEL DC100	MODEL DC110	MODEL DC130	MODEL TA102A	
	TB1 PIN 4 "COM"	REAR TERMINAL BLOCK PIN 5 "ANALOG COM"	REAR COMMON (8X)	REAR PIN 3 or 6 "COM"	REAR PIN 30d,z	
FROM		TO				
+24 VDC	MODEL S106A	MODEL DC100	MODEL DC110	MODEL DC130	MODEL TA102A	
	TB1 PIN 5 "+24VDC"	REAR TERMINAL BLOCK PIN 4 "DC OUT"	REAR CH1-8 24V	REAR PIN 4 or 7 "DC OUT"	REAR PIN 28d,z	

Power Connections

figure 13



# GENERAL MONITORS

## Model S106A

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## Installation

### 3.6 Maintaining the X/P Integrity

The Model S106A is rated explosion proof for Class I, Division 1, Group B, C & D hazardous locations. Some of the factors that influence the explosion proof integrity of the Model S106A housing are:

- Strength of the enclosure material
- Thickness of the enclosure walls
- Flame path between the housing and cover
- Flame path of threaded joints

The acceptable limits for explosion proof housings that are used in Class I hazardous locations are defined in CSA Standard C22.2 No.30-M1986.

Anytime the cover of the smart sensor housing is removed or the cover bolts are loosened, the flame path between the lid and the housing is effected. If power is to be left on while removing the cover or loosening the cover bolts on the Model S106A, it will be necessary to de-classify the area.

When replacing the cover, the gap between the lid and the housing should be less than .0015 inch (.038 mm). Make sure that the flame path is clear of dirt and debris before replacing the cover. This can be verified by tightening the cover bolts to a torque setting of 50 inch-pounds or by using a feeler gauge to ensure the gap between the cover and the housing is less than .0015 inch (.038 mm).

There are four entry holes, one on the left and right sides and two on the bottom of the Model S106A housing. These holes are dedicated for the sensor, the reset switch and conduit. Each hole is tapped for 3/4 NPT threads. If a particular entry hole is not used, it must be plugged during operation in the field. The factory installs plugs in the unused entry holes, except one. A red plastic cap is placed into the remaining hole and must be removed before conduit can be attached to the housing.

The Model S106A will have the following items placed in the three remaining entry holes, at the factory:

- A sensor, if present (otherwise a red plastic cap)
- A reset switch, if present (otherwise an aluminum housing plug)
- An aluminum housing plug

The sensor, reset switch and aluminum housing plug have seven threads. Each of these components is screwed into the housing using five to seven turns. If it becomes necessary to replace the sensor, reset switch and/or the aluminum housing plug, the user must use five to seven turns to ensure the explosion proof integrity of the housing is maintained.



# GENERAL MONITORS

## Model S106A

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# GENERAL MONITORS

## Model S106A

## 4.0 Operation

### 4.1 Relay Options

The Model S106A has user selectable relay options. The three types of relay options that are available for the Warn and Alarm Relays are Energized or De-Energized, Latching or Non-Latching and the Set Point. Each of these relays has one Normally Open and one Normally Closed contact.

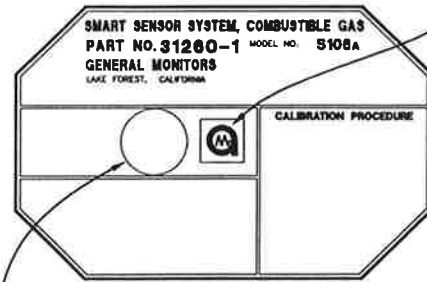
The Energized/De-Energized option specifies if the relay is to have power applied normally (energized) or if the relay is normally at mechanical rest (de-energized). The Latching/Non-Latching option specifies whether the Warn/Alarm relay contacts need to be manually reset or if they reset automatically. If the non-latching option is selected, the user should read section 5.4 in the Appendix. The set point option specifies the level of gas concentration at which the Warn/Alarm relay will activate. When the gas concentration exceeds a particular set point (Warn or Alarm, that relay will activate).

The Fault relay has no options that are user selectable options. The standard configuration for the Fault relay is Energized and Non-Latching. When a Fault condition is present the Fault circuit is activated and the Fault code appears in the display window. The Fault codes and their remedies are presented in section 4.4 of this Instruction Manual.

#### Procedure for setting the Warn & Alarm relay options:

- Place the magnet over the General Monitors' (GMI) Logo on the cover and observe the Digital Display (figure 14).

General Monitors Logo



Display Window  
figure 14

- The display will indicate a steady pair of bars “- -” (figure 15). This lets the user know that the magnet has been properly placed over the GMI Logo.

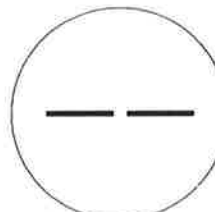


figure 15

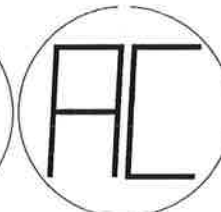


figure 16

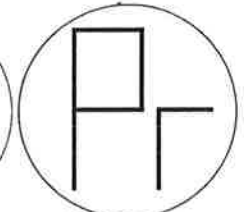


figure 17

- Keep the magnet placed over the Logo. Next, a flashing pair of bars “- -” will appear on the display, then the letters “AC” (figure 16) followed by “Pr” (figure 17). Then the letters “AL” will appear.
- When the letters “AL” (figure 18) appear on the display, remove the magnet. This is the Warn / Alarm Relay Options Mode. The Warn relay options will be selected first, then the Alarm options. The Warn & Alarm relay option sequences are identical.



figure 18



# GENERAL MONITORS

## Model S106A

### Operation

#### Relay Options (*continued*)

- The display will alternate between “En” and “dE” (figure 19), until the magnet is re-applied. Apply and remove the magnet when the desired option appears on the display. “En” stands for Energized and “dE” stands for De-Energized. When this selection has been made, the next option will appear.

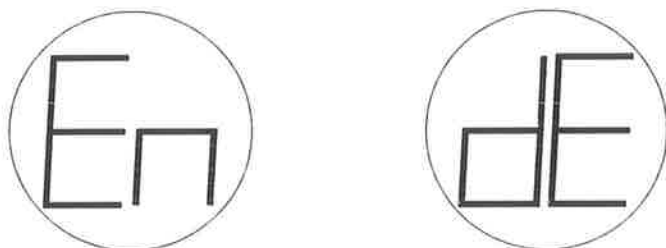


figure 19

- The display will alternate between “LA” and “nL” (figure 20), until the magnet is re-applied. Apply and remove the magnet when the desired option appears on the display. “LA” stands for Latching and “nL” stands for Non-Latching. When this selection has been made, the next option will appear.

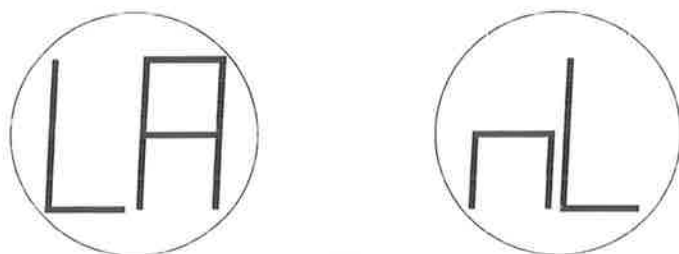


figure 20

- The display will sequence through the Warn Set Point Levels beginning with “5” and increasing in increments of 5 up to “60” and then back to “5” (figure 21),

where the the display will increase again in increments of 5. Apply and remove the magnet when the desired Warn Set Point appears on the display.

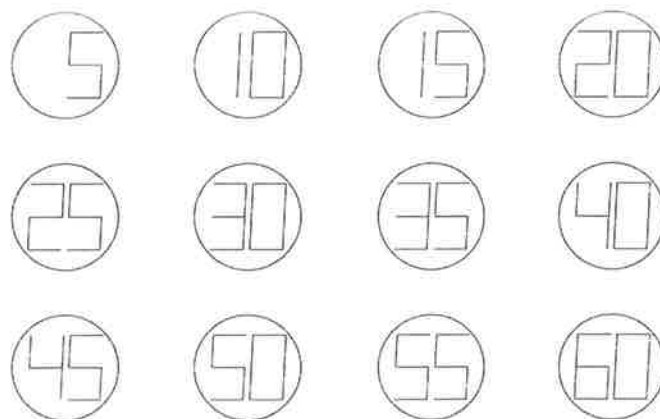


figure 21

- When this selection has been made, the Alarm sequence will begin and the same options will need to be set for the Alarm relay.
- The Energized/De-Energized option for the Alarm relay will be displayed as in figure 19.
- The Latching/Non-Latching option for the Alarm relay will be displayed as in figure 20.
- Finally, the Alarm Set Point option will be displayed as in figure 21 (cannot be lower than the Warn set point).

**NOTE:** After the Warn and Alarm relay options are selected the Model S106A will revert to the calibration mode and must be calibrated.



# GENERAL MONITORS

## Model S106A

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## Operation

### 4.2 Program Review Mode

The Program Review (Pr) Mode allows the operator to view the relay options that have been selected for the Warn & Alarm relays. To enter the Program Review Mode place the magnet over the GMI logo on the cover and wait until “Pr” appears in the display window. Then remove the magnet.

The display will indicate the Warn options and then the Alarm options in the sequence listed below:

- Warn Relay Options

Energized (En) or De-Energized (dE)  
Latching (LA) or Non-Latching (nL)  
Warn Set Point (#)

- Alarm Relay Options

Energized (En) or De-Energized (dE)  
Latching (LA) or Non-Latching (nL)  
Alarm Set Point (#)

Each selection will be displayed for approximately 5 seconds before sequencing to the next option. When the last option has been displayed the unit will return to normal operation.

**NOTE : The Program Review Mode does not allow the operator to make changes to the relay options.**

### 4.3 Calibration

Activating the Calibration Switch will automatically disable the alarm circuits by sending a 1.5mA (0mA optional) output signal. This will prevent activation of the relay contacts when using a General Monitors Readout/Relay Display Module with the Model S106A.

General Monitors recommends that the Model S106A Combustible Gas Enhanced Smart Sensor be calibrated one hour after start-up, and that calibration be checked at least every ninety (90) days to ensure system integrity. General Monitors is not implying that the customer should expect problems with sensor life or stability but “frequent” calibration checks merely ensure the integrity of the life protecting equipment.

The above statement is not intended to discourage the customer from checking calibration more frequently. Frequent calibration checks are recommended for environments that have problems such as mud collecting on the sensor head, sensors accidentally being painted over, etc.

**NOTE: A calibration check consists of applying a known concentration of gas to the sensor and observing the reading on the Model S106A, the Readout/Relay Module, or other computer data collecting systems.**

General Monitors recommends that a calibration schedule be established and followed. A log book should also be kept showing calibration dates and dates of sensor replacement.

#### Calibration Procedure:

- If it is suspected that combustible gas is present, it will be necessary to purge the sensor environment with *Zero Air*. If *Zero Air* is not available, cover the sensor for about thirty seconds before applying the calibration gas. *Zero Air* is air that is hydrocarbon free.





# GENERAL MONITORS

## Model S106A

### Operation

#### Calibration (continued)

- Place the magnet over the GMI Logo on the cover (figure 14) of the unit and hold it there until "AC" (figure 16) appears on the display (about ten seconds). Allow about five seconds for the unit to acquire the zero reading before applying the calibration gas. If the GMI Portable Purge Calibrator (P/N 1400150) is **not** used when calibrating the Model S106A with Methane (CH<sub>4</sub>), the SPAN gas flow rate needs to be 440cc/min to 460cc/min. See Appendix, section 5.4.

- Apply a 50% LEL gas concentration to the sensor. The display will change from "AC" (Automatic Calibration) to "CP" (Calibration in Progress) indicating that the sensor is responding to the calibration gas (figure 22).

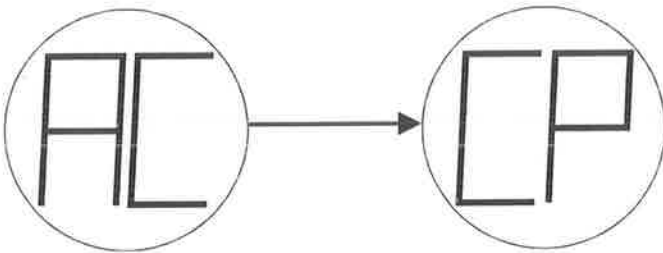


figure 22

- After one or two minutes the display will change from "CP" to "CC" (figure 23) indicating that the calibration is complete.

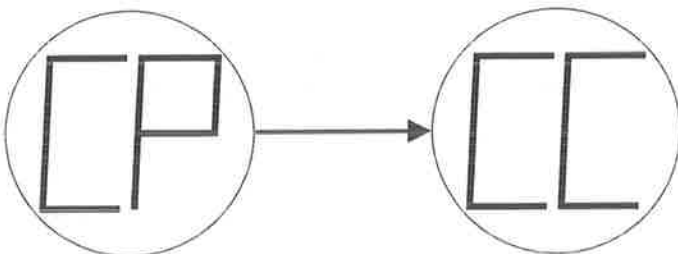


figure 23

- Remove the gas and wait for the unit to return to normal operation. The display will indicate a few percent LEL and then drop to "0" (figure 24).

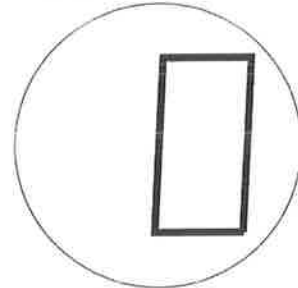


figure 24

- The unit is now calibrated and the new ZERO and SPAN values have been stored in the non-volatile memory (EEPROM).

The Model S106A can be returned to normal operation, if the magnet is re-applied ninety seconds after initiating the calibration sequence (with the old calibration values valid).

If the Model S106A is placed in the Calibration Mode and no gas is applied for six minutes, the unit will revert to a Fault condition. Re-applying the magnet over the GMI Logo will return the unit to the Calibration mode (with the old calibration values valid).

#### Calibration Check Mode:

If it is desired to check the sensor for its response without sending a gas concentration signal to a remote display device, this can be accomplished by placing the Model S106A into the "Calibration Check" mode. Placing the S106A in this mode inhibits the Warn & Alarm relays.



# GENERAL MONITORS

## Model S106A

## Operation

### Calibration *(continued)*

Procedure for checking the calibration:

- Place the magnet over the GMI Logo on the cover of the Model S106A. Remove the magnet when a **flashing** pair of bars, “- -”, appears on the display (about three seconds).

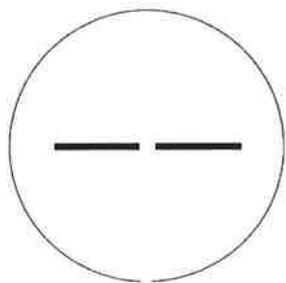


figure 25

- Apply the test gas to the sensor and the value of the gas concentration will be indicated by the flashing display in one to two minutes.
- When the reading has stabilized and the test is complete, remove the gas and the unit will return to normal operation when the concentration drops below 5% LEL.

The test gas concentration must be at least 10% LEL before the unit will complete the Calibration Check sequence. If the Model S106A is placed in the Calibration Check mode and no gas is applied for six minutes, the unit will revert to a Fault condition. Re-applying the magnet over the GMI Logo will return the unit to normal operation.

### Calibration Equipment:

The **Portable Purge Calibrator** is a compact, accurate and safe system containing no explosive gas concentration. The lecture bottle is filled with a standard 50% LEL mixture of gas/air. Using a known gas/air

mixture reduces the likelihood of error in field calibration. The included hose and cup adapter allow for quick calibrations.

Pre-mixed calibration gases at approximately 50% LEL are available, in lecture bottles, at 1200 psia, 8.3 MPa maximum pressure.

- Butadiene  $C_4H_6$
- Butane  $C_4H_{10}$
- Ethane  $C_2H_6$
- Hydrogen  $H_2$
- Methane  $CH_4$
- Propane  $C_3H_8$

Please specify the gas upon ordering. Spare bottles containing these gases may be ordered. Methane and Hydrogen lecture bottles may be returned to General Monitors for refilling.

The **Portable Calibration Chamber** is a 3 liter (3000 cc) sample chamber with a spring driven mixing fan. A porthole allows the chamber to be placed on the sensor for calibration. A syringe is included for accurate measurement of volatile test liquids. Sensors should be calibrated to a specific vapor for greatest accuracy. A hydrocarbon sensor calibrated for 50% LEL Acetone, for example, will detect all hydrocarbons and most combustible solvent vapors, however, it will accurately read ONLY the % LEL of Acetone.

The indicated measures of volatile liquids found on the next page produces 50% LEL vapor mixtures at 75° Fahrenheit (25° Celsius) temperature and standard pressure when used with the Portable Calibration Chamber (see Appendix, section 5.4).



# GENERAL MONITORS

## Model S106A

### Operation

#### Calibration (continued)

*Volatile liquids are not supplied by General Monitors. Below is a list of volatile liquids and the volume required (in microliters) to produce 50% LEL in the 3 liter chamber.*

Acetaldehyde	136
Acetic Acid	140
Acetone	112
Acetonitrile	96
Acrylonitrile	120
Amyl Acetate	100
Amylamine	156
Benzene	65
Butyl Acetate	137
Butyl Acrylate	132
Butyl Alcohol	78
sec-Butyl Alcohol	95
tert-Butyl Alcohol	138
Butyl Cellosolve	88
Butyraldehyde	102
Cyclohexane	86
Decane	95
Diethyl Ketone	103
Diisobutyl Ketone	82
Dimethylformamide	104
p-Dioxane	104
Dodecane	83
Ethanol (Ethyl Alcohol)	118
Ethyl Acetate	119
Ethyl Amine	140
Ethyl Benzene	60
Ethyl Ether	120
Ethylene Oxide	89
Gasoline 100 Octane	107
Heptane, Normal	94
Hexane, Normal	86
Isopentane	99
Isoprene	89
Isopropyl Alcohol	93
Isopropyl Ether	120
JP-4 Jet Fuel	183
Methanol	148
Methyl Ethyl Ketone (MEK)	76
Methyl Methacrylate	111
Naptha (Petroleum Ether)	96
Octane	99
Pentane, Normal	106
Propanal	114
Propyl Acetate	106
Propylamine	103
Propylbenzene	68
Propylene Oxide	98
Styrene	63
Tetradecane	79
Tetrahydrofuran	99
Tetrahydrofurfuryl Alcohol	89
Toluene	78
1,1,1-Trichlorethane	456
Trichloroethylene	438
Triethylamine	102
Vinyl Acetate	152
Vinyl Ethyl Ether	99
o-Xylene	67
p-Xylene	83
Xylenes	83

REFERENCE NFPA-1994

#### 4.4 Digital Display Codes

The following codes will appear on the display when then unit is placed in a mode other than the normal operating mode.

SU	Start-Up Mode
-- (steady)	Magnetic Switch Activated
-- (flashing)	Test Gas Mode
AC	Automatic Calibration
CP	Calibration in Progress
CC	Calibration is Complete
AL	Alarm Options Mode
Pr	Program Review
En	Energized Relay Option
dE	De-Energized Relay Option
LA	Latching Relay Option
nL	Non-Latching Relay Option
5,10,...,60	Alarm Set Point Option
F1	Failed to Zero during calibration
F2	Failed to complete the calibration
F3	Failed to Span during calibration
F4	Sensor Reference Bead Error
F5	Sensor Active Bead Error
F6	Low Supply Voltage
F7	EEPROM Verification Failure
F8	Negative Zero Drift
F9	Calibration check period exceeded

SU This is displayed for about fifty seconds during start-up and after a Fault condition has been corrected.

-- Appears on the display when the magnet has been properly positioned over the GMI Logo and when the Test Gas Mode can be or has been entered.



# GENERAL MONITORS

## Model S106A

### Operation

#### Digital Display Codes (*continued*)

**AC**            These codes appear on the display during the calibration process. For more information about these codes, refer to Section 4.3.

**AL, Pr**        These codes are used for selecting and viewing the Warn & Alarm Relay options. For more information about these codes, refer to section 4.1.

**F1,F2,F3**      These codes will appear on the display if a Fault condition occurs. For more information about these codes, refer to Section 4.5.

When the unit is in the normal operating mode, the display will indicate the presence of combustible gas in percent of the Lower Explosive Level (% LEL). The range of detection is from 0 to 99% LEL.

**99 (flashing)** Over-Range, a gas concentration exceeding 99% LEL is present.

#### 4.5 Fault Codes & Their Remedies

The Model S106A has self-diagnostics incorporated into the microprocessor's program. If a Fault is detected, the output signal will drop to 0mA, the Fault relay will de-energize and a Fault code will be displayed. The output signal will inform a remote display module that the Model S106A is in the Fault Mode. The display will indicate a Fault code that can be viewed at the sensor site. There are nine Fault conditions that are monitored by the microprocessor.

When a Calibration Fault (F1, F2, F3) has occurred and has been corrected, the unit will automatically revert to the calibration process and the unit must be re-calibrated. If a Fault other than a Calibration Fault occurs, after it is corrected the unit will return to the Start-Up Mode (SU).

#### Fault Codes and their Remedies:

**F1 = Failed to Zero during Calibration**

**Faulty Sensor** - If both Catalytic Beads are not closely matched. This may happen as a sensor approaches the end of its useful life or if the Beads have become corroded. **ACTION** - Replace the sensor.

**Gas Present** - If the magnet was applied with a high level of gas present, the Model S106A will not be able to obtain a valid ZERO. **ACTION** - Ensure the sensor is in clean air.

**F2 = Failed to complete the Calibration**

This Fault will occur if the unit is placed in the calibration mode and no gas has been applied within six minutes. **ACTION** - Make sure there is calibration gas present, re-apply magnet and attempt to calibrate.

**F3 = Failed to Span during Calibration**

**Low Gas** - If the gas concentration applied to the unit does not give sufficient response for a valid SPAN parameter. **ACTION** - Use the correct gas concentration, i.e. 50% LEL.

**Bad Sensor** - If the sensor response has gone below an acceptable level. **ACTION** - Replace the sensor.



# GENERAL MONITORS

## Model S106A

### Operation

#### Fault Codes & Their Remedies (*continued*)

**NOTE:** If the unit fails to calibrate and an F1 or an F3 code is displayed, the calibration gas must be removed, and the sensor must see clean air for at least five minutes before a second calibration is initiated.

#### F4 = Sensor Reference Bead Error

This fault may occur as a result of one of the following:

- excessive negative drift
- an open sensor reference bead
- the sensor BLACK wire is disconnected

**ACTION** - Attempt to recalibrate the unit. If this is unsuccessful make sure that the BLACK sensor wire is connected to the terminal block. If these actions do not cure the fault condition, then replace the sensor.

#### F5 = Sensor Active Bead Error

This fault occurs if the sensor active bead becomes open circuited or, if the sensor WHITE or the sensor RED lead becomes disconnected. **ACTION** - Check the WHITE and RED wires then replace the sensor.

#### F6 = Low Supply Voltage

This fault occurs if the supply voltage drops below +17.5VDC approximately. **ACTION** - Ensure that the supply voltage is at least +20VDC at the Model S106A.

Correcting Fault conditions F4 through F9 will initiate the Start-Up Mode.

**NOTE:** With long supply leads, a considerable voltage drop may occur due to the electrical resistance of the leads.

The maximum cable resistance which the Model S106A can tolerate is dependent on the supply voltage.

A maximum of 20 ohms per conductor (40 ohms loop) at +24VDC minimum, or a maximum of 10 ohms per conductor (20 ohms loop) at +20VDC minimum.

#### F7 = EEPROM Verification Failure

This fault occurs during calibration when an attempt to verify the calibration parameters just written to the non-volatile memory fails. **ACTION** - Place the magnet over the GMI Logo and the unit will attempt another EEPROM write and verify.

#### F8 = Negative Zero Drift

If the zero baseline of the sensor drifts 10% of full scale below zero for more than 20 seconds this fault will occur. **ACTION** - A routine re-calibration will be required.

#### F9 = Calibration Check Period Exceeded

If the Model S106A is left in the Test Gas Mode for more than six minutes without a Test Gas being applied, this fault will occur. **ACTION** - Place the magnet over the General Monitors Logo to return the unit to normal operation.

**NOTE:** Anytime a sensor is replaced, the unit should be disconnected from all alarms, as the unit may go upscale upon power-up.



# GENERAL MONITORS

## Model S106A

### 5.0 Appendix

#### 5.1 Specifications

##### 5.1.1 System Specifications

Sensor Type:  
Diffusion, low temp. catalytic bead

Standard industrial types: Combustible Gas; Solvent Special; Standard and High Temperature Versions (See section 5.3)

Typical Life: 3 years in normal service

Accuracy:  
±3% LEL up to 50% LEL, ±5% LEL above 50% LEL and less than 100% LEL

Zero Drift:  
Less than 5% per year

Response Time:  
With 100% LEL Methane Applied,  
T50 < 10 sec. & T90 < 30 sec.

Readout/Relay Modules (See section 5.4):

DC100	Single Channel Display
DC110	Eight Channel Display
DC120	X/P, Dual Channel Display
DC130	Dual Channel Display
TA102A	Single Channel, 02 Series

Fault Conditions Monitored:  
Low DC Supply, Sensor Bead Open,  
Calib. Out of Range, EEPROM Failure

Warranty:  
Two Years

Approvals:  
CSA certified to C22.2 No.152

Cenelec certified (with SST flame arrestor sensors only)

FMRC Approved.

CE Mark approval against EMC Directive and Product Safety

##### 5.1.2 Electrical Specifications

Input Power:  
24 VDC @ 250 mA nom., 1A during SU  
20 to 30 VDC range

Output Current: (0-22mA @ 300 Ohms max. load)

Fault:	0.0mA
Calibration:	1.5mA (0mA optional)
Test Gas:	1.5mA (always)
Relay Options:	1.5mA (always)
0-100%LEL:	4 to 20mA
Over-range:	20 to 22mA

Electrical Classification:  
Class I, Division 1, Groups B, C & D  
NEMA 4x rated

Alarm, Warn & Fault Relay Contact Rating:  
SPDT - 5A 250VAC, 5A 30VDC,  
resistive max.

Recommend Three Wire Shielded Cable:

Maximum distance between the Model S106A and the power source.

<u>AWG</u>	<u>Feet</u>	<u>Meters</u>
22	750	228
20	1100	335
18	1600	488
16	2250	685
14	4500	1372



# GENERAL MONITORS

## Model S106A

## Appendix

### Specifications (*continued*)

#### Electrical Specifications (*continued.*)

For interfacing with 250 ohm input impedance devices, the following maximum cable lengths apply, with respect to the Analog Signal, with the total loop resistance less than 300 ohms.

<u>AWG</u>	<u>Feet</u>	<u>Meters</u>
22	1600	488
20	2400	730
18	3800	1160
16	5200	1585
14	9000	2740

**NOTE:** Good design practices dictate cable lengths conservatively shorter than the maximum given values.

#### 5.1.3 Mechanical Specifications

Weight (approx)	5.5 LB	2.5 kg
Length	6.34 in.	161 mm
Height (w/bolts)	3.40 in.	86 mm
Width at the base	4.10 in.	104 mm
Between mounting hole centers	4.99 in.	127 mm
Between outside edges of mounting flanges	6.00 in.	152 mm

#### 5.1.4 Environmental Specifications

Operating Temperature Range:  
Sensor (See section 5.4)  
-65°F to 200°F  
-55°C to 93°C

High Temperature Sensor (See section 5.4)  
-65°F to 400°F  
-55°C to 200°C

Electronics (pc board assemblies)  
-40°F to 140°F  
-40°C to 60°C

Storage Temperature Range:  
(Smart Sensor Assembly)  
-58°F to 158°F  
-50°C to 70°C

Humidity Range:  
10 to 95% Relative Humidity  
(non-condensing)



# GENERAL MONITORS

## Model S106A

### Appendix

#### 5.2 Engineering Documentation

##### 5.2.1 Termination & Outline Drawings

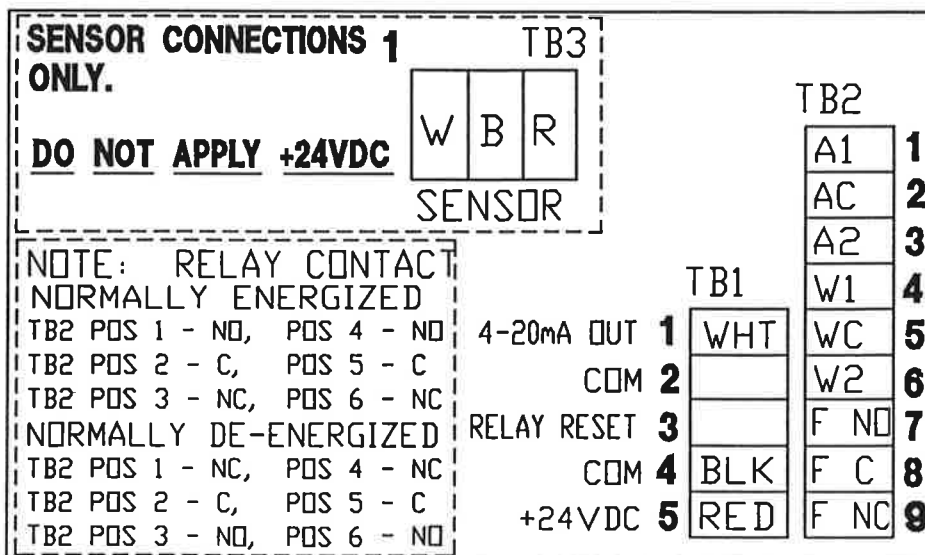
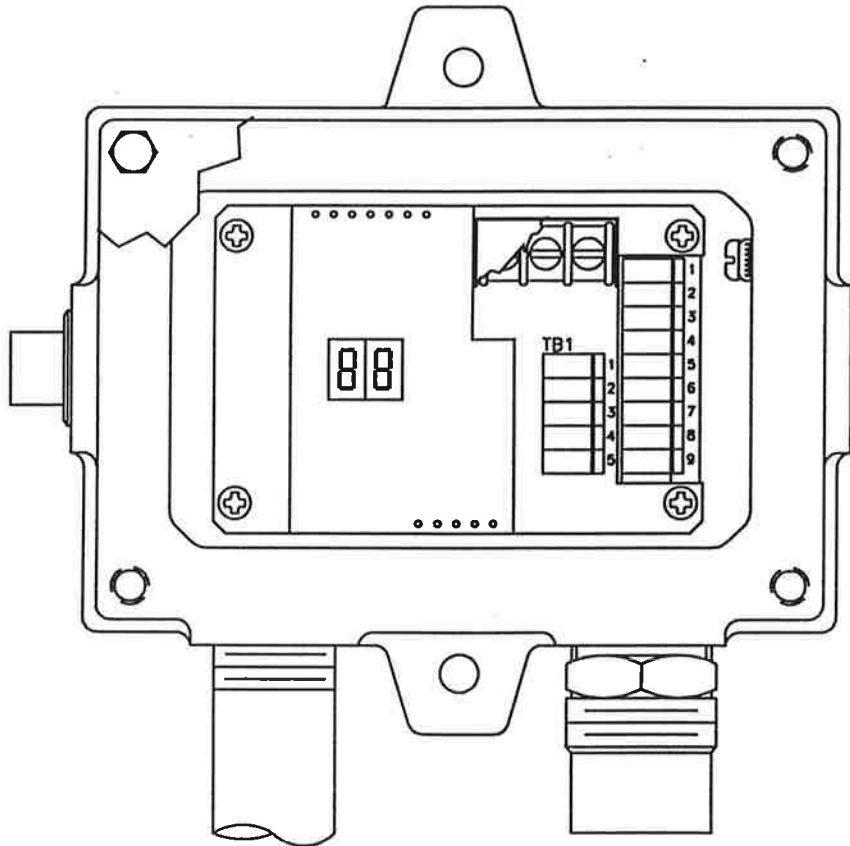


figure 26





# GENERAL MONITORS

## Model S106A

### Appendix

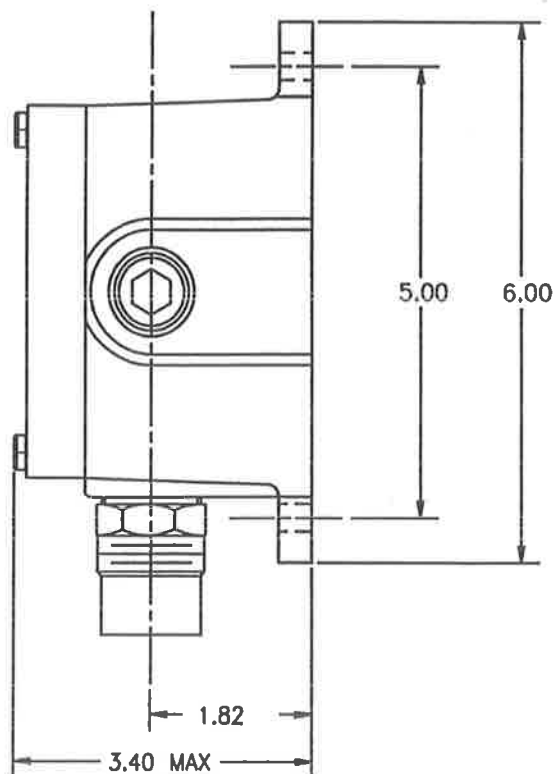
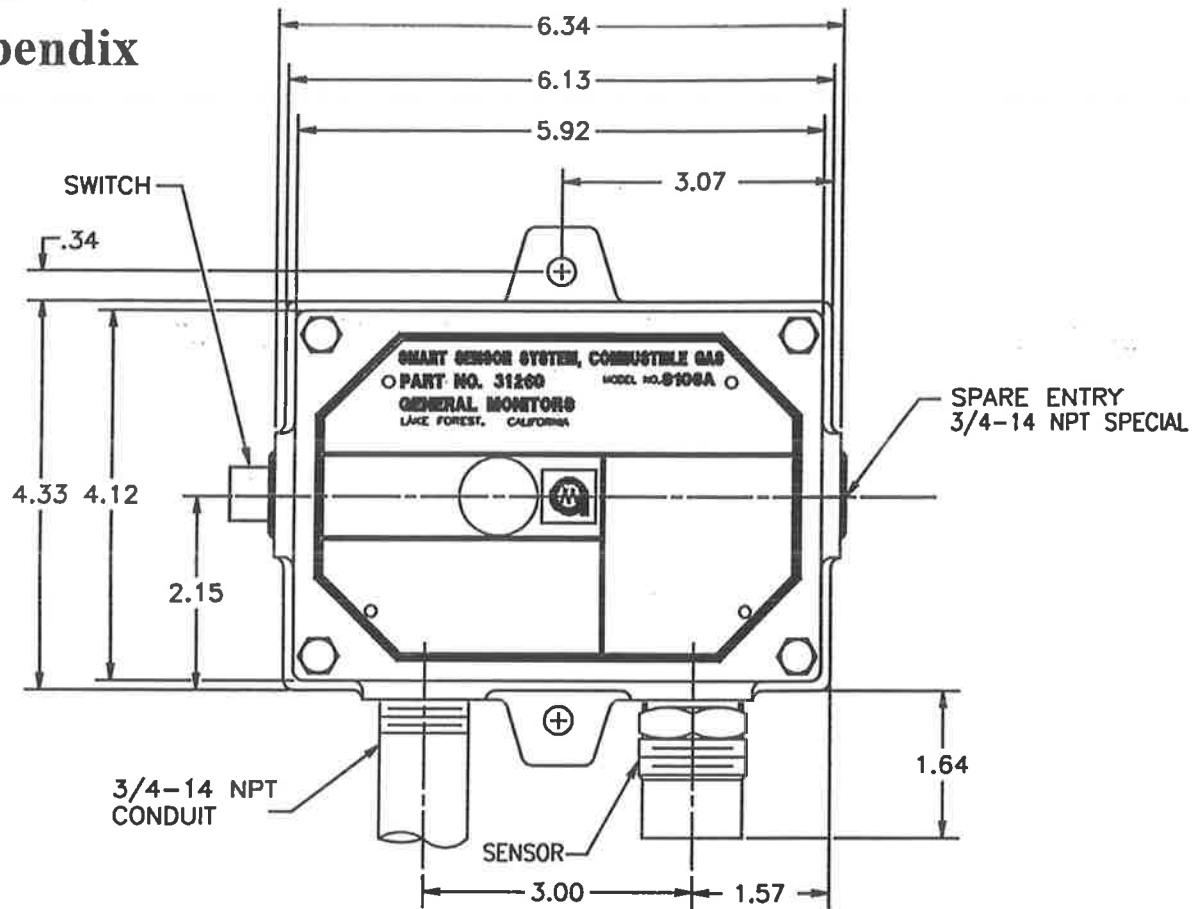


figure 27



# GENERAL MONITORS

## Model S106A

### Appendix

#### 5.2.2 Termination Drawing

#### CE Marked Units

HOUSING WITH COVER REMOVED FOR CLARITY

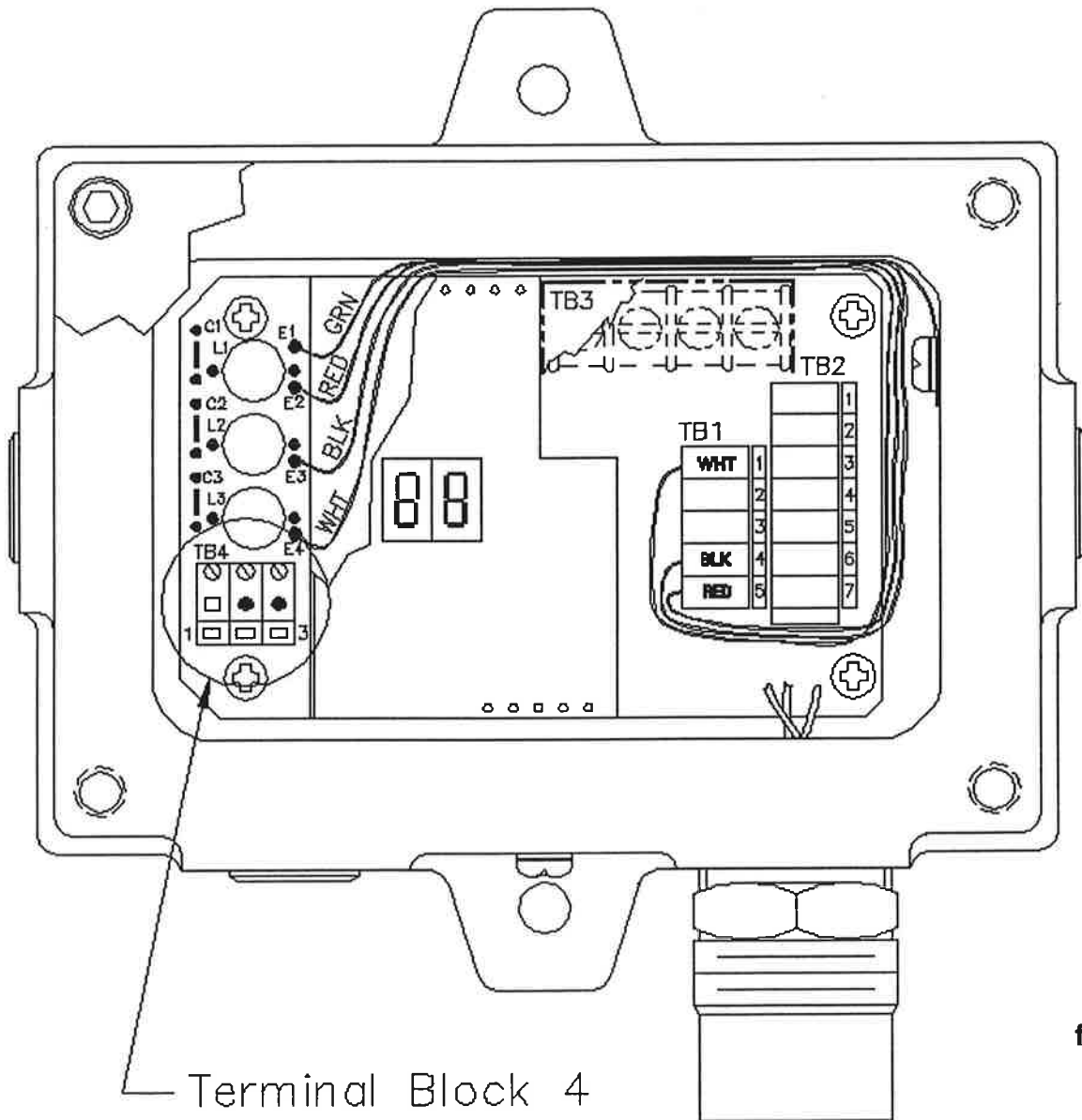


figure 28

- Position 1 – Analog (4–20 mA) White
- Position 2 – Common (–24 Vdc) Black
- Position 3 – Power (+24 Vdc) Red



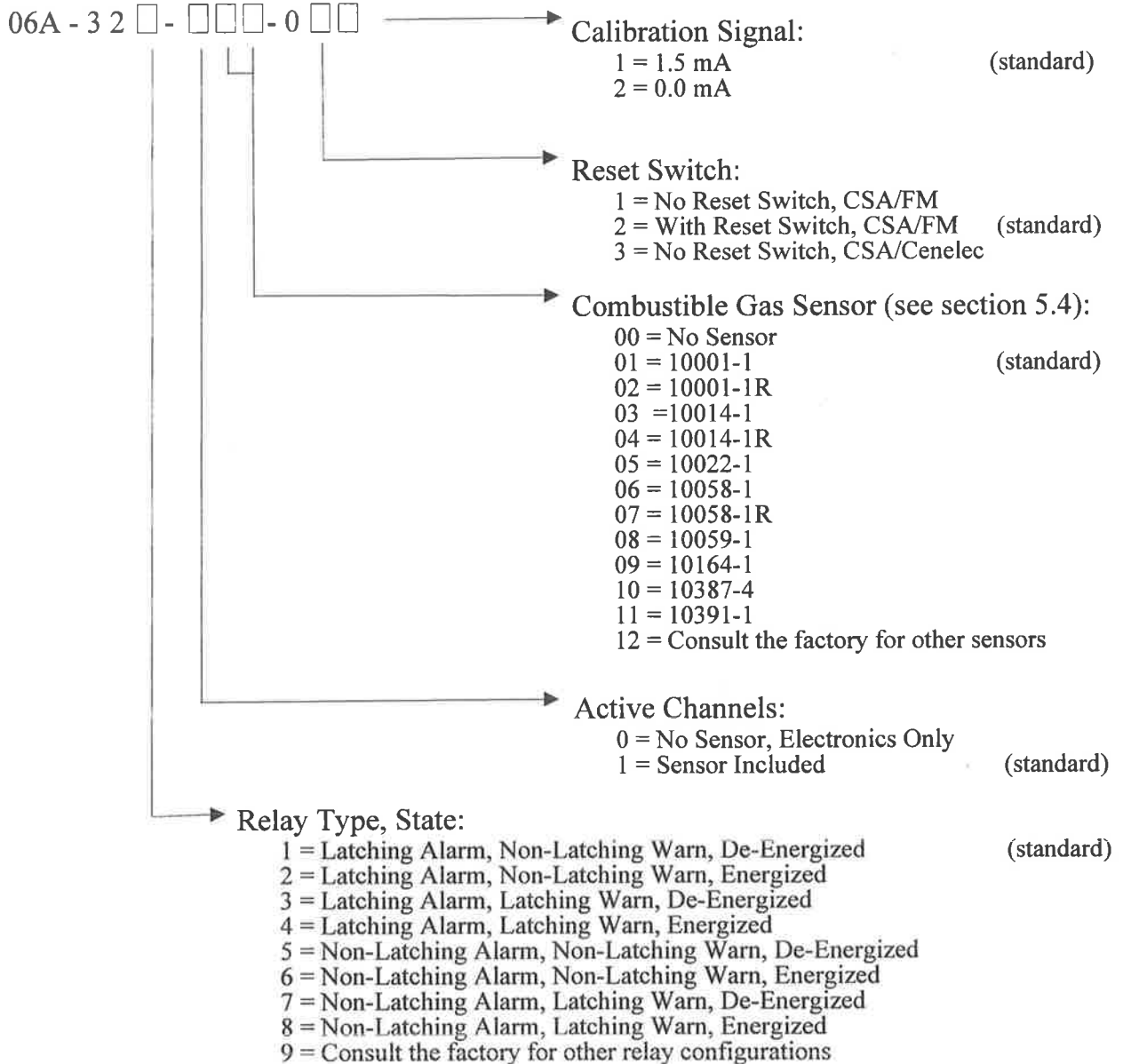
# GENERAL MONITORS

## Model S106A

### Appendix

#### 5.3 Ordering Information

##### 5.3.1 Configuration Codes



The Standard Configuration for the Model S106A is: **S106A-321-101-021**



# GENERAL MONITORS

## Model S106A

### Appendix

#### 5.3.2 Spare Parts & Accessories

To order spare parts and/or accessories, please contact your nearest General Monitors Representative or General Monitors directly and give the following information:

- Part Number of Spare Part or Accessory
- Description of Spare Part or Accessory
- Quantity of Spare Part or Accessory

#### Sensors:

10001-1	General Purpose, Alum.,
10001-1R	General Purpose, Alum., Poison Resistant
10014-1	General Purpose, Alum., High Temperature
10014-1R	General Purpose, Alum., Hi-Temp, Poison Resistant
10022-1	General Purpose, Alum., Industrial PTB
10058-1	General Purpose, SST
10058-1R	General Purpose, SST, Poison Resistant
10059-1	General Purpose, SST, Industrial PTB
10164-1	Hydrogen Specific, Alum.
10387-4	General Purpose, Alum., Super Poison Resistant
10391-1	General Purpose, SST, Hi-Temperature
10102-1	Dummy Sensor

#### Sensor Housing:

10252                      Universal Housing

#### Sensor Accessories:

10460-2                      Test Gas Applicator  
 10041                        Duct Mounting Plate  
 10044-1                      Dust Guard Kit - 1 Guard  
                                     12 Replaceable Screens  
 10042-1                      Replaceable Screens,  
                                     Box of 12  
 10395-1                      Splash Guard Assembly  
 50060-1                      H<sub>2</sub>S Guard Filter  
 50061-1                      Purafil Insert Assembly  
 10110-1                      Dust Guard Assembly  
 1800822                      Dust Guard, Sintered  
 SST

#### Calibration Equipment:

10221-1                      Model RC-3, Remote  
                                     Calibrator Assembly  
 10378-1                      RC-3 Interconnection  
                                     Assembly  
 10345-1                      RC-3 Position Indicator  
 10375-1                      RC-3 Battery Assembly  
 10233-1                      RC-3 Wind Shield  
 1400200                      3 Liter CAL Chamber  
                                     with syringe  
 1400204                      Fan Motor for the 3 liter  
                                     Chamber  
 1400207                      Fan Blade for the 3 liter  
                                     Chamber



# GENERAL MONITORS

## Model S106A

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### Appendix

#### Calibration Equipment (*continued*):

928-700 Chamber	Dish for the 3 liter	Cylinder refills are available for Methane and Hydrogen only. Replacement cylinders must be ordered for the other gases.	
928-715	250 microliter syringe		
1400150-M Calibrator,	Portable Purge	922-009 Gauge	Pressure Regulator
	Methane @ 50% LEL	1400152-1	Small Calibration Cup
1400150-H Calibrator,	Portable Purge	1400154	Large Calibration Cup
	Hydrogen @ 50% LEL	Smart Sensor (S106A) Replacement Parts:	
1400150-BD Calibrator,	Portable Purge	31265-1 Electronics	Control Board
	Butadiene @ 50% LEL	31270-1 Electronics	Converter Board
1400150-B Calibrator,	Portable Purge	30080-1 Electronics	Display Board
	Butane @ 50% LEL	10884-8	Cover Assembly
1400150-E Calibrator,	Portable Purge	30051-1	Explosion-Proof SPST Switch
	Ethane @ 50% LEL	30060-1	Calibration Magnet
1400150-PR Calibrator,	Portable Purge	925-5007	Cover Assy O-Ring
	Propane @ 50% LEL	Recommended Spare Parts for One (1) Year:	
1400155-M	Replacement Cylinder, Methane @ 50% LEL	1	Extra Calibration Magnet (30060-1)
1400155-H	Replacement Cylinder, Hydrogen @ 50% LEL		
1400155-BD	Replacement Cylinder, Butadiene @ 50% LEL		
1400155-B	Replacement Cylinder, Butane @ 50% LEL		
1400155-E	Replacement Cylinder, Ethane @ 50% LEL		
1400155-PR	Replacement Cylinder, Propane @ 50% LEL		



## Appendix

### 5.4 FMRC Approval

Factory Mutual Research Corporation  
1151 Boston-Providence Turnpike  
Norwood, Massachusetts 02062

Approval of the transmitter does not include or imply approval of apparatus to which the transmitter may be connected and which process the electronic signal for the eventual end use. In order to maintain FMRC approved system, the control instrument, to which the subject instrument is connected, must be FMRC approved.

The following sensors have been FMRC approved for use with the Model S106A:

- 10001-1 Aluminum Body General Purpose Combustible Gas Sensor
- 10058-1 Stainless Steel Body General Purpose Combustible Gas Sensor

The following apparatus have been FMRC approved (although they have not been verified as part of a Model S106A system):

- Model DC100 Single Channel Readout Relay Display Module
- Model DC110 Eight Channel Readout Relay Display Module
- Model DC120 Explosion Proof Dual Channel Readout Relay Display Module
- Model DC130 Dual Channel Readout Relay Display Module

Factory Mutual Research Corporation has tested the Model S106A according to the criteria listed under the FMRC Approval Standards for Combustible Gas Detector, Class Numbers 6310 & 6320.

FMRC has tested the Model S106A using the specifications listed in section 5.1 (of this instruction manual), permitting an operating temperature of -40°F to +140°F (-40°C to +60°C), a general purpose sensor (10001-1 or 10058-1) attached to the housing (i.e. not remoted), calibration performed with a General Monitors' Portable Purge Calibrator using 50% LEL gas (Methane, Hydrogen, Butadiene, Butane, Ethane or Propane) and the procedure listed in section 4.3 of this (instruction manual). The conduit containing wires connected to the relay contacts must be sealed. If the non-latching relay option has been selected, from the relay options, the user must provide alternate means of latching the relay output.



# GENERAL MONITORS

## Model S106A

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## GENERAL MONITORS

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email: [gmmac@mistral.co.uk](mailto:gmmac@mistral.co.uk)





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 Hanburg Compressor SERVICE : LEVEL CONTROLLER				NO	BY	DATE	REVISION	SPEC NO	FILE 14.11.L		
				0	TK	01/27/00	FOR PURCHASE	JOB #	99420		
								DATE			
								REQ.			
				BY	CHK'D	APPR.					
				GWW							
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							
4	BODY OR CAGE MATERIAL	CS	CS	CS							
	RATING	300#	300#	600#							
B O D Y	CONN. SIZE	LOC. UPPER	60 mm	60 mm	60 mm						
	TYPE	NPT	NPT	NPT							
	CONN. SIZE	LOC. LOWER	mm	mm	mm						
	TYPE										
/	CASE MOUNTING (RH, LH, TOP)										
	TYPE	INTERNAL	INTERNAL	INTERNAL							
A	ROTATABLE HEAD										
8											
9											
E	10	ORIENTATION	VERTICAL	VERTICAL	VERTICAL						
	11	COOLING EXTENSION									
	12										
D I S /	13	DIMENSIONS	48 OD x 305 mm	48 OD x 305 mm	48 OD x 305 mm						
	14	INSERTION DEPTH	STD mm	STD mm	STD mm						
	15	DISPLACER EXTENSION	--- mm	--- mm	--- mm						
	16	DISP. OR FLOAT MATERIAL	304SS	304SS	304SS						
F L O	17	DISPLACER SPRING/TUBE MTL	K-MONEL	K-MONEL	K-MONEL						
	18										
	19										
X M T R	20	FUNCTION	CONTROLLER	CONTROLLER	CONTROLLER						
	21	OUTPUT	35 KPAG	35 KPAG	35 KPAG						
	22	CONTROL MODES	ON-OFF	ON-OFF	ON-OFF						
	23	DIFFERENTIAL									
	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						
	28										
S E R V I C E	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	0.65	1.00	0.65	1.00	0.65	1.00		
	32	PRES. MAX.	PRES. NORMAL	4516 kPa(g)	483 kPa(g)	4516 kPa(g)	1302 kPa(g)	8720 kPa(g)	3608 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 P T I O N S	36	AIRSET	SUPPLY GAGE	YES		YES		YES			
	37	GAGE GLASS CONNECTIONS									
	38	GAGE GLASS MODEL NO.									
	39	CONT: NUM	CONT: FORM								
	40	CONTACT RATING									
	41	ACTION OF CONTACTS									
	42										
	43										
	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				
								SPEC NO		FILE 14,11,L		
CUSTOMER : Apache Canada Limited				NO	BY	DATE	REVISION			JOB # 99420		
PLANT : 1478HP Hamburg Compressor				0	TK	01/27/00	FOR PURCHASE			DATE		
SERVICE : LEVEL GAUGE- ENGINE AND COMPRESSOR UTILITIES				1	CG	7/20/00	LG-130 WAS TUBULAR			REQ.		
										BY	CHK'D	APPR.
										GWW		

1. GAGE COLUMN \_\_\_\_\_ COCKS \_\_\_\_\_  
ASSEMB. WITH NIPPLES \_\_\_\_\_ 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 \_\_\_\_\_

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				
260	0	1	SHOP CUT			Atm.	20	Atm.	121	No	COMP. OIL SUPPLY	T-260	152
235A	0	1	SHOP CUT			48	82	97	121	No	JACKET WATER	T-235A	152
235B	0	1	SHOP CUT			48	54	97	121	No	AUX. WATER	T-235B	152
284	0	1	SHOP CUT			Atm.	20	Atm.	121	No	WASTE OIL	T-284	152
270	0	1	SHOP CUT			Atm.	20	Atm.	121	No	ENG. OIL SUPPLY	T-270	152
130	2	1	321		1RL9	14	20	101	121	No	SEAL POT	NOTE 1	152

MFR: PENBERTHY

MODEL NUMBER: TUBULAR, c/w N7A Valves

P.O. NUMBER:

NOTES: 1: c/w 330J GAGE COCKS (V-130)

# 2680-268T Series

## 2680-268T Series Liquid Level Controllers

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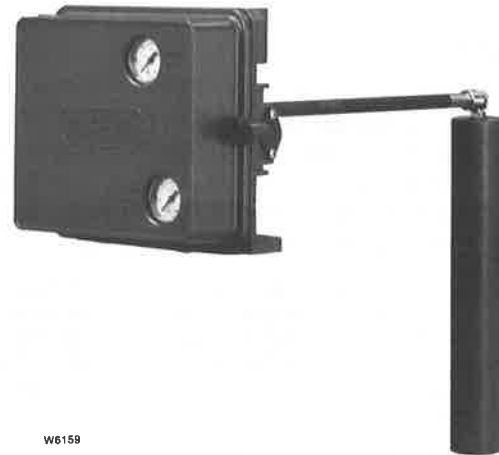


Figure 1. 2680 Series Controller with Type 268T Sensor

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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.

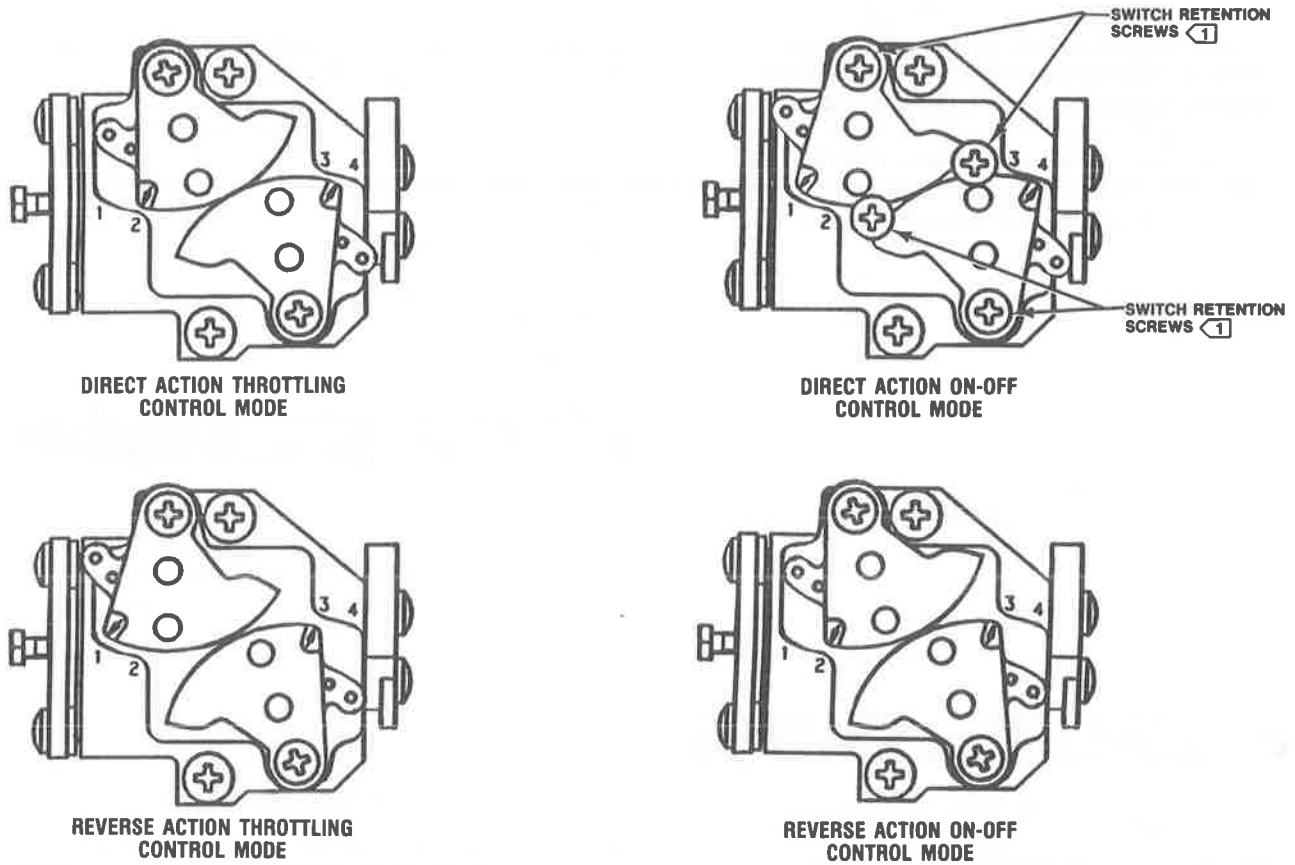
#### Description

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.



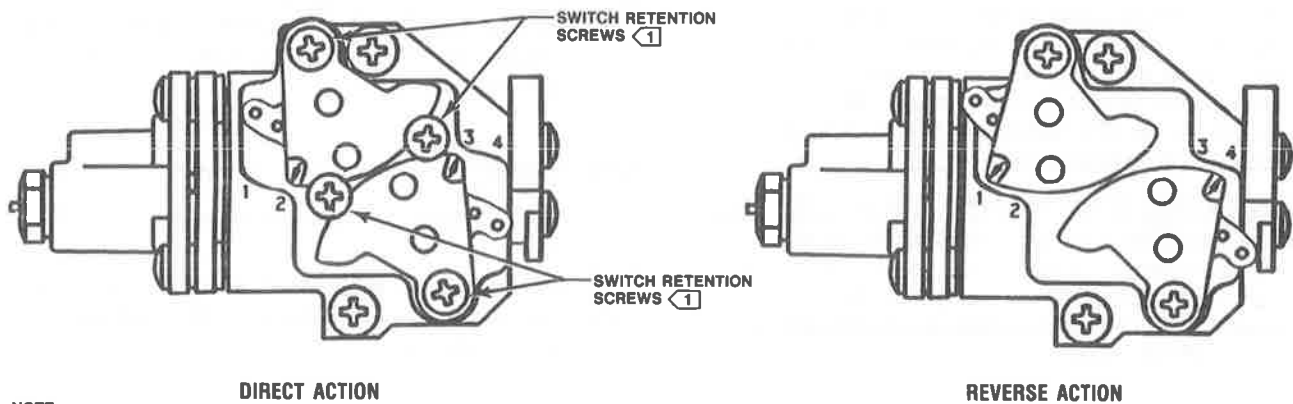
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# 2680-268T Series



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.  
 B2339

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



NOTE:  
 1 ALL FOUR SWITCH RETENTION SCREWS SHOWN ONLY ON THIS VIEW. OTHER VIEW SHOWS ONLY TWO SWITCH RETENTION SCREWS IN ORDER TO ILLUSTRATE THE SWITCH CONFIGURATION.  
 B2340

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

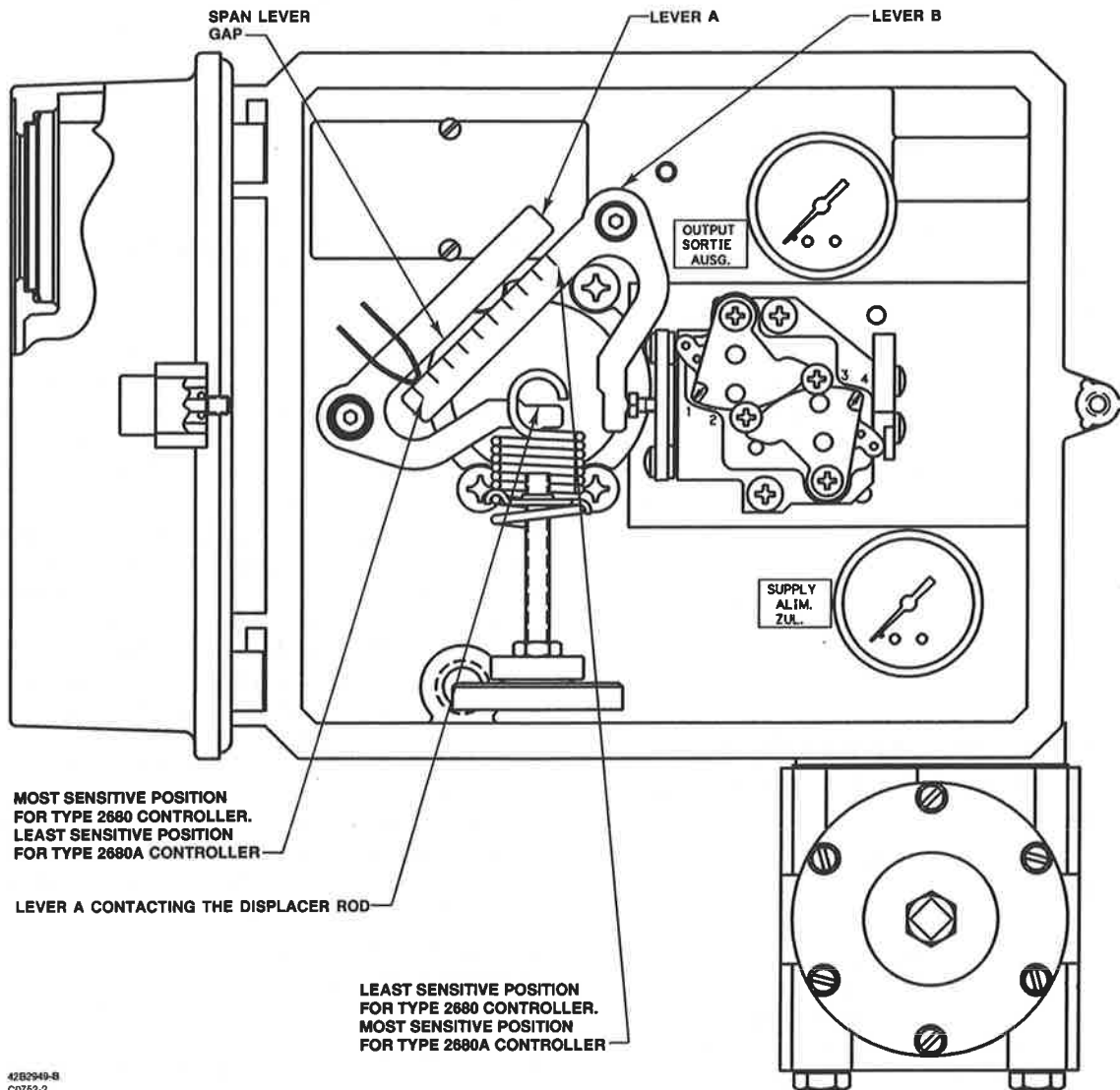


Figure 5. Proportional Band Adjustments

## 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.

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 dis-

# 2680-268T Series

---

placer 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.

## 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 moment 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 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.

## 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.

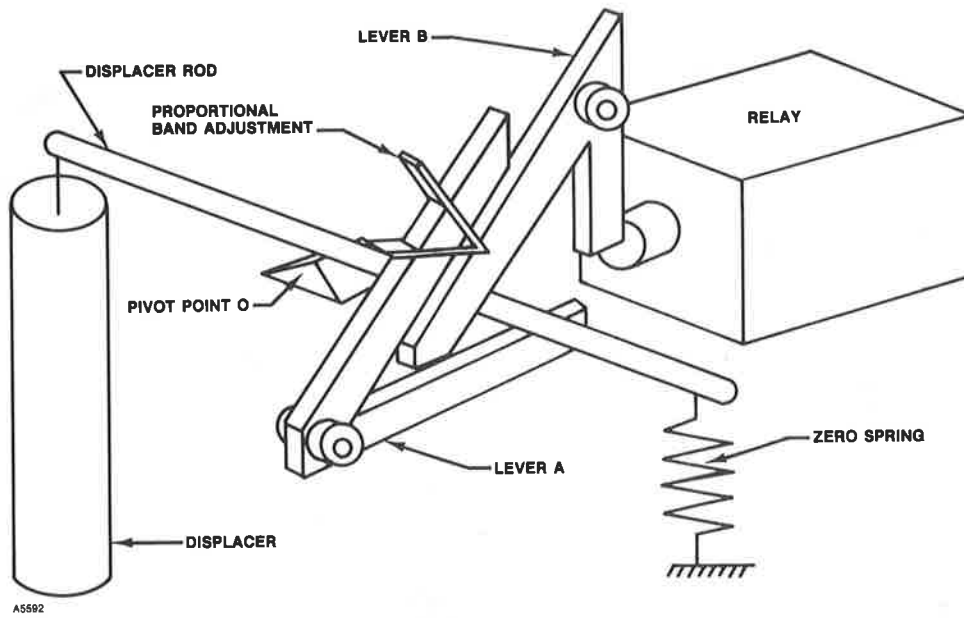


Figure 6. Operational Schematic

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:

- 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.

### 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

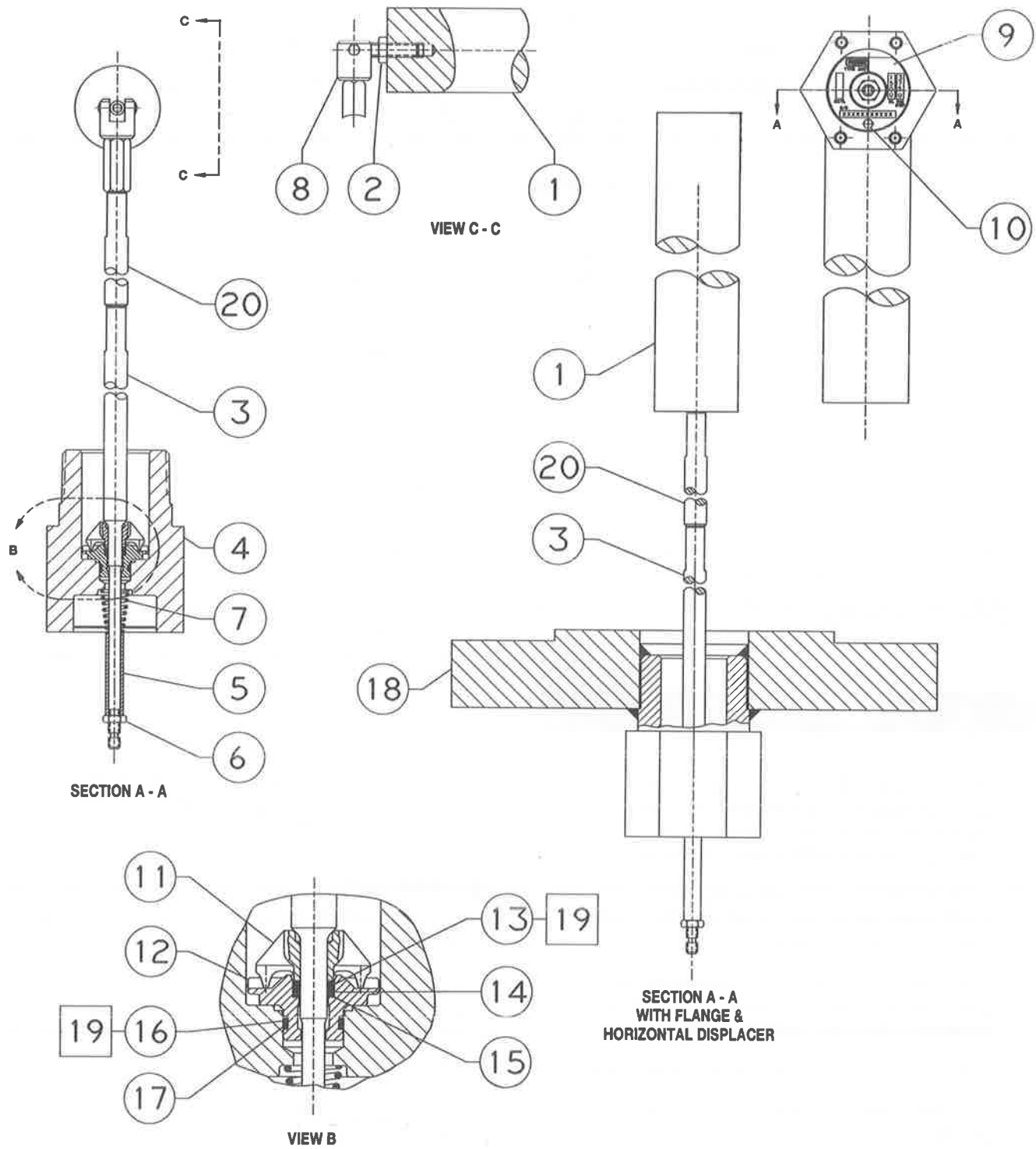
1. Remove the controller from the sensor by following the procedure outlined in the previous section.
2. Remove the sensor from the tank.
3. Unscrew the hex nut (key 6) and removing the spacer (key 5) and spring (key 7). After removing the spring, replace the spacer (key 5) and hex nut (key 6) on the 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.



# 2680-268T Series



44B5016-A

Figure 7. Type 268T Sensor

## Assembly



**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. 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).
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.

# 2680-268T Series

Key	Description	Part Number	Key	Description	Part Number
16*	Filter (Type 2680/2680A)	11B2307 X012	<b>Sensor</b>		
17*	O-Ring, nitrile (Type 2680/2680A)	14A1968 X012	1	Displacer	
18	Machine Screw, stainless steel (2 req'd)	5908124 X012		1-7/8x12-inches	
19*	Sensor Gasket, composition	12B2933 X012		PVC	12B2936 X032
20	Cover, marine grade aluminum	42B2895 X012		S31603 (316L SST)	12B2956 X032
21	Cover Lens, plexiglass (2 req'd) Type 2680/2680A	1R1922 05032		2-3/4x8-inches	
	Type 2680E	1R1922 X0022		PVC	12B2958 X032
22*	Gasket, neoprene (2 req'd)	1V5521 06992	2	Hex Nut, S31600 (vertical displacer only)	12B2959 X032
23	Retaining Ring, steel (2 req'd)	11A6502 X012	3	Displacer Rod, S17400 (17-4PH SST)	1A3421 X0042
24*	Cover Gasket, nitrile	12B2905 X012	4	Sensor Connection	14B5018 X012
34	Relay Mounting Screw, stainless steel (2 req'd) (Type 2680/2680A)	12B2921 X012		2-inch NPT Connection	34B4962 X012
45*	Relay Mounting O-Ring, nitrile (not shown) Type 2680/2680A	10A3804 X012		2-inch slip-on Connection	34B5019 X012
46*	Relay Mounting O-Ring, nitrile (not shown) Type 2680/2680A	10A8217 X042	5	Spacer, S30400 (304 SST)	12B2945 X012
51	Relay Adjustment Screw	Incl in Parts Kits	6	Hex Nut, S31600	1A4117 X0022
53	Valve Assembly	Incl in Parts Kits	7	Conical Spring, S31600	12B2931 X012
54	Valve Assembly O-Ring	Incl in Parts Kits	8	Universal Joint, S31600 (vert displ only)	13B8749 X012
55	Self-Tapping Screw, stainless steel (2 req'd)	1P4269 28982	9	Nameplate	---
56	Nameplate	---	10	Drive Screw, stainless steel	1A3682 28982
57	Screen, stainless steel	0L0783 43062	11	Pivot Body, CB7CU-1 (17-4PH SST)	24B4960 X012
58	Hex Nut, stainless steel	1A4117 X0012	12	Pivot Base, CF8M (316 SST)	24B4967 X012
59*	Filter Gasket, neoprene (Type 2680/2680A)	1C8986 03012	13*	O-Ring,	
60	Cap Screw, stainless steel (2 req'd) Type 2680/2680A	1C3988 X0022		Highly Saturated Nitrile	11B2308 X022
61	Sealant Zinc-plate No. 770 (not furnished with controller) (Type 2680/2680A)			Fluoroelastomer	11B2308 X032
<b>The following part numbers are for the Type 2680E only.</b>			14*	Anti-Extrusion Ring, PTFE	14B4964 X012
62*	Switch, stainless steel		15*	Retaining Ring, S30400 (304 SST)	14B4965 X012
	SPDT	20B5075 X012	16*	O-Ring	
	DPDT	20B5076 X012		Highly Saturated Nitrile	10A3716 X062
63	Split Ring, steel/zn pl (2 req'd)	13B8088 X012		Fluoroelastomer	10A3716 X022
64	Spacer, S31600	23B8089 X012	17*	Backup Ring	
65	Self Tap Screw, stainless steel	13B8090 X012		Nitrile	14B4940 X012
66	Label, alum	13B8091 X012		Fluoroelastomer	14B5017 X012
67*	O-Ring, nitrile	13B8326 X012	18	Flange Assembly, steel (includes flange and 2-inch slip-on sensor connection, key 4)	
68	Machine Screw, stainless steel	16A6935 X022		W/2x2 Flange	
69	Square Nut, stainless steel	16A6711 X022		Class 150 RF	34B5013 X012
70*	O-Ring, nitrile	1U8790 06562		Class 300 RF	34B5013 X022
71	Pipe Plug, S31600, (2 req'd)	1A7675 35072		Class 600 RF	34B5013 X032
73	Lubricant	T13078 T0012		Class 600 RTJ	34B5013 X042
				Class 1500 RF	34B5013 X052
				Class 1500 RTJ	34B5013 X062
				W/4x2 Flange	
				Class 150 RF	34B5013 X072
				Class 300 RF	34B5013 X082
				Class 600 RF	34B5013 X092
				Class 600 RTJ	34B5013 X102
				Class 900 RF	34B5013 X112
				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

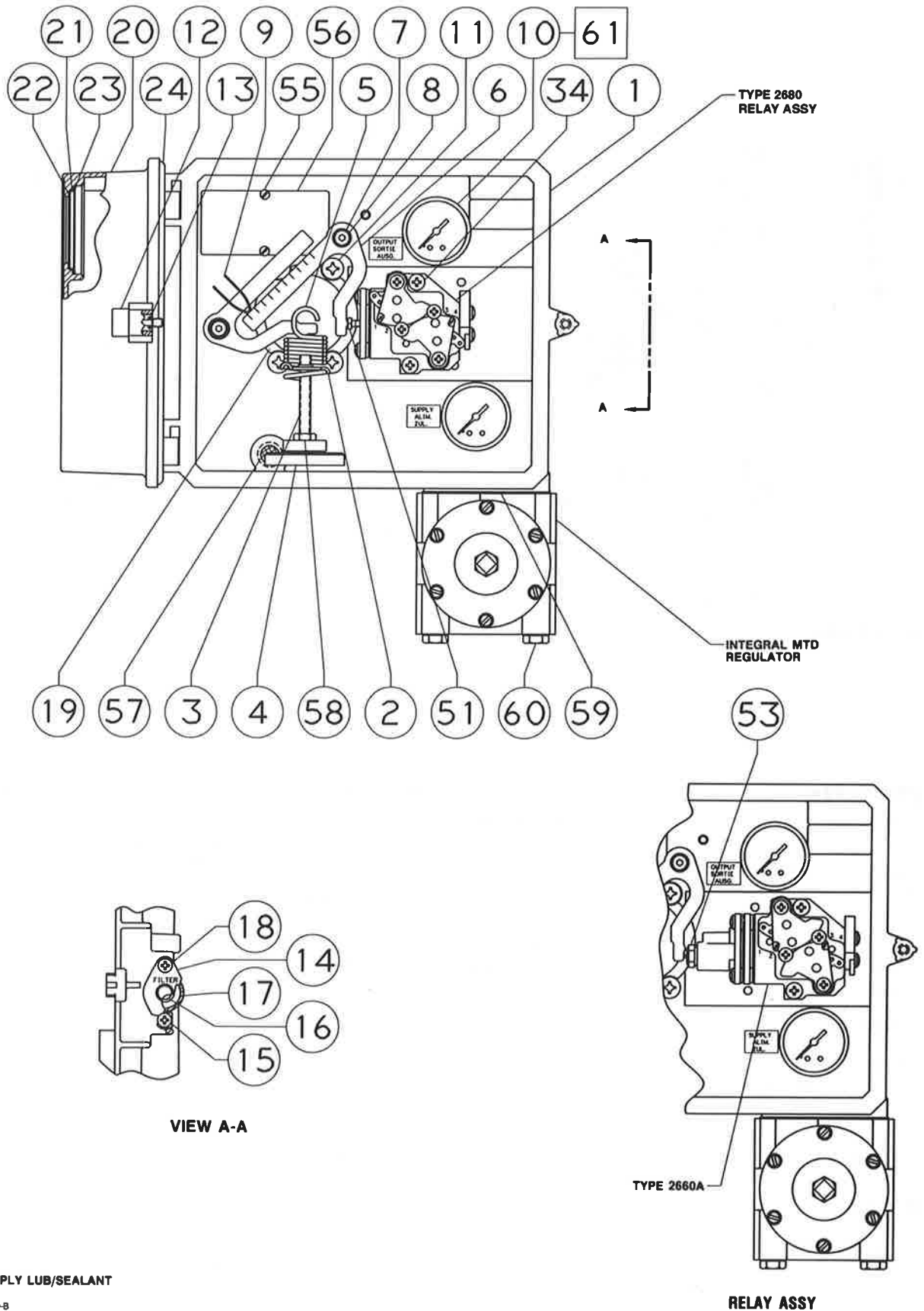
\*Recommended spare part

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Singapore 0512



# 2680-268T Series



□ APPLY LUB/SEALANT

22950-B

Figure 8. Type 2680 and 2680A Liquid Level Controllers

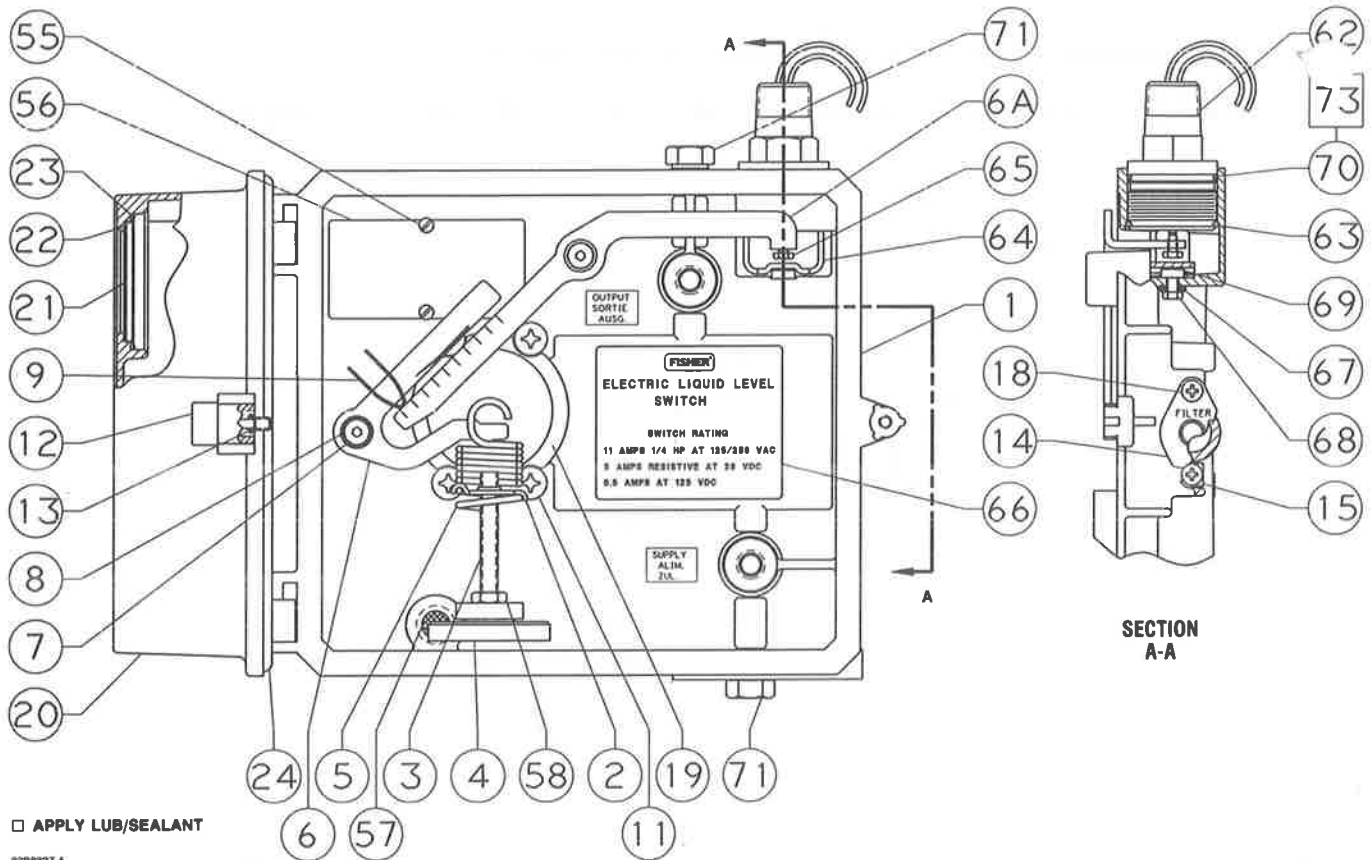


Figure 9. Type 2680E Liquid Level Controller

## Parts Kits

Key	Description	Part Number
<b>Controller</b>		
Repair kits include relay assembly and O-rings (keys 34, 45, and 46 relay mounting screw and O-rings)		
Type 2680		
Low temperature		R2660XRLY12
High temperature		32B2951X022
Type 2680A		
Low temperature		R2660XRLY22
High temperature		32B2951X042
<b>Sensor</b>		
Repair kit includes keys 13, 14, 15, 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

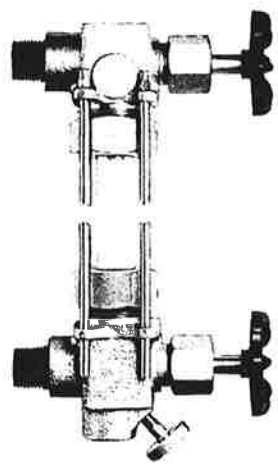
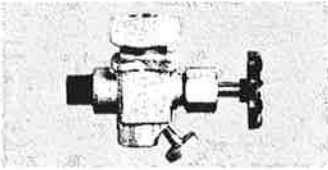
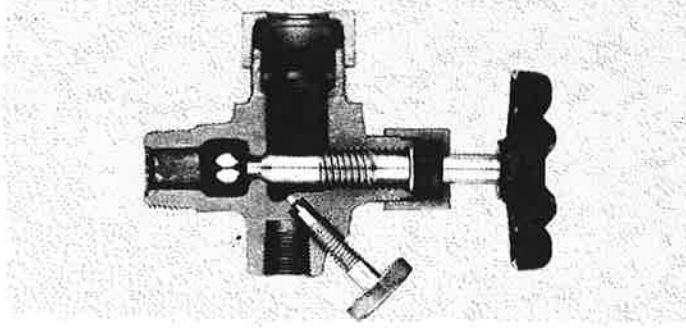
Key	Description	Part Number
2	Zero Spring Seat, S31600 (316 SST)	22B2904 X012
3	Zero Adjustment Bolt, stainless steel	12B2907 X012
4	Spring Adjustment, S31600	22B2896 X012
5	Zero Spring, (17-7PH SST)	
	Type 2680/2680A (25 lb. spring)	12B2893 X012
	Type 2680A (5 lb. spring)	12B2957 X012
	Type 2680E (5 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 (2 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-Hing, nitrile	1D1346 06992
14	Filter Cap, reinforced plexiglass	22B2898 X012
15	Cap Screw, stainless steel (2 req'd)	16A6711 X022

LC-100/110/120  
 LG-235A/B/260/270/284/130

# 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		X		X
1/8" Glass Dia.				
3/8" Glass Dia.				X
<b>VESSEL CONNECTION</b>				
Solid Shank		X		X
1/2" NPTM				
3/4" NPTM			X	
Socketweld			X	
1/2" Male				X
3/4" Male				X
Flanged			X	X
<b>DRAIN CONNECTION</b>				
1/8" 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	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
<b>POLISHED BODY (bronze valves)</b>			X	X
<b>GUARD RODS (4 per valve set)</b>			X	X
3/16" (4.8 mm) Dia.			X	X

**DIMENSIONS**

Model	Dimension X inches (cm)	Dimension Y inches (cm)
All models	2 (5.1)	3/4 (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**

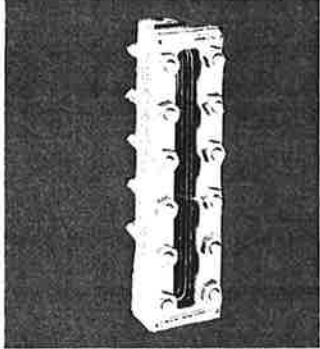
Model	Maximum working pressure, psi (kPa) at temperatures to —							Maximum Steam Pressure
	with standard neoprene glass packing			with optional teflon glass packing				
	-20F (-29C)	+100F (+38C)	+200F (+93C)	+300F (+149C)	+400F (+204C)	+450F (+232C)	+500F (+260C)	
	psi (kPa)	psi (kPa)	psi (kPa)	psi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

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

# TECHNICAL DATA direct reading flat glass liquid level gage model RL (REFLEX-L SERIES)

Section 2000  
Bulletin 2210  
Issued 5/87  
Replaces 4/86

Pressures to 2400 psi @ + 100F (16500 kPa @ + 38C)  
Temperature range - 20F to + 600F (- 29C to + 316C)



### Quality construction

All materials conform to AISI or ASTM Specifications.

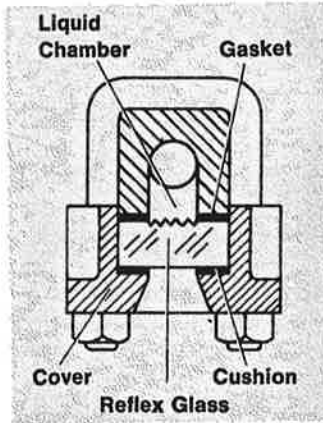
- **Liquid chamber** — one piece steel regardless of number of gage sections — optional materials available.
- **Cover** — encloses glass to reduce stress and resist glass breakage
- **Bolts and nuts** — alloy steel for high temperature service
- **Glass** — tempered borosilicate glass is standard for high strength and resistance to thermal shock and erosion
- **Gasket and cushion** — die cut from quality material providing resiliency and long life

### Pressure/temperature ranges

Complete pressure and temperature ranges are given in the following chart. The maximum operating pressure and temperature ordinarily determine the largest glass size that can be used.

### Visible and overall gage lengths

Model RL gages are available in single through 10 section units and visible lengths from 3 3/4 inches (9.5 cm) to 139 3/4 inches (355.0 cm). The visible and overall gage lengths for each combination of gage sections and glass size are given in the following table.

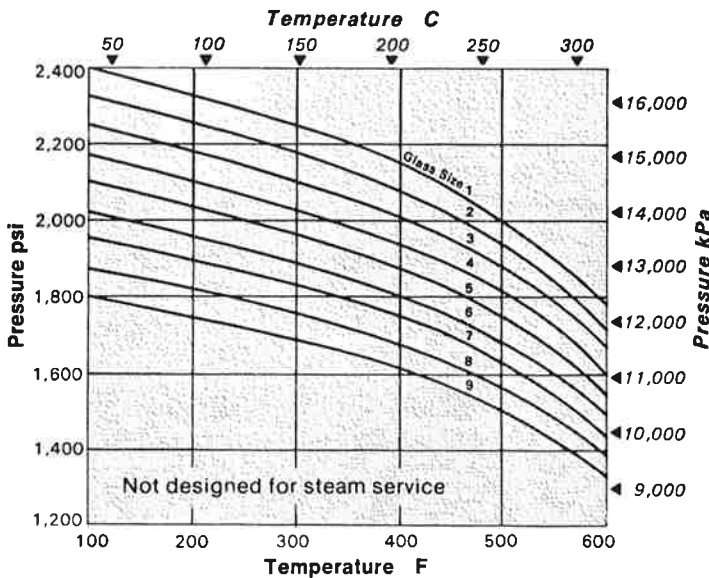


### DIMENSIONS

Approved Models Available

Sec-tions	Model	Glass Size	Visible Length		End Connected Overall Length	
			Inches	cm	Inches	cm
1	RL	1	3 3/4	9.5	5 1/4	13.3
1	RL	2	4 3/4	12.1	6 1/4	15.9
1	RL	3	5 3/4	14.6	7 1/4	18.4
1	RL	4	6 3/4	17.1	8 1/4	21.0
1	RL	5	7 1/4	20.0	9 3/8	23.8
1	RL	6	9 1/8	23.2	10 3/8	27.0
1	RL	7	10 1/4	26.0	11 3/4	29.8
1	RL	8	11 7/8	30.2	13 3/8	34.0
1	RL	9	12 5/8	32.1	14 1/8	35.9
2	RL	4	15	38.1	16 1/2	41.9
2	RL	5	17 1/4	43.8	18 3/4	47.6
2	RL	6	19 3/4	50.2	21 1/4	54.0
2	RL	7	22	55.9	23 1/2	59.7
2	RL	8	25 1/4	64.1	26 3/4	67.9
2	RL	9	26 3/4	67.9	28 1/4	71.8
3	RL	6	30 3/8	77.2	31 7/8	81.0
3	RL	7	33 3/4	85.7	35 1/4	89.5
3	RL	8	38 5/8	98.1	40 1/8	101.9
3	RL	9	40 1/8	103.8	42 3/8	107.6
4	RL	7	45 1/2	115.6	47	119.4
4	RL	8	52	132.1	53 1/2	135.9
4	RL	9	55	139.7	56 1/2	143.5
5	RL	7	57 1/4	145.4	58 3/4	149.2
5	RL	8	65 3/8	166.1	66 7/8	169.9
5	RL	9	69 1/8	175.6	70 3/8	179.4
6	RL	8	78 3/4	200.0	80 1/4	203.8
6	RL	9	83 1/4	211.5	84 3/4	215.3
7	RL	8	92 1/8	234.0	93 1/8	237.8
7	RL	9	97 1/8	247.3	98 1/8	251.1
8	RL	8	105 1/2	268.0	107	271.8
8	RL	9	111 1/2	283.2	113	287.0
9	RL	8	118 7/8	301.9	120 3/8	305.8
9	RL	9	125 5/8	319.1	127 1/8	322.9
10	RL	8	132 1/4	335.9	133 3/4	339.7
10	RL	9	139 3/4	355.0	141 1/4	358.8

### PRESSURE/TEMPERATURE



### STANDARD/OPTIONAL FEATURES

	Standard	Optional
<b>END CONNECTIONS</b>		
Threaded	1/2" NPTF 3/4" NPTF	X
Socketweld	1/2" (12.7 mm) Female 3/4" (19.1 mm) Female	X
Flanged		X
<b>SIDE OR BACK CONNECTIONS</b>		
Threaded	1/2" NPTF 3/4" NPTF	X
Socketweld	1/2" (12.7 mm) Female 3/4" (19.1 mm) Female	X
Flanged		X

**PENBERTHY, INC.**

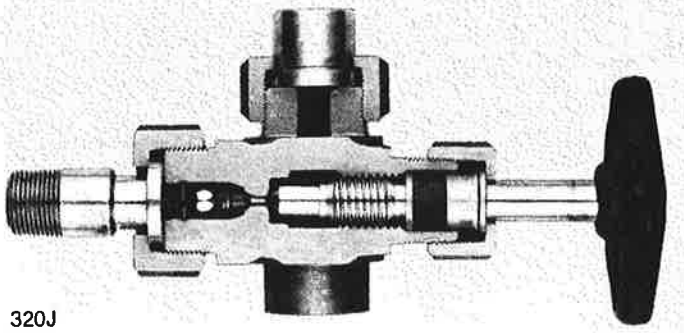
320 Locust St., Prophetstown, IL 61277 USA  
TEL: (815) 537-2311 FAX: (815) 537-5764

LG-100/110/120/130

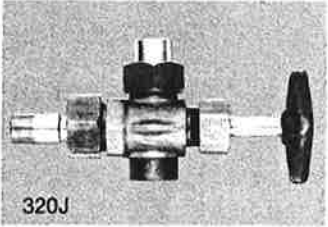
# TECHNICAL DATA valves for flat glass gages series 300 (OFFSET PATTERN)

Section 2000  
Bulletin 2231  
Issued 5/87  
Replaces 4/86

**1500 lb. ASA rating — Pressures to 4000 psi @ + 100F (27600 kPa @ + 38C)  
Three temperature ranges from - 300F to + 750F (- 184C to + 399C)**



320J



320J

**Design features**

The 300 series includes models 320J and 330J with these standard features —

- Offset pattern
- Integral bonnet
- Gage connection  
Model 320J — Union  
Model 330J — Rigid
- Union vessel connection
- Ball check shutoff
- Integral seat

A variety of optional features are available when specified.

Optional materials can be specified for the valve body and trim. (Trim consists of the stem, stem packing retainer, and ball check.) Standard and optional materials conform to AISI or ASTM Specifications.

**ASME Boiler Code**

Series 300 valve sets that are acceptable for ASME Boiler Code are available as an option.

Model 320J valve sets with this option can be supplied either with ball check shutoffs or with them omitted, as specified. Valve sets with ball checks have a vertical rising ball in the lower valve and a horizontal ball in the upper valve.

Model 330J valve sets with the ASME Boiler Code option have the ball check shutoffs omitted.

**Dimensions**

To obtain maximum gage length permissible for given vessel center-to-center dimension —

$$\text{Maximum Gage Length} = \left( \frac{\text{Valve Center-to-Center Dimension}}{\text{Dimension X}} \right) - \left( \frac{\text{Dimension Y}}{\text{X}} \right)$$

To determine overall length of nipples needed to make up a gage set for fixed vessel center-to-center dimension —

$$\text{Combined Nipple Length} = \left( \frac{\text{Valve Center-to-Center Dimension}}{\text{Dimension X}} \right) - \left( \frac{\text{Gage Length} + \text{Dimension Y}}{\text{X}} \right)$$

Overall nipple length can be divided between nipples to suit the application. Minimum length required for each nipple is: 1 1/8" for 1/2" NPT nipple; 1 3/8" for 3/4" NPT nipple.

Penberthy Floating Shank union vessel connection permits valve center-to-center dimension to vary 3/8" (9.5 mm) total from actual vessel center-to-center dimension.

**DIMENSIONS**

Model	Dimension X Inches (cm)	Dimension Y Inches (cm)
320J	6-1/8 (15.6)	3-7/8 (9.8)
330J	2-7/8 (7.3)	5/8 (1.6)

**PRESSURE / TEMPERATURE RANGES**

Construction	Maximum working pressure, psi (kPa) at temperatures to —									
	- 300F (- 184C)	- 150F (- 101C)	- 20F (- 29C)	+ 100F (+ 38C)	+ 200F (+ 93C)	+ 300F (+ 149C)	+ 400F (+ 204C)	+ 500F (+ 260C)	+ 550F (+ 288C)	+ 750F (+ 399C)
Forged Steel			4000 (27600)	4000 (27600)	3900 (26900)	3815 (26300)	3730 (25700)	3525 (24300)	3355 (23100)	2620 (18100)
3 1/4" Nkl Steel		4000 (27600)	4000 (27600)	4000 (27600)	3900 (26900)	3815 (26300)	3730 (25700)	3525 (24300)	3355 (23100)	2620 (18100)
Stainless Steel	4000 (27600)	4000 (27600)	4000 (27600)	4000 (27600)	3900 (26900)	3815 (26300)	3730 (25700)	3525 (24300)	3355 (23100)	2755 (19000)

**STANDARD / OPTIONAL FEATURES**

	Model 320J		Model 330J	
	Standard	Optional	Standard	Optional
<b>OFFSET PATTERN</b>		X		X
<b>INTEGRAL BONNET</b>		X		X
<b>GAGE CONNECTION</b>				
Union		X		
1/2" NPTF			X	
1/2" NPTM			X	
3/4" NPTF			X	
3/4" NPTM				
Rigid				X
1/2" NPTF				
3/4" NPTF				X
Socketweld				
1/2" Female			X	
1/2" Male			X	
3/4" Male			X	
3/4" Female				X
Flanged			X	
Spherical Union			X	
1/2" NPTF			X	
1/2" NPTM			X	
3/4" NPTM			X	
<b>VESSEL CONNECTION</b>				
Union				
1/2" NPTF			X	X
1/2" NPTM			X	X
3/4" NPTM		X		X
1" NPTM (Non-Floating)			X	X
* Solid Shank				
1/2" NPTM			X	X
3/4" NPTM			X	X
1" NPTM			X	X
Socketweld				
1/2" Male			X	X
3/4" Male			X	X
1" Male			X	X
Flanged			X	X
Spherical Union			X	X
1/2" NPTF			X	X
1/2" NPTM			X	X
3/4" NPTM			X	X
<b>VENT/DRAIN CONNECTION</b>				
1/2" NPTF		X		X
3/4" NPTF			X	X
<b>BALL CHECK SHUTOFF</b>				
<b>Horizontal Lower and Upper Valves</b>			X	X
Vertical Lower/Horizontal Upper Valve (Acceptable for ASME Service)			X	
Omitted (Acceptable for ASME Service)			X	X
Vacuum — Horizontal Upper and Lower			X	X
<b>SEAT — Integral</b>		X		X
<b>HANDWHEEL w/STANDARD PITCH THREADS</b>		X		X
<b>HANDWHEEL w/QUICK CLOSING THREAD</b>			X	X
<b>LEVER w/QUICK CLOSING THREAD (1/4 TURN)</b>			X	X

\* BALL CHECKS ARE NOT AVAILABLE WITH SOLID SHANK VESSEL.



PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3				LEVEL INSTRUMENTS (DISPLACER OR FLOAT)				SHEET OF	
CUSTOMER : PROPAK PLANT : 1380 HP STOCK COMPRESSOR SERVICE : LEVEL SWITCHES				NO	BY	DATE	REVISION	SPEC NO	FILE 14.11.L
				0	TK	01/27/00	FOR PURCHASE	JOB #	99420
								DATE	
								REQ.	
				BY	CHKD	APPR			
1	TAG NO.	L/LC/LSL-262		L/LC/LSL-270					
2	SERVICE	ENGINE LUBE OIL		COMPRESSOR LUBE OIL					
3	LINE NO. / VESSEL NO.								
B O D Y / C A S E	4	BODY OR CAGE MATERIAL							
		RATING							
	5	CONN. SIZE	LOC. UPPER	mm	mm	mm	mm		
		TYPE							
	6	CONN. SIZE	LOC. LOWER	mm	mm	mm	mm		
		TYPE							
	7	CASE MOUNTING (RH, LH, TOP)							
		TYPE							
	8	ROTATABLE HEAD							
	10	ORIENTATION							
	11	COOLING EXTENSION							
12	CAGE								
D I S P L A C E R	13	DIMENSIONS	MFR. STANDARD	mm	MFR. STANDARD	mm	mm	mm	
	14	INSERTION DEPTH		mm		mm	mm	mm	
	15	DISPLACER EXTENSION		mm		mm	mm	mm	
	16	DISP. OR FLOAT MATERIAL	MFR. STANDARD		MFR. STANDARD				
	17	DISPLACER SPRING/TUBE MTL							
18									
19									
X M T R	20	FUNCTION	LIQUID LEVEL CONTROLLER		LIQUID LEVEL CONTROLLER				
	21	OUTPUT							
	22	CONTROL MODES							
	23	DIFFERENTIAL							
	24	OUTPUT ACTION: LEVEL RISE	CONTACTS CLOSE		CONTACT CLOSE				
	25	MOUNTING	LOCAL		LOCAL				
	26	ENCLOSURE CLASS	CLASS 1, DIV. II, XP		CLASS 1 DIV. 11, XP				
	27	ELEC. POWER OR AIR SUPPLY	INSTRUMENT GAS		INSTRUMENT GAS				
	28								
S E R V I C E	29	UPPER LIQUID							
	30	LOWER LIQUID	LUBE OIL		LUBE OIL				
	31	SP. GR. UPPER	SP. GR. LOWER						
	32	PRES. MAX.	PRES. NORMAL	kPag ATM. kPa(g)	kPa(g) ATM. kPa(g)	kPag	kPa(g)	kPa(g)	
	33	TEMP. MAX.	TEMP. NORM.	° C 16 ° C	° C 16 ° C	° C	° C	° C	
34									
35									
O P T I O N S	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									
45	MANUFACTURER	KENCO		KENCO					
46	MODEL NO.	LCE-27		LCE-9					
47	P. O. NUMBER								

NOTES:

AREA UNIT #: 152

# KENCO ENGINEERING

P.O. BOX 470426 • TULSA, OK 74147 • PHONE (918) 663-4406 • TELEFAX (918) 663-4480 • <http://www.kenco-eng.com>

L1/LC / LSL-262/270

## INSTALLATION INSTRUCTIONS FOR MODEL LCE, LCE-3318, LCE-3358, LCE-HL, AND LCE-DPDT OIL LEVEL SWITCHES WITH ADAPTERS (INCLUDING HIGH PRESSURE MODELS)

Note: For fire safe oil level controllers (LCE-FS) see additional instructions in this work sheet covering installation of fire safe valves.

### ELECTRICAL RATINGS:

15 AMP, 125/250/480 VAC  
0.5 AMP, 125 VDC  
0.25 AMP, 250 VDC  
1/8 HP, 125 VDC  
1/4 HP, 250 VAC

### I. SWITCH ADJUSTMENTS FOR LOW LEVEL SWITCH CONFIGURATIONS: SEE FIGURE 1

- Remove the conduit lid
- Loosen nuts A and B
- Turn screw C clockwise to lower the trip point
- Turn screw counterclockwise to raise the trip point
- After adjustment is complete, tighten nuts A and B and re-attach the lid

Figure 1

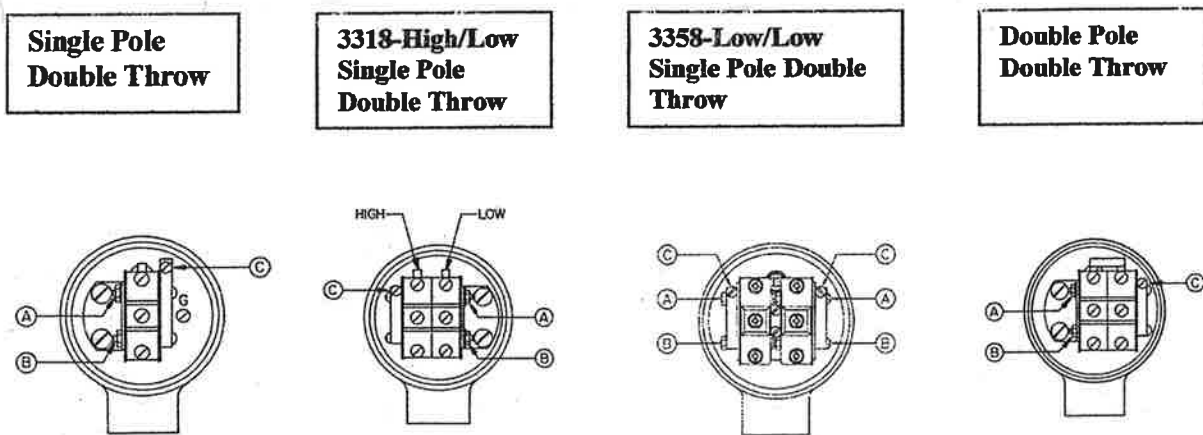
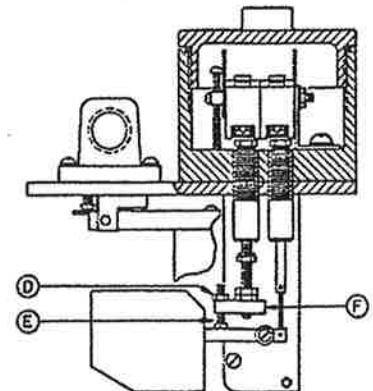


Figure 2

### LCE-3318 HIGH LEVEL SWITCH ADJUSTMENT: SEE FIGURE 2

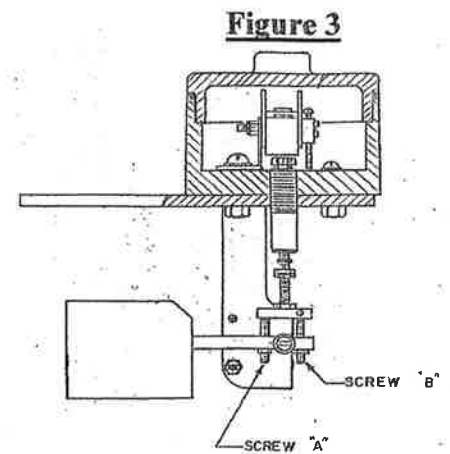
NOTE: To adjust the high level trip point on the LCE-3318, the cover plate and the float must be removed from the controller. This may require connections from the oil supply tank and electrical conduit to be disconnected temporarily.

- Adjust oil level to the desired "HIGH" level.
- Remove the 4 cover plate bolts and raise the cover plate to expose the float and switch actuating mechanism.  
Loosen lock nut on push rod at location D.
- To raise the high level trip point, thread adjustment screw E into the actuator F.
- To lower the high level trip point, thread adjustment screw E out of the actuator F.
- After high level trip point is adjusted, tighten lock nut D on the adjustment screw E against the actuator F. Replace cover and check operation of unit.



## LCE-HL HIGH LEVEL OR LOW LEVEL SWITCH ADJUSTMENT INSTRUCTIONS:

- Remove the (4) bolts on the cover plate and remove the cover plate assembly from the controller
- For low level, loosen the nut on screw "B"
- Turn screw "B" clockwise to lower the trip point or counterclockwise to raise the trip point
- Tighten the nut on screw "B" to set the trip point
- For high level, loosen the nut on screw "A"
- Turn screw "A" clockwise to raise the trip point or counterclockwise to lower the trip point
- Tighten the nut on screw "A" to set the trip point



## II. INSTALLATION AND MAINTENANCE INSTRUCTIONS FOR OIL INLET VALVE:

- Connect the oil supply line to the oil inlet on the oil level controller. The minimum recommended supply line is  $\frac{3}{8}$ " I.D. The supply line must be clean and it is recommended that it be flushed with solvent before installation.
- Connect the oil supply line to the oil supply tank. If there is no existing valve at the tank or the existing supply outlet, a shut-off valve should be placed in the line to prevent oil loss when cleaning the inlet screen or filter.
- For high pressure models HP-A, pressure range must be between 5 psi and 34 psi. For high pressure models HP-B, the pressure range must be between 35 psi and 70 psi.
- The oil inlet valve is adjusted to maintain the oil level at the center of the sight glass. Low or high levels are often caused by two problems:
  1. Excessive oil inlet pressure, which will cause the unit to overflow.
  2. Improper equalizing lines between the crankcase and the controller will also result in improper levels.

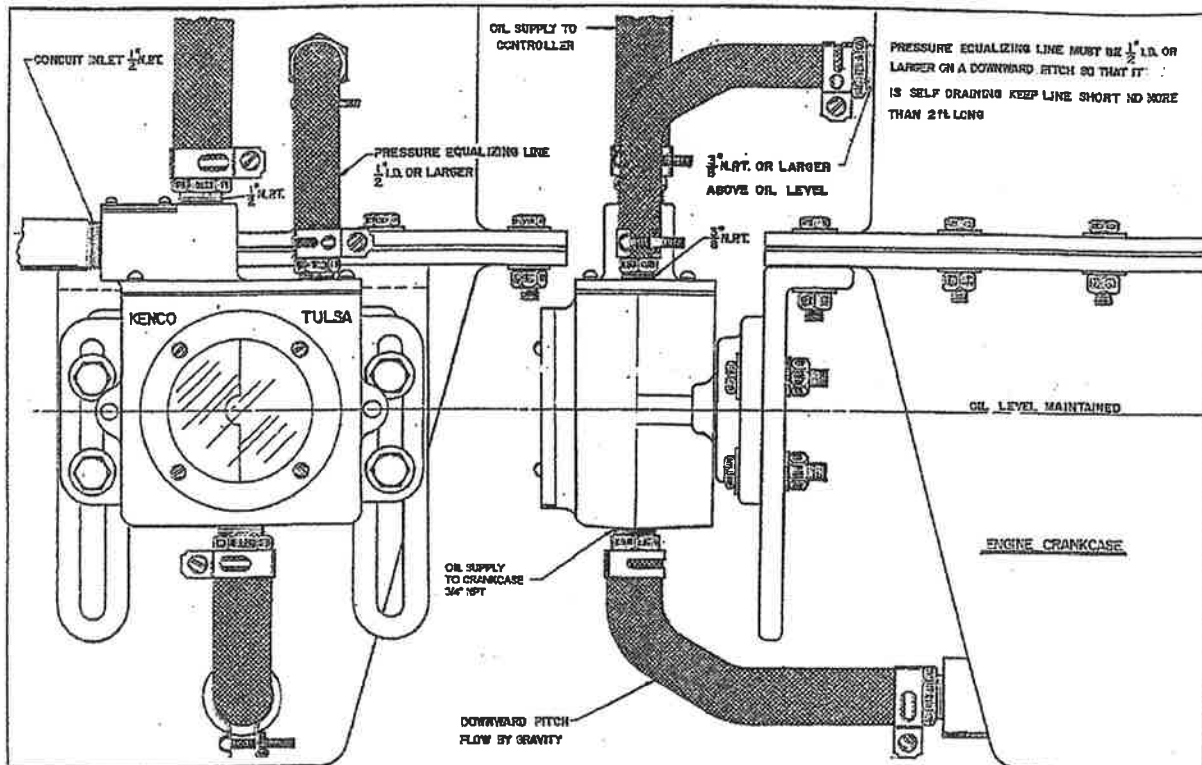
Note: Low pressure models require a minimum of 2' of head pressure and a maximum of 15' of oil inlet head pressure.

## III. INSTALLATION INSTRUCTIONS FOR UNITS WITH ADAPTERS:

OIL LEVEL CONTROLLERS WITH -9 (Universal adapter), -10 (Slotted universal adapter), -12 (Pole mounted adapter) AND -FS OPTIONS

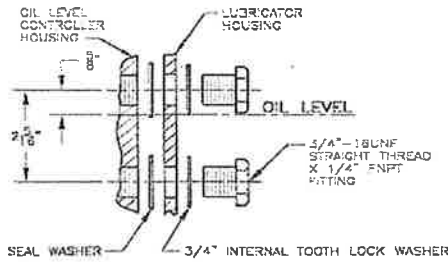
- Set the controller so that the centerline of the sight window corresponds to the desired oil level in the crankcase. Mount the controller close to the crankcase and connect the hose from the  $\frac{3}{4}$ " outlet located on the controller to the crankcase. NOTE: The outlet port on the oil level controller must be located below the oil level in the crankcase.
- An equalizing line must be used between the controller and crankcase in order to equalize the pressure. The tubing must be a minimum of  $\frac{1}{2}$ " I.D. and must be kept under 2 feet. DO NOT loop this line. It must be trap free and self draining, with a downward pitch flow by gravity.

**Figure 4: Typical Mount of -9 Adapter (Shown with Kenco 512 Oil Controller)**



**OIL LEVEL CONTROLLER WITH -11 AND -11-FS OPTION (for Mechanical Lubricators): See Figure 5**

**Figure 5**



- Drill holes in the lubricator housing as shown, and mount the controller with the inlet located on the top side using the seal washers and mounting bolts provided.
- Place the seal washers between the controller and the lubricator housing.

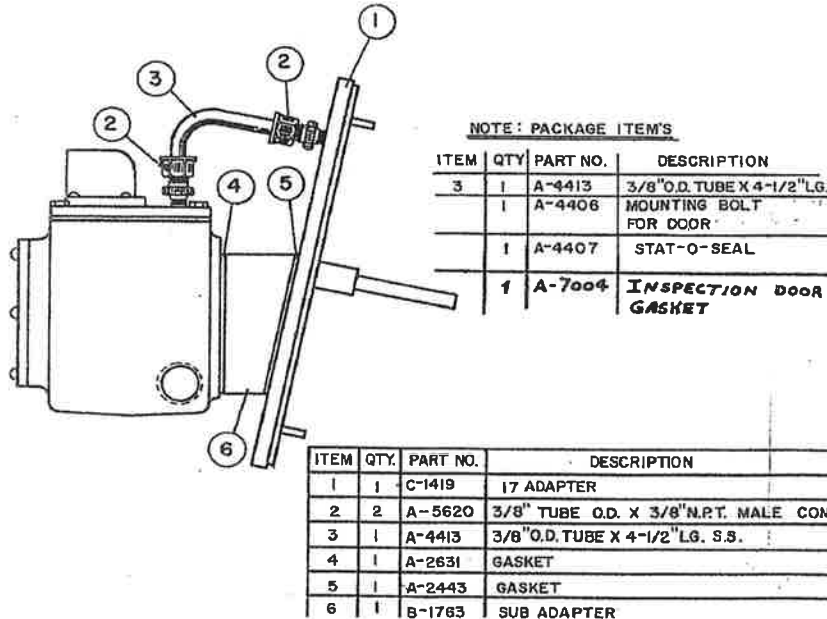
**OIL LEVEL CONTROLLER WITH -14 AND -14-FS OPTION (White Compressor)**

- Remove the triangular blind flange located on the compressor and mount the controller assembly in its place.
- NOTE: It is important to install a drain line between the drain outlet of the compressor and the controller.

**OIL LEVEL CONTROLLER WITH -17 (Waukesha VHP Engines F2895, F3251, F5108, L5790 & L7042), -18 (-17 w/ meter), -27 (for newer Waukesha engines same as -17), -37 (Waukesha P9390), -38 (same as -37 w/ meter) AND -FS OPTIONS**

- Remove the cast aluminum inspection door from the engine. Remove the clamp bar from the old door.
- For -17, -18, -37, -38 install the o-ring into the groove of the Kenco door and replace the clamp bar on the back side of the door using the 5/8" bolts and the stat-o-seals supplied by Kenco.
- For -27, install the o-ring into the groove of the Kenco door and replace the clamp bar on the back side of the door using the 7/16" bolts and the stat-o-seals supplied by Kenco.
- Install the equalizing line between the controller cover plate and the door (Tubing and connectors supplied by Kenco).
- Place the controller assembly into the inspection port of the engine and tighten the center bolt(s) down.
- Install oil inlet line into the controller oil valve or the meter inlet port.
- NOTE: For the -18 model, refer to the additional instructions supplied with the 1618 Kenco Low Flow meter.

**Figure 6: -Door Assembly for -17, -18, -27, -37, -38**



**OIL LEVEL CONTROLLER WITH -24 (Ariel Compressor JGB, JGE, JGH, JGK, JGR, JGT, JGV, & JGW) and -48 (Ariel compressor JGC & JGD) AND -FS OPTIONS**

- Remove the sight glass located on the crankcase and replace it with the oil controller assembly using the mounting bolts and gasket supplied with the unit.

**OIL LEVEL CONTROLLERS WITH -1 (Clark MA & CFA) -2 (Clark HMB & TMB), -3 (Clark RA, IRA, HBA, HCA, HLA, TLA), -6 (Cooper-Bessemer GMW), -7 (Cooper-Bessemer GMV), -8 (Cooper-Bessemer GMX), -16, -16-R, -16-6.25 (Cooper-Bessemer BMV & 275) AND FS OPTION**

- Remove the visual oil gauge assembly from the engine and replace it with the oil level controller and adapter assembly supplied with a gasket and mounting bolts when applicable.

## OIL LEVEL CONTROLLERS WITH -4 (Ingersoll-Rand SVG & KVS), -5 (Ingersoll-Rand KVG) AND FS OPTIONS

- Remove the visual oil gauge assembly from the engine and replace it with the oil level controller and adapter assembly supplied with a gasket and mounting bolts when applicable.
  - If an equalizing line exists for the engine sight glass and detach the equalizing line from the sight glass while still attached to the engine.
  - Install the oil controller and then reattach the equalizing line to the vent located at the top of the adapter.
- Note: It is important to insure that there are no loops in this line for it must be trap free and self draining.

### IV. INSTALLATION INSTRUCTIONS FOR FIRE SAFE VALVES: See Figure 7

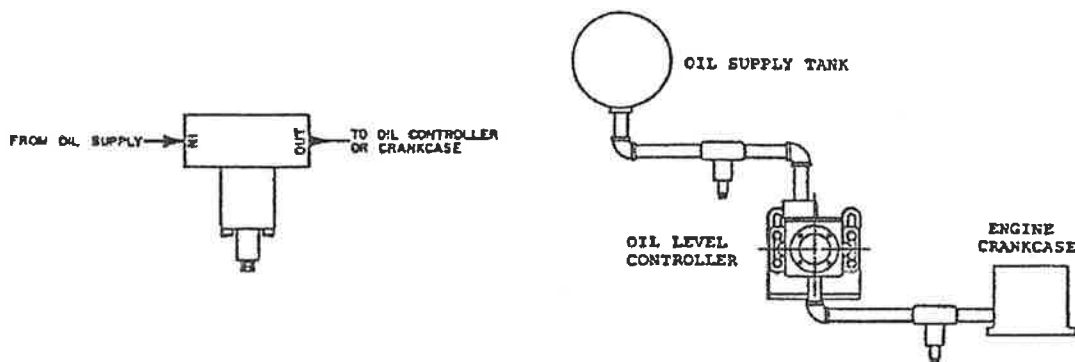
#### MODEL 50-FS AND 75-FS (PATENT NO. 3,877,476)

NOTE: All lines between thermal valves, supply tanks and the controller must be made of steel. DO NOT use rubber hose. The lines should be 3/4" I.D.

- The eutectic fuse element should always be in a downward position to help the element melt when heat is applied to the valve.
- The 50-FS valve should be installed in the oil supply line as close to the controller as possible. Meters, filters and pressure regulators should be installed between the controller and the 50-FS.
- The 75-FS valve should be located as close to the crankcase as possible and the oil outlet line should be a minimum 3/4" I.D. to insure adequate oil flow to the crankcase.

NOTE: The 75-FS valve is not required when using -FS adapters other than -9 and -12.

### FIGURE 7: FIRE SAFE VALVE INSTALLATION



### V. START-UP PROCEDURES

- Flush the supply system and the supply line with solvent to remove all burrs and construction debris.
- Insure that the oil supply tank is full.
- After the engine has been running for 1 hour, visually check the oil level in the sight glass. The oil level should be in the center of the sight glass.
- With the engine running, check the crankcase oil level. It should be the same as the oil level in the oil controller. If not, check the installation of the equalizing line (if applicable) see instruction for the equalizing line at -9.
- Check all piping connections for leaks and repair as needed.

### VI. SIX MONTH SUGGESTED MAINTENANCE PLAN

#### Oil Valve Service

- Close the oil supply valve and disconnect the oil supply line.
- Place a pan under the controller to catch the oil from the oil supply line.
- Remove the inlet oil housing and clean the screen.
- Once the screen is clean, reassemble and open the oil supply valve.
- Check all piping connections for leaks and repair as needed.

#### Switch Service

- Test switches to insure that the switches are operating correctly.
- Shut the engine off.  
Disconnect the equalizing line (if applicable).  
Place a blunt rod through the vent hole on the cover plate and depress the oil float.
- Observe the engine panel to determine if the switches make and break contact.
- If the switch is functioning properly, replace the equalizing line or vent plug.
- If the switch does not function, it must be replaced (refer to a replacement parts list).

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		
				0	TK	01/27/00	FOR PURCHASE	JOB #	99420		
				1	GWW	00.09.22	ADD LS-130	DATE			
								REQ.			
								BY	CHK'D	APPR.	
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	CONN. SIZE	LOC. UPPER	mm	mm	mm	mm					
	TYPE										
D	CONN. SIZE	LOC. LOWER	mm	mm	mm	mm					
	TYPE										
/	CASE MOUNTING (RH, LH, TOP)										
	TYPE	48 mm NPT	48 mm NPT	48 mm NPT							
A	ROTATABLE HEAD										
G	ORIENTATION	HORIZONTAL	HORIZONTAL	HORIZONTAL							
	COOLING EXTENSION										
E	CAGE	NONE	NONE								
D	DIMENSIONS	MFR STD	mm	MFR STD	mm	MFR STD	mm	mm	mm		
	INSERTION DEPTH	MFR STD	mm	MFR STD	mm	MFR STD	mm	mm	mm		
I	DISPLACER EXTENSION		mm		mm		mm	mm	mm		
	DISP. OR FLOAT MATERIAL	BUOYGLAS	BUOYGLAS	STAINLESS STEEL							
/	DISPLACER SPRING/TUBE MTL	MFR STD	MFR STD	316SS							
				YES							
F											
L	FUNCTION	SWITCH	SWITCH	SWITCH							
	OUTPUT										
O	CONTROL MODES	ON/OFF	ON/OFF	ON/OFF							
	DIFFERENTIAL										
X	OUTPUT ACTION: LEVEL RISE	CONTACTS CLOSE	CONTACTS CLOSE	CONTACT OPEN							
	MOUNTING	EXTERNAL	EXTERNAL	EXTERNAL							
M	ENCLOSURE CLASS	CLASS I, DIV II, XP	CLASS I, DIV II, XP	CLASS I, DIV II, XP							
	ELEC. POWER OR AIR SUPPLY	24V DC	24V DC	24V DC							
T											
R	UPPER LIQUID	AIR	AIR	HC VAPOR							
	LOWER LIQUID	50/50 GLYCOL/WATER	50/50 GLYCOL/WATER	OIL / HC'S							
S	SP. GR. UPPER	SP. GR. LOWER	1.0	1.0	0.65	1.0					
	PRES. MAX.	PRES. NORMAL	101 kPa(g)	101 kPa(g)	101 kPa(g)	101 kPa(g)	100 kPa(g)	40 kPa(g)	kPa(g)	kPa(g)	
E	TEMP. MAX.	TEMP. NORM.	-28/121 ° C	16 ° C	-28/121 ° C	16 ° C	-28/45 ° C	21 ° C	* C	* C	
V	AIRSET	SUPPLY GAGE									
	GAGE GLASS CONNECTIONS										
I	GAGE GLASS MODEL NO.										
	CONT:NUM	CONT: FORM	ONE - SPST	ONE - SPST	ONE - SPDT						
O	CONTACT RATING		2 AMPS @ 30 VDC	2 AMPS @ 30 VDC	2 AMPS @ 30 VDC						
	ACTION OF CONTACTS		OPEN ON LOW LEVEL	OPEN ON LOW LEVEL	OPEN ON HIGH LEVEL						
N											
S	MANUFACTURER	MURPHY	MURPHY	MURPHY							
	MODEL NO.	L1111	L1111	L1100-SS							
	P. O. NUMBER										

NOTES:

AREA UNIT #: .152

LS-100/110/120/130  
LSL-235A/B

LDV-92151N  
Revised 08-99  
Section 15  
(00-02-0175)

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



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.

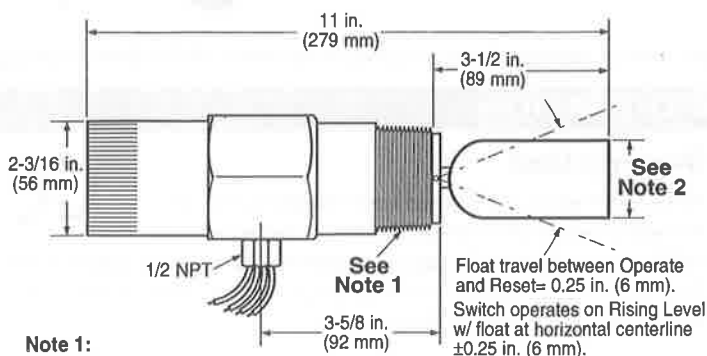
Specifications	L1100	L1111	L1150	L1200	L1250	L1200N	L1200NDVO	L1200NDVOR
<b>Body</b>								
• Standard: Electroless Nickel plated steel	X <sup>A</sup>	X <sup>A</sup>	X <sup>A</sup>	X <sup>B</sup>	X <sup>B</sup>	X <sup>B</sup>	X <sup>B</sup>	X <sup>B</sup>
• Optional: 316 Stainless Steel <sup>†</sup>	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 <sup>™</sup> 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 <sup>™</sup> float	X	X		X		X	X	X
• Optional: 0.65 with 304 Stainless Steel <sup>†</sup>	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 (0-517 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

<sup>A</sup> = 1-1/2 NPT    <sup>B</sup> = 2 NPT    <sup>†</sup> 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

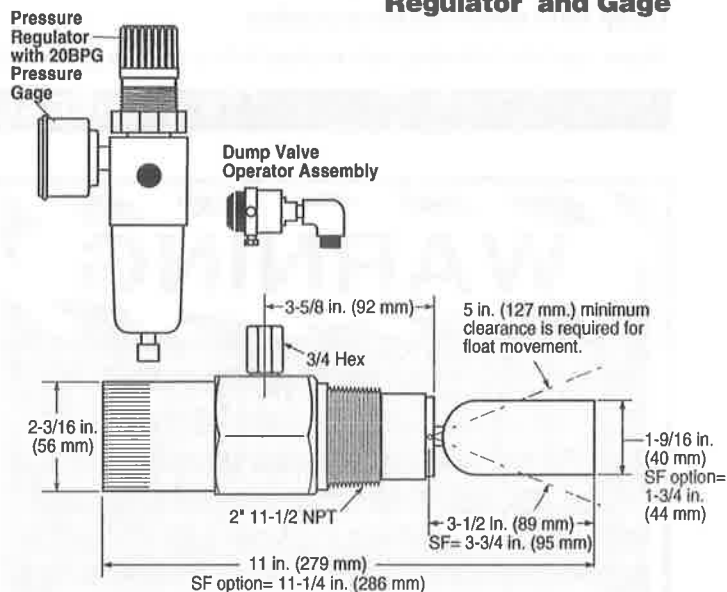


**Note 1:**  
**L1100:** 1-1/2 NPT  
**L1200:** 2 NPT

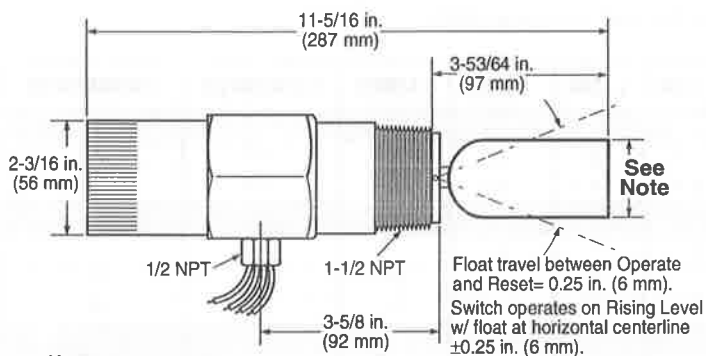
**Note 2:** 1-9/16 (40 mm)

**SF option:**  
**L1100:** 1-1/2 (38 mm)  
**L1200:** 1-3/4 (44 mm)

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

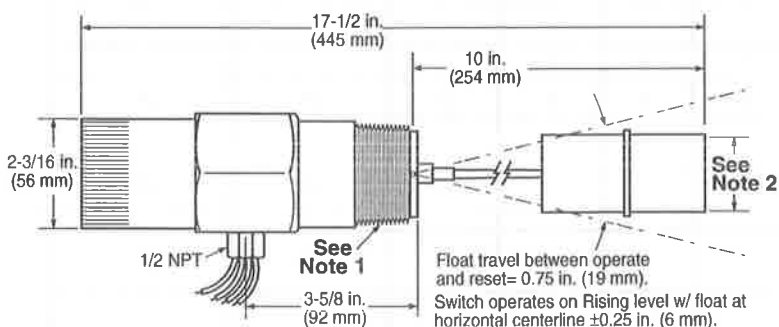


## L1111



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

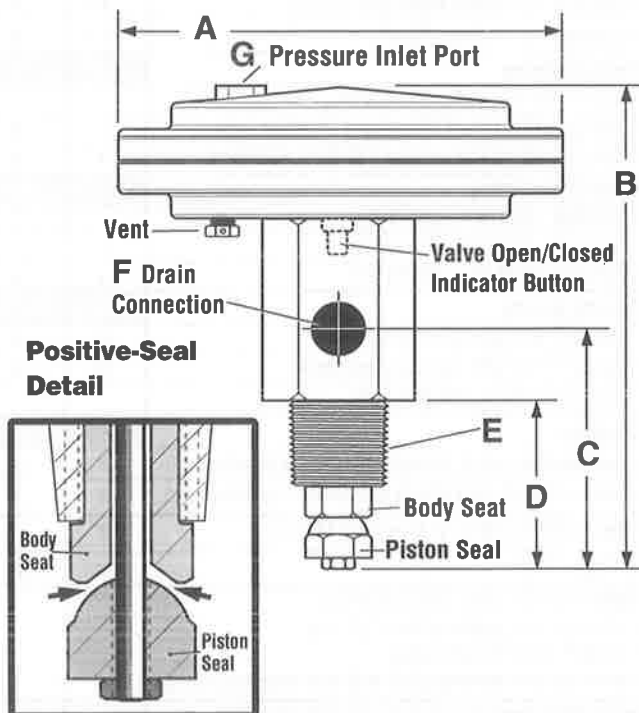
## L1150 and L1250



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

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

## 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

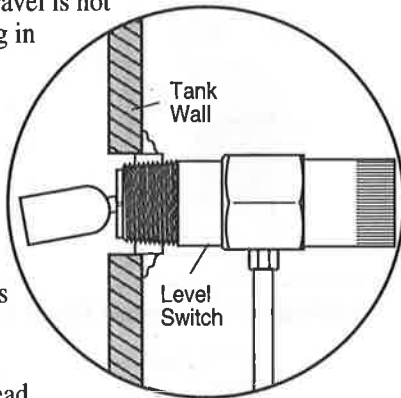
NOTE: Dimensions are in inches and (millimeters)



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

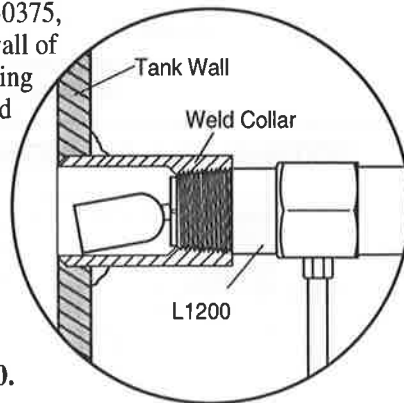
### Direct Installation into the Wall of the Pressure Vessel

1. 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.
2. BE SURE that the float and extension are tight and that the lock washer is in place.
3. 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.
4. 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.
5. 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.
6. BE SURE all electrical connections are insulated and the cover is fully installed before reconnecting electrical power.
7. BE SURE all pressure connections are tight before pressurizing the system.



### Installation with a Weld Collar

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



### Installation Using External Float Chamber 15050697



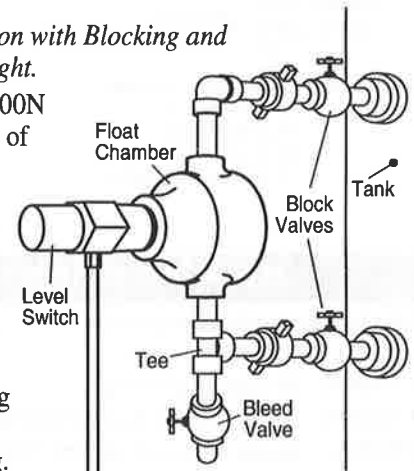
**CAUTION: USE "NON SPARKING TOOLING".**

1. 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.

2. 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.

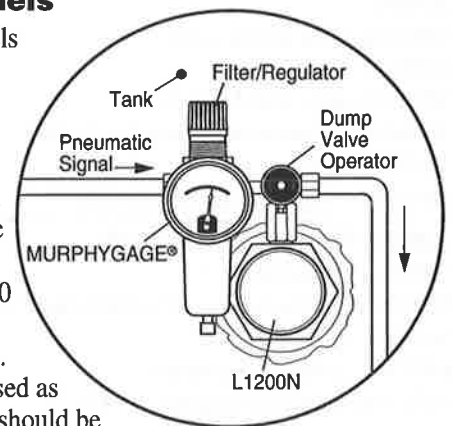
*NOTE: A typical installation with Blocking and Bleed valves is shown at right.*

3. 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.
4. To complete installation and wiring, follow the instructions for mounting directly into wall of the vessel and for wiring.



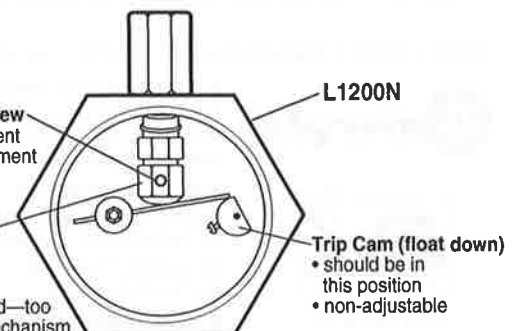
### Pneumatic Models

1. 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.*
2. All pressure connections must be tight and maintained tight so as not to leak air/gas.
3. 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

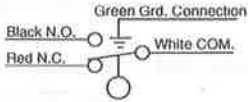
- Hex Adjustment Nut
- turn left until air seepage stops
- Caution: only slight adjustment is needed—too much will lock up mechanism



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

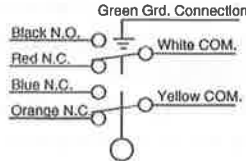
## ELECTRICAL INFORMATION

### SPDT (Snap Switch)



**Switch Rating:** 5 A @ 125-250- 480 VAC  
 1/2 A @ 125 VDC  
 1/4 A @ 250 VDC  
 2A @ 6-30 VDC Resistive  
 1A @ 6-30 VDC Inductive

### DPDT (Snap Switch)



**Switch Rating:** 10 A @ 125-250 VAC  
 1/2 A @ 125 VDC  
 1/4 A @ 250 VDC  
 10 A @ 6-24 VDC Inductive/Resistive

## 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.

**FRANK W. MURPHY MANUFACTURER** P.O. Box 470248; Tulsa, Oklahoma 74147; USA tel. (918) 627-3550 fax (918) 664-6146 e-mail sales@fwmurphy.com http://www.fwmurphy.com



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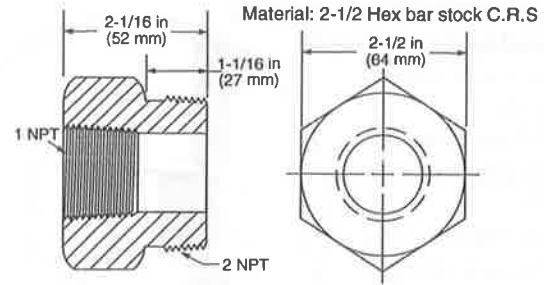
USA-ISO 9001 FM 28221  
 UK-ISO 9002 FM 29422

Printed in U.S.A.

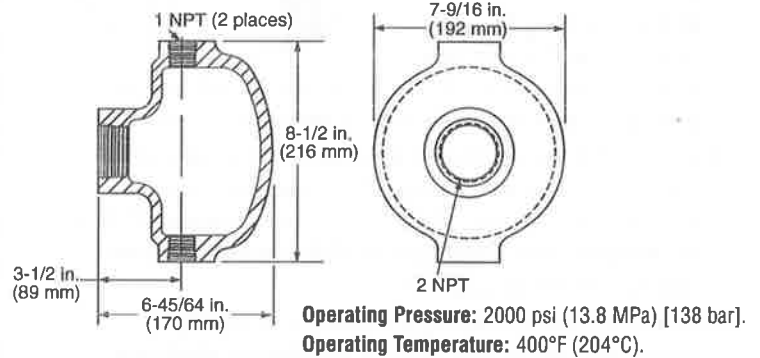
## ACCESSORIES

Order by part number designation.

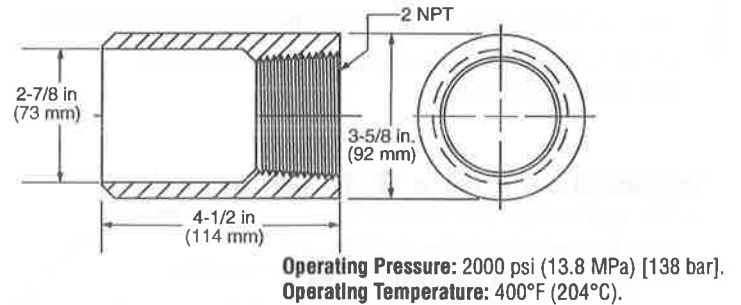
### 55050617: DV850/DV875 Adapter Bushing



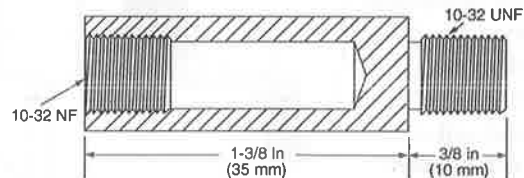
### 15050697: External Float Chamber



### 15050375: Weld Collar



### 15000892: Float Shaft Extension



## 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.

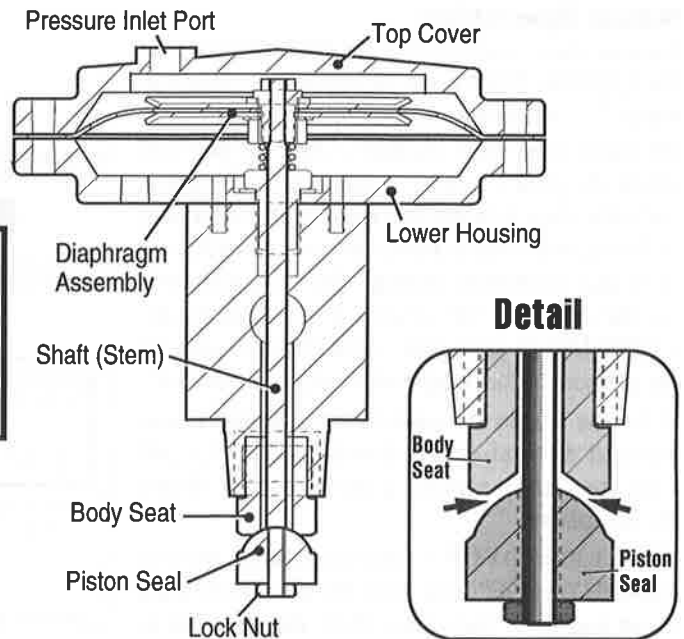
**NOTE:** Relieve pressure from scrubber or use the block valves before removing the DV dump valve.

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.

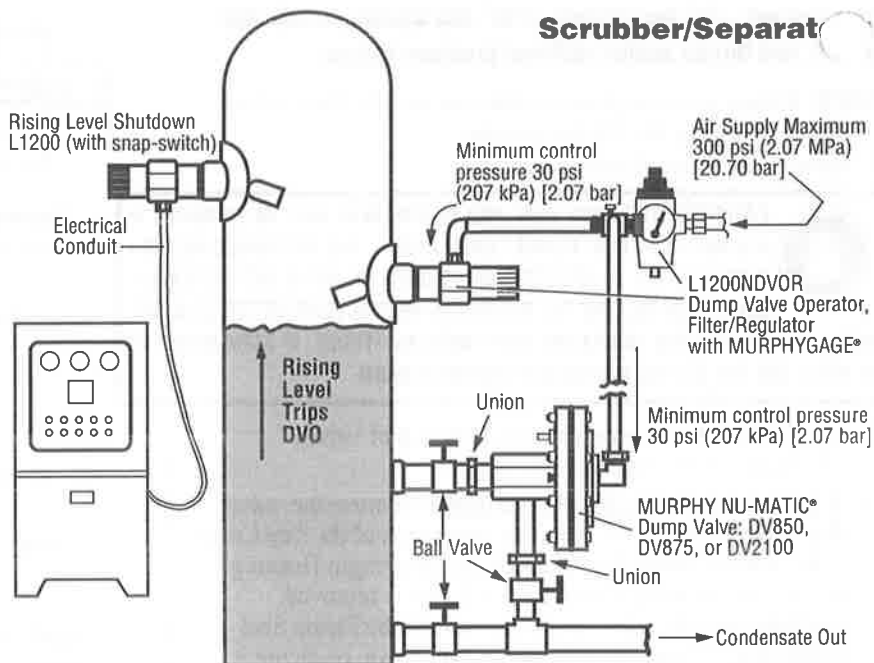
## TYPICAL INSTALLATION ON GAS COMPRESSORS

### 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.

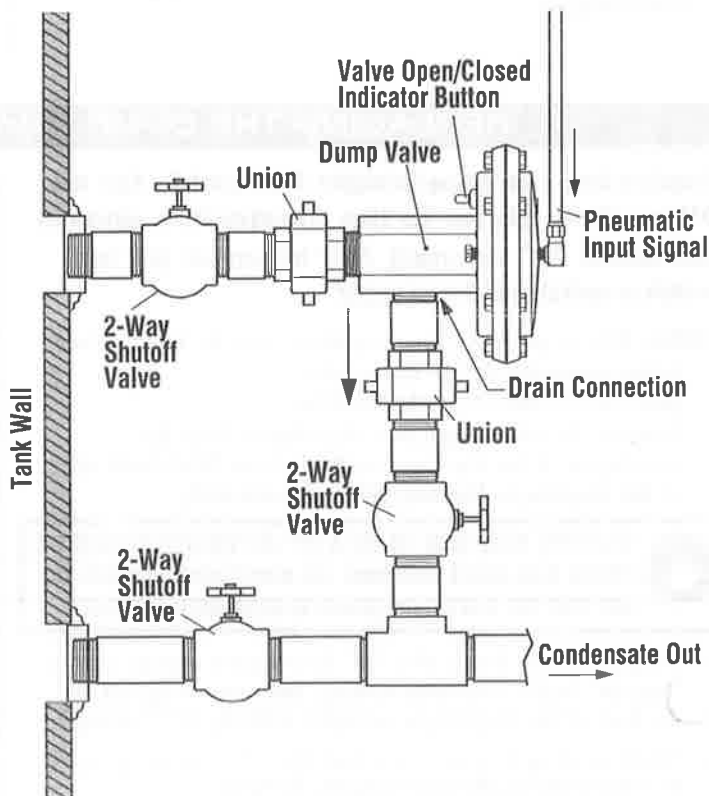
1. Install a manual shutoff (2-way) valve and a union between the DV valve and the vessel to facilitate valve repair or replacement.
2. Position the DV valve drain connection so it is on the bottom.
3. Install a 2-way valve to the drain line between the lower vessel entry and the condensate out line.
4. Be sure the unit is screwed tight and does not leak liquid.
5. 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).
6. 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:

1. Close the shutoff valve between the scrubber and the DV valve.
2. Operate the dump valve to equalize pressure to the drain (condensate out) line.
3. 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.

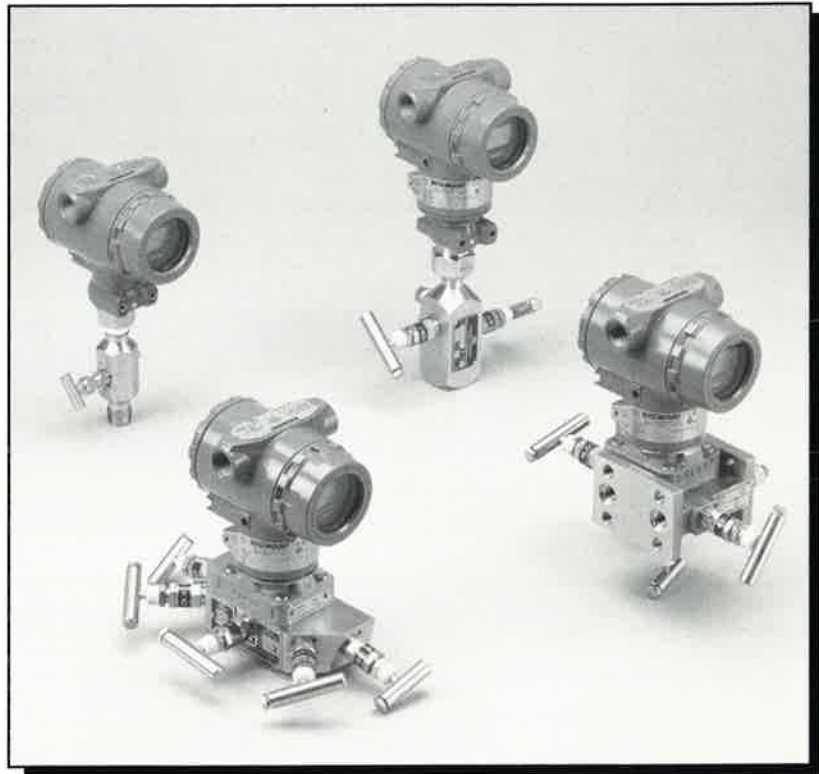
### Typical Dump Valve installation



LIT-100

00809-0100-4001  
English  
Rev. DA

# Model 3051 Smart Pressure Transmitter Family



**ROSEMOUNT®**

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

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## Introduction

### 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.

---

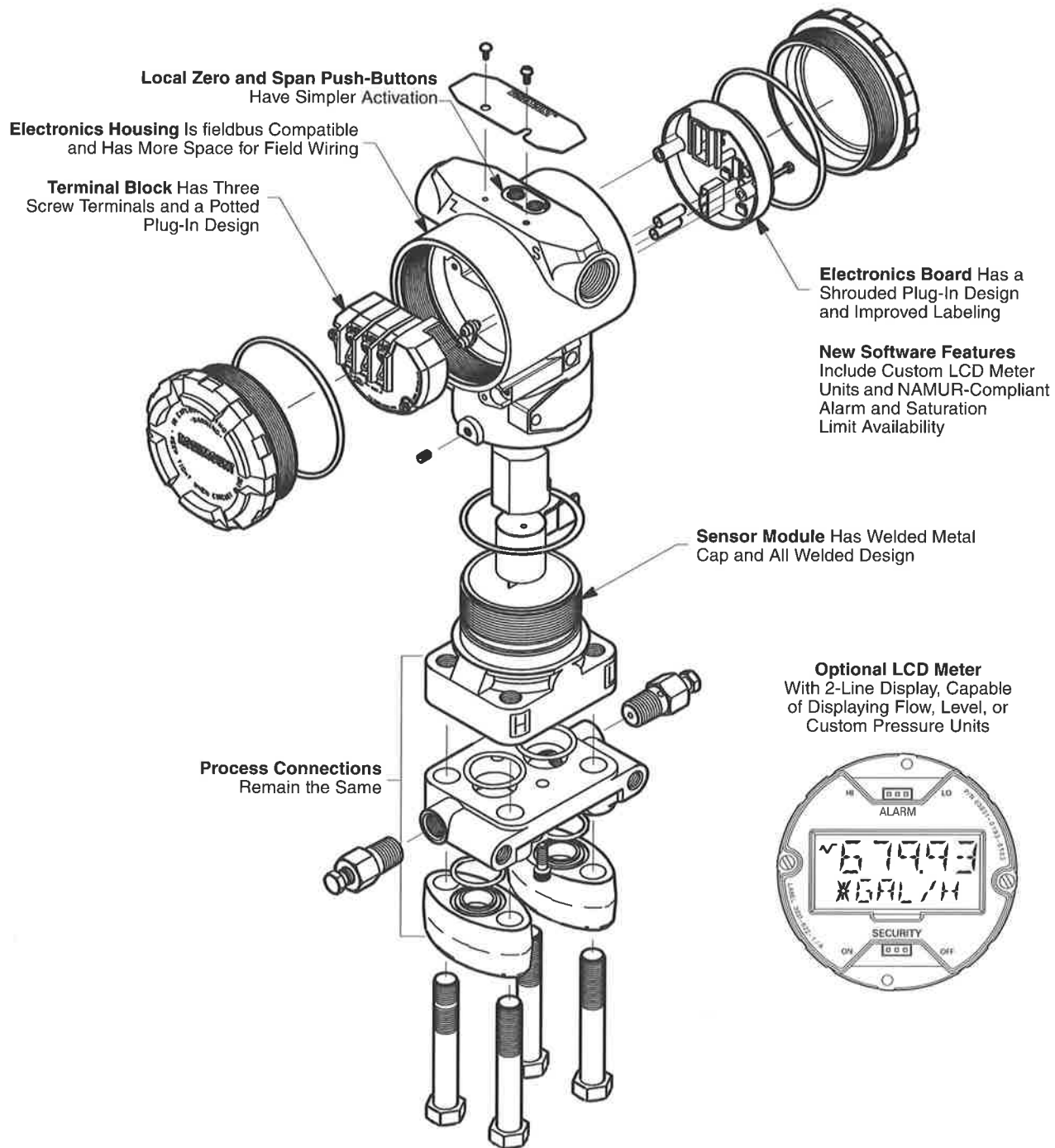
#### **NOTE**

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; 3051LCD

## 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.

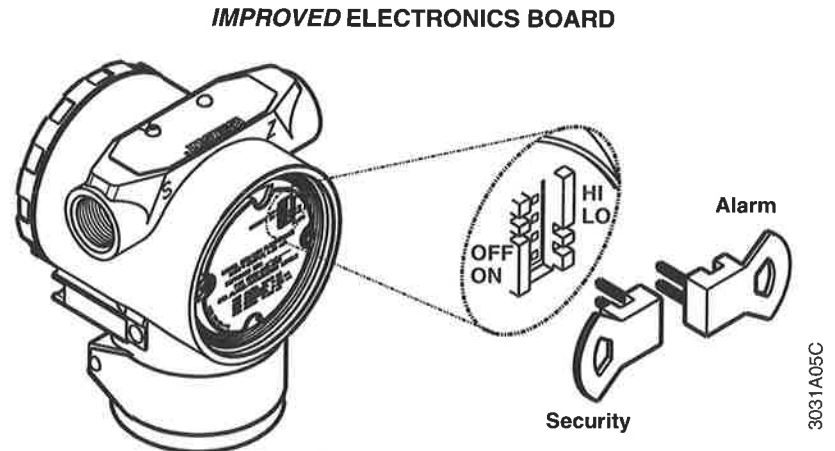


1. If the transmitter is installed, secure the loop and remove power.
2. Remove the housing cover opposite the field terminal side. Do not remove the transmitter covers in explosive atmospheres when the circuit is alive.
3. Reposition the jumpers as desired.
  - Figure 2-1 shows the jumper positions 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.

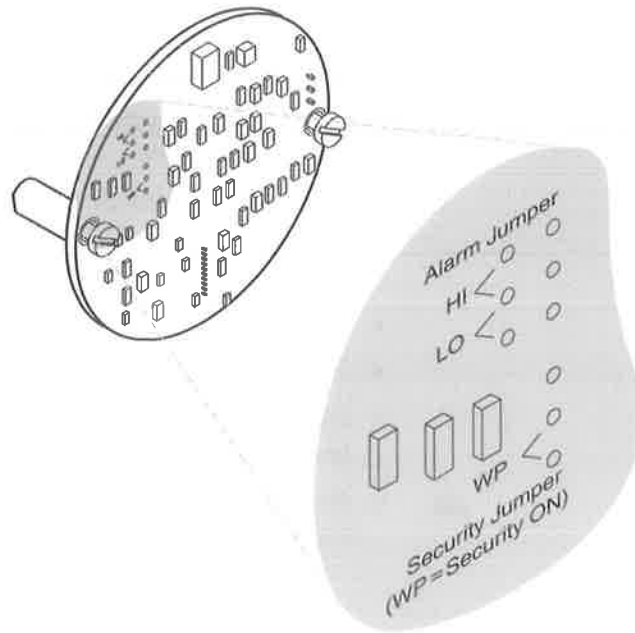
FIGURE 2-1. *Improved Electronics Board*.



### 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.

3051-3051B

**NOTE**

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

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

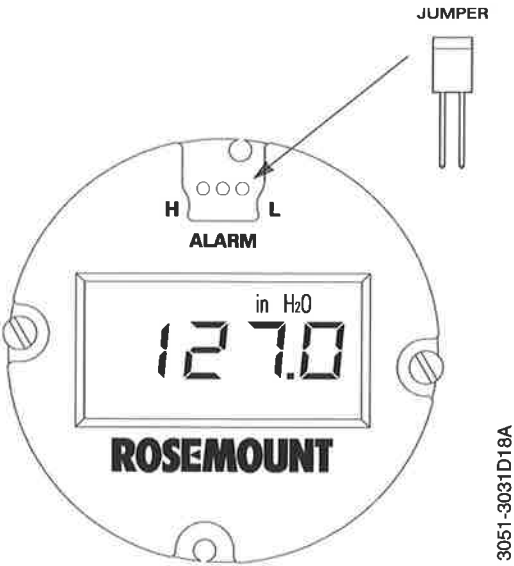


3051LCD

**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.

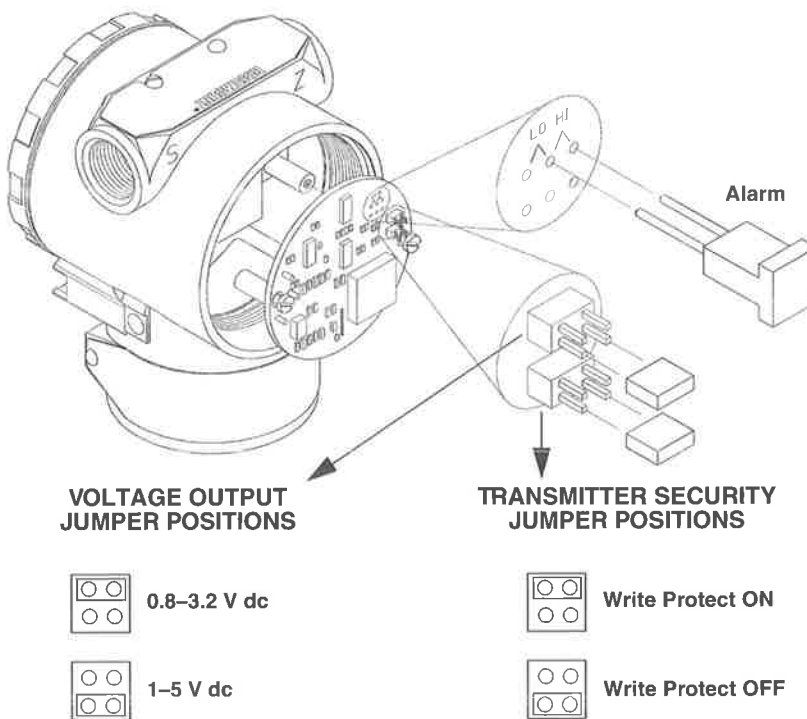
### SELECTING OUTPUT RANGE FOR LOW-POWER OUTPUT TRANSMITTERS

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

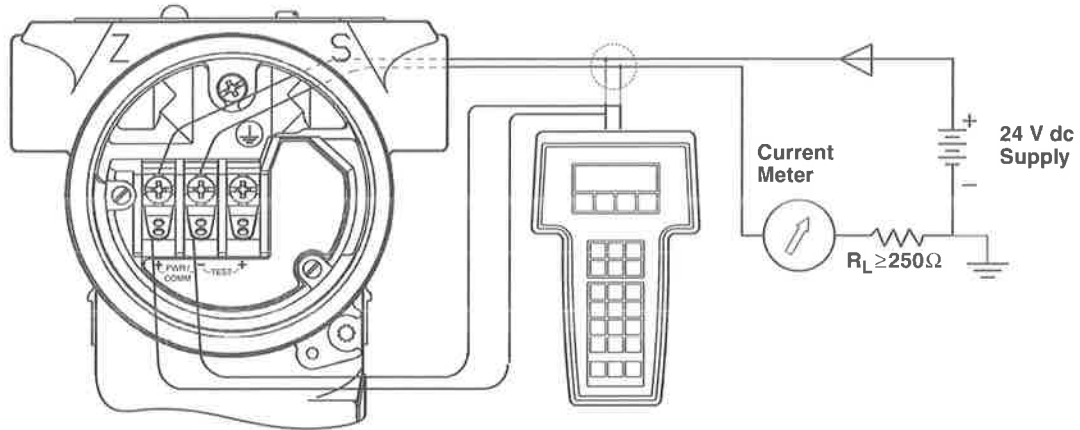
Whenever you are preparing to send or request data that would disrupt the loop or change the output of the transmitter, you must set your process application loop to manual. Both the HART Communicator Model 275 and the Rosemount Model 268 will prompt you to set the loop to manual when necessary. Keep 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)**

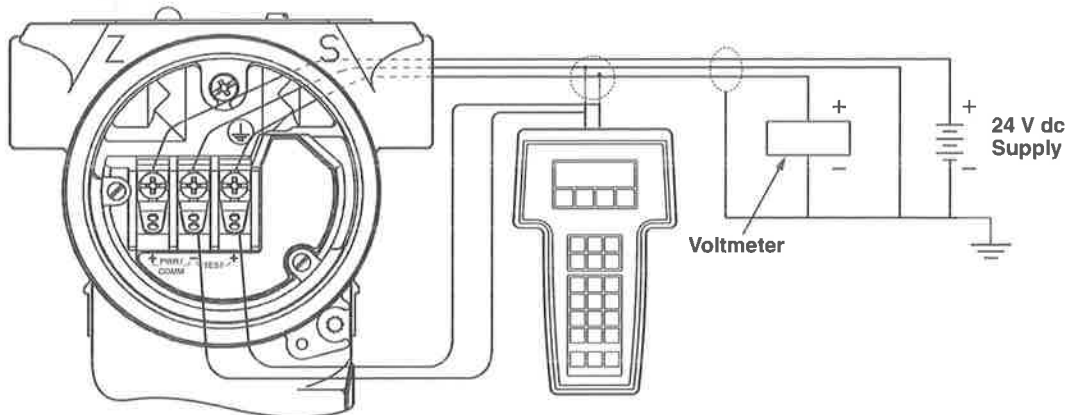
Connect the bench equipment as shown in Figure 2-6 and 2-7, and turn on the HART-based communicator by pressing the ON/OFF key. The communicator will search for a HART-compatible device and will indicate when the connection is made. If the communicator fails to connect, it will indicate that no device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

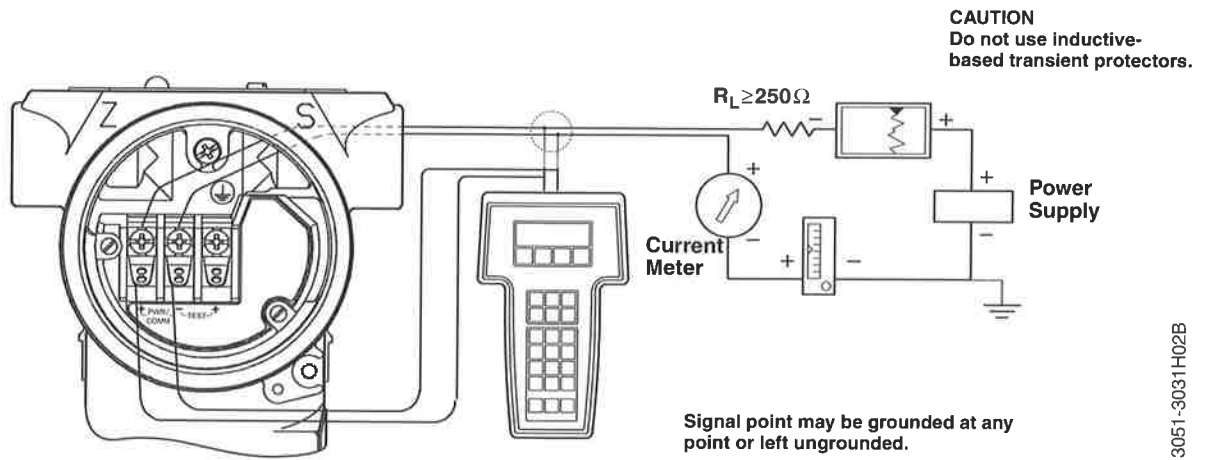


3051-3031I02B

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

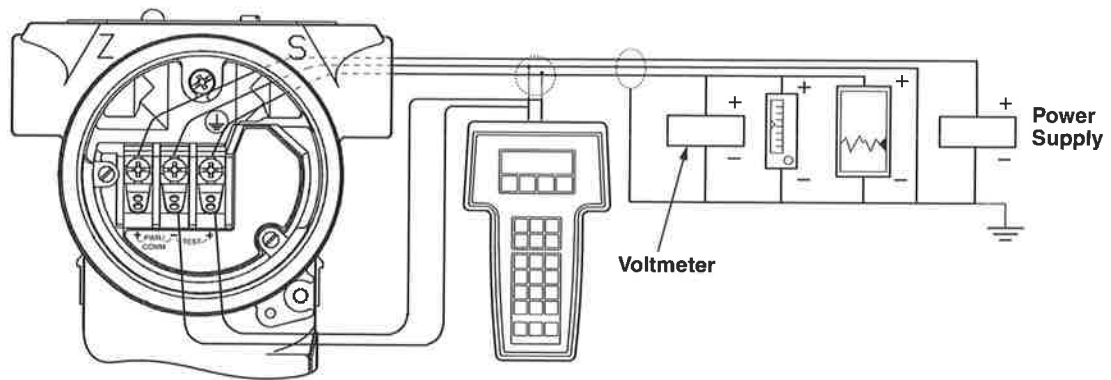
The following diagrams illustrate wiring loops for a field hook-up with a HART-based communicator.

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 ±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**

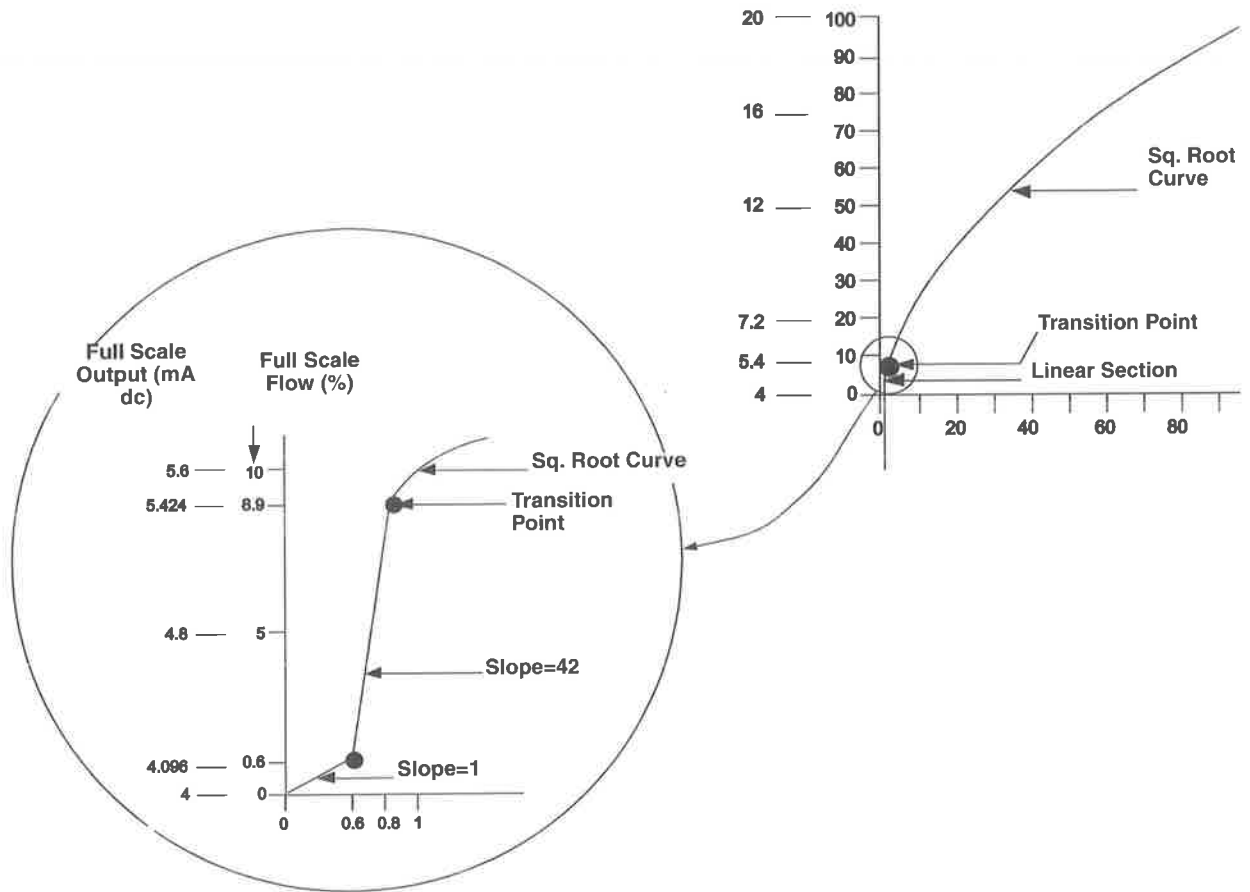
HART Comm.	1, 3, 5
Model 268	F3, F2, F1, F1

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**

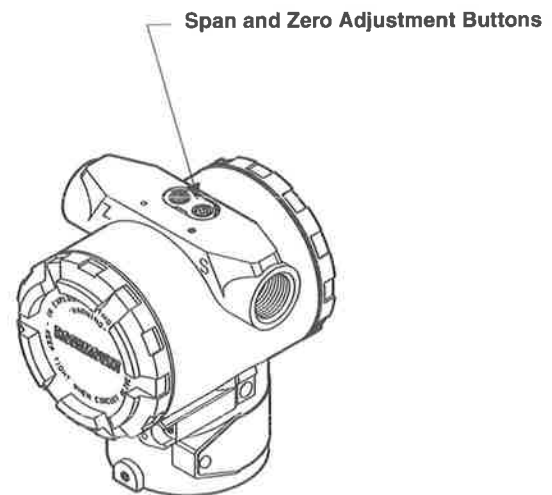
The zero and span adjustments on previous versions of the transmitter are screws instead of buttons. To activate the zero and span adjustments loosen the screws until they pop up.

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.



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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

HART Comm.	1, 2, 1, 1
Model 268	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

HART Comm.	1, 2, 2
Model 268	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)

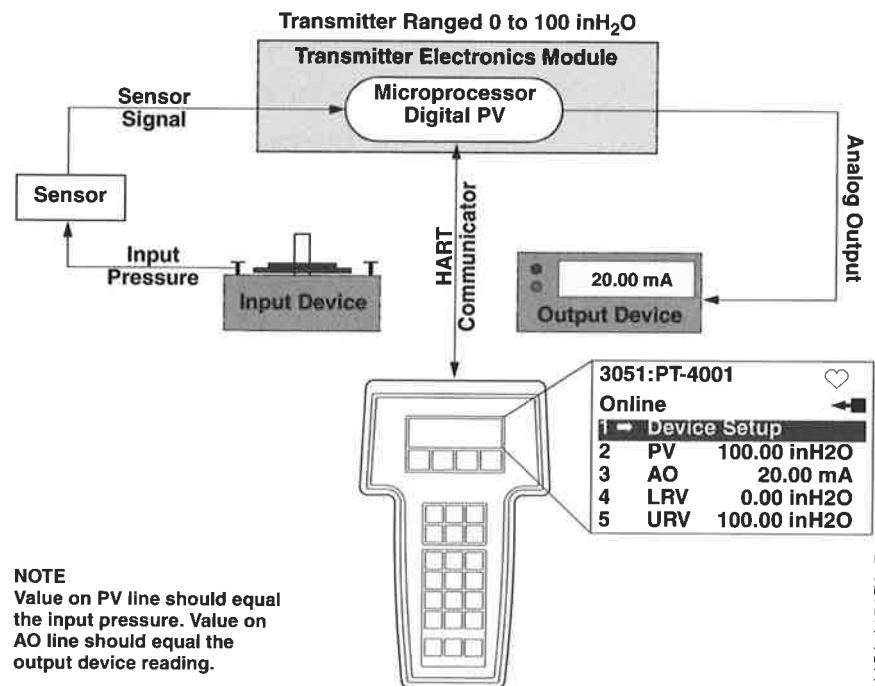
Figure 2-12 on page 2-21 illustrates the Model 3051 transmitter data flow. This data flow can be summarized in four major steps:

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.



**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:

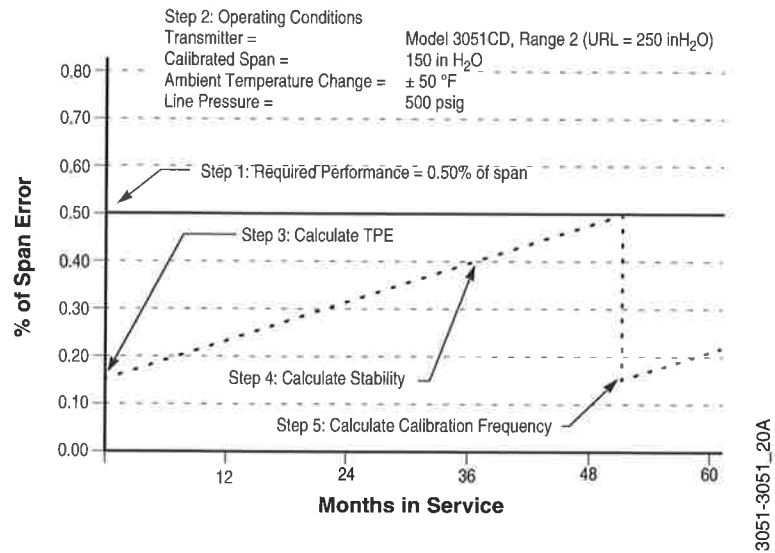
1. Connect a pressure source, a HART communicator, and a digital readout device to the transmitter.
2. Establish communication between the transmitter and the communicator.
3. Apply pressure equal to the upper range point pressure (100 inH<sub>2</sub>O, for example).
4. Compare the applied pressure to 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

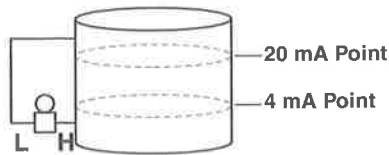
You can trim the sensor using either the full trim or the zero trim function. The trim functions vary in complexity, and their use is application-dependent. Both trim functions alter the transmitter's interpretation of the input signal.

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.

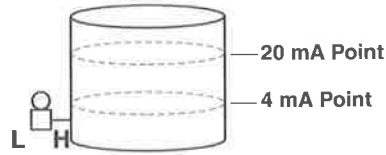
When performing a zero trim, ensure that the equalizing valve is open and all wet legs are filled to the correct levels.

### NOTE

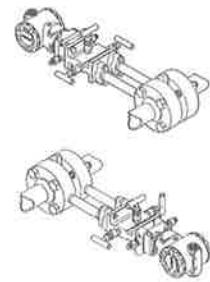
**Do not perform a zero trim on Model 3051 Absolute pressure transmitters.** A zero trim is zero based, and absolute pressure transmitters reference absolute zero. To correct mounting position effects on a Model 3051 Absolute Pressure Transmitter, perform a low trim within the full sensor trim function. 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**

HART Comm.	1, 2, 3, 3, 1
Model 268	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**

HART Comm.	1, 2, 3, 3
Model 268	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.

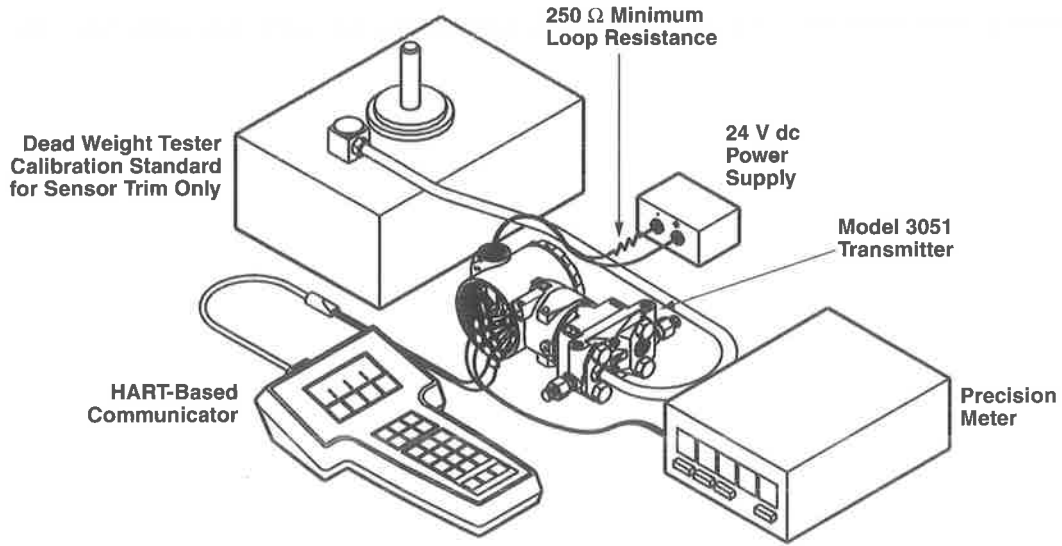
2. From the communicator **MAIN** menu select *1 Device setup*, *2 Diagnostics and service*, *3 Calibration*, *3 Sensor trim*, *2 Lower sensor trim* to prepare to adjust the lower trim point.

**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

### Digital-to-Analog Trim

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

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).

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.

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.

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

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

### 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**

HART Comm.	1, 4, 3, 3, 3
Model 268	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.

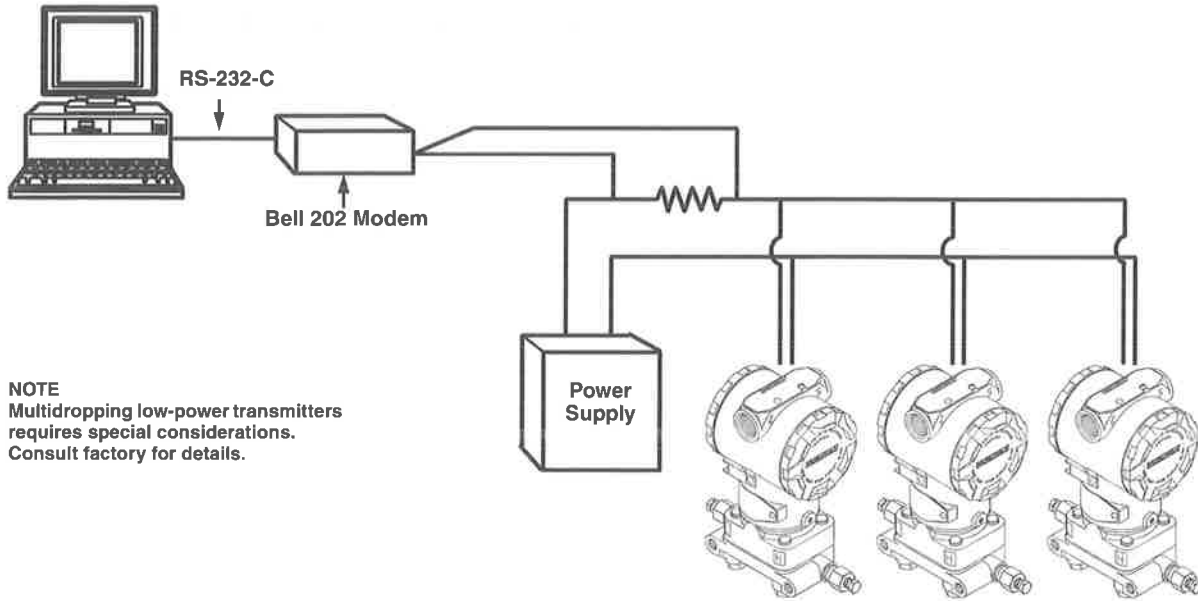
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### NOTE

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**

HART Comm.	1, 4, 3, 3, 1
Model 268	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**

HART Comm.	1, 4, 3, 3, 2
Model 268	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**

HART Comm.	Left arrow, 4, 1
Model 268	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.

# Installation

## 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.**

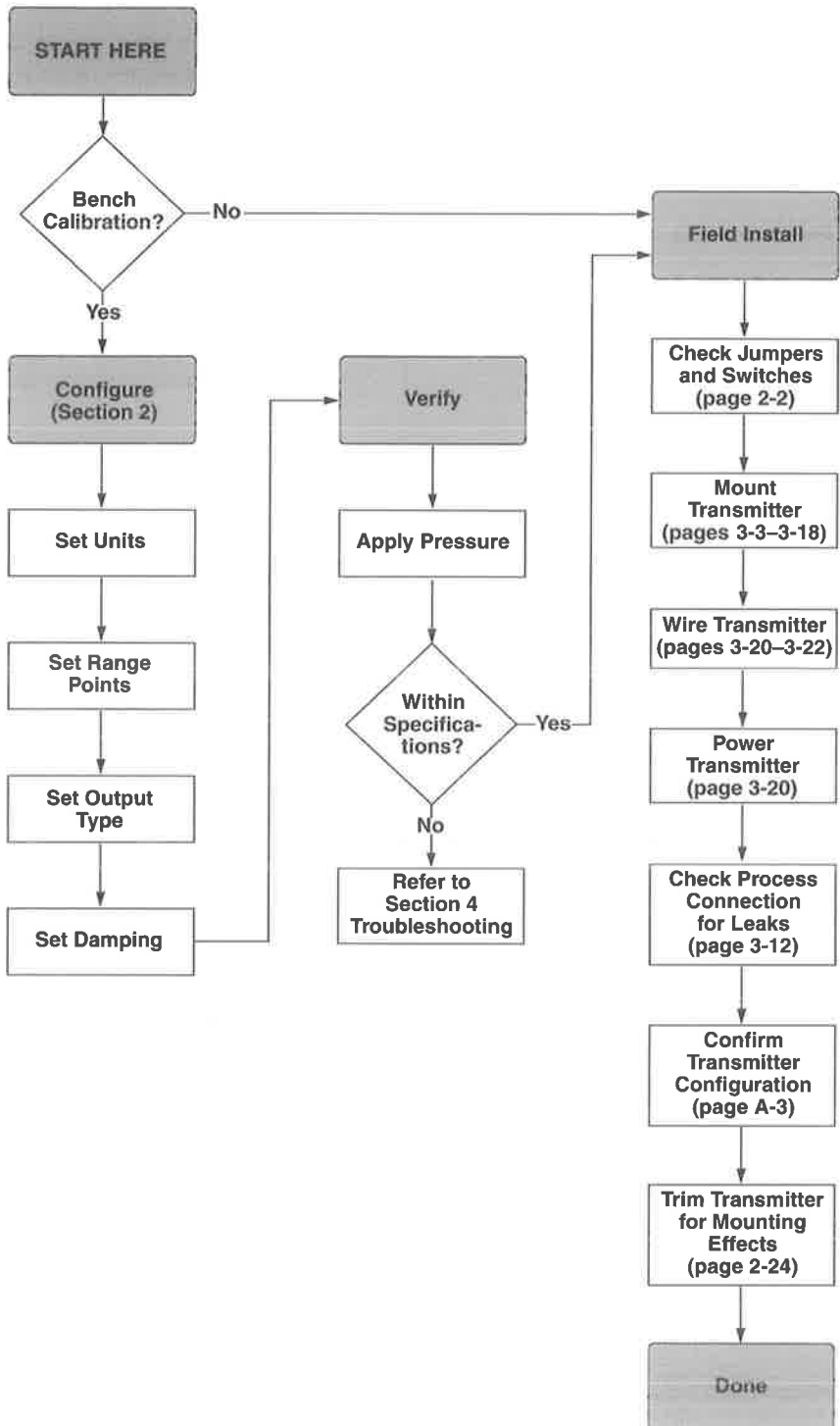
- Use only bolts supplied with the Model 3051 or sold by Rosemount Inc. as spare parts for the Model 3051.

**⚠ 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.

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### 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.

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### 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.

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### 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.

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### NOTE

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

---



# Rosemount Model 3051 Smart Pressure Transmitters

FIGURE 3-2. Model 3051CD Dimensional Drawings.

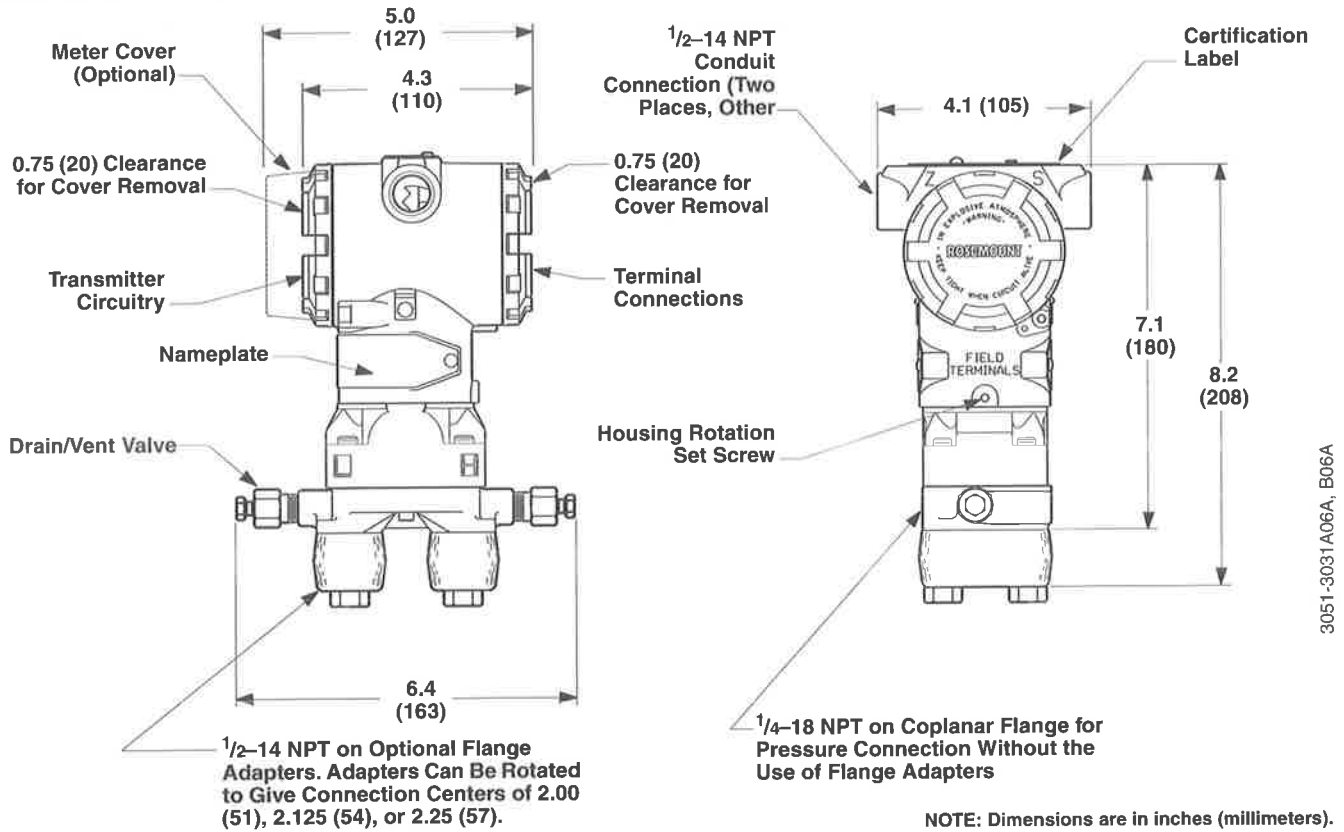


FIGURE 3-3. Model 3051CG and 3051CA Dimensional Drawings.

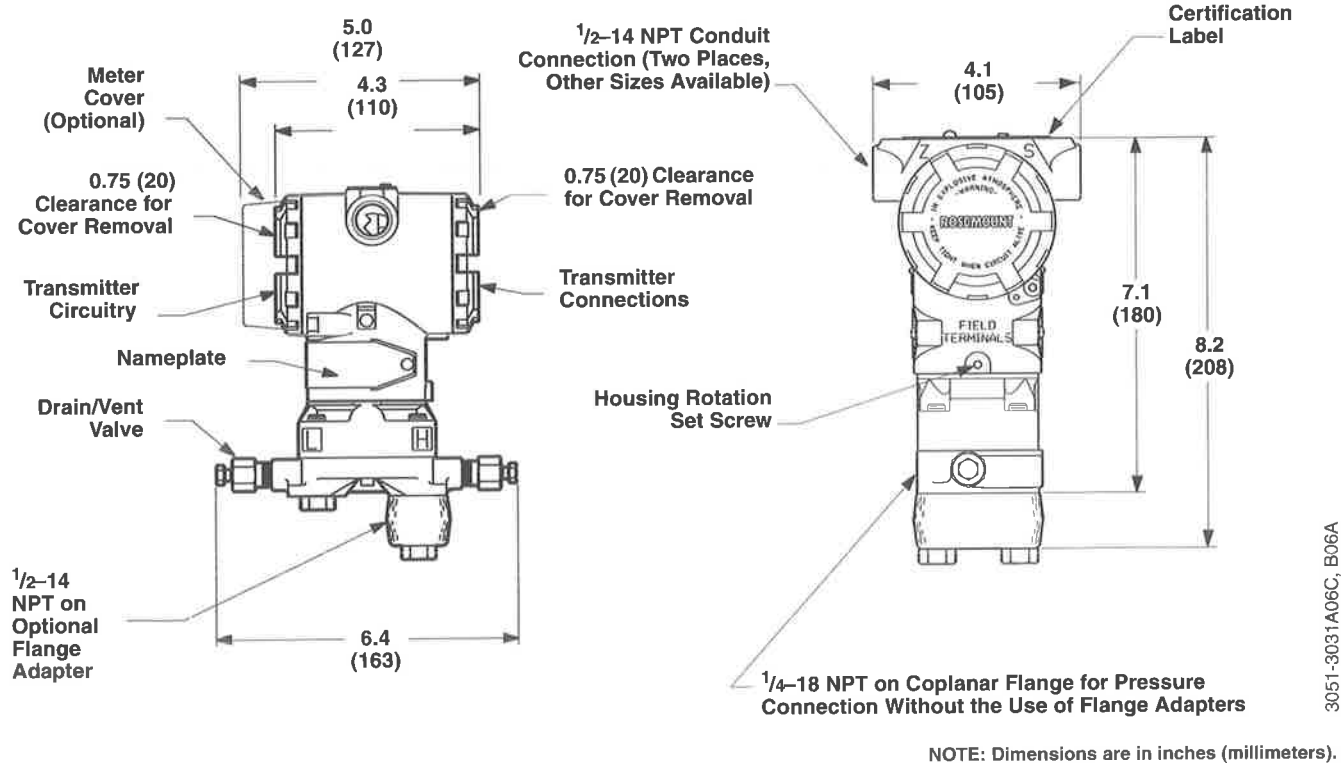


FIGURE 3-4. Model 3051C (Traditional Flange) Dimensional Drawings.

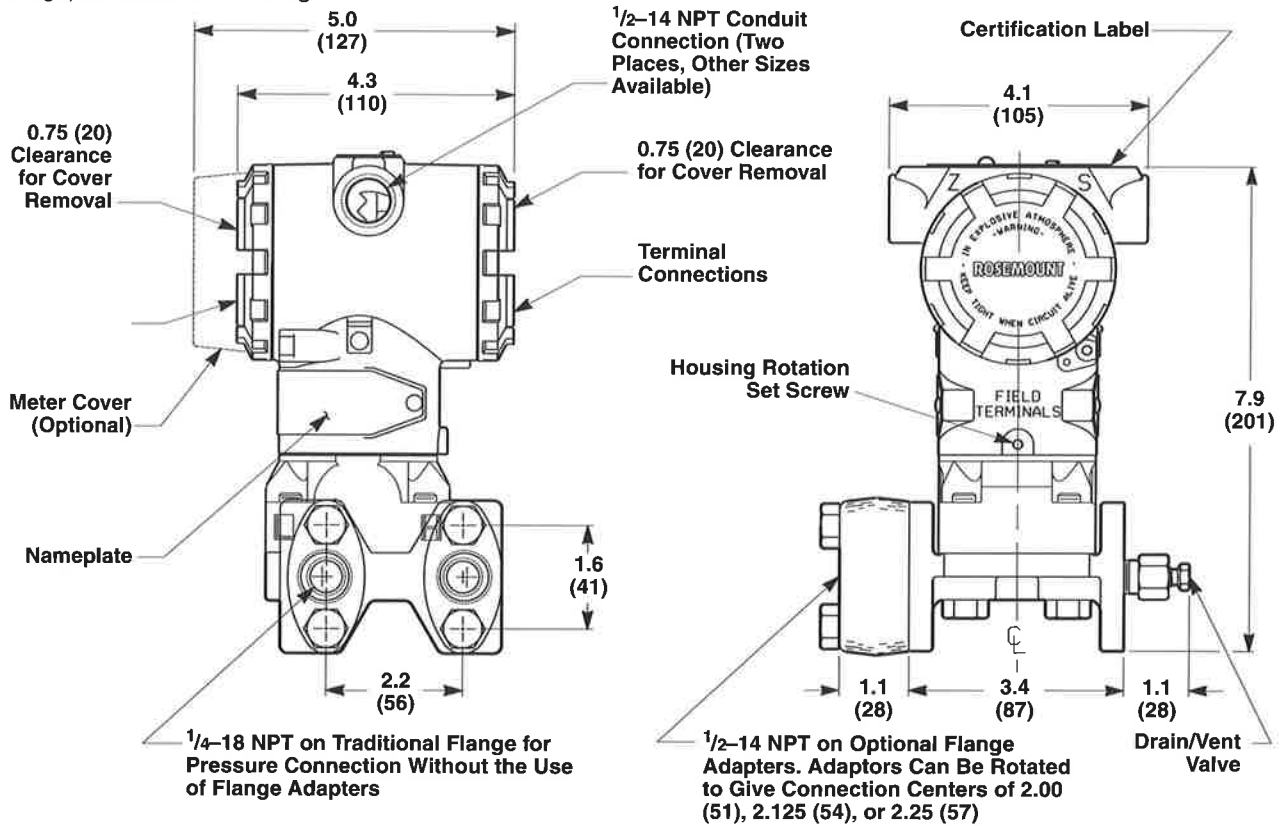


FIGURE 3-5. Model 3051T Dimensional Drawings.

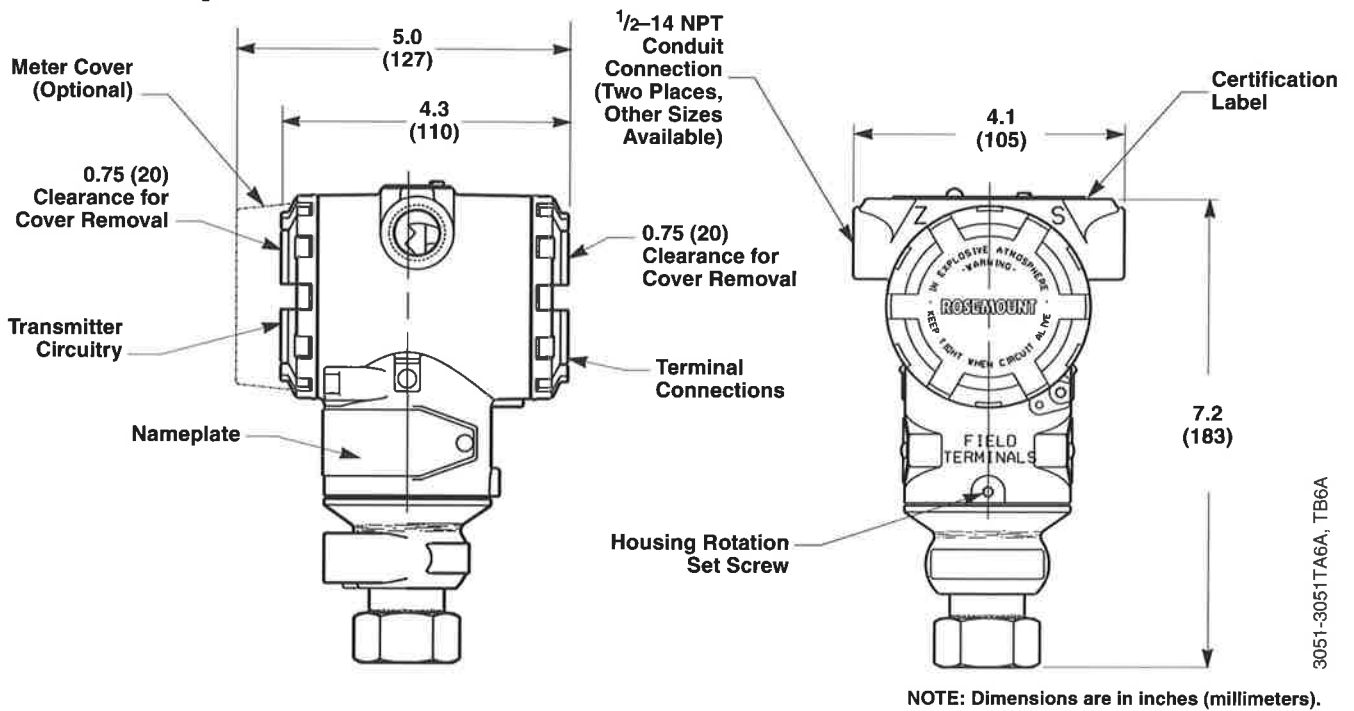


FIGURE 3-6. Model 3051H  
Dimensional Drawings.

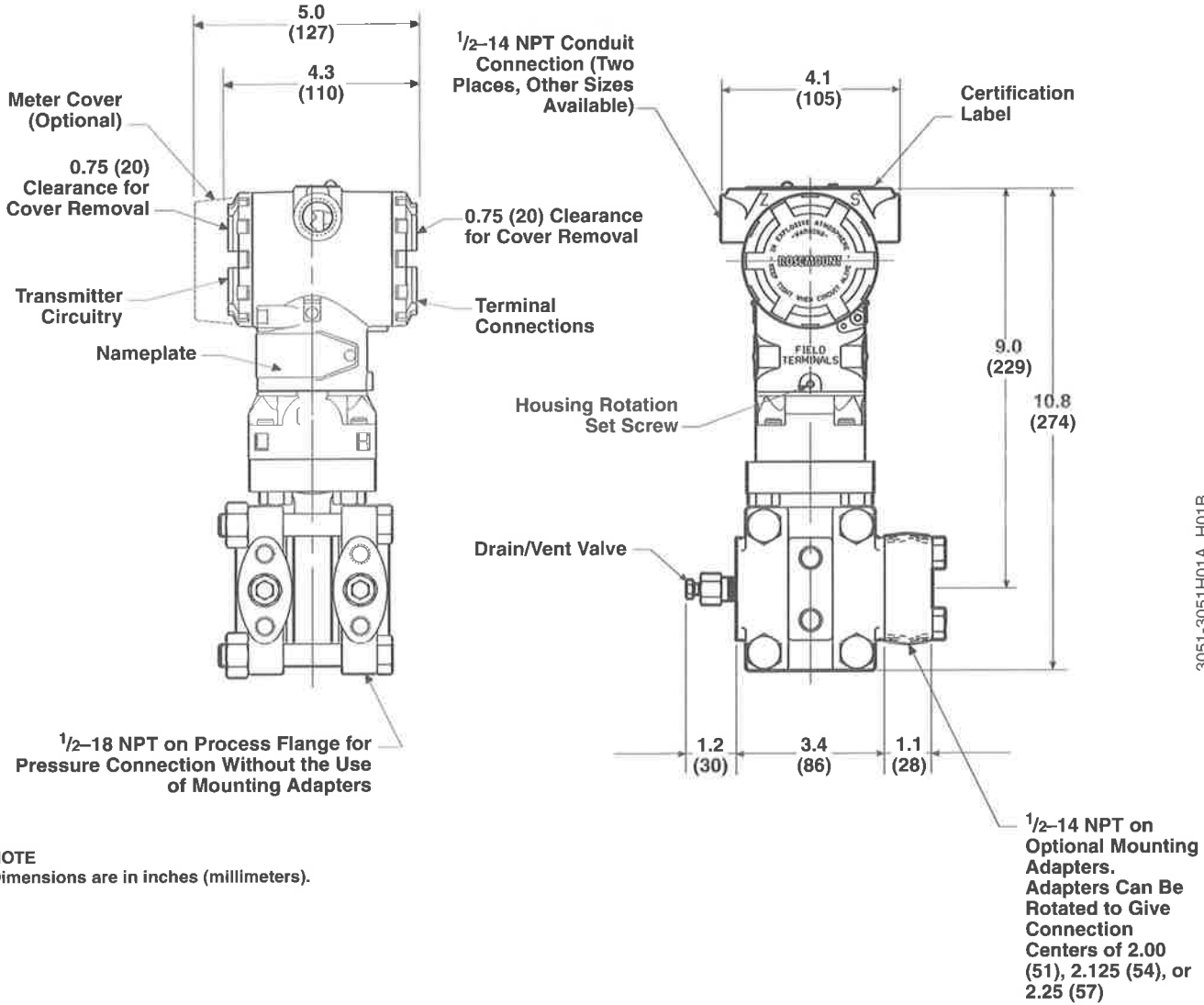


TABLE 3-1. Model 3051L Dimensional Specifications—*Except Where Noted, Dimensions Are in Inches (Millimeters).*

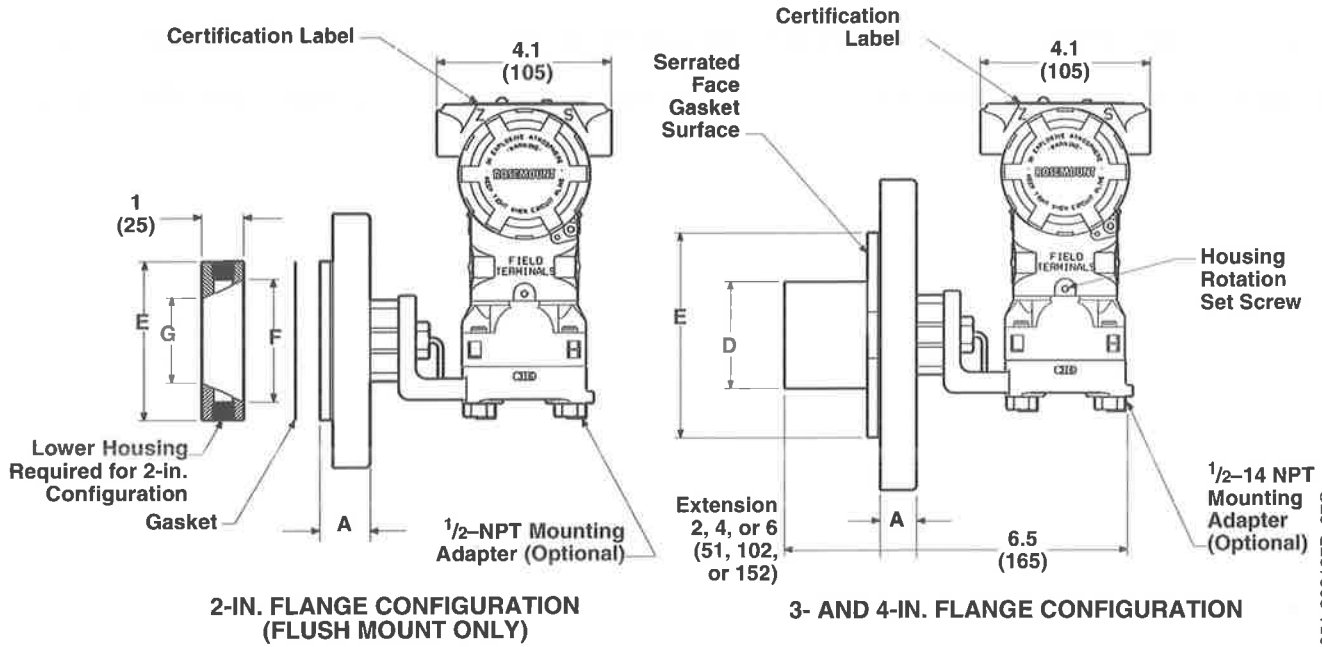
Class	Pipe Size	Flange Thickness A	Bolt Diameter B	Outside Diameter C	No. of Bolts	Bolt Hole Diameter	Exten. Diam. (1) D	O.D. Gask. Surf. E	Lower Housing	
									Xmtr Side F	Proc. Side G
ASME B 16.5 (ANSI) 150	2 (51)	1.12 (28)	4.75 (121)	6.0 (152)	4	0.75 (19)	NA	3.75 (95)	2.9 (74)	2.16 (55)
	3 (76)	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

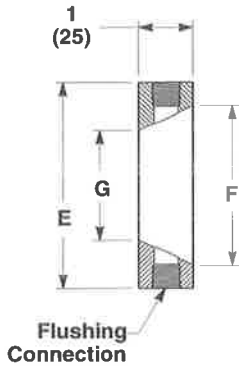
Use this table in conjunction with Figure 3-7.

FIGURE 3-7. Model 3051L  
Dimensional Drawings.

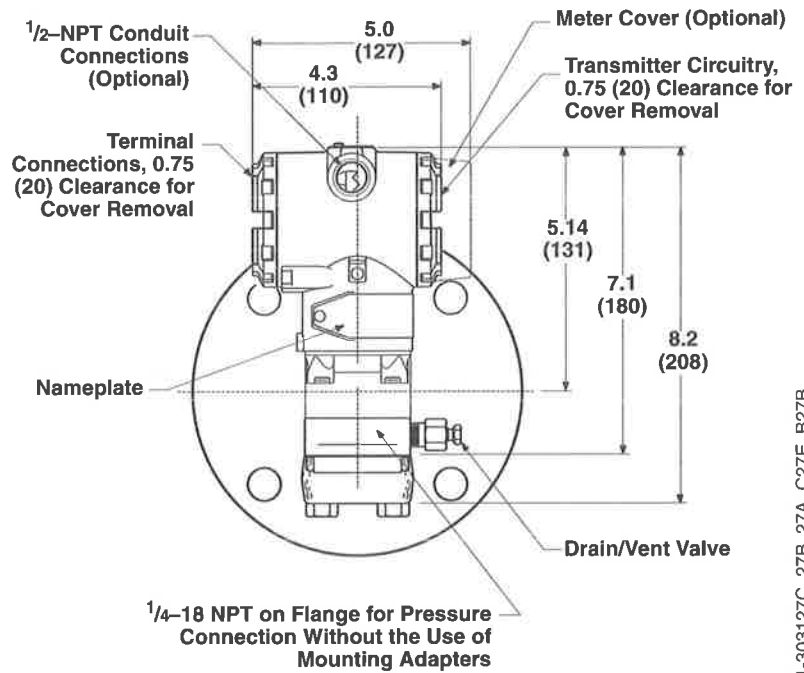
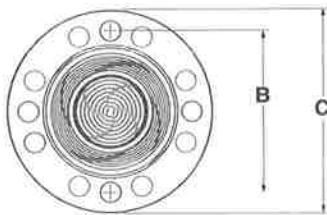


3051-303127B, 27C

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



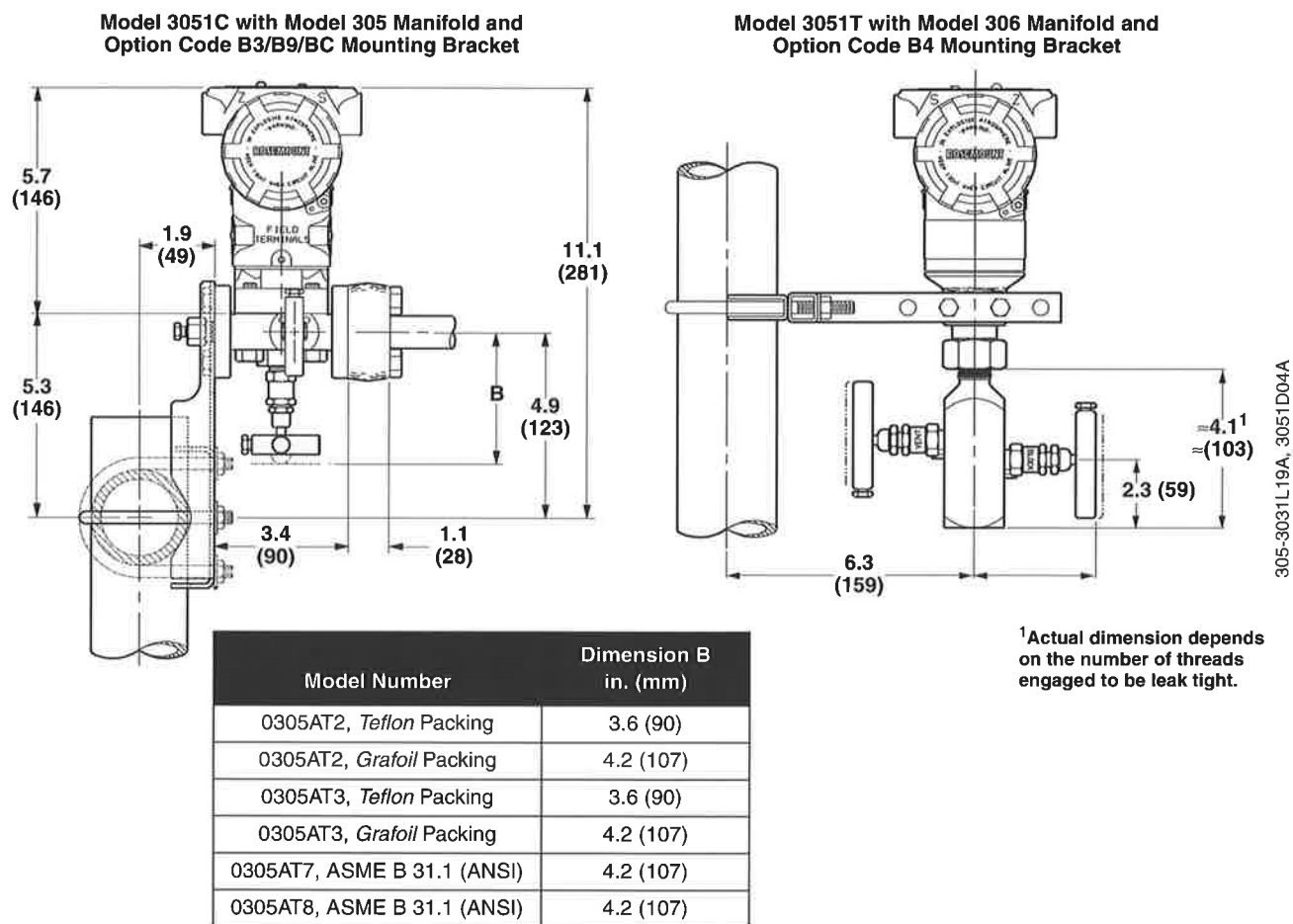
**DIAPHRAGM ASSEMBLY AND MOUNTING FLANGE**



NOTE: Dimensions are in inches (millimeters).

3051-303127C, 27B, 27A, C27E, B27B

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



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**

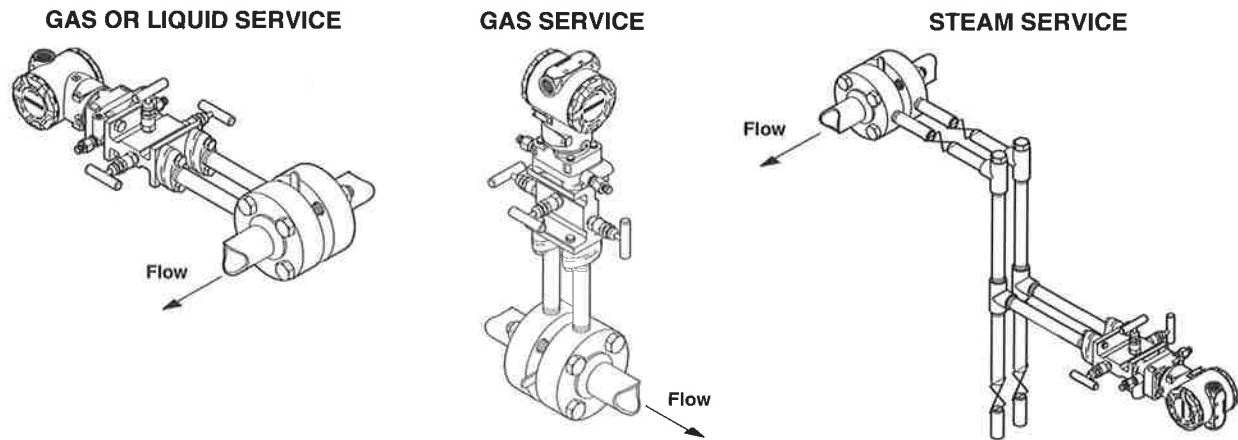
- Place taps to the side of the line.
- Mount the transmitter below the taps to ensure that the impulse piping will stay filled with condensate.
- Fill impulse lines with water to prevent the steam from contacting the transmitter directly and to ensure accurate measurement start-up.

**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.

---

FIGURE 3-9. Installation Examples.



3051-3031A03A, B03A, C03A

### 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  $\frac{1}{4}$ -18 NPT. Flange adapter unions with  $\frac{1}{2}$ -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  $2\frac{1}{8}$ -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),  $2\frac{1}{8}$  inches (54 mm), or  $2\frac{1}{4}$  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.

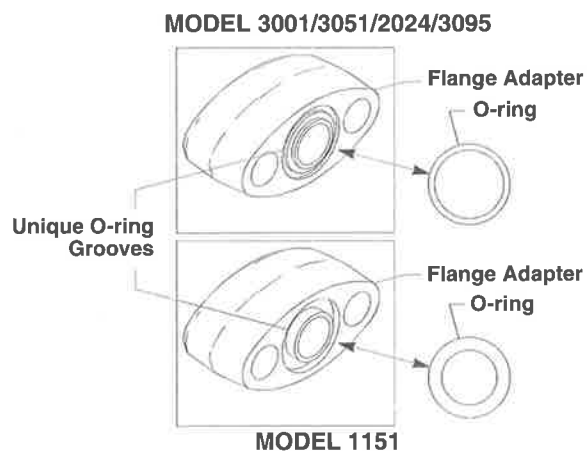
To install adapters to a Coplanar flange, perform the following procedure:

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.



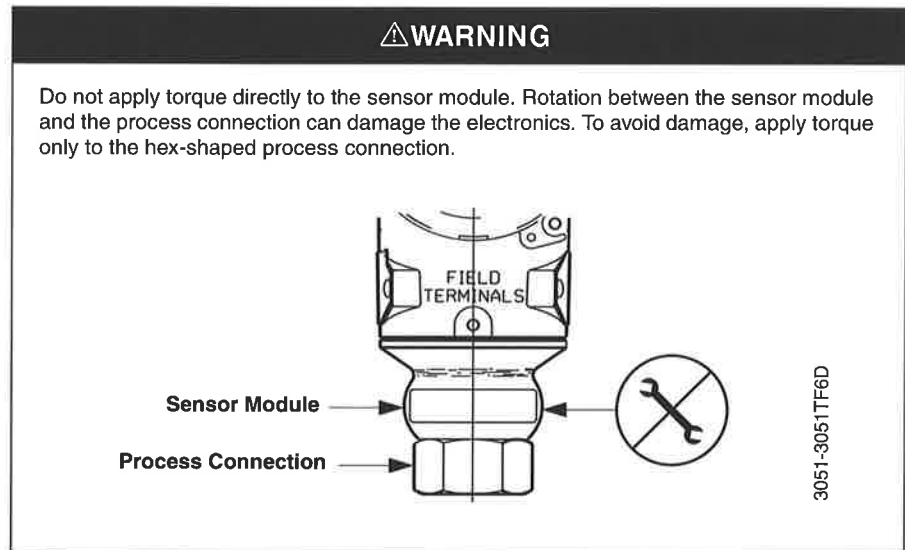
3051-0569A01A

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



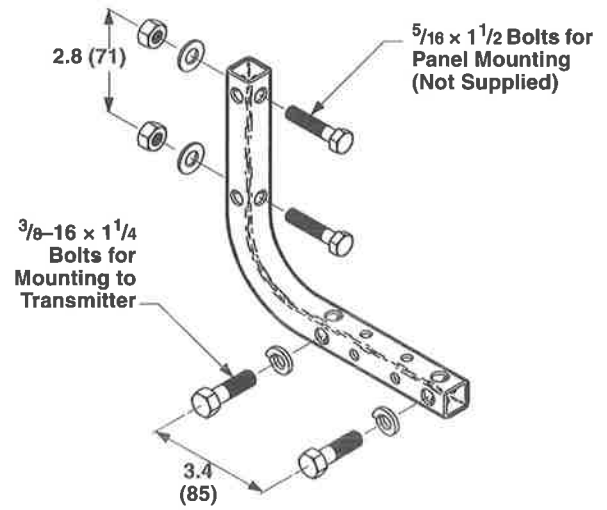
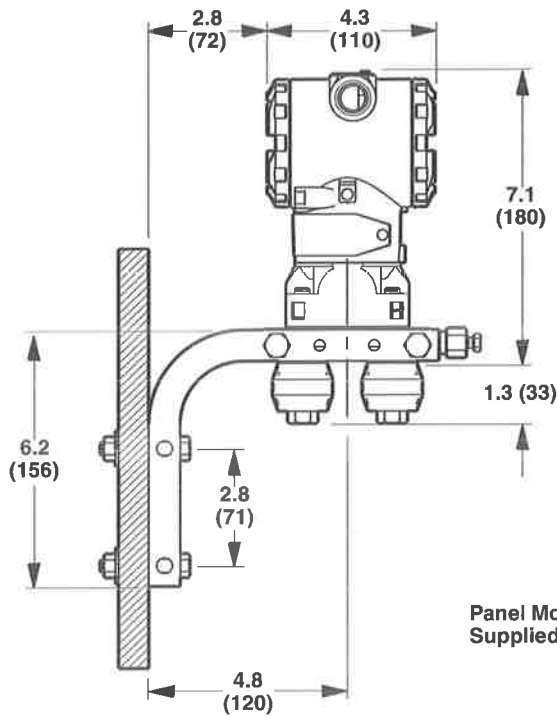
### Housing Rotation

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.

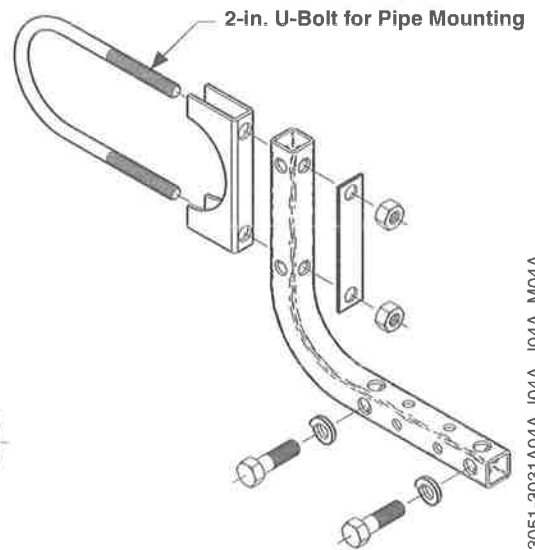
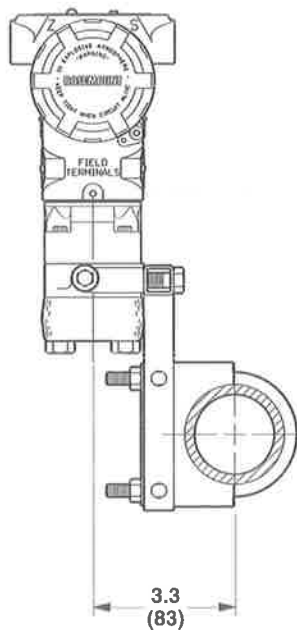
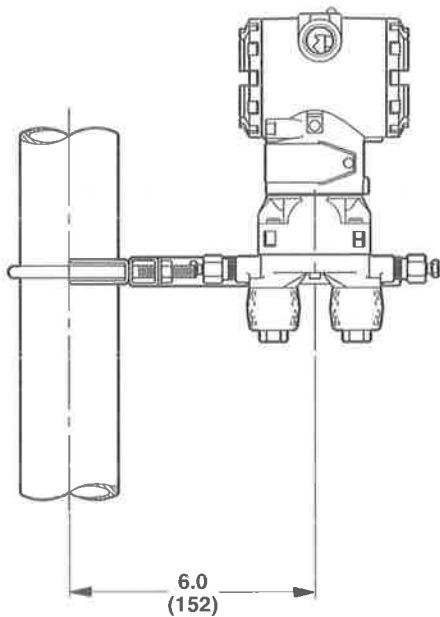
FIGURE 3-10. Coplanar Flange Mounting Configurations with Optional Bracket (B4) for 2-in. Pipe or Panel Mounting.

PANEL MOUNTING



Panel Mounting Configuration  $\frac{3}{8}$ -16 x  $1\frac{1}{4}$  Bolts (2) Supplied for Attaching Bracket to Transmitter

PIPE MOUNTING

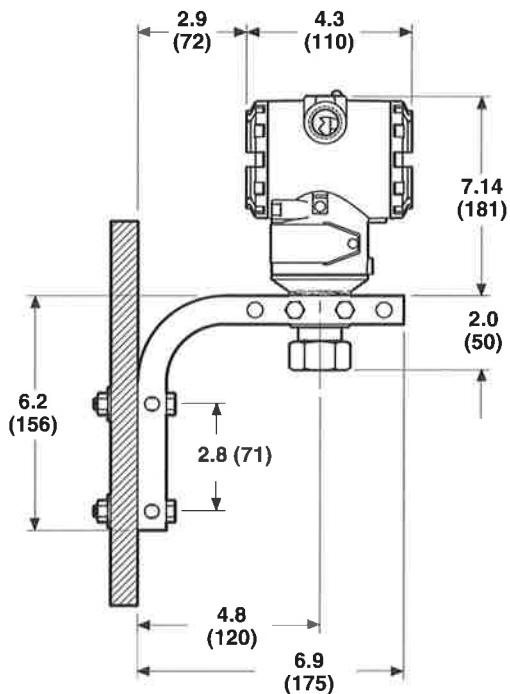


3051-3031A04A, I04A, J04A, M04A

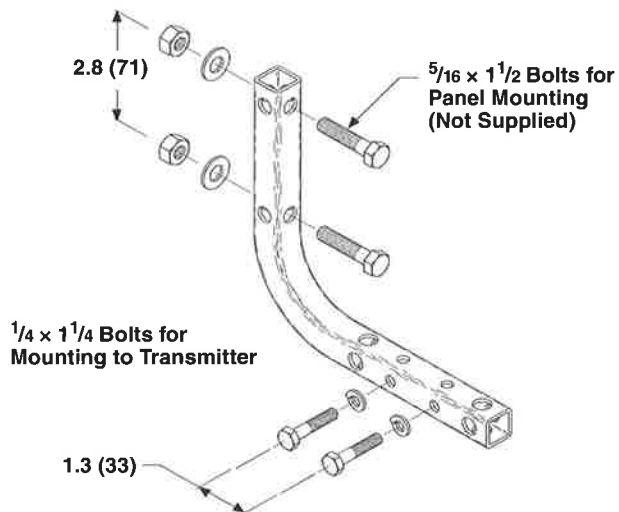
NOTE  
Dimensions are in inches (millimeters).

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

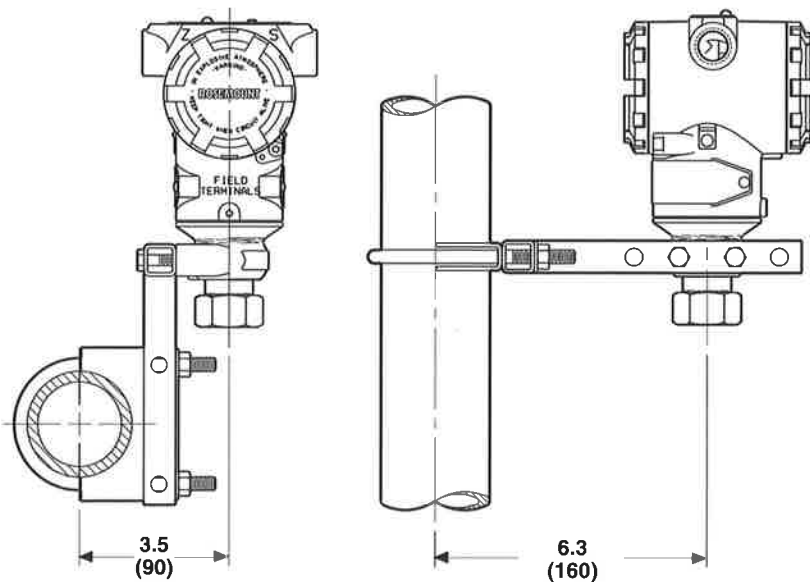
PANEL MOUNTING



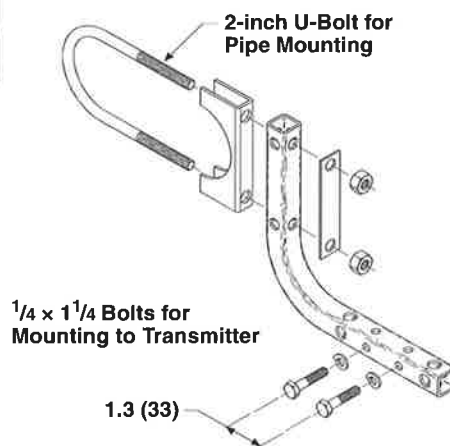
PANEL MOUNTING BRACKET



PIPE MOUNTING



PIPE MOUNTING BRACKET

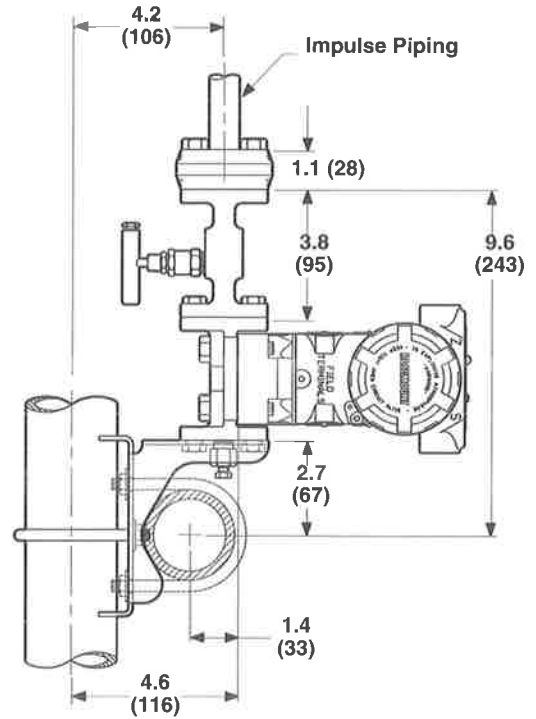
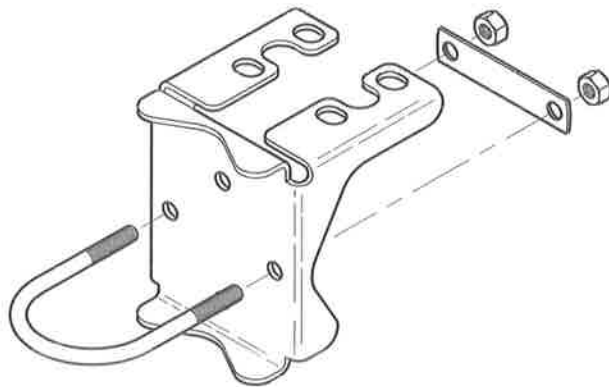


NOTE  
Dimensions are in inches (millimeters).

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**

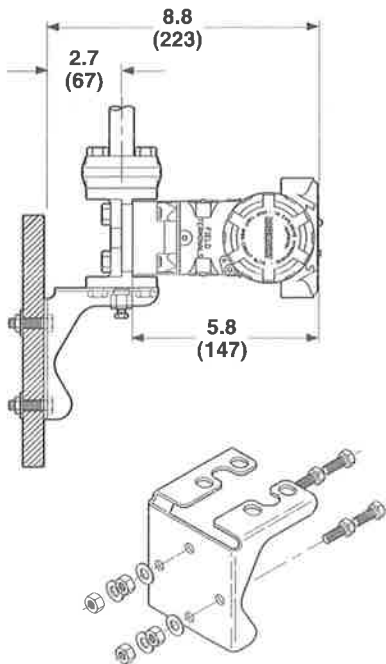


**NOTE**  
Dimensions are in inches (millimeters).

3051-3031C19A, I19A

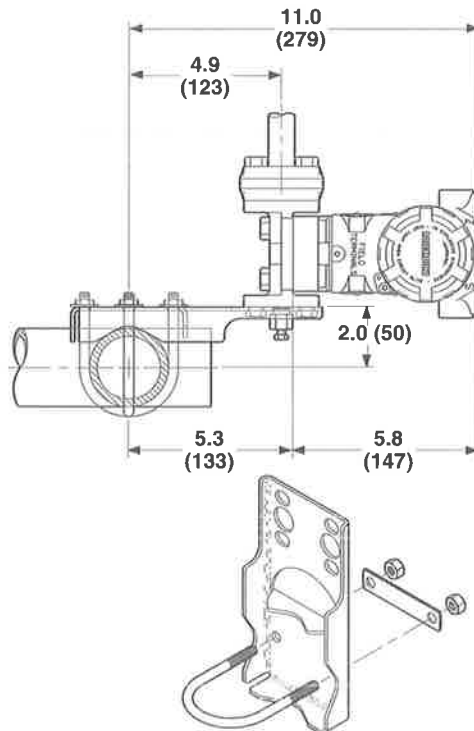
FIGURE 3-13. Optional Mounting Brackets for Traditional Flange Options B2/B8, B3/B9/BC.

**OPTION B2/B8: TRADITIONAL FLANGE PANEL MOUNTING BRACKET**



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

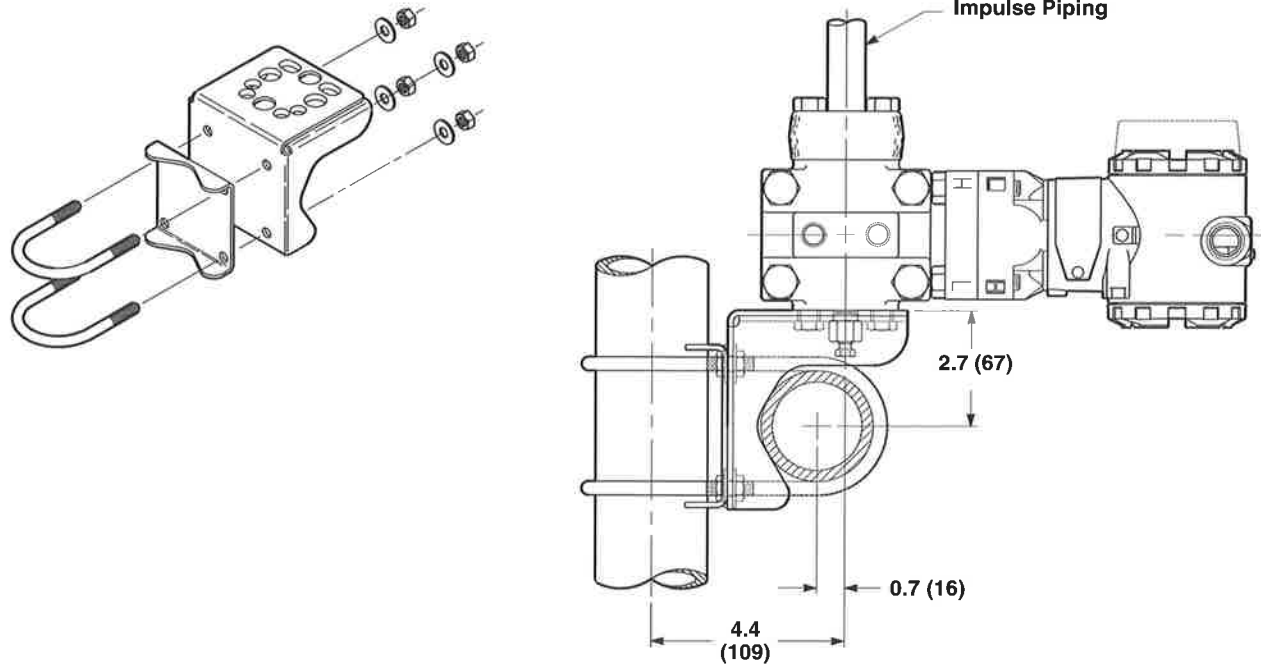
**OPTION B3/B9/BC: TRADITIONAL FLANGE**



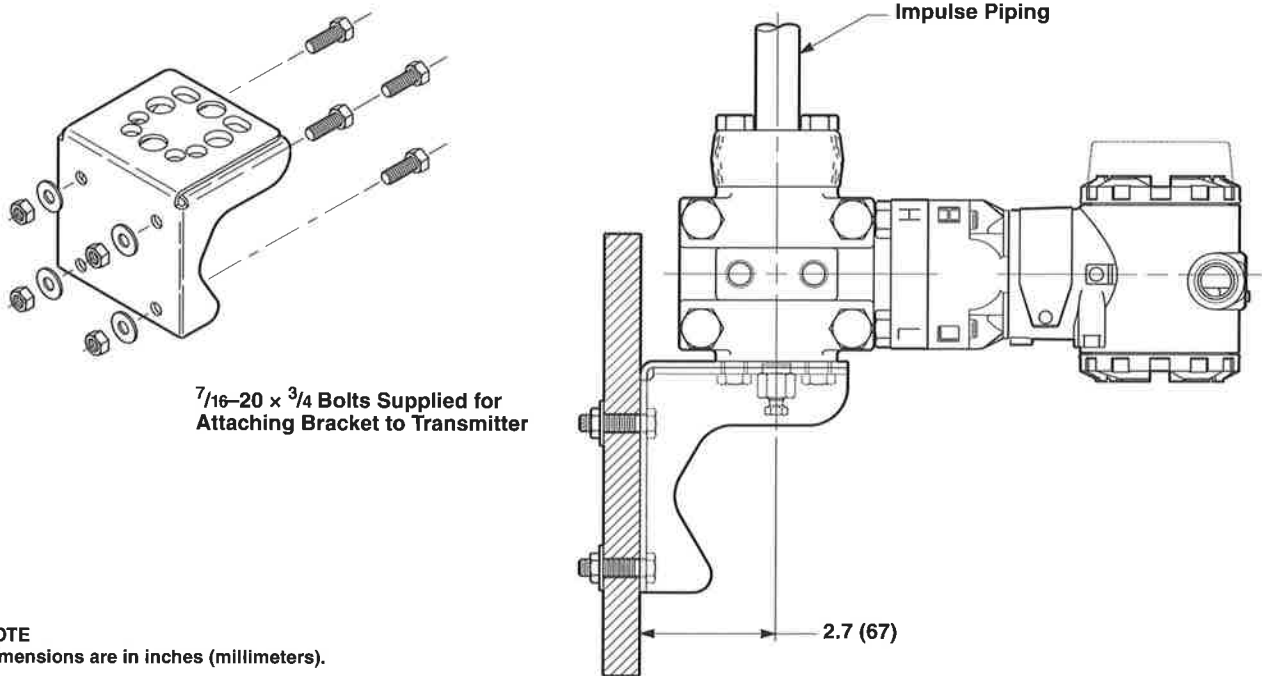
3051-3031E19B, H19A, J19D, J19E

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

2-IN. PIPE MOUNTING CONFIGURATION



PANEL MOUNTING CONFIGURATION



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.

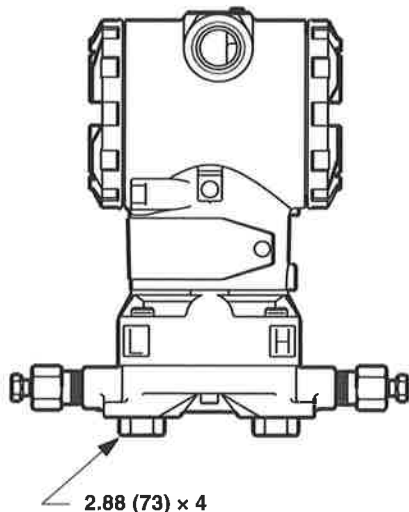
TABLE 3-2. Bolt Installation Torque Values.

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)

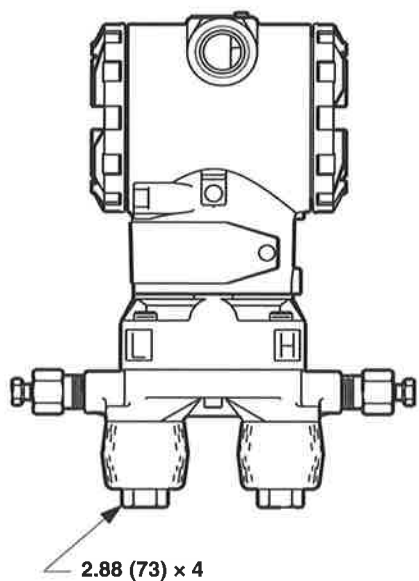
 See "Safety Messages" on page 3-1 for complete warning information.

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

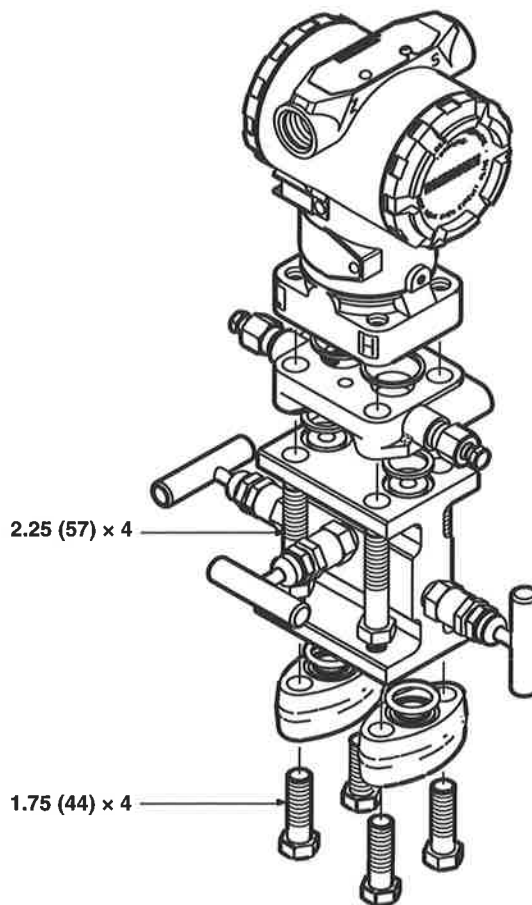
TRANSMITTER WITH FLANGE BOLTS



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)

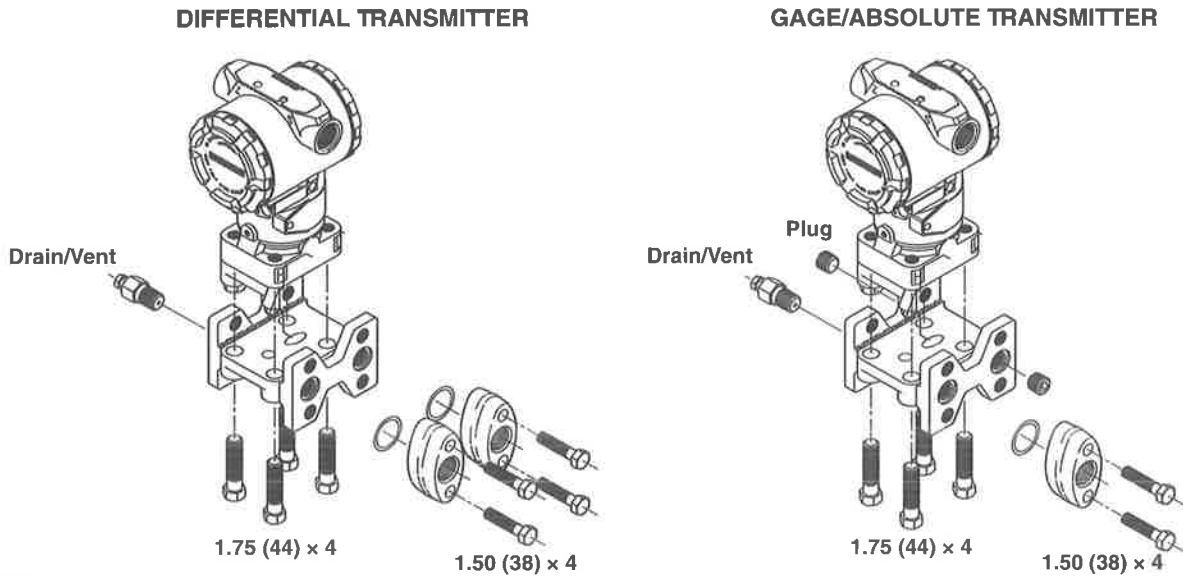
**NOTE**  
Dimensions are in inches (millimeters).

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

3051-3031E06FD E06F; 305-3031A29P



FIGURE 3-16. Traditional Flange Bolt Configurations.



3051-3031B07G, B07I

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

## 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.

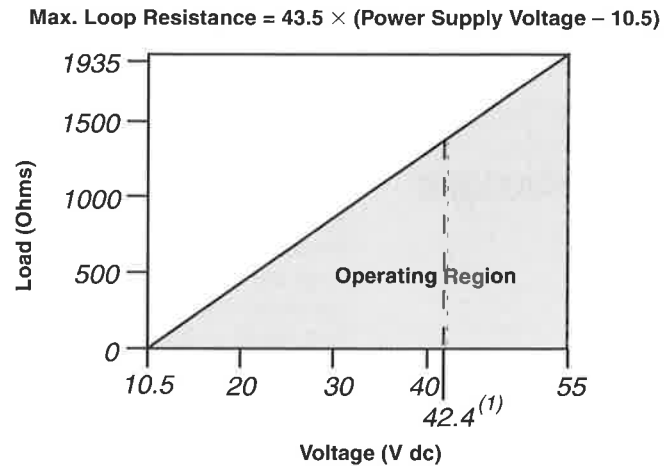
#### **NOTE**

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.



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.

---

#### 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.

---

### 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).

---

#### 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.



# Troubleshooting

## OVERVIEW

Table 4-1 provides summarized troubleshooting suggestions for the most common operating problems.

If you suspect a malfunction despite the absence of any diagnostic messages on the communicator display, follow the procedures described here to verify that transmitter hardware and process connections are in good working order. Always deal with the most likely and easiest-to-check conditions first.

## 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 that the instruments in the loop are installed according to intrinsically safe or nonincendive field wiring practices.

#### ⚠ CAUTION

**Static electricity can damage sensitive components.**

- Observe safe handling precautions for static-sensitive components.

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

**⚠** 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

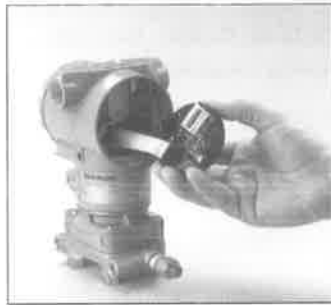
If you are disassembling a transmitter with a LCD meter, loosen the two captive screws that are visible on the right and left side of the meter display. The two screws anchor the LCD meter to the electronics board and the electronics board to the housing.



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.

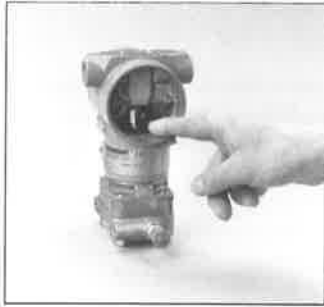


4. Disconnect the sensor module ribbon cable to release the electronics board from the transmitter.



 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.

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3051-059AB

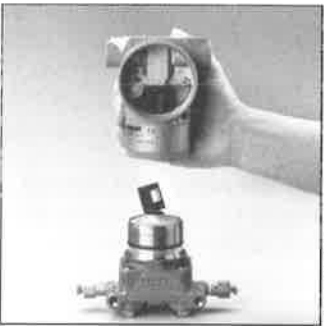
2. Loosen the housing rotation set screw with a  $\frac{9}{64}$ -inch hex wrench, and back off one full turn.

---

### 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



3051-062AB




3051-060AB

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.



3051-059AB

#### 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.

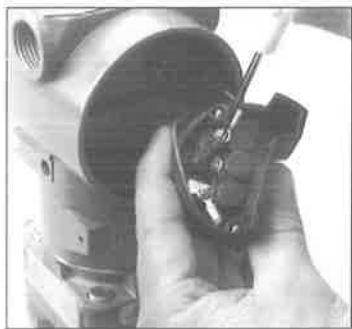
### NOTE

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

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.

## Reassemble the Process Sensor Body

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)
<i>Monel</i> —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**

*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.*

**Reference Accuracy**

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

**Zero Error (can be calibrated out at line pressure)**

Zero line pressure effect per 1000 psi (6,9 MPa).

**Ambient Temperature Effect per 50 °F (28 °C)**

**Static Pressure Effect per 1000 psi (6,9 MPa)**

Model	Range	Zero Effect with Static Pressure	Zero Effect with Static
		≤ 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

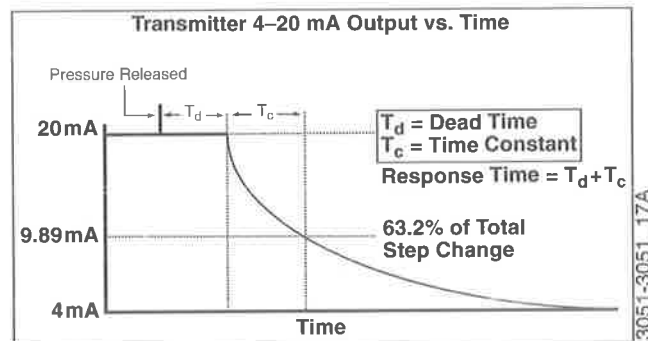


Figure 5-1. Typical Smart Transmitter Response Time

**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)	5 psia (260 mmHg)	0 psia (0 mmHg)
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.

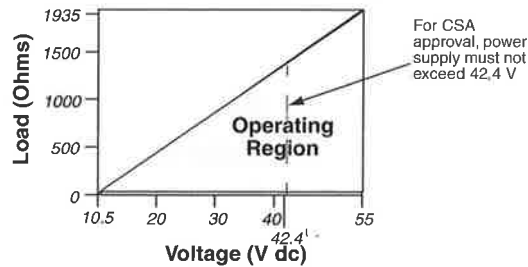
**Power Supply**

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:

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 kΩ (V<sub>out</sub> 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
$C_i = 0.01 \text{ }\mu\text{F}$ (Output Code A)	A-G
$C_i = 0.042 \text{ }\mu\text{F}$ (Output Code M)	A-G
$L_i = 10 \text{ }\mu\text{H}$	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, $\geq 300$ $\Omega$	
$\leq 25$ V, $\geq 200$ $\Omega$		
$\leq 22$ V, $\geq 180$ $\Omega$		
	$\leq 30$ V, $\geq 150$ $\Omega$	C–D
Output Code M	Supply $\leq 28$ V, $\geq 300$ $\Omega$ Return $\leq 10$ V, $\geq 47$ $\Omega$	A–D
	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)									
Code	Model 3051CD		Model 3051CG		Model 3051CA		CD	CG	CA
	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		•	•	—
<i>NOTE: 3051CG lower range limit varies with atmospheric pressure.</i>									
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)					•	•	•	
<i>NOTE: Not available with hazardous locations certification Options Codes I1, N1, E4, and K6.</i>									
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					•	•	•	
<i>NOTE: Materials of Construction Codes 3, 7, and 8 meet NACE material recommendations per MR 01-75.</i>									
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 × 1.5 (CM20)		•	•	•	
C	Polyurethane-covered Aluminum			PG 13.5		•	•	•	
D	Polyurethane-covered Aluminum			G½		•	•	•	
J	SST			½–14 NPT		•	•	•	
K	SST			M20 × 1.5 (CM20)		•	•	•	
L	SST			PG 13.5		•	•	•	

# Rosemount Model 3051 Transmitter for Flow, Level, and Pressure Measurement

TABLE 5-6. Model 3051C Differential, Gauge, 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, <i>Hastelloy C</i> , <i>Hastelloy C</i> Drain/Vent, <i>Hastelloy C</i> Flange Adapter	•	•	•
H4	Traditional Flange, <i>Monel</i> , <i>Monel</i> Drain/Vent, <i>Monel</i> Flange Adapter	•	•	•
H7	Traditional Flange, 316 SST, <i>Hastelloy C</i> 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>				
Code	Integral Mount Manifold Options	CD	CG	CA
S5	Assemble to Model 305 Integral Manifold	•	•	•
Code	Integral Mount Primary Elements (Optional)	CD	CG	CA
S4	Factory Assembly to Rosemount Primary Element ( <i>Annubar</i> 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>	•	•	•
Code	Diaphragm Seal Assemblies (Optional) <i>NOTE: Standard flange and adapter bolts are austenitic 316 SST.</i>	CD	CG	CA
S1	One Diaphragm Seal (Direct Mount or Capillary Connection Type)	•	•	•
S2	Two Diaphragm Seals (Direct Mount or Capillary Connection Type)	•	•	•
Code	Optional All Welded Diaphragm Seal Systems (for high vacuum applications) <i>NOTE: Standard flange and adapter bolts are austenitic 316 SST.</i>	CD	CG	CA
S7	One Diaphragm Seal, All-Welded System (Capillary Connection Type)	•	•	•
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)	•	•	•
Code	Mounting Bracket Options	CD	CG	CA
B4	<i>Coplanar</i> Flange Bracket for 2-in. Pipe or Panel Mounting, all SST	•	•	•
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	•	•	•
Code	Hazardous Locations Certification Options	CD	CG	CA
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	•	•	•

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	<i>Monel</i> 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 <i>HART</i> 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	•	•	•

Typical Model Number: 3051CD 2 A 2 2 A 1 A B4

(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		
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 × 1.5 (CM20)	•
C	Polyurethane-covered Aluminum	PG 13.5	•
D	Polyurethane-covered Aluminum	G½	•
J	SST	½–14 NPT	•
K	SST	M20 × 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)			•	
NOTE: Not available with hazardous certification Option Codes I1, N1, E4, and K6.					
HIGH PRESSURE SIDE					
Code	Diaphragm Size	Material	Extension Length	Available	
G0	2 in./DN 50	316L SST	Flush Mount Only	• • •	
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	When specifying this option code, a lower housing must be selected from the flushing connection options table.  NOTE Extension diameters are sized to fit Schedule 80 pipe.	
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	SST	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)	•
Code	O-ring Material			Available
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		•
Code	Diaphragm Seal Assemblies (Optional)			Available
S1	One Diaphragm Seal (requires low pressure side Option Code 31 capillary connection type)			•
Code	Hazardous Locations Certification Options			Available
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			•
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 Adapters (Optional)			Available
L4	Austenitic 316 SST Bolts			•
L5	ASME B 16.5 (ANSI)/ASTM-A-193-B7M Bolts			•
Code	Meter Options			Available
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)			•

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>						
		<b>Diaphragm Size</b>				
Code	Ring Material	Number	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>					
Code	3051HD	3051HG			
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/10in 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>					
Code	Output	HD	HG		
A	4-20 mA with Digital Signal Based on <i>HART</i> Protocol	•	•		
M	Low-Power 1-5 V dc with Digital Signal Based on <i>HART</i> 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>					
Code	Process Flange Material	Drain/Vent	Flange Adapters	HD	HG
2	SST	SST	SST	•	•
7	SST	<i>Hastelloy</i>	SST	•	•
<i>NOTE: Process Connection Code 7 meets NACE material recommendations per MR 01-75.</i>					
Code	Process Isolating Diaphragm	HD	HG		
2	316L SST	•	•		
3	<i>Hastelloy C-276</i> (Meets NACE material recommendations per MR 01-75)	•	•		
5	Tantalum	•	•		
Code	O-ring Material	HD	HG		
A	Glass-Filled TFE	•	•		
Code	Process Fill Fluid	HD	HG		
D	<i>D.C. 200</i> Silicone	•	•		
H	Inert	•	•		
N	<i>Neobee M-20</i>	•	•		
Code	Sensor Module Isolator Material	HD	HG		
2	SST	•	•		
Code	Sensor Module Fill Fluid	HD	HG		
1	Silicone	•	•		
2	Inert (Halocarbon)	•	•		
Code	Housing Material	Conduit Entry Size	HD	HG	
A	Polyurethane-covered Aluminum	½-14 NPT	•	•	
B	Polyurethane-covered Aluminum	M20 × 1.5 (CM20)	•	•	
C	Polyurethane-covered Aluminum	PG 13.5	•	•	
D	Polyurethane-covered Aluminum	G½	•	•	
J	SST	½-14 NPT	•	•	
K	SST	M20 × 1.5 (CM20)	•	•	
L	SST	PG 13.5	•	•	
Code	Integral Mount Manifold Options	HD	HG		
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>	•			
Code	Mounting Bracket Options	HD	HG		
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 ( <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	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	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 <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>	•	•
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/10in 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 × 1.5 (CM20)		•	•	
C	Polyurethane-covered Aluminum	PG 13.5		•	•	
D	Polyurethane-covered Aluminum	G½		•	•	
J	SST	½-14 NPT		•	•	
K	SST	M20 × 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>						

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	CES/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	•	•
Typical Model Number: 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

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.				
0 to 0.167 psia/5 psia, Range 0 (includes Traditional SST flange and SST bolts).				
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	•	—	—
0 to 30 psia/0.3 psia, Range 1				
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	•	—	—
0 to 150/1.5 psia, Range 2				
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	•	—	—
0 to 800 psia/8 psia, Range 3				
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.

Item No.	Model 3051T Sensor Modules <sup>(1)</sup>	Isolating Diaphragm	Housing Material	Silicone Fill		Inert Fill																																	
				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 <i>Hastelloy C</i> 316L SST <i>Hastelloy C</i> 316L SST	Aluminum Aluminum Aluminum Aluminum Aluminum	03031-3112-3112 03031-3112-3113 03031-3102-3112 03031-3102-3113 03031-3132-3112	• • • • •	03031-3112-1112 03031-3112-1113 03031-3102-1112 03031-3102-1113 03031-3132-1112	• • • • •																																
								316L SST <i>Hastelloy C</i> 316L SST <i>Hastelloy C</i>	SST SST SST SST	03031-3111-3112 03031-3111-3113 03031-3101-3112 03031-3101-3113	• • • •	03031-3111-1112 03031-3111-1113 03031-3101-1112 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 <i>Hastelloy C</i> 316L SST <i>Hastelloy C</i> 316L SST	Aluminum Aluminum Aluminum Aluminum Aluminum	03031-3112-3122 03031-3112-3123 03031-3102-3122 03031-3102-3123 03031-3132-3122	• • • • •	03031-3112-1122 03031-3112-1123 03031-3102-1122 03031-3102-1123 03031-3132-1122	• • • • •																		
																						316L SST <i>Hastelloy C</i> 316L SST <i>Hastelloy C</i>	SST SST SST SST	03031-3111-3122 03031-3111-3123 03031-3101-3122 03031-3101-3123	• • • •	03031-3111-1122 03031-3111-1123 03031-3101-1122 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 <i>Hastelloy C</i> 316L SST <i>Hastelloy C</i> 316L SST	Aluminum Aluminum Aluminum Aluminum Aluminum	03031-3112-3132 03031-3112-3133 03031-3102-3132 03031-3102-3133 03031-3132-3132	• • • • •	03031-3112-1132 03031-3112-1133 03031-3102-1132 03031-3102-1133 03031-3132-1132	• • • • •				
																																				316L SST <i>Hastelloy C</i> 316L SST <i>Hastelloy C</i>	SST SST SST SST	03031-3111-3132 03031-3111-3133 03031-3101-3132 03031-3101-3133	• • • •
		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 <i>Hastelloy C</i> 316L SST <i>Hastelloy C</i> 316L SST	Aluminum Aluminum Aluminum Aluminum Aluminum	03031-3112-3142 03031-3112-3143 03031-3102-3142 03031-3102-3143 03031-3132-3142	• • • • •																																
								316L SST <i>Hastelloy C</i> 316L SST <i>Hastelloy C</i>	SST SST SST SST	03031-3111-3142 03031-3111-3143 03031-3101-3142 03031-3101-3143	• • • •	03031-3111-1142 03031-3111-1143 03031-3101-1142 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 <i>Hastelloy C</i> 316L SST <i>Hastelloy C</i> 316L SST	Aluminum Aluminum Aluminum Aluminum Aluminum	03031-3112-3012 03031-3112-3013 03031-3102-3012 03031-3102-3013 03031-3132-3012	• • • • •																		
																						316L SST <i>Hastelloy C</i> 316L SST <i>Hastelloy C</i>	SST SST SST SST	03031-3111-3012 03031-3111-3013 03031-3101-3012 03031-3101-3013	• • • •	03031-3111-1012 03031-3111-1013 03031-3101-1012 03031-3101-1013	• • • •												

TABLE 5-17. (continued) Model 3051T Gage and Absolute Pressure Transmitters.

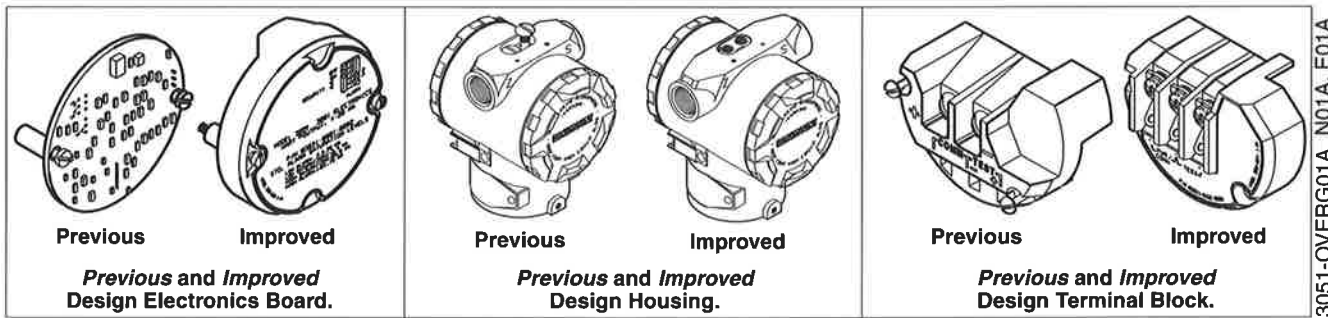
		Silicone Fill			Inert Fill		
Item No.	Model 3051T Sensor Modules <sup>(1)</sup>	Isolating Diaphragm	Housing Material	Part Number		Part Number	
8	<b>Absolute Sensor Module<sup>(2)</sup></b> <b>0-1.5/150 psig, Range 2</b> 1/4-18 NPT Female 1/4-18 NPT Female 1/2-14 NPT Female 1/2-14 NPT Female G1/2A DIN 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	03031-3112-3022	•	03031-3112-1022	•
		<i>Hastelloy C</i>	Aluminum	03031-3112-3023	•	03031-3112-1023	•
		316L SST	Aluminum	03031-3102-3022	•	03031-3102-1022	•
		<i>Hastelloy C</i>	Aluminum	03031-3102-3023	•	03031-3102-1023	•
		316L SST	Aluminum	03031-3132-3022	•	03031-3132-1022	•
		316L SST	SST	03031-3111-3022	•	03031-3111-1022	•
		<i>Hastelloy C</i>	SST	03031-3111-3023	•	03031-3111-1023	•
		316L SST	SST	03031-3101-3022	•	03031-3101-1022	•
		<i>Hastelloy C</i>	SST	03031-3101-3023	•	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 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	03031-3112-3032	•
<i>Hastelloy C</i>	Aluminum			03031-3112-3033	•	03031-3112-1033	•
316L SST	Aluminum			03031-3102-3032	•	03031-3102-1032	•
<i>Hastelloy C</i>	Aluminum			03031-3102-3033	•	03031-3102-1033	•
316L SST	Aluminum			03031-3132-3032	•	03031-3132-1032	•
316L SST	SST			03031-3111-3032	•	03031-3111-1032	•
<i>Hastelloy C</i>	SST			03031-3111-3033	•	03031-3111-1033	•
316L SST	SST			03031-3101-3032	•	03031-3101-1032	•
<i>Hastelloy C</i>	SST			03031-3101-3033	•	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 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	03031-3112-3042	•
		<i>Hastelloy C</i>	Aluminum	03031-3112-3043	•	03031-3112-1043	•
		316L SST	Aluminum	03031-3102-3042	•	03031-3102-1042	•
		<i>Hastelloy C</i>	Aluminum	03031-3102-3043	•	03031-3102-1043	•
		316L SST	Aluminum	03031-3132-3042	•	03031-3132-1042	•
		316L SST	SST	03031-3111-3042	•	03031-3111-1042	•
		<i>Hastelloy C</i>	SST	03031-3111-3043	•	03031-3111-1043	•
		316L SST	SST	03031-3101-3042	•	03031-3101-1042	•
		<i>Hastelloy C</i>	SST	03031-3101-3043	•	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 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	03031-3112-3052	•
<i>Hastelloy C</i>	Aluminum			03031-3112-3053	•	03031-3112-1053	•
316L SST	Aluminum			03031-3102-3052	•	03031-3102-1052	•
<i>Hastelloy C</i>	Aluminum			03031-3102-3053	•	03031-3102-1053	•
316L SST	Aluminum			03031-3122-3052	•	03031-3122-1052	•
316L SST	SST			03031-3111-3052	•	03031-3111-1052	•
<i>Hastelloy C</i>	SST			03031-3111-3053	•	03031-3111-1053	•
316L SST	SST			03031-3101-3052	•	03031-3101-1052	•
<i>Hastelloy C</i>	SST			03031-3121-3053	•	03031-3121-1053	•

(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						
Electronics Board—Assembly Required			CD	CG	CA	L	H	T
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

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>							
	<i>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.</i>							
	<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>			<b>CD</b>	<b>CG</b>	<b>CA</b>	<b>L</b>	<b>H</b>	<b>T</b>
11	<b>Process Flanges</b>							
	Differential <i>Coplanar</i> Flange Nickel-plated Carbon Steel	03031-0388-0025	•	—	—	—	—	—
	316 SST	03031-0388-0022	•	—	—	—	—	—
	<i>Hastelloy C</i>	03031-0388-0023	•	—	—	—	—	—
	<i>Monel</i>	03031-0388-0024	•	—	—	—	—	
11	Gage/Absolute <i>Coplanar</i> Flange Nickel-plated Carbon Steel	03031-0388-1025	—	•	•	—	—	—
	316 SST	03031-0388-1022	—	•	•	—	—	—
	<i>Hastelloy C</i>	03031-0388-1023	—	•	•	—	—	—
	<i>Monel</i>	03031-0388-1024	—	•	•	—	—	—
	<i>Coplanar</i> Flange Alignment Screw (package of 2 screws)	03031-0309-0001	•	•	•	—	—	—
	Traditional Flange 316 SST	03031-0320-0002	•	•	•	—	—	—
	<i>Hastelloy C</i>	03031-0320-0003	•	•	•	—	—	—
	<i>Monel</i>	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	•	•	•	—	—	—
	<i>Hastelloy C</i>	02024-0069-0003	•	•	•	—	—	—
	<i>Monel</i>	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	•	—	—	—	•	—
	<i>Hastelloy C</i> Stem and Seat Kit	01151-0028-0023	•	—	—	—	•	—
	<i>Monel</i> Stem and Seat Kit	01151-0028-0024	•	—	—	—	•	—
	316 SST Ceramic Ball Drain/Vent Kit	01151-0028-0122	•	—	—	—	•	—
	<i>Hastelloy C</i> Ceramic Ball Drain/Vent Kit	01151-0028-0123	•	—	—	—	•	—
	<i>Monel</i> 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	—	•	•	•	•	—
	<i>Hastelloy C</i> Stem and Seat Kit	01151-0028-0013	—	•	•	•	•	—
	<i>Monel</i> Stem and Seat Kit	01151-0028-0014	—	•	•	•	•	—
	316 SST Ceramic Ball Drain/Vent Kit	01151-0028-0112	—	•	•	•	•	—
	<i>Hastelloy C</i> Ceramic Ball Drain/Vent Kit	01151-0028-0113	—	•	•	•	•	—
	<i>Monel</i> 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 <i>Teflon</i> <sup>(1)</sup>	03031-0234-0001	•	•	•	—	—	—
	Process Flange, Graphite-filled <i>Teflon</i>	03031-0234-0002	•	•	•	—	—	—
12	Flange Adapter, Glass-filled <i>Teflon</i> <sup>(1)</sup>	03031-0242-0001	•	•	•	—	—	—
	Flange Adapter, Graphite-filled <i>Teflon</i>	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	—	—	—	—	—	•
	Traditional Flange Bracket Kits							
	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	•	•	•	—	—	—
	3051H Bracket Kits							
	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	—	—	—	—	•	—

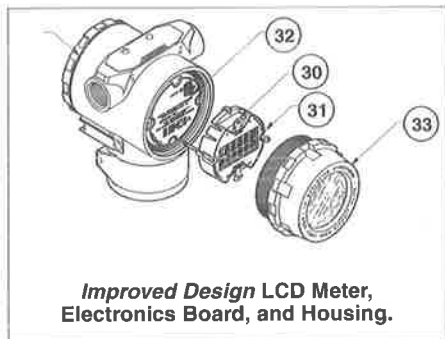
TABLE 5-18. (continued) Model 3051C Differential, Gage, Absolute, and Liquid Level Transmitters.

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) 316 SST (set of 4) ANSI/ASTM-A-193-B7M <i>Monel</i>	03031-0312-0001 03031-0312-0002 03031-0312-0003 03031-0312-0004	• • • •	• • • •	• • • •	— — — —	— — — —	— — — —	
	26	Flange/Adapter Bolt Kit {73 mm (2.88 in.)} Carbon Steel (set of 4) 316 SST (set of 4) ANSI/ASTM-A-193-B7M <i>Monel</i>	03031-0306-0001 03031-0306-0002 03031-0306-0003 03031-0306-0004	• • • •	• • • •	• • • •	— — — —	— — — —	— — — —
		27	Manifold/Flange Kit {57 mm (2.25 in.)} Carbon Steel (set of 4) 316 SST (set of 4) ANSI/ASTM-A-193-B7M <i>Monel</i>	03031-0311-0001 03031-0311-0002 03031-0311-0003 03031-0311-0004	• • • •	— — — —	— — — —	— — — —	— — — —
			28	<b>Traditional Flange</b> Differential Flange and Adapter Bolt Kit {44 mm (1.75 in.)} Carbon Steel (set of 8) 316 SST (set of 8) ANSI/ASTM-A-193-B7M <i>Monel</i>	03031-0307-0001 03031-0307-0002 03031-0307-0003 03031-0307-0004	• • • •	— — — —	— — — —	— — — —
				Gage/Absolute Flange and Adapter Bolt Kit Carbon Steel (set of 6) 316 SST (set of 6) ANSI/ASTM-A-193-B7M <i>Monel</i>	03031-0307-1001 03031-0307-1002 03031-0307-1003 03031-0307-1004	— — — —	• • • •	• • • •	— — — —
	Manifold/Traditional Flange Bolts Carbon Steel 316 SST			Use Bolts Supplied with Anderson Greenwood Manifold Use Bolts Supplied with Anderson Greenwood Manifold					
	23 24	<b>Level Flange, Vertical Mount</b> Flange Bolt Kit Carbon Steel (set of 4) 316 SST (set of 4) <i>(Each kit contains bolts for one transmitter.)</i>		03031-0395-0001 03031-0395-0002	• •	• •	• •	— —	— —
		36 37	<b>3051H Flange</b> Process Flange Bolt Kit, Carbon Steel Flange Bolt (set of 4) Adapter Bolts (set of 4)	02051-0164-0001	—	—	—	—	•
36 37	Process Flange Bolt Kit, 316 SST Bolt for Process Flange (set of 4) Nut for Process Flange (set of 4) Adapter Bolts (set of 4)		02051-0164-0002	—	—	—	—	•	—

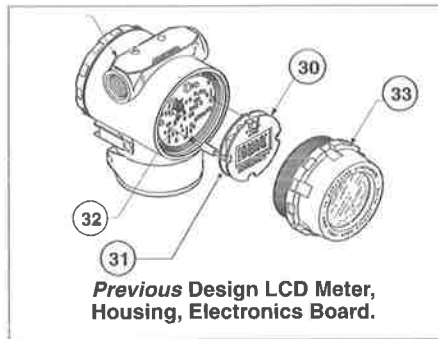
(1) One spare part is recommended for every 25 transmitters.  
 (2) One spare part is recommended for every 50 transmitters

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>			CD	CG	CA	L	H	T
	<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	•	•	•	•	•	•
<b>Meter for Improved 316 SST Housing</b>			CD	CG	CA	L	H	T
	<i>Meter Kit</i> <sup>(1)</sup>	03031-0193-0111	•	•	•	•	•	•
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>	03031-0193-0012	•	•	•	•	•	•
<b>Meter for Previous Aluminum Housing</b>			CD	CG	CA	L	H	T
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.								
	<i>Improved Meter for Previous Housing</i>	03031-0193-1103	•	•	•	•	•	•
30	Meter Display							
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>							
	Improved Kit for Previous SST Housing <sup>(1)</sup>	03031-0193-1111	•	•	•	•	•	•
30	Meter Display							
31	Captive Mounting Hardware							
32	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>							
	Improved Meter for Previous Housing <sup>(1)</sup>	03031-0193-1103	•	•	•	•	•	•
30	Meter Display							
31	Captive Mounting Hardware							
32	10-pin Interconnection Header							
	Cover Assembly Kit	03031-0193-0012	•	•	•	•	•	•

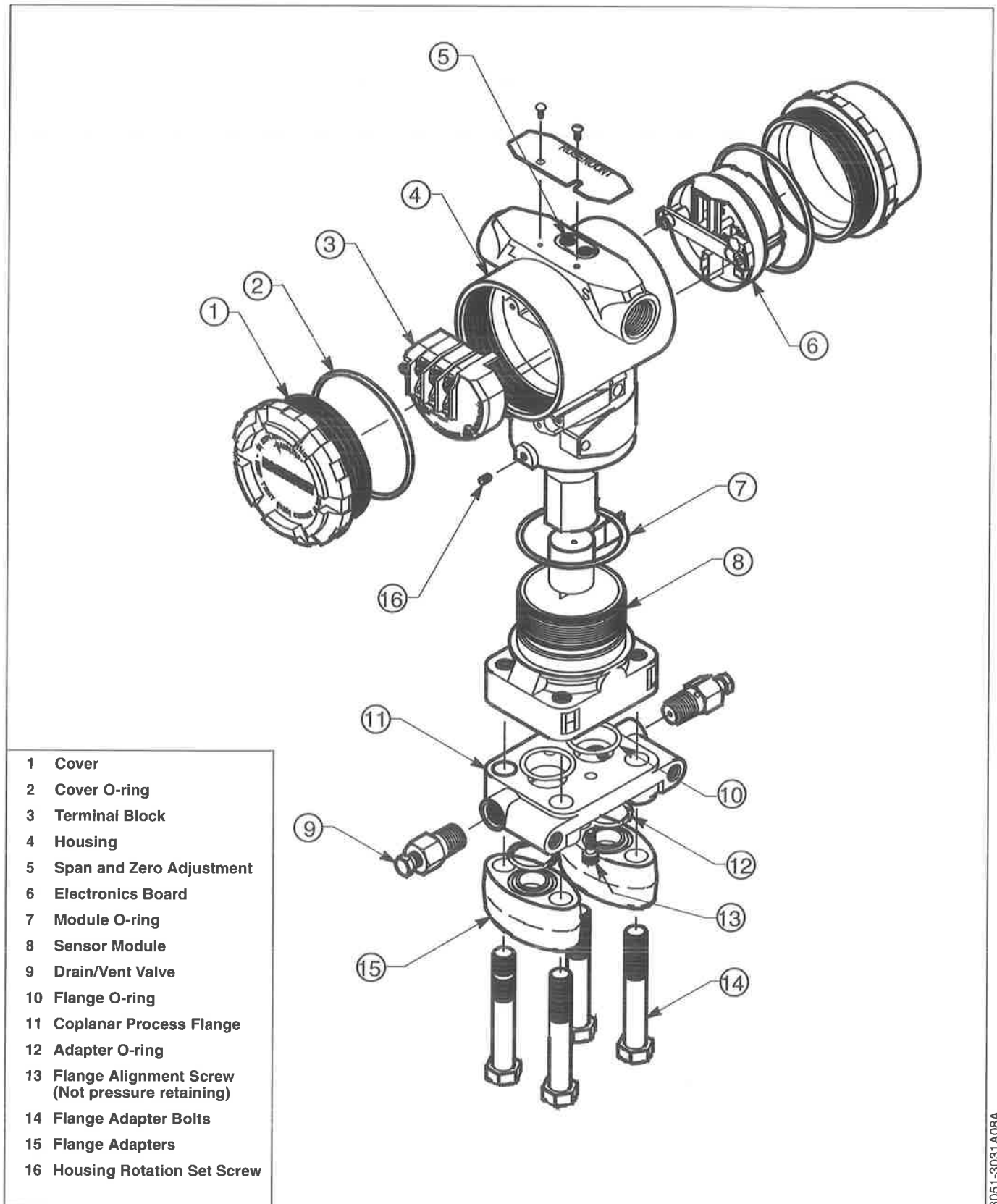


Figure 5-2. Model 3051C Exploded View (with Coplanar Flange).

3051-3031A08A

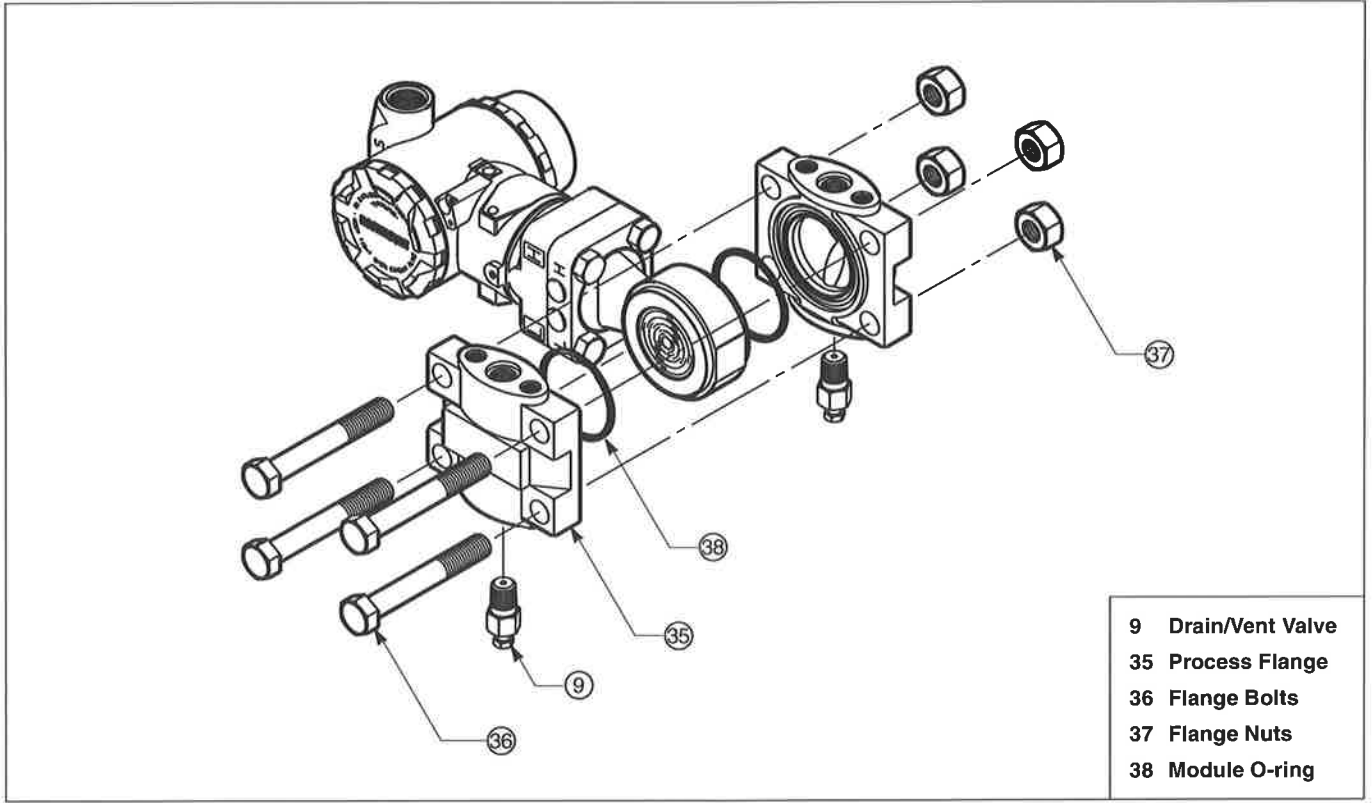


Figure 5-3. Model 3051H Exploded View.

3051-3051HB2A

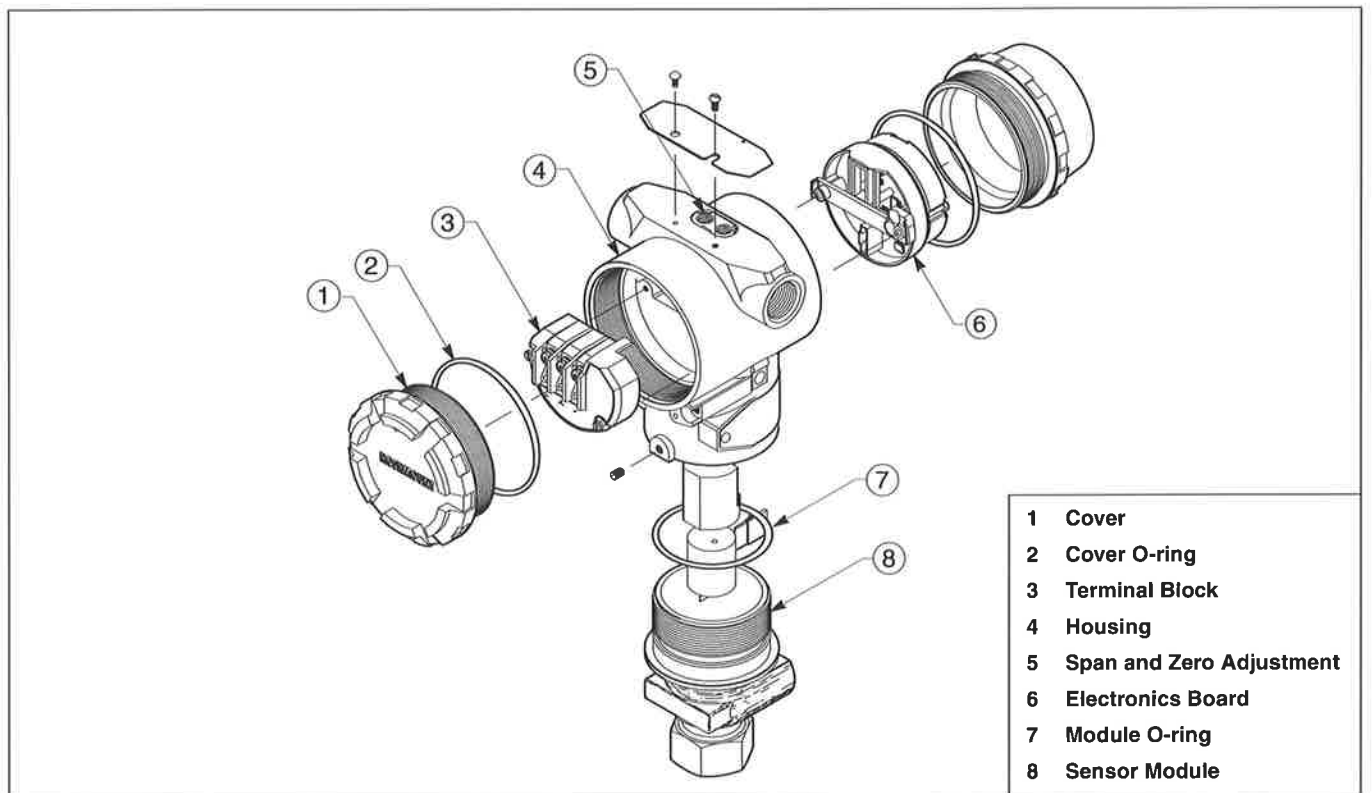


Figure 5-4. Model 3051T Exploded View.

3051-3051A08A

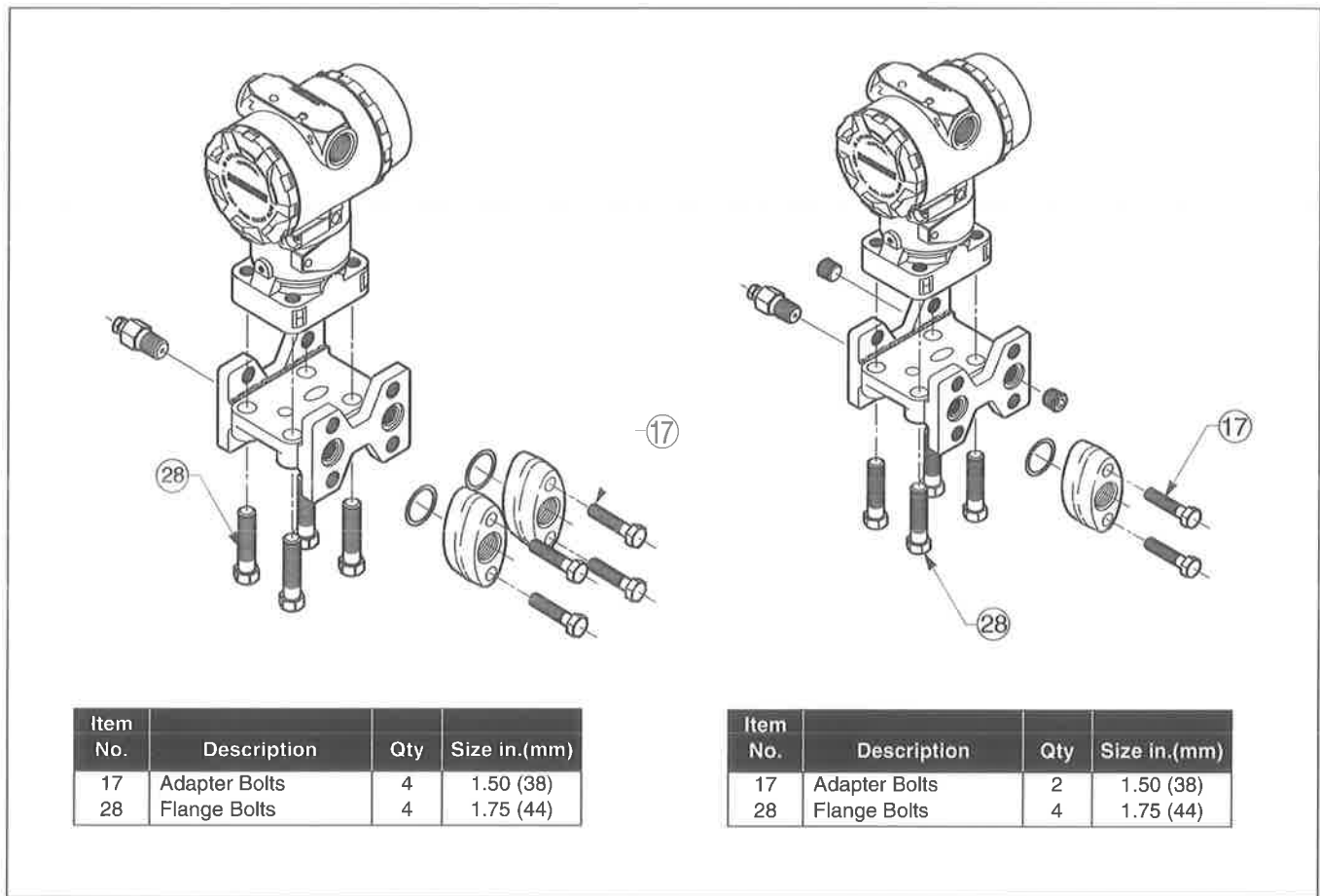
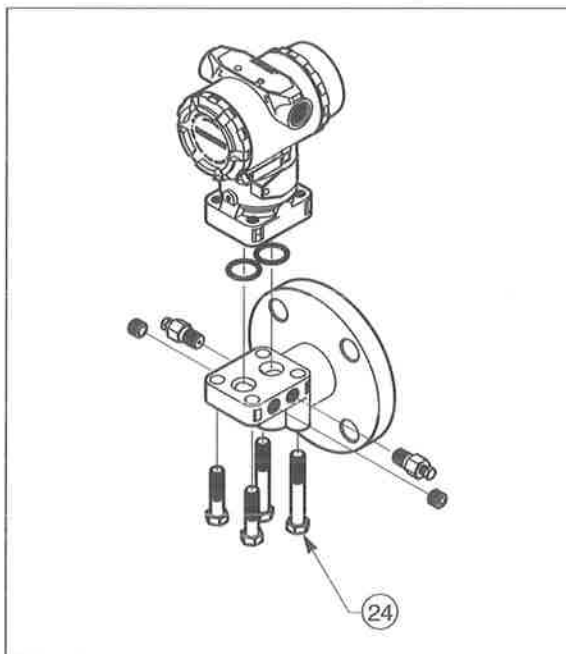


Figure 5-5. Traditional Flange Configuration.



3001-3001A01G

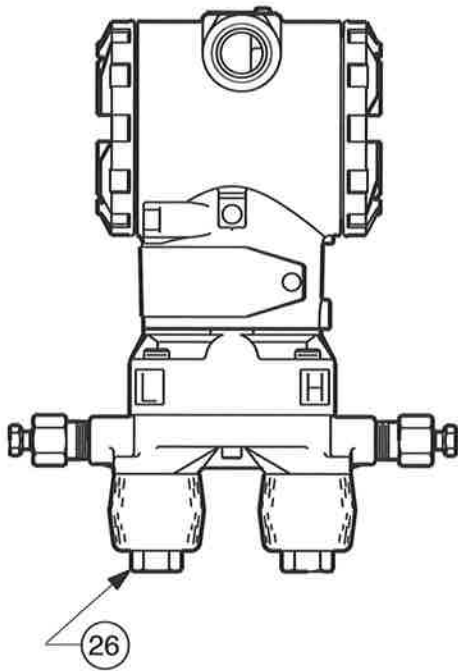
Figure 5-6. Level Flange, Vertical Mount.

Item No.	Description	Qty	Size in.(mm)
24	Flange Bolts	2	1.75 (44)
		2	2.875 (73)

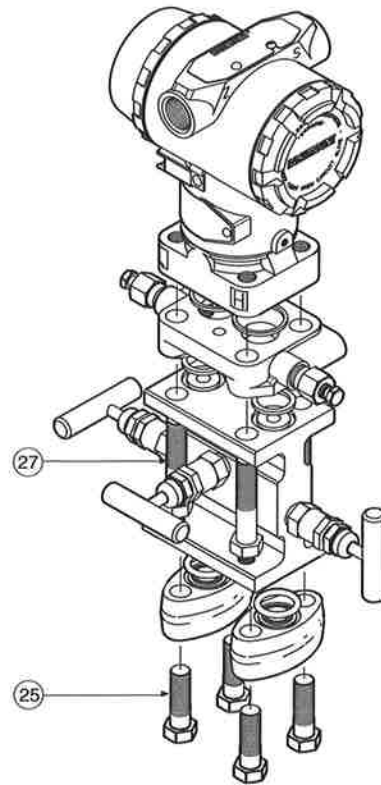
3051-3031B07M 3051-3051B07L



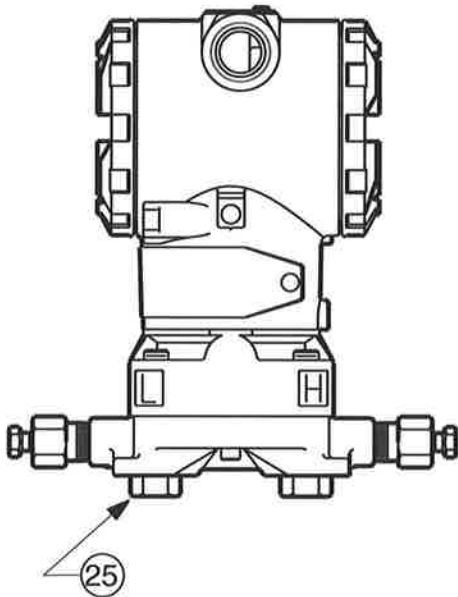
Transmitter with  
*Coplanar Flange* and  
Flange/Adapter Bolts



Transmitter with *Coplanar Flange*,  
3-Valve Manifold, and Flange Adapters  
(Differential Version)



Transmitter with  
*Coplanar Flange* and  
Flange Bolts



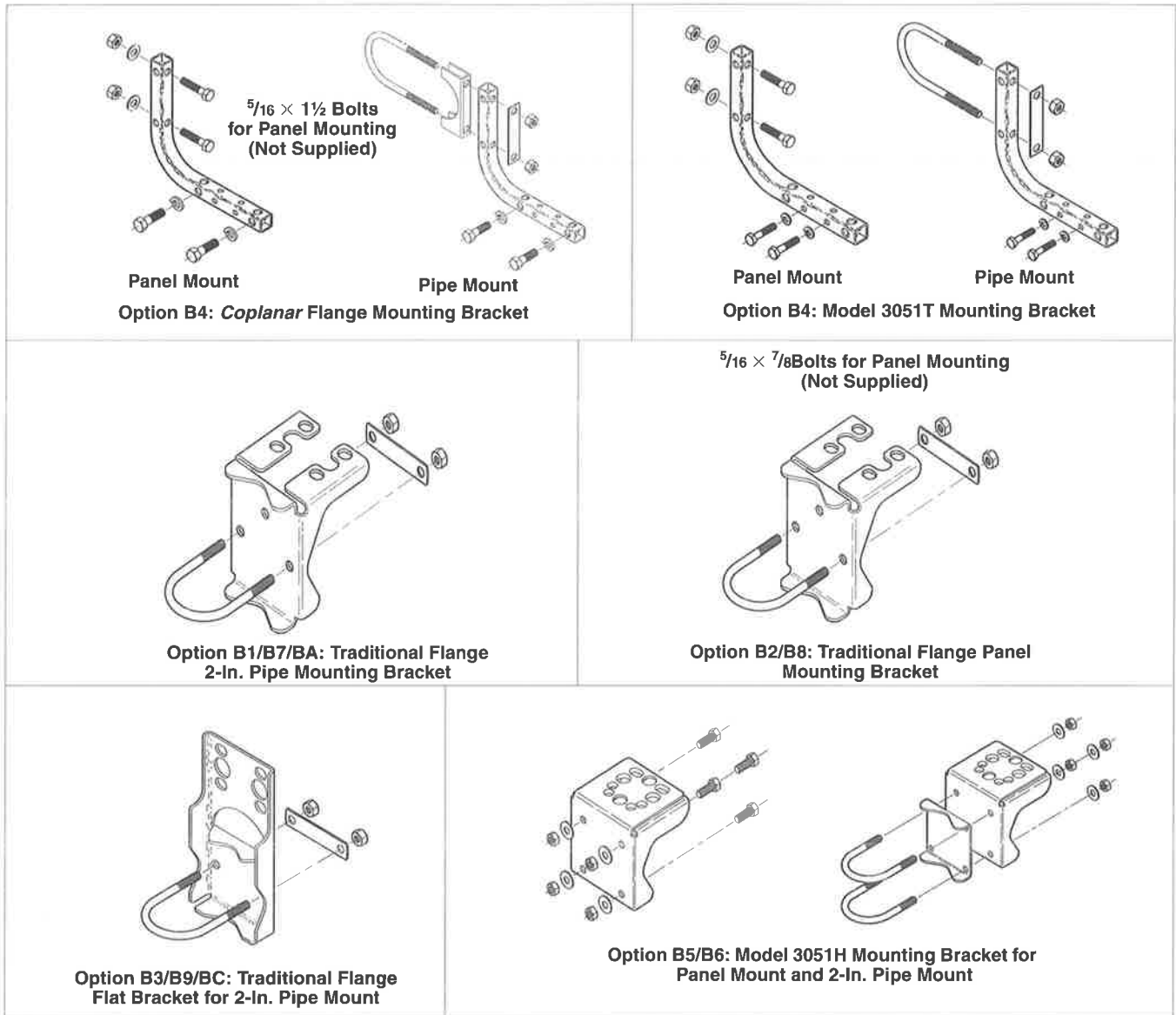
Item No.	Description	Qty	Size in.(mm)
25	Adapter Bolts	4	1.50 (38)
26	Flange/Adapter Bolts	4	2.88 (73)
27	Manifold/Flange Bolts	4	2.25 (57)

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



3051-3031-I04B, J04B, I04B, 2088-2088A04A, 3051-3031C19A, H19A, F19B, G19A

Figure 5-8. Mounting Bracket Kits.

## Options

### 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:

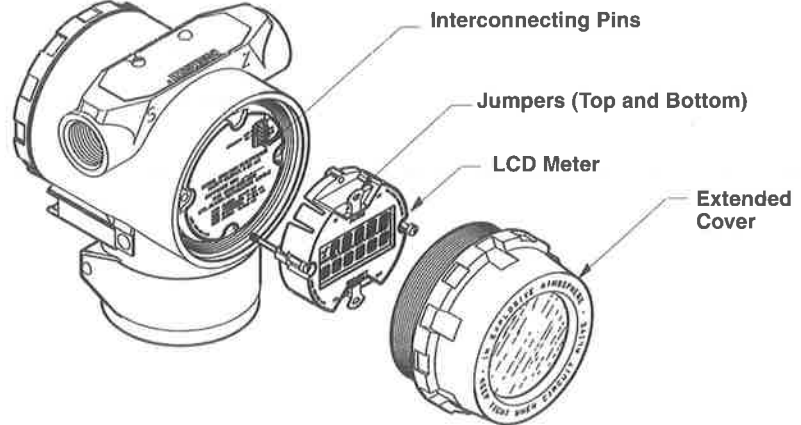
- decimal point position
- upper range values
- lower range values
- engineering units
- transfer function

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)**

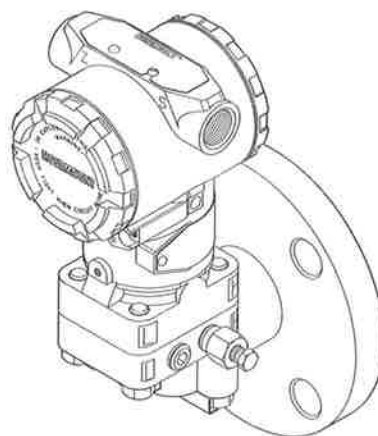
This option provides a flange for the Model 3051C that converts it to a horizontal mount level transmitter or a vertical mount level transmitter. A vented fitting on the low pressure side of the flange makes it suitable for use with a gage pressure transmitter. The fitting can be removed and replaced 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)**

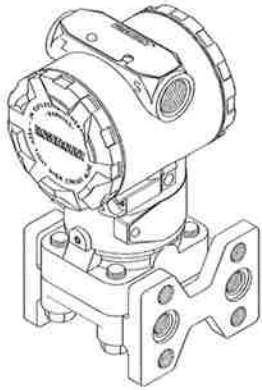
The traditional flange option converts the mounting configuration of the Model 3051 to one similar to traditional style transmitters. This allows the Model 3051 to replace traditional transmitters without changing existing manifolds, impulse piping, or bracket arrangements. The traditional flange also 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.

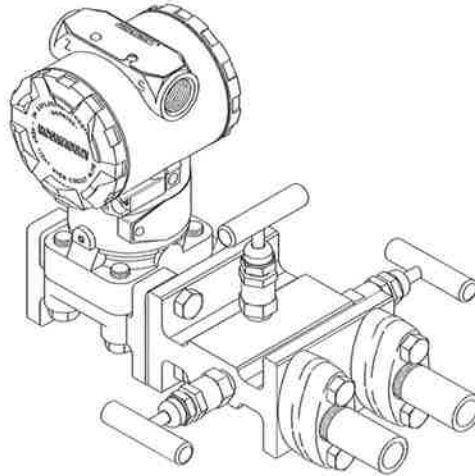
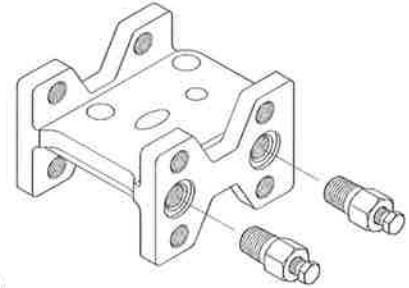
Option Code	Flange Material	Drain/Vent Valve Material	Flange Adapter Material	Flange to Adapter Bolt Size Length/Diameter
H2	316 SST	SST	SST	7/16-in.
H3	Hastelloy C	Hastelloy C	Hastelloy C	7/16-in.
H4	Monel	Monel	Monel	7/16-in.
H7	316 SST	Hastelloy C	SST	7/16-in.
HJ	SST	SST	SST	7/16-in.
HK	SST	SST	N/A	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.

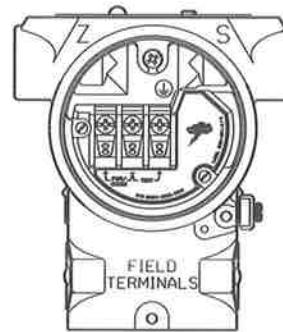
Transient protection terminal blocks can be ordered as an option (Option Code T1), or as a spare part to retrofit existing Model 3051 transmitters in the field. The spare part number for the transient protection terminal block assembly is 03031-0332-0002.

### 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).



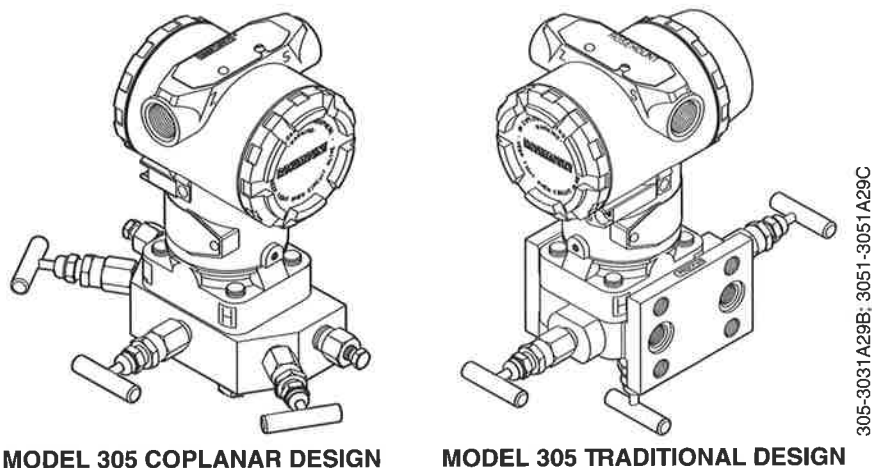
## Installation Procedure

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 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.

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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.



3051-3051A01A





HARDWARE SELECTABLE INFORMATION	
Alarm Option: <input type="checkbox"/> High★ <input type="checkbox"/> Low	<b>NOTE:</b> Specify C4 Option in model structure when ordering NAMUR-compliant alarm and saturation limits. <sup>(1)</sup>
Transmitter Security: <input type="checkbox"/> Off★ <input type="checkbox"/> On	
SIGNAL SELECTION: (Software Selectable)	
<input type="checkbox"/> 4–20 mA with simultaneous digital signal based on <i>HART</i> protocol★ <input type="checkbox"/> Burst mode of <i>HART</i> digital process variable <sup>(2)</sup> Burst mode output options: <input type="checkbox"/> Primary variable in engineering units <input type="checkbox"/> Primary variable in percent of range <input type="checkbox"/> All dynamic variables in engineering units <input type="checkbox"/> All dynamic variables in engineering units and the primary variable mA value <input type="checkbox"/> 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.

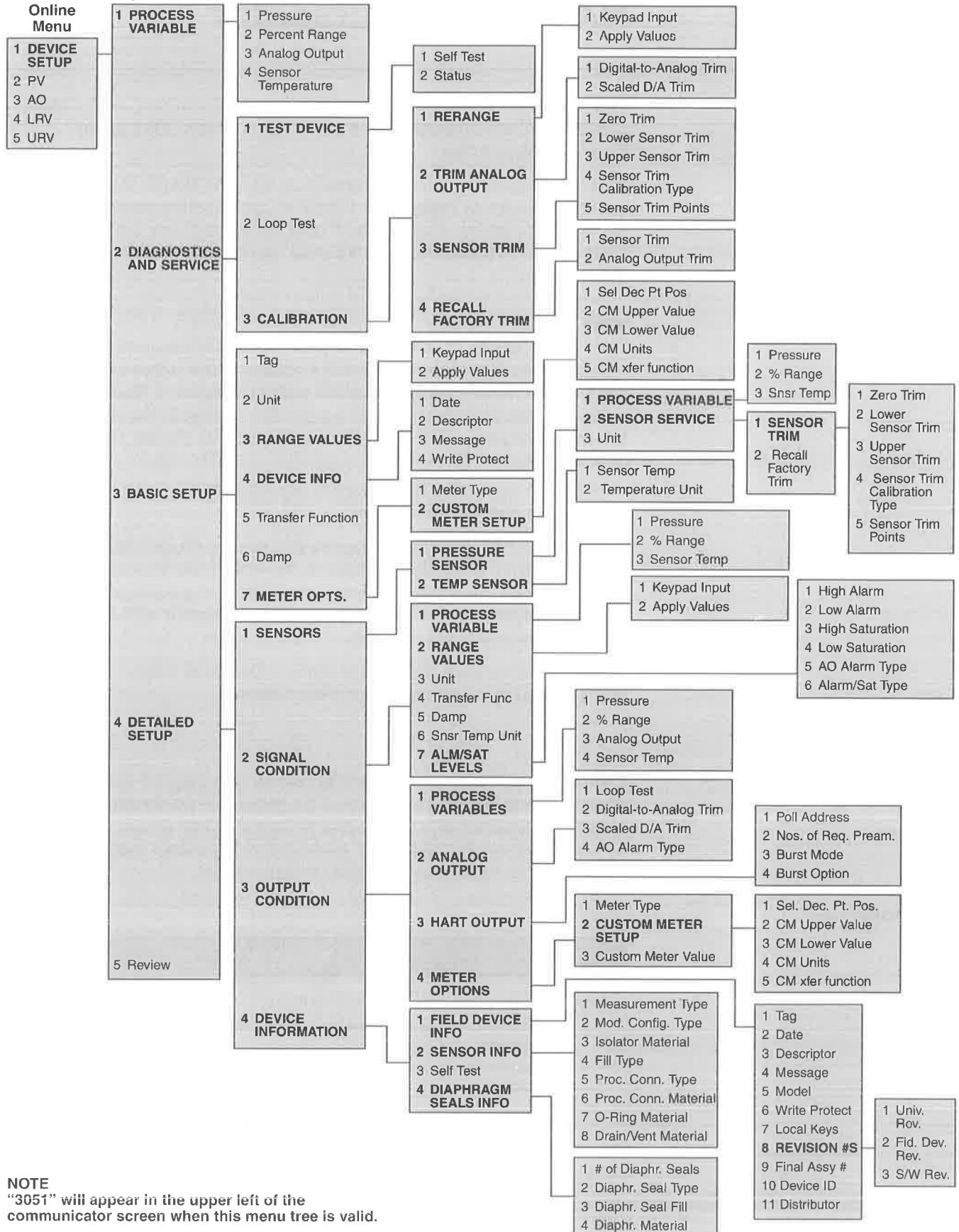
### Warnings (⚠)

#### ⚠ 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.

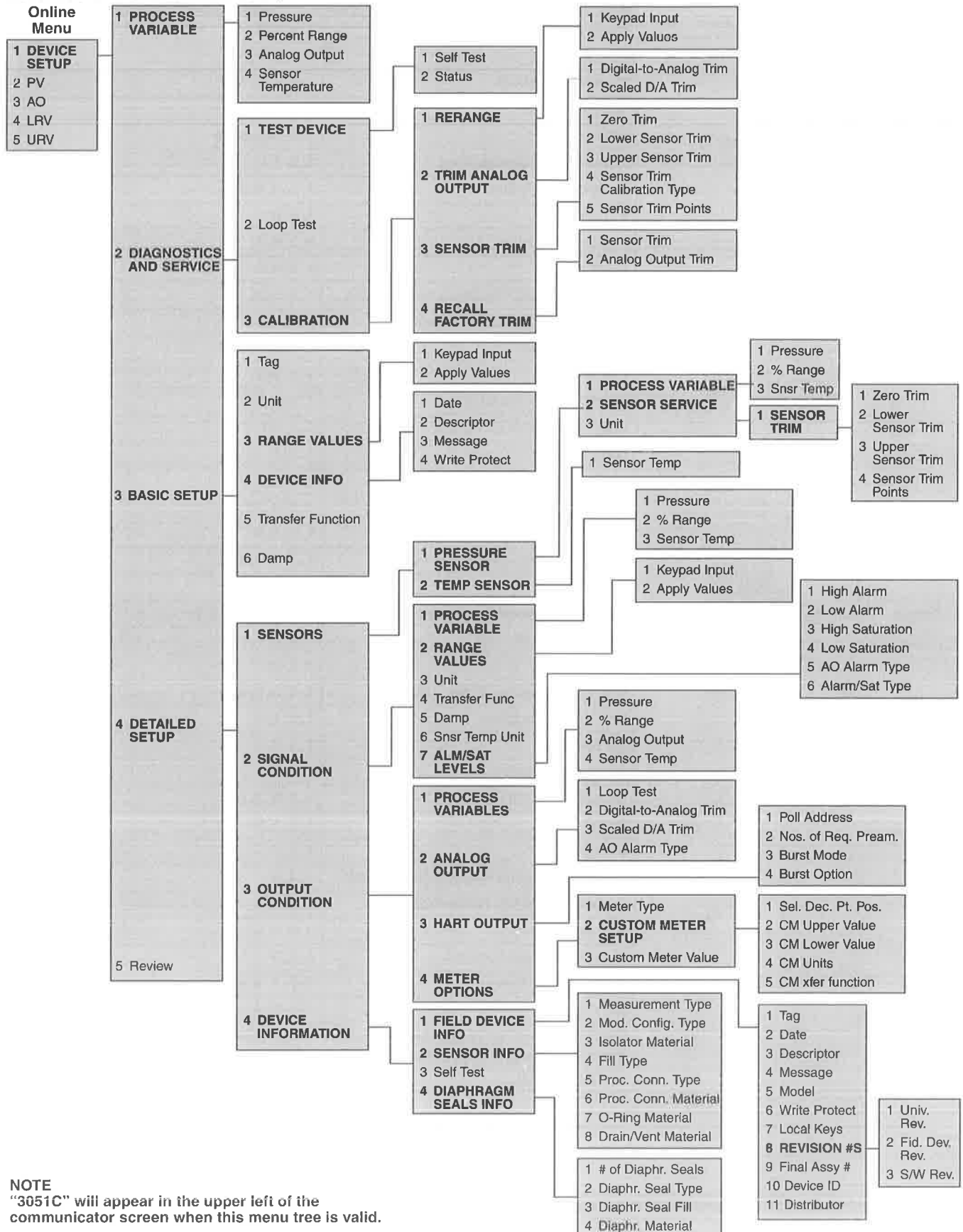


**NOTE**  
 "3051" will appear in the upper left of the communicator screen when this menu tree is valid.

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).

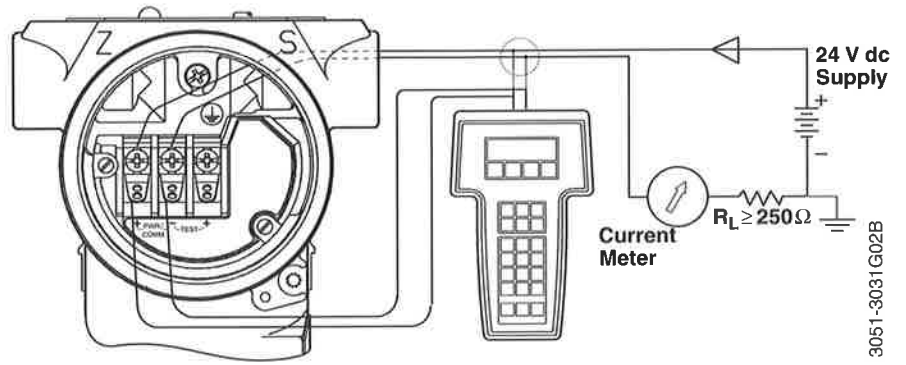


FIGURE A-5. Bench Hook-up  
(Low Power Transmitters).

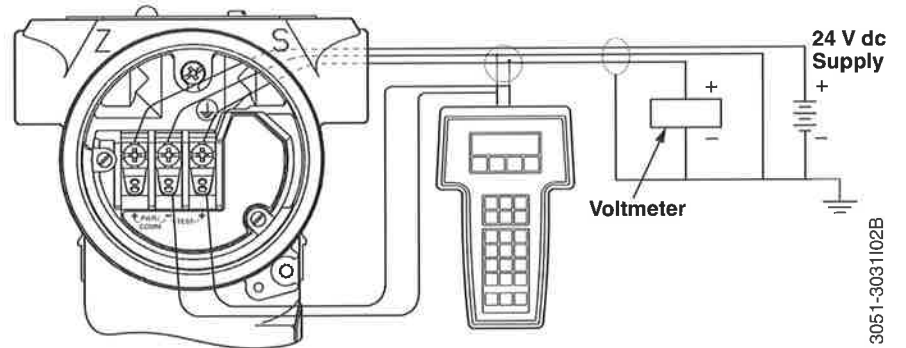


FIGURE A-6. Field Hook-up  
(4–20 mA Transmitters).

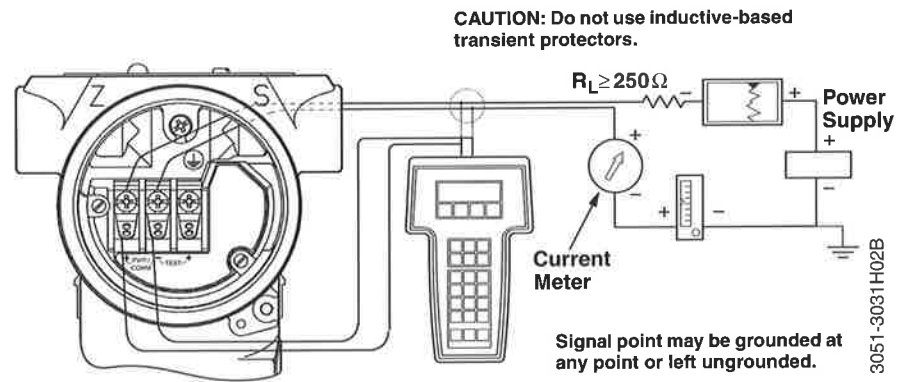
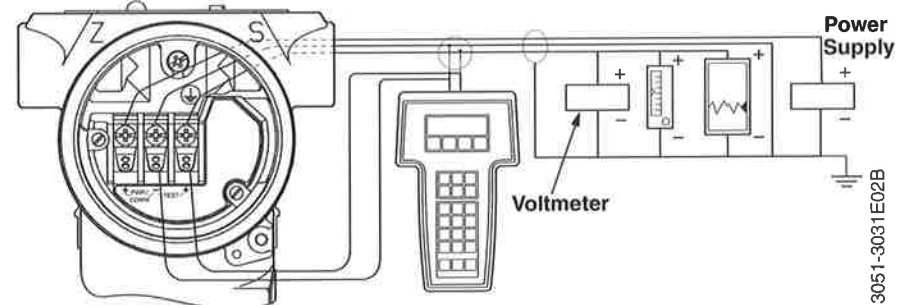


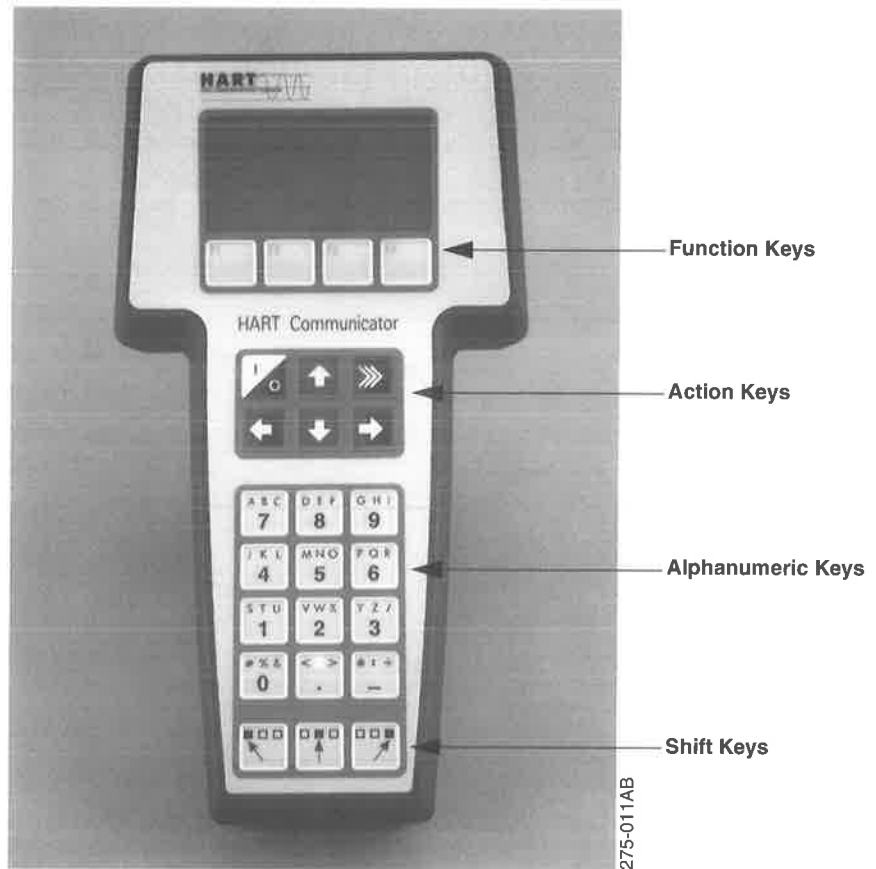
FIGURE A-7. Field Hook-up  
(Low Power Transmitters).



## 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
<b>1k snsr EEPROM error-factory ON</b>	Replace the sensor module
<b>1k snsr EEPROM error-user-no out ON</b>	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.
<b>1k snsr EEPROM error-user ON</b>	Perform a full trim to recalibrate the transmitter.
<b>4k micro EEPROM error-factory ON</b>	Replace the electronics board.
<b>4k micro EEPROM error-user-no out ON</b>	Use the hart communicator to reset the message field.

Message	Description
<b>4k micro 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.

Figure B-1. Model 268 Menu Tree.

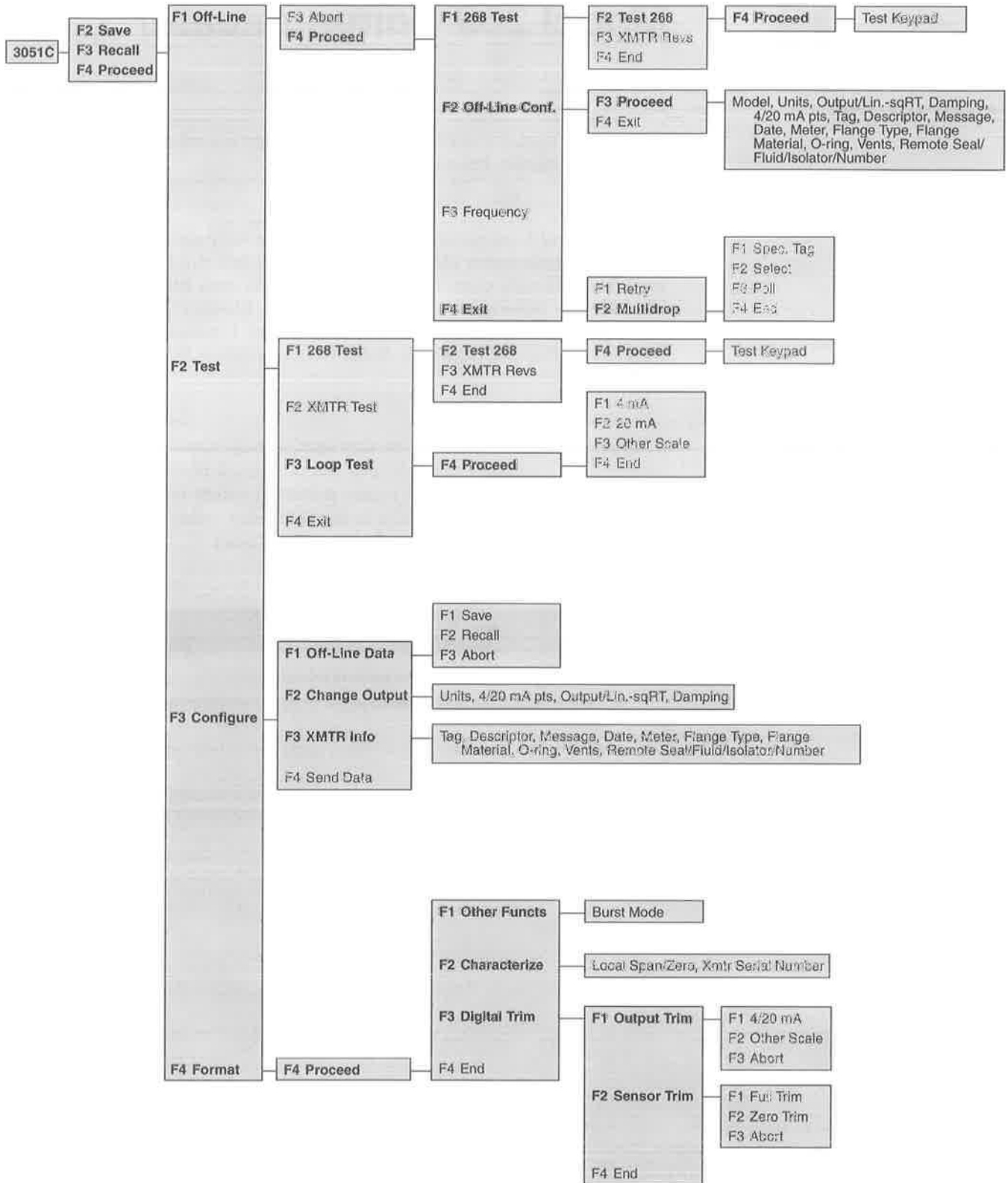


TABLE B-1. Model 268 Fast Key Equivalents.

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).

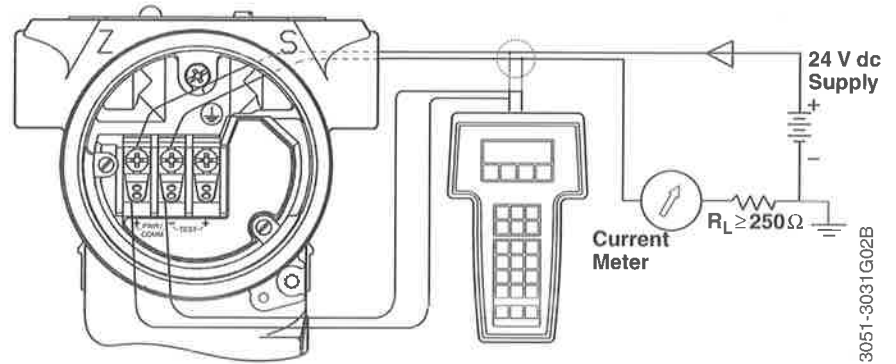


Figure B-3. Bench Hook-up (Low Power Transmitters).

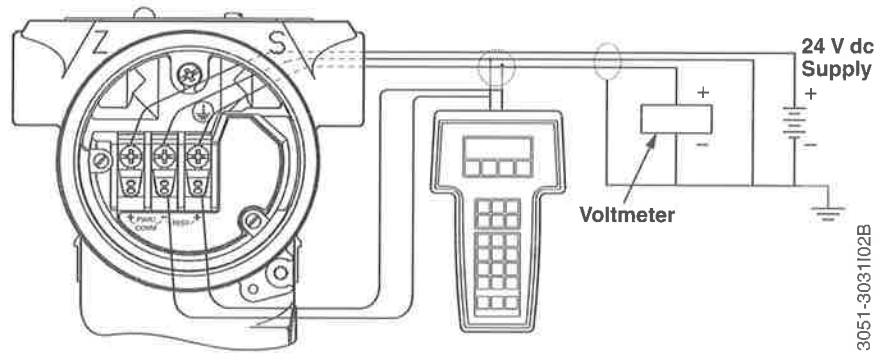




Figure B-4. Field Hook-up (4–20 mA Transmitters).

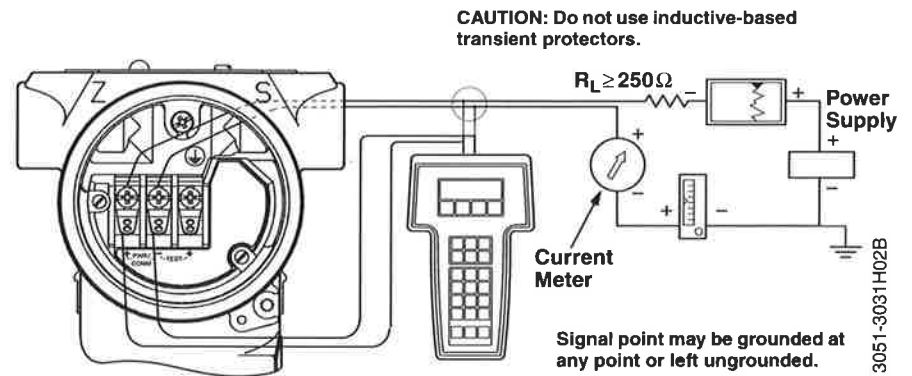
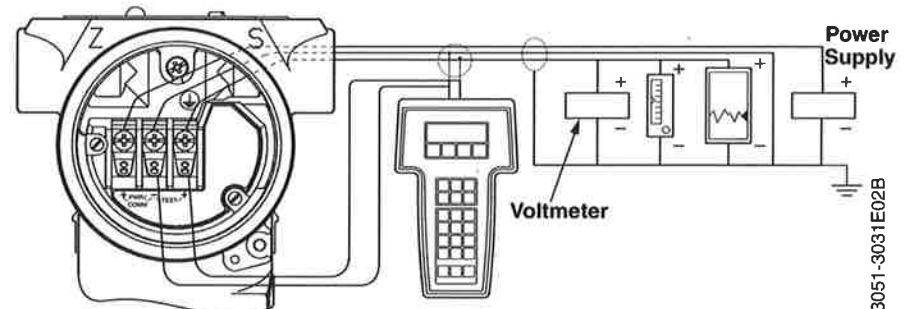


Figure B-5. Field Hook-up (Low Power Transmitters).



## COMMUNICATOR KEYS

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.

### Dedicated Keys

#### 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**.

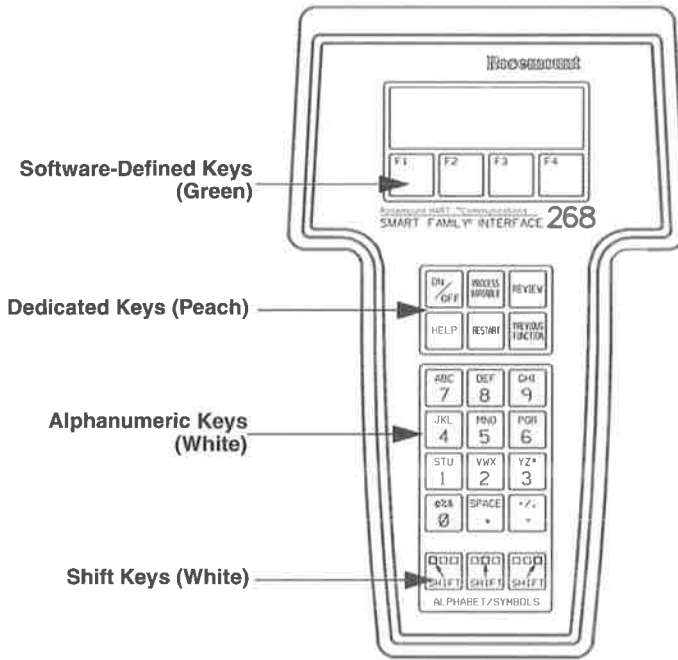
#### Process Variable

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.

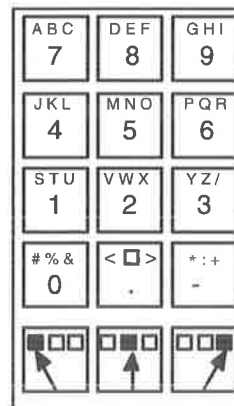
**Previous Function**

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.

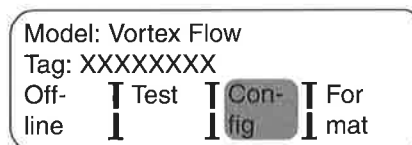
**(F2 x 7)**—Means to push the **F2** key seven consecutive times.

**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>Ofln 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  -TOLERANCE- .X - .1 [2.5] .XX - .02 [0.5] .XXX - .010 [0.25]  FRACTIONS      ANGLES - 1/32              - 2°  DO NOT SCALE PRINT	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		
APP'D. GOVT.	SIZE A	FSCM NO	DWG NO.	03031-1019
	SCALE	N/A	WT.	SHEET 1 OF 9



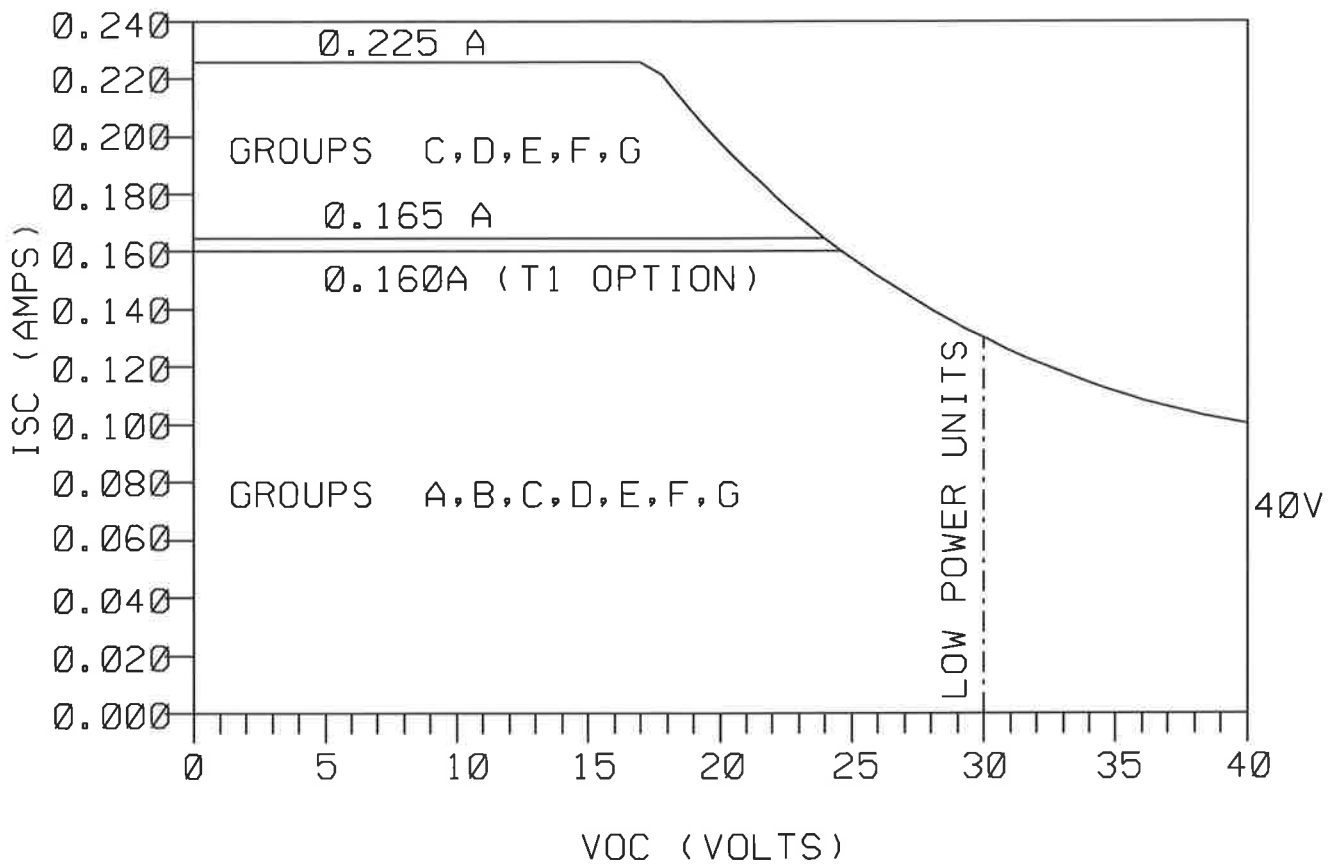
1019A01A





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

DR. **MIKE DOBE**

ISSUED

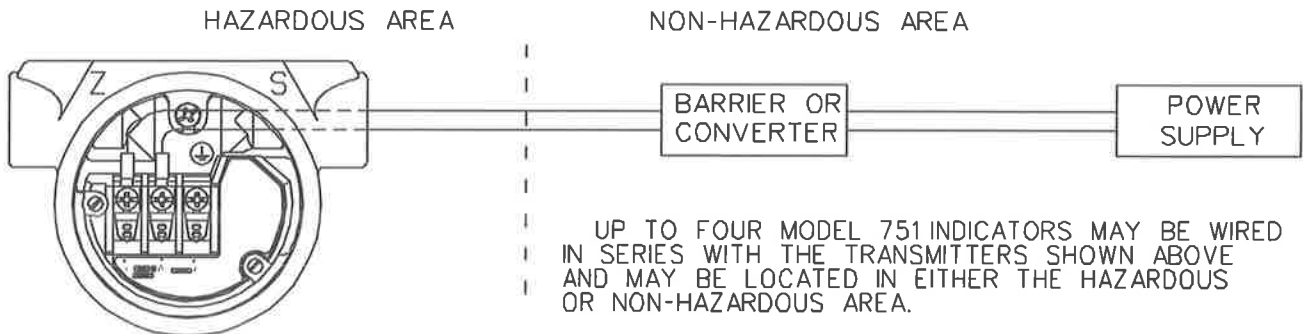
CAD Maintained, (MICROSTATION).

SIZE A	FSCM NO	DWG NO. 03031-1019
SCALE N/A	WT.	SHEET 2 OF 9

1019A02A

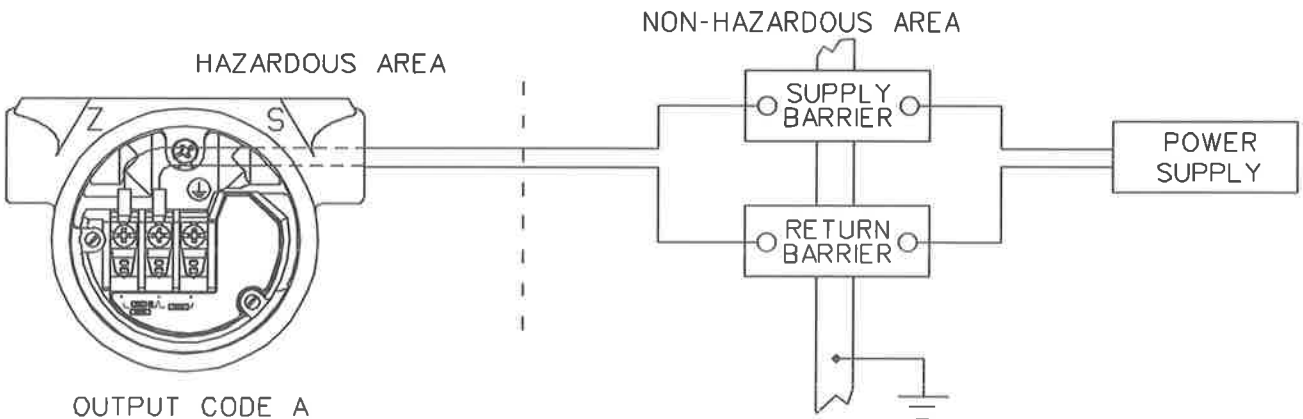
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004088		

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	
DR.	<b>MIKE DOBE</b>
ISSUED	

SIZE		FSCM NO		DWG NO.	
A				03031-1019	
SCALE	N/A	WT.		SHEET	3 OF 9

CAD Maintained, (MICROSTATION).

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 <sub>MAX</sub> = 40V	V <sub>T</sub> OR V <sub>OC</sub> IS LESS THAN OR EQUAL TO 40V
I <sub>MAX</sub> = 165MA	I <sub>T</sub> OR I <sub>SC</sub> IS LESS THAN OR EQUAL TO 165MA
P <sub>MAX</sub> = 1 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 <sub>I</sub> = .01μF	C <sub>A</sub> IS GREATER THAN .01μF
L <sub>I</sub> = 10μH	L <sub>A</sub> IS GREATER THAN 10μH

\* FOR T1 OPTION:

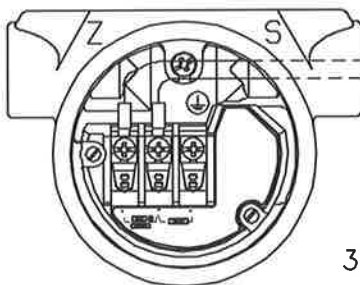
I <sub>MAX</sub> = 160MA	I <sub>T</sub> OR I <sub>SC</sub> IS LESS THAN OR EQUAL TO 160MA
L <sub>I</sub> = 1.05MH	L <sub>A</sub> IS GREATER THAN 1.05MH

CLASS I, DIV. 1, GROUPS C AND D

V <sub>MAX</sub> = 40V	V <sub>T</sub> OR V <sub>OC</sub> IS LESS THAN OR EQUAL TO 40V
I <sub>MAX</sub> = 225MA	I <sub>T</sub> OR I <sub>SC</sub> IS LESS THAN OR EQUAL TO 225MA
P <sub>MAX</sub> = 1 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 <sub>I</sub> = .01μF	C <sub>A</sub> IS GREATER THAN .01μF
L <sub>I</sub> = 10μH	L <sub>A</sub> IS GREATER THAN 10μH

\* FOR T1 OPTION:

L <sub>I</sub> = 1.05MH	L <sub>A</sub> IS GREATER THAN 1.05MH
-------------------------	---------------------------------------



HAZARDOUS AREA | NON-HAZARDOUS AREA

ASSOCIATED APPARATUS  
(SEE SHEET 3)

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

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</b> OF <b>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
$C_T = .042\mu F$	$C_A$ IS GREATER THAN $.042\mu F$
$L_T = 10\mu H$	$L_A$ IS GREATER THAN $10\mu H$

\*

FOR T1 OPTION:

$L_T = 0.75MH$	$L_A$ IS GREATER THAN $0.75MH$
----------------	--------------------------------

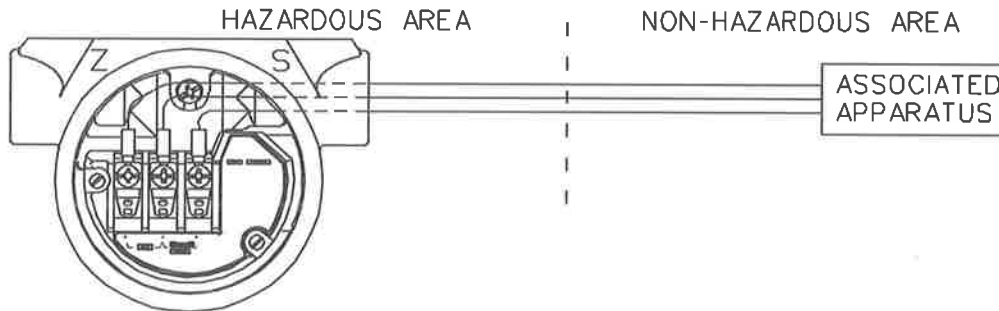
CLASS I, DIV. 1, GROUPS C AND D

$V_{MAX} = 30V$	$V_T$ 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
$C_T = .042\mu F$	$C_A$ IS GREATER THAN $.042\mu F$
$L_T = 10\mu H$	$L_A$ IS GREATER THAN $10\mu H$

\*

FOR T1 OPTION:

$L_T = 0.75MH$	$L_A$ IS GREATER THAN $0.75MH$
----------------	--------------------------------



OUTPUT CODE M  
AVAILABLE FOR THE MODELS LISTED

3051C	3051H
3051L	3051CA
3051P	3051T

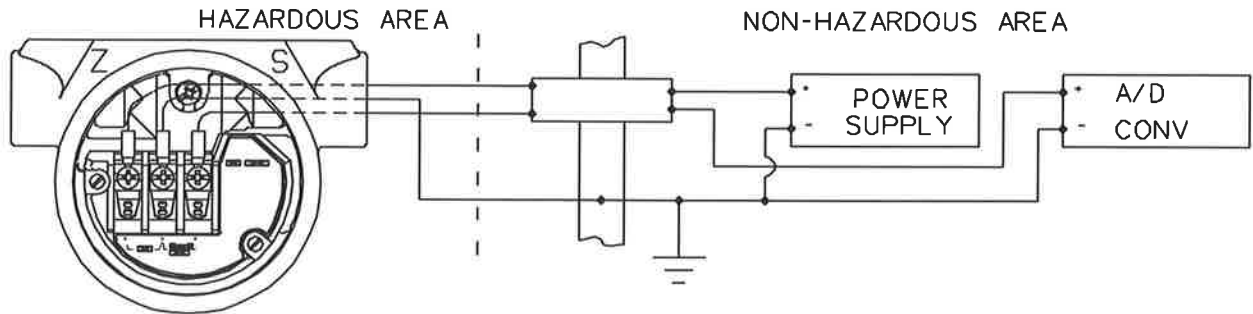
ROSEMOUNT INC. 12001 TECHNOLOGY DRIVE EDEN PRAIRIE, MN 55344 USA	
DR.	<b>MIKE DOBE</b>
ISSUED	

CAD Maintained, (MICROSTATION).		
SIZE A	FSCM NO	DWG NO. 03031-1019
SCALE N/A	WT.	SHEET 5 OF 9

1019A05A

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004088		

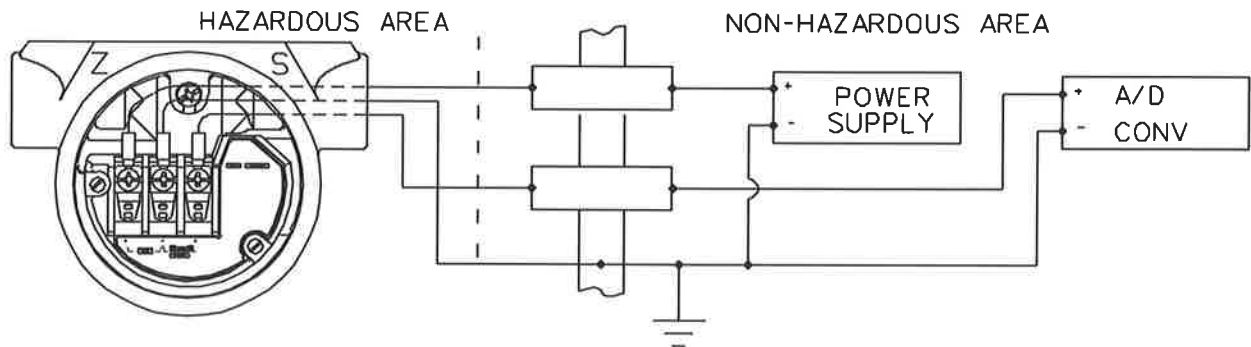
CIRCUIT DIAGRAM 3  
ONE DUAL CHANNEL BARRIER



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	

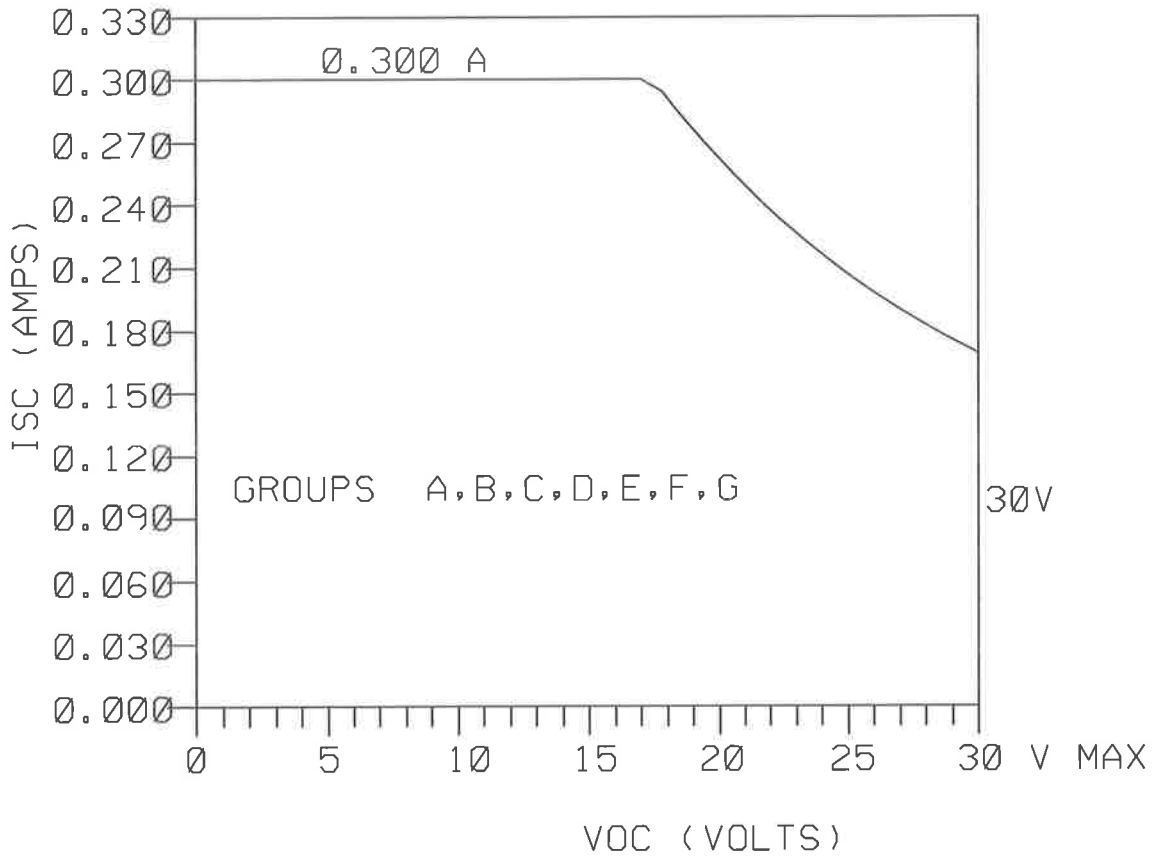
SIZE	FSCM NO	DWG NO.	CAD Maintained, (MICROSTATION).	
A		03031-1019		
SCALE	N/A	WT.	SHEET	6 OF 9

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

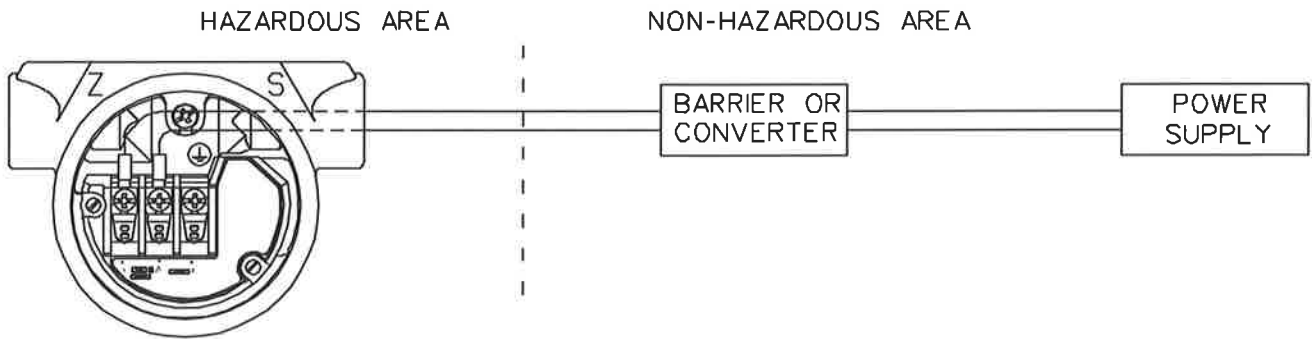
CAD Maintained, (MICROSTATION).

DR. <b>Myles Lee Miller</b>	SIZE A	FSCM NO	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT.	SHEET 7 OF 9

1019A07A

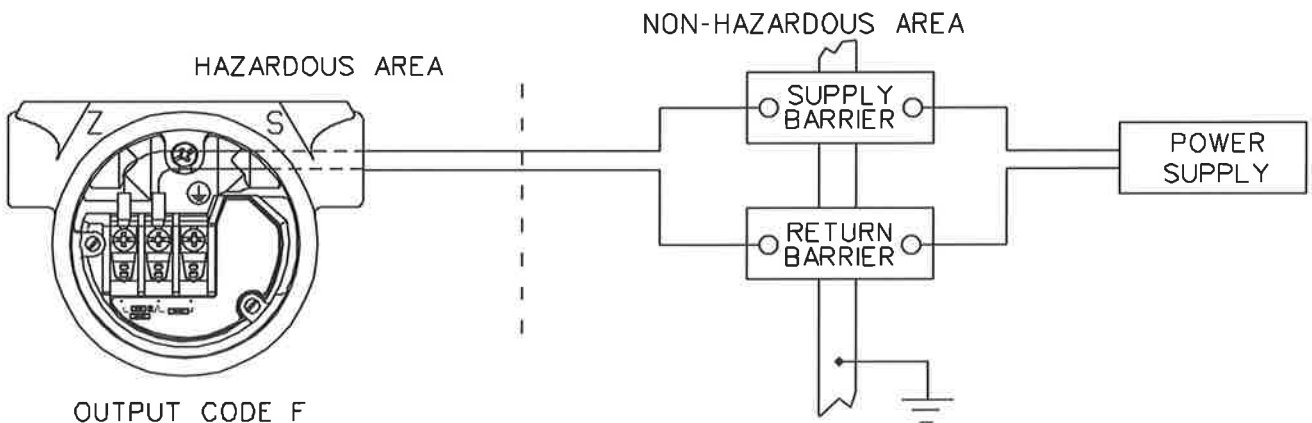
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004088		

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

CAD Maintained, (MICROSTATION).

SIZE	FSCM NO	DWG NO.
A		03031-1019
SCALE	N/A	WT.
		SHEET 8 OF 9

1019A08A

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004088		

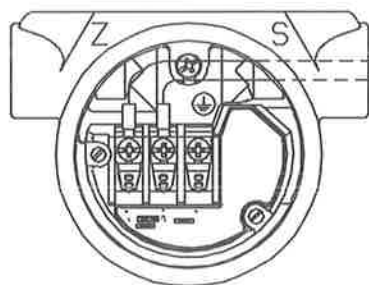
ENTITY CONCEPT APPROVALS

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 (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 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
$P_{MAX} = 1.3 WATT$	$(\frac{V_T \times I_T}{4})$ 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 $0\mu H$



HAZARDOUS AREA | NON-HAZARDOUS AREA

ASSOCIATED APPARATUS  
(SEE SHEET 3)

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

CAD Maintained, (MICROSTATION).

SIZE A	FSCM NO	DWG NO. 03031-1019
SCALE N/A	WT.	SHEET 9 OF 9



1019A09A



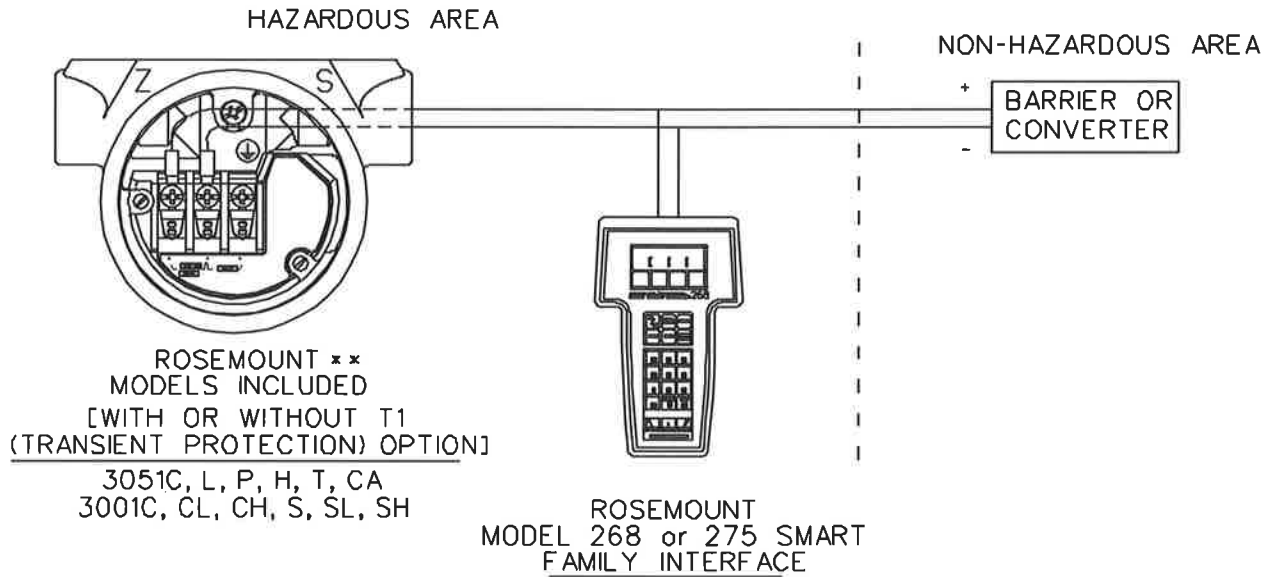
CONFIDENTIAL AND PROPRIETARY  
INFORMATION IS CONTAINED  
HEREIN AND MUST BE  
HANDLED ACCORDINGLY

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)



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.	<b>ROSEMOUNT MEASUREMENT</b>		ROSEMOUNT INC. 12001 TECHNOLOGY DRIVE EDEN PRAIRIE, MN 55344 USA
	DR. <b>Miko Dobo</b> 08/27/90	FISHER-ROSEMOUNT		
	CHK'D	TITLE		
	APP'D. <b>GLEN MONZO</b> 8/31/90	INDEX OF I.S. CSA FOR 3051C/L/P/H/T & 3001C/S		
	APP'D. GOVT.	SIZE A	FSCM NO	DWG NO. 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 \\ SUPPLY $\leq 30V_{\geq}$ 150 \\ RETURN $\leq 10V_{\geq}$ 47 \	GROUPS A, B, C, D  GROUPS C, D

\* MAY BE USED WITH ROSEMOUNT MODEL 268 or 275 SMART FAMILY INTERFACE.

ROSEMOUNT INC.  
12001 TECHNOLOGY DRIVE  
EDEN PRAIRIE, MN 55344 USA

DR. **Mike Dohc**

ISSUED

CAD Maintained, (MICROSTATION).

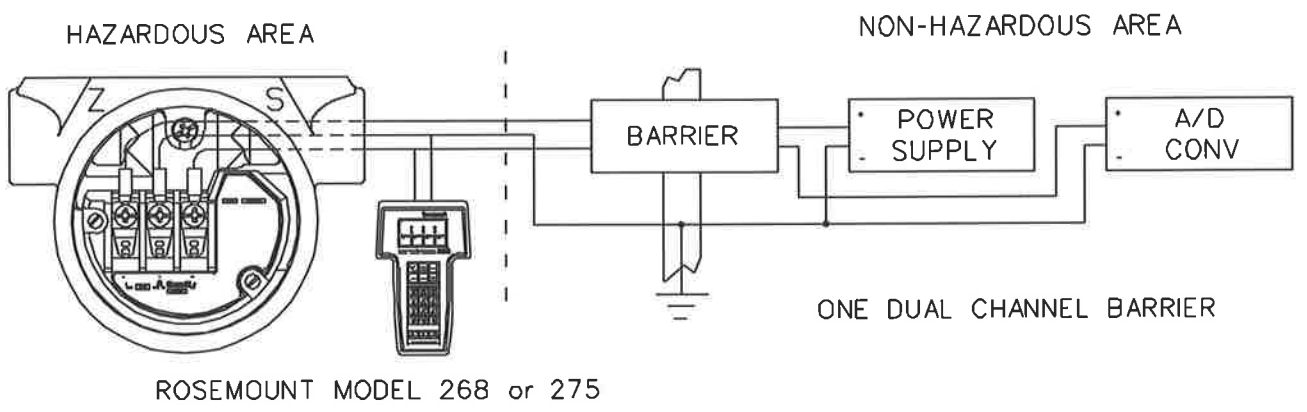
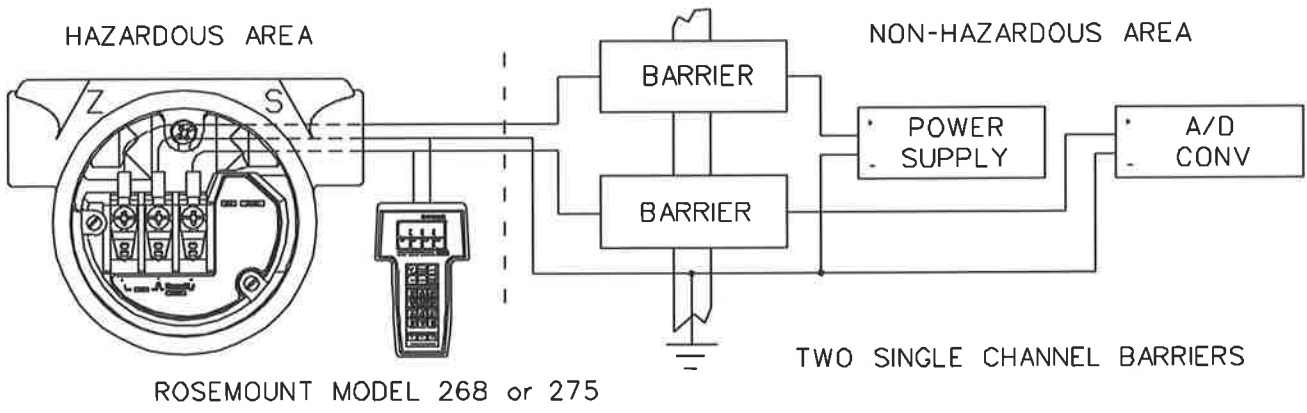
SIZE A	FSCM NO	DWG NO. 03031-1024
SCALE N/A	WT.	SHEET 2 OF 4

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

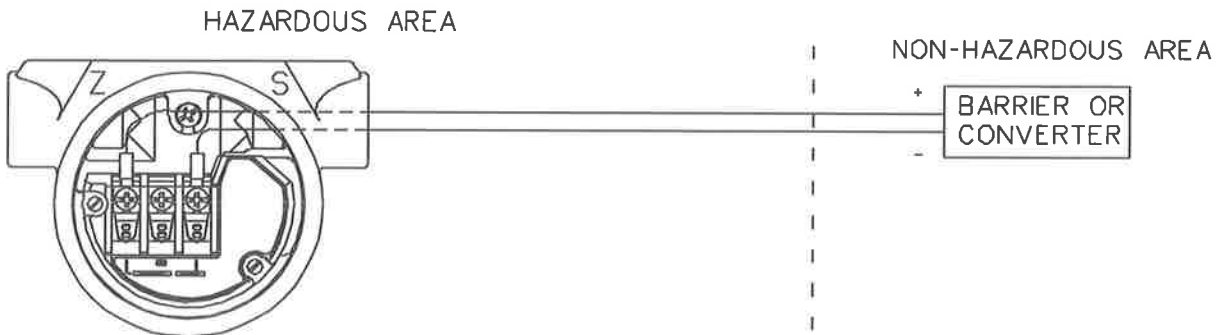
REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004232		

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)



ROSEMOUNT \*\*  
MODELS INCLUDED  
[WITH OR WITHOUT T1  
(TRANSIENT PROTECTION) OPTION]  
3051C, L, P, H, T, CA  
3001C, CL, CH, S, SL, SH

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 EMBLEMES  
DE CLASSE I, DIVISION 2.

ROSEMOUNT INC. 12001 TECHNOLOGY DRIVE EDEN PRAIRIE, MN 55344 USA		CAD Maintained, (MICROSTATION).		
DR. Myles Lee Miller	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

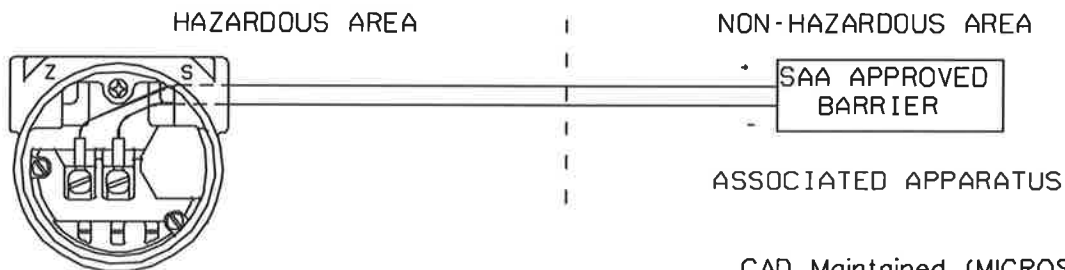
\* SEE SHEET 2 FOR LOW POWER CONFIGURATION.

ENTITY PARAMETER FOR EX IA IIC T6 CLASS I, ZONE 0 PROTECTION:

APPARATUS PARAMETER	BARRIER PARAMETER
VMAX = 30V	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 = 0.01μ F	CA IS GREATER THAN 0.01 MICROFARADS
LI = 10μH	LA IS GREATER THAN 10 MICROHENRIES
FOR T1 OPTION ONLY	
IMAX = 160MA	ISC IS LESS THAN OR EQUAL TO 160MA
LI = 1.05MH	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.	<b>ROSEMOUNT MEASUREMENT</b>		ROSEMOUNT INC. 12001 TECHNOLOGY DRIVE EDEN PRAIRIE, MN 55344 USA
	DR. <b>Mike Dobe</b> 12/30/91	FISHER-ROSEMOUNT		
	CHK'D	TITLE		SAA I.S. INDEX FOR 3051 & 3001
	APP'D. <b>GLEN MONZO</b> 5/8/92	SIZE A	FSCM NO	DWG NO. 03031-1026
	APP'D. GOVT.	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

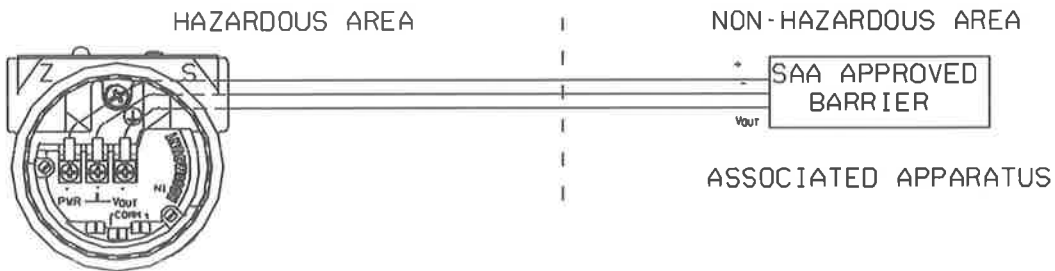
- 3051C      3051T
- 3051L      3051CA
- 3051P
- 3051H

ENTITY PARAMETER FOR EX IA IIC T6 CLASS I, ZONE 0 PROTECTION:

APPARATUS PARAMETER	BARRIER PARAMETER
VMAX = 30V IMAX = 200MA PMAX = 0.9W	VOC IS LESS THAN OR EQUAL TO 30V ISC IS LESS THAN OR EQUAL TO 200MA $\frac{VOC \times ISC}{4}$ IS LESS THAN OR EQUAL TO 0.9W
CI = 0.042 F LI = 10μH FOR T1 OPTION ONLY	CA IS GREATER THAN 0.042 MICROFARADS LA IS GREATER THAN 10 MICROHENRIES
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 A	FSCM NO	DWG NO. 03031-1026	
ISSUED	SCALE N/A	WT.	SHEET 2 OF	2

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 & III	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>	8/13/91
	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.

BARRIER MANUFACTURER	MODEL	APPROVED FOR CLASS I DIVISION 1, GROUPS
FOXBORO	2AI-I2V-FGB 2AI-I3V-FGB 2AS-I3I-FGB 3A2-I2D-CS-E/FGB-A 3A2-I3D-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.	<b>ROSEMOUNT MEASUREMENT</b>		ROSEMOUNT INC. 12001 TECHNOLOGY DRIVE EDEN PRAIRIE, MN 55344 USA
	DR. <b>MIKE DOBE</b> 2/7/90	FISHEROSEMOUNT		
	CHK'D	TITLE		
	APP'D. <b>K. CARLSON</b> 03/13/90	INDEX OF I.S. BARRIER SYSTEMS FOR MOD. 268 SMART FAMILY INTERFACE		
<b>-TOLERANCE-</b> .X * .1 [2.5] .XX * .02 [0.5] .XXX * .010 [0.25]	APP'D. GOVT.	SIZE A	FSCM NO	DWG NO. 00268-0031
FRACTIONS * 1/32 ANGLES * 2°		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  $V_{OC}$ ) AND MAXIMUM SHORT CIRCUIT CURRENT ( $I_T$  OR  $I_{SC}$ ) AND MAXIMUM OUTPUT POWER ( $\frac{V_{OC} \times I_{SC}}{4}$  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 ( $L$ ) OF THE INTRINSICALLY SAFE APPARATUS. THE APPROVED ENTITY CONCEPT PARAMETERS ARE AS FOLLOWS:  
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

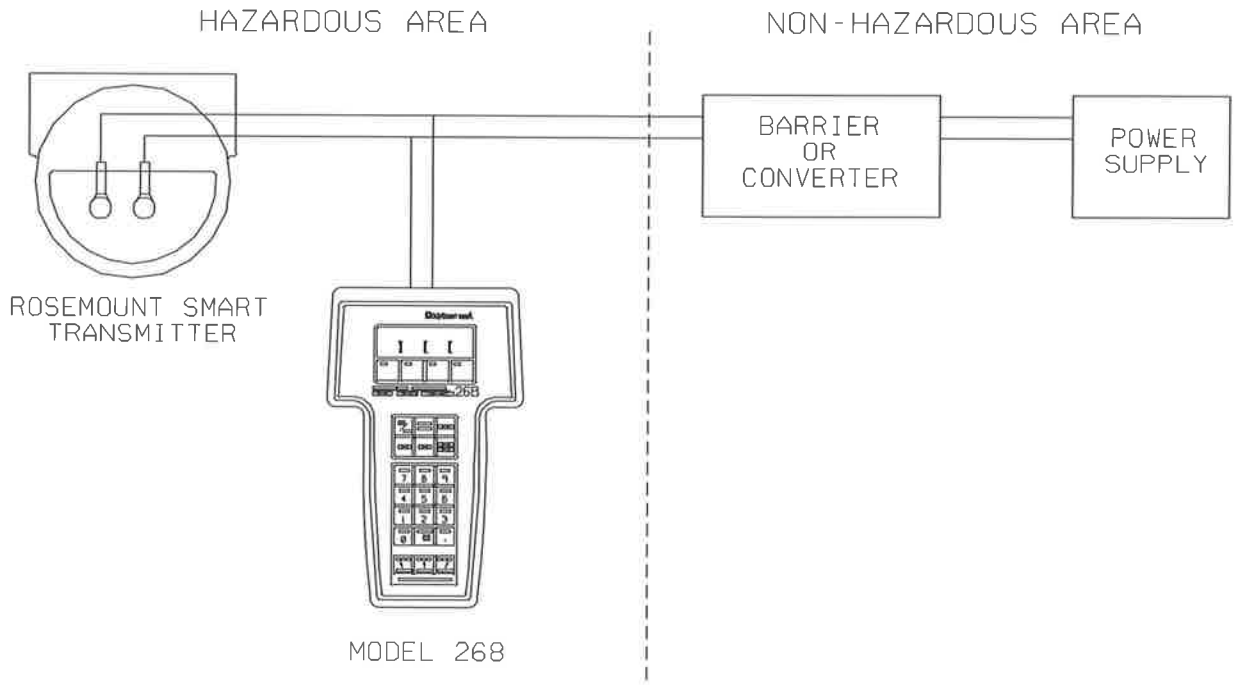
VOC = 1.5 VD.C.
ISC = 27 MA
$C_A = 10,000$ UF
$L_A = 46$ MH

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

ROSEMOUNT INC.  
12001 TECHNOLOGY DRIVE  
EDEN PRAIRIE, MN 55344 USA

CAD Maintained, (MICROSTATION).

DR. <b>D.PEARSON</b>	SIZE <b>A</b>	FSCM NO	DWG NO. <b>00268-0031</b>
ISSUED	SCALE <b>N/A</b>	WT.	SHEET <b>3</b> OF <b>7</b>

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 ( $I_m = I_{sc} + 27mA$  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.

$$I_m = 100mA + 27mA = 127mA$$

ENTER TABLE AT  $I_m = 130mA$ ;  $L_a = 2.0mH$

--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

$$I_m = 41.8mA + 27mA = 68.8mA;$$

ENTER TABLE AT 70mA AND READ  $L_a = 7.5mH$

ADD CONNECTED INDUCTANCE OF SYSTEM:

MODEL 268	$L_1 = 1.1mH$
MODEL 3051 TRANSMITTER	$L_1 = 0.48mH$
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. <b>S.BARDUSON</b>	30JUL90	SIZE A	FSCM NO	DWG NO. <b>00268-0031</b>
ISSUED	SCALE N/A	WT.		SHEET 5 OF 7

0031A05A





---

# 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

CUSTOMER : APACHE CANADA LIMITED  
 PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE  
 SERVICE : PRESSURE INDICATORS

NO	BY	DATE	REVISION
0	TK	01/27/00	FOR PURCHASE

SHEET 1 OF  
 SPEC NO FILE 14.11.P

JOB # 99420

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 21 mm X OTHER  
 BOTTOM BACK X
- 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	0-1100	NO	207	ENGINE FUEL GAS		
PI-227	0	1	0-1100	NO	690	STARTER GAS		
PI-259	0	1	0-1100	NO	690	LUBE OIL		
PI-286	0	1	0-100	NO	41	DISTANCE PIECE PURGE		
PI-287	0	1	0-400	NO	172	PACKING PURGE		

MFR: WIKA

MODEL NUMBER: MODEL 232.53

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		DATE		REVISION			
				0		TK		01/27/00		FOR PURCHASE	
				JOB #		99420		DATE		REQ.	
				BY		CHK'D		APPR.			
GENERAL	1	TAG NO.	PRV-286		PRV-287		PRV-130				
	2	SERVICE	FUEL GAS SUPPLY		FUEL GAS SUPPLY		PRESSURE RELIEF				
	3	LINE NO. / VESSEL NO.					V-130				
	4	LINE SIZE / SCHED. NO.	13 mm TUBING		13 mm TUBING		48 mm				
	5	FUNCTION	Forward Pressure Regulator		Forward Pressure Regulator		PROTECT VESSEL				
BODY	6	TYPE OF BODY	GLOBE		GLOBE		GLOBE				
	7	BODY SIZE	PORT 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									
	ACTUATOR	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	827 kPa		827 kPa		2069 kPa				
25		SPRING RANGE	34 TO 241 kPa		34 TO 241 kPa		34 TO 241 kPa		kPa		
26		SET POINT	41 kPa		172 kPa		100 kPa		kPa		
27											
ACCESSORIES		28	FILT REG	SUPPLY GAGE							
	29	LINE STRAINER									
	30	HOUSING VENT									
	31	INTERNAL RELIEF									
	32	OPTIONS					NACE				
SPECIFICATIONS	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	170	kPa		kPa
	41	MAX. SHUT OFF	MAX. DELTA P	kPa(g)	kPa	kPa(g)	kPa	kPa(g)	kPa	kPa(g)	kPa
	42	TEMP. MAX.	OPERATING	82 °C	16 °C	82 °C	16 °C	82 °C	16 °C	°C	16 °C
	43	OPER. SP. GR.	MOL. WT.	0.65	18.827	0.65	18.827	0.65	18.827	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		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.

IP-219  
PRV-1/S/286/287  
67CF Series

# 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.

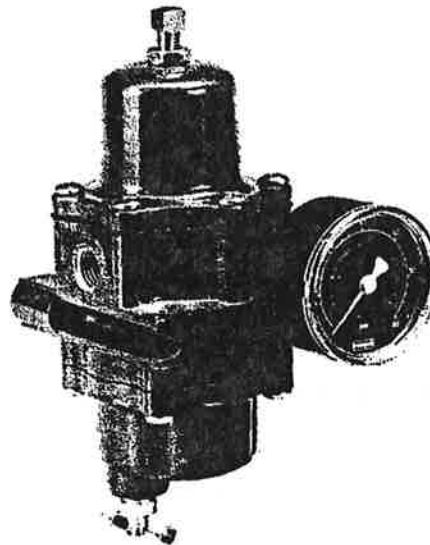
### Specifications

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.



## 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:  $C_g$ : 11.7;  $C_v$ : 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

# 67CF Series

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

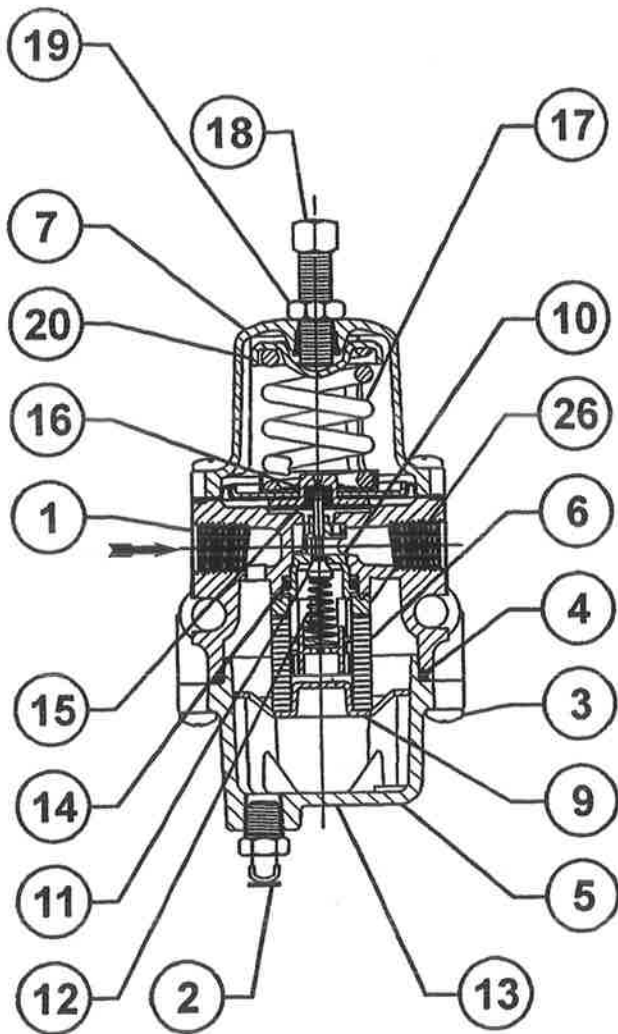
Key	Description	Part Number
12 <sup>(1,2)</sup>	Valve Spring	
	Stainless steel	T14105T0012
	Inconel (NACE)	T14116T0012
13 <sup>(1,2)</sup>	Valve Retainer	T14071T0012
14 <sup>(1,2)</sup>	O-Ring	
	Nitrile (NBR)	T14063T0012
	Fluoroelastomer (FKM)	T14063T0022
	Silicone (VMQ)	T14063T0032
15 <sup>(1,2)</sup>	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	10B2857X012
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.

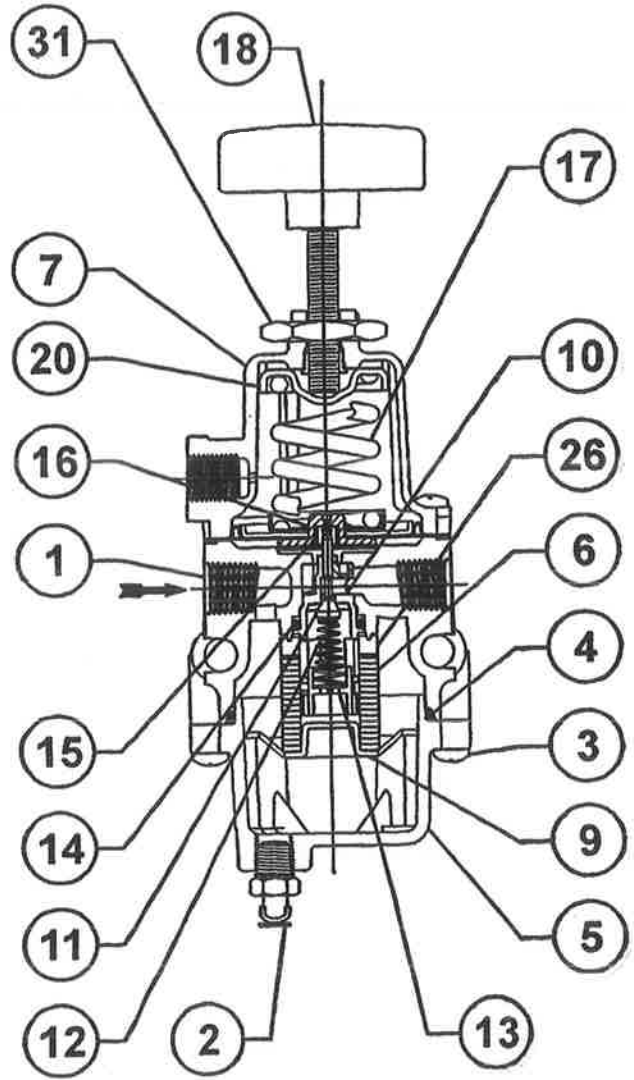


# 67CF Series



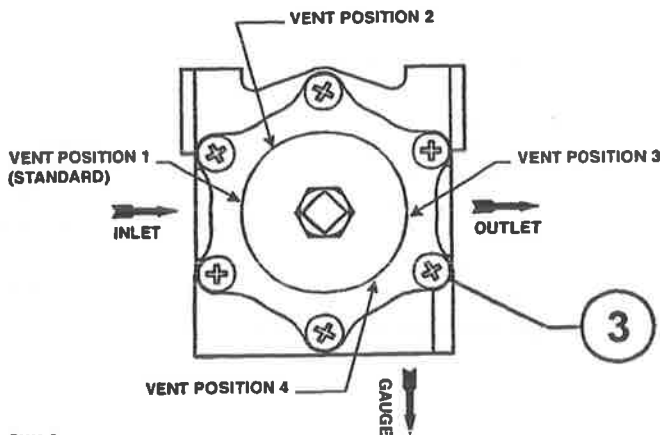
B2693

**STANDARD CONSTRUCTION**



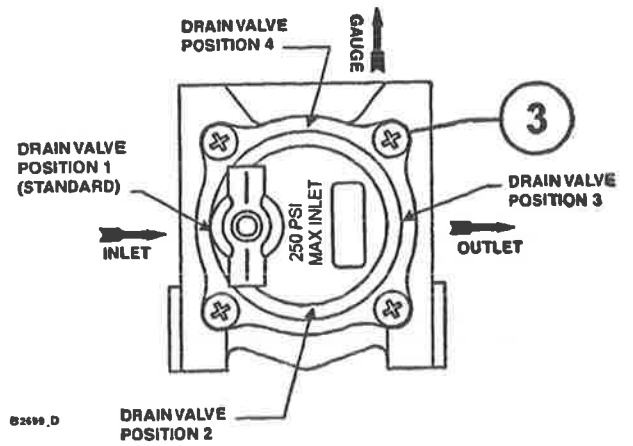
B2696

**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*

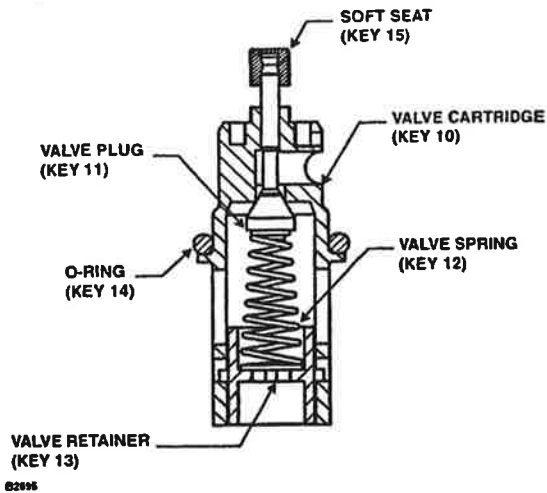


Figure 3. Valve Cartridge Assembly

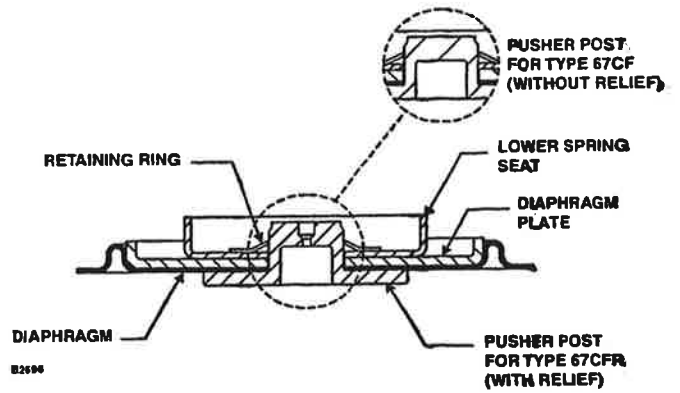


Figure 4. Diaphragm Assembly (Key 16)

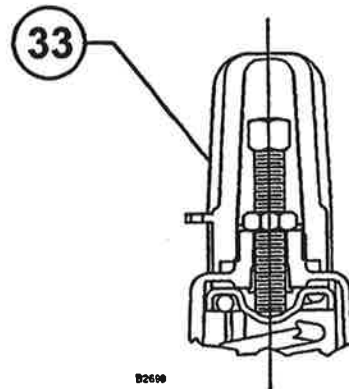


Figure 5. Optional Closing Cap (Only Available with the 1/4-inch Spring Case Vent)

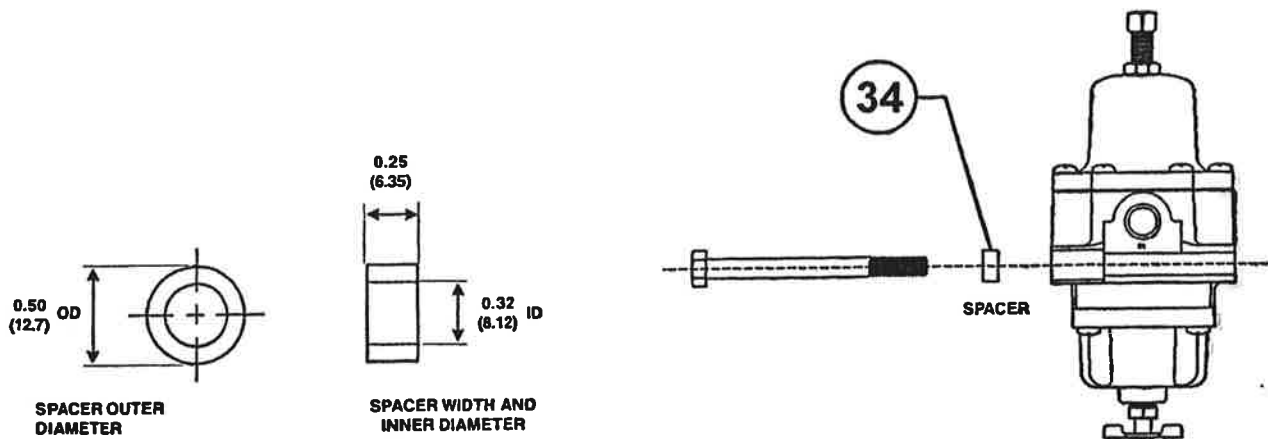


Figure 6. Spacer Diameter and Assembly  
(For Installing 67CF Series Regulator in an Existing Installation if the Mounting Bolts are too Long)

# 67CF Series

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**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 (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.

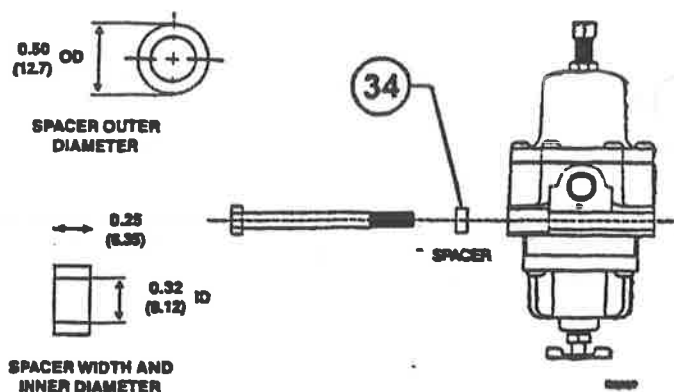


Figure 1. Spacer Diameter and Installation

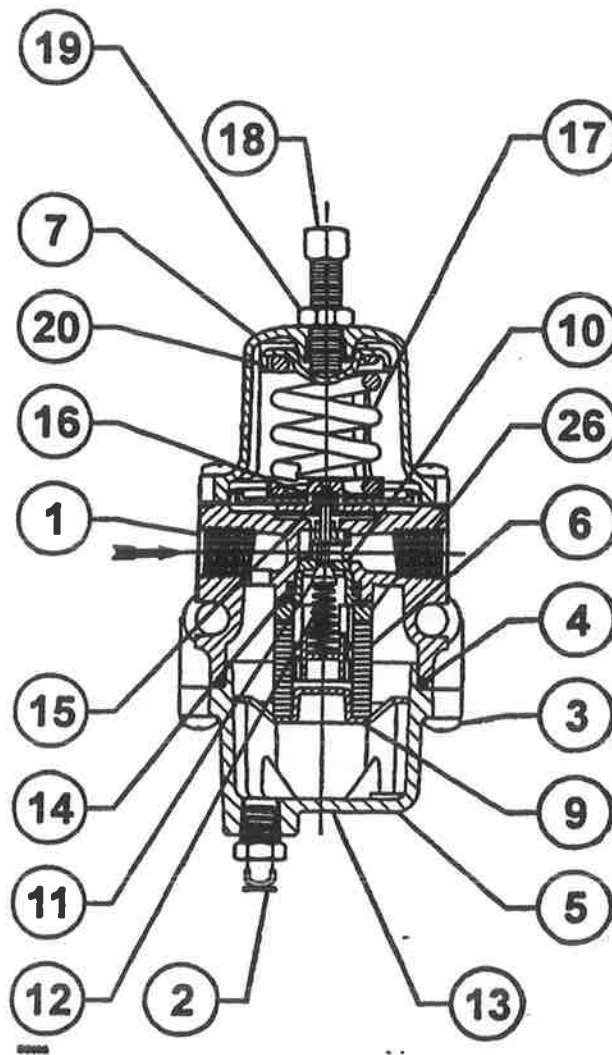


Figure 2. 67CF Series Assembly Drawings

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## Type 98L and Type 98H Back Pressure and Relief Valves



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.

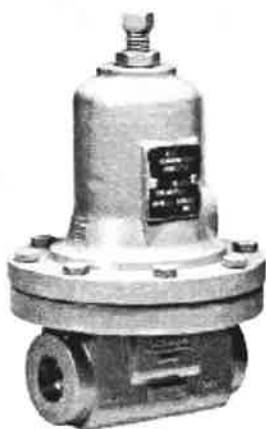
If the spring case develops a leak or if the outlet continually vents gas, service to the unit may be required. Failure to correct trouble could result in a hazardous condition. Only a qualified person must install or service the unit.

### 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.

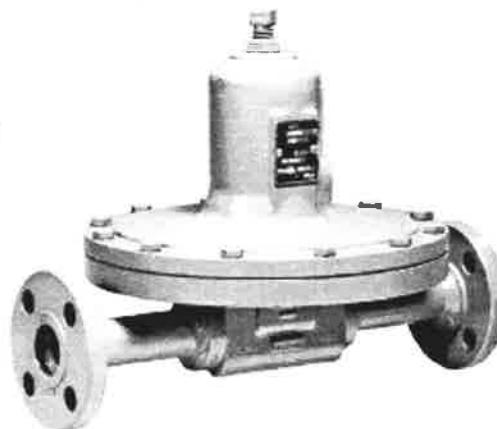
### Specifications

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

Available Constructions		Allowable Temperature Ranges <sup>(5)</sup>		
<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>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>		
End Connection Style		Approximate Weight, lb (kg)		
<p>NPT screwed, socket weld, or ANSI flanged-14 inches face to face (DIN flanged-356mm face to face)</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>		
Body Sizes				
<p>■ 1/4, ■ 1/2, ■ 3/4, ■ 1, ■ 1-1/2, ■ 2</p>				
Maximum Inlet Pressures, Psig <sup>(1,5)</sup> (Set Pressure Plus Buildup)				
TYPE NUMBER	STEEL (WCB) OR STAINLESS STEEL BODY/ ALL TRIMS TO 150°F <sup>(2)</sup> (66°C)	CAST IRON BODY		
		All Trims to 150°F <sup>(3)</sup> (66°C)	Metal Trims <sup>(4)</sup>	
			To 315°F (66°C)	To 406°F (208°C)
98L	125 (52)	60 (16)	60 (16)	60 (16)
98H	300 (149)	300 (149)	300 (149)	250 (121)
Relief Pressure Ranges				
<p>See table 2</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.

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
	29 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
	29 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
	29 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.

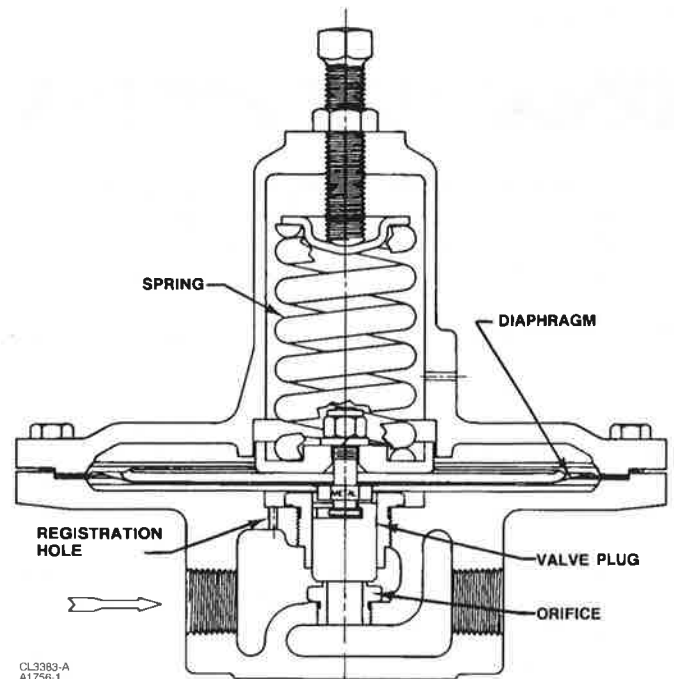


Figure 2. Type 98L Relief Valve Operational Schematic

## 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 an elastomer diaphragm or an 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
-----	-------------	-------------

### Note

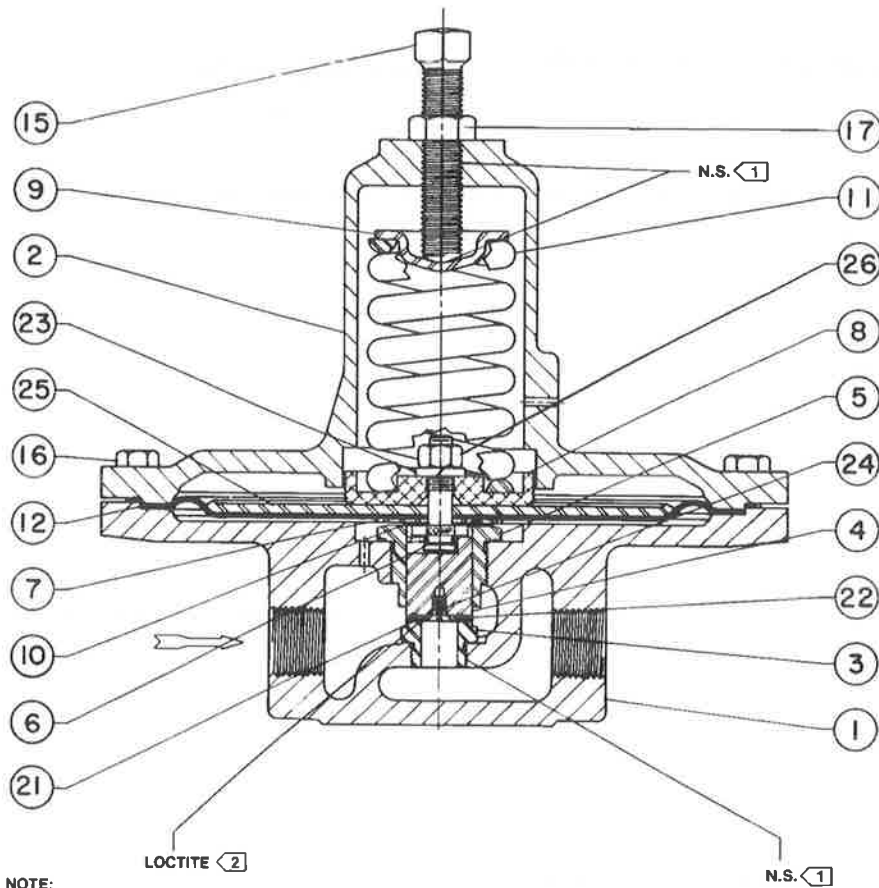
In this parts list, parts marked NACE are intended for corrosion-resistant service as detailed in the National Association of Corrosion Engineers (NACE) standard MR0175-92.

Parts kit (included are keys 3, 4, 10, 12, 19, 21, 22 and 24). Also included for 98H only is key 14.

Elastomer Trim  
 1/4-inch body  
 1/2-inch body  
 3/4 and 1-inch body  
 1-1/2 and 2-inch body  
 Type 98H only  
 Metal Trim  
 1/4-inch body  
 1/2-inch body  
 3/4 and 1-inch body  
 1-1/2 and 2-inch body  
 Type 98H only

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 (NACE)	1L3447 36142
	1/2-inch body, std (NACE)	1L3398 35072
	3/4 and 1-inch bodies, std (NACE)	1L3398 40032
	1-1/2 and 2-inch bodies, std (NACE)	1L3428 36142
	1-1/2 and 2-inch bodies, std (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

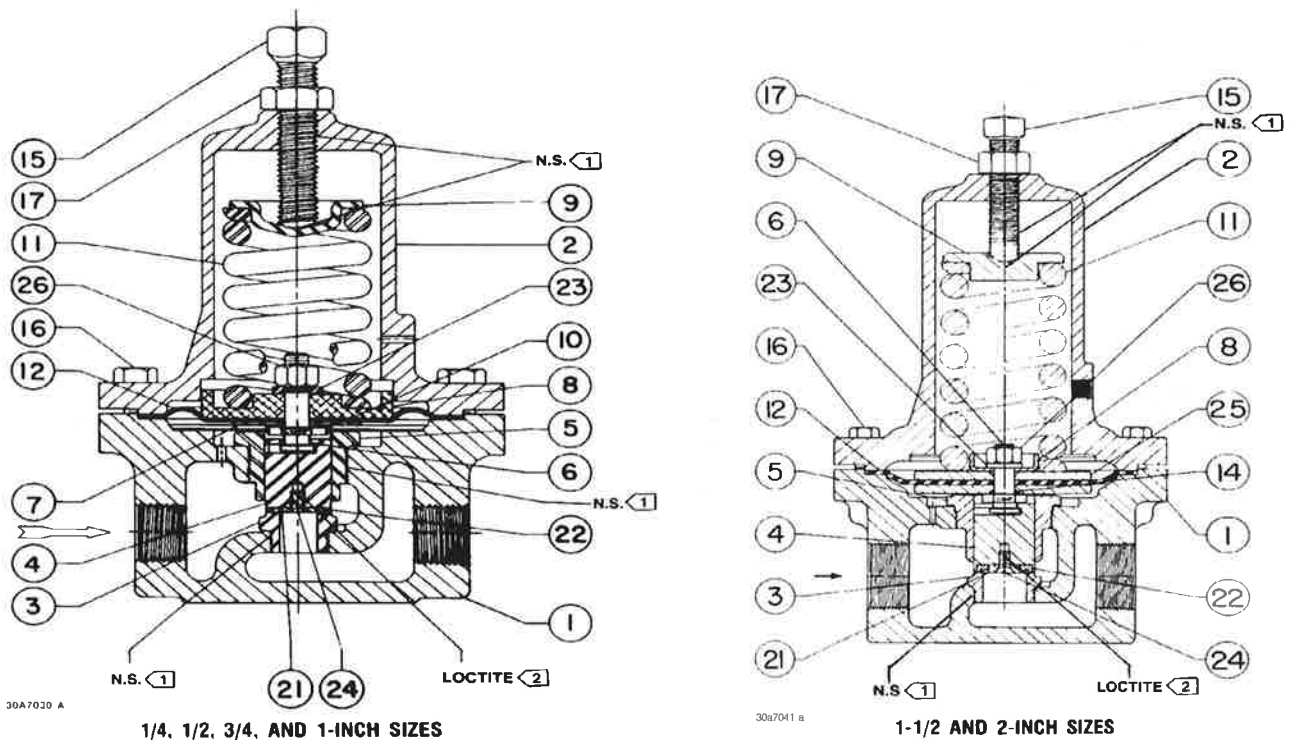


**NOTE:**  
**PARTS NOT SHOWN 13, 18, & 20**  
 1 NEVER-SEEZ MARK OWNED BY COMPOUND CORP.  
 2 LOCTITE GRADE "A" MARK OWNED BY LOCTITE CORP.

30A7028  
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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		1/2-inch body	1A3537 24122
	For handwheel	1J4964 28982		3/4 and 1-inch bodies	1A3192 24122
	3/4 and 1-inch bodies Standard	1A3308 28982		1-1/2 and 2-inch bodies Type 98H only	1A3681 24112
	1-1/2 and 2-inch bodies Standard, Type 98H only	1A6801 28992	18	Drive Screw (not shown) Stainless steel (2 req d)	1A3682 28982
16	Cap Screw, steel pl Type 98L		19*	Diaphragm Gasket, elastomer Use w/302 stainless steel diaphragm	
	1/4-inch body (10 req d)	1A4078 24052		Type 98H	
	1/2-inch body (10 req d)	1A3816 24052		1/4-inch body	1E3931 04022
	3/4 and 1-inch bodies (12 req d)	1A3369 24052		1/2-inch body	1E3961 04022
	Type 98H			3/4 and 1-inch bodies	1E3993 04022
	1/4-inch body (6 req d)	1A3917 24052		1-1/2 and 2-inch bodies	1P7879 04022
	1/2-inch body (8 req d)	1A3526 24052		Type 98L	
	3/4 and 1-inch bodies (8 req d)	1A3418 24052		1/4-inch body	1E3940 04022
	1-1/2 and 2-inch bodies (8 req d)	1K5684 28982		1/2-inch body	1E3970 04022
				3/4 and 1-inch bodies	1E3904 04022



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	Description	Part Number	Key	Description	Part Number
25	Diaphragm Head Type 98L, steel zinc plated 1/4-inch body 1/2-inch body 3/4 and 1-inch bodies Type 98H, steel 1-1/2 and 2-inch bodies (2 req d) Standard (NACE)	1L3455 25072 1L3396 25072 1L3421 25072  1P7882 25012 1P7882 35072	28	Handwheel, zinc 1/2-inch body only	1J4961 44012
26	Locknut, steel zinc plated 1/4 and 1/2-inch bodies 3/4 and 1-inch bodies 1-1/2 and 2-inch bodies, Type 98H only	1L8723 24122 1L8722 24122 1P7887 24122	29	Machine Screw, steel pl 1/2-inch body With handwheel only	1A8517 28982
			30	Lockwasher, steel 1/2-inch body With handwheel only	1A3523 32992
			51	NACE Tag, not shown	19A6034 X012
			52	Tag Wire, not shown (NACE)	1U7581 X0022

## Key 1 Regulator Body, NPT

BODY SIZE, INCHES	TYPE 98H				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	2L1373533092	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	21B0804X0022	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 TO METAL SEAT		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

\*Recommended spare part.

## 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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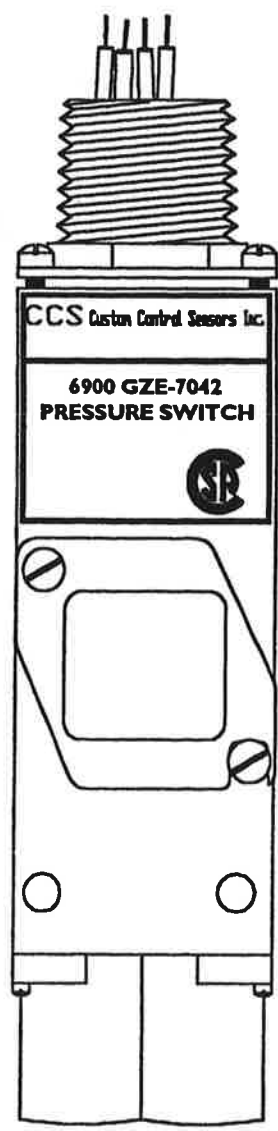
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# INSTALLATION AND OPERATION MANUAL

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 Res.	VOLTS	AMPERES Res.
250AC-50/60 Hz	11	125AC-50/60Hz	11
125DC	0.5	30 DC	5

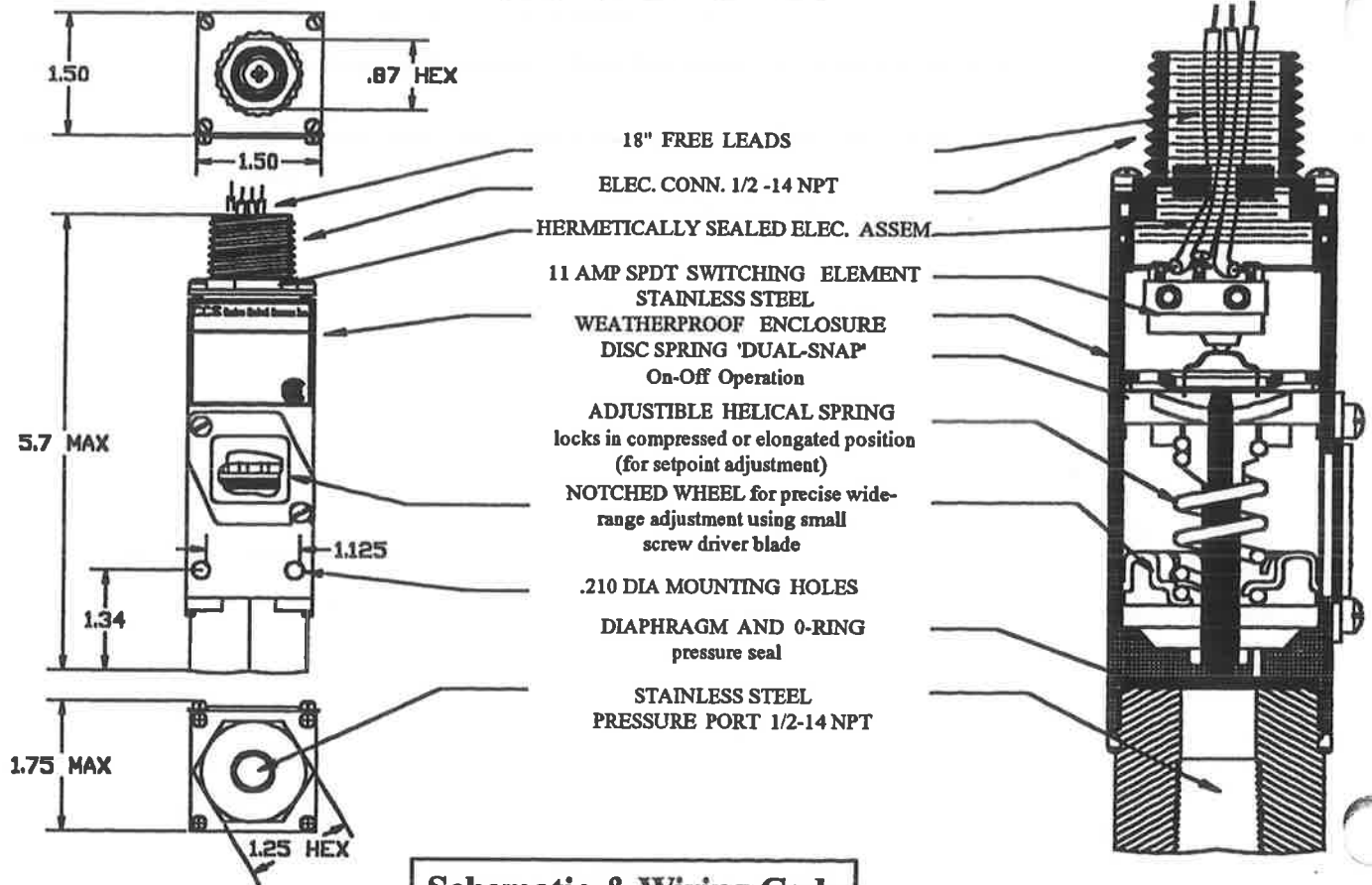
**CUSTOMER SPECIFICS**

PROPAK SYSTEMS LIMITED.  
 Purchase Order No.: 57965-285  
 Telematic Work Order No.: 920787  
**Model      Tag No.      Calibration**

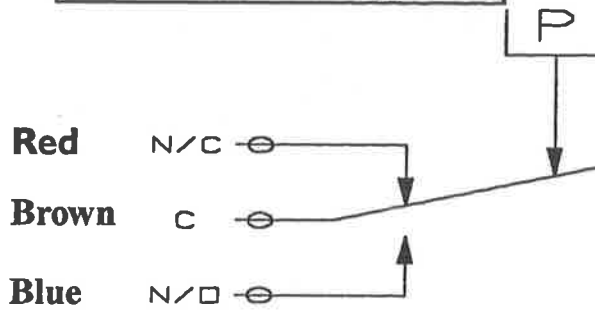
- Standard Features:**
- \* U.L./CSA - See Note
  - \* Explosion proof: Div. 1,2
  - \* NEMA: 4,7,9 & 13
  - \* Weatherproof
  - Ambient Temp. Range - 30° to 160° F  
- 34° to 71° C
  - EXTERNALLY ADJUSTABLE**
  - WIDE RANGE DIAPHRAGM**
  - Shipping Wt. Approx. 28 oz. (794 grams)

**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 host environmental conditions, contact the factory to determine suitability.

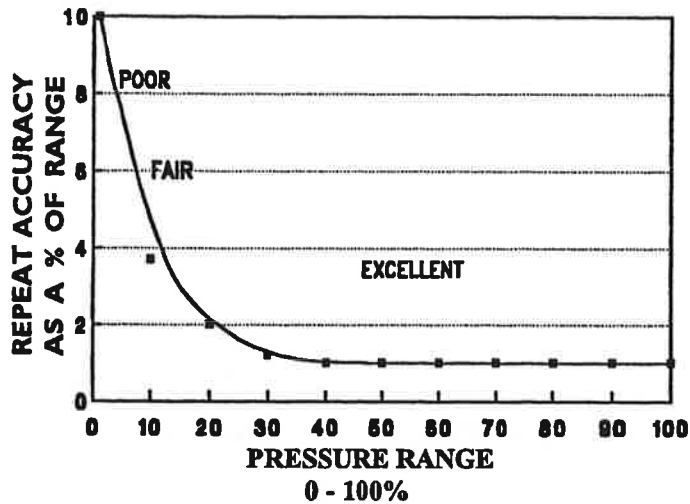
**ADJUSTMENT:** Field adjustable units should be set no closer than 1/2 turn from either end of their adjustment range.

**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.

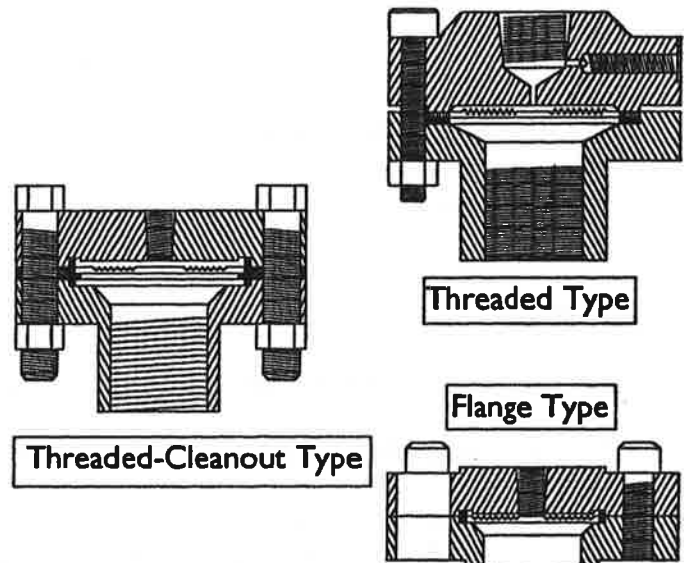
**Steam Service:** For steam or other high temperature applications the pressure switch should be mounted with the pressure connection up and with three or four circular loops, or pigtails, in the pressure lines. The vertical mounting allows condensate to accumulate in the dead ended pressure line and 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.



# **Telematic Controls INC.**

## **PRESSURE SWITCH INSTRUCTIONS**

### **GENERAL PRECAUTIONS**

1. ALWAYS TREAT THE PRESSURE SWITCH AS A SENSITIVE INSTRUMENT.
2. DO NOT APPLY PRESSURE ABOVE PROOF PRESSURE.
3. DO NOT INSERT A SCREWDRIVER OR OTHER PHYSICAL OBJECT INTO THE PRESSURE PORT IN AN ATTEMPT TO ACTUATE THE SWITCH, DAMAGE TO THE DIAPHRAGMS MAY RESULT.

### **INSTALLATION**

1. Apply a light film of antiseize compound/thread sealant to pipe threads and install the unit into its intended location.
2. Connect the unit electrically in accordance with wiring diagram/instructions.
3. After installation check the switch operation by raising and lowering the pressure. Ensure the pressure is increased or decreased sufficiently to overcome the switch deadband. Set the actuation point, if not preset, in accordance with the setting procedure.

### **PRESSURE SETTING**

1. Connect the unit to a variable pressure source.
2. Connect the Electrical Assembly to test lamps or other continuity tester to observe switch action.
3. **INCREASING PRESSURE ADJUSTMENT** : Increase the pressure to the determined set point. The normally closed (N/C) contacts should open (red/brown leads) and the normally open (N/O) contacts should close (blue/brown leads). Turn the ADJUSTMENT WHEEL in accordance with the cover instructions, for the desired actuation point.  
**NOTE\*\*** It is necessary to lower the pressure by the amount of the deadband to deactuate the switch once actuated. The listed deadband is approximate only and may vary in excess of  $\pm 50\%$ .
4. **DECREASING PRESSURE ADJUSTMENT**: Similar to 3 above except the set point pressure is approached decreasingly. N/C contacts are closed at or below setpoint and N/O contacts are open. As in 3 the pressure must be increased by the amount of the deadband to reset the pressure switch.

# GLOSSARY OF TERMS AND DEFINITIONS

**ACCURACY(REPEATABILITY)** - Accuracy is the maximum operational set point deviation of a single sensor (a pressure, temperature, or flow switch) under one given set of environmental and operational conditions.

**ACTUATION AND DEACTUATION POINT** - The actuation point (sometimes called the set point) is the exact point at which the electrical circuit controlled by the switching element is opened (or closed) on increasing pressure or temperature. The deactuation point is the opposite, or the point at which the electrical circuit is closed (or opened) on decreasing pressure or temperature.

**ADJUSTABLE RANGE** - The total range within which the actuation point (set point) of a sensor may be adjusted.

**AMBIENT TEMPERATURE RANGE** - The maximum and minimum temperature that will surround the sensor during use and/or test.

**CANADIAN ELECTRICAL CODES (CEC)** - a voluntary code for adoption and enforcement by regulatory authorities.

**CRITICAL SET POINT** - The critical set point is the set point of the unit which is held to the closest tolerance. It can be either the actuation (increasing) or deactuation (decreasing) point.

**CSA (Canadian Standards Association)** - A non-profit voluntary association engaged in standards development and certification activities. A CSA certified electrical product conforms to applicable requirements of the Canadian Electrical Code. Representative prototypes are tested prior to certification and CSA maintains a production surveillance program to ensure continuing performance.

**DEAD BAND (DIFFERENTIAL, ACTUATION VALUE)** - the difference between the actuation point and the deactuation point of a sensor. For instance, if a pressure switch reaches its actuation point and closes the snap action switch at 100 psi, it is in an actuated condition. If the pressure then drops and the switch deactuates (returns to its normal condition) at 90 psi, it is said to have a dead band of 10 psi.

**DOUBLE POLE DOUBLE THROW (DPDT) SWITCHING ELEMENT** - A DPDT switching element has six electrical terminals. In simple terms, it is two SPD switches operating at the same settings. This type of switch can handle two independent circuits without using a relay.

**FIELD ADJUSTMENT** - A pressure switch design that provides for adjustment of set points in the field.

**FIRE RESISTANT** - A pressure sensor that is designed with a high melting point barrier (steel) that will prevent full flow of sensed flammable fluid from feeding an externally caused fire.

**HERMETIC SEAL** - A method of sealing the electrical switching element in a sensor so that it is unaffected by all ambient external corrosive and explosive gases. Sealing must be accomplished by soldering, brazing, welding, and glass to metal fusion.

**LIMP DIAPHRAGM** - An elastomer or plastic diaphragm which is used in a pressure sensor. This type of diaphragm conforms to the shape of the sensing pressure plate and has no rigid structure itself. CCS uses polyimide or viton/dacron limp diaphragms.

**NORMALLY CLOSED SWITCHING ELEMENT** - Is one in which terminals are wired so that current can flow through the switching element until the plunger pin is actuated to open the circuit.

**NORMALLY OPEN SWITCHING ELEMENT** - Is one in which the terminals are wired so that no current can flow through the switching element until the plunger pin is actuated to close the circuit.

**POLYIMIDE** - A polymeric film possessing a unique combination of physical and mechanical properties which include long life, excellent deformation/set resistance, high resistance to temperature extremes, good tensile strength, and outstanding resistance to organic compounds. Polyimide is not recommended for water service above 140°F (60°C)

**PRESSURE, ABSOLUTE** - The difference between zero pressure (a perfect vacuum) and some known pressure. It may be arrived at by adding barometric pressure to gauge pressure.

**PRESSURE, AMBIENT** - The pressure (usually, but not necessarily atmospheric) surrounding the pressure sensor.

**PRESSURE, ATMOSPHERIC** - The actual weight per unit area of the earth's atmosphere at a given locale and altitude. Atmospheric pressure at sea level is approximately 14.7 psi or 30 inches of mercury or 408 inches of water.

**PRESSURE, PROOF** - Proof pressure (normally 1 1/2 times system pressure) is the maximum pressure which may be applied to any pressure sensor without causing permanent damage.

**PRESSURE, SYSTEM** - The nominal pressure level that a system will operate at including work load.

**PRESSURE SENSING ELEMENT** - That portion of the pressure switch that is in contact with and moves as a result of a change in pressure of the fluid. The most common type of pressure sensing elements are diaphragms, accordion bellows, bourdon tubes and pistons.

**PRESSURE SWITCH** - A sensor that upon the increase or decrease of a pressure or vacuum, opens or closes one or more electrical switching elements at a predetermined set point.

**RESPONSE TIME OR TIME CONSTANT** - The amount of time (in seconds) in which the sensor operates after being subjected to a step temperature increase where the difference between the initial soak temperature and actuation temperature equals 63% of the step temperature. The response time is expressed for a designated flow (feet per second), media and system pressure (PSIG).

**SEISMIC SHOCK AND VIBRATION** - Low frequency, high amplitude waves produced as a result of earth movement. CCS pressure sensors are generally unaffected by seismic shock and vibration.

**SINGLE POLE DOUBLE THROW (SPDT) SWITCHING ELEMENT** - A SPDT switching element has one normally open, one normally closed and one common terminal. Three terminals mean that the switch can be wired with the circuit either normally open (N/O) or normally closed (N/C).

**WETTED PARTS** - Materials in a sensor that are directly exposed to the media.

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 #	99420	
				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	60 mm	48 mm	48 mm					
O	9	FLANGE RATING OR SCREWED	300#	600#	900#					
N	10	TYPE OF FACING	RF	RF	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									
F	28	FLUID	NATURAL GAS	NATURAL GAS	NATURAL GAS					
L	29	REQUIRED CAPACITY	11.80 MMSCFD $\Delta$	11.80 MMSCFD $\Delta$	11.80 MMSCFD $\Delta$					
U	30	MOL. WEIGHT	17.958 $\Delta$	17.958 $\Delta$	17.958 $\Delta$					
I	31	OPER. PRESS.	2683 $\Delta$ kPa(g)	4857 $\Delta$ kPa(g)	8356 $\Delta$ kPa(g)					
D	32	OPER. TEMP.	107 $\Delta$ °C	100 $\Delta$ °C	96 $\Delta$ °C					
A	33	BACK PRESS.: CONSTANT								
T	34	VARIABLE								
A	35	TOTAL								
	36	% ALLOWABLE OVERPRESSURE	10	10	10					
	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>					
	46	SELECTED AREA	506.45 mm <sup>2</sup>	198.064 mm <sup>2</sup>	198.064 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								

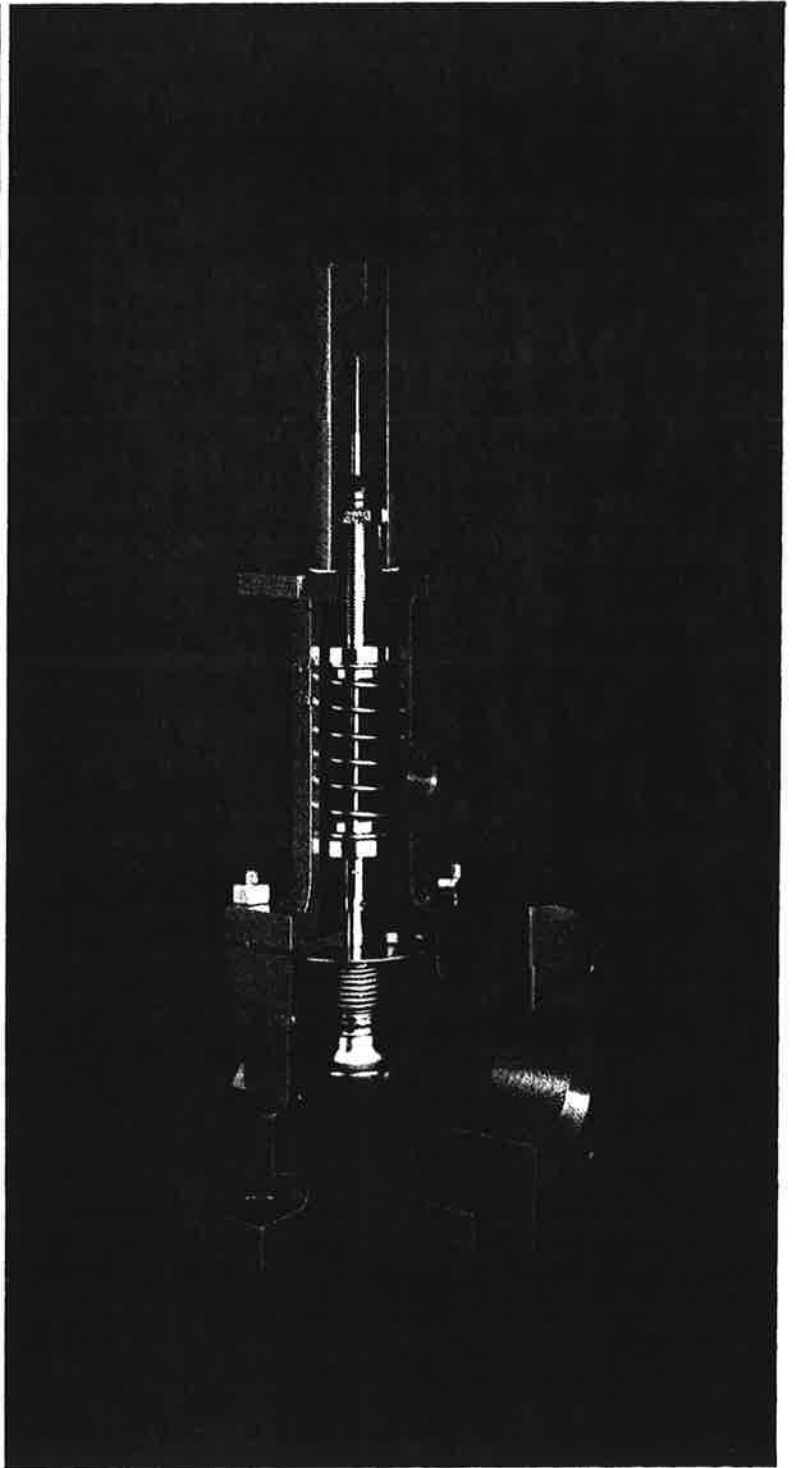
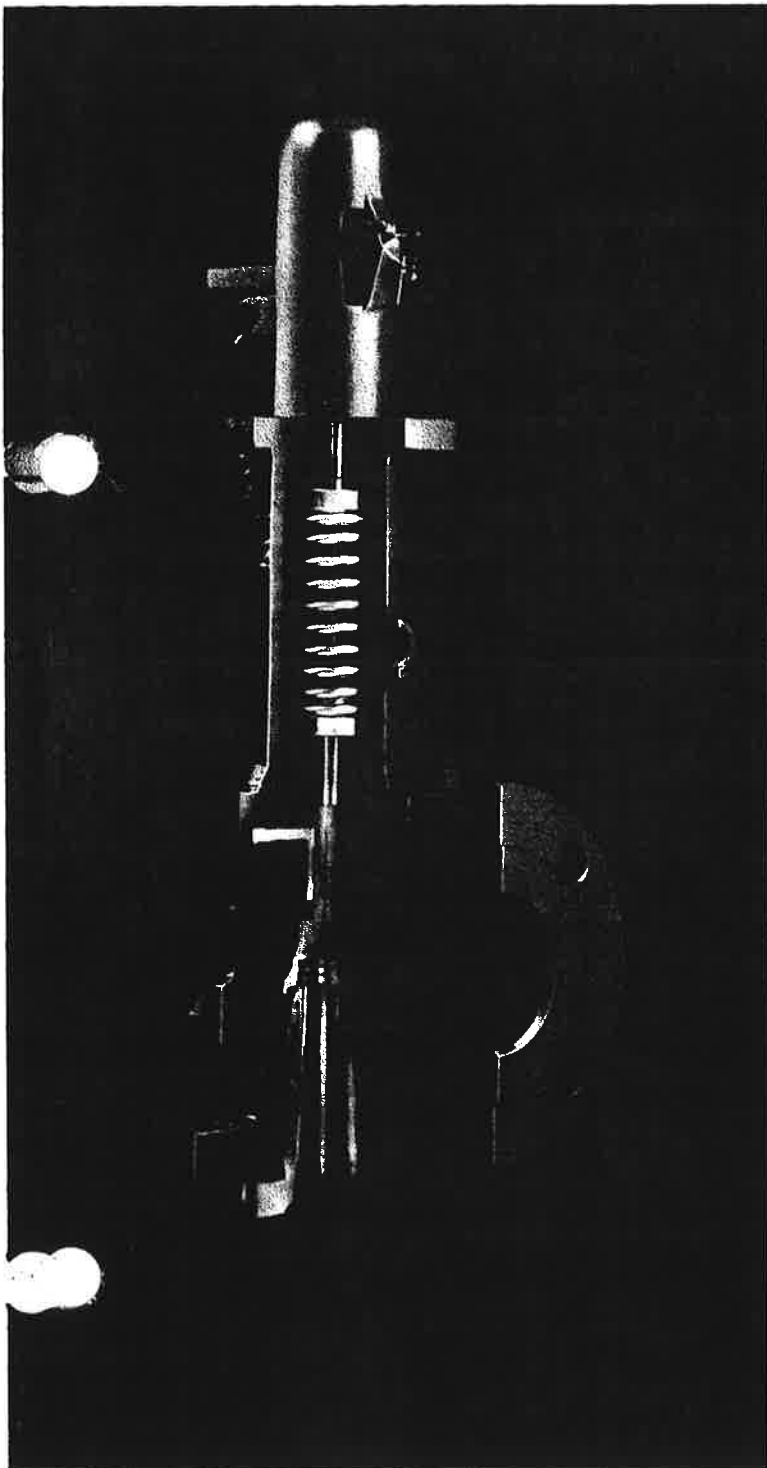
NOTES:  
1. NACE MR-1075 LEVEL 1 MATERIAL REQUIRED.

AREA UNIT # :  
ISA FORM SM20.53

## 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.

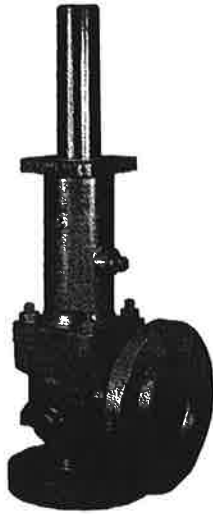
\*\*Hastelloy is a registered trademark of Haynes International, Inc.

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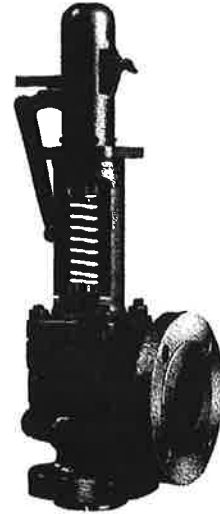
Features and Benefits	Page	2	Equivalents and Conversion Factors	Page	51
Introduction/Description	Pages	3-5	Capacity Tables (Metric)	Pages	52-57
Style Variations Descriptions	Pages	6-7	Crosby Critical Application Valves	Page	58
Style Designation Chart	Page	8	JBS-BP/JLT-JBS-BP Balancing Piston	Page	59
O-Ring Soft Seats	Page	9	Flange Information	Page	59
Valve Materials of Construction	Pages	10-11	NACE MR0175 Sour Gas Service	Pages	60-61
Caps and Lifting Levers	Pages	12-13	Seat Tightness Standard	Page	62
Specifications	Pages	14-43	Ordering Information/Warranty	Page	63
Capacity Tables (U.S.C.S.)	Pages	44-50	Crosby Products, Services and Worldwide Network	Back Cover	



**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 CI 150, 300, 600, 900, 1500 and 2500. Standard outlet flanges are ANSI CI 150 or CI 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**

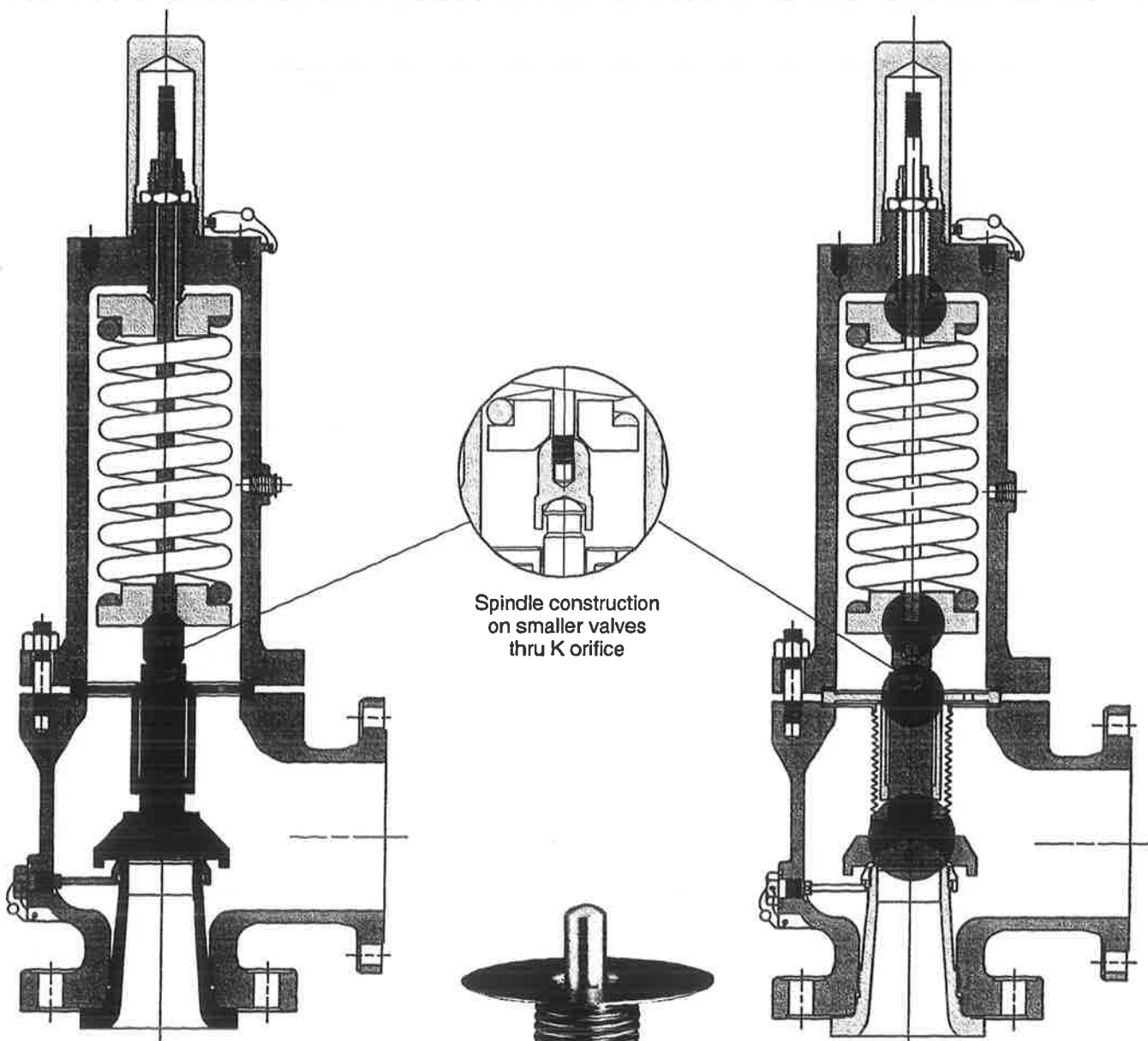
For applications where the valve must remain hot to prevent service fluid from solidifying, optional steam jackets are available. Contact the factory.

<b>Sizes:</b>	<b>1" D 2" to 8" T2 10"*</b>
<b>Orifices:</b>	<b>D (0.110 sq.in.) to T2 (27.872 sq.in.)* D (71 sq.mm) to T2 (17981 sq.mm)*</b>
<b>Inlet Ratings:</b>	<b>ANSI CI 150, 300, 600, 900, 1500 and 2500</b>
<b>Temperature Range:</b>	<b>-450F to +1000F (-268C to +538C)</b>
<b>Pressure Range:</b>	<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)**</b>

\*Larger sizes are available on application. \*\* Consult Factory for lower set pressures.

See Catalog No. 307 for details.

**Crosby® Styles JOS, JBS, and JLT Pressure Relief Valves**  
 handle process fluids in hostile environments;  
 provide seat tightness and reliable performance you need

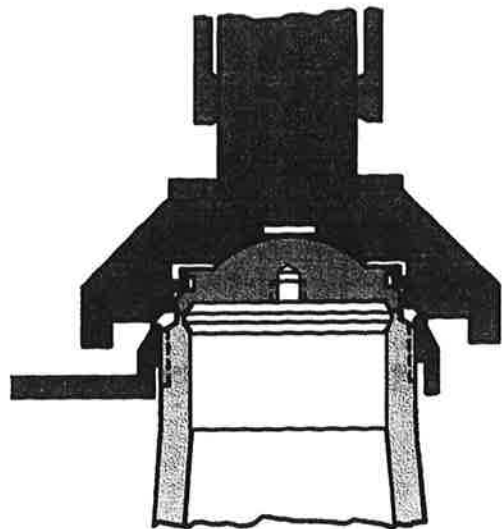


Spindle construction  
 on smaller valves  
 thru K orifice

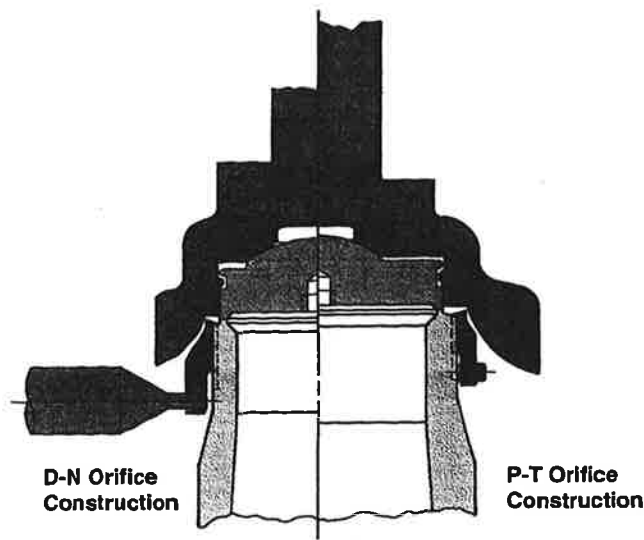
All internal parts shown in color are stainless steel as standard.

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.

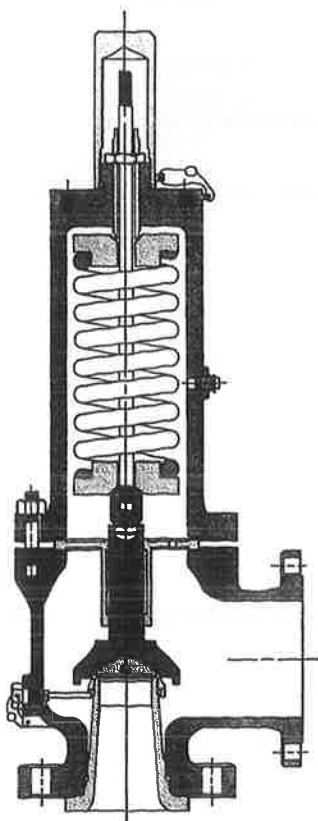
### Exceptional soft seat tightness

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, EPR, 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

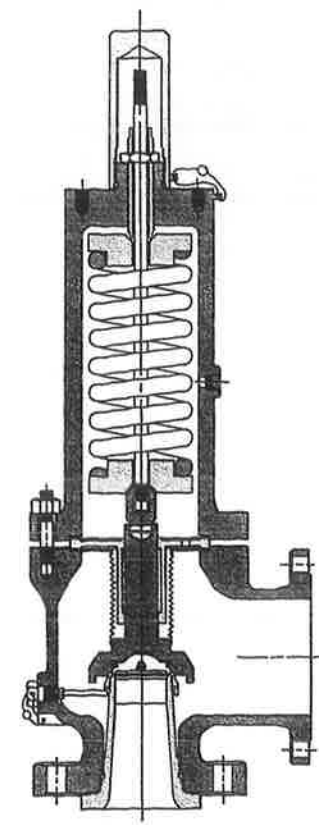


**Style JOS**

## 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**

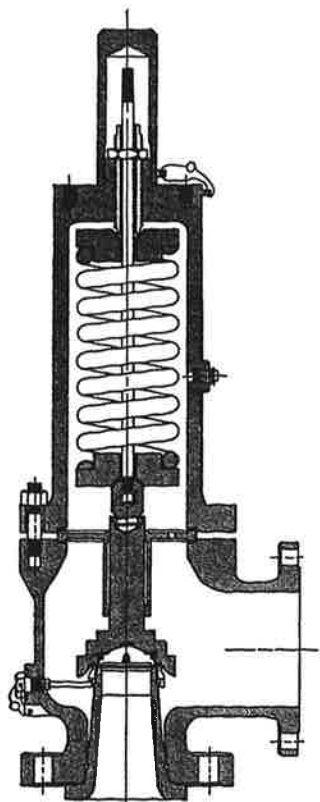
## Crosby Balanced Bellows Style JBS

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.

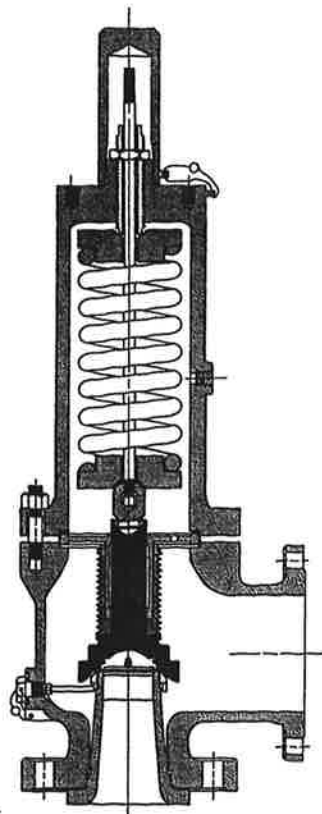
Balanced pressure relief valves must be installed when the built up back pressure in the exhaust system is allowed to exceed 10% of the valve set pressure. Style JBS valves must also be installed when the back pressure is superimposed and variable. A more detailed explanation on back pressure is available 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**

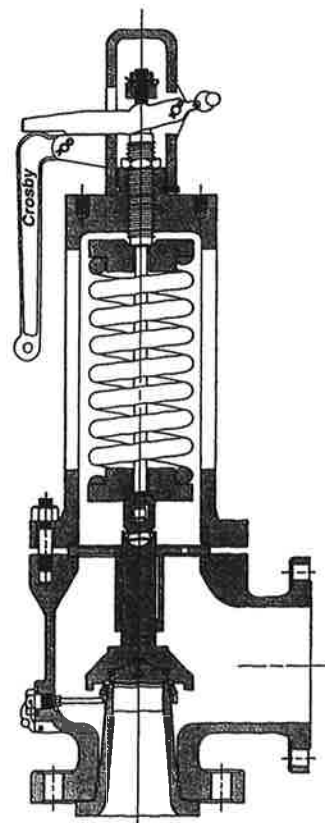
## Crosby Liquid Service Valves Styles JLT-JOS and JLT-JBS

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

## Size Inlet x Orifice x Outlet

## Style

## Pressure/Temperature Inlet Flange Range Ratings (3)

## Material Variations (4)

## Caps and Lifting Levers (Type)

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)

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.

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  
Flange facings such as ring type joint  
Sour gas service materials and certifications  
Special CI 300 outlets (where not standard)  
Special Teflon (FEP) bellows coating  
Special spring coatings or plating  
Block bodies  
Bonnet and cap inside painting  
or plastic coating  
Bug screens  
Special materials not cataloged

Flanges to international standards  
Special flanges  
Stellited nozzle and disc insert  
Special casting or machined  
surface tests  
Special cleaning  
Special painting or coatings  
Special Testing  
Steam jacketed bodies  
Supplementary loading

**CAUTION!**  
Refer to pages 14 through 43 to verify that the  
JOS/JBS/JLT model number specified is avail-  
able 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**

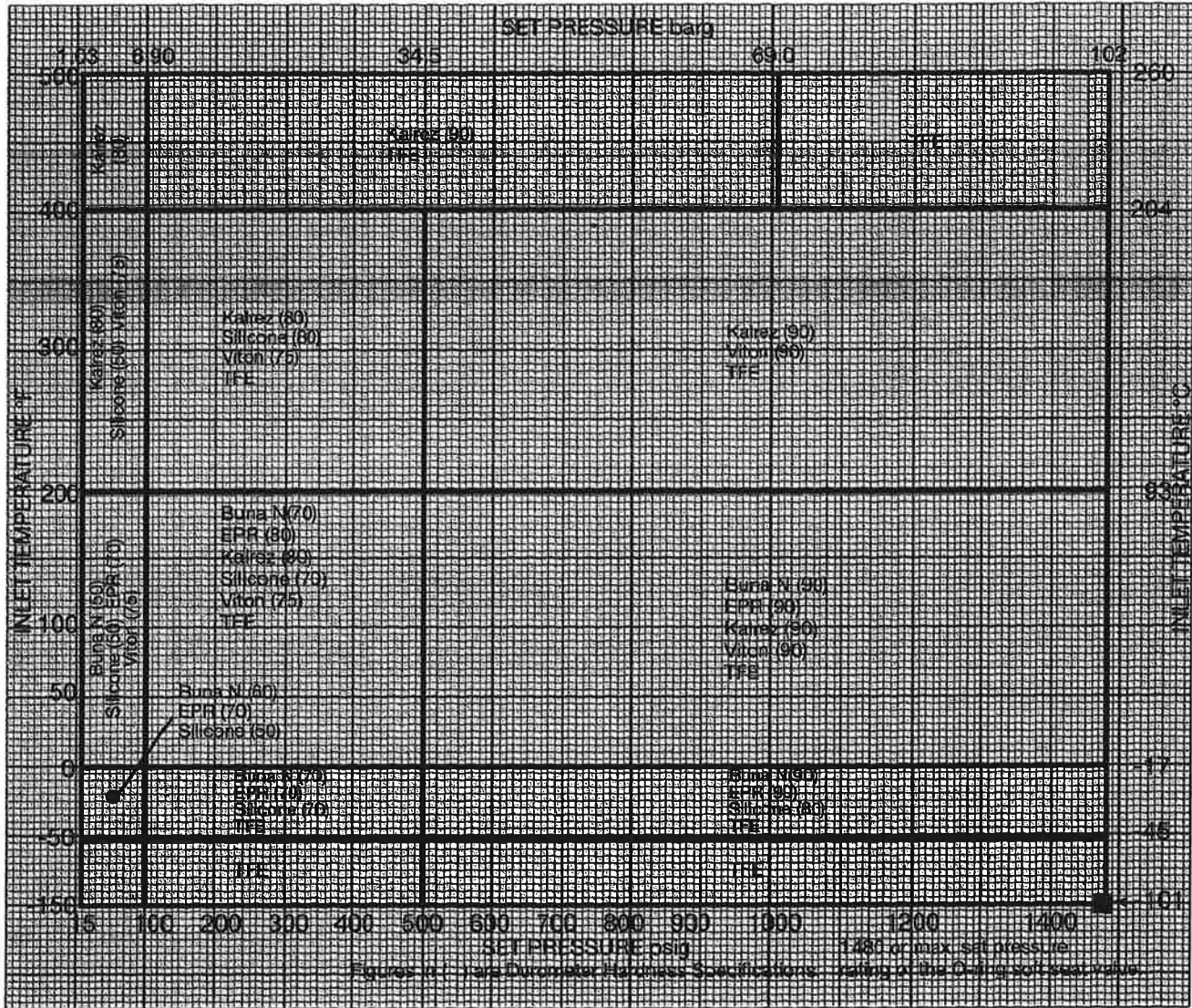
(3) To specify a K orifice (1.838 sq.in.)(1186 sq.mm) Style JOS conventional valve with open bonnet and standard materials for ASME Code Section VIII steam service at 600 psig (41.3 barg) and +600F (+316C) with a regular lifting lever, the following designation applies:

**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

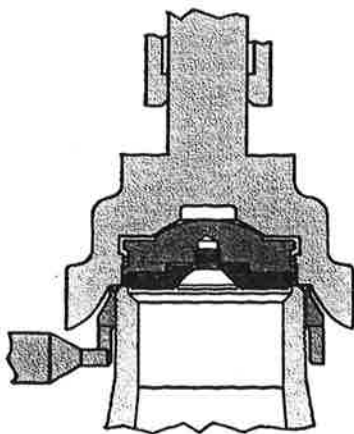


EPR = Ethylene Propylene Rubber

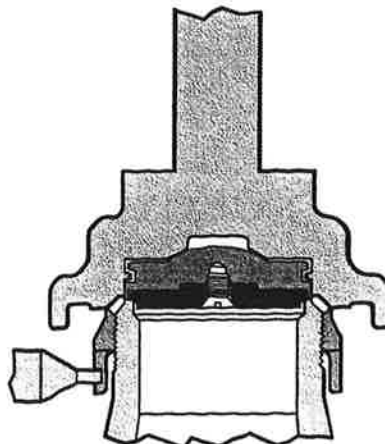
Note: Other soft seat materials are available on request.

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**



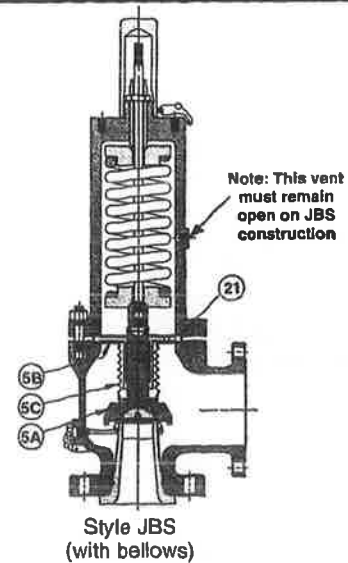
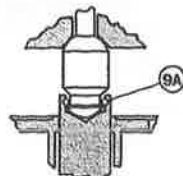
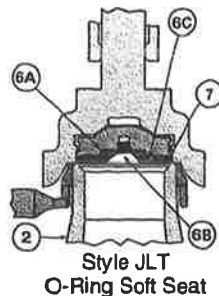
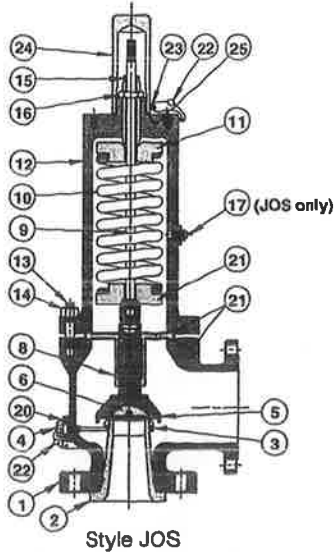
**JOS/JBS O-Ring Soft Seat**

ORIFICE	MAXIMUM SET PRESSURE LIMITS	
	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 (-288C to -80C)
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. <sup>(6)</sup>	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>(9)</sup>	Alloy St. <sup>(3)(8)</sup>	Alloy St. <sup>(3)(8)</sup>	Carbon St. <sup>(9)</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.

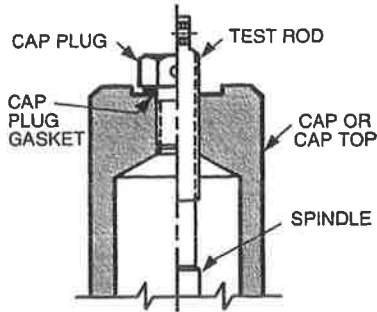
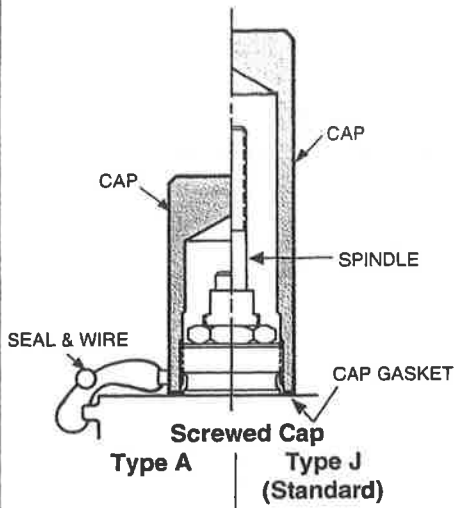
(10) Temperature limit for 316 stainless steel spring is +450F (+232C).

(11) Permitted by ASME Code Case 1750-10

(12) Top flange on D and E orifice bellows is 316 stainless steel.

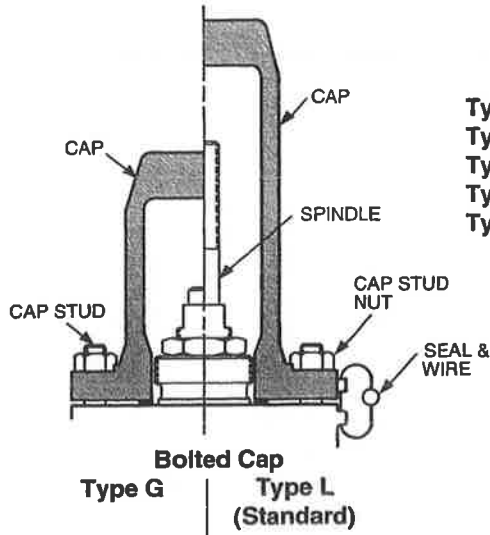
**Note:** Cotter pins used to lock spindle into disc holder are in L orifice and above only.

# Caps and Lifting Levers

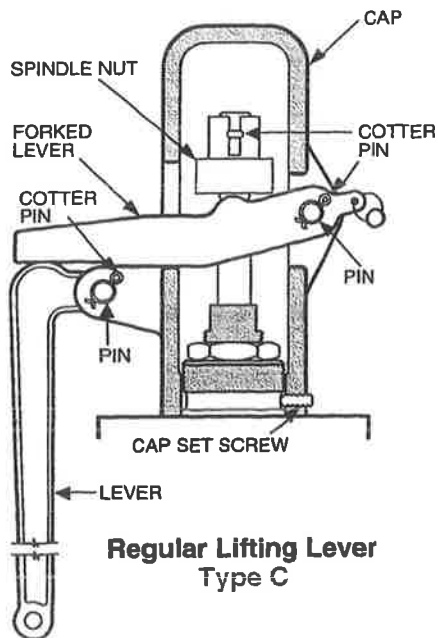


**Cap and Test Rod**

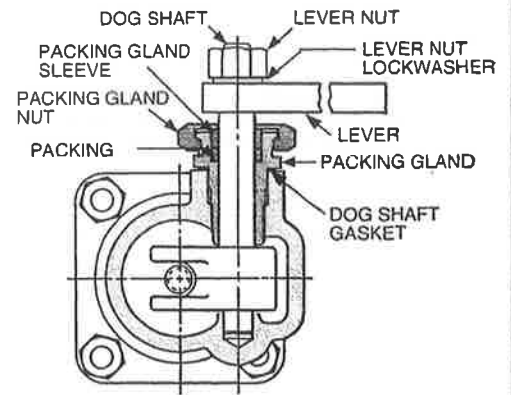
- Type B - Screwed Cap
- Type E - Packed Lifting Lever
- Type H - Bolted Cap
- Type K - Screwed Cap (Standard)
- Type M - Bolted Cap (Standard)



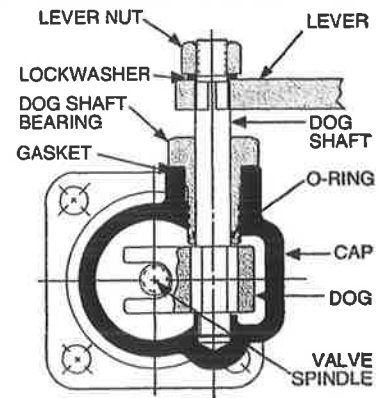
**Bolted Cap**  
Type G | Type L (Standard)



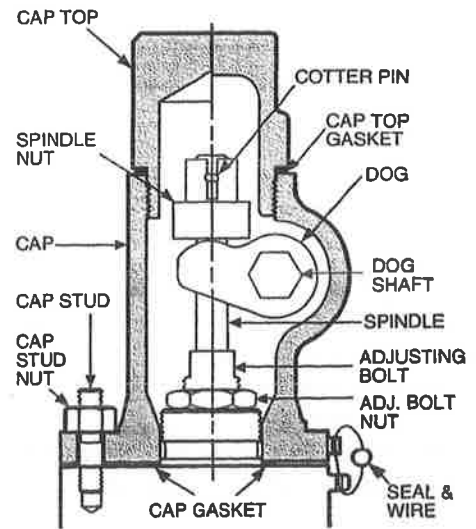
**Regular Lifting Lever**  
Type C



**Packed Lifting Lever**  
Type D  
(Top View of Packing Gland construction used for special materials)



**Packed Lifting Lever**  
Type D  
Top View



**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 (-23C to +538C)	JOS/JBS-( )4 -75F to -21F (-59C to -30C)	JOS/JBS-( )2 -450F to -78F (-268C to -60C)	( )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		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- JBS- JLT- *JOS-H-	15 25 35 45	1D2	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 75	1½D2 1½D2 1½D2½	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- JBS- JLT- JOS-H-	16 26 36 46	1D2	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 76	1½D2 1½D2 1½D2½	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- JBS- JLT- JOS-H-	37 47	1D2	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- JBS- JLT-	57 67 77	1½D2 1½D2 1½D2½	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- JBS- JLT-	14 24 34 44	1D2	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	1D2	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).

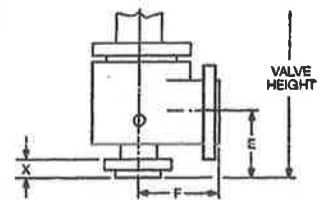
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

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

### D Orifice

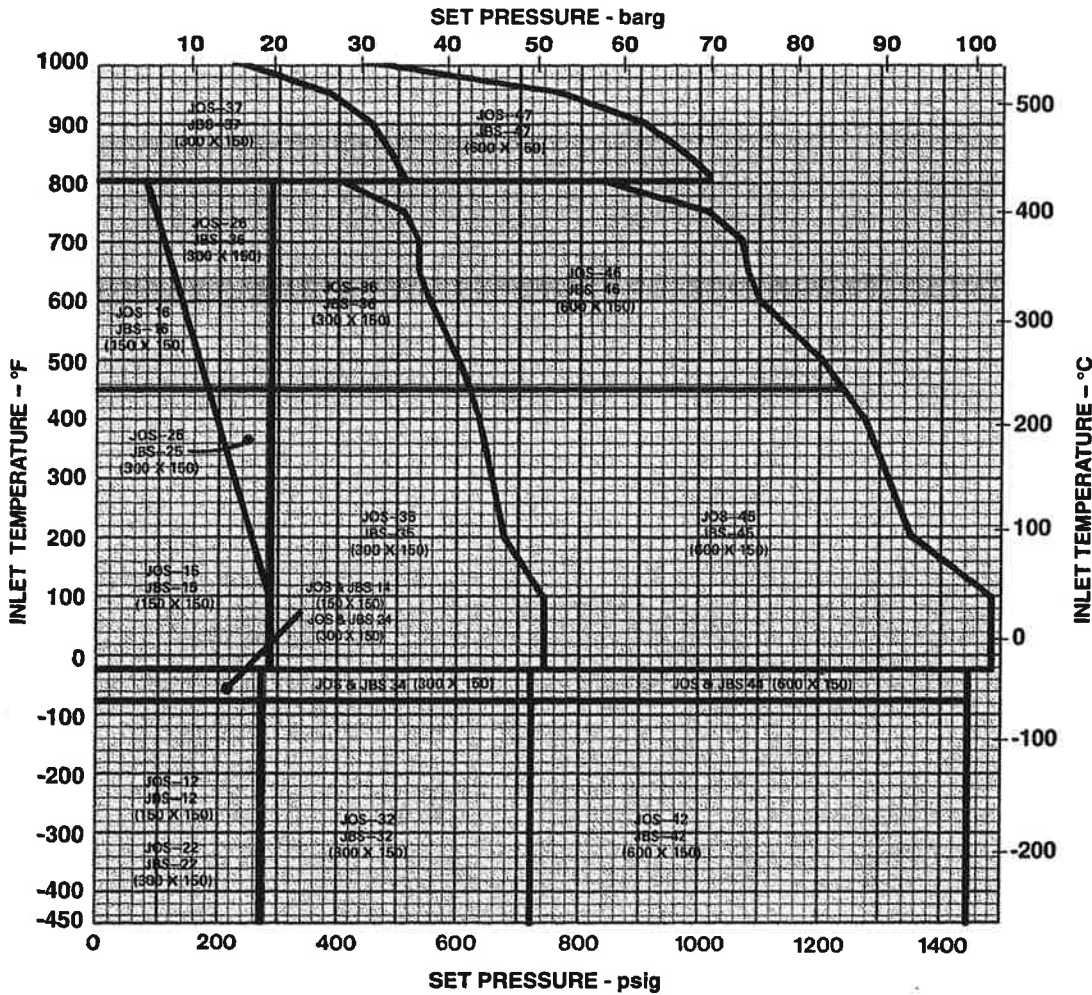
Valve Style	Valve Dimensions - in. (mm)							Approx. Weight lbs(kg)
	Center to Face		Use To Find Bolt Length	Approximate Height				
	Inlet	Outlet		Valve (Cap) Type				
	E	F	X	J & L	C	D	J	
JOS- JBS- JLT- JOS-H-	12,14,15,16, 22,24,25,26	4-1/8 (105)	4-1/2 (114)	1-9/16 (40)	19-3/4 (502)	19 (483)	19-1/2 (495)	36 (16)
JOS- JBS- JLT- JOS-H-	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)
JOS- JBS- JLT- JOS-H-	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- JBS- JLT-	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)
JOS- JBS- JLT-	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)



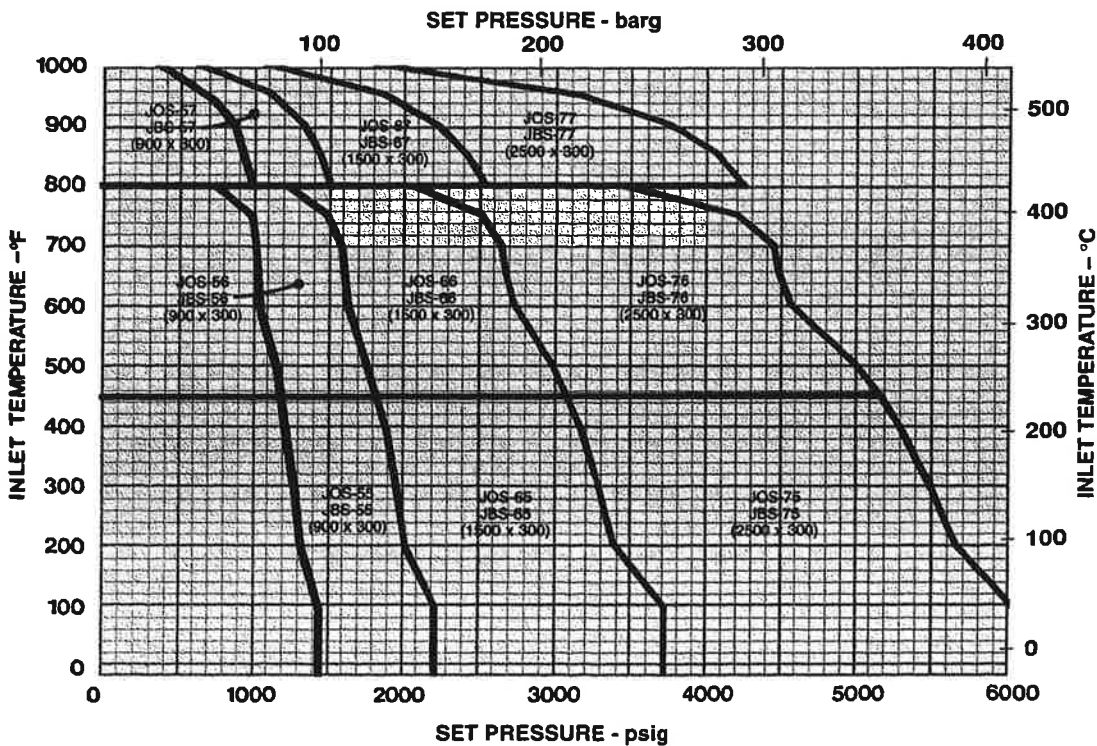
TYPE J (SCREWED CAP)  
 TYPE C (REGULAR LIFTING LEVER)  
 (also JOS-H)  
 TYPE D (PACKED LIFTING LEVER)  
 TYPE L (BOLTED CAP)

# Pressure-Temperature Limit Chart - To ANSI CI 600

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)**

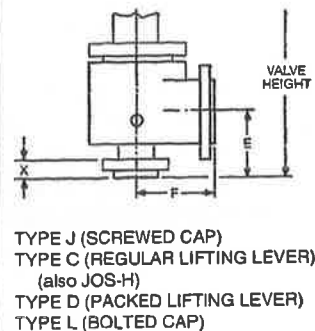
Valve Style	Valve Size		Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig						Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg		
	Inlet x Orifice x Outlet	Inlet	Outlet	Inlet						JOS †	JBS †	Inlet						JOS †	JBS †		
				-450F to -76F	-75F to -21F	-20F to +100F	* +450F	+800F	+1000F			-268C to -60C	-59C to -30C	-29C to +38C	* +232C	+427C	+638C				
JOS- JBS- JLT- *JOS-H-	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- JBS- JLT-	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- JBS- JLT- JOS-H-	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- JBS- JLT-	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- JBS- JLT- JOS-H-	37 47	1E2 1E2	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- JBS- JLT-	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- JBS- JLT-	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- JBS- JLT-	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- JBS- JLT- JOS-H-	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- JBS- JLT-	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)





# 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 -76F	-75F to -21F	-20F to +100F	+450F	+800F	+1000F	-268C to -60C	-50C to -30C	29C to +38C			+232C	+427C	+538C					
JOS- JBS- JLT- *JOS-H-	15 25 35 45	1½F2 1½F2 1½F2 1½F2	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 75	1½F2½ 1½F2½ 1½F2½	900 1500 2500	300 300 300			2220 3705 5000	1845 3080 5000			740 740 740	500 500 500			153 255 344	127 212 344			51.0 51.0 51.0	34.4 34.4 34.4	
JOS- JBS- JLT- JOS-H-	16 26 36 46	1½F2 1½F2 1½F2 1½F2	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	5.5 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 76	1½F2½ 1½F2½ 1½F2½	900 1500 2500	300 300 300				1845 3080 5000	1235 2060 3430		740 740 740	500 500 500				127 212 344	85.1 142 236			51.0 51.0 51.0	34.4 34.4 34.4
JOS- JBS- JLT- JOS-H-	37 47	1½F2 1½F2	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- JBS- JLT-	57 67 77	1½F2½ 1½F2½ 1½F2½	900 1500 2500	300 300 300					1525 2540 4230	670 1115 1860	740 740 740	500 500 500					105 175 291	46.1 76.8 128	51.0 51.0 51.0	34.4 34.4 34.4	
JOS- JBS- JLT-	14 24 34 44	1½F2 1½F2 1½F2 1½F2	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	1½F2 1½F2 1½F2 1½F2	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).

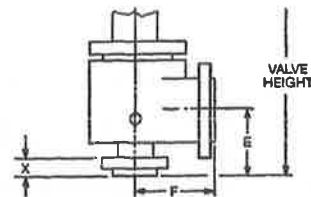
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

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

## F Orifice

Valve Style	Valve Dimensions - in. (mm)	Valve Dimensions - in. (mm)						Approx. Weight lbs(kg) Type
		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	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)
	32,34,35,36,37	4-7/8 (124)	6 (152)	1-3/4 (44)	23-1/4 (591)	22-1/2 (572)	23-1/4 (591)	50 (23)
	42,44,45,46,47	4-7/8 (124)	6 (152)	1-3/4 (44)	23-1/4 (591)	22-1/2 (572)	23-1/4 (591)	50 (23)
	55,56,57,65,66,67	4-7/8 (124)	6 (152)	2 (51)	23 (584)	21-1/4 (540)	21-3/4 (552)	65 (29)
	75,76,77	5-1/2 (140)	6-1/2 (165)	2-1/2 (64)	26-3/4 (679)	26 (660)	26-3/4 (679)	85 (39)

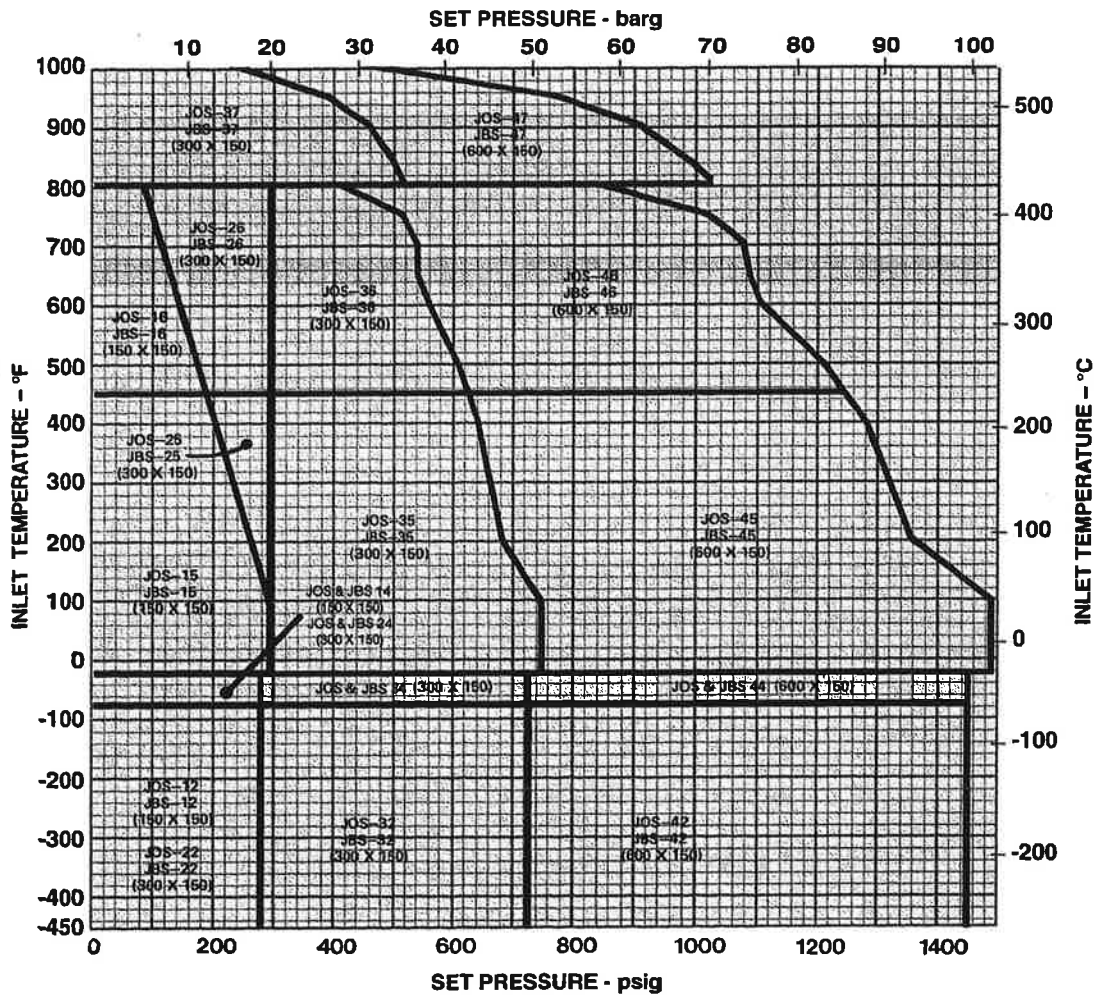


TYPE J (SCREWED CAP)  
 TYPE C (REGULAR LIFTING LEVER)  
 (also JOS-H)  
 TYPE D (PACKED LIFTING LEVER)  
 TYPE L (BOLTED CAP)

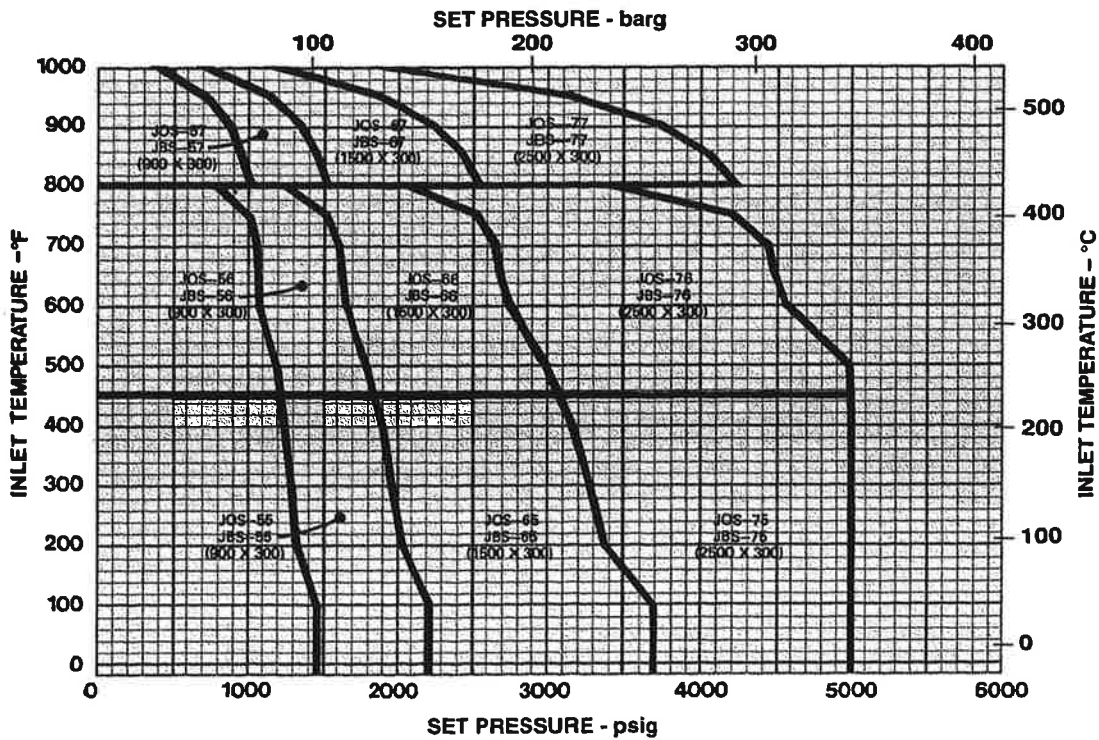


### Pressure-Temperature Limit Chart - To ANSI CI 600

F Orifice  
 0.307 sq. in.  
 (198 sq. mm)  
 Effective Area



### 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								Inlet								
				Inlet	Outlet	-450F to -76F	-76F 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 G2 1/2	150	150			285	185			285	230			19.6	12.7			19.6	15.8	
JBS-25	1 1/2 G2 1/2	300	150			285	285			285	230			19.6	19.6			19.6	15.8	
JLT-35	1 1/2 G2 1/2	300	150			740	615			285	230			51.0	42.4			19.6	15.8	
*JOS-H-45	1 1/2 G2 1/2	600	150			1480	1235			285	230			102	85.1			19.6	15.8	
JOS-55	1 1/2 G2 1/2	900	300			2220	1845			740	470			153	127			51.0	32.4	
JBS-65	2 G3	1500	300			3705	3080			740	470			255	212			51.0	32.4	
JLT-75	2 G3	2500	300			3705	3705			740	470			255	255			51.0	32.4	
JOS-16	1 1/2 G2 1/2	150	150				185	80		285	230			12.7	5.51			19.6	15.8	
JBS-26	1 1/2 G2 1/2	300	150				285	285		285	230			19.6	19.6			19.6	15.8	
JLT-36	1 1/2 G2 1/2	300	150				615	410		285	230			42.4	28.2			19.6	15.8	
JOS-H-46	1 1/2 G2 1/2	600	150				1235	825		285	230			85.1	56.8			19.6	15.8	
JOS-56	1 1/2 G2 1/2	900	300				1845	1235		740	470			127	85.1			51.0	32.4	
JBS-66	2 G3	1500	300				3080	2060		740	470			212	142			51.0	32.4	
JLT-76	2 G3	2500	300				3705	3430		740	470			255	236			51.0	32.4	
JOS-37	1 1/2 G2 1/2	300	150					510	225	285	230						35.1	15.5	19.6	15.8
JBS-47	1 1/2 G2 1/2	600	150					1015	445	285	230						69.9	30.6	19.6	15.8
JOS-57	1 1/2 G2 1/2	900	300					1525	670	740	470						105	46.1	51.0	32.4
JBS-67	2 G3	1500	300					2540	1115	740	470						175	76.8	51.0	32.4
JLT-77	2 G3	2500	300					3705	1860	740	470						255	128	51.0	32.4
JOS-14	1 1/2 G2 1/2	150	150		275					275	230		18.9					18.9	15.8	
JBS-24	1 1/2 G2 1/2	300	150		275					275	230		18.9					18.9	15.8	
JBS-34	1 1/2 G2 1/2	300	150		720					275	230		49.6					18.9	15.8	
JLT-44	1 1/2 G2 1/2	600	150		1440					275	230		99.2					18.9	15.8	
JOS-12	1 1/2 G2 1/2	150	150	275						275	230	18.9						18.9	15.8	
JBS-22	1 1/2 G2 1/2	300	150	275						275	230	18.9						18.9	15.8	
JBS-32	1 1/2 G2 1/2	300	150	720						275	230	49.6						18.9	15.8	
JLT-42	1 1/2 G2 1/2	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).

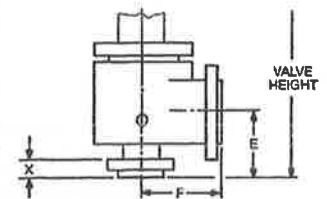
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

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

## G Orifice

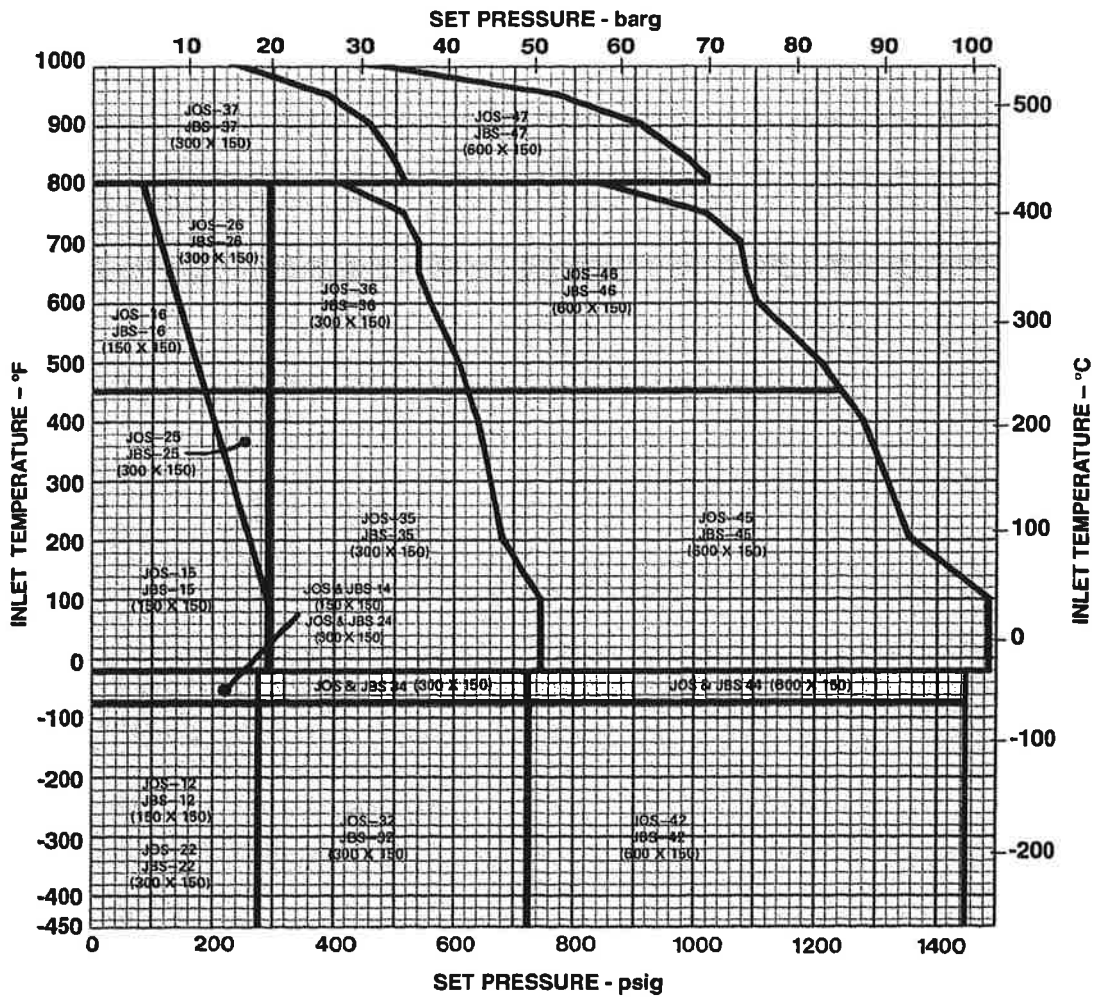
Valve Style	Valve Style	Valve Dimensions - in. (mm)						Approx. Weight lbs(kg) Type J
		Center to Face		Use To Find Bolt Length	Approximate Height			
		Inlet	Outlet		Valve (Cap) Type			
		E	F	X	J & L	C	D	
JOS-12,14,15,16	22,24,25,26	4-7/8 (124)	4-3/4 (121)	1-3/4 (44)	23-1/4 (591)	22-1/2 (572)	23-1/4 (591)	50 (23)
	32,34,35,36	4-7/8 (124)	6 (152)	1-3/4 (44)	23-1/4 (591)	22-1/2 (572)	23-1/4 (591)	50 (23)
JOS-37,47	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)
JOS-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)



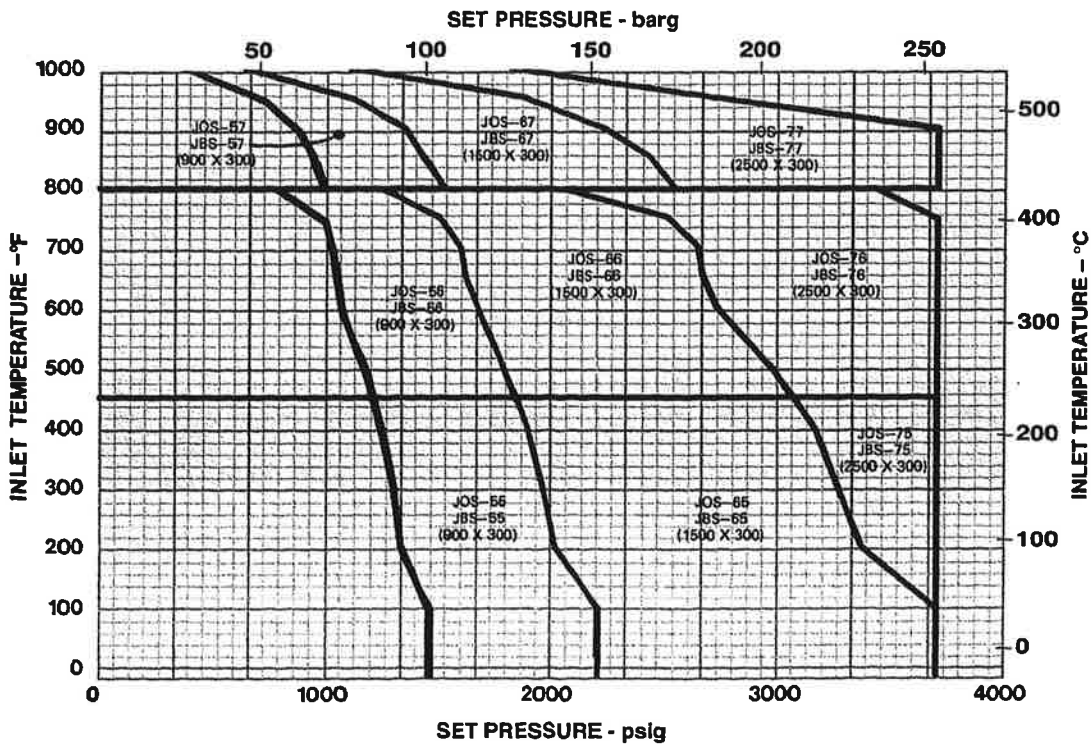
TYPE J (SCREWED CAP)  
 TYPE C (REGULAR LIFTING LEVER)  
 (also JOS-H)  
 TYPE D (PACKED LIFTING LEVER)  
 TYPE L (BOLTED CAP)

# 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)

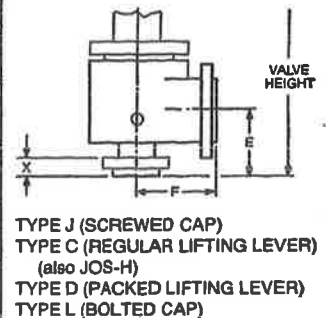
Valve Style	Valve Size		Standard Connections ANSI Flanges Raised Face		Maximum Set Pressure - psig						Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg		
	Inlet x Orifice x Outlet	Inlet	Outlet	Inlet						JOS †	JBS †	Inlet						JOS †	JBS †		
				-450F to -76F	-75F to -21F	-20F to +100F	+450F	+800F	+1000F			-268C to -60C	-59C to -30C	29C to +38C	+232C	+427C	+538C				
JOS- JBS- JLT- *JOS-H-	15 25 35 45	1 1/2H3 1 1/2H3 2H3 2H3	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	2H3 2H3	900 1500	150 300			2220 2750	1845 2750			285 740	230 415			153 189	127 189			19.6 51.0	15.8 28.6	
JOS- JBS- JLT- JOS-H-	16 26 36 46	1 1/2H3 1 1/2H3 2H3 2H3	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	2H3 2H3	900 1500	150 300				1845 2750	1235 2060		285 740	230 415			127 189	85.1 142			19.6 51.0	15.8 28.6	
JOS- JBS- JLT- JOS-H-	37 47	2H3 2H3	300 600	150 150					510 815	225 445	285 285	230 230					35.1 56.2	15.5 30.6	19.6 19.6	15.8 15.8	
JOS- JBS- JLT-	57 67	2H3 2H3	900 1500	150 300						1225 2040	670 1115	285 415	230 415					84.4 140	46.1 76.8	19.6 51.0	15.8 28.6
JOS- JBS- JLT-	14 24 34 44	1 1/2H3 1 1/2H3 2H3 2H3	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	1 1/2H3 1 1/2H3 2H3 2H3	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

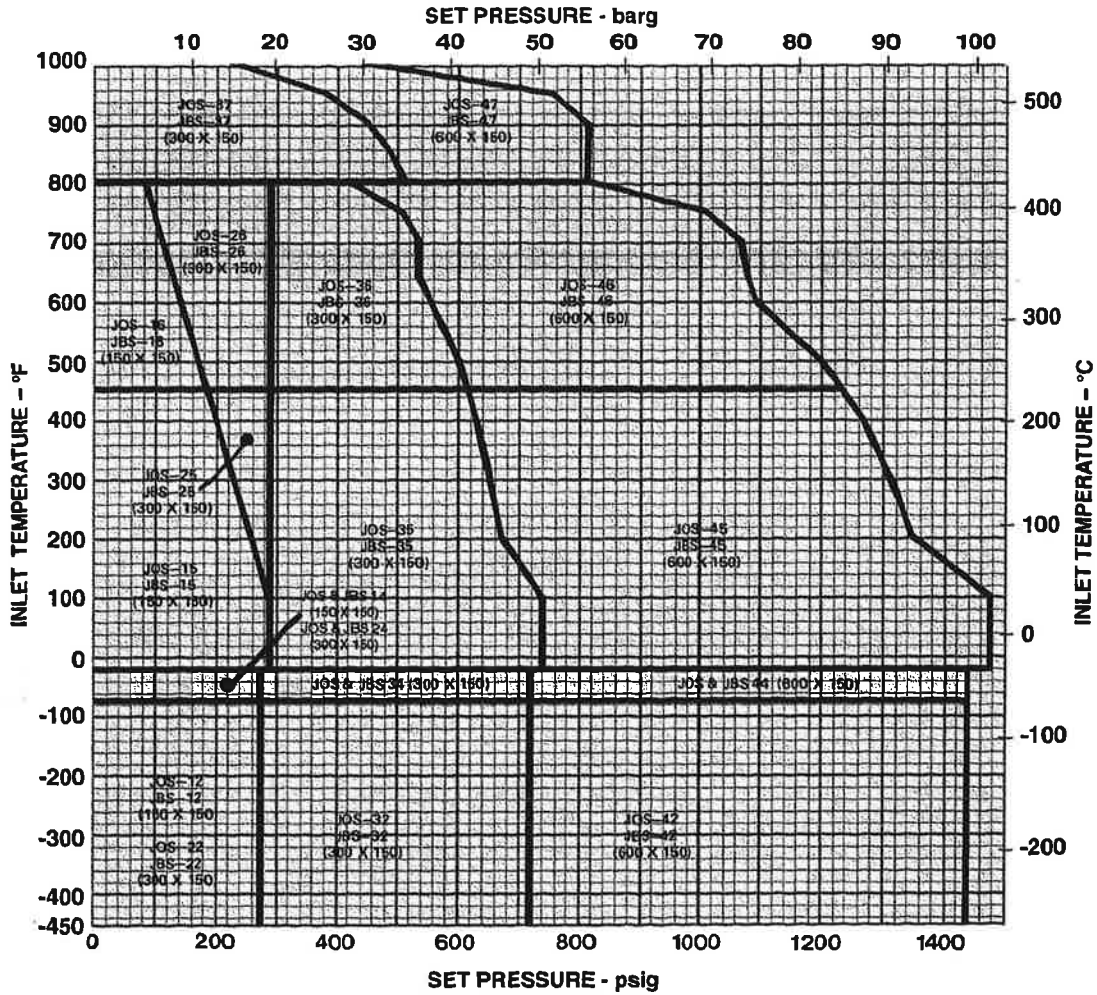
## H Orifice

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- JLT- JOS-H-	12,14,15,16 22,24,25,26	5-1/8 (130)	4-7/8 (124)	1-11/16 (43)	23-1/2 (597)	22-3/4 (578)	23-1/4 (591)	55 (25)
	32,34,35,36 37,47	5-1/8 (130)	4-7/8 (124)	1-13/16 (46)	23-1/2 (597)	22-3/4 (578)	23-1/4 (591)	60 (27)
JOS- JBS- JLT- JOS-H-	42,44,45,46	6-1/16 (154)	6-3/8 (162)	1-13/16 (46)	26-3/4 (679)	26 (660)	26-3/4 (679)	75 (34)
	55,56,57,65,66,67	6-1/16 (154)	6-3/8 (162)	2-5/16 (59)	28-1/4 (718)	27-1/2 (699)	28-1/4 (718)	110 (50)

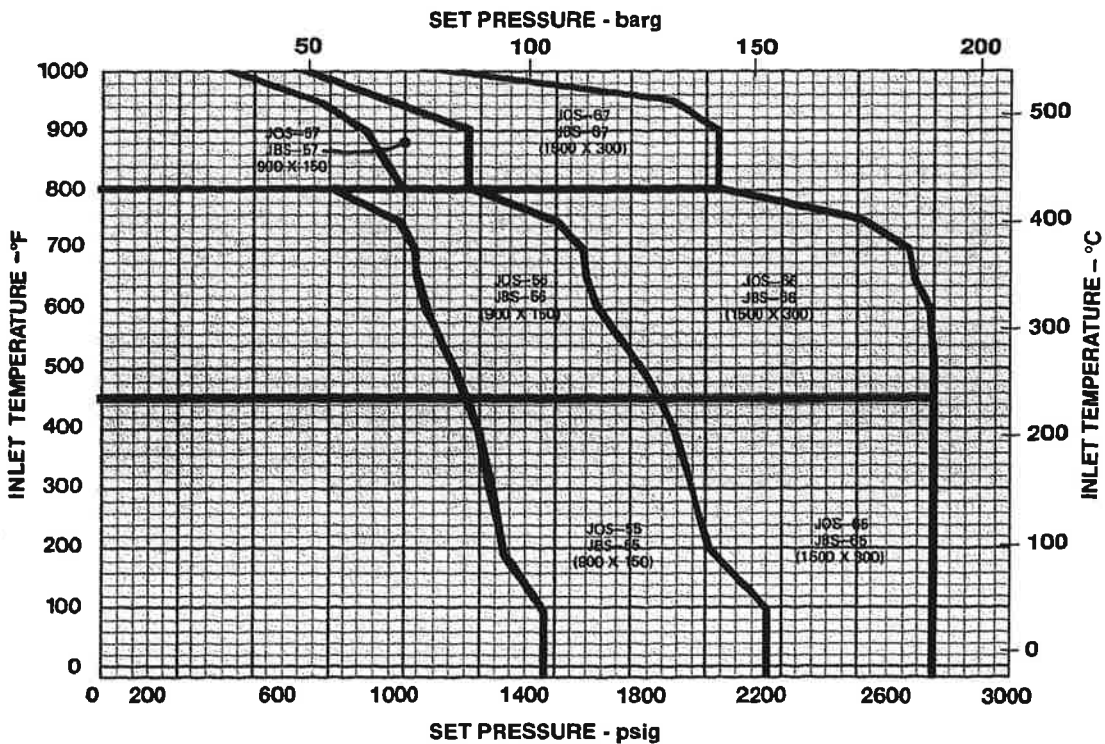


# Pressure-Temperature Limit Chart - To ANSI CI 600

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 -60C	-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).

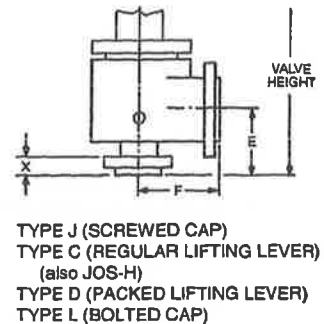
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

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

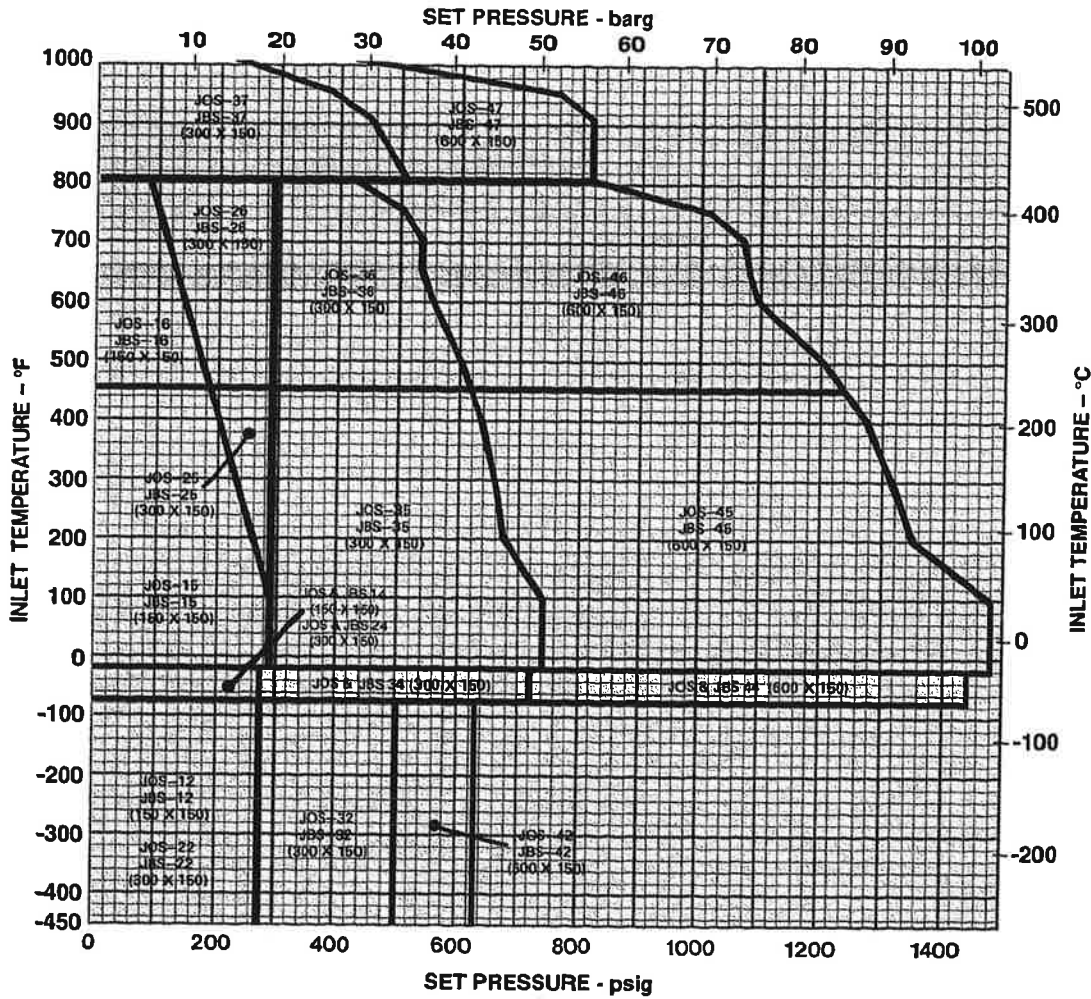
## J Orifice

Valve Style	Valve 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	
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)

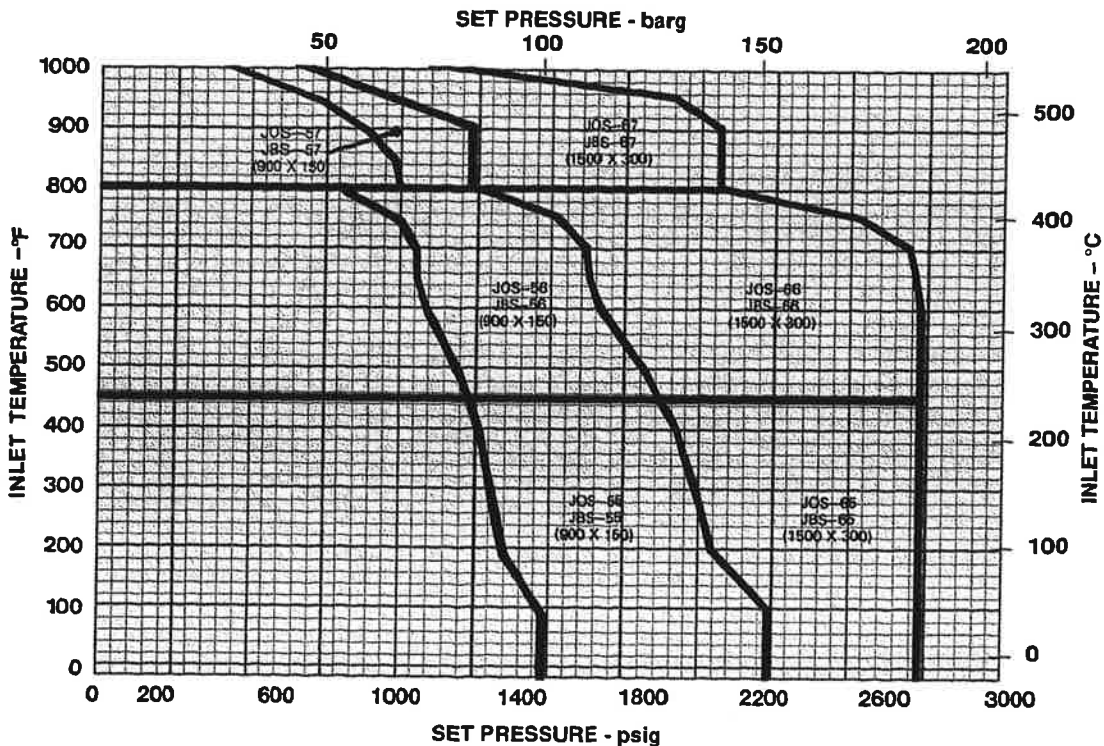


# Pressure-Temperature Limit Chart - To ANSI CI 600

**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		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			-269C to -60C	-59C to -30C	-29C to +38C	+232C	+427C	+538C			
JOS-25	15	3K4	150	150			285	185			285	150			19.6	12.7			19.6	10.3
JBS-25	25	3K4	300	150			285	285			285	150			19.6	19.6			19.6	10.3
JLT-35	35	3K4	300	150			740	615			285	150			51.0	42.4			19.6	10.3
*JOS-H-45	45	3K4	600	150			1480	1235			285	200			102	85.1			19.6	13.7
JOS-55	55	3K6	900	150			2220	1845			285	200			153	127			19.6	13.7
JBS-65	65	3K6	1500	300			2220	2220			600	200			153	153			41.3	13.7
JOS-26	16	3K4	150	150				185	80		285	150			12.7	5.51			19.6	10.3
JBS-26	26	3K4	300	150				285	285		285	150			19.6	19.6			19.6	10.3
JLT-36	36	3K4	300	150				615	410		285	150			42.4	28.2			19.6	10.3
JOS-H-46	46	3K4	600	150				1235	825		285	200			85.1	56.8			19.6	13.7
JOS-56	56	3K6	900	150				1845	1235		285	200			127	85.1			19.6	13.7
JBS-66	66	3K6	1500	300				2220	2060		600	200			153	142			41.3	13.7
JOS-37	37	3K4	300	150					510	225	285	150					35.1	15.5	19.6	10.3
JBS-47	47	3K4	600	150					815	445	285	200					56.1	30.6	19.6	13.7
JOS-H-57	57	3K4	900	150						1225	670	285	200				84.4	46.1	19.6	13.7
JBS-67	67	3K6	1500	300						2040	1115	600	200				140	76.8	41.3	13.7
JOS-14	14	3K4	150	150		275					275	150		18.9					18.9	10.3
JBS-24	24	3K4	300	150		275					275	150		18.9					18.9	10.3
JLT-34	34	3K4	300	150		720					275	150		49.6					18.9	10.3
JOS-H-44	44	3K4	600	150		1440					275	200		99.2					18.9	13.7
JOS-12	12	3K4	150	150	275						275	150	18.9						18.9	10.3
JBS-22	22	3K4	300	150	275						275	150	18.9						18.9	10.3
JLT-32	32	3K4	300	150	525						275	150	36.1						18.9	10.3
JOS-H-42	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).

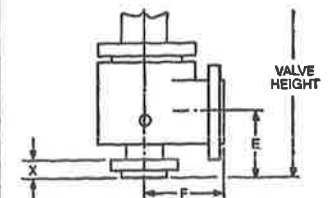
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

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- JBS- JLT- JOS-H-	12,14,15,16	6-1/8	6-3/8	2-1/8	29-3/4	29	29-3/4	116
	22,24,25,26	(156)	(162)	(54)	(756)	(737)	(756)	(52)
	32,34,35,36,37,47	6-1/8	6-3/8	2-1/8	29-3/4	29	29-3/4	117
		(156)	(162)	(54)	(756)	(737)	(756)	(53)
	42,44,45,46	7-1/4	7-1/8	2-1/8	33	32-1/2	33-1/4	160
		(184)	(181)	(54)	(838)	(826)	(845)	(73)
	57	7-1/4	7-1/8	2-5/16	33	32-1/2	33-1/4	175
		(184)	(181)	(59)	(838)	(826)	(845)	(79)
55,56	7-13/16	8-1/2	2-11/16	39	38	38-3/4	185	
	(198)	(216)	(68)	(991)	(965)	(984)	(84)	
65,66,67	7-3/4	8-1/2	2-11/16	39	38	38-3/4	195	
	(197)	(216)	(68)	(991)	(965)	(984)	(88)	

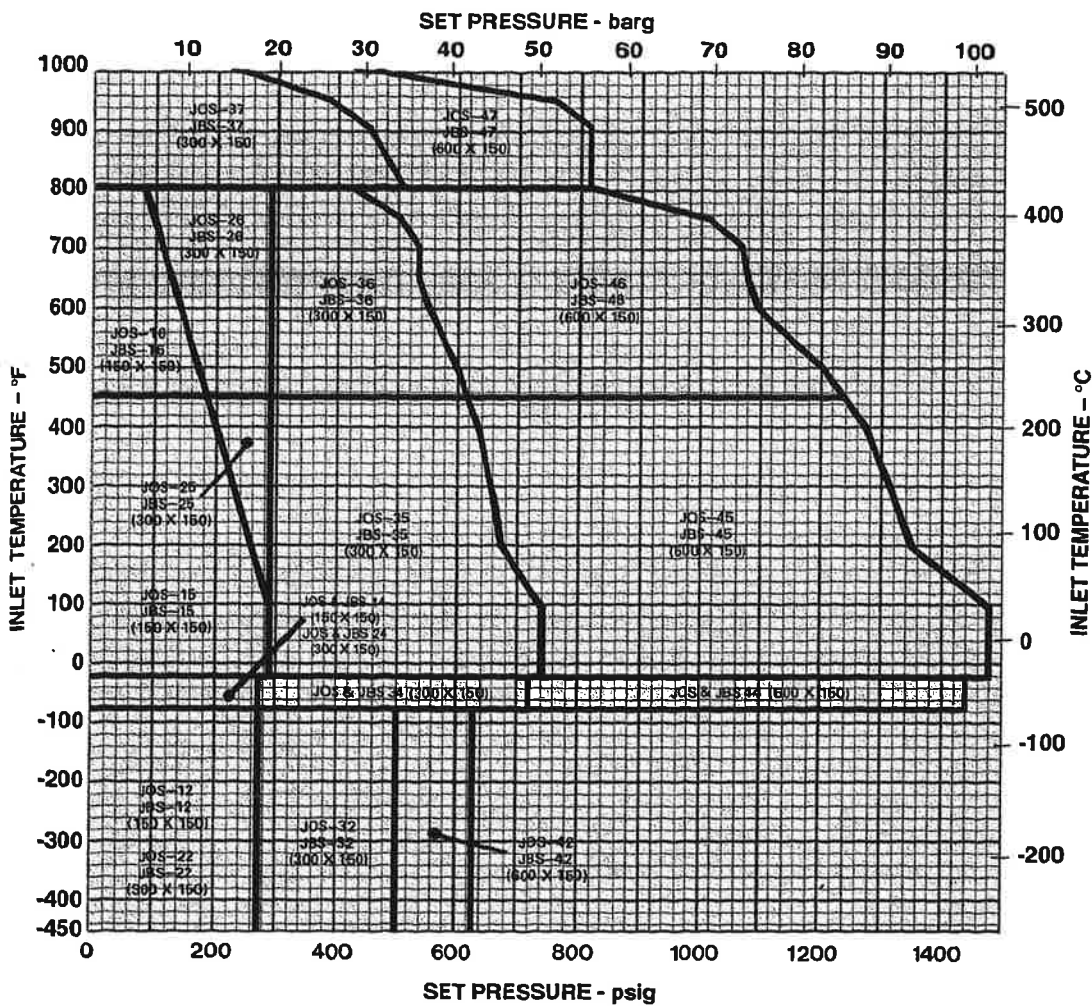


TYPE J (SCREWED CAP)  
 TYPE C (REGULAR LIFTING LEVER)  
 (also JOS-H)  
 TYPE D (PACKED LIFTING LEVER)  
 TYPE L (BOLTED CAP)

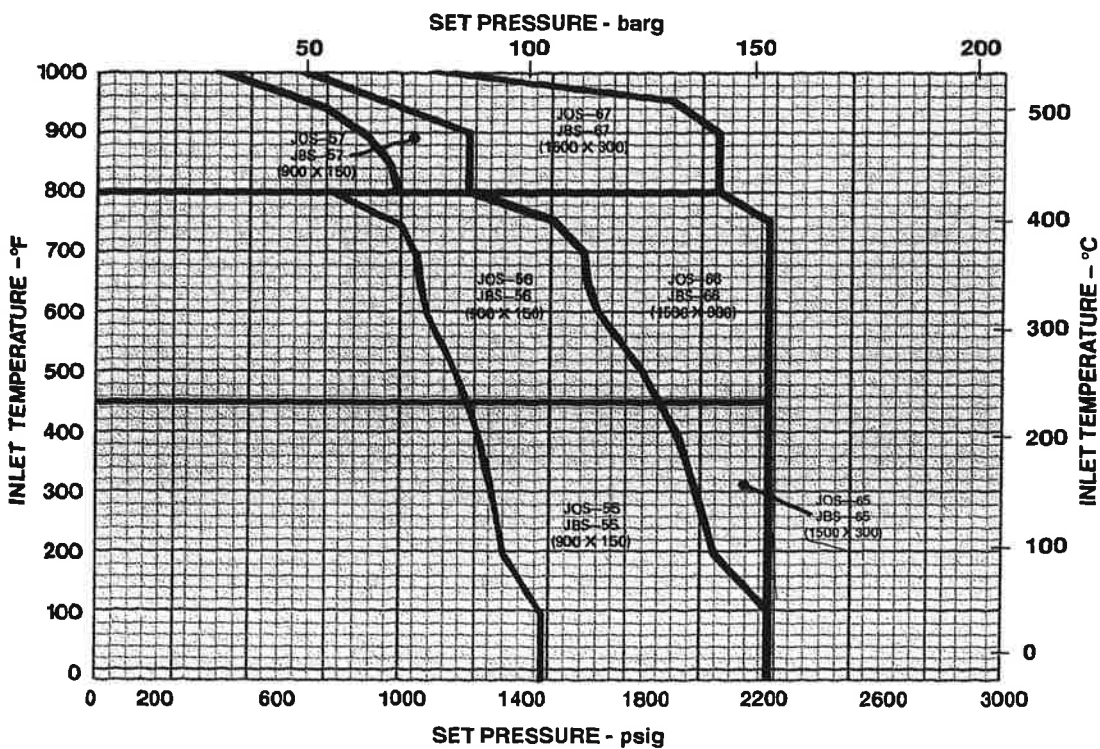


# Pressure-Temperature Limit Chart - To ANSI CI 600

**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)

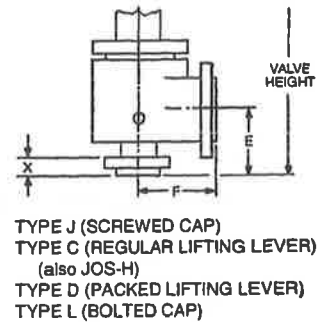
Valve Style	Valve Size		Standard Connections		Maximum Set Pressure - psig						Back Press. Limit @100F psig		Maximum Set Pressure - barg						Back Press. Limit @38C barg	
	Inlet x Orifice x Outlet	ANSI Flanges Raised Face	Inlet						JOS †	JBS †	Inlet						JOS †	JBS †		
			-450F to -76F	-75F to -21F	-20F 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	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	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

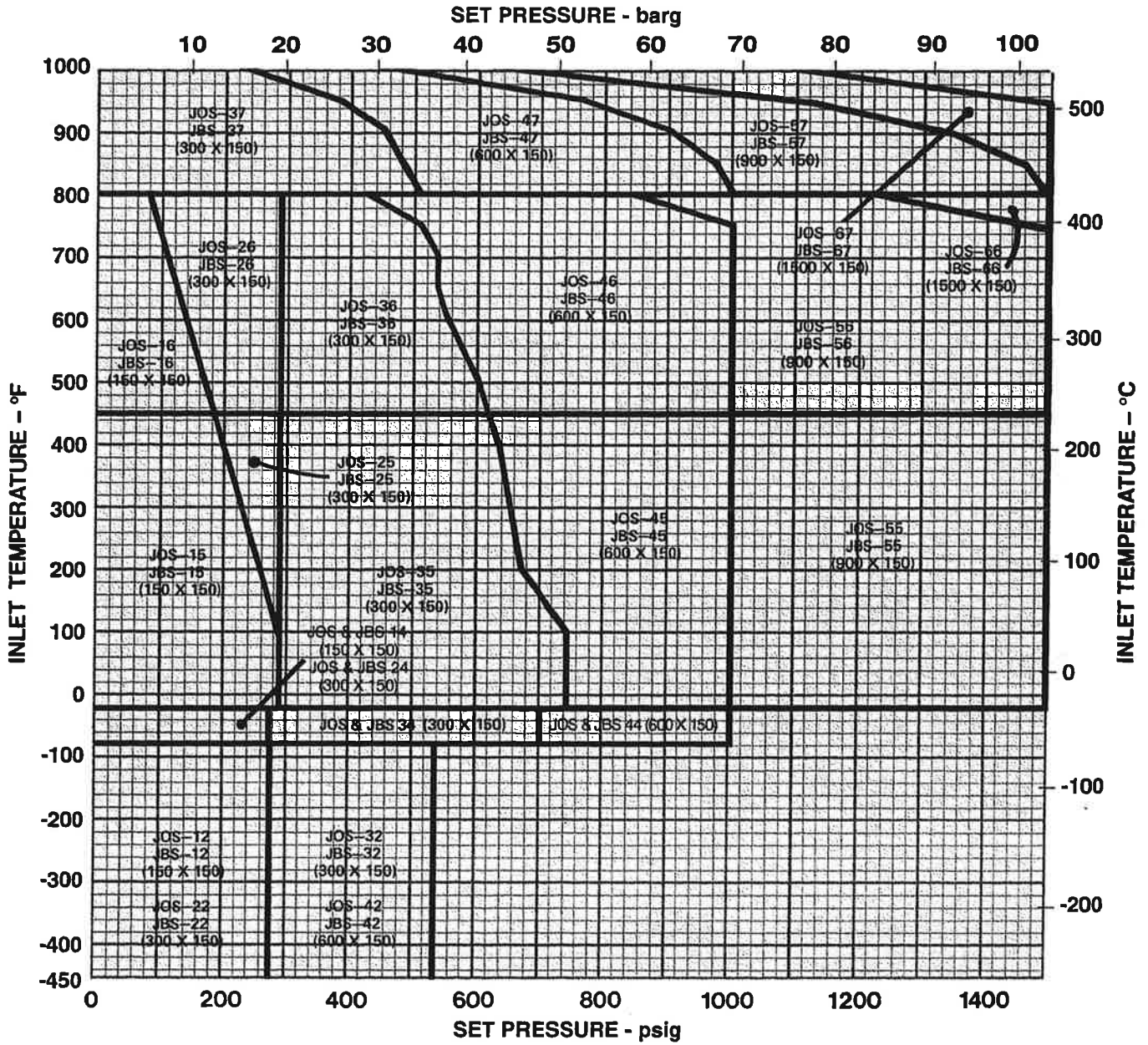
## L Orifice

Valve Style	Valve Dimensions - in. (mm)							Approx. Weight lbs(kg) Type J
	Center to Face		Use To Find Bolt Length	Approximate Height			Valve (Cap) Type	
	Inlet	Outlet		J & L	C	D		
	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	-268C 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).

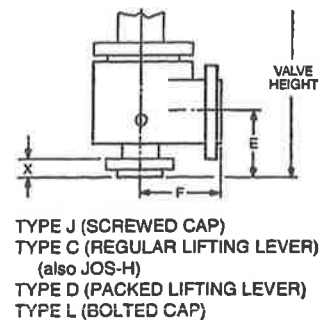
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

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

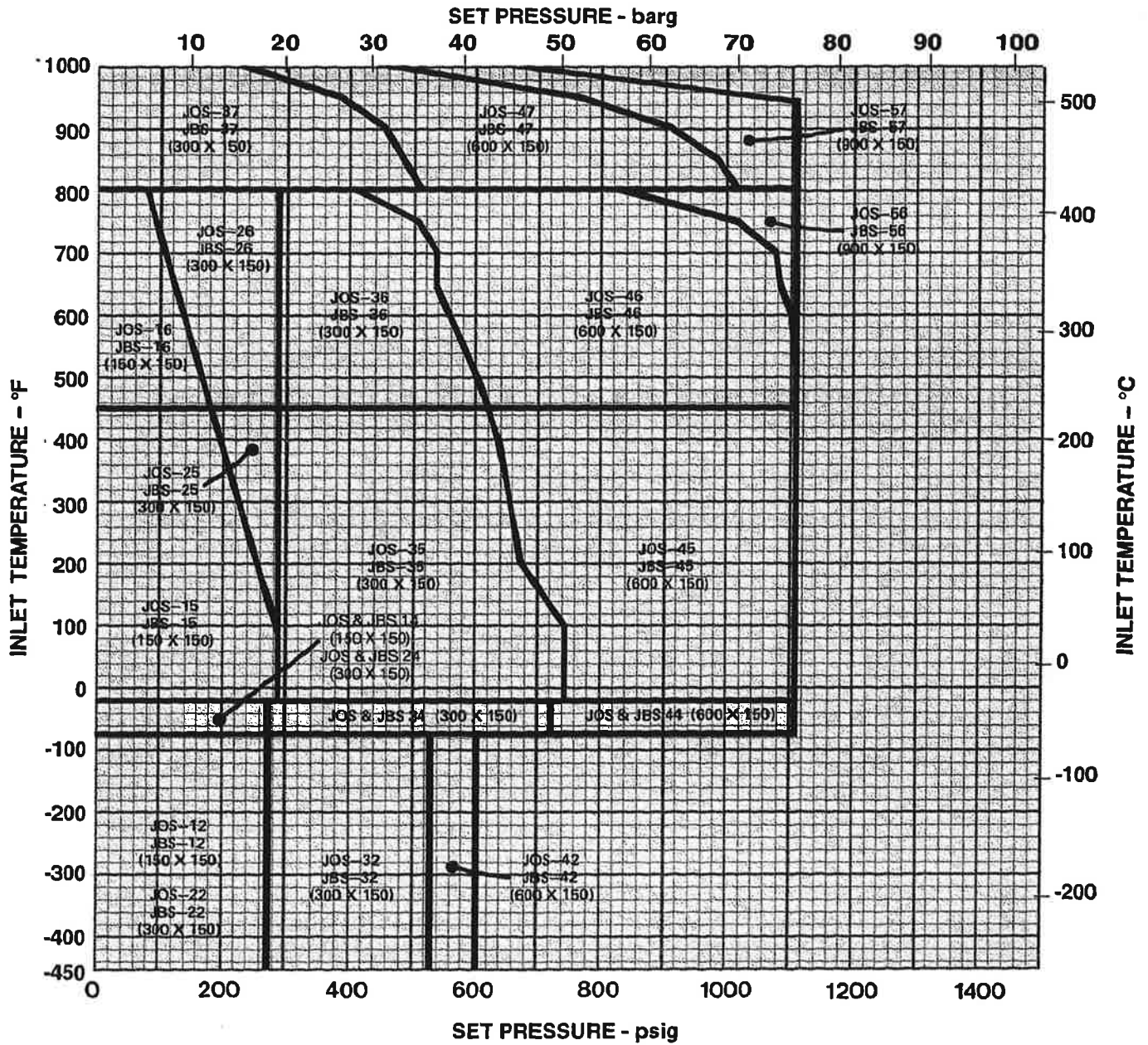
M Orifice

Valve Style	Valve Dimensions - in. (mm)							Approx. Weight lbs(kg)
	Center to Face		Use To Find Bolt Length	Approximate Height			Type	
	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 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 †
JOS-15 JBS-25 JLT-35 *JOS-H-45	4N6	150	150			285	185			285	80			19.6	12.7			19.6	5.51	
JOS-16 JBS-26 JLT-36 JOS-H-46	4N6	150	150			285	185	80		285	80			19.6	19.6			19.6	5.51	
JOS-37 JBS-47	4N6	300	150					510	225	285	160						35.1	15.5	19.6	11.0
JOS-14 JBS-34 JLT-44	4N6	150	150		275					275	80		18.9					18.9	5.51	
JOS-12 JBS-32 JLT-42	4N6	150	150	275						275	80	18.9						18.9	5.51	

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).

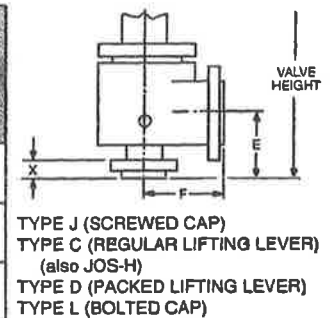
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

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

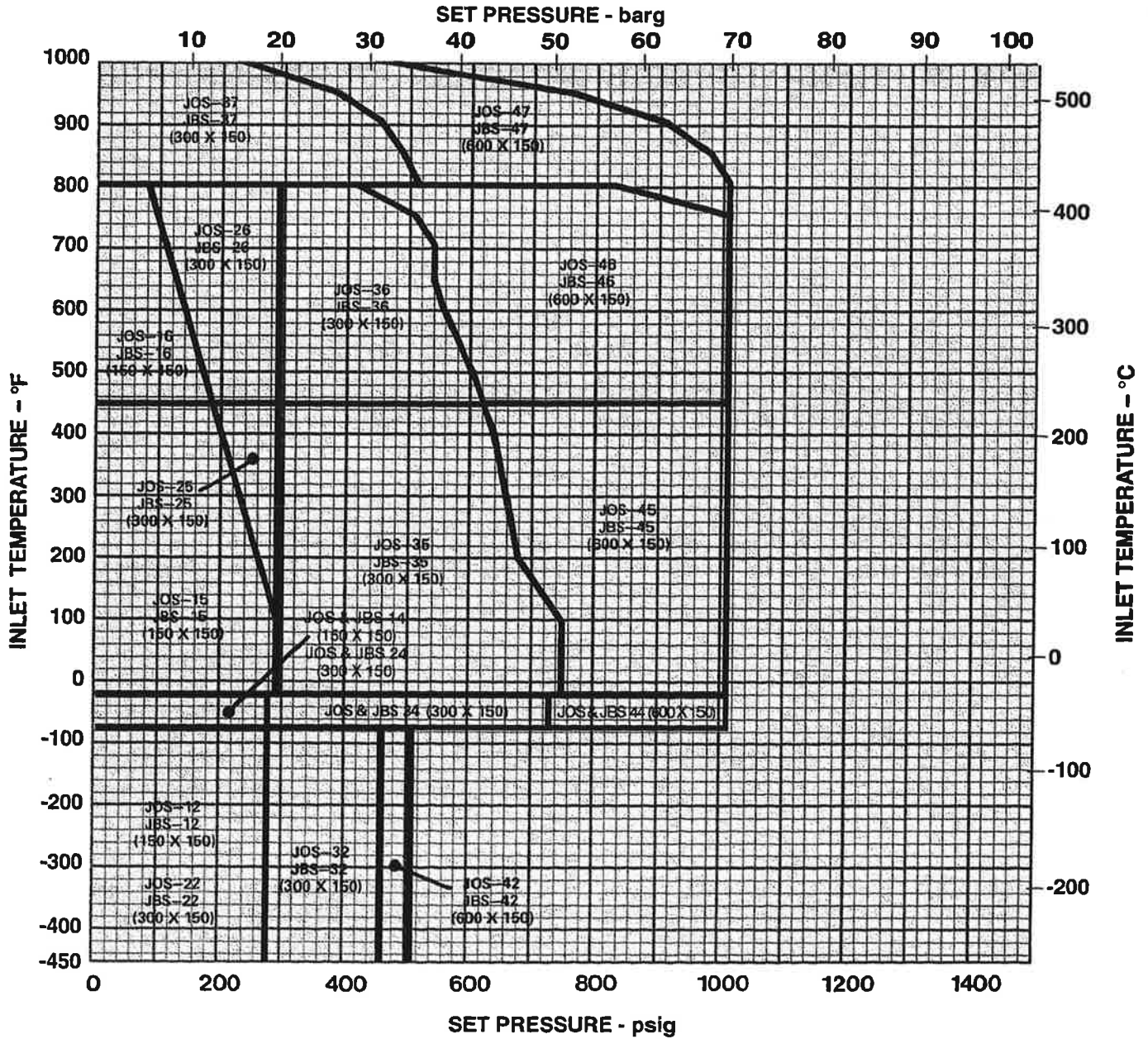
## N Orifice

Valve Style	Valve Dimensions - in. (mm)							Approx. Weight lbs(kg)
	Center to Face		Use To Find Bolt Length	Approximate Height			Type J	
	Inlet	Outlet		J & L	C	D		
	E	F	X					
JOS-12,14,15,16 JBS-22,24,25,26	7-3/4 (197)	8-1/4 (210)	2-1/8 (54)	43-1/4 (1099)	42-1/4 (1073)	43 (1092)	260 (118)	
JLT-32,34,35,36,37 JOS-H-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)	280 (127)	
	7-3/4 (197)	8-3/4 (222)	2-3/8 (60)	43-1/4 (1099)	42-1/4 (1073)	43 (1092)	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 & Orifice & 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						JOS †	JBS †	Inlet						JOS †	JBS †	
			Inlet	Outlet	-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-15	15	4P6	150	150			285	185			285	80			19.6	12.7			19.6	5.51	
JBS-25	25	4P6	300	150			285	285			285	80			19.6	19.6			19.6	5.51	
JLT-35	35	4P6	300	150			525	525			285	150			36.1	36.1			19.6	10.3	
*JOS-H-45	45	4P6	600	150			1000	1000			285	150			68.9	68.9			19.6	10.3	
JOS-16	16	4P6	150	150				185	80		285	80				12.7	5.51		19.6	5.51	
JBS-26	26	4P6	300	150				285	285		285	80				19.6	19.6		19.6	5.51	
JLT-36	36	4P6	300	150				525	410		285	150				36.1	28.1		19.6	10.3	
JOS-H-46	46	4P6	600	150				1000	825		285	150				68.9	56.8		19.6	10.3	
JOS-37	37	4P6	300	150						510	225	285	150					35.1	15.5	19.6	10.3
JBS-47	47	4P6	600	150						1000	445	285	150					68.9	30.6	19.6	10.3
JOS-14	14	4P6	150	150		275					275	80			18.9				18.9	5.51	
JBS-24	24	4P6	300	150		275					275	80			18.9				18.9	5.51	
JBS-34	34	4P6	300	150		525					275	150			36.1				18.9	10.3	
JLT-44	44	4P6	600	150		1000					275	150			68.9				18.9	10.3	
JOS-12	12	4P6	150	150	175						275	80	12.0						18.9	5.51	
JBS-22	22	4P6	300	150	175						275	80	12.0						18.9	5.51	
JBS-32	32	4P6	300	150	300						275	150	20.6						18.9	10.3	
JLT-42	42	4P6	600	150	480						275	150	33.0						18.9	10.3	

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).

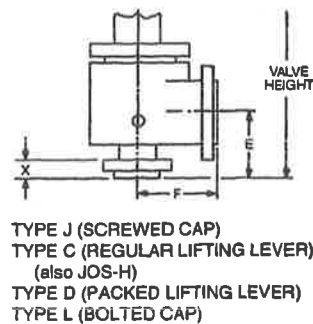
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

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

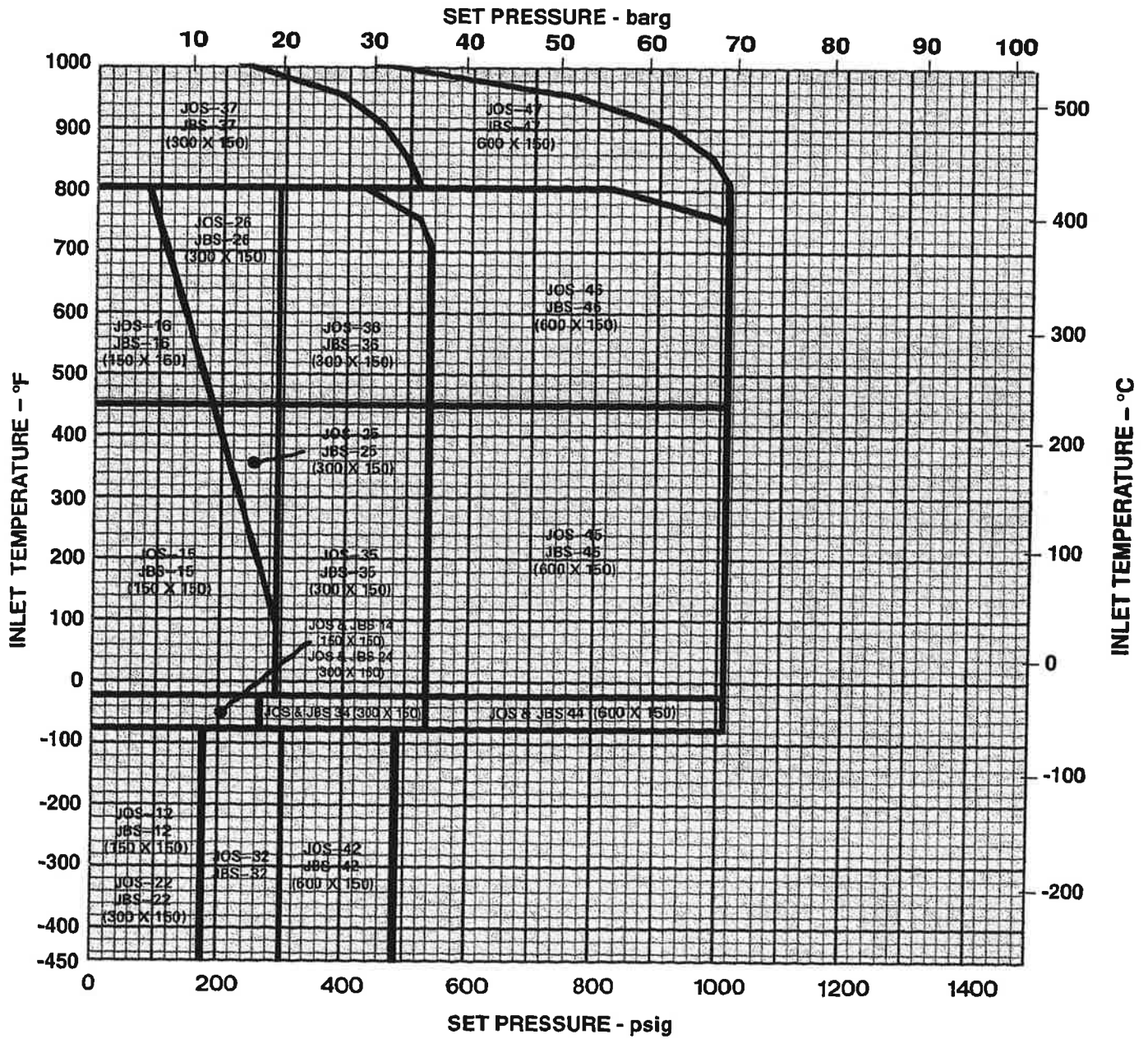
Valve Style	Valve Dimensions - In. (mm)	Center to Face			Use To Find Bolt Length	Approximate Height			Approx. Weight lbs(kg)
		Inlet	Outlet	Y		Valve (Cap) Type			
		E	F	X	J & L	C	D	J	
JOS-12,14,15,16,22,24,25,26	7-1/8 (181)	9 (229)	2-1/8 (54)	42-1/2 (1080)	41-1/2 (1054)	42-1/4 (1073)	270 (122)		
JBS-32,34,35,36,37	8-7/8 (225)	10 (254)	2-1/8 (54)	44-1/4 (1124)	43-1/4 (1099)	44 (1118)	286 (130)		
JLT-JOS-H-42,44,45,46,47	8-7/8 (225)	10 (254)	2-9/16 (65)	46-1/2 (1181)	45-1/2 (1156)	46-1/4 (1175)	401 (182)		





# 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	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	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
JOS-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
JOS-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).

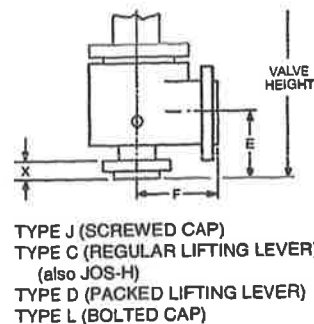
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

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

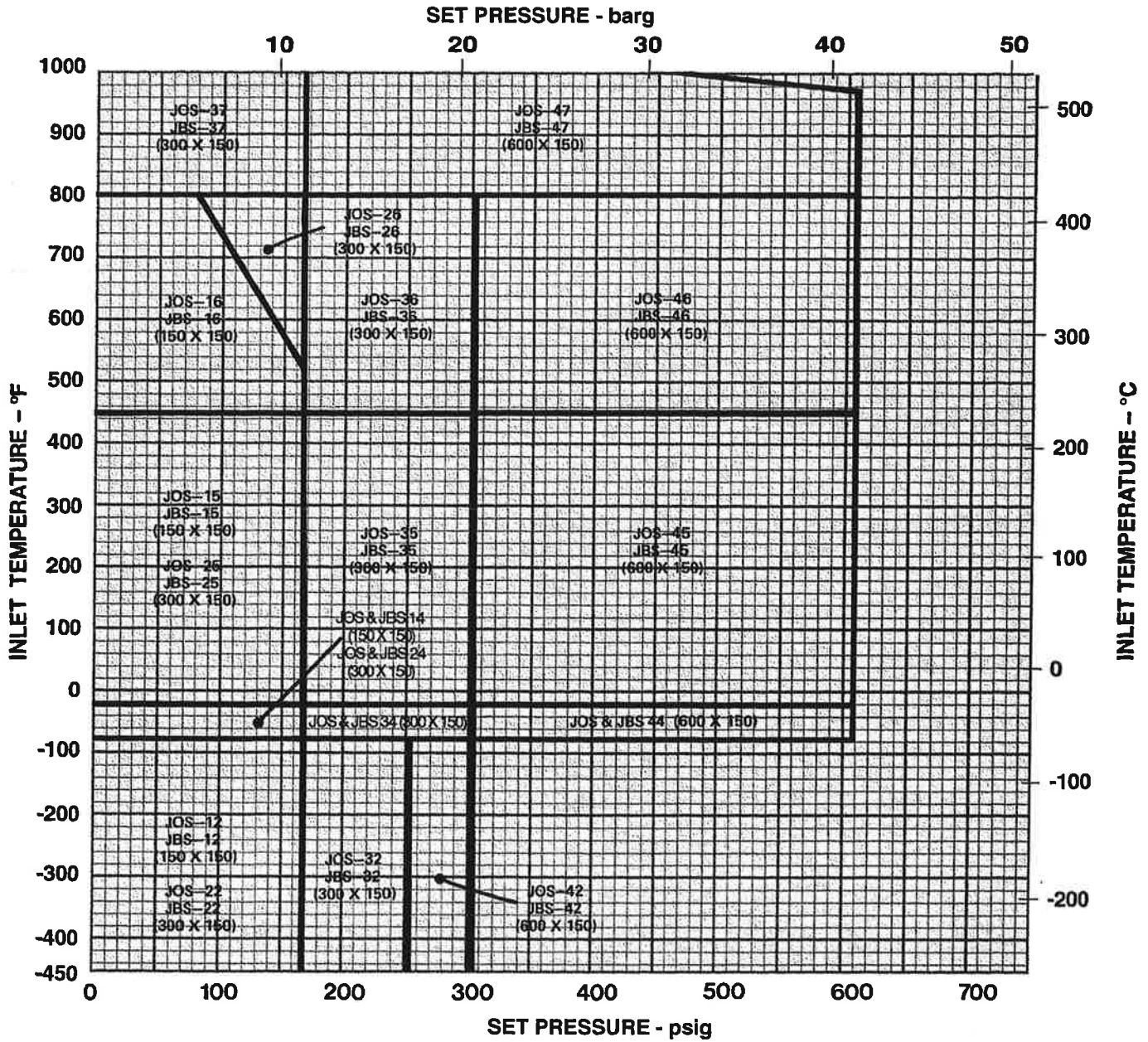
## Q Orifice

Valve Style	Valve Dimensions - In. (mm)	Valve Dimensions - In. (mm)					Approx. Weight lbs(kg)	Type	
		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	12,14,15,16, 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	32,34,35,36,37 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)	



# 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						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	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- JBS- JLT- JOS-H-	16 26 36 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- JBS- JLT- JOS-H-	37 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- JBS- JLT-	14 24 34 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- JBS- JLT-	12 22 32 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).

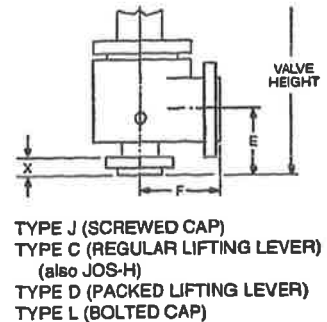
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

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

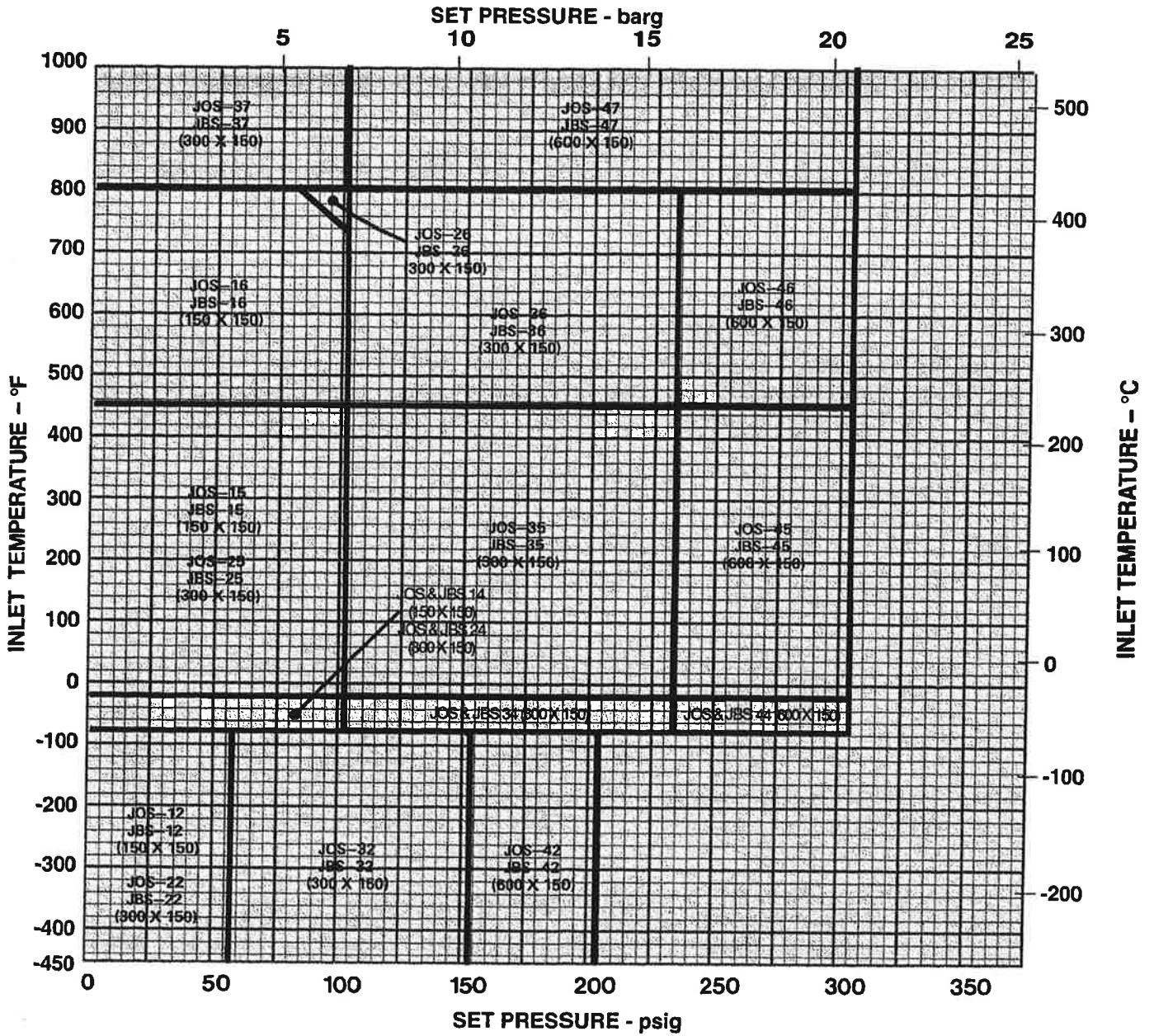
## R Orifice

Valve Style	Valve Dimensions - in. (mm)	Valve Dimensions - in. (mm)						Approx. Weight (lb)(kg)
		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-	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)
JLT- JOS-H-	32,34,35,36,37	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)
	42,44,45,46,47	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)



# 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		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	Inlet		Inlet							JOS †	JBS †	Inlet						JOS †	JBS †
			Inlet	Outlet	-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	8T10	150	150			65	65				30	30			4.48	4.48			2.06	2.06
JBS-25	25	8T10	300	150			65	65				30	30			4.48	4.48			2.06	2.06
JLT-35	35	8T10	300	150			120	120				60	60			8.27	8.27			4.13	4.13
*JOS-H-45	45	8T10	300	150			300	300				100	100			20.6	20.6			6.89	6.89
JOS-16	16	8T10	150	150			65	65				30	30			4.48	4.48			2.06	2.06
JBS-26	26	8T10	300	150			65	65				30	30			4.48	4.48			2.06	2.06
JLT-36	36	8T10	300	150			120	120				60	60			8.27	8.27			4.13	4.13
JOS-H-46	46	8T10	300	150			300	300				100	100			20.6	20.6			6.89	6.89
JOS-37	37	8T10	300	150					300	225		60	60					20.6	15.5	4.13	4.13
JOS-14	14	8T10	150	150		65						30	30		4.48					2.06	2.06
JBS-24	24	8T10	300	150		65						30	30		4.48					2.06	2.06
JLT-34	34	8T10	300	150		120						60	60		8.27					4.13	4.13
JOS-12	12	8T10	150	150	50							30	30	3.44						2.06	2.06
JBS-22	22	8T10	300	150	50							30	30	3.44						2.06	2.06
JLT-32	32	8T10	300	150	65							60	60	4.48						4.13	4.13

\*Upper temperature limit of JOS-H-15, 25, 35 and 45 valves is +650F (+343C).

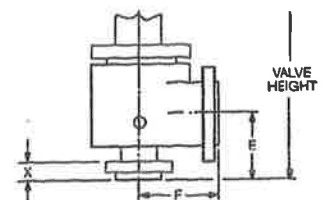
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

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

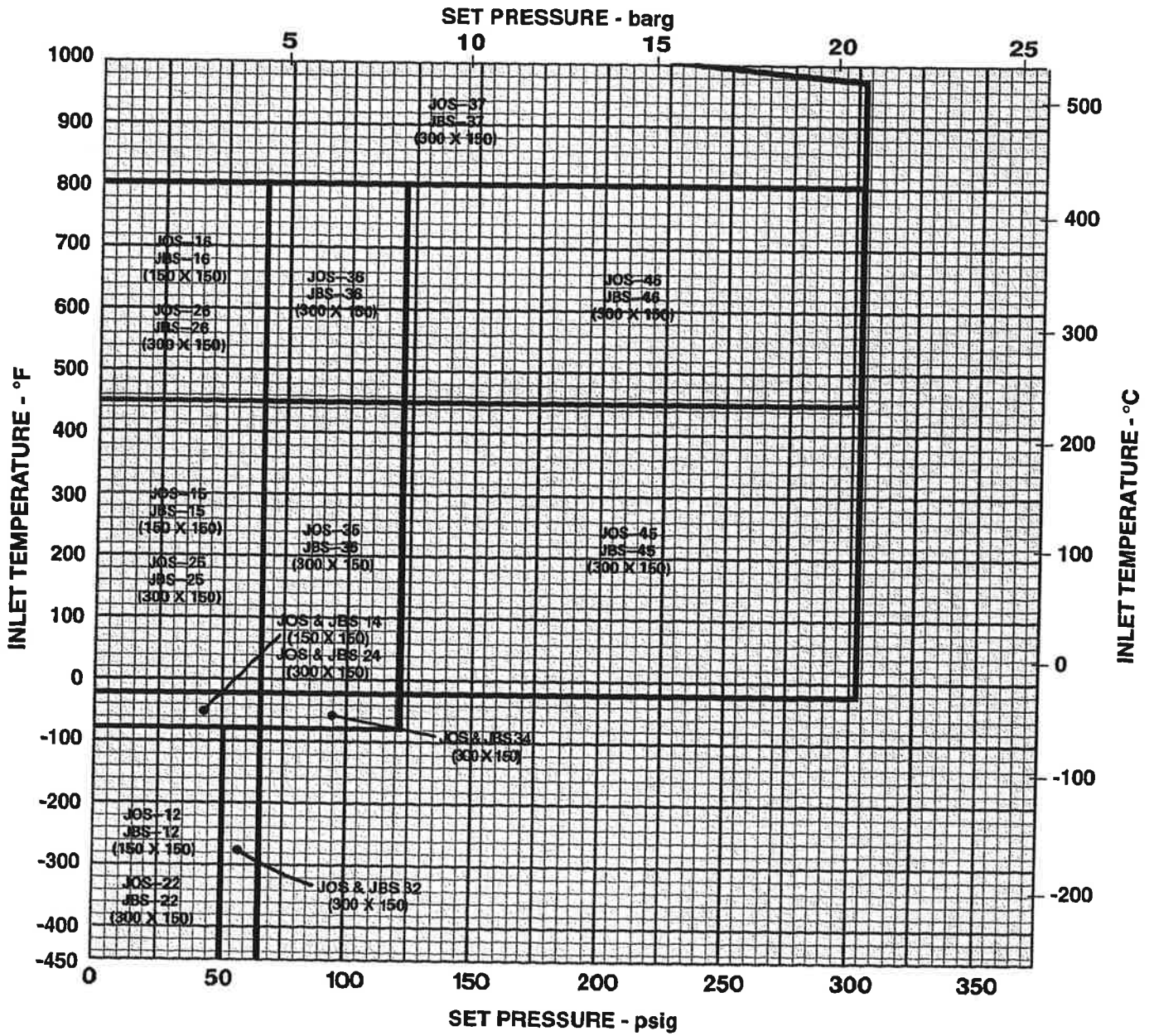
Valve Style	Valve Dimensions - In. (mm)	Valve Dimensions - In. (mm)						Approx. Weight lbs(kg)
		Center to Face		Use To Find Bolt Length	Approximate Height			
		Inlet	Outlet		J & L	C	D	
JOS-12,14,15,16,22,24,25,26	10-7/8 (276)	11 (279)	2-9/16 (65)	59-1/2 (1511)	58-1/2 (1486)	59-1/4 (1505)	882 (400)	
JLT-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)	
JOS-H-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

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			-268C to -60C	-59C to -30C	-29C to +38C	+232C	+427C	+538C			
JOS- JBS- *JOS-H- 45	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- 46	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	37	8T210	300	150					300	225	60	60					20.6	15.5	4.13	4.13
JOS- JBS- 34	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- 32	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).

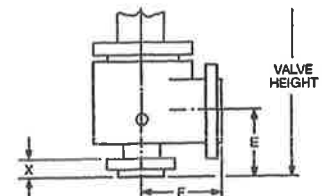
†Outlet pressure for temperatures above +100F (+38C) should not exceed the ANSI flange rating.

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 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- 22,24,25,26	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)
JOS-H- 32,34,35,36,37	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)
JOS-H- 45,46	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)

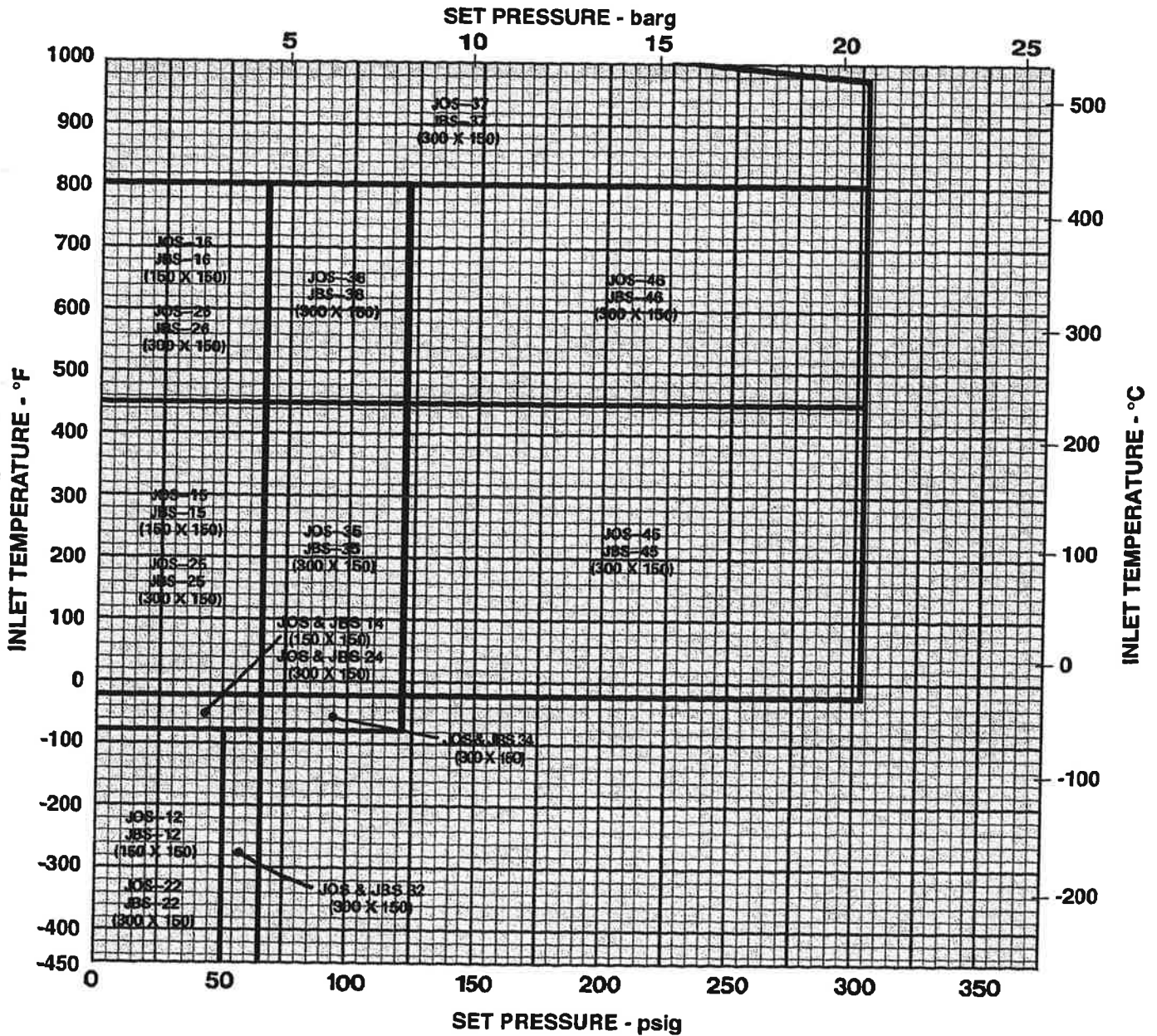


TYPE J (SCREWED CAP)  
 TYPE C (REGULAR LIFTING LEVER)  
 (also JOS-H)  
 TYPE D (PACKED LIFTING LEVER)  
 TYPE L (BOLTED CAP)



# Pressure-Temperature Limit Chart

**T2 Orifice**  
 27.872 sq. in.  
 (17981 sq.mm)  
 Effective Area





# Air Capacities Styles JOS and JBS

Set Pressures **USCS UNITS**  
800-6000 psig (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	45660	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<sup>†</sup>** (United States Customary System)

Note: USCS Units for water and liquids are U.S. gallons per minute  
 (1 U.S. gallon equals 0.8327 Imperial gallon).

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 $\Delta P$ (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	945	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.  
<sup>†</sup>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 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).

Differential Pressure $\Delta P$ (psi)	ORIFICE LETTER DESIGNATION AND EFFECTIVE AREA, sq. in.													
	D	E	F	G	H	J	K	L	M	N	P	Q	R	T
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. 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.	0.0	10.8	16.9	27.7	43.3	71.0	101	157	198	239	352	610	863	1436	1639
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  
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  $\Delta P^*$   
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 710	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	
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.





# Pressure Relief Valves - Custom Designed by Crosby Engineering

***Crosby can design and manufacture pressure relief valves to meet your unique requirements.***

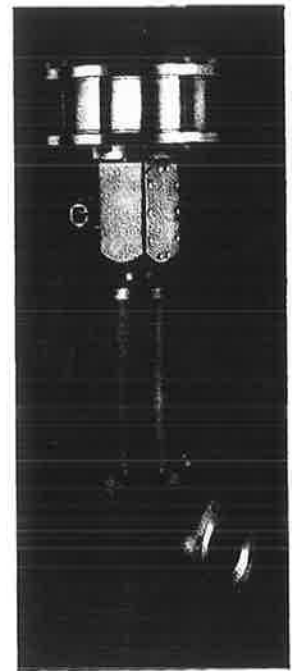
## **Application:**

- ◆ 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.***

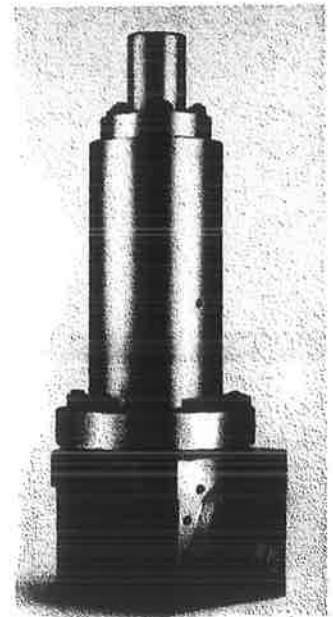
**One single Crosby Block Body Pressure Relief Valve installation can handle the capacity of multiple API-526 standard valves with:**

- ◆ Fewer potential leak paths
- ◆ Less down time and maintenance
- ◆ Fewer spare parts required
- ◆ Cost savings on inlet and outlet piping

## **Design Details:**

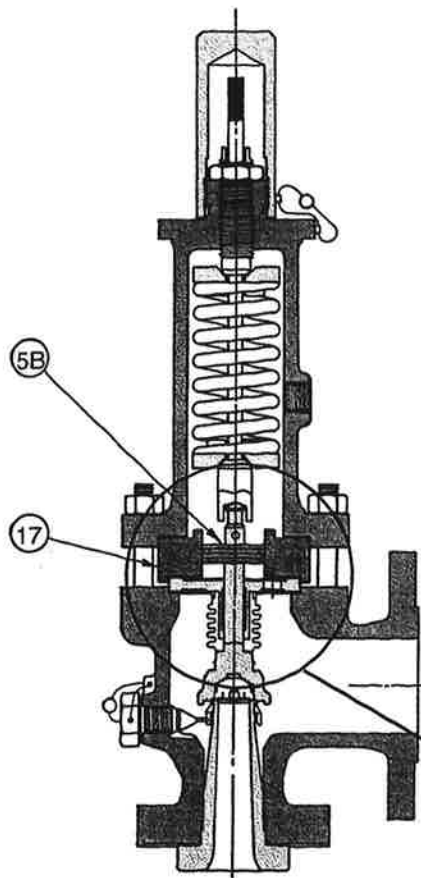
- ◆ Full nozzle design for maximum tightness
- ◆ Geometrically designed valve block body and bonnet for weight savings
- ◆ Dissimilar materials are used for guiding surfaces to eliminate galling
- ◆ Interference fitted inlet studs provided
- ◆ Available in orifice sizes from "D" through "T2"
- ◆ Materials 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

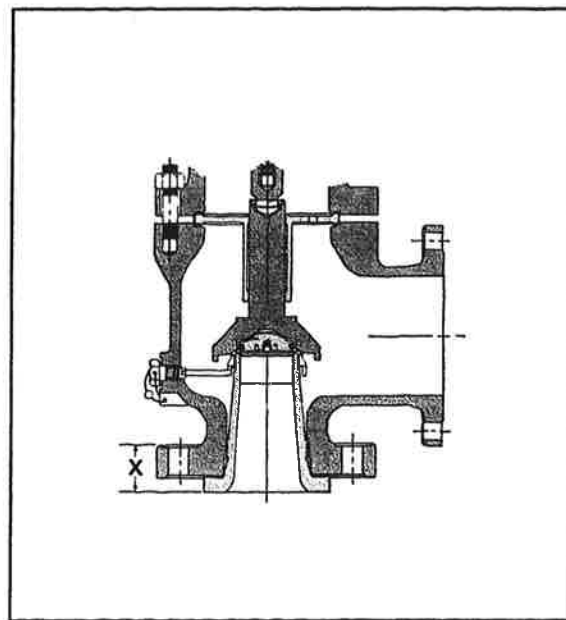
The auxiliary balancing piston is incorporated in the basic bellows valve, modified to include the piston (5B) and the cylinder (17) which is part of the disc holder. The guiding clearances are held to a minimum and, in addition, grooves in the piston form a labyrinth seal to reduce flow between the 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

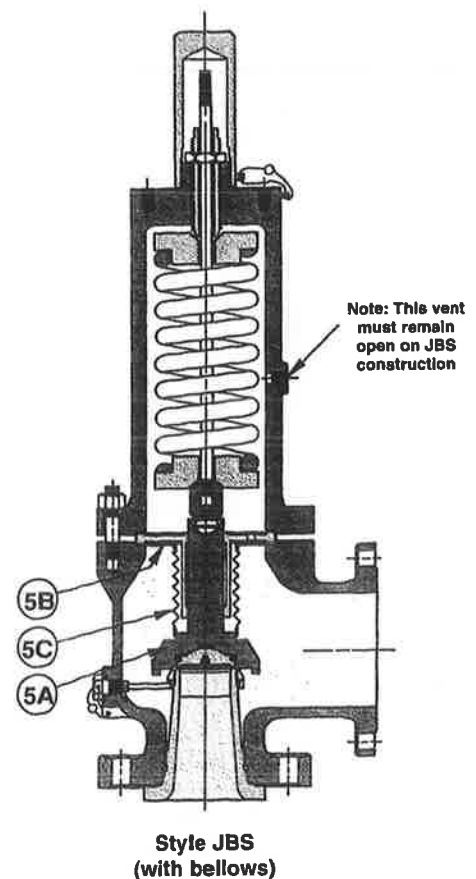
**Level 1** - For applications where compliance with NACE MR0175 is required for wetted parts in the primary (upstream) pressure zone of the pressure relief valve.

**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.

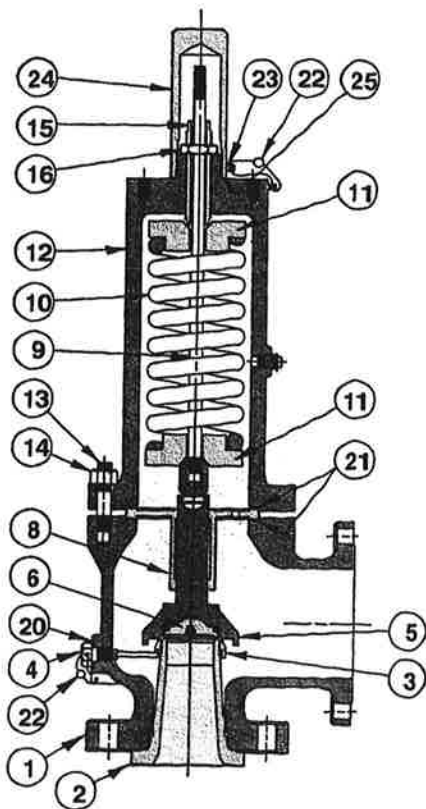
**Note 2** - Top flange on D and E orifice bellows is 316 stainless steel.

## 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

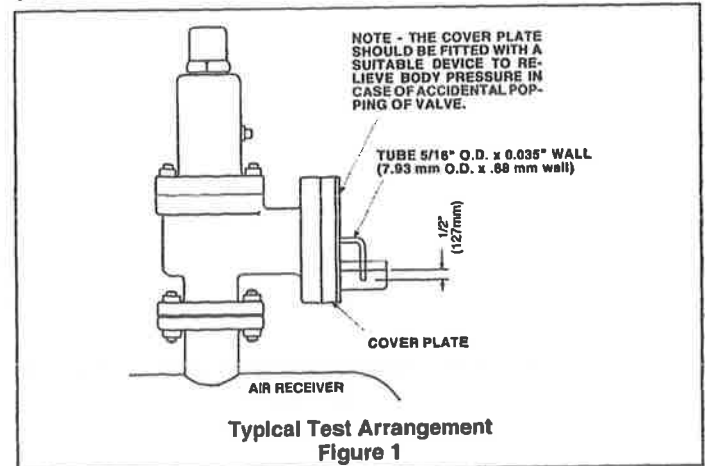
### Crosby Seat Tightness Standard - Water Service Valves (Style JLT)

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.

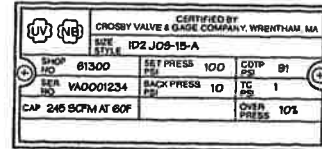
## Ordering Information

<b>Quantity</b>	<b>Example</b>
Nominal valve size (inlet x orifice x outlet)	5 4 x L x 6
Valve style	JOS-45
Inlet connection rating and facing	600 RF
Outlet connection rating and facing	150 RF
Service (liquid, gas or vapor)	Air
Set pressure (psig)	800 psig
Back pressure (psig) if any, and whether constant or variable	Atmosphere
Maximum service temperature (°F)	Ambient 60F
Cap or lifting lever type	Type C
Valve materials	Standard
Seat material	Metal-to-metal standard
Code requirements	ASME Unfired Pressure Vessel Code Section VIII
Required capacity	45433 SCFM
Accumulation (allowable overpressure)	10%
Molecular weight - vapor	-
Specific gravity - gases and liquids	1.0
Viscosity - liquids	-

## 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.

## 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 FULL SPECTRUM SERVICES

# 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

## CROSBY

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Tlx: (851) 34431 CROSBY  
Fax: (44) (1858) 434728

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Tel: (44) (1224) 722562  
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#### Crosby Valve Ltd.

4361 Harvester Road  
Units 8 & 9  
Burlington  
Ontario L7L 5M4  
Canada  
Tel: (905) 681-2310  
Fax: (905) 681-1884

### Singapore (Asia Pacific Operations)

#### Crosby Valve Pte. Ltd.

510 Thomson Road  
#14-03 SLF Building  
Singapore 1129  
Tel: (65) 353-8879  
Tlx: RS25621 CROSBY  
Fax: (65) 353-6092

REGIONAL OFFICES — California, Texas, Bahrain, China

JOINT VENTURES — Brazil, India

MANUFACTURING AFFILIATES — France, Japan, Spain

SALES REPRESENTATIVES WORLDWIDE — Ask for Crosby Worldwide Directory

## Valve Test Certificate and Serial Number File

Sales Order CS1952-1  
Customer PROPAK SYSTEMS  
P/O# 112143  
Date 23 JUNE 00

112143

AS APPROPRIATE, ENSURE ALL UNITS ARE SPECIFIED AS PER CUSTOMERS' REQUIREMENTS

Code Case \_\_\_\_\_ Code Stamp UV V NC

Description 1990C-LCC

Size 26.7mm Province AB

Set Pressure 1000 kPa Cold Diff. Test Pressure \_\_\_\_\_

Back Pressure 0 Temperature 66°C

Capacity 528 Nm<sup>3</sup>/HR AIR

Tag PSV-200 (00409-152)

Serial Number B128371-1-15

Cap Assembly  Screwed  Plain  Packed

Spring Number AA17CR

Spring Range 140 to 169

Stamped/Checked by AB

Assembled by AB

Service Medium: NATURAL GAS Comments: 145 PSZ

- Medium  Air  
 Steam  
 Water

Manufacturers Hydrostatic Test Numbers

Nozzle \_\_\_\_\_

Base Assembly \_\_\_\_\_

Checked by AB

Conversion of manufacturers parts as per Code Case 2079

Part description	Dimension after machining	Machined by

Spring washers machined and meet the required tolerance  Check box for acceptance

Set/Test Pressure 1<sup>st</sup> 145

2<sup>nd</sup> 145

3<sup>rd</sup> 145

Reseat Pressure 121

Blow Down 24

Simmer Point 143

Leakage Rate  meets API 527 OR \_\_\_\_\_ BPM

Ring Settings: Upper \_\_\_\_\_

Lower 8 Notches

Gauge No. H03A3

Back pressure test performed at:

- 30 psig / 205 kPag
- 100 psig / 690 kPag
- Other \_\_\_\_\_
- Not Applicable

**RECEIVED**  
JUN 27 2000

Tested by AB

Stamping checked by AB

Witnessed by \_\_\_\_\_  
(Customer Inspector)

Remarks: \_\_\_\_\_  
The valve furnished on the above order has been inspected, tested and found to be in accordance with specifications, drawings, and requirements of this order

## Valve Test Certificate and Serial Number File

112143

Sales Order C51952-1  
Customer PROPAK SYSTEMS  
P/O# 112143  
Date 23 JUNE 00

AS APPROPRIATE, ENSURE ALL UNITS ARE SPECIFIED AS PER CUSTOMERS' REQUIREMENTS

Code Case \_\_\_\_\_ Code Stamp (UV) V NC

Description 1996C

Size 33.4 mm Province AB

Set Pressure 1000 kPa Cold Diff. Test Pressure \_\_\_\_\_

Back Pressure 0 Temperature 66 °C

Capacity 1402 Nm<sup>3</sup>/HR AIR

Tag PSV-200 (00410-152)

Serial Number B128373-1-5

Cap Assembly  Screwed  Plain  Packed

Spring Number P411CR

Spring Range 138 to 154

Stamped/Checked by AD

Assembled by AD

Service Medium: NATURAL GAS Comments: 145 PSI

- Medium  Air  
 Steam  
 Water

Manufacturers Hydrostatic Test Numbers

Nozzle \_\_\_\_\_  
 Base Assembly \_\_\_\_\_  
 Checked by AD

Conversion of manufacturers parts as per Code Case 2079

Part description	Dimension after machining

Machined by \_\_\_\_\_  
 Checked by \_\_\_\_\_  
 Spring washers machined and meet the required tolerance  Check box for acceptance

Set/Test Pressure 1<sup>st</sup> 145

*Liquid Trim Valves Only*  
Record popping pressure (if applicable). 2<sup>nd</sup> 145

3<sup>rd</sup> 145

Reseat Pressure 126

Blow Down 19

Simmer Point 143

Leakage Rate  meets API 527 OR \_\_\_\_\_ BPM

Ring Settings: Upper \_\_\_\_\_

Lower 5 Notches

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JUN 27 2000

Gauge No. H003A3

Back pressure test performed at:

- 30 psig / 205 kPag
- 100 psig / 690 kPag
- Other \_\_\_\_\_
- Not Applicable

Tested by RT

Stamping checked by RT

Witnessed by \_\_\_\_\_  
(Customer Inspector)

Remarks: \_\_\_\_\_  
The valve furnished on the above order has been inspected, tested and found to be in accordance with specifications, drawings, and requirements of this order



## Valve Test Certificate and Serial Number File

112143

Sales Order 105195.2-1  
 Customer PROPAK SYSTEMS  
 P/O# 112143  
 Date 23 JUNE 00

AS APPROPRIATE, ENSURE ALL UNITS ARE SPECIFIED AS PER CUSTOMERS' REQUIREMENTS

Code Case 2208 Code Stamp (UV) V NC

Description 1996C-5G10

Size 33.4 mm Province AB

Set Pressure 1000 kPa Cold Diff. Test Pressure           

Back Pressure 0 Temperature 66 °C

Capacity 1402 Nm 3/4R AR

Tag PSV-200 (00411-152)

Serial Number B128373-1-3

Cap Assembly  Screwed  Plain  Packed

Spring Number P411 CRCA

Spring Range 138 to 154

Stamped/Checked by AB

Assembled by AB

Service Medium: SOUR GAS

Comments: 145 PSI

- Medium  Air  
 Steam  
 Water

Manufacturers Hydrostatic Test Numbers  
 Nozzle             
 Base Assembly             
 Checked by AB

Conversion of manufacturers parts as per Code Case 2079

Part description	Dimension after machining

Machined by             
 Checked by             
 Check box for acceptance

Set/Test Pressure 1<sup>st</sup> 198 psi

2<sup>nd</sup> 148 psi

3<sup>rd</sup> 148 psi

Reseat Pressure 126 psi

Blow Down 22 psi

Simmer Point 145 psi

Leakage Rate  meets API 527 OR            BPM

Ring Settings: Upper           

Lower 5 Notches

Gauge No. H003A3

- Back pressure test performed at:
- 50 psig / 205 kPag
  - 100 psig / 690 kPag
  - Other
  - Not Applicable

Tested by AC

Stamping checked by AC

Witnessed by             
 (Customer Inspector)

Remarks:             
 The valve furnished on the above order has been inspected, tested and found to be in accordance with specifications, drawings, and requirements of this order

**RECEIVED**  
 JUN 27 2000

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		PRESSURE INSTRUMENTS				SHEET _____ OF _____	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : PRESSURE TRANSMITTERS		NO	BY	DATE	REVISION	SPEC NO	FILE 14.11.P
		0	TK	01/28/00	ISSUED FOR PURCHASE	JOB #	99420
						DATE	
						REQ.	
					BY	CHK'D	APPR.
1	TAG NO.: PT-100	SERVICE: PLANT INLET					
2	FUNCTIONS	RECORD	INDICATE	CONTROL	BLIND	TRANS. <u>X</u>	
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 1, DIV. 2, GR. C & D		
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	
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 0 - 1724 kPag	MAX. 7584 kPag	BURST 7584 kPag			
		OVERRANGE PROTECTION TO					
21	PROCESS DATA	PRESSURE : NORMAL 483 kPag	MAX. 4516 kPag	ELEMENT RANGE			
22	PROCESS CONN.	14 mm NPT <u>X</u>	21 mm NPT	OTHER c/w 21 mm NPT BUSHING, note 1			
		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.	WIKA					
27	MODEL NO.	892.13.520					
28	P. O. NUMBER						

NOTES:

- SUPPLIER TO PROVIDE BUSHING ADAPTOR CONVERTING STANDARD PROCESS CONNECTION TO 1/2" NPT.
- MATERIALS MUST COMPLY WITH NACE MR 0175 SPECIFICATIONS.

AREA. UNIT #: 152

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		PRESSURE INSTRUMENTS				SHEET	OF
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : PRESSURE TRANSMITTERS		NO	BY	DATE	REVISION	SPEC NO	FILE 14.11.P
		0	TK	01/28/00	ISSUED FOR PURCHASE	JOB #	99420
						DATE	
						REQ.	
						BY	CHK'D APPR.
1	TAG NO.: PT-210	SERVICE: 1ST STAGE OUTLET					
2	FUNCTIONS	RECORD	INDICATE	CONTROL	BLIND	TRANS.	X
3	CASE	MFR STD	X	NOM SIZE	COLOR : MFR STD	X	OTHER
4	MOUNTING	FLUSH	SURFACE	YOKE	OTHER		
5	ENCLOSURE CLASS	GENERAL PURPOSE	WEATHER PROOF	EXPLOSION PROOF	CLASS 1, DIV. 2, GR. 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		
10	TRANSMITTER OUTPUT	4 - 20 mA	X	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
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	X	VACUUM	ABSOLUTE	COMPOUND	
18	ELEMENT TYPE	DIAPHRAGM	X	HELIX	BOURDON	BELLOWS	OTHER
19	MATERIAL	316 SS	X	BER. COPPER	OTHER		
20	RANGE	FIXED	0- 2758 kPag	MAX. 4999 kPag	BURST 24822 kPag		
		OVERRANGE PROTECTION TO					
21	PROCESS DATA	PRESSURE : NORMAL 1333kPag MAX. 4516 kPag ELEMENT RANGE					
22	PROCESS CONN.	14 mm NPT	X	21 mm NPT	OTHER c/w 21 mm NPT BUSHING, note 1		
		LOCATION : BOTTOM	X	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.	WIKA					
27	MODEL NO.	892.23.520					
28	P. O. NUMBER						

NOTES:

- SUPPLIER TO PROVIDE BUSHING ADAPTOR CONVERTING STANDARD PROCESS CONNECTION TO 1/2" NPT.
- MATERIALS MUST COMPLY WITH NACE MR 0175 SPECIFICATIONS.

AREA. UNIT #: 152

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3				PRESSURE INSTRUMENTS		SHEET _____ OF _____	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : PRESSURE TRANSMITTERS				NO	BY	DATE	REVISION
				0	TK	01/28/00	ISSUED FOR PURCHASE
				JOB # 99420		DATE _____	
				REQ. _____		BY _____	
				CHK'D _____		APPR. _____	

1	TAG NO.: PT-211	SERVICE: 2ND STAGE OUTLET
2	FUNCTIONS	RECORD _____ INDICATE _____ CONTROL _____ BLIND _____ TRANS. <u>X</u>
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</u> , DIV. 2, GR. C & D
6	POWER SUPPLY	FOR USE IN INTRINSICALLY SAFE SYSTEM <u>X</u> OTHER _____
7	CHART	117 V 60Hz _____ OTHER AC _____ DC <u>X</u> VOLTS <u>24</u>
8	CHART DRIVE	STRIP _____ ROLL _____ FOLD _____ CIRCULAR _____ TIME MARKS _____
9	SCALES	SPEED _____ POWER _____
		TYPE _____
		RANGE 1 _____ 2 _____ 3 _____ 4 _____
X	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 _____
C	11 CONTROL MODES	P = PROP ( GAIN ), I = INTEGRAL ( AUTO RESET ), D = DERIVATIVE ( RATE ), SUB : S = SLOW F = FAST
O		P _____ PI _____ PD _____ PID _____ IF _____ DF _____ IS _____ DS _____
N		OTHER _____
S	12 ACTION	ON MEAS. INCREASE OUTPUT : INCREASES _____ DECREASES _____
T	13 AUTO - MAN SWITC	NONE _____ MFR STD _____ OTHER _____
R	14 SET POINT ADJ.	MANUAL _____ EXTERNAL _____ REMOTE _____ OTHER _____
O	15 MANUAL REG.	NONE _____ MFR STD _____ OTHER _____
L	16 OUTPUT	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(ga) _____ 42 - 206 kPa (ga) _____ OTHER _____
L		
E	17 SERVICE	GAGE PRES <u>X</u> VACUUM _____ ABSOLUTE _____ COMPOUND _____
L	18 ELEMENT TYPE	DIAPHRAGM <u>X</u> HELIX _____ BOURDON _____ BELLOWS _____ OTHER _____
E	19 MATERIAL	316 SS <u>X</u> BER. COPPER _____ OTHER _____
M	20 RANGE	FIXED <u>0- 6895 kPag</u> MAX. <u>12066 kPag</u> BURST <u>55158 kPag</u>
E		OVERRANGE PROTECTION TO _____
N	21 PROCESS DATA	PRESSURE : NORMAL <u>3691 kPag</u> MAX. <u>8908 kPag</u> ELEMENT RANGE _____
T	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>892.23.520</u>
28	P. O. NUMBER	_____

NOTES:

- SUPPLIER TO PROVIDE BUSHING ADAPTOR CONVERTING STANDARD PROCESS CONNECTION TO 1/2" NPT.
- MATERIALS MUST COMPLY WITH NACE MR 0175 SPECIFICATIONS.

AREA. UNIT # : 152

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3				PRESSURE INSTRUMENTS				SHEET _____ OF _____	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : PRESSURE TRANSMITTERS				NO	BY	DATE	REVISION	SPEC NO	FILE 14.11.P
				0	TK	01/28/00	ISSUED FOR PURCHASE	JOB #	99420
								DATE	
								REQ.	
				BY	CHK'D	APPR.			
1	TAG NO.: PT-212	SERVICE:	3RD STAGE OUTLET						
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</u> , DIV. 2, GR. C & D	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 _____							
X	10 TRANSMITER OUTPUT	4 - 20 mA <u>X</u> 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 _____							
T	12 ACTION	ON MEAS. INCREASE OUTPUT INCREASES _____ DECREASES _____							
R	13 AUTO - MAN SWITC	NONE _____ MFR STD _____ OTHER _____							
O	14 SET POINT ADJ.	MANUAL _____ EXTERNAL _____ REMOTE _____ OTHER _____							
L	15 MANUAL REG.	NONE _____ MFR STD _____ OTHER _____							
L	16 OUTPUT	4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(ga) _____ 42 - 206 kPa (ga) _____ OTHER _____							
E	17 SERVICE	GAGE PRES <u>X</u> VACUUM _____ ABSOLUTE _____ COMPOUND _____							
L	18 ELEMENT TYPE	DIAPHRAGM <u>X</u> HELIX _____ BOURDON _____ BELLOWS _____ OTHER _____							
E	19 MATERIAL	316 SS <u>X</u> BER. COPPER _____ OTHER _____							
M	20 RANGE	FIXED <u>0- 13790 kPag</u> MAX. <u>31718 kPag</u> BURST <u>99974 kPag</u>	OVERRANGE PROTECTION TO _____						
N	21 PROCESS DATA	PRESSURE : NORMAL <u>8380 kPag</u> MAX. <u>11377 kPag</u> ELEMENT RANGE _____							
T	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>892.23.520</u>							
28	P. O. NUMBER	_____							
NOTES: 1. SUPPLIER TO PROVIDE BUSHING ADAPTOR CONVERTING STANDARD PROCESS CONNECTION TO 1/2" NPT. 2. MATERIALS MUST COMPLY WITH NACE MR 0175 SPECIFICATIONS.									
AREA. UNIT # : <u>152</u>									

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3				PRESSURE INSTRUMENTS				SHEET _____ OF _____	
				NO		BY		DATE	
				0		TK		01/28/00	
				REVISION		FOR PURCHASE		JOB # 99420	
CUSTOMER : APACHE CANADA LIMITED								DATE	
PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE								REQ.	
SERVICE : PRESSURE TRANSMITTERS								BY _____	
								CHK'D _____	
								APPR. _____	
1 TAG NO.: PT-257		SERVICE: ENGINE PRESSURE BLOCK							
2 FUNCTIONS		RECORD _____ INDICATE _____ CONTROL _____ BLIND _____ TRANS. <u>X</u>							
3 CASE		OTHER _____							
4 MOUNTING		MFR STD <u>X</u> NOM SIZE _____ COLOR : MFR STD <u>X</u> OTHER _____							
5 ENCLOSURE CLASS		FLUSH _____ SURFACE _____ YOKE _____ OTHER _____							
6 POWER SUPPLY		GENERAL PURPOSE _____ WEATHER PROOF _____ EXPLOSION PROOF _____ CLASS <u>1, DIV. 2, GR. C &amp; D</u>							
7 CHART		FOR USE IN INTRINSICALLY SAFE SYSTEM <u>X</u> OTHER _____							
8 CHART DRIVE		117 V 60Hz _____ OTHER AC _____ DC <u>X</u> VOLTS <u>24</u>							
9 SCALES		STRIP _____ ROLL _____ FOLD _____ CIRCULAR _____ TIME MARKS _____							
		SPEED _____ POWER _____							
		TYPE _____							
		RANGE 1 _____ 2 _____ 3 _____ 4 _____							
X 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 _____							
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 _____							
R 13 AUTO - MAN SWITC		NONE _____ MFR STD _____ OTHER _____							
O 14 SET POINT ADJ.		MANUAL _____ EXTERNAL _____ REMOTE _____ OTHER _____							
L 15 MANUAL REG.		NONE _____ MFR STD _____ OTHER _____							
L 16 OUTPUT		4 - 20 mA _____ 10 - 50 mA _____ 21 - 103 kPa(ga) _____ 42 - 206 kPa (ga) _____ OTHER _____							
E 17 SERVICE		GAGE PRES <u>X</u> VACUUM _____ ABSOLUTE _____ COMPOUND _____							
L 18 ELEMENT TYPE		DIAPHRAGM <u>X</u> HELIX _____ BOURDON _____ BELLOWS _____ OTHER _____							
E 19 MATERIAL		316 SS <u>X</u> BER. COPPER _____ OTHER _____							
M 20 RANGE		FIXED <u>0 - 690 kPag</u> MAX. <u>3448 kPag</u> BURST <u>3448 kPag</u>							
		OVERRANGE PROTECTION TO _____							
N 21 PROCESS DATA		PRESSURE : NORMAL <u>50</u> MAX. <u>70</u> ELEMENT RANGE _____							
T 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>892.13.500</u>							
28 P. O. NUMBER		_____							

NOTES:

1. SUPPLIER TO PROVIDE BUSHING ADAPTOR CONVERTING STANDARD PROCESS CONNECTION TO 1/2" NPT.

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		PRESSURE INSTRUMENTS				SHEET _____ OF _____	
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : PRESSURE TRANSMITTERS		NO	BY	DATE	REVISION	SPEC NO	FILE 14.11.P
		0	TK	01/28/00	ISSUED FOR PURCHASE	JOB #	99420
						DATE	
						REQ.	
					BY	CHK'D	APPR.
1	TAG NO.: PT-281	SERVICE: K-200 COMPRESSOR LUBE OIL PRESSURE					
2	FUNCTIONS	RECORD _____	INDICATE _____	CONTROL _____	BLIND _____	TRANS. <u>X</u>	
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 1, DIV. 2, GR. C & D		
6	POWER SUPPLY	FOR USE IN INTRINSICALLY SAFE SYSTEM <u>X</u>	OTHER _____				
7	CHART	117 V 60Hz _____	OTHER AC _____	DC <u>X</u>	VOLTS <u>24</u>		
8	CHART DRIVE	STRIP _____	ROLL _____	FOLD _____	CIRCULAR _____	TIME MARKS _____	
9	SCALES	SPEED _____			POWER _____		
		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 - 690 kPag</u>	MAX. <u>3448 kPag</u>	BURST <u>3448 kPag</u>			
		OVERRANGE PROTECTION TO _____					
21	PROCESS DATA	PRESSURE : NORMAL <u>345 kPag</u>	MAX. <u>400 kPag</u>	ELEMENT RANGE _____			
22	PROCESS CONN.	14 mm NPT <u>X</u>	21 mm NPT _____	OTHER c/w 21 mm NPT BUSHING, note 1			
		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>892.13.500</u>					
28	P. O. NUMBER	_____					

NOTES:

- SUPPLIER TO PROVIDE BUSHING ADAPTOR CONVERTING STANDARD PROCESS CONNECTION TO 1/2" NPT.

AREA. UNIT #: 152

**WIKA****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

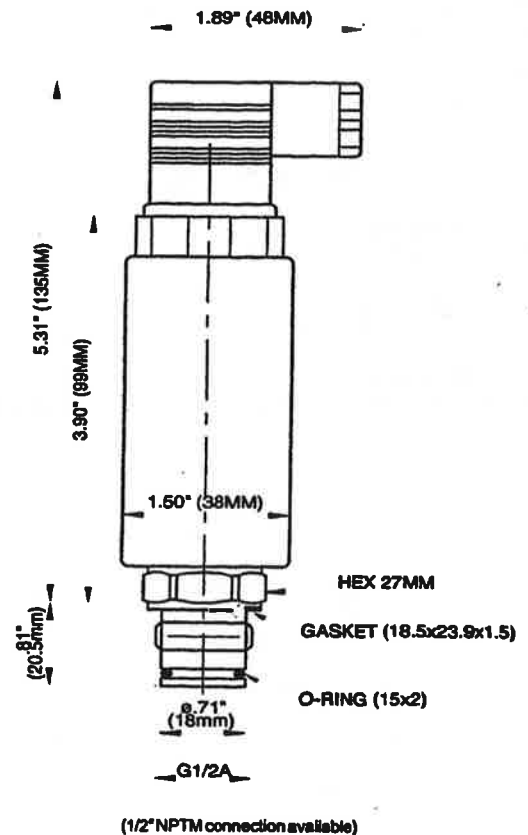
**Tronic**

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

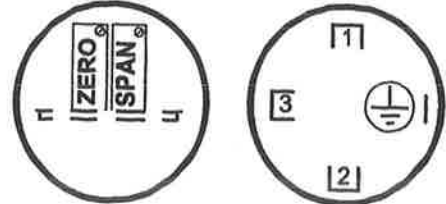
**Vibration protection**  
Internal electronics 100% potted in epoxy casting resin

**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	E Ex ia II C T5	E Ex ia II C T6
Power supply	10...28 VDC	10...28 VDC
Short circuit Rating	660mA	660mA
Power Rating	(1.75W)	(1.75W)
Operating Temperature	-5°/150 °F(-5°/165 °F)	-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**  
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**WIKA Branch Office**  
1535 Meyerside Drive, Unit #6  
Mississauga, Ontario L5T 1M9  
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<http://www.wika.ca>

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		PRESSURE INSTRUMENTS				SHEET OF		
CUSTOMER : PROPAK PLANT : 1380 HP STOCK COMPRESSOR SERVICE : PRESSURE TRANSMITTERS		NO	BY	DATE	REVISION	SPEC NO	FILE 14.11.P	
		0	TK	01/28/00	FOR PURCHASE	JOB #	99420	
						DATE		
						REQ.		
						BY	CHK'D	APPR.
1	TAG NO.: PT-257	SERVICE: ENGINE PRESSURE BLOCK						
2	FUNCTIONS	RECORD	INDICATE	CONTROL	BLIND	TRANS. X		
3	CASE	MFR STD X	NOM SIZE	COLOR: MFR STD X	OTHER			
4	MOUNTING	FLUSH	SURFACE	YOKE	OTHER			
5	ENCLOSURE CLASS	GENERAL PURPOSE	WEATHER PROOF	EXPLOSION PROOF	CLASS 1, DIV. 2, GR. 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			
10	TRANSMITTER OUTPUT	4 - 20 mA X	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		
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 X	VACUUM	ABSOLUTE	COMPOUND			
18	ELEMENT TYPE	DIAPHRAGM X	HELIX	BOURDON	BELLOWS	OTHER		
19	MATERIAL	316 SS X	BER. COPPER	OTHER				
20	RANGE	FIXED 0 - 690 kPag	MAX. 3448 kPag	BURST 3448 kPag				
21	PROCESS DATA	OVERRANGE PROTECTION TO						
22	PROCESS CONN.	PRESSURE: NORMAL 50	MAX. 70	ELEMENT RANGE				
		14 mm NPT X	21 mm NPT	OTHER c/w 21 mm NPT BUSHING, note 1				
		LOCATION: BOTTOM X	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.	WIKA						
27	MODEL NO.	892.13.500						
28	P. O. NUMBER							

NOTES:

- SUPPLIER TO PROVIDE BUSHING ADAPTOR CONVERTING STANDARD PROCESS CONNECTION TO 1/2" NPT.

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		PRESSURE INSTRUMENTS				SHEET _____ OF _____ SPEC NO _____ FILE 14.11.P		
CUSTOMER : PROPAK PLANT : 1380 HP STOCK COMPRESSOR SERVICE : PRESSURE TRANSMITTERS		NO	BY	DATE	REVISION	JOB #	99420	
		0	TK	01/28/00	ISSUED FOR PURCHASE	DATE		
						REQ.		
						BY	CHK'D	APPR.
1	TAG NO.: PT-281	SERVICE: K-200 COMPRESSOR LUBE OIL PRESSURE						
2	FUNCTIONS	RECORD _____	INDICATE _____	CONTROL _____	BLIND _____	TRANS. X _____		
3	CASE	MFR STD X _____	NOM SIZE _____	COLOR : MFR STD X _____	OTHER _____			
4	MOUNTING	FLUSH _____	SURFACE _____	YOKE _____	OTHER _____			
5	ENCLOSURE CLASS	GENERAL PURPOSE _____	WEATHER PROOF _____	EXPLOSION PROOF _____	CLASS 1, DIV. 2, GR. 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 _____						
10	TRANSMITTER OUTPUT	4 - 20 mA X _____	10 - 50 mA _____	21 - 103 kPa(g) _____	42 - 206 kPa (g) _____	OTHER _____		
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 X _____	VACUUM _____	ABSOLUTE _____	COMPOUND _____			
18	ELEMENT TYPE	DIAPHRAGM X _____	HELIX _____	BOURDON _____	BELLOWS _____	OTHER _____		
19	MATERIAL	316 SS X _____	BER. COPPER _____	OTHER _____				
20	RANGE	FIXED 0 - 690 kPag _____	MAX. 3448 kPag _____	BURST 3448 kPag _____				
21	PROCESS DATA	OVERRANGE PROTECTION TO _____ PRESSURE : NORMAL 345 kPag _____ MAX. 400 kPag _____ ELEMENT RANGE _____						
22	PROCESS CONN.	14 mm NPT X _____	21 mm NPT _____	OTHER c/w 21 mm NPT BUSHING, note 1 _____				
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.	WIKA _____						
27	MODEL NO.	892.13.500 _____						
28	P. O. NUMBER	_____						

## NOTES:

- SUPPLIER TO PROVIDE BUSHING ADAPTOR CONVERTING STANDARD PROCESS CONNECTION TO 1/2" NPT.

AREA UNIT #: 152

ISA FORM SM20.40A

MPRESS-INS.XLT



**Pressure Transmitters**  
**Intrinsically Safe or Non-Incendive Safe**  
 Piezoresistive • Model 892.13.500  
 Thin Film • Model 892.23.510

**Tronic**

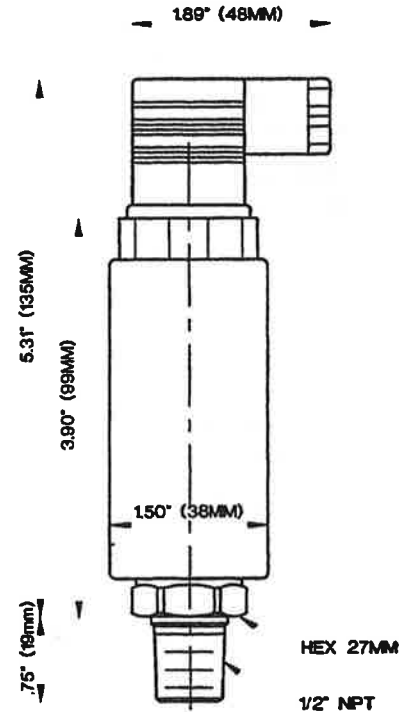
Intrinsically safe pressure transmitters are engineered for applications requiring Class I, Division I protection in hazardous environments. Each unit undergoes extensive quality control testing and calibration to achieve an accuracy of 0.25% full scale. The printed circuit board uses state-of-the-art 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

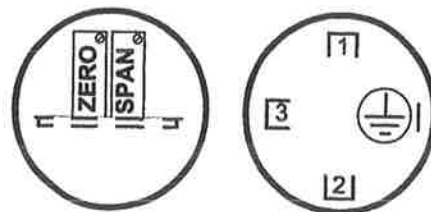
### Wiring

#### 2-Wire Current Loop

SIGNAL	DIN PLUG
Supply +	Pin 1
Signal -	Pin 2

\* 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

CANADIAN STANDARDS ASSOCIATION  
Class I, Division 1, Group A, B, C & D  
V<sub>max</sub> = 28v    C<sub>i</sub> = 33nF  
I<sub>max</sub> = 220 mA    L<sub>i</sub> = 80 μH

CENELEC/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    C<sub>i</sub> = 20 nF  
I<sub>max</sub> = 660 mA    L<sub>i</sub> = 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.

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

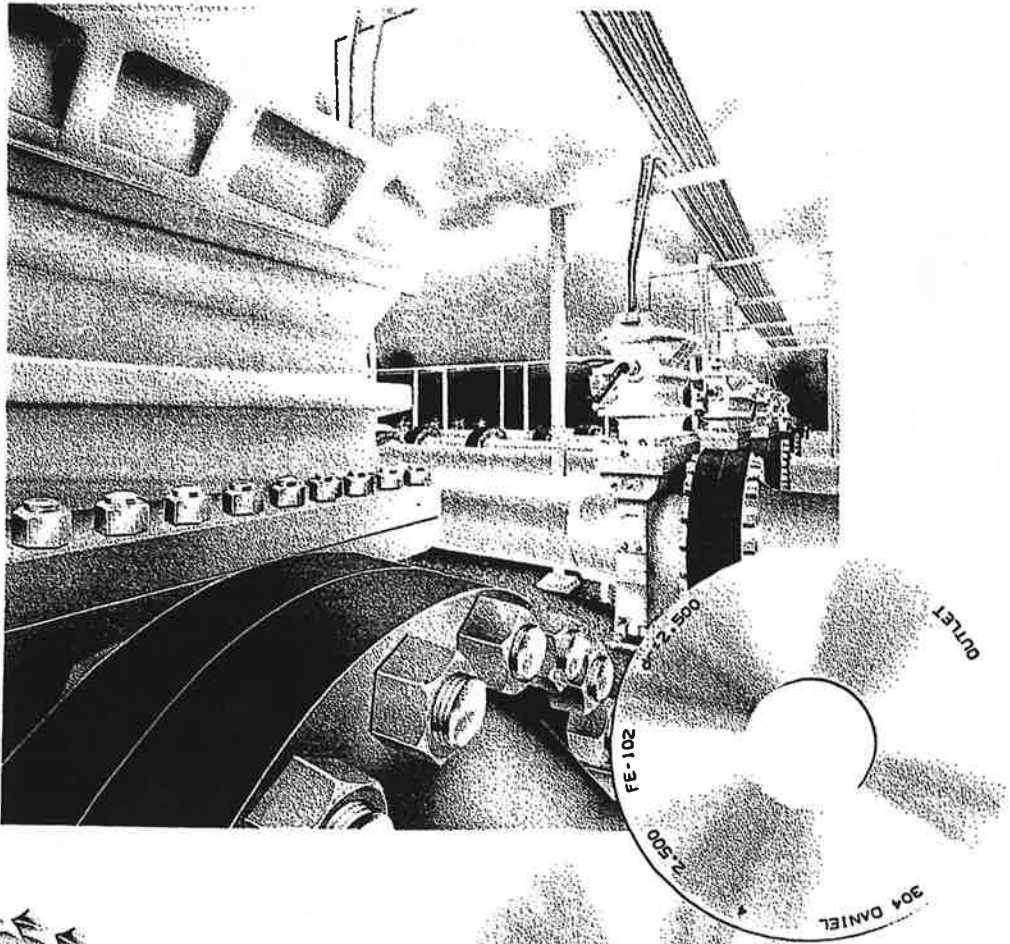
1535 Meyerside Drive, Unit #6  
Mississauga, Ontario L5T 1M9  
TEL (905) 795-1677 Fax (905) 795-1669  
<http://www.wika.ca>



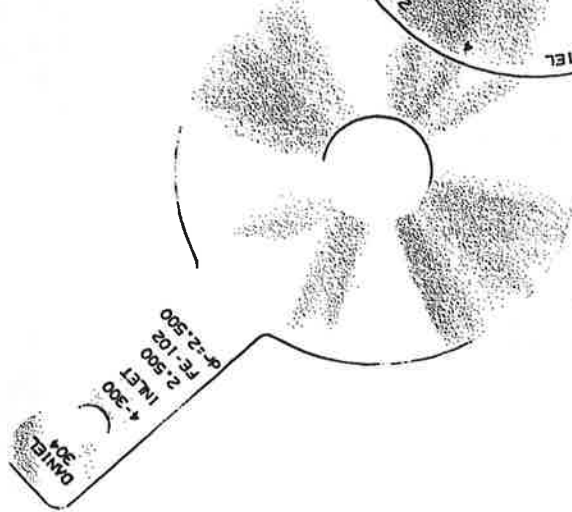
PROPAC SYSTEMS LTD POSTAL BAG #2, AIRDRIE, ALBERTA, CANADA T4B 2C3			ORIFICE PLATES AND FLANGES				SHEET _____ OF _____					
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : RESTRICTION ORIFICES			NO	BY	DATE	REVISION	JOB # 99420					
			1	CG	06/23/00	ISSUED TO DRAFTING	DATE					
			2	SW	07/04/00	REV'D RATING AND PLATE THK	REQ.					
			3	GWW	11/01/00	REVISE MAX. FLOW	BY	CHK'D	APPR.			
ORIFICE PLATES 1. CONCENTRIC <input checked="" type="checkbox"/> _____ OTHER _____ 2. ISA STANDARD <input checked="" type="checkbox"/> _____ OTHER _____ 3. BORE : MAXIMUM RATE <input checked="" type="checkbox"/> _____ NEAREST 3.2 mm _____ 4. MATERIAL: 304SS _____ 316SS <input checked="" type="checkbox"/> 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 _____									
			13 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					
F 18 MAX. FLOW			11.80 MMSCFD $\Delta$		11.80 MMSCFD $\Delta$		11.80 MMSCFD $\Delta$					
L 19 NOR. FLOW												
U 20 PRESSURE <span style="float:right">kPa (g)</span>			413		1360		3742					
I 21 TEMPERATURE <span style="float:right">° C</span>			20		48		48					
D 22 SPECIFIC GRAVITY AT BASE												
23 OPER. SP. GR.												
24 SUPERCOMP. FACTOR												
25 MOL. WEIGHT <span style="float:right">CP / CV</span>			18.8		18.8		18.8					
D 26 OPER. VISC. <span style="float:right">cP</span>												
A 27 QUALITY % OR SUPERHEAT												
T 28 BASE PRESS. <span style="float:right">BASE TEMP</span>												
A												
M 29 TYPE OF METER												
E 30 DIFF. RANGE - DRY												
T 31 SEAL SP. GR. AT 15°C												
E 32 STAT PRESS. RANGE <span style="float:right">kPa</span>												
R 33 SEAL SP. GR. AT 15°C												
34 CHART MULTIPLIER												
VANES REOD <span style="float:right">VANE MATERIAL</span>												
GOVT. APPROVED METER RUN												
P 35 BETA = d / D			1		1		1					
L 36 ORIFICE BORE DIAMETER			114.3 $\Delta$ mm		88.9 $\Delta$ mm		53.975 $\Delta$ mm					
A 37 LINE I. D. <span style="float:right">PIPE SCHED</span>			202.717 mm SCHED 40		154.051 mm SCHED 40		97.1804 mm SCHED 80					
T 38 NOM. IPE OD <span style="float:right">RATING</span>			219 mm 300#		168 mm 300# $\Delta$		114 mm 600#					
E 39 VENT OR DRAIN HOLE												
/ 40 PLATE THICKNESS <span style="float:right">mm</span>			3 $\Delta$		3 $\Delta$		3 $\Delta$					
F 41 FLANGE MATL <span style="float:right">TRIM</span>												
L 42 MFR			DANIEL		DANIEL		DANIEL					
A 43 MODEL NO.			ORIFICE PLATE		ORIFICE PLATE		ORIFICE PLATE					
N 44 P. O. NUMBER												
G												
E												
NOTES:												
AREA. UNIT # :												

# Orifice Plates and Plate Sealing Units

CATALOG 500



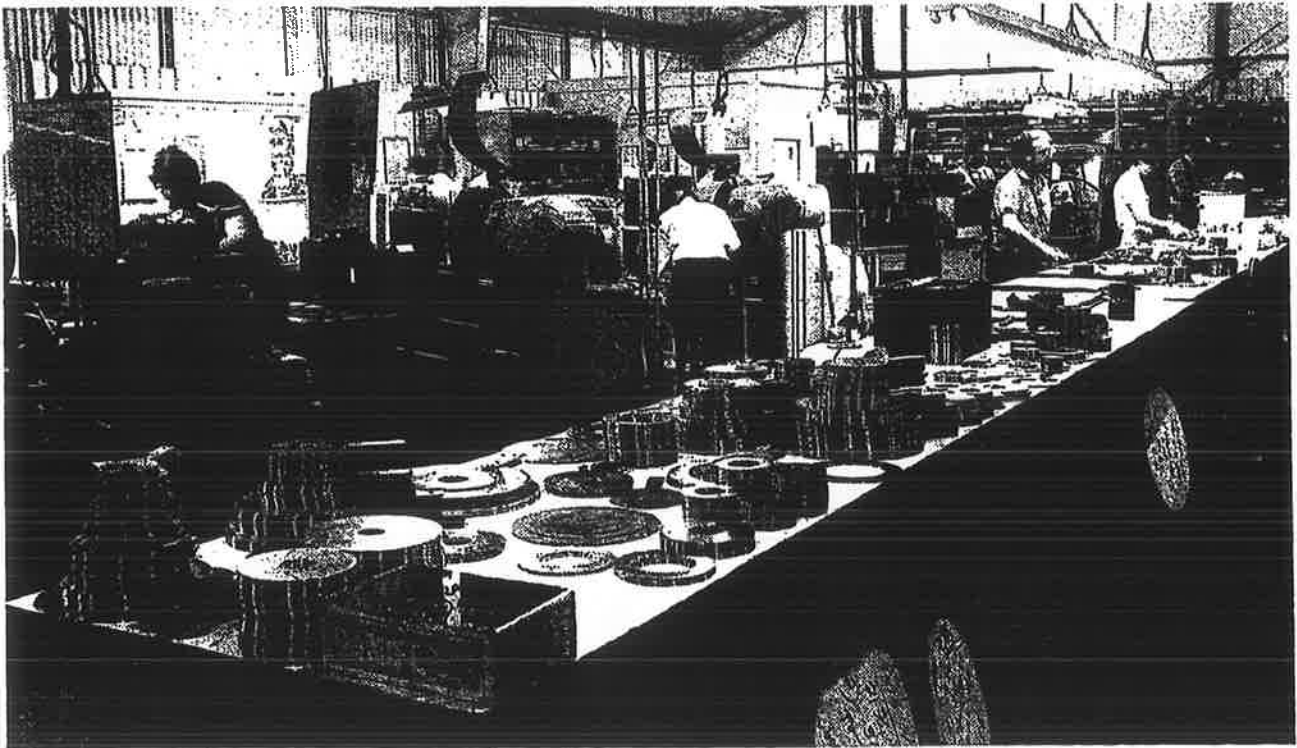
CERTIFICATE QSR-16  
878 OLD EAST ROAD  
HOUSTON, TEXAS 77068 USA



# 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.



# Design Specifications

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:**

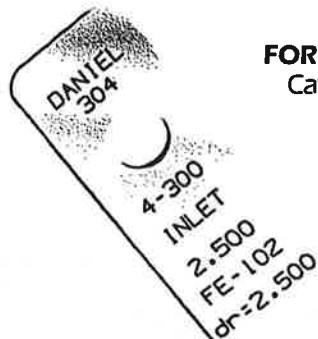
Stock materials are 304 and 316 Stainless Steel, Monel and Hastelloy. Other materials furnished on request.

**Design:**

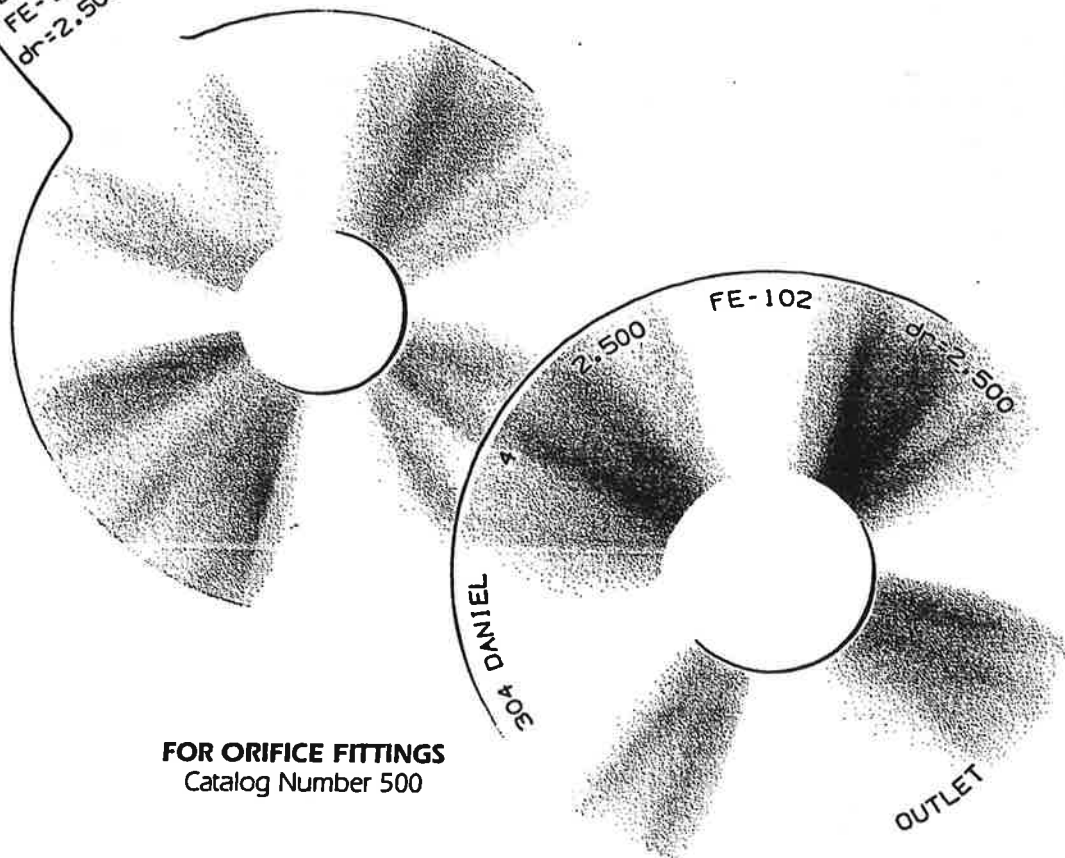
Normal stocked items are the standard design used in all industries. Special designs are available on request.

**Sizes:**

Daniel Orifice Plates have been furnished in line sizes from 1/4 inch to 60 inches.



**FOR ORIFICE FLANGES**  
Catalog Number 520

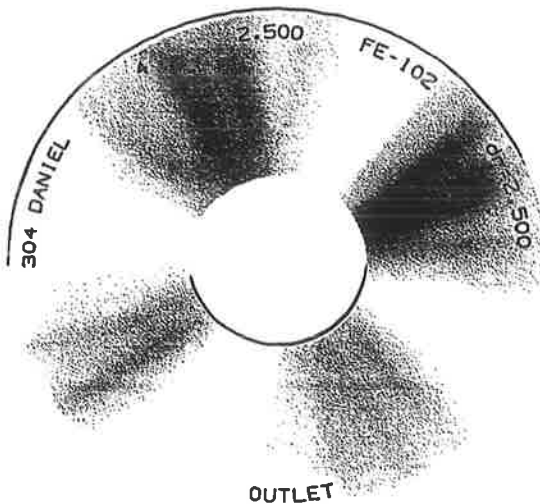


**FOR ORIFICE FITTINGS**  
Catalog Number 500

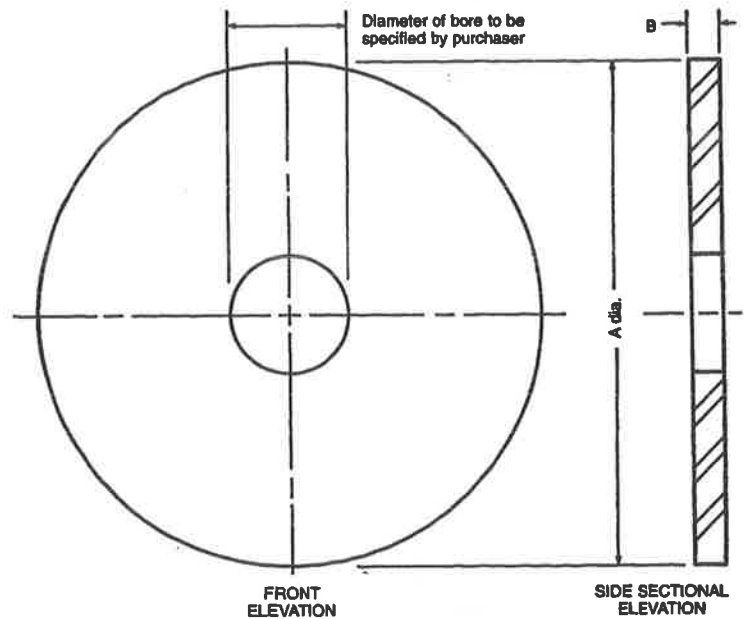
## CATALOG NO. 500

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:

1. CATALOG NUMBER
2. LINE SIZE
3. DIMENSION "A", IF NOT AS LISTED
4. MATERIAL
5. QUANTITY
6. REQUIRED ORIFICE SIZE
7. 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"

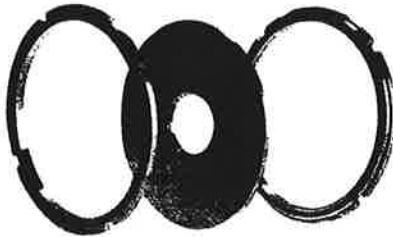
The Daniel Dual Seal is the most simple and practical orifice plate sealing device for normal flowing streams. It is precision molded from 70-80 Shore nitrile synthetic rubber\*\* and provides four rubber-to-metal sealing surfaces 360° around the plate. The units positively seal against both outer faces 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<sup>®</sup>

## "SSR" SNAP SEAL RING\*



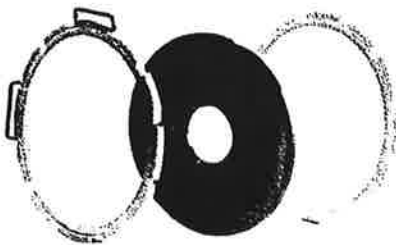
"SSRC" in 2" - 8", "SSR" in 10" & up  
\*U.S. Patent 4,478,251

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<sup>®</sup> 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



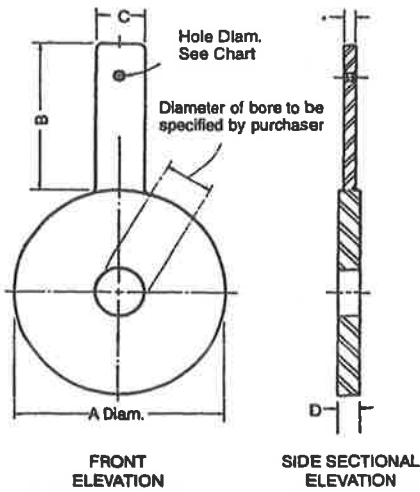
"MSC" in 2" - 8", "MS" in 10" & up

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

# Orifice Flange Plates

## 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

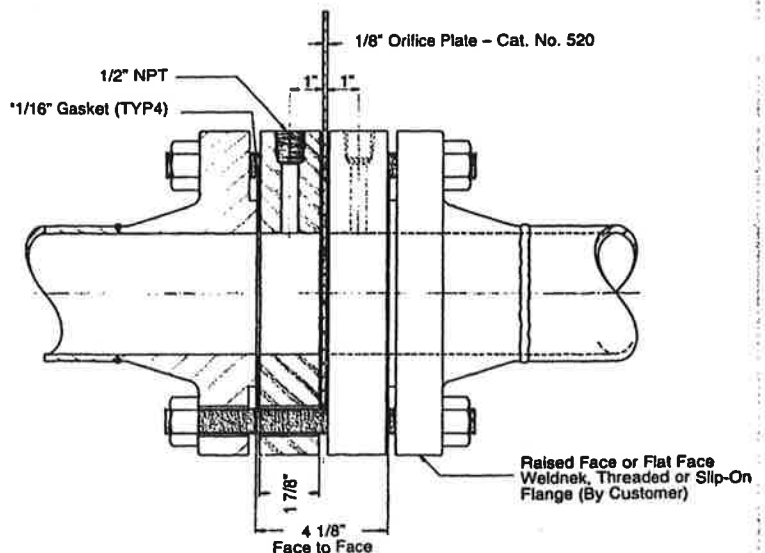
### WHEN ORDERING, PLEASE SPECIFY:

1. CATALOG NUMBER
2. SIZE, FLANGE ANSI RATING
3. DIMENSION "A", IF NOT AS LISTED
4. MATERIAL
5. QUANTITY
6. REQUIRED ORIFICE SIZE

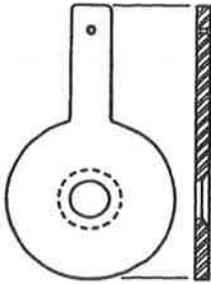
## Orifice Holding Blocks

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.

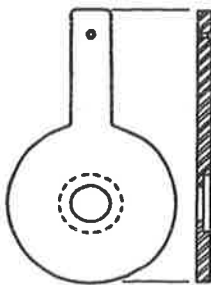
For additional information or prices, contact Daniel's Sales Department. When ordering please specify: nominal line size, line I.D., and material desired.



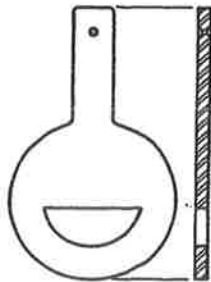
\*Taps are located for use with 1/16" thick gaskets. If other thickness gaskets are to be used, specify so that tap holes can be properly located.

**BORE AND BEVEL**

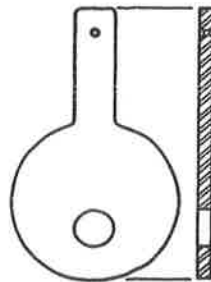
The Bore and Bevel is the standard method of limiting the plate edge thickness. The bevel is machined on a 45° angle to the desired edge thickness. Unless otherwise specified, plates will be beveled to 1/50 of the line I.D. or 1/8 of the orifice bore, minimum governing.

**BORE AND COUNTERBORE**

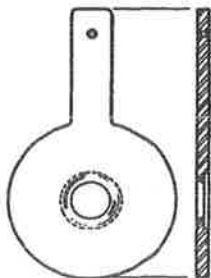
The Bore and Counterbore is a special method to limit the plate edge thickness. Instead of beveling at the normal 45 degrees, the plate is counterbored to the desired edge thickness.

**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.

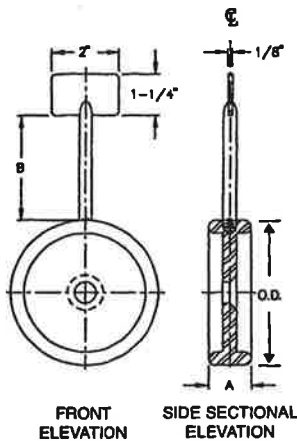
**QUARTER-ROUND**

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.

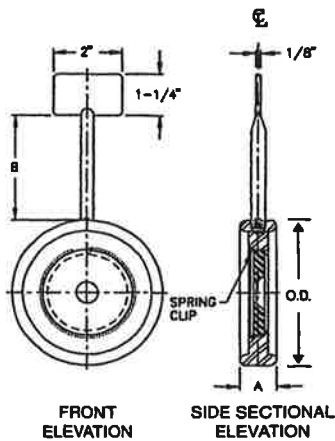
# Handle-Type Ring-Joint Orifice Plate Holders

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

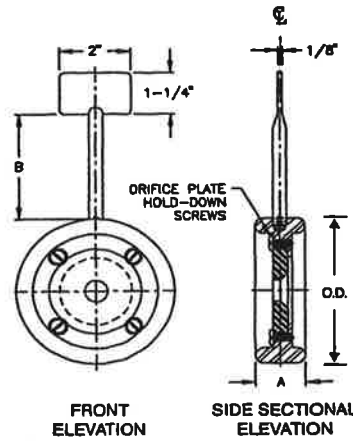
and holder. Orifice Plates are not included and must be ordered separately. Catalog 580 and 590 Plate Holders are available in cadmium plated mild steel and Type 304 and Type 316 Stainless Steel in most sizes and ratings. Catalog No. 560 Plate Holders are a one-piece integral plate seal. Catalog No. 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.

\*Approximate distance between flanges.

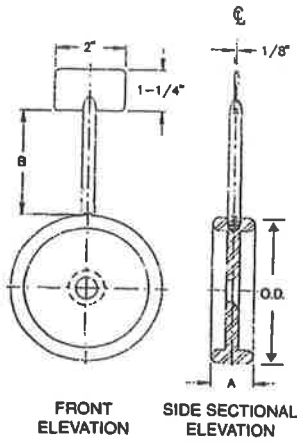
Standard plate thickness for above holders (except 2-8" 560) are as follows:  
 1/2" - 8" = 1/8  
 10" - 14" = 1/4  
 16" - 24" = 3/8

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.

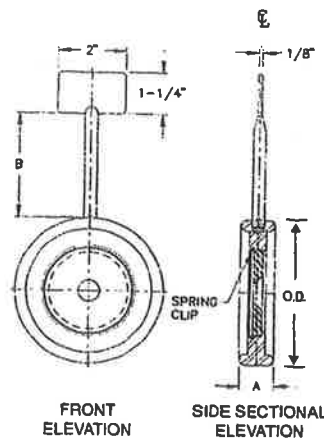
†Catalog 560 Holders in 2" through 8" sizes have 1/4" thick plates as standard. Add 1/8" to 'A' and 'Approx. Gap' dimensions for 560 Holders in these sizes.



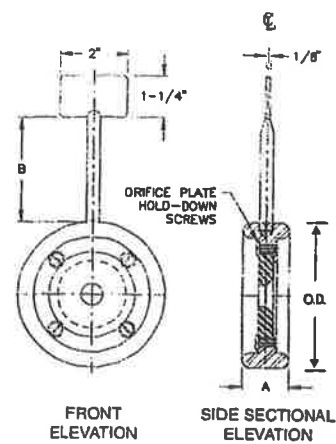
# Handle-Type Ring-Joint Orifice Plate Holders



**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.				
<b>V A P O R / G A S</b>	Viscosity cp @ Flowing Cond.				
	Flow Units				
	Maximum Flow				
	Normal Flow				
	Specific Gravity				
	Molecular Weight				
	Flowing Density lbs./ft <sup>3</sup> -yf				
	Barometric Pressure or Elev. at Plant Site (approx.)				
	Pressure Base				
	Temperature Base				
<b>S T E A M</b>	Supercom. Factor @ Flowing T. & P.				
	Viscosity-cp @ Flowing T. & P.				
	Flow Units				
<b>S T E A M</b>	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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## **DANIEL MEASUREMENT AND CONTROL**

Houston, Texas, Telephone: (713) 467-6000, Fax: (713) 827-3880  
Larbert, Scotland, Telephone: + 44-1324-556111, Fax: + 44-1324-562290

**OFFICES AND REPRESENTATIVES WORLDWIDE**

*www.danielind.com*



SV-276



# Amot® MODEL 4057 3-WAY VALVES

## FEATURES

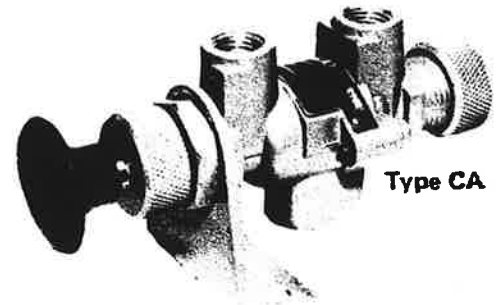
- BALANCED FORCE DESIGN-  
PRESSURE CAN BE APPLIED  
TO ANY PORT.
- BUBBLE-TIGHT SEAL
- CENTER DEAD SPOT-STD.
- PORT OVERLAP-OPTIONAL
- ARRANGED FOR PANEL OR  
BRACKET MOUNTING

## HOW TO ORDER

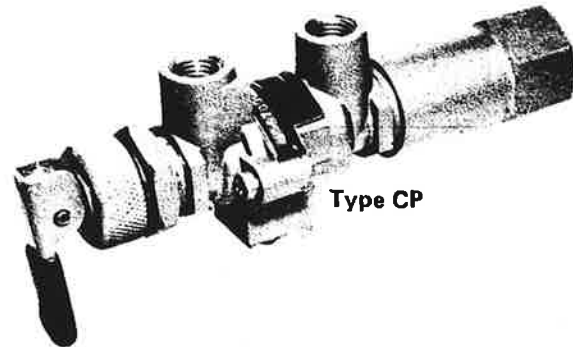
When ordering please specify the following:

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 CA



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)

PROVIDE MAXIMUM RELIABILITY FOR ALL APPLICATIONS

**INSTALLATION**

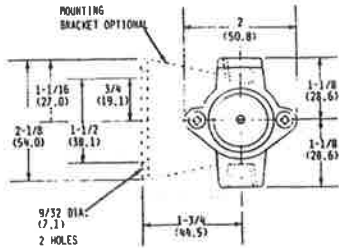
All connections on 4057 Valves are made with 1/4" pipe thread fittings. Apply a quality thread sealant such as Loctite Pipe Sealant to pipe thread connections but do not permit it to enter the valve passages. Teflon thread sealing tape may be used but must be applied so that shreds of the tape do not 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**

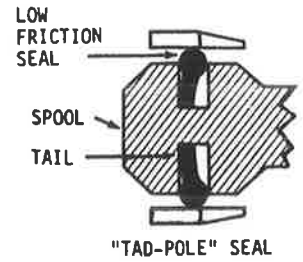
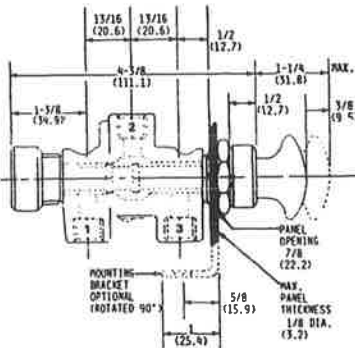
Dimensions in Inches  
Millimetres in ( )



**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**

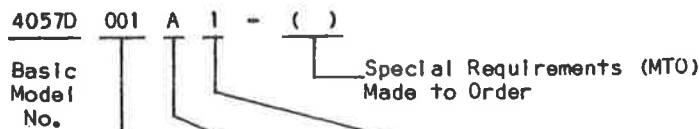


Table A Operator, Finish & Thread Code No.					Table B Seal Material Code No.		Table C Spool Code No.		
Valve Type	Standard NPT	Gulf-proofed NPT	Standard *BSP (PL)	Gulf-proofed *BSP (PL)	Buna N	Viton	Standard	Valve Port Overlap	Type C1 only has 3 Seal Rings, not 4
CA	001	019	073	091	A	F	1	2	-
CB	002	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	C	H	1	2	-
SB	009	027	081	099	E	K	5	6	-
CS	010	028	082	100	A	F	1	2	-
CT	011	029	083	101	E	K	1	2	-
CG	013	031	085	103	C	H	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.

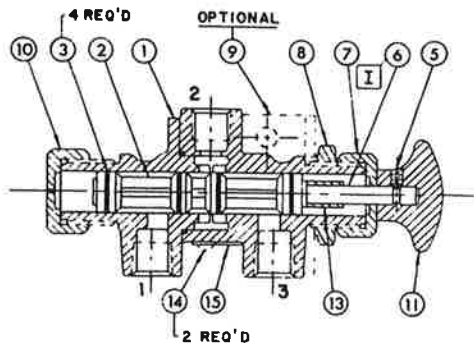
NOTE: Letters or numbers in the MTO space, other than nothing, AI or AA, indicate the unit is built to special requirements and some of the other code numbers may not be valid. Check with the factory for full specification of such models.

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.

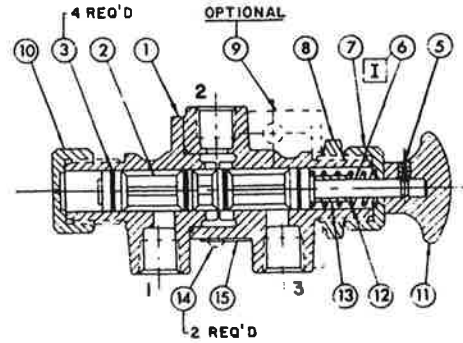
PARTS LIST



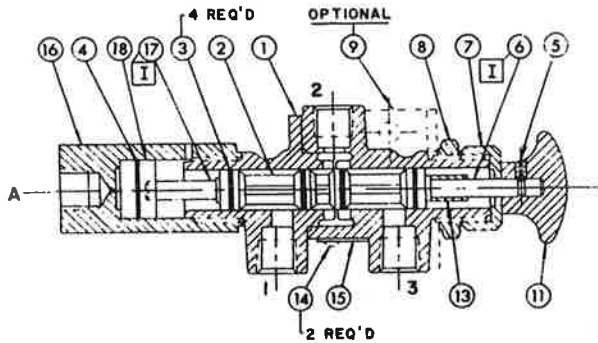
TYPE CA



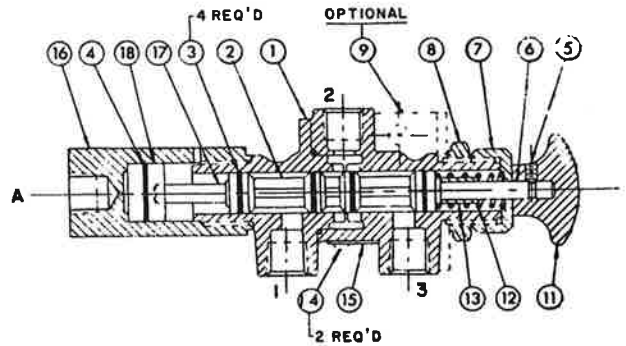
TYPE CB



TYPE CD



TYPE CE



**I** Indicates grade of adhesive used

Ref. No.	Part No.	Description
1	7909X001	Body Assembly, NPT, Standard Finish
1	7909X002	Body Assembly, BSP (PL), Standard Finish
1	7909X003	Body Assembly, BSP (Tr), Standard Finish
1	7909X011	Body Assembly, NPT, Gulfproofed
1	7909X012	Body Assembly, BSP (PL), Gulfproofed
1	7909X013	Body Assembly, BSP (Tr), Gulfproofed
2	7893	Spool, Center Dead Spot (standard)
2	7930L001	Spool, Valve Port Overlap
*3	7896L001	Seal Ring, Buna N (standard)
*3	7896L002	Seal Ring, Viton
*4	7898L001	Seal Ring, Buna N (standard)
*4	7898L002	Seal Ring, Viton

(continued on next page)

This Parts List effective with Serial No. C761 except Type CT effective with Serial No. A821.  
 \* Recommended Service Parts

Construction and material details can be determined from the Model Code System in the AMOT Sales Literature using the complete Model Number stamped on the nameplate. See Form No. 747 in the AMOT Catalog under Tab Section 6.

When communicating with AMOT regarding this unit, always give the Model No. and Serial No. If ordering service parts, also include the Description, Part No., and quantity desired.

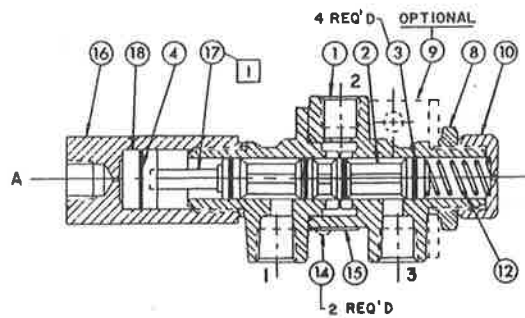
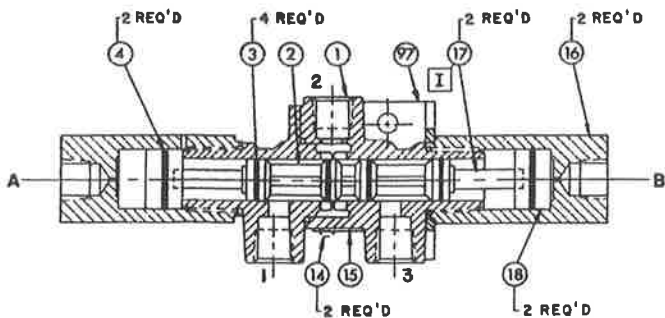
AMOT Controls Corporation  
 P.O. Box 1312  
 First Street & Nevin Avenue  
 Richmond, CA 94802  
 U.S.A.  
 Tel: (415) 236-8300  
 Tlx: 33-5442

MODEL 4057  
 3-WAY VALVES

Form 612  
 Rev. 9  
 1-86

TYPE CF

TYPE CG

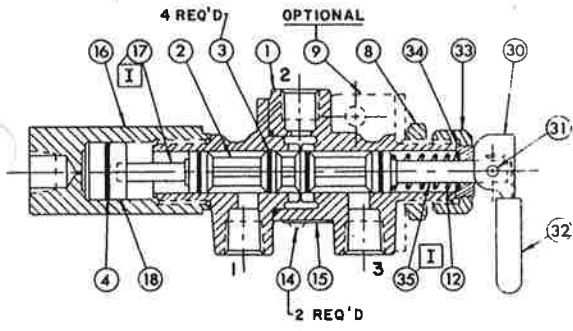


Ref. No.	Part No.	Description
5	690L002	Setscrew
6	6549L001	Rod
7	3626L002	Cap, Standard Finish
7	3626L012	Cap, Gulfproofed
8	3496	Nut, Standard Finish
8	3496L001	Nut, Gulfproofed (USA only)
9	5186	Bracket
10	3626L004	Cap, Standard Finish
10	3626L014	Cap, Gulfproofed
11	681	Knob
12	7154L034	Spring
13	5999L001	Sleeve
14	705L001	Drive Screw
15	7895	Nameplate, USA
15	9450	Nameplate, UK
16	7923L001	End Cap, NPT, Standard Finish
16	7923L011	End Cap, NPT, Gulfproofed
16	7923L002	End Cap, BSP (PL), Standard Finish
16	7923L012	End Cap, BSP (PL), Gulfproofed
16	7923L003	End Cap, BSP (Tr), Standard Finish
16	7923L013	End Cap, BSP (Tr), Gulfproofed
17	7865L001	Stem
18	7899	Piston
30	6492X	Reset Latch Assembly, Standard Finish
30	6492X001	Reset Latch Assembly, Gulfproofed (USA Only)
31	236L001	Pin
32	3423	Latch Protector
33	3626L003	Cap, Standard Finish
33	3626L013	Cap, Gulfproofed
34	6073	Spacer, Stainless Steel #416 (standard)
34	6073L001	Spacer, Stainless Steel #303
35	6656L001	Rod
43	339L004	Screw
44	84	Nut, Standard Finish
44	913L010	Nut, Gulfproofed
45	6864	Housing, Standard Finish
45	6864L001	Housing, Gulfproofed
46	2767	Piston, Standard Finish
46	2767L001	Piston, Gulfproofed
*47	2254	Diaphragm, Buna N (standard)
*47	2254L002	Diaphragm, Viton
*48	714L004	Seal
49	6863	Bonnet, NPT, Standard Finish
49	6863L001	Bonnet, NPT, Gulfproofed
49	6863L003	Bonnet, BSP (PL), Standard Finish
49	6863L013	Bonnet, BSP (PL), Gulfproofed
49	6863L004	Bonnet, BSP (Tr), Standard Finish
49	6863L014	Bonnet, BSP (Tr), Gulfproofed
50	582L008	Screw, Standard Finish
50	491L137	Screw, Gulfproofed (USA Only)
51	3626L001	Cap, Standard Finish
51	3626L011	Cap, Gulfproofed
52	980L001	Screw
53	750L001	Screw
53	147L003	Screw, Gulfproofed (USA Only)
54	101	Lockwasher
54	148	Lockwasher, Gulfproofed (USA Only)
55	7902	Follower
56	6612L007	Spring
61 (Note 2)	7154L054	Spring
62 (Note 2)	9661	End Cap, Standard Finish
62 (Note 2)	9661L010	End Cap, Gulfproofed

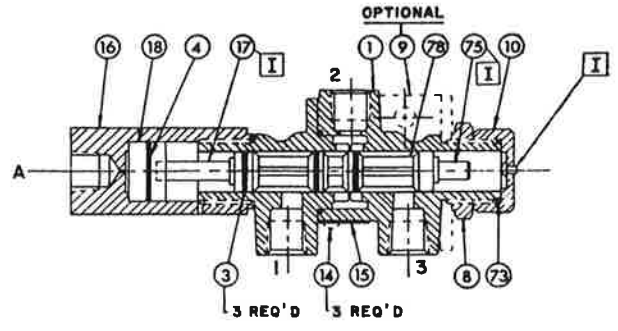
(continued on next page)



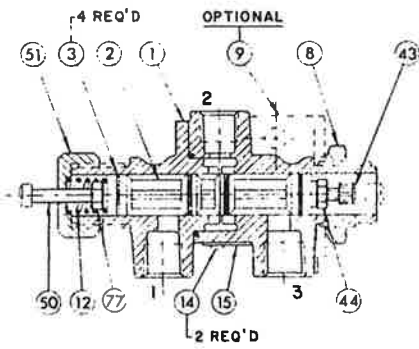
TYPE CP



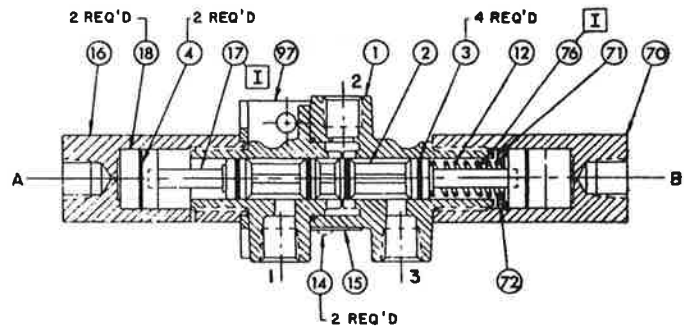
TYPE C1



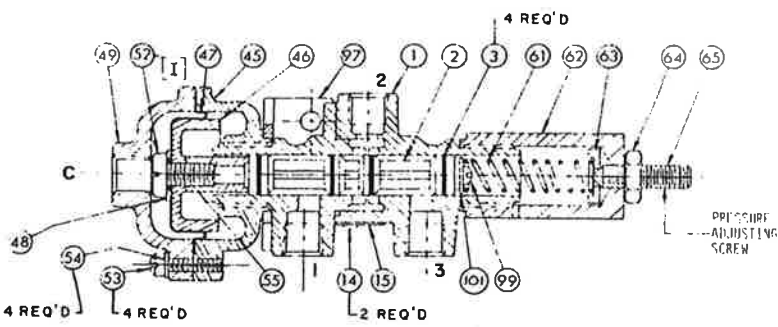
TYPE CS



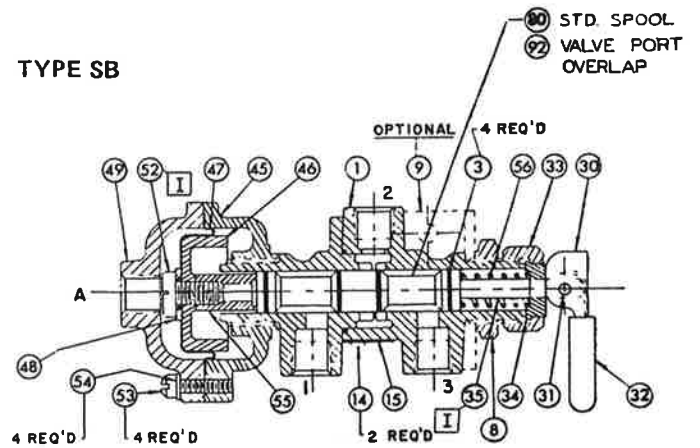
TYPE C2



TYPE CT



TYPE SB

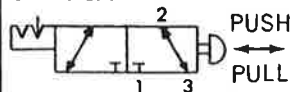


Ref. No.	Part No.	Description
63	6306	Spring Seat
64	87	Nut
64	11119	Nut, Gulfproofed, (USA Only)
65	466L002	Setscrew, Steel, Standard Finish
65	11179L125	Setscrew, Gulfproofed, (USA Only)
70	7935L001	End Cap, NPT, Standard Finish
70	7935L002	End Cap, BSP (PL), Standard Finish
70	7935L003	End Cap, BSP (Tr), Standard Finish
70	7935L011	End Cap, NPT, Gulfproofed
70	7935L012	End Cap, BSP (PL), Gulfproofed
70	7935L013	End Cap, BSP (Tr), Gulfproofed
71	595	Retaining Ring
72	6885	Washer
*73	1168	O-ring, Buna N (standard)
*73	504	O-ring, Viton
75	7865L003	Stem
76	7865L004	Stem
77	11018L001	Nut
77	9941	Nut, Gulfproofed (USA Only)
79	9241	End Cap, Standard Finish
79	9241L001	End Cap, Gulfproofed
80	9298L001	Spool
81	2392	Piston
82	3051	Diaphragm, Buna N
83	190	Washer
84	714L001	Seal
85	409L001	Screw
86	7403L003	Bonnet, NPT, Standard Finish
86	7403L004	Bonnet, BSP (PL), Standard Finish
86	9276L003	Bonnet, BSP (Tr), Standard Finish
86	7403L011	Bonnet, NPT, Gulfproofed
86	7403L012	Bonnet, BSP (PL), Gulfproofed
86	9276L013	Bonnet, BSP (Tr), Gulfproofed
87	56L008	Capscrew
87	784L125	Capscrew, Gulfproofed (USA Only)
88	102	Lockwasher
88	473	Lockwasher, Gulfproofed (USA Only)
89	9312	Adapter, Standard Finish
89	9312L001	Adapter, Gulfproofed
90	9313	Bushing
91	9314	Pushrod
92	9298	Spool, Valve Port Overlap
93	7154L046	Spring
94	9379L001	End Cap, NPT, Standard Finish
94	9379L002	End Cap, NPT, Gulfproofed
94	9379L012	End Cap, BSP (PL), Standard Finish
94	9379L003	End Cap, BSP (PL), Gulfproofed
94	9379L013	End Cap, BSP (Tr), Standard Finish
94	9379L011	End Cap, BSP (Tr), Gulfproofed
95	9398	Spacer
96	7865L005	Stem
97	5186L001	Bracket
98	2209	Spring
99 (Note 2)	74L001	Screw
101 (Note 2)	141	Washer
1	764L107	Adhesive

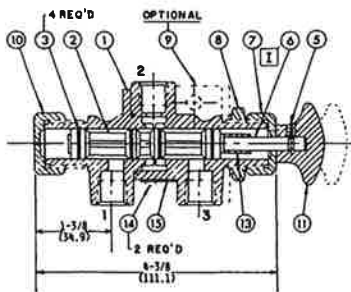
- Note: 1. See appropriate assembly drawing for quantity of parts required - one (1) required unless otherwise noted.
2. For Valves prior to Serial No. A821, service with Spring (61), Screw (99), Washer (101) and End Cap (62) together to give higher spring cycle life. Order Service Kit No. 9179X (9179X001 for Gulfproofed) and specify the Valve Model No. and Serial No.

VALVE TYPE DESCRIPTION TABLE

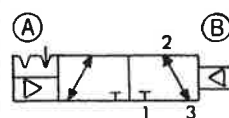
TYPE CA



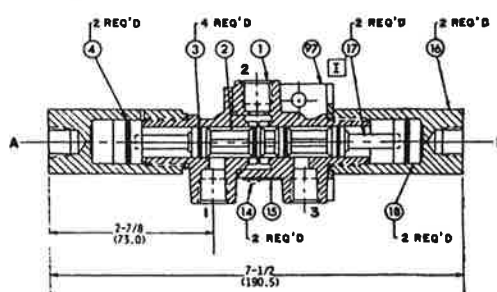
Manual Operated  
5 lbs Force Required



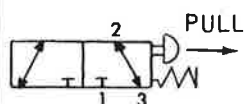
TYPE CF



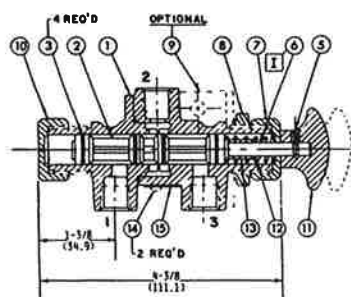
Double Pilot Operated  
10 psi Pressure Required



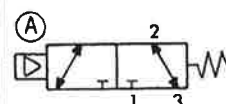
TYPE CB



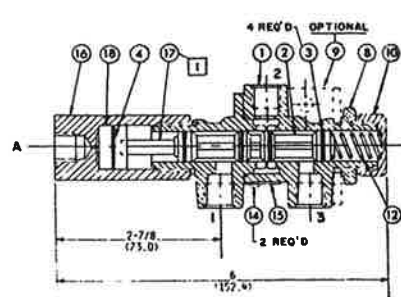
Manual Pull  
Spring Return  
15 lbs Force Required



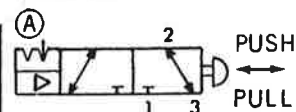
TYPE CG



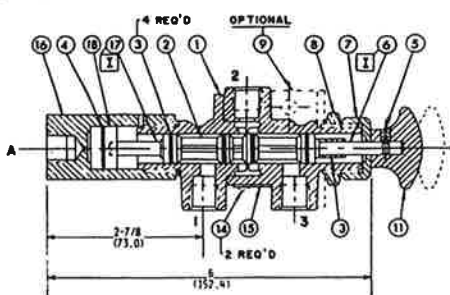
Pressure Operated,  
Spring Return  
26 psi Pressure Required



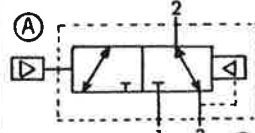
TYPE CD



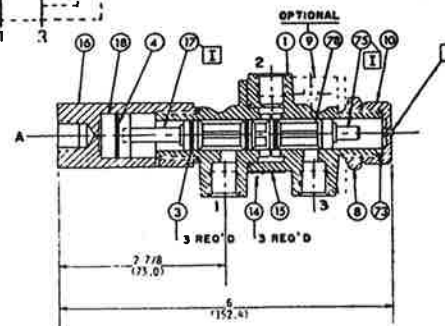
Manual or  
Pressure Operated  
Manual Return  
10 psi Pressure or  
6 lbs Force Required



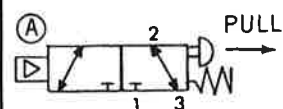
TYPE C1



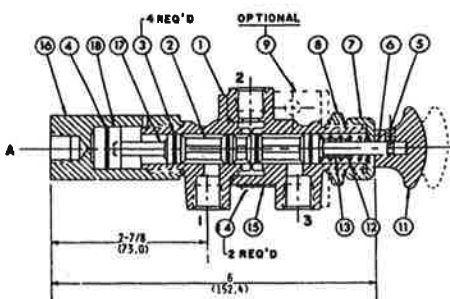
Normally Open  
Pressure Operated  
Internal Pressure Return



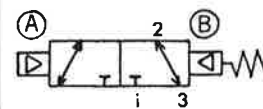
TYPE CE



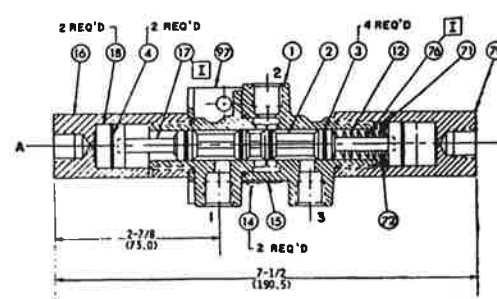
Manual or  
Pressure Operated  
Spring Return  
26 psi Pressure or  
16 lbs Force Required



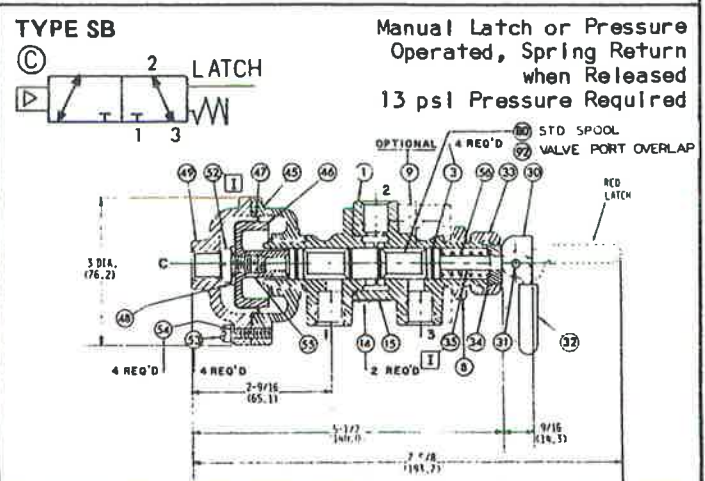
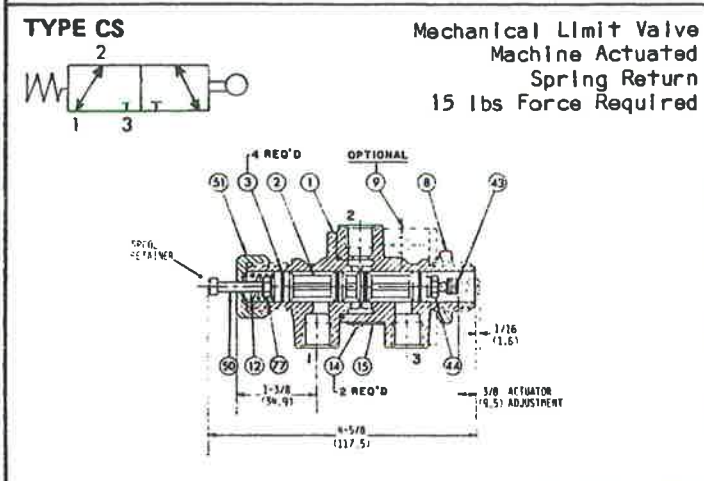
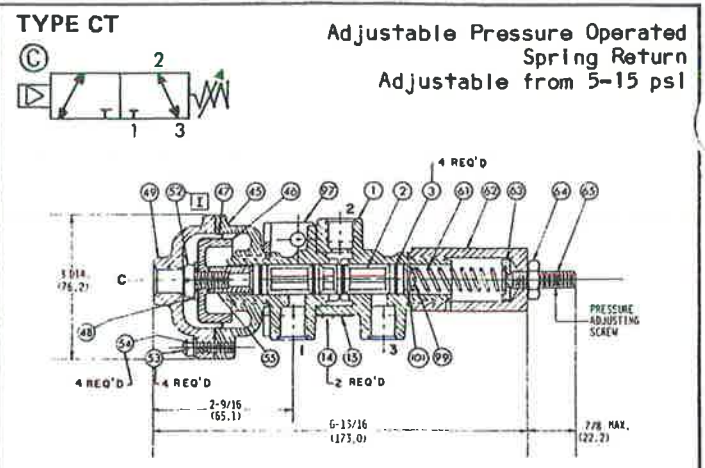
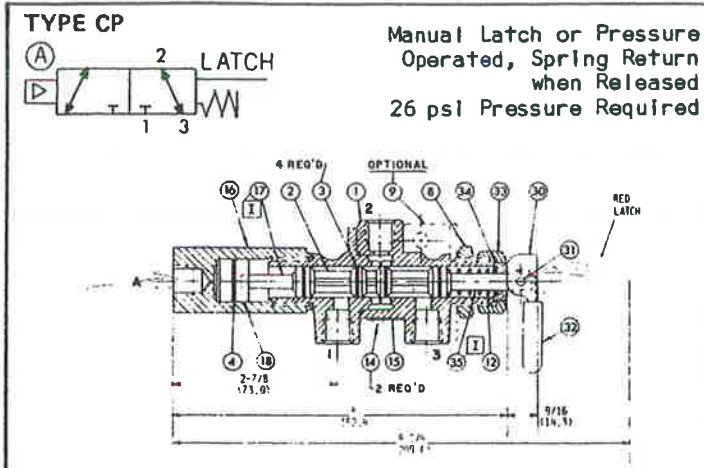
TYPE C2



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. C7C



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

50V-101/223/227/228/276

# 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(E,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

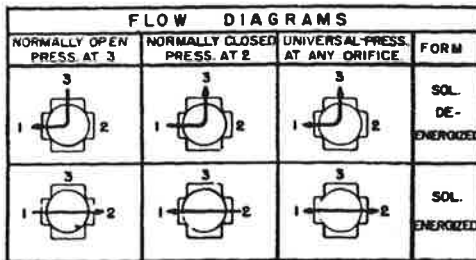
Connect pipe or tubing to valve according to markings on the valve body. Refer to flow diagrams above. Apply pipe compound or teflon tape sparingly to male pipe threads only. When tightening connections do not use the valve body or solenoid as a lever. Locate wrenches as close as possible to the connection 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, CATA. 32C				
WATT RATING	CATALOGUE I PREFIX	MAX. AMBIENT TEMP. F.	MAX. FLUID TEMP. F.	
			1/8 NPT	1/4 NPT
10.1 & 17.1	NONE, FB, KP, KP, SC, SD, SF, SP	125	180	200
10.1 & 17.1	HB, HT, KB, KH, SS, ST, SU	140	180	200
11.6 & 22.6	NONE, KB, KP, KP, SC, SD, SF, SP	104	120	150
11.6 & 22.6	HP, HT, KB, KH, SS, ST, SU, SV	104	120	150

\* MINIMUM AMBIENT TEMPERATURE - 40 F.

## INSTALLATION

Check nameplate for correct catalogue number, pressure, fluid and electrical service.

**ASCOELECTRIC limited**

P.O. Box 160, Brantford, Ontario N3T 5M8

(519)758-2700 fax (519)758-5540

**ASCO**

Printed in Canada

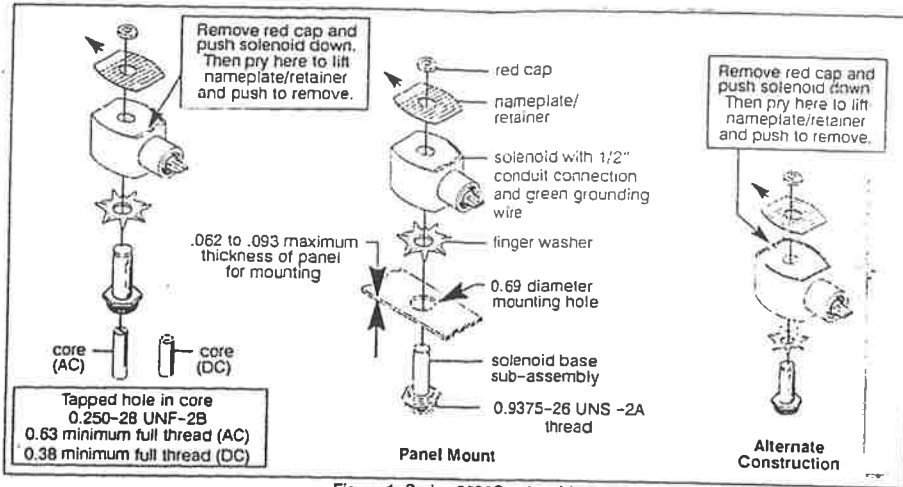


Figure 1. Series 8003G solenoids

**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

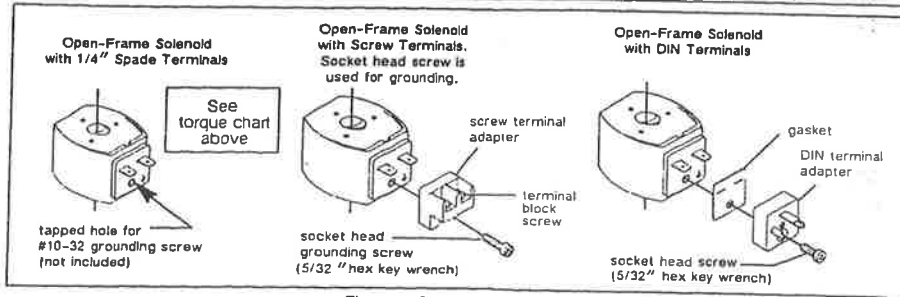


Figure 2. Open-frame solenoids

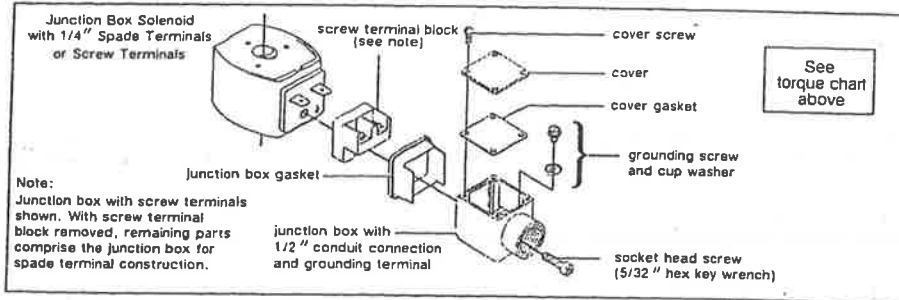


Figure 3. Junction box (optional feature)

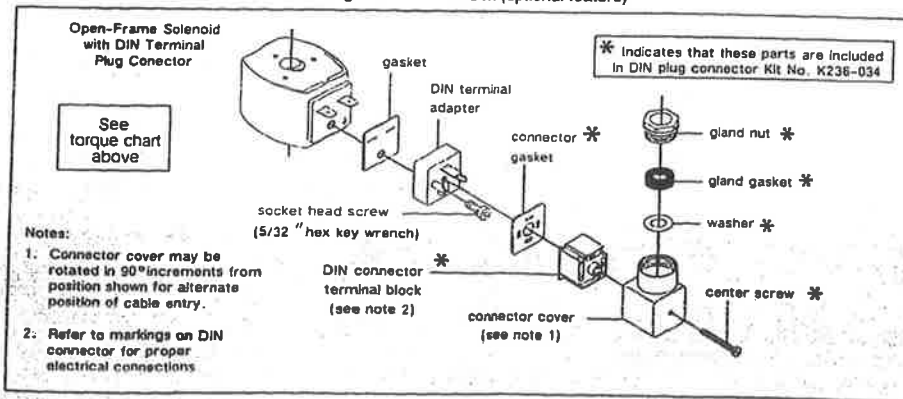


Figure 4. DIN plug connector kit No. K236-034 (optional feature)

**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.

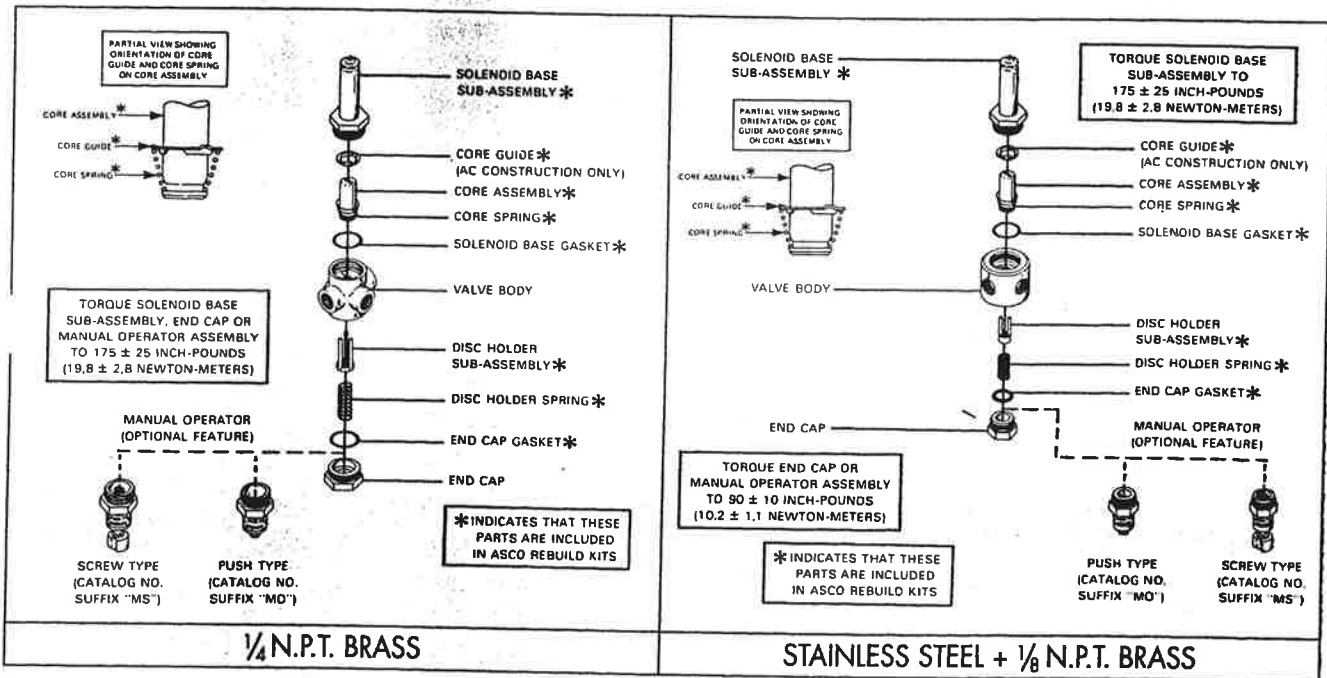


Fig. 5 Series 8320G Valves

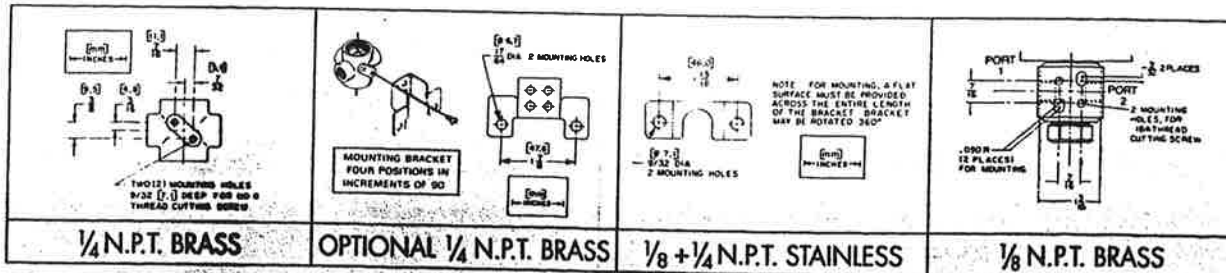


Fig. 6 Mounting

# 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, telles 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 généreusement 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 - Evitez 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 DIFFERENTIELLE 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 Electriques 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 inexate:** 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 PIECES 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.  
- a noter - Les pièces indiquées avec (\*) sur le dessin d'assemblage sont incluses dans l'ensemble de pièces de rechange.





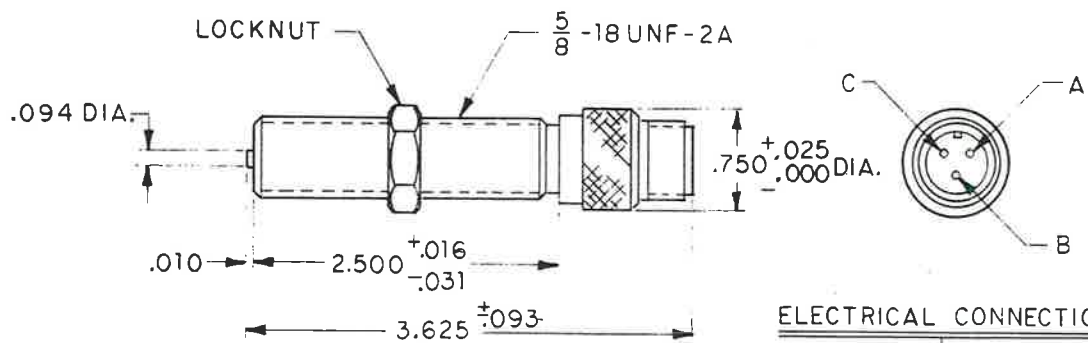


99420-152

SS-229

112337

DATE	BY	REVISION RECORD	AUTH.	DR.	CK.



**ELECTRICAL CONNECTIONS**

PIN A	+POWER SUPPLY
PIN B	OUTPUT
PIN C	COMMON

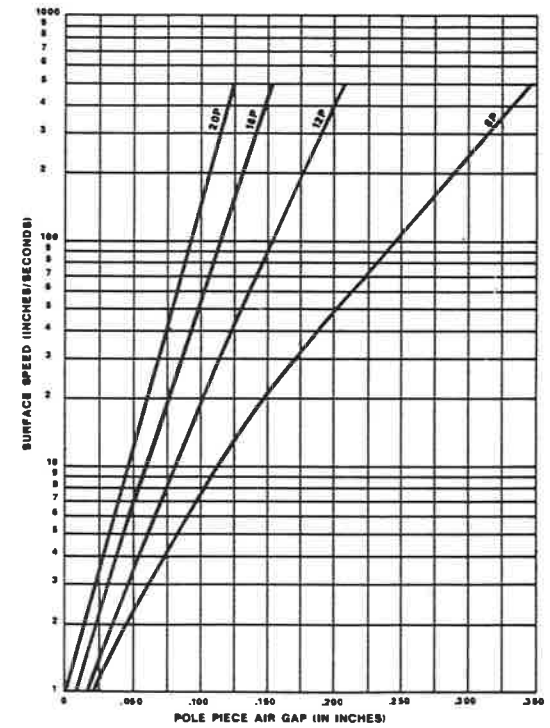
SPECIFICATIONS

POWER SUPPLY: 5 TO 15VDC.  
 OPERATING TEMPERATURE: -40°F TO +250°F  
 OUTPUT VOLTAGE: TTL COMPATIBLE, 50 ±10% DUTY CICLE.  
 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.



MATERIAL:	TOLERANCES (EXCEPT AS NOTED)	DYNALCO CONTROLS DIVISION		
	DECIMAL			
FINISH:	± .005	TITLE DIGITAL OUTPUT PICKUP M928	APPROVED BY <i>LIC 1/27/86</i>	
	FRACTIONAL		DATE	DRAWING NUMBER
	± 1/64	7-28-86	B 8000928	
	ANGULAR			
	± 1/2°			



PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		TEMPERATURE CONTROLLERS				SHEET 1 OF 1			
CUSTOMER : APACHE CANADA LIMITED PLANT : 1478HP HAMBURG COMPRESSOR PACKAGE SERVICE : TEMPERATURE CONTROLLER		NO	BY	DATE	REVISION	SPEC NO	FILE 14.11.T		
		1	SW	06/09/00	ISSUED FOR PURCHASE	JOB #	99420		
		2	CG	7/13/00	MODEL WAS HT-12T c/w 3PG	DATE	06/09/00		
						REQ.			
						BY	CHK'D	APPR.	
						SW			
1	TAG NO. : TC-210	AC-210 DISCHARGE TEMPERATURE							
2	FUNCTIONS	RECORD	INDICATE	CONTROL	X	BLIND	TRANS.		
3	CASE	MFR STD	X	NOM SIZE		COLOR : MFR STD	X	OTHER	
4	MOUNTING	FLUSH		SURFACE		YOKE		OTHER DIRECT	
5	ENCLOSURE CLASS	GENERAL PURPOSE		WEATHERPROOF	X	EXPLOSIONPROOF		CLASS	
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	
10	TRANSMITTER OUTPUT	4 - 20 mA		10 - 50 mA		21 - 103 kPa(ga)		42 - 206 kPa (ga)	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
12	ACTION	ON MEAS. INCREASE OUTPUT :	INCREASES		DECREASES	X			
13	AUTO - MAN SWITCH	NONE	X	MFR STD		OTHER			
14	SET POINT ADJ.	MANUAL	X	EXTERNAL		REMOTE		OTHER	
15	MANUAL REG.	NONE	X	MFR STD		OTHER			
16	OUTPUT	4 - 20 mA		10 - 50 mA		21 - 103 kPa(ga)		42 - 206 kPa (ga) X	OTHER
17	FILL	SAMA CLASS							
18	PROCESS DATA	TEMP: NORMAL	49 ° C	MAX.	113 ° C	MAX. PRESSURE	3412	kPa (g)	
19	RANGE	FIXED	-34 to 204 ° C	ADJ. RANGE		SET AT	49	° C	
20	BULB	OVERRANGE PROTECTION TO							
		TYPE	MTL	SST	EXTENSION:	LENGTH	mm	TYPE	
		SIZE: DIAMETER	10	mm	LENGTH	298	mm	INSERTION	mm
		CONN.		LOCATION	mm	ABOVE		BELOW	
21	CAPILLARY	MFR. STD		LENGTH	mm	MTL.		ARMOR	
22	WELL	MTL.	316SS	INSERTION	mm	LAG EXT.	mm	CONN. 27 mm	
		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						
26	MFR. & MODEL NO.	KIMRAY							
27	MODEL NO.	T-12 c/w SEPERABLE SOCKET							
28	P. O. NUMBER								
NOTES: 1. SOUR SERVICE.									
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.

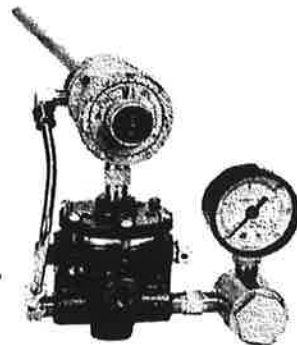
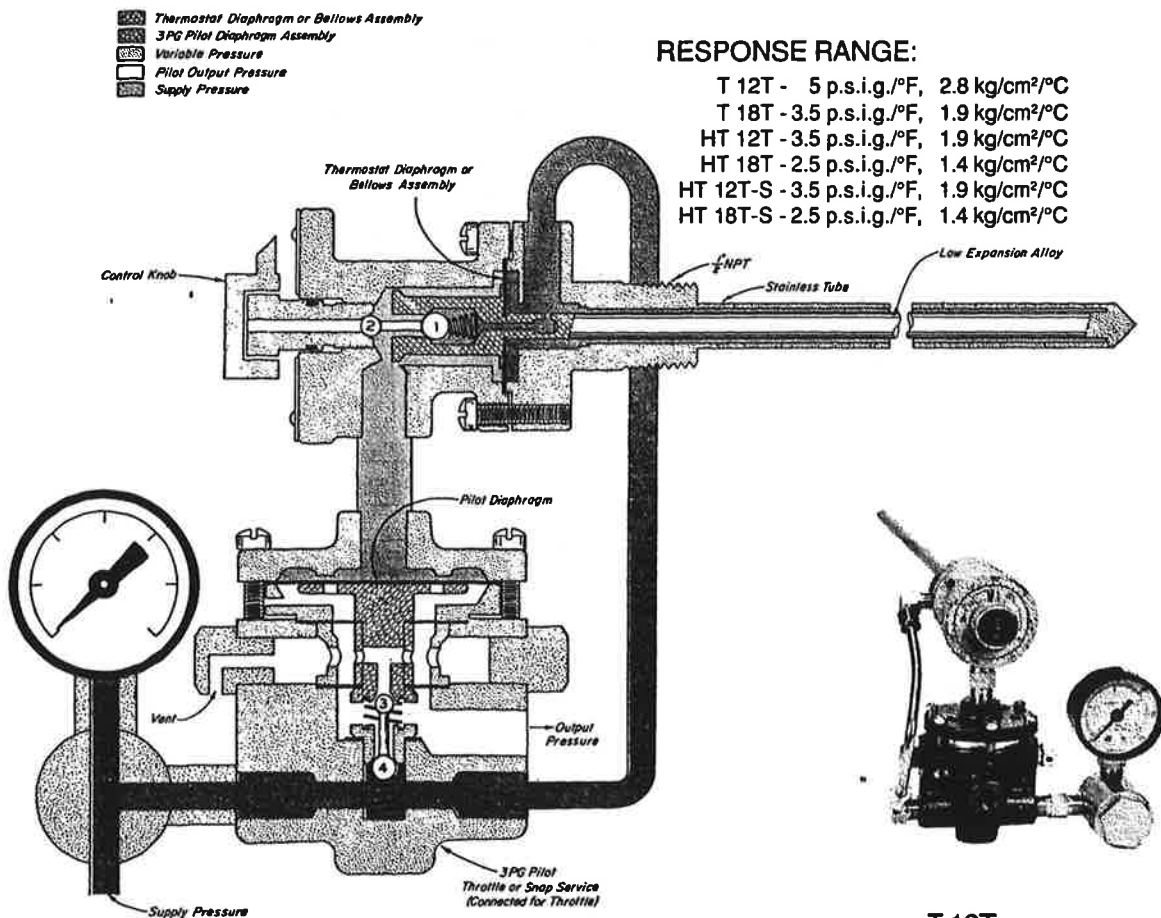
The 3 PG Pilot may be used for snap service when connected as a snapper pilot. For snap connection of the 3 PG Pilot refer to catalog section "Y".

**SUPPLY PRESSURE:**

5 to 30 p.s.i.g.
.35 to 2.11 kg/cm <sup>2</sup> .

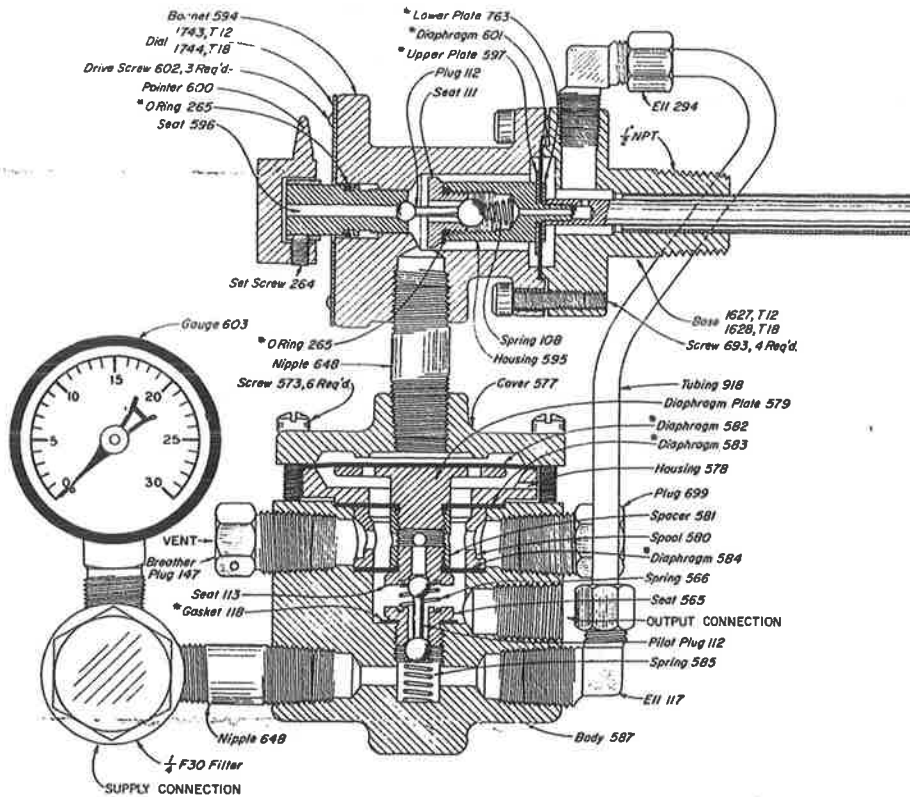
**RESPONSE RANGE:**

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

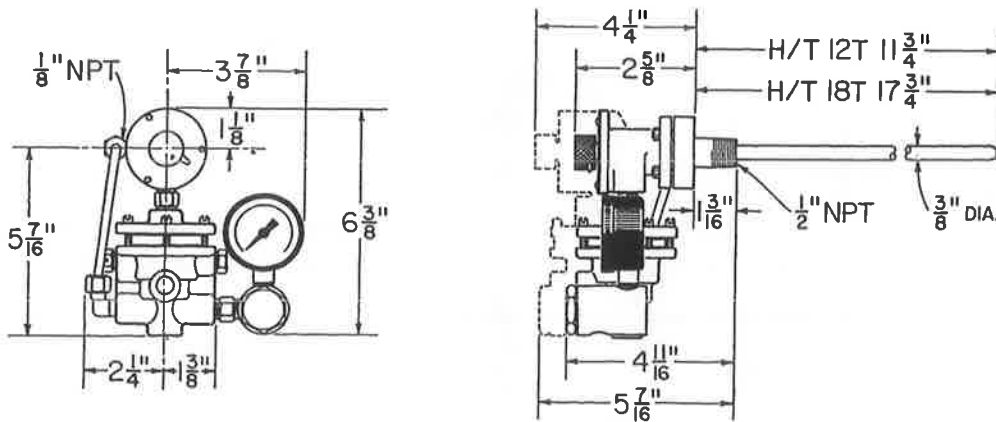


T 12T

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.

PROPAK SYSTEMS LTD POSTAL BAG # 2 AIRDRIE, ALBERTA, CANADA T4B 2C3			THERMOCOUPLE				SHEET 1 OF 1				
							SPEC NO		FILE 14.11.T		
CUSTOMER : PROPAK PLANT : 1478 HP STOCK COMPRESSOR SERVICE : THERMOCOUPLE			NO BY DATE REVISION			JOB # 99420					
			0 TK 02/02/00 FOR PURCHASE			DATE					
			1 CL 06/09/00 ADDED TE-225			REQ.					
						BY		CHK'D		APPR.	
1. COMPLETE ASSEMBLY X OTHER _____ HEAD 2. SCREWED COVER X OTHER _____ 3. EXPLOSION PROOF X CLASS I, DIV II, GR C&D 4. MATERIAL ALUMINUM COND. CONN. 27mm 5. NIPPLE SIZE N/A DIMENSION "N" 3048 mm NIPPLE NUN BCN BUN NCN N - NIPPLE B - BUSHING C - COUPLING ELEMENT 6. PLANTINUM NICKEL OTHER K-TYPE 7. ICE POINT RESISTANCE TOLERANCE % 8. TEMPERATURE RANGE 0-1260°C 9. LEADS : STD X POTTED HERM, SEALED			10. SHEATH MATERIAL 316SS O. D. 21mm NPT 11. MOUNTING THREAD 21mm NPT 12. CONSTRUCTION : 2 - WIRE X 3 - WIRE 4 - WIRE LEAD WIRE RECEPTACLE BAY LOCK OTHER WELL OR TUBE 13. MATERIAL 304SS 14. CONSTRUCTION: TAPERED STRAIGHT X DRILLED X BUILT-UP CLOSED-END 15. DIM : MFR STD X O. D. mm I. D. mm 16. INTERNAL THREAD 21mm NPT 17. PROCESS CONNECTION AS LISTED BELOW								

TAG NO.	REV	MODEL NO.	WELL DIMENSIONS		ELEMENT LENGTH	SINGLE	DUAL	SERVICE	NOTES	PROCESS CONNECTION
			"U" mm	"T"						
TE-282	0	AI-8113-U-14-120"-K-4.0"	64			X		COMP LUBE OIL		27mm NPT
TE-225	1	AI-8113-U-14-180-K-10"	178			X				27mm NPT

MFR: ALLTEMP

MODEL NUMBER: SERIES 8000 K-TYPE THERMOCOUPLE ASSEMBLIES C/W THERMOWELLS

P.O. NUMBER:

NOTES:

PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, 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 #	99420
		1	GWW	00.09.26	ISSUED FOR PURCHASE	DATE	SEPTEMBER 26, 2000
						REQ.	
						BY	CHK'D APPR.
						GW	
1	TAG NO.: TE - 282	COMPRESSOR CRANKCASE LUBE OIL TEMPERATURE					
2	FUNCTIONS	RECORD	INDICATE	CONTROL	BLIND	TRANS.	
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
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	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
12	ACTION	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	73 ° C	MAX. 88 ° C	MAX. PRESSURE	689 kPa (g)	
20	BULB	FIXED	0 - 1260 C	ADJ. RANGE	SET AT	82 ° C	
21	CAPILLARY	OVERRANGE PROTECTION TO _____					
22	WELL	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
		MFR. STD	X	LENGTH	1524 mm	MTL.	ARMOR FLEXIBLE
		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		
26	MFR. & MODEL NO.	ATS ALLTEMP - SERIES 8000					
27	MODEL NO.	THERMOCOUPLE P/N: AI-8113-U-14-36"-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							



TE-100/110/120/122A/B  
124/126/205/282

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# THERMO-KINETICS INDUSTRIAL THERMOCOUPLES

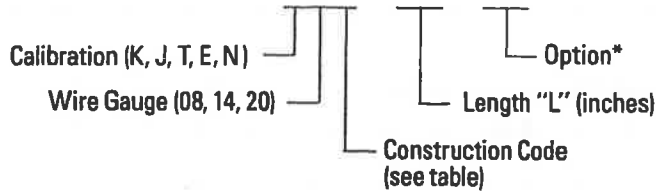
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*Sensible Solutions to Temperature Measurement*



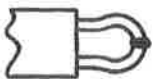
**THERMO-KINETICS**  
COMPANY LIMITED

(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><b>*OPTION</b> for angle-type specify "X" length in inches eg: X18</p>

Standard construction is butt-weld with oval insulators (type B)

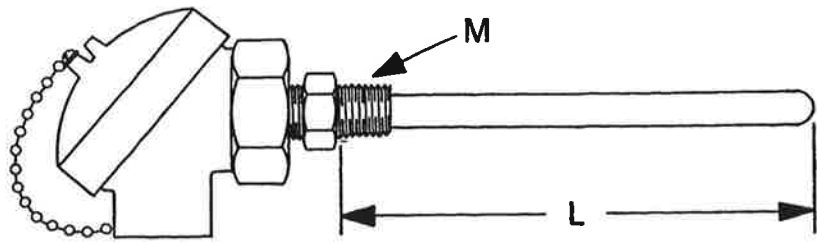


Butt-welded junction

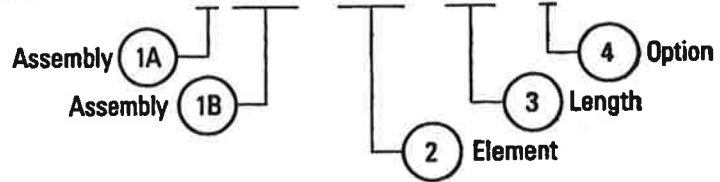


Twist-welded junction





(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

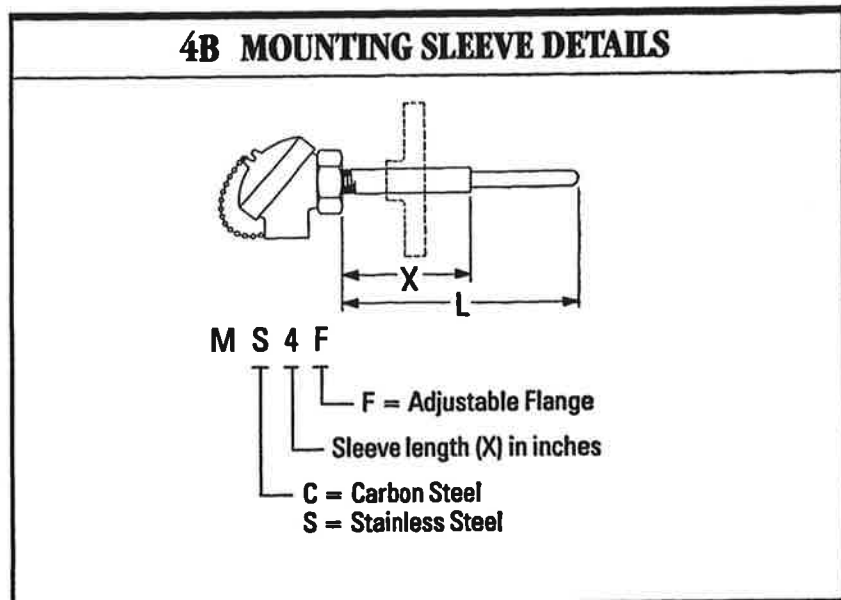
3 LENGTH
Specify length "L" in inches.

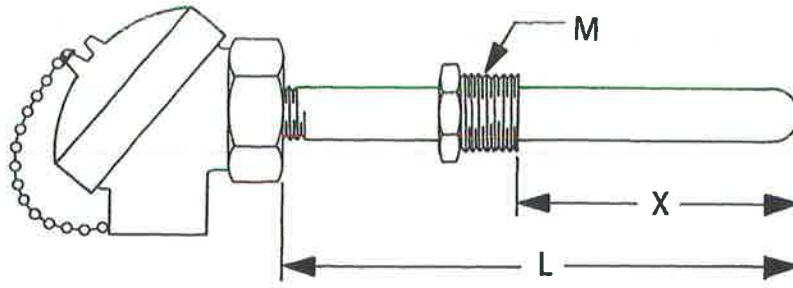
Standard lengths: 12-48" in 6" increments

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

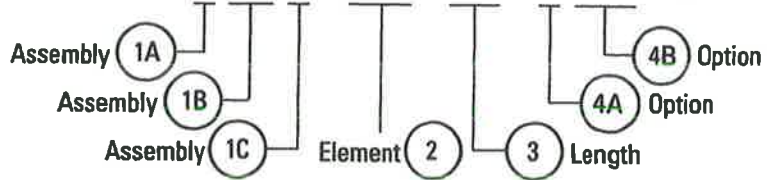
1B PROTECTION TUBE			
CODE	MATERIAL (O.D.×I.D.)	"M"	REPLACEMENT P/N
5130	Mullite (3/8"×1/4")	3/4" NPT	CP-0604-32-"L"
5230	Mullite (11/16"×7/16")	3/4" NPT	CP-1107-32-"L"
5240	Mullite (11/16"×7/16")	1" NPT	CP-1107-42-"L"
5350	Mullite (1"×3/4")	1-1/4" NPT	CP-1612-53-"L"
6130	Alumina (3/8"×1/4")	3/4" NPT	AP-0604-32-"L"
6230	Alumina (11/16"×7/16")	3/4" NPT	AP-1107-32-"L"
6240	Alumina (11/16"×7/16")	1" NPT	AP-1107-42-"L"
6350	Alumina (1"×3/4")	1-1/4" NPT	AP-1612-53-"L"
7400	Silicon Carbide (1 3/4"×1")	—	SP-2816-SC-"L"





(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)

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

2 ELEMENT	
See details on page 2	

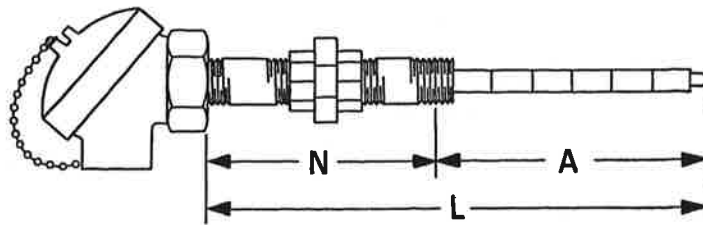
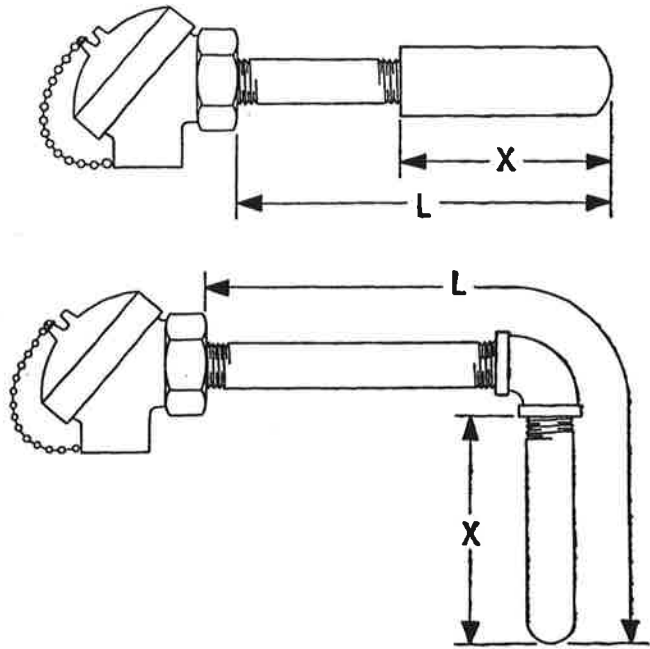
3 LENGTH	
Specify length "L" in inches.	

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)

4B WELDED BUSHING DETAILS (for opt. B only)	
<p><b>B 4 S 16</b></p> <p>"X" length in inches</p> <p>MATERIAL: C = Carbon Steel S = Stainless Steel</p> <p>THREAD SIZE: 2: 1/2" NPT 4: 1" NPT (M) 3: 3/4" NPT 5: 1-1/4" NPT</p>	

- P C 12

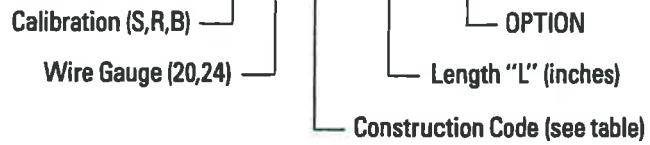
"X" length (inches)  
 MATERIAL: C = Carbon steel  
 S = Stainless steel  
 P = Pipe Extension  
 A = Angle Type



(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)

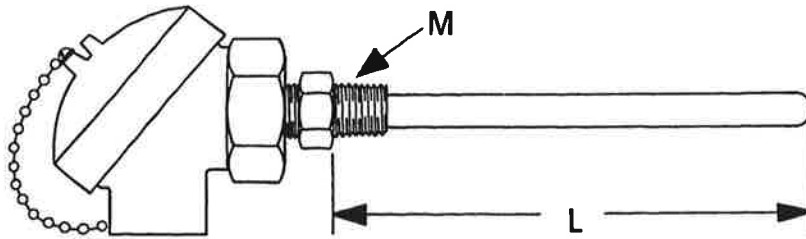
(Sample Configuration) **CATALOG NUMBER:** TK - S 24 X - 24.0 - 0



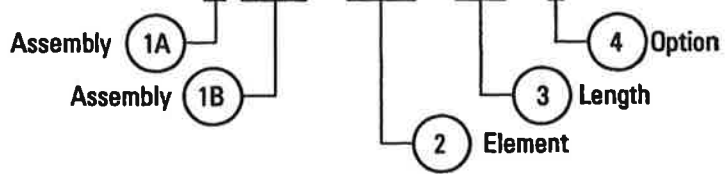
CONSTRUCTION CODE		
CODE	DESCRIPTION	ILLUSTRATION
T	Bare element	
U	Mullite, double bore full length insulator	
V	Alumina, double bore full length insulator	
W	Mullite, double bore full length insulate with collar	
X	Alumina, double bore full length insulator with collar	
Y	Mullite 4 bore full length 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)



(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

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"

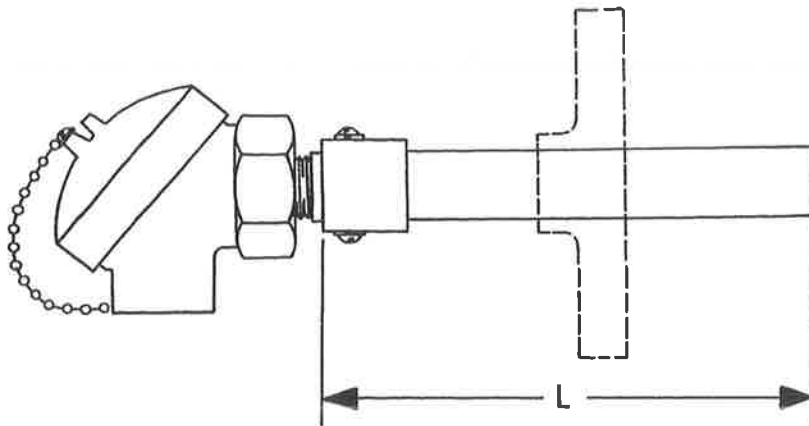
2 ELEMENT
See details on page 6

3 LENGTH
Specify length "L" in inches.

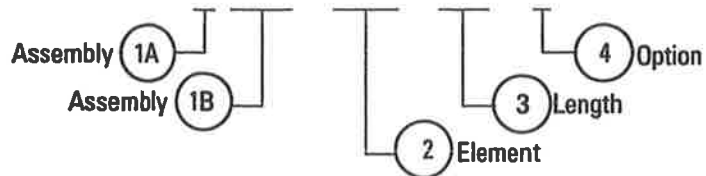
Standard lengths: 12-48" in 6" increments

4A OPTIONS	
CODE	DESCRIPTION
0	None
M	Mounting Sleeve (see 4B)
X	Special (describe in detail)

4B MOUNTING SLEEVE DETAILS	
<p>M S 4 F</p> <p>F = Adjustable Flange</p> <p>Sleeve length (X) in inches</p> <p>C = Carbon Steel</p> <p>S = Stainless Steel</p>	



(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.

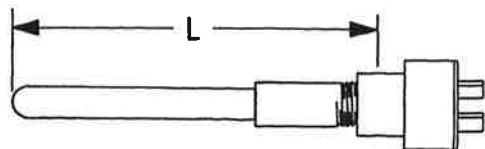
\*\*For SiC outer tube only

Standard lengths: 12-48" in 6" increments

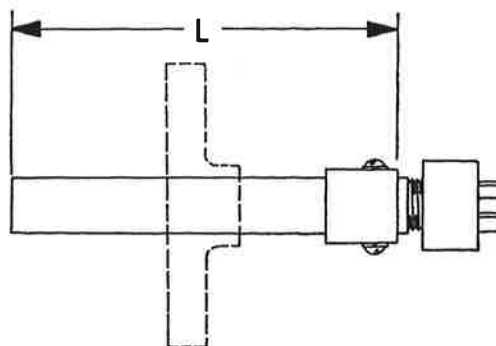
1B PROTECTION TUBES								
CODE	PRIMARY (INNER) TUBE				SECONDARY (OUTER) TUBE			
	MATERIAL	O.D.	I.D.	REPLACEMENT P/N	MATERIAL	O.D.	I.D.	REPLACEMENT P/N
513M	Mullite	3/8"	1/4"	CP-0604-00-"L"	Mullite	11/16"	7/16"	CP-1107-32-"L"
513R				CP-0604-00-"L"	Alumina	11/16"	7/16"	AP-1107-32-"L"
513S				CP-0604-42-"L"	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.



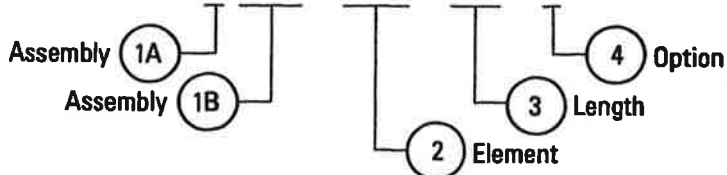


**SINGLE PROTECTION TUBE**



**DOUBLE PROTECTION TUBE**

(Sample Configuration) **CATALOG NUMBER: TA - E 5220 - R24X - 36.0 - 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"

### 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

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.

<b>LIMITS • OF • ERROR</b>				
<b>TC TYPE</b>	<b>TEMPERATURE RANGE</b>		<b>LIMITS-OF-ERRORS*</b>	
	<b>°C</b>	<b>°F</b>	<b>STANDARD</b>	<b>SPECIAL</b>
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 -200 to 0°C	32 to 2300°F -330 to 32°F	±0.75% or 2.2°C (4°F) ±2% or 2.2°C (4°F)	±0.4% or 1.1°C (2°F) —
T	0 to 350°C -200 to 0°C	32 to 200°F -330 to 32°F	±0.75% or 2.2°C (4°F) 1.5% or 1°C (1.8°F)	±0.4% or 1.1°C (2°F) —
E	0 to 900°C -200 to 0°C	32 to 1100°F -330 to 32°F	±0.5% or 1.7°C (3°F) ±1% or 1.7°C (3°F)	±0.4% or 1.1°C (2°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

<b>MAXIMUM TEMPERATURE LIMITS</b>								
<b>TC TYPE</b>	<b>RECOMMENDED MAXIMUM TEMPERATURE LIMITS</b>							
	<b>8 GAUGE (.125")</b>		<b>14 GAUGE (.064")</b>		<b>20 GAUGE (.032")</b>		<b>24 GAUGE (.020")</b>	
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



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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



PROPAK SYSTEMS LTD POSTAL BAG # 2, AIRDRIE, ALBERTA, CANADA T4B 2C3		TEMPERATURE INSTRUMENTS ( FILLED SYSTEM )				SHEET _____ OF _____					
CUSTOMER : APACHE CANADA LIMITED PLANT : 2-6 HAMBURG COMPRESSOR STATION SERVICE : 1478HP COMPRESSOR PACKAGE		NO	BY	DATE	REVISION	SPEC NO	FILE 14.11.T				
		0	GWW	00.10.02	FOR PURCHASE	JOB #	99420				
						DATE					
						REQ.					
					BY	CHK'D	APPR.				
					GWW						
1	TAG NO.	TIC/TE-225 AIR COOLER PLENUM TEMPERATURE									
2	FUNCTIONS	RECORD	INDICATE	X	CONTROL	X	BLIND	TRANS.			
3	CASE	MFR STD	X	NOM SIZE	COLOR : MFR STD	X	OTHER				
4	MOUNTING	FLUSH		SURFACE	YOKE		OTHER	WALL MOUNT			
5	ENCLOSURE CLASS	GENERAL PURPOSE		WATERPROOF	X	EXPLOSIONPROOF		CLASS			
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					
X	10	TRANSMITTER OUTPUT	4 - 20 mA	10 - 50 mA	3 - 15 psi(g)	6 - 30 psi(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	
				X							
		OTHER									
R	12	ACTION	ON MEAS. INCREASE OUTPUT :	INCREASES	X	DECREASES					
O	13	AUTO - MAN SWITCH	NONE	X	MFR STD	OTHER					
L	14	SET POINT ADJ.	MANUAL	X	EXTERNAL	REMOTE	OTHER				
L	15	MANUAL REG.	NONE	X	MFR STD	OTHER					
E	16	OUTPUT	4 - 20 mA	10 - 50 mA	3 - 15 psi(g)	6 - 30 psi(g)	X	OTHER			
R											
17	FILL	SAMA CLASS	COMPENSATION								
E	18	PROCESS DATA	TEMP: NORMAL	65	° F	MAX. 10-100	° F	MAX. PRESSURE ATM	psi(g)		
L	19	RANGE	FIXED	0 to 100	° F	ADJ. RANGE		SET AT	65	° F	
E			OVERRANGE PROTECTION TO								
M	20	BULB	TYPE	STD	MTL.	SS	EXTENSION:	LENGTH	in.	TYPE	
			SIZE: DIAMETER	9/16	in.	LENGTH	7.0	in.	INSERTION	in.	
			CONN.		LOCATION		in.	ABOVE		BELOW	
N	21	CAPILLARY	MFR. STD	X	LENGTH	180	in.	MTL.	SS	ARMOR	X
T	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 #:											

TIC/TE-225

**Fisher Controls**

Instruction Manual

**4196A, B, C, and S Series  
Temperature Indicating  
Controllers**



November 1989

Form 5216

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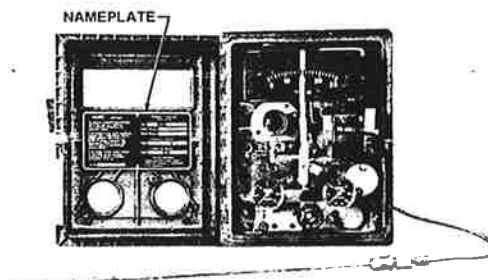
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WS495-1

**PIPESTAND-MOUNTED CONTROLLER**



WS496\*

**INTERIOR OF CONTROLLER**

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**Principle of Operation: Differential Gap**

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**Section 1  
 Introduction**

**Scope of Manual**

This instruction manual provides installation, operating, calibration, maintenance, and parts ordering information for the 4196A, B, C, and S Series temperature indicating controllers. Portions of this manual apply only to specific configurations in the 4196 Series product line. A typical controller is shown in figure 1-1.

The different configurations of the 4196 Series controller are indicated by letter suffixes in the type number that correspond to the mode and option designated in table 1-1. Refer to table 1-1 for the definition of each 4196 Series type number.

The type number of the controller is on the nameplate. Refer to figure 1-1 for the location of the nameplate.

**Note**

**Only personnel qualified through training or experience should install, operate, and maintain this controller. If there are any**

**questions concerning these instructions, contact your Fisher sales representative or sales office before proceeding.**

**Description**

The controllers described in this manual provide:

- Proportional-only control (4196A Series),
- Proportional-plus-reset control (4196B Series)
- Proportional-plus-reset-plus-rate control (4196C Series)
- Differential gap control (4196S Series)

Specific type numbers are shown in table 1-1.

Each unit in this product family shows process temperature and set point on an easy-to-read process scale. The controller output is a pneumatic signal that operates a final control element.

**Specifications**

Specifications for the 4196A, B, C, and S Series controllers are listed in table 1-2.



Table 1-1. Available Configurations

TYPE NUMBER <sup>(1)</sup>	MODES				OPTIONS		
	Proportional-Only Suffix Letter A	Proportional-Plus-Reset Suffix Letter B	Proportional-Plus-Reset-Plus-Rate Suffix Letter C	Differential Gap Suffix Letter S	Anti-Reset Windup Suffix Letter F	Remote Set Point Suffix Letter M	Internal Auto/Manual Station Suffix Letter E
4196A	X	---	---	---	---	---	---
4196AE	X	---	---	---	---	---	X
4196AM	X	---	---	---	---	X	---
4196AME	X	---	---	---	---	X	X
4196B	---	X	---	---	---	---	---
4196BE	---	X	---	---	---	---	X
4196BF	---	X	---	---	X	---	---
4196BFE	---	X	---	---	X	---	X
4196BM	---	X	---	---	---	X	---
4196BME	---	X	---	---	---	X	X
4196BFM	---	X	---	---	X	X	---
4196BFME	---	X	---	---	X	X	X
4196C	---	---	X	---	---	---	---
4196CE	---	---	X	---	---	---	X
4196CF	---	---	X	---	X	---	---
4196CFE	---	---	X	---	X	---	X
4196CM	---	---	X	---	---	X	---
4196CME	---	---	X	---	---	X	X
4196CFM	---	---	X	---	X	X	---
4196CFME	---	---	X	---	X	X	X
4196S	---	---	---	X	---	---	---
4196SE	---	---	---	X	---	---	X
4196SM	---	---	---	X	---	X	---
4196SME	---	---	---	X	---	X	X

1. Reverse-acting constructions are designated by the suffix letter R in the type number.

Table 1-2. Specifications

<p><b>Available Configurations</b></p> <p>See table 1-1</p> <p><b>Input Signal<sup>(1)</sup></b></p> <p><b>Type:</b> Temperature between -100 and 700°F (-75 and 370°C). See table 1-3 for available ranges</p> <p><b>Minimum Span:</b> 100°F or 60°C</p> <p><b>Maximum Span:</b> 600°F or 300°C</p> <p><b>Process Scale</b></p> <p>Matched to the range of the sensing element as standard. Optional<sup>(2)</sup> scales available</p> <p><b>Output Signal: Proportional, Proportional-Plus-Reset, or Proportional-Plus-Reset-Plus-Rate<sup>(1)</sup></b></p> <p><b>Range:</b> 3 to 15 psig (0.2 to 1.0 bar) or 6 to 30 psig (0.4 to 2.0 bar)</p> <p><b>Action:</b> Field-reversible between direct (increasing sensed temperature increases output pressure) or reverse (increasing sensed temperature decreases output pressure)</p> <p><b>Output Signal: Differential Gap<sup>(1)</sup></b></p> <p><b>Range:</b> 0 and 20 psig (0.0 and 1.4 bar) or 0 and 35 psig (0.0 and 2.4 bar)</p>	<p><b>Action:</b> Field-reversible between direct (increasing sensed temperature increases output pressure) or reverse (increasing sensed temperature decreases output pressure)</p> <p><b>Supply and Output Connections</b></p> <p>1/4-inch NPT female</p> <p><b>Supply Pressure Requirements</b></p> <p>See table 1-4</p> <p><b>Remote Set Point Pressure Ranges</b></p> <p>3 to 15 psig (0.2 to 1.0 bar) or 6 to 30 psig (0.4 to 2.0 bar)</p> <p><b>Maximum Allowable Pressure In Closed Vessel (For Temperature Bulb)<sup>(4)</sup></b></p> <p><b>3/8-inch (9.7 mm) Diameter Temperature Bulb:</b> 1000 psig (69 bar)</p> <p><b>9/16-inch (14.3 mm) Diameter Temperature Bulb:</b> 500 psig (34.5 bar)</p> <p>Also, see tables 2-1 and 2-2</p>
--	--

- Continued -

Table 1-2. Specifications (Continued)

<p><b>Controller Adjustments</b></p> <p><b>Proportional Band<sup>(1)</sup>:</b> 5 to 500% of process scale range</p> <p><b>Reset<sup>(1)</sup>:</b> Adjustable from 0.01 to 74 minutes per repeat (from 100 to under 0.0135 repeats per minute)</p> <p><b>Rate<sup>(1)</sup>:</b> Adjustable from 0 to 20 minutes</p> <p><b>Differential Gap Controller<sup>(1)</sup>:</b> 5 to 100% of process scale range</p> <p><b>Set Point:</b> Continuously adjustable from 0 to 100% of the scale range</p>	<p><b>Differential Gap Controllers (S Series Controllers)</b></p> <p><i>0 and 20 psig (0.0 and 1.4 Bar) Output: 3.5 scfh (0.1 m<sup>3</sup>/h)</i></p> <p><i>0 and 35 psig (0.0 and 2.4 Bar) Output: 5.0 scfh (0.14 m<sup>3</sup>/h)</i></p>
<p><b>Controller Performance</b></p> <p><b>Repeatability<sup>(1)</sup>:</b> 0.4% of output span</p> <p><b>Dead Band<sup>(1)</sup>:</b> Less than 0.3% of input span</p> <p><b>Time Constant of Temperature Bulb:</b> 6 to 12 seconds for a 200°F (110°C) span (bare bulb in agitated liquid)</p>	<p><b>Delivery Capacity<sup>(2)</sup>: All 4196 Series</b></p> <p><b>3 to 15 psig (0.2 to 1.0 Bar) Output: 210 scfh (5.9 m<sup>3</sup>/h)</b></p> <p><b>6 to 30 psig (0.4 to 2.0 Bar) Output: 370 scfh (10.4 m<sup>3</sup>/h)</b></p> <p><b>Exhaust Capacity<sup>(3)</sup>: All 4196 Series</b></p> <p><b>3 to 15 psig (0.2 to 1.0 Bar) Output: 170 scfh (4.6 m<sup>3</sup>/h)</b></p> <p><b>6 to 30 psig (0.4 to 2.0 Bar) Output: 260 scfh (7.0 m<sup>3</sup>/h)</b></p>
<p><b>Steady-State Air Consumption: A, B, and C Series Controllers<sup>(1)(3)</sup></b></p> <p><b>Without Auto/Manual Station</b></p> <p><i>3 to 15 psig (0.2 to 1.0 Bar) Output: 3.5 scfh (0.1 m<sup>3</sup>/h)</i></p> <p><i>6 to 30 psig (0.4 to 2.0 Bar) Output: 5.0 scfh (0.14 m<sup>3</sup>/h)</i></p> <p><b>With Auto/Manual Station (suffix letter E)</b></p> <p><i>3 to 15 psig or 6 to 30 psig (0.2 to 1.0 Bar or 0.4 to 2.0 Bar) Output: 10.0 scfh (0.28 m<sup>3</sup>/h)</i></p>	<p><b>Operative Ambient Temperature Limits<sup>(1)</sup></b></p> <p>– 40 to 160°F (– 40 to 71.1°C)</p> <p><b>Mounting</b></p> <p>Controller can be mounted on pipestand, panel, wall, or actuator. See figures 2-1, 2-2, 2-3, and 2-4.</p> <p><b>Approximate Weight</b></p> <p>10 pounds (4.5 kg)</p>
<p>1. These terms are defined in ISA Standard S51.1:1979.</p> <p>2. Consult your Fisher sales office or sales representative for additional information.</p>	<p>3. Scfh at 60°F, 14.7 psia (m<sup>3</sup>/h at 0°C, 1.01325 bar, absolute).</p> <p>4. At 100°F (40°C).</p>



Table 1-3. Available Temperature Ranges of Temperature Bulbs<sup>(1)</sup>

TEMPERATURE SPANS		STANDARD OPERATING RANGES	TEMPERATURE RANGE LIMITS <sup>(2)</sup>		TEMPERATURE BULB DIAMETER	OVERRANGE LIMITS <sup>(3)</sup>		MAXIMUM TEMPERATURE <sup>(4)</sup>
	°F	°F	°F Minimum	°F Maximum	Inch	°F Minimum	°F Maximum	°F
English Units	100	0 to 100	-25	200	9/16	-10	150	375
		50 to 150				40	200	
		100 to 200				90	250	
	150	50 to 200	-25	225		35	275	
		0 to 150				-15	225	
		---				75	300	
	200	0 to 200	0	300	3/8	-20	300	450
		50 to 250				30	350	
		100 to 300				80	400	
	300	0 to 300	-25	325	9/16	-30	450	750
	300	-100 to 200	-100	275		-130	350	
		100 to 400	25	400		70	550	
400	0 to 400	-100	450	-40	600	1000		
500	0 to 500	-100	600	-50	750			
600	0 to 600	-100	700	-60	900	1100		
	°C	°C	°C Minimum	°C Maximum	mm	°C Minimum	°C Maximum	°C
Metric Units	60	-20 to 40	-30	95	14.3	-26	70	190
		0 to 60				-6	90	
		60 to 120				38	150	
	100	-15 to 85	-15	150	9.5	-25	135	230
		0 to 100				-10	150	
		50 to 150				40	200	
	150	0 to 150	-30	160	14.3	-15	225	400
	150	-75 to 75	-75	135		-90	150	
		50 to 200	-5	200		35	275	
	200	0 to 200	-75	230	-20	300	535	
	250	0 to 250	-75	315	-25	375		
	300	0 to 300	-75	370	-30	450	590	

1. Contact your Fisher sales office or sales representative about other spans and ranges.  
 2. Temperature spans can be specified between the minimum and maximum values.  
 3. All temperature bulbs are tested to +50 percent of overrange limits. With travel stops in place, if the overrange limits are exceeded, the controller may require recalibration.  
 4. With travel stops in place, temperatures in excess of these values may cause permanent damage to the temperature element.

Table 1-4. Supply Pressure Data

Output Signal Range		Normal Operating Supply Pressure <sup>(1)</sup>	Maximum Pressure To Prevent Internal Damage <sup>(2)</sup>
Psig	3 to 15	20	40
	6 to 30	35	40
Bar	0.2 to 1.0	1.4	2.8
	0.4 to 2.0	2.4	2.8

1. If this pressure is exceeded, control may be impaired.  
 2. If this pressure is exceeded, damage to the controller may result.

## Section 2 Installation, Mounting, and Connections

### Standard Installation

The controllers should be mounted with the housing vertical (as shown in figures 2-1, 2-2, 2-3, and 2-4) so that the vent points down.

### Pipestand Mounting

Refer to figure 2-1. Pipestand mounting parts are provided to mount the controller to a 2-inch (nominal) pipe. Attach a bracket (key 68) to the controller with cap screws (key 66) and lock washers (key 67). Attach two clamps (key 69) to the bracket, and fasten the controller to the pipe.

### Panel Mounting

Refer to figure 2-2. Cut a hole in the panel surface using the dimensions shown in figure 2-2. Slide the controller into the hole, and attach the bracket (key 68) to the rear of the controller using three cap screws (key 66) and washers (key 67). Tighten the screws (key 70) to seat the case snugly and evenly against the panel surface.

### Wall Mounting

Refer to figure 2-3. Drill holes in the wall (using the dimensions in figure 2-3) to align with the four holes in the bracket (key 68). If the tubing is to run through the wall, drill a hole in the wall large enough to accept the tubing.

Mount the controller to the bracket using three cap screws (key 66) and lock washers (key 67). Attach the bracket to the wall, using suitable screws or bolts.

### Actuator Mounting

Refer to figure 2-4. Controllers specified for mounting on a control valve actuator are mounted at the factory. If the controller is ordered separately for installation on a control valve actuator, mount the unit as described in this section. Mounting parts vary for different actuator types.

Attach the mounting bracket to the actuator yoke with cap screws, lock washers, and spacer spools. Attach the controller to the bracket with cap screws, lock washers, and spacer spools. On some designs, the mounting bracket is attached to the actuator casing rather than to the yoke.

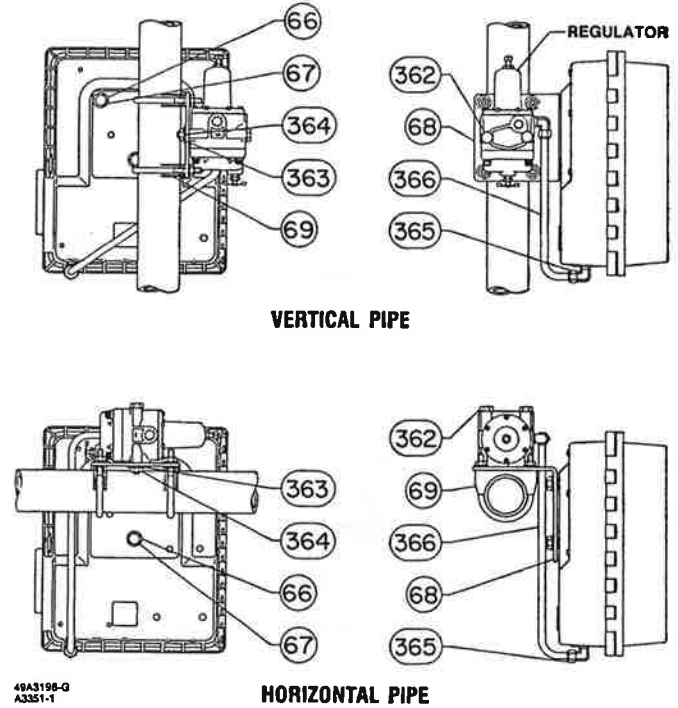


Figure 2-1. Pipestand Mounting

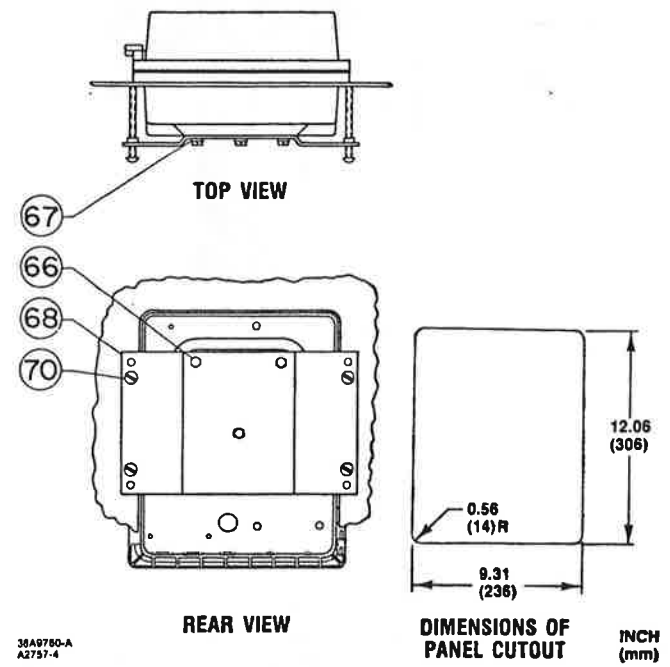


Figure 2-2. Panel Mounting

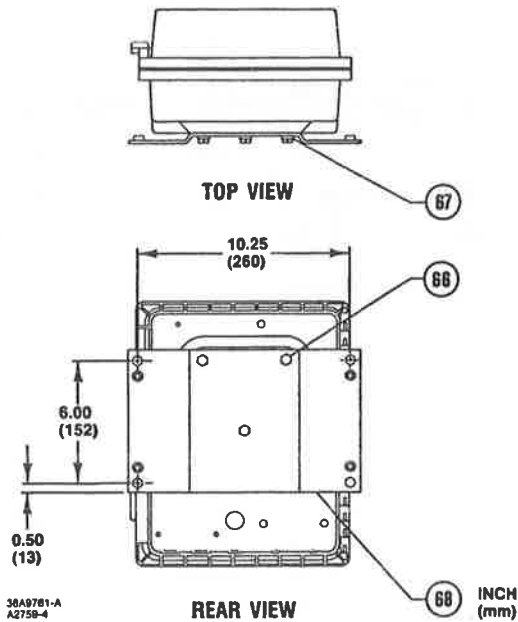


Figure 2-3. Wall Mounting

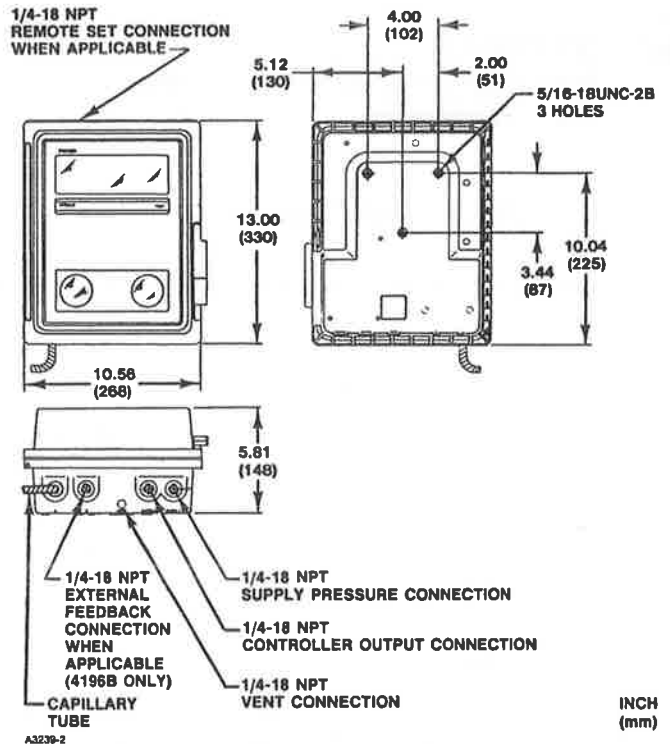


Figure 2-5. Location of Connections

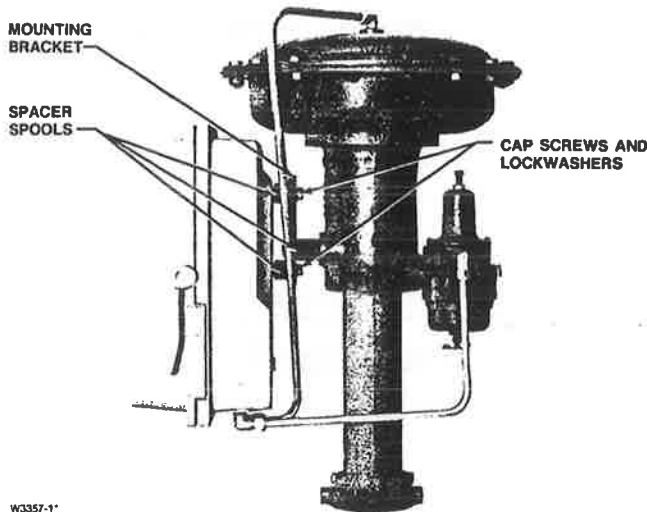


Figure 2-4. Typical Actuator Mounting

## Connections

### Piping

Refer to figure 2-5 for piping connection locations. All pressure connections on 4196 Series controllers are 1/4-inch NPT female. Use 1/4-inch or 3/8-inch pipe or tubing for supply, output, and remote set point piping. Use 1/2-inch pipe for the remote vent pipe, if one is required.

## Temperature Sensing Bulb, Bushings, and Thermowells

### WARNING

Failure of the thermowell may result in personal injury or equipment damage due to escaping process fluid. To avoid such injury or damage, be sure the process fluid velocity and pressure are within the thermowell limits in tables 2-1 and 2-2.

Process temperature is sensed by a temperature element consisting of a bulb immersed in the process fluid, a bendable extension, and an armored capillary tube (see figure 6-22). When the temperature bulb is to be placed within a closed vessel, bushings are available to attach the bulb to the vessel. The bushing (dimensions are shown in figure 2-6) penetrates the vessel and the temperature element is attached to the bushing with a threaded connection.

If the process pressure exceeds the limitations of the temperature bulb, or if the process fluid is corrosive, a thermowell (dimensions are shown in figure 2-6) is recommended which penetrates the vessel and isolates the temperature bulb from the process fluid. Table 2-1 lists process fluid velocities for thermowells. Table 2-2 lists maximum process pressures for thermowells.

BUSHING						
TEMPERATURE BULB DIA.		DIMENSION				
		A(1)	B		C	
Inch	mm		Inch	mm	Inch	mm
3/8	10	1/2-14 NPSM	0.44	11	0.44	11
9/16	14	1-20 UNEF	0.75	19	0.63	16

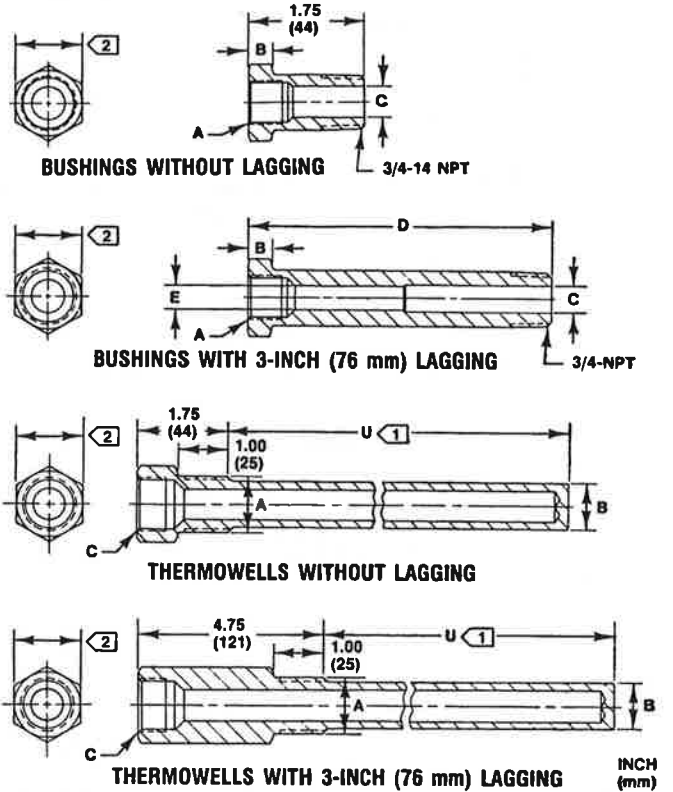
1. Seat area per SAMA Standard RC-17-10-1983.

LAGGED BUSHING										
TEMPERATURE BULB DIA.		DIMENSION								
		A(1)	B		C		D		E	
Inch	mm		Inch	mm	Inch	mm	Inch	mm	Inch	mm
3/8	10	1/2-14 NPSM	0.44	11	0.47	12	4.44	113	0.44	11
9/16	14	1-20 UNEF	0.75	19	0.66	17	4.75	121	0.63	16

1. Seat area per SAMA Standard RC-17-10-1983.

THERMOWELL							
TEMPERATURE BULB DIAMETER		DIMENSION				U (Insertion Length)	
		A	B		C(1)		
Inch	mm		Inch	mm		Inch	mm
3/8	10	1/2-14 NPT 3/4-14 NPT	0.63	16	1/2-14 NPSM-2B	7.5	191
			0.77	20		10.5	267
						16	406
9/16	145	3/4-14 NPT	0.88	22	1-20 UNEF-2B	7.5	191
						10.5	267
						16	406
						24	559

1. Seat area per SAMA Standard RC-17-10-1983.



NOTES:  
 1 TOLERANCES FOR THIS DIMENSION ARE AS FOLLOWS:  
 ± 0.06 INCH (1.5 mm) WHEN LENGTH IS 12 INCHES (305 mm) OR LESS  
 ± 0.125 INCH (3.2 mm) WHEN LENGTH IS GREATER THAN 12 INCHES (305 mm)  
 2 1-1/8 INCH HEX FOR 3/8-INCH TEMPERATURE BULB;  
 1-1/4 INCH HEX FOR 9/16-INCH TEMPERATURE BULB  
 A3240-2

Figure 2-6. Bushing and Thermowell Dimensions

With the controller case mounted so the temperature bulb reaches the process, screw the bulb into the bushing or thermowell. To make installation of the temperature bulb easier, bend the bendable extension. The bendable extension has a minimum bend radii of 1-1/4.

If the temperature bulb is to be installed in a pipe, process velocity is an important consideration. Install the bulb where the process temperature is to be measured, keeping in mind the velocity limits shown in table 2-1. Tapered thermowells, built to withstand even greater process velocities, are also available. After proper installation of the thermowell, the temperature element is then attached to the thermowell with a threaded connection.

Vent

**WARNING**

If a flammable or hazardous gas is being used as the supply pressure medium and the controller is in an enclosed area, per-

sonal injury and property damage could result from fire or explosion of accumulated gas. A remote vent on the controller is recommended to remove part of the exhaust gas to a ventilated area. However, the controller case and cover do not form a gas-tight seal and leaks may occur. To avoid injury or damage, provide adequate ventilation and necessary safety measures.

**CAUTION**

When installing a remote vent pipe, take care not to overtighten the pipe in the vent connection. Excessive torque will damage the threads in the connection.

The vent (see figure 2-5) must be protected against the entrance of any foreign material that could plug it. Use 1/2-inch pipe for the remote vent pipe, if one is required. Check the vent periodically to be certain it is not plugged.

Table 2-1. Maximum Process Fluid Velocities<sup>(1)</sup> for Thermowells

THERMOWELL SIZE	TEMPERATURE BULB DIAMETER		MATERIAL	INSERTION LENGTH <sup>(2)</sup> , INCH (mm)							
				7.5 (191)		10.5 (267)		16 (406)		24 (610)	
	Inch	mm		Feet/s	m/s	Feet/s	m/s	Feet/s	m/s	Feet/s	m/s
1/2 NPT	3/8	10	Brass	38	11.6	19	5.8	8	2.4	---	---
			Carbon steel	48	14.6	25	7.6	11	3.4	---	---
			304 stainless steel/316 stainless steel	50	15.2	26	7.9	11	3.4	---	---
			Monel	48	14.6	24	7.3	11	3.4	---	---
3/4 NPT	3/8	10	Brass	54	16.5	27	8.2	12	3.7	---	---
			Carbon steel	69	21.0	35	10.7	15	4.6	---	---
			304 stainless steel/316 stainless steel	72	21.9	37	11.3	16	4.9	---	---
			Monel	68	20.7	35	10.7	15	4.6	---	---
3/4 NPT	9/16	14	Carbon steel	97	29.6	49	14.9	21	6.4	10	3.0
			304 stainless steel/316 stainless steel	100	30.5	51	15.5	22	6.7	10	3.0
			Monel	95	28.9	49	14.9	21	6.4	9	2.7

1. For gas, air, or steam. Values may be lower for liquids.  
 2. This is the U dimension in figure 2-6.

Table 2-2. Maximum Process Pressures for Thermowells

THERMOWELL SIZE	TEMPERATURE BULB DIAMETER		MATERIAL	TEMPERATURE °F (°C)											
				70 (21)		200 (93)		400 (204)		600 (316)		800 (427)		1000 (538)	
	Inch	mm		Psig	Bar	Psig	Bar	Psig	Bar	Psig	Bar	Psig	Bar	Psig	Bar
1/2 NPT	3/8	10	Brass	2810	193.9	2530	174.6	440	30.4	---	---	---	---	---	---
			Carbon steel	3160	218.0	3040	209.8	2900	200.1	2770	191.1	2110	145.6	---	---
			304 SST	4120	284.3	3740	258.1	3400	234.6	3280	226.3	3180	219.4	2750	189.8
			316 SST	4120	284.3	4120	284.3	3850	265.7	3760	259.4	3680	253.9	3080	212.5
			Monel	3820	263.6	3530	243.6	3250	224.3	3210	221.5	3130	215.9	---	---
3/4 NPT	3/8	10	Brass	5000	345.0	4200	289.8	1000	69.0	---	---	---	---	---	---
			Carbon steel	5200	358.8	5000	345.0	4800	331.2	4600	317.4	3500	241.5	---	---
			304 SST	7000	483.0	6200	427.8	5600	386.4	5400	372.6	5200	358.8	4500	310.5
			316 SST	7000	483.0	7000	483.0	6400	441.6	6200	427.8	6100	441.6	5100	351.9
			Monel	6500	448.5	6000	414.0	5400	372.6	5300	365.7	5200	358.8	---	---
3/4 NPT	9/16	14	Carbon steel	2310	159.4	2030	140.1	1900	131.1	1820	125.6	1430	98.7	---	---
			304 SST	3470	239.4	3080	212.5	2520	173.9	2430	167.7	1850	127.7	1630	112.5
			316 SST	3470	239.4	3470	239.4	3240	223.6	3150	217.4	3100	213.9	2600	179.4
			Monel	3070	211.8	2510	173.2	2460	169.7	2410	166.3	2150	148.4	---	---

Supply Pressure Connections



Personal injury or property damage might occur from explosion due to an uncontrolled process medium if a clean, dry, non-corrosive air is not provided to the instrument. Install a 40-micron filter and suitable equipment to dry the supply medium. Establish a periodic maintenance cycle to ensure that the filtering equipment is operating effectively.

For corrosive media, make sure the tubing and instrument components that contact the corrosive medium are of suitable non-corrosive material. The use of unsuitable materials might result in personal injury or property damage due to the uncontrolled release of the corrosive media.

Personal injury or property damage might occur from explosion due to overpressurizing any system component. To avoid such injury or damage, provide suitable pressure relieving or pressure limiting devices if supply pressure is capable of exceeding the maximum allowable pressures listed in table 1-4.

Supply pressure must be clean, dry air or noncorrosive gas. Use a suitable supply pressure regulator to reduce the supply pressure source to 20 psig (1.4 bar) for an output signal range of 3 to 15 psig (0.2 to 1.0 bar) and to 35 psig (2.4 bar) for an output signal range of 6 to 30 psig (0.4 to 2.0 bar). Also, install a 40-micron filter and suitable equipment to dry the supply medium. Establish a maintenance cycle to ensure that the regulator and filter are working correctly.

Use a suitable supply pressure regulator to reduce the supply pressure source to the following values.



### For the 4196A, B, and C Series controllers:

- 20 psig (1.4 bar) for an output signal range of 3 to 15 psig (0.2 to 1.0 bar)
- 35 psig (2.4 bar) for an output signal range of 6 to 30 psig (0.4 to 2.0 bar)

### For the 4196S Series controllers:

- 20 psig (1.4 bar) for an output signal range of 0 and 20 psig (0.0 and 1.4 bar)
- 35 psig (2.4 bar) for an output signal range of 0 and 35 psig (0.0 and 2.4 bar)

### Remote Set Point Pressure (suffix letter M) Connections

If the controller has the remote set point option, connect the remote set point pressure to the top of the controller

case at the location shown in figure 2-5. Use clean, dry air or a noncorrosive gas. If pressure is supplied to the remote set point connection with a regulator, a small bleed orifice should be placed between the regulator and remote set point connection to prevent inadvertent pressure variations due to regulator lock-up.

### External Feedback Connections (4196B Series Controllers Only)

When a secondary controller in an override application has this option, reset windup is minimized in the secondary controller. Connect the external feedback connection of the secondary controller to the customer-supplied high or low select relay (see figure 2-5).



## Section 3 4196A Series Proportional-Only Controllers

### Section Description

This section includes descriptions of adjustments and procedures for prestartup and startup. Location of adjustments is shown in figures 3-1 and 3-2. To better understand the adjustments and overall operation of the controller, refer to the section describing the principles of operation and to the schematic diagram, figure 3-3. Unless otherwise noted, key numbers refer to figure 6-16.

### Adjustments: Manual Set Point

Adjust the set point by moving the set point adjustment until it indicates the desired value of temperature on the process temperature scale. Move the adjustment to the right to increase the set point, and to the left to decrease it.

If the controller is equipped with the optional internal or external set point adjustment, turn the adjustment knob clockwise to increase the process set point, and counterclockwise to decrease the process set point.

### Adjustments: Remote Set Point (suffix letter M)

#### CAUTION

Do not manually move the set point indicator on controllers with remote set point. Moving the set point indicator could damage the controller.

If the controller is equipped with the remote set point option, vary the remote set point pressure to change the set point. Increase the pressure to increase the set point and decrease the pressure to decrease the set point.

### Adjustments: Proportional Band (PB ADJ)

To adjust the proportional band, open the controller cover, and locate the proportional band knob (PB ADJ). Rotate the knob until the pointer indicates the desired value.

### Changing Controller Action

Controller action can be switched from direct to reverse or vice versa by simply loosening the screws on the proportional band indicator cover and pulling the cover outward so the proportional band can be rotated to the desired action. The white portion of the adjustment produces direct controller action; the black portion produces reverse controller action.

## Switching the Auto/Manual Station (suffix letter E)

#### CAUTION

Switching the controller between automatic and manual mode without balancing can cause a rapid, unwanted change in the process.

Refer to figure 6-18 if the controller has the auto/manual station option. Two balance methods are used to equalize the manual output pressure with the controller output pressure. To switch from automatic to manual mode, carefully adjust the loader knob until the metal ball inside the plastic tube moves into the switching zone. Then move the automatic/manual station switch to MANUAL. Turn the loader knob clockwise to increase the controller output or counterclockwise to decrease it. To switch from manual to automatic mode, adjust the set point adjustment to move the ball into the switching zone. Turn the switch to AUTO, and move the set point adjustment to control the output.

When the auto/manual station switch is in AUTO, adjusting the loader knob has no effect on the controller output. When the auto/manual switch is in MANUAL, changing the set point adjustment has no effect on the controller output.

### Prestartup Checks

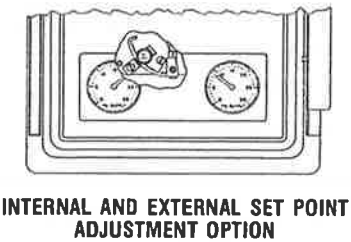
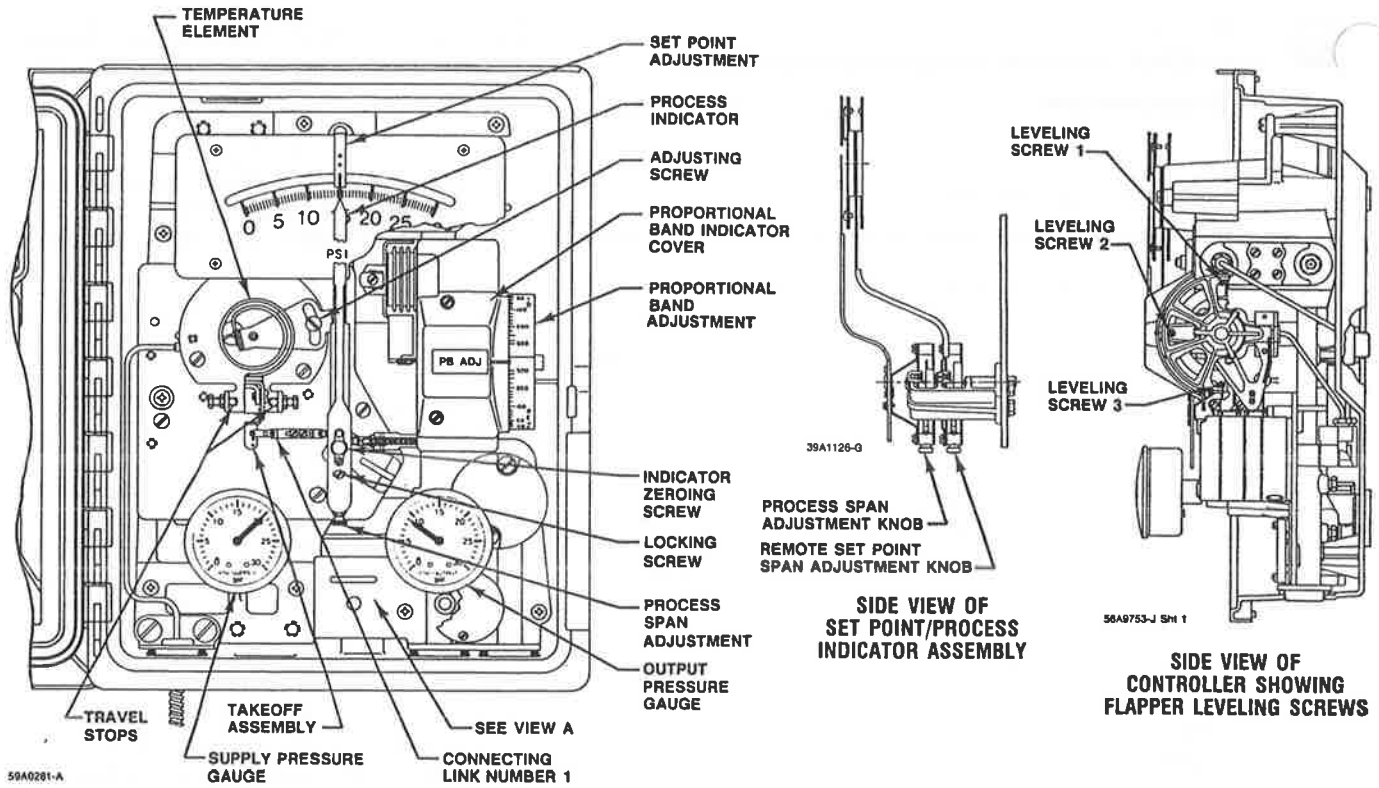
When performing the checks, open loop conditions must exist. An open loop exists when the controller output does not affect the input pressure or other control signal to the controller.

Refer to figure 3-1 for location of adjustments and figure 6-16 for location of key numbers.

#### Note

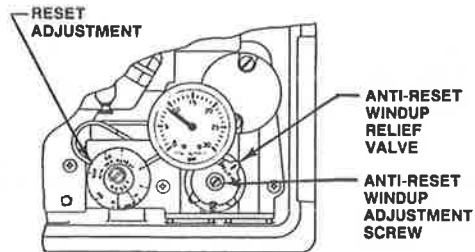
If the controller has the auto/manual station option (suffix letter E), be sure the controller is in the automatic mode prior to performing prestartup checks.

1. Plug the controller output, then connect supply pressure to the supply pressure regulator, and be sure it is delivering the proper supply pressure to the controller. Provide a means of measuring the controller output pressure.
2. For controllers with remote set point (suffix letter M), connect regulated pressure of 3 to 15 psig (0.2 to 1.0 bar) or 6 to 30 psig (0.4 to 2.1 bar) to the remote set point connection at the top of the controller case.
3. Remove the two screws (key 6) and lift off the proportional band indicator cover (key 36).



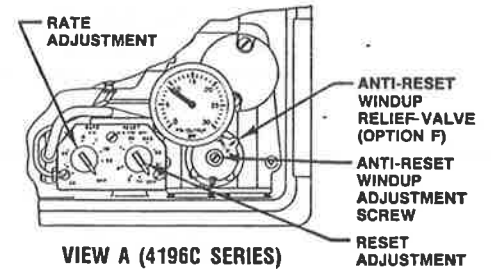
56A9753-J SH 5

C0588-2



**VIEW A (4196B SERIES)**

56A9753-J SH 2



**VIEW A (4196C SERIES)**

56A9752-L SH 3

*Figure 3-1. Location of Controller Parts and Adjustments*

4. Adjust the set point a minimum of 20 percent of input span above the process temperature pointer.

5. Adjust the proportional band knob to 5 percent direct action.

6. The process pointer should read ambient temperature  $\pm 1$  percent of span. Be sure that the bulb is exposed to air only and is not resting against the floor, test bench, or other surface.

7. The controller output pressure should be 0 psig.

8. Rotate the proportional band to 5 percent reverse action.

9. The controller output should be within 2 psig (0.14 bar) of the supply pressure.

10. If the controller output is within tolerance, adjust the proportional band to 400 percent in the desired action, secure the proportional band indicator cover (key 36) with the machine screws (key 6), and go to the startup procedure. If the controller output pressure is not within tolerance, go to the 4196A Series calibration procedure for recalibration.

## Startup

### Note

**When performing the startup procedures, keep in mind that the initial settings are guidelines and will vary, depending on the actual process being controlled.**

1. Adjust the set point indicator to the desired set point.

2. Set the proportional band adjustment to 50 percent. If 50 percent is expected to be too wide, set the proportional band adjustment to a narrower (smaller) value.

3. If the controller is used in conjunction with a control valve, slowly open the upstream and downstream manual control valves in the pipeline, and close the manual bypass valve if one is used.

4. Narrow the proportional band setting (toward the lowest percent) until cycling occurs. Then, broaden the proportional band slightly until stable control is attained.

5. Create a load upset by momentarily changing the set point. If cycling occurs, broaden the proportional band until stable control is attained. Double this value for the final proportional band setting.

## Calibration

### General Calibration Instructions

#### Note

**If the controller has the auto/manual station option, be sure the controller is in the automatic mode prior to performing calibration.**

If the prestartup checks revealed faulty adjustment of the process pointer or flapper misalignment, perform the calibration described in this section. These instructions are valid for either shop or field calibration, provided that open process loop conditions exist. Unless otherwise noted, key numbers refer to figure 6-16.

### Temperature Baths

Some calibration procedures require that the process temperature be simulated. A temperature bath (liquid or sand, depending on temperature requirements) is recommended. Bath temperature should be able to cover 0 to 100 percent of the temperature element input span.

The bath should be capable of maintaining a temperature to within  $\pm 0.10$  percent of the input span and should be agitated so that the temperature is consistent throughout.

If available, three baths, preset at 0 percent, 50 percent, and 100 percent of input span, could be used to simplify and speed up the calibration process. Also, provide a means of measuring bath temperature. Use a thermometer or resistance temperature detector (RTD) accurate to within  $\pm 0.05$  percent of input span.

### Calibration: Process Pointer Zero and Span Adjustment

#### Note

**Any adjustment of the process pointer span adjustment screw requires readjustment of the process pointer zero adjustment screw.**

1. Refer to figure 3-1 for location of adjustments.

2. Remove the two screws (key 6) and lift off the proportional band indicator cover (key 36).

3. Set the proportional band adjustment to between DIRECT and REVERSE.

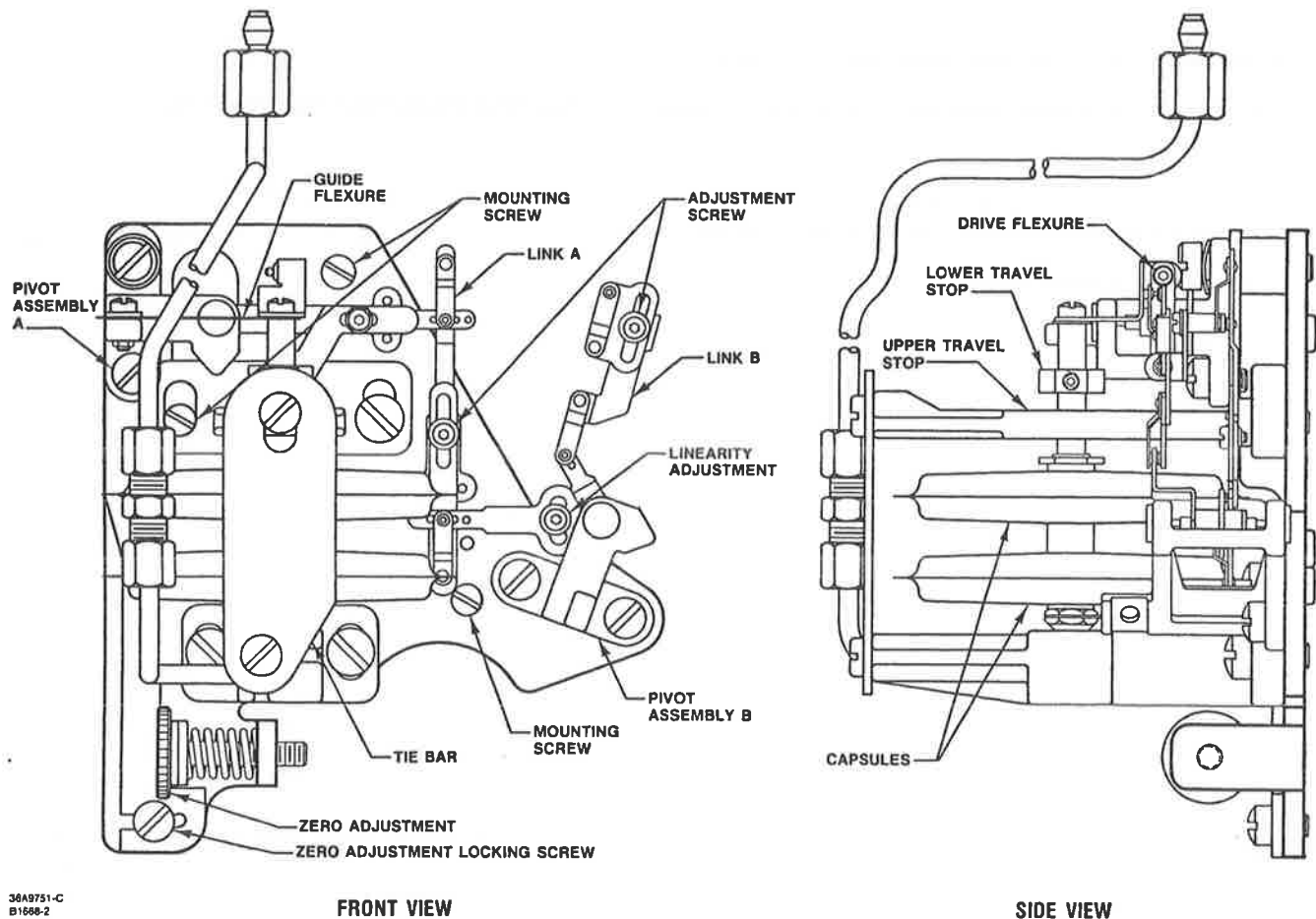


Figure 3-2. Location of Parts and Adjustments (Remote Set Point Option)

4. Place the temperature bulb in the 0 percent bath. Allow a minimum of 5 minutes for the controller to stabilize.

5. Adjust the process pointer to the lowest limit of the input scale by loosening the zero adjustment locking screw and turning the zero adjustment screw.

6. Place the temperature bulb in the 100 percent bath. Allow a minimum of 5 minutes for the controller to stabilize.

7. Note whether the process pointer indication is above or below the upper limit of the process scale.

8. Adjust the span screw as follows: Clockwise to increase the span for a low indication; counterclockwise to decrease span for a high indication. Adjust the span screw to correct one-half the error.

9. Repeat steps 4 through 8 until the error is eliminated.

10. Place the temperature bulb in the 50 percent bath. Allow a minimum of 5 minutes for the controller to stabilize. If the process pointer indicates within  $\pm 1$  percent of the 50 percent process scale mark, proceed to step 17. If the process pointer error is greater than  $\pm 1$  percent, proceed to step 11.

11. Adjust the process pointer to correct for half of the error at 50 percent on the process scale by loosening the zero adjustment locking screw and turning the zero adjustment screw. Then, tighten the zero adjustment locking screw.

12. Place the temperature bulb in the 0 percent bath. Allow a minimum of 5 minutes for the controller to stabilize.

13. The process pointer should indicate a zero scale reading  $\pm 1$  percent of scale span.

14. Place the temperature bulb in the 100 percent bath. Allow a minimum of 5 minutes for the controller to stabilize.

15. Process pointer should indicate full scale reading  $\pm 1$  percent of process scale range.

16. If error is greater than  $\pm 1$  percent, repeat steps 4 through 15. If the error cannot be reduced to within  $\pm 1$  percent of span, proceed to the maintenance calibration procedure.

17. Perform the following remote set point zero and span procedure, if required, and the flapper alignment procedure.

### Calibration: Remote Set Point Zero and Span Adjustment (suffix letter M)

#### Note

**Any adjustment of the set point indicator span adjustment screw requires readjustment of the set point zero adjustment screw.**

1. Refer to figures 3-1 and 3-2 for location of adjustments. Key numbers are referenced in figures 6-16.

2. Remove the two screws (key 6) and lift off the proportional band indicator cover (key 36).

3. Set the proportional band between DIRECT and REVERSE.

4. Perform the remote set point zero and span adjustment procedure. Begin by loosening the zero adjustment locking screw; then adjust the indicator zeroing screw (see figure 3-1) until the set point indicator aligns with the lowest scale limit and tighten the zero adjustment locking screw.

5. Apply remote set point pressure equal to the upper range limit.

6. Note whether the set point indicator is above or below the highest scale limit. Turn the remote set point span adjustment knob (see figure 3-1) clockwise to increase set point indicator travel and counterclockwise to decrease travel. To avoid overcorrecting with the span adjustment, only correct for approximately one-half the error with the span adjustment.

7. Repeat steps 3 through 6 until the set point is aligned at both points on the scale.

8. Adjust the remote set point pressure to 50 percent of the remote set point range.

9. Verify that the remote set point indicator is within  $\pm 1$  percent of the mid-scale mark and if so, proceed to

step 12. If the indicator is not within  $\pm 1$  percent, but is within  $\pm 2$  percent of the mid-scale mark, then proceed with step 10.

#### Note

**If, after completion of step 9 above, the set point indicator is not within  $\pm 2$  percent, proceed to the remote set point calibration procedure in section 5.**

10. Loosen the zero adjustment locking screw and adjust the zero screw to bring the set point indicator within the  $\pm 1$  percent tolerance at mid-scale. Do not move the indicator more than  $\pm 1$  percent since this will increase the error beyond the tolerance at the lower and upper scale limits. Tighten the zero adjustment locking screw.

11. Adjust the remote set point pressure to the lower and upper range limits and verify the set point indicator is within  $\pm 1$  percent.

12. If necessary, return to the process pointer zero and span calibration procedure in this section. Otherwise, proceed with calibration by returning to the flapper alignment procedure in this section.

### Flapper Alignment

#### General Instructions

#### Note

**If process pointer zero and span adjustment or remote set point zero and span adjustment is required, it must be done before the following flapper alignment procedure.**

Leveling screw numbers and adjustments are shown in figure 3-1. Key numbers refer to figure 6-16. Provide a means of applying supply pressure to the controller and an accurate means of measuring output pressure. After flapper alignment, go to the appropriate startup instructions.

#### Flapper Alignment: Proportional-Only Controllers

1. For controllers with manual set point, move the set point adjustment to 50 percent of the scale range. For controllers with remote set point (suffix letter M), adjust the remote set point pressure until the set point indicator is at 50 percent of the scale range.

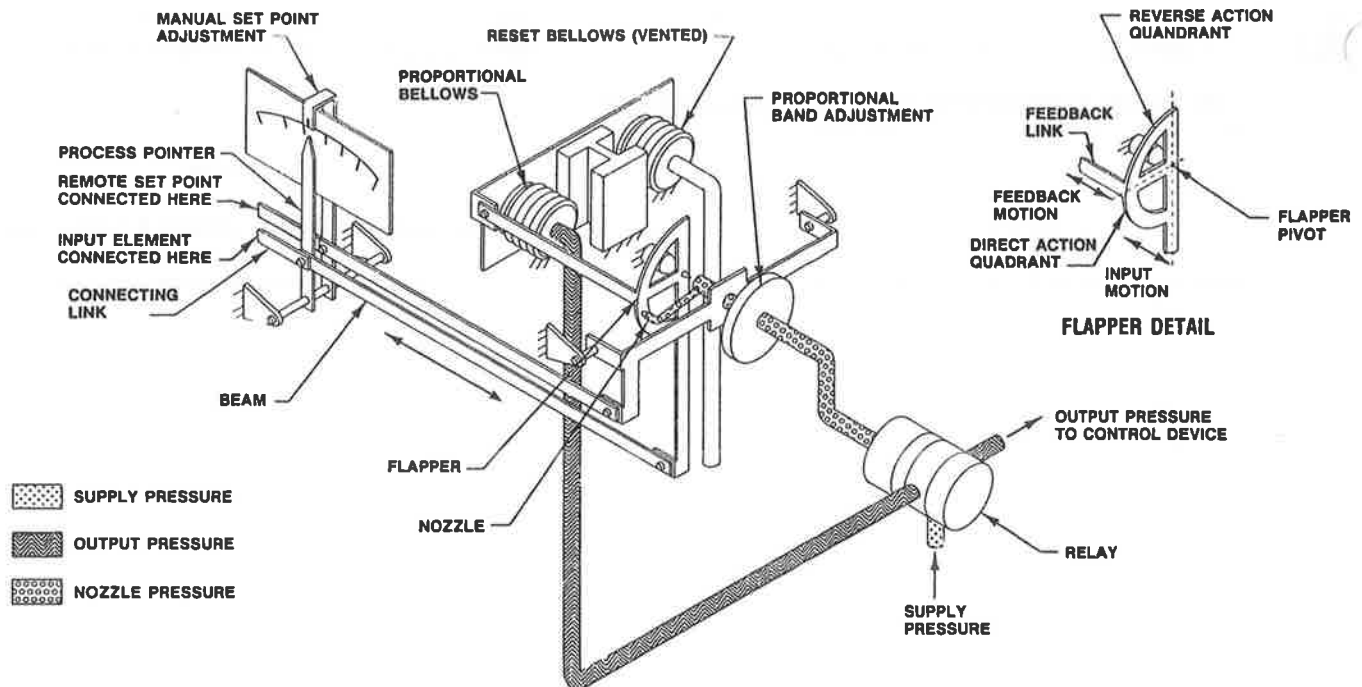
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Figure 3-3. Schematic of Operation for 4196A Series Controllers

2. If a temperature bath is available, adjust the bath for 50 percent of the scale range and place the temperature bulb in the bath. Allow 5 minutes for the controller to stabilize. If a bath is not available, note the location where link number 1 is connected and then disconnect link number 1 from the temperature element takeoff assembly.

3. If link number 1 was disconnected, manually position the process pointer to 50 percent of the scale range and tape the process pointer to the temperature scale at the mid-range value.

4. Remove the two proportional band (PB ADJ) cover screws (key 6), and lift off the proportional band indicator cover (key 36).

5. Adjust the proportional band adjustment to between DIRECT and REVERSE.

6. Controller output should be  $9 \pm 0.10$  psig ( $0.62 \pm 0.007$  bar) for a 3 to 15 psig (0.2 to 1.0 bar) output or  $18 \pm 0.2$  psig ( $1.2 \pm 0.01$  bar) for a 6 to 30 psig (0.4 to 2.0 bar) output. If not, adjust flapper leveling screw 2.

7. Adjust the proportional adjustment to 20 percent direct acting.

8. Controller output should be  $9 \pm 0.25$  psig ( $0.62 \pm 0.02$  bar) or  $18 \pm 0.5$  psig ( $1.2 \pm 0.04$  bar). If not, adjust flapper leveling screw 3.

9. Adjust the proportional band adjustment to 20 percent reverse acting.

10. Controller output should be  $9 \pm 0.25$  psig ( $0.62 \pm 0.02$  bar) or  $18 \pm 0.5$  psig ( $1.2 \pm 0.04$  bar). If not, adjust flapper leveling screw 1.

11. Repeat steps 5 through 10 until the output of the controller remains in tolerance as the proportional band is adjusted between the three calibration points.

12. Remove the tape holding the process pointer to the scale and, if link number 1 was removed, reconnect it to the same hole in the temperature element takeoff assembly.

13. Set the proportional band adjustment to 400 percent in the desired controller action. Replace the proportional band indicator cover (key 36), and tighten two screws (key 6).

## Principle of Operation: Proportional-Only Controllers

### Overall Operation

Refer to the schematic diagram in figure 3-3.

The input element is connected to the process pointer and to the flapper by connecting links. As the process temperature increases (in a direct-acting controller), the flapper moves toward the nozzle, restricting flow through the nozzle and increasing nozzle pressure.



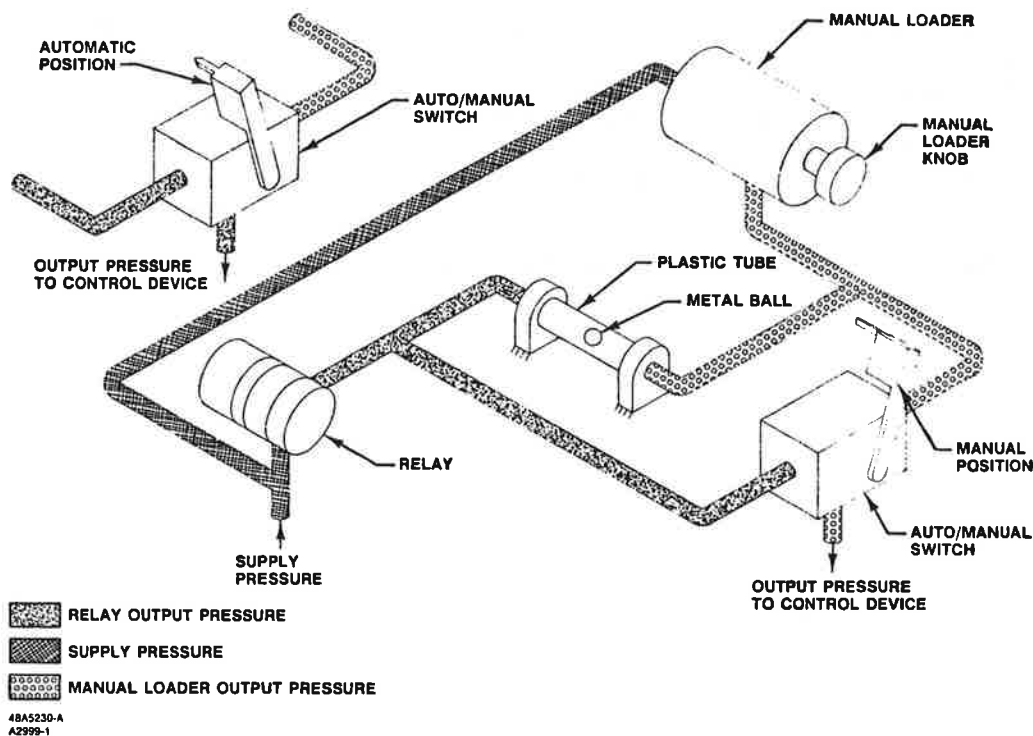


Figure 3-4. Schematic of Auto/Manual Option

When this occurs, relay action increases the output pressure (delivery) of the controller. Output pressure is fed back to the proportional bellows. The action of the proportional bellows counteracts the flapper movement that resulted from the process temperature change and backs the flapper away from the nozzle until equilibrium is reached.

The set point adjustment changes the proximity of the nozzle and flapper as does a change in process temperature except that, when the set point is changed, the nozzle is moved with respect to the flapper.

The proportional band adjustment knob positions the nozzle on the flapper. Increasing (widening) the proportional band moves the nozzle to a position on the flapper where less input and more feedback motion occurs, which decreases the gain of the controller. Decreasing (narrowing) the proportional band moves the nozzle toward a position where more input and less feedback motion occurs, which increases the gain. The controller action is changed from direct to reverse by turning the proportional band adjustment knob to position the nozzle on the flapper quadrant where the direction of the flapper motion versus input motion is reversed (see flapper detail in figure 3-3). With the controller in the reverse-acting mode, an increase in process temperature causes a decrease in output pressure.

### Remote Set Point Option (suffix letter M)

The capability to pneumatically adjust the controller set point from a remote location is available with all 4196 Series controllers. A remote set point change occurs when a control pressure is applied to the capsular element within the remote set point assembly. The expansion and contraction of the capsule moves the set point indicator via the connecting linkage. Increasing the control pressure to the capsule increases the controller set point and decreasing the control pressure reduces the controller set point.

This option is designated by the suffix letter M in the type number.

### Auto/Manual Station Option (suffix letter E)

Controllers with the auto/manual station option (designated by the suffix E in the type number) have piping on the output side of the relay as shown in figure 3-4. Supply pressure to the relay is also applied to the manual loader. The manual loader, functioning as a regulator, applies pressure to one side of the plastic sight tube and to the auto/manual station switch. Output pressure from the relay registers on the other side of the plastic sight tube as well as in the auto/manual station switch.

## 4196A, B, C, and S Series

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When the auto/manual station switch is in the MANUAL position, the output of the manual loader is channeled through the auto/manual switch and becomes the output of the controller. When the auto/manual switch is in the AUTO position, the output of the relay is channeled through the switch to become the output of the controller.

Before the auto/manual switch is operated, the output

of the relay must equal the output of the manual loader to avoid bumping the process. Adjusting the set point varies the pressure on the left-hand side of the plastic tube. Adjusting the manual loader knob varies the pressure on the right-hand side. When the pressures are equal, the metal ball is centered in the tube and held in place by a small magnet. A pressure imbalance forces the ball to one end of the tube where it forms a seal, blocking air flow through the tube.

## Section 4

### 4196B Series

### Proportional-Plus-Reset Controllers

### And 4196C Series

### Proportional-Plus-Reset-Plus-Rate Controllers

#### Section Description

This section includes descriptions of adjustments and procedures for prestartup and startup procedures. Location of adjustments is shown in figures 3-1 and 3-2. To better understand the adjustments and overall operation of the controller, refer to the section describing the principles of operation and to the schematic diagrams, figures 4-1, 4-2, and 4-3. Unless otherwise noted, key numbers refer to figure 6-16.

#### Adjustments: Manual Set Point

To adjust the set point, open the controller cover, and move the set point adjustment until the pointer indicates the desired value of temperature on the process temperature scale. Move the adjustment to the right to increase the set point, and to the left to decrease it. If the controller is equipped with the optional external or internal set point adjustment, turn the adjustment knob clockwise to increase the process set point, and counterclockwise to decrease the process set point.

#### Adjustments: Remote Set Point (suffix letter M)

##### CAUTION

Do not manually move the set point indicator on controllers with remote set point. Moving the set point indicator could damage the controller.

If the controller is equipped with the remote set point option, vary the remote set point pressure to change the set point. Increase the pressure to increase the set point and decrease the pressure to decrease the set point.

#### Adjustments: Proportional Band (PB ADJ)

To adjust the proportional band, open the controller cover, and locate the proportional band knob (PB ADJ). Rotate the knob until the desired value is beneath the pointer. Adjusting the proportional band has a minimal effect on the set point.

#### Changing Controller Action

Controller action can be switched from direct to reverse or vice versa by simply loosening the screws on the proportional band indicator cover and pulling the cover outward so the proportional band can be rotated to the desired action. The white portion of the adjustment produces direct controller action; the black portion produces reverse controller action.

#### Reset

To adjust reset, open the controller cover, and locate the RESET adjustment. Rotate the adjustment clockwise to decrease or counterclockwise to increase the minutes per repeat. Increasing the minutes per repeat provides a slower reset action.

#### Anti-Reset Windup (suffix letter F)

If the arrow on the relief valve points toward the top of the controller case, as shown in figure 3-1, the valve opens when output pressure falls. If the arrow points in the opposite direction, the valve opens when output pressure rises. Turn the adjusting screw counterclockwise to increase differential relief pressure; clockwise to decrease it. Differential relief pressure is factory set at 5 psi (0.3 bar). Maximum differential relief pressure is 7 psi (.05 bar); minimum is 2 psi (0.1 bar).

#### Switching the Auto/Manual Station (suffix letter E)

##### CAUTION

Switching the controller between automatic and manual mode without balancing can bump the process.

Please refer to figure 6-18 if the controller has the auto/manual station option. Also, see figure 3-4.

Two balance methods are used to equalize the manual output pressure with the controller output pressure. To switch from automatic to manual mode, carefully adjust the loader knob until the metal ball inside the plastic tube moves into the switching zone. Then move the automatic/manual station switch to MANUAL. Turn the loader knob clockwise to increase the controller output or counterclockwise to decrease it. To switch from manual to automatic mode, adjust the set point adjustment to move the ball into the switching zone. Turn the switch to AUTO and move the set point adjustment to control the output.

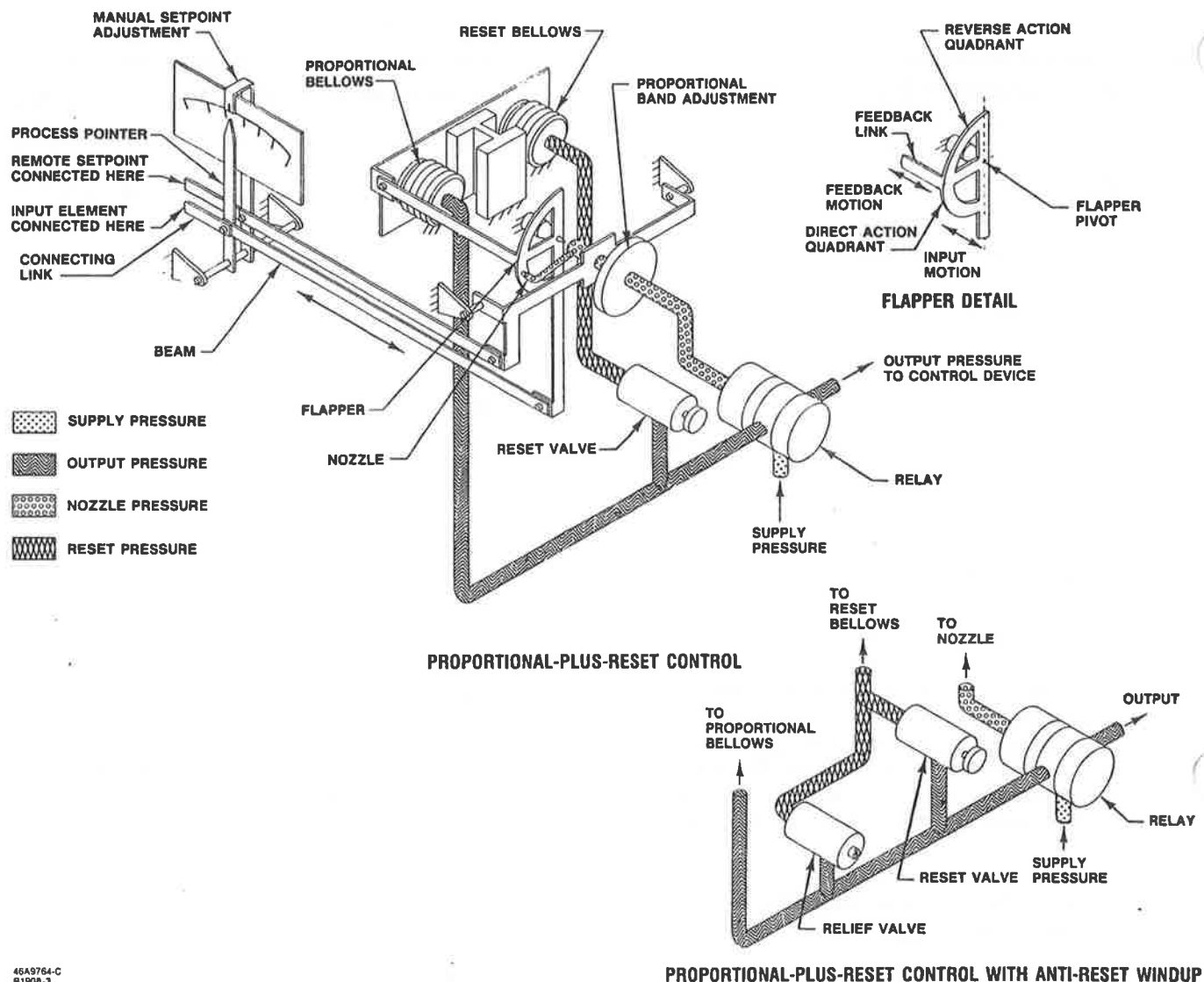


Figure 4-1. Schematic of Operation for 4196B Series Controllers

When the automatic/manual switch is in AUTO, adjusting the loader knob has no effect on the controller output. When the automatic/manual switch is in MANUAL, changing the set point adjustment has no effect on the controller output.

### Prestartup Checks

When performing the checks, open loop conditions must exist. An open loop exists when the controller output does not affect the input pressure or other control signal to the controller.

Refer to figure 3-1 for location of adjustments and to figure 6-16 for location of key numbers.

### Note

If the controller has the auto/manual station option (suffix letter E), be sure the controller is in the automatic mode prior to performing prestartup checks. If the controller has the external feedback option, connect the controller output connection to the external feedback connection (see figure 2-5) and with full output pressure and the RESET knob adjusted to 0.01 minutes/repeat, verify the tubing connections do not leak. Disconnect after completing the prestartup checks.

1. Plug the controller output and connect supply pressure to the supply pressure regulator. Be sure the regulator is delivering the proper supply pressure to the

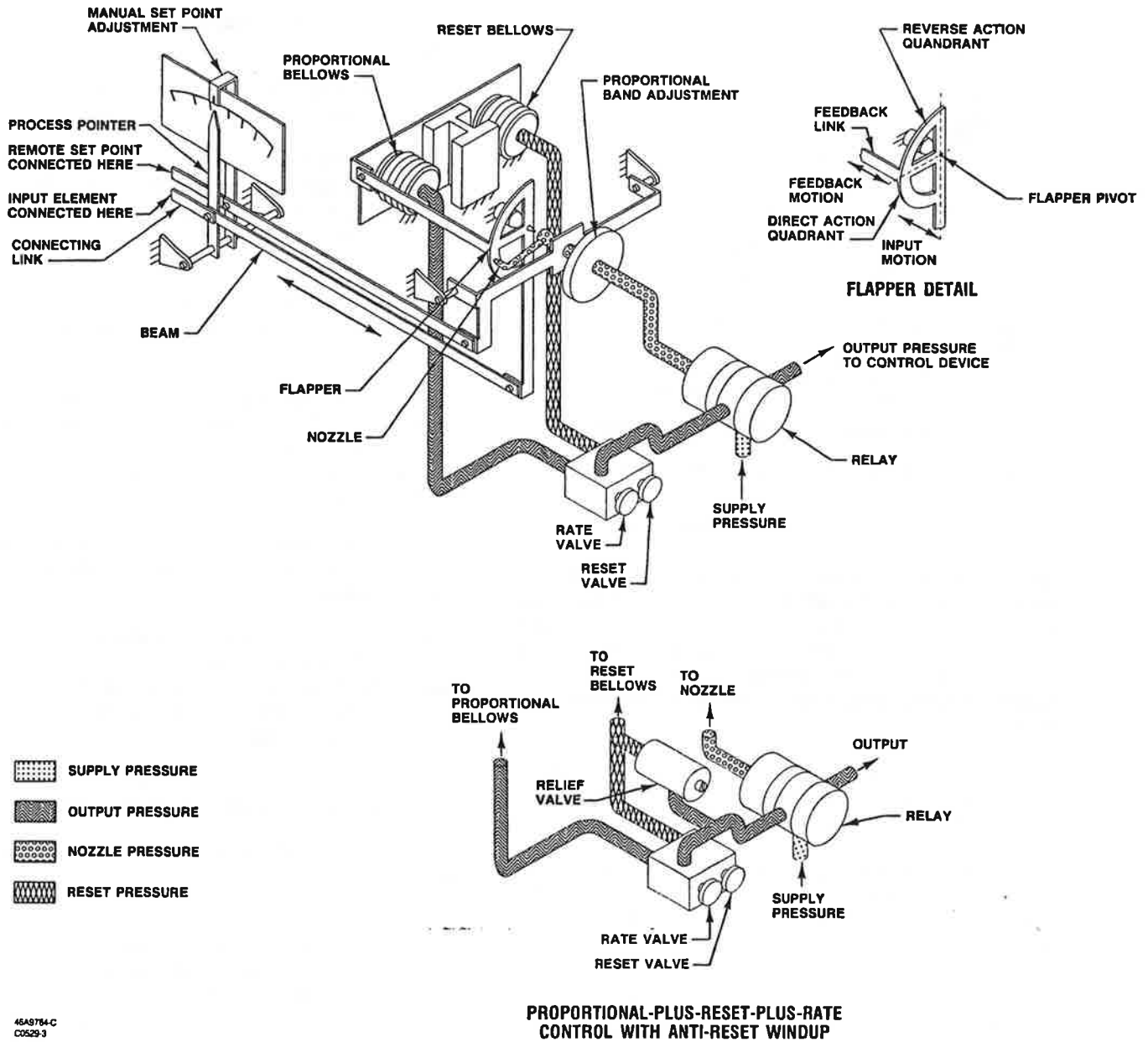


Figure 4-2. Schematic of Operation for 4196C Series Controllers

controller. Provide a means of measuring the controller output pressure.

2. For controllers with remote set point, connect regulated pressure of 3 to 15 psig (0.2 to 1.0 bar) or 6 to 30 psig (0.4 to 2.1 bar) as required to the remote set point connection at the top of the controller case.

3. Remove the two screws (key 6) and lift off the proportional band indicator cover (key 36).

4. Turn the proportional band adjustment knob (PB ADJ) to 100 percent in the required controller action.

5. Turn the RESET adjustment knob to 0.01 minutes per repeat.

6. Turn the RATE adjustment knob to OFF (4196C Series).

7. For controllers with manual set point, move the set point indicator to 5 percent of the scale span to the right of the process pointer. For controllers with remote set point (suffix letter M), adjust the remote pressure setting until the set point indicator is at 5 percent of process scale span to the right of the process pointer.

If the controller is direct-acting, the controller output should begin falling or be steady at 0 psi. If the controller is reverse-acting, the controller output should begin rising or be steady within approximately 2 psig (0.14 bar) of supply pressure.

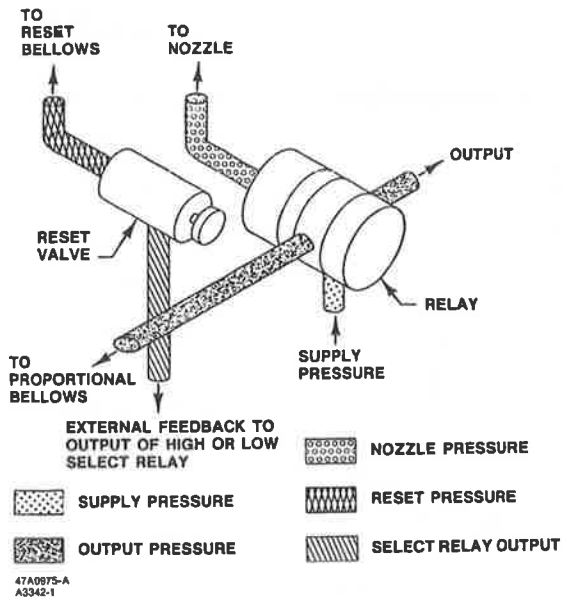


Figure 4-3. Schematic of External Feedback Option

8. Adjust the set point indicator to 5 percent of process scale span to the left of the process pointer. If the controller is direct-acting, the controller output should begin rising or be steady within approximately 2 psi of supply pressure. If the controller is reverse-acting, the controller output should begin falling or be steady at 0 psig.

9. If the controller does not perform as indicated in steps 7 and 8, refer to the flapper alignment procedure in the Calibration section for 4196B, C controllers.

10. If the controller output is correct, set the proportional band to 400 percent in the desired controller action. Replace the proportional band indicator cover (key 36) and tighten the two screws (key 6).

## Startup

### Note

**When performing the startup procedures, keep in mind that the initial settings are guidelines and will vary depending on the actual process being controlled.**

1. Adjust the set point indicator to the desired set point.

2. Determine the initial proportional band setting in percent from the following equation:

3. Turn the proportional band adjustment knob (PB ADJ) to the percentage calculated from the equation.

4. Turn the RESET adjustment knob to 0.2 minutes per repeat.

5. Turn the RATE adjustment knob to 0.25 minutes (4196C Series).

6. If the controller is used in conjunction with a control valve, slowly open the upstream and downstream manual control valves in the pipeline, and close the manual bypass valve if one is used.

7. Turn the RESET adjustment knob to 2 minutes per repeat. Turn the RATE adjustment knob to OFF. Then, narrow the proportional band setting (toward the lowest percent) until cycling occurs.

8. Create a load upset by momentarily changing the set point. If cycling occurs, further broaden the proportional band until stable control is attained. Double this value and turn the proportional band setting (PB ADJ) to this final value.

9. Turn the RESET adjustment knob in small increments toward the fastest setting (lowest number) until cycling occurs.

10. Create a load upset by momentarily changing the set point. If cycling occurs, change the reset setting by turning the RESET knob back from the fast setting made in step 9. Make the change in small increments until stable control is attained.

Multiply the new reset value by 3 for the final reset setting and turn the RESET knob to that value.

11. Turn the RATE adjustment knob toward the slowest setting (highest number) in small increments until cycling occurs.

12. Create a load upset by momentarily changing the set point. If cycling occurs, speed up the rate action by turning the RATE knob toward a faster setting (lower number) from the setting made in step 11. Make the change in small increments until stable control is attained.

Divide the new rate value by 3 for the final rate setting and turn the RATE knob to that value.

13. Once stable control is attained, the process indicator and set point adjustment should be in line. If they are aligned, return the set point to the desired value. If they are not, readjust the set point to the desired control point, and proceed with step 14.

14. If the process indicator is within 5 percent of the set point indicator, turn the adjustment screw on link number 3 (see figure 6-5 for location) until the process indicator aligns with the set point adjustment. Turn the screw slightly clockwise to increase the process indication or counterclockwise to decrease it. If the process

indicator is misaligned with the set point indicator by more than 5 percent of the scale span, refer to the flapper alignment procedure in the calibration section for Types 4196 B and C controllers.

## Calibration

### General Calibration Instructions

#### Note

**If the controller has the auto/manual station option, be sure the controller is in the automatic mode prior to performing calibration.**

If the prestartup checks or startup procedures reveal faulty adjustment of the process indicator or flapper misalignment, perform the calibration described in this section. These instructions are valid for either shop or field calibration, provided that open process loop conditions exist. Unless otherwise noted, key numbers refer to figure 4-16.

### Temperature Baths

Some calibration procedures require that the process temperature be simulated. A temperature bath (liquid or sand, depending on temperature requirements) is recommended. Bath temperature should be able to cover 0 to 100 percent of the temperature element input span. The bath should be capable of maintaining a temperature to within  $\pm 0.10$  percent of the input span and should be agitated so that the temperature is consistent throughout.

If available, three baths, preset at 0 percent, 50 percent, and 100 percent of input span, could be used to simplify and speed up the calibration process. Also, provide a means of measuring bath temperature. Use a thermometer or resistance temperature detector (RTD) accurate to within  $\pm 0.05$  percent of input span.

### Calibration: Process Pointer Zero and Span Adjustment

#### Note

**Any adjustment of the process pointer span adjustment screw will require readjustment of the process pointer zero adjustment screw.**

1. Refer to figure 3-1 for location of adjustments. Refer to figure 6-16 for the location of key numbers.

2. Remove the two screws (key 6) and lift off the proportional band indicator cover (key 36).

3. Set the proportional band adjustment to between DIRECT and REVERSE.

4. Place the temperature bulb in the 0 percent bath. Allow a minimum of 5 minutes for the controller to stabilize.

5. Adjust the process pointer to the lowest limit of the input scale by loosening the zero adjustment locking screw and turning the zero adjustment screw.

6. Place the temperature bulb in the 100 percent bath. Allow a minimum of 5 minutes for the controller to stabilize.

7. Note whether the process pointer indication is above or below the upper limit of the process scale.

8. Adjust the span screw as follows: Clockwise to increase the span for a low indication; counterclockwise to decrease span for a high indication. Adjust the span screw to correct one-half the error.

9. Repeat steps 4 through 8 until the error is eliminated.

10. Place the temperature bulb in the 50 percent bath. Allow a minimum of 5 minutes for the controller to stabilize. If the process pointer indicates within  $\pm 1$  percent of the 50 percent process scale mark, proceed to step 17. If the process pointer error is greater than  $\pm 1$  percent, proceed to step 11.

11. Adjust the process pointer to correct for half the error at 50 percent by loosening the zero adjustment locking screw and turning the zero adjustment screw.

12. Place the temperature bulb in the 0 percent bath. Allow a minimum of 5 minutes for the controller to stabilize.

13. The process pointer should indicate a zero-scale reading of  $\pm 1$  percent of scale span.

14. Place the temperature bulb in the 100 percent bath. Allow a minimum of 5 minutes for the controller to stabilize.

15. The process pointer should indicate a full-scale reading of  $\pm 1$  percent of process scale range.

16. If the error is greater than  $\pm 1$  percent, repeat steps 10 through 14. If the error cannot be reduced to  $\pm 1$  percent of span or less, proceed to the maintenance calibration procedure in section 6.

17. Perform the following flapper alignment procedure.

## Calibration: Remote Set Point Zero and Span Adjustment (suffix letter M)

### Note

Any adjustment of the set point indicator span adjustment screw will require readjustment of the indicator zero adjustment screw.

1. Refer to figures 3-1 and 3-2 for location of adjustments. Key numbers are referenced in figure 6-16.

2. Remove the two screws (key 6) and lift off the proportional band indicator cover (PB ADJ, key 36).

3. Set the proportional band between DIRECT and REVERSE and apply remote set point pressure equal to the lower range limit.

4. Loosen the zero adjustment locking screw and adjust the zero screw until the set point indicator aligns with the lowest scale limit and tighten the zero adjustment locking screw.

5. Apply remote set point pressure equal to the upper range limit.

6. Note whether the set point indicator is above or below the highest scale limit. Turn the remote set point span screw clockwise to increase set point indicator travel and counterclockwise to decrease travel. To avoid overcorrecting with the span adjustment, only correct for approximately one-half the error with the span adjustment.

7. Repeat steps 3 through 6 until the set point is aligned at both points on the scale.

8. Adjust the remote set point pressure to 50 percent of the remote set point range.

9. Verify that the remote set point indicator is within  $\pm 1$  percent of the mid-scale mark and if so, proceed to step 12. If the indicator is not within  $\pm 1$  percent but is within  $\pm 2$  percent of the mid-scale mark, then proceed with step 10. If the set point indicator is not within  $\pm 2$  percent, proceed to the remote set point maintenance calibration procedure in section 6.

10. Loosen the zero adjustment locking screw and adjust the zero screw to bring the set point indicator within the  $\pm 1$  percent tolerance at mid-scale. Do not move the indicator more than  $\pm 1$  percent since this will increase the error beyond the tolerance at the lower and upper scale limits. Tighten the zero adjustment locking screw.

11. Adjust the remote set point pressure to the lower and upper range limits and verify the set point indicator is within  $\pm 1$  percent.

12. If necessary, proceed to the process pointer zero and span calibration procedure in this section. Otherwise, proceed to the flapper alignment procedure in this section.

## Flapper Alignment General Instructions

### Note

If process pointer zero and span adjustment or remote set point zero and span adjustment is required, it must be done before the following flapper alignment procedure.

Leveling screw numbers and adjustments are shown in figure 3-1. Key numbers are shown in figure 6-16. Provide a means of applying supply pressure to the controller and an accurate means of measuring output pressure. After flapper alignment, go to the appropriate startup instructions.

### Flapper Alignment: Proportional-Plus-Reset or Proportional-Plus-Reset-Plus-Rate Controllers

1. Adjustments are shown in figure 3-1. Key numbers refer to figure 6-16.

2. For controllers with manual set point, move the set point adjustment to 50 percent of the scale range. For controllers with remote set point (suffix letter M), adjust the remote set point pressure until the set point indicator is at 50 percent of the scale range.

3. Remove two screws (key 6) and lift off the proportional band indicator cover (key 36).

4. Adjust the RESET valve to 0.01 minutes per repeat.

5. Adjust the RATE knob to OFF.

6. If the controller has the external feedback option (available with the 4196B Series only), shut off the supply pressure, connect the controller output to the external feedback connection, and turn on the supply pressure. See figure 2-5 for the location of the output and external feedback connections.

7. If a temperature bath is available, adjust the bath for 50 percent of the scale range and place the temperature bulb in the bath. Allow 5 minutes for the controller to stabilize. If a bath is not available, prepare to disconnect link number 1. Note the location where link number 1 is connected and then disconnect link number 1 from temperature element takeoff assembly.



stabilize. If a bath is not available, prepare to disconnect link number 1. Note the location where link number 1 is connected and then disconnect link number 1 from the temperature element takeoff assembly.

8. If link number 1 was disconnected, manually position the process pointer to 50 percent of the scale range and tape the process pointer to the temperature scale at the mid-range value.

#### Note

**Because of the high controller gain, the controller output will not totally stabilize in steps 8 through 12. The controller output gauge is adequate to monitor the output pressure during this procedure.**

9. Set the proportional band between DIRECT and REVERSE.

10. Adjust the flapper leveling screw number 2 until the controller output is stable at any value within the output range.

11. Adjust the proportional band to 20 percent direct acting. Adjust flapper leveling screw number 3 until the controller output is stable at any value within the output range.

12. Adjust the proportional band to 20 percent reverse acting. Adjust flapper leveling screw number 1 until the controller output is stable at any value within the output range.

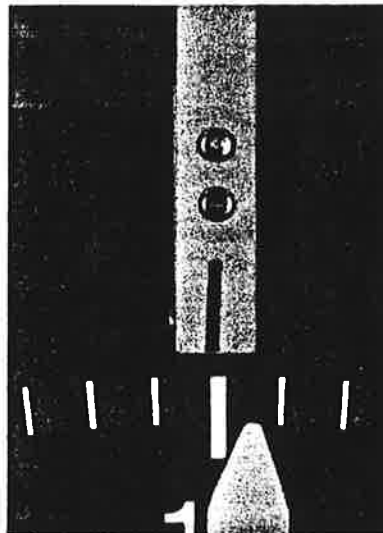
13. Repeat steps 8 through 11 until the controller output remains stable with no adjustments of the flapper leveling screws.

#### Note

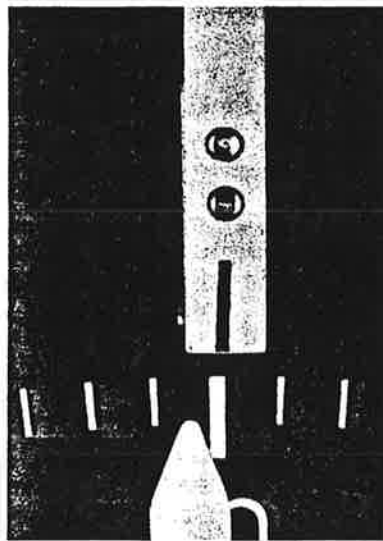
**Use steps 13 through 19 to check flapper alignment.**

14. Adjust the proportional band to 100 percent direct action.

15. If link number 1 was previously disconnected, remove the tape and align the process pointer with the right-hand edge of the set point indicator, as shown in figure 4-4. If link number 1 was not disconnected and a temperature bath is used, adjust the set point indicator so the process pointer aligns with the right-hand edge. The controller output should be within 2 psig (0.14 bar) of the supply pressure.



RIGHT-HAND EDGE



LEFT-HAND EDGE

Figure 4-4. Alignment of the Process Pointer with the Set Point Adjustment

16. Align the process pointer with the left-hand edge of the set point indicator, as shown in figure 3-5. Controller output pressure should go to 0 psig.

17. Adjust the proportional band to 100 percent reverse action.

18. The controller output should be within 2 psig (0.14 bar) of supply pressure.

19. Align the process pointer with the right-hand edge of the set point indicator. The controller output should be 0 psig.

20. If the controller does not perform as indicated in steps 13 through 18, the flapper is not correctly aligned. Repeat steps 8 through 18.

21. Set the proportional band to 400 percent in the desired controller action. Replace the proportional band indicator cover (key 36) and tighten the two screws (key 6). Reconnect link number 1, if disconnected, to the same hole in the temperature element takeoff assembly.

## Principle of Operation: Proportional-Plus-Reset or Proportional-Plus-Reset-Plus-Rate Controllers

### Overall Operation

Refer to the schematic diagram in figure 4-1 for 4196B Series controllers. Refer to the schematic diagram in figure 4-2 for 4196C Series controllers.

The input element connects to the process pointer and to the flapper by connecting links. As the process temperature increases (in a direct-acting controller), the flapper moves toward the nozzle, restricting flow through the nozzle and increasing nozzle pressure. When this occurs, relay action increases the output pressure (delivery) of the controller. Output pressure is fed back to the proportional bellows and to the reset bellows. The action of the proportional bellows quickly counteracts the flapper movement that resulted from the process temperature change and backs the flapper away from the nozzle. Pressure in the reset bellows opposes the action of the proportional bellows and slowly moves the flapper closer to the nozzle. The result of this interaction is that when the process temperature changes, proportional action temporarily reduces the gain of the controller for improved stability. The process temperature then slowly returns to set point, as pressure in both bellows equalizes via the reset action.

The set point adjustment changes the proximity of the nozzle and flapper as does a change in process temperature, except that when the set point changes, the nozzle moves with respect to the flapper.

The proportional band adjustment knob positions the nozzle on the flapper. Increasing (widening) the proportional band moves the nozzle to a position on the flapper where less input and more feedback motion occurs, which decreases the gain of the controller. Decreasing (narrowing) the proportional band moves the nozzle toward a position where more input and less feedback motion occurs, which increases the gain. The controller action is changed from direct to reverse by turning the proportional band adjustment knob to position the nozzle on the flapper quadrant to a point where the direction of the flapper motion versus input motion is reversed (see flapper detail in figure 4-1). With the controller in the reverse-acting mode, an increase in process temperature causes a decrease in output pressure.

A 4196C Series controller also has a rate valve (figure 4-2), which is an adjustable restriction that momentarily increases the controller gain to accelerate the corrective action for process control systems where the process temperature changes slowly. A proportional-plus-reset-plus rate controller responds to a change in process temperature as follows: First, the rate action delays the proportional action just long enough to allow the controller to respond to the change quickly with high gain, but not long enough for the high gain to cause instability. Then, the low gain provided by the proportional action keeps the system stable. Finally, reset action slowly increases the gain and returns the process temperature toward the set point.

### Anti-Reset Windup Option

Anti-reset windup is available on all 4196B and C Series controllers and is designated by the suffix letter F in the type number. The differential relief valve operates when the difference between proportional bellows pressure and reset bellows pressure reaches a predetermined value. Anti-reset windup reduces overshoot of the process temperature that can result from large or prolonged deviation from set point, such as during start-up.

### Remote Set Point Option (suffix letter M)

The capability to adjust the controller set point from a remote location is available with all 4196 Series controllers. This option is designated by the suffix letter M in the type number.

With this option, a control pressure is applied to the capsular element within the remote set point assembly. The expansion and contraction of the capsule moves the set point adjustment via connecting linkage. Increasing the control pressure to the capsule increases the set point setting, and decreasing the control pressure reduces the set point setting.

### Auto/Manual Station Option (suffix letter E)

Controllers with the auto/manual station option (designated by the suffix letter E in the type number) have piping on the output side of the relay as shown in figure 3-4. Supply pressure to the relay is also applied to the manual loader. The manual loader, functioning as a regulator, applies pressure to one side of the plastic sight tube and to the auto/manual switch. Output pressure from the relay registers on the other side of the plastic sight tube as well as in the auto/manual switch.

When the auto/manual switch is in the MANUAL position, the output of the manual loader is channeled through the auto/manual switch and becomes the output of the controller. When the auto/manual switch is in the AUTO position, the output of the relay is channeled through the switch to become the output of the controller.

Before the auto/manual switch is operated, the output of the relay must equal the output of the manual loader to avoid bumping the process. Adjusting the set point varies the pressure on the left-hand side of the plastic tube. Adjusting the manual loader knob varies the pressure on the right-hand side. When the pressures are equal, the metal ball is centered in the tube and is held in place by a small magnet. A pressure imbalance forces the ball to one end of the tube where it forms a seal blocking air flow through the tube.

### External Feedback Option

External feedback is available with all 4196B Series controllers. Controllers with this option have an external connection on the bottom of the controller case (see figure 2-5). This connection breaks the positive feedback (reset) loop inside the controller and brings it outside (see figure 4-3). The connection allows the positive feedback loops of two controllers (primary and secondary) to be tied together when the controllers are used in an override application. When connected, the secondary controller tracks the primary controller, minimizing reset windup.



## Section 5

### 4196S Series Differential Gap Controllers

#### Section Description

This section includes descriptions of adjustments and procedures for prestartup and startup procedures. Location of adjustments is shown in figures 3-1 and 3-2. To better understand the adjustments and overall operation of the controller, refer to the section describing the principles of operation and to the schematic diagrams shown in figure 5-1.

#### Adjustments: Manual Set Point

The set point adjustment adjusts the upper or lower switching point, depending on controller action. To adjust the set point, open the controller cover, and move the set point adjustment until it indicates the desired value of temperature on the process temperature scale. Move the adjustment to the right to increase the set point and to the left to decrease it. Adjusting the set point adjustment does not effect the differential gap setting.

#### Adjustments: Remote Set Point (suffix letter M)

##### CAUTION

Do not manually move the set point indicator on controllers with remote set point. Moving the set point indicator could damage the controller.

If the controller is equipped with the remote set point option, vary the remote set point pressure to change the set point. Increase the pressure to increase the set point, and decrease the pressure to decrease the set point.

#### Adjustments: Proportional Band (PB ADJ)

The proportional band knob (PB ADJ) adjusts the width of the gap between switching points. To adjust the proportional band, open the controller cover, and locate the proportional band knob. Rotate the knob until the desired value is opposite the line on the proportional band indicator cover.

#### Changing Controller Action

Controller action can be switched from direct to reverse or vice versa by simply loosening the screws on the proportional band indicator cover and moving the cover

out so the proportional band knob can be rotated to the desired action. The white portion of the adjustment enables direct controller action; the black portion enables reverse controller action.

#### Switching the Auto/Manual Station (suffix letter E)

##### CAUTION

Switching the controller between automatic and manual mode without balancing can bump the process.

Please refer to figure 6-19 if the controller has the auto/manual station option. Two balance methods are used to equalize the manual output pressure with the controller output pressure. To switch from automatic to manual mode, carefully adjust the loader knob until the metal ball inside the plastic tube moves into the switching zone. Then, move the automatic/manual station switch to MANUAL. Turn the loader knob clockwise to increase the controller output or counterclockwise to decrease it. To switch from manual to automatic mode, adjust the set point adjustment or, with remote set point pressure, move the ball into the switching zone. Turn the switch to AUTO and adjust the set point manually or with remote set point pressure to control the output.

When the automatic/manual switch is in AUTO, adjusting the loader knob has no effect on the controller output. When the automatic/manual switch is in MANUAL, changing the set point adjustment has no effect on the controller output.

#### Prestartup Checks

When performing the checks, open process loop conditions must exist. Refer to figure 3-1 for location of adjustments.

##### Note

If the controller has the auto/manual station option (suffix letter E), be sure the controller is in the automatic mode prior to performing prestartup checks.

1. Plug the controller output and connect supply pressure to the supply pressure regulator. Be sure the regulator is delivering the proper supply pressure to the controller. Provide a means of measuring the controller output pressure.
2. For controllers with remote set point (option M), connect regulated pressure of 3 to 15 psig (0.2 to 1.0

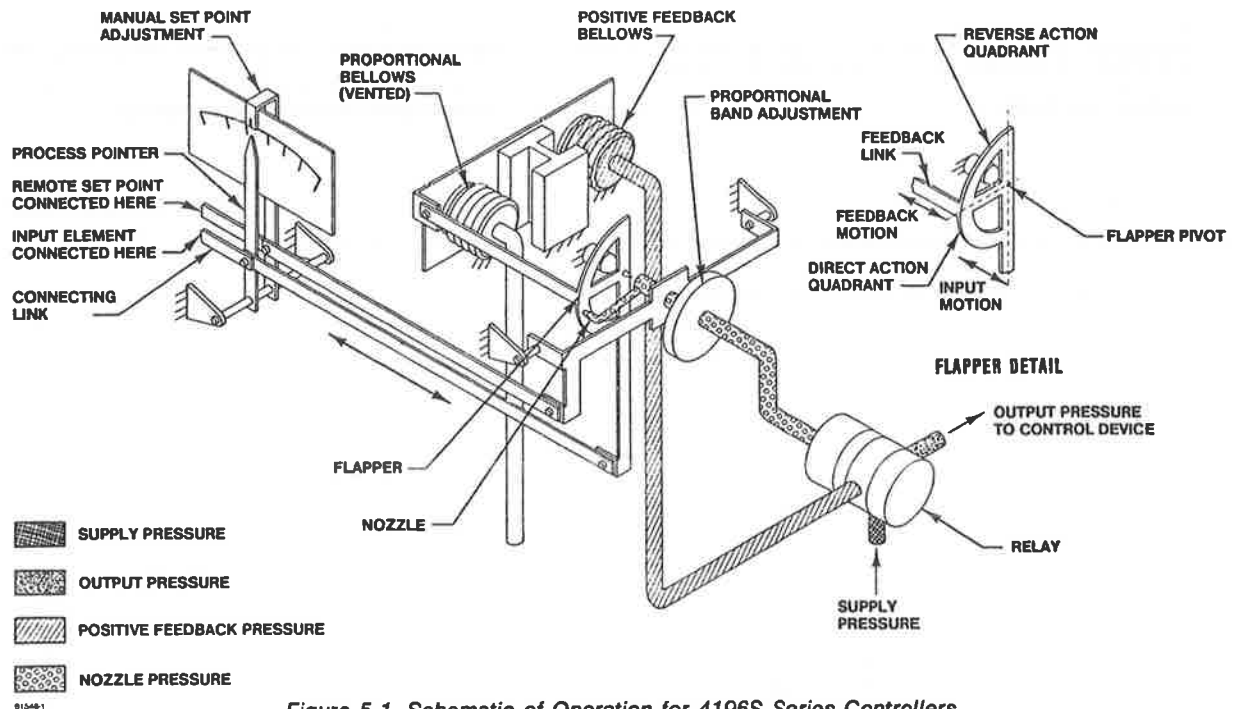


Figure 5-1. Schematic of Operation for 4196S Series Controllers

bar) or 6 to 30 psig (0.4 to 2.1 bar) to the remote set point connection at the top of the controller case.

3. Remove the two screws (key 6) and lift off the proportional band indicator cover (key 36). Set the proportional band knob between DIRECT and REVERSE.

4. The process indicator should indicate the process temperature. For example, with the process temperature at 50 percent of the input span, the process pointer should be at 50 percent,  $\pm 1.0$  percent of its span. Slight adjustment of the indicator zero screw may be necessary. See figure 3-1 for zero adjustment and locking screw location.

5. If desired, the accuracy can be verified at other points on the scale. If the indicator appears to be out of calibration, refer to the process zero and span adjustment portion of the calibration procedure.

6. Install the proportional band indicator cover (key 36) and tighten two screws (key 6).

## Startup

### Note

When performing the startup procedures, keep in mind that the initial settings are guidelines and will vary, depending on the actual process being controlled.

It is recommended that the controller switching points be set as described in the calibration procedures.

When placing a controller in service, slowly open the upstream and downstream manual control valves in the pipeline and close the manual bypass valve if such valves are used.

## Calibration

### General Calibration Instructions

#### Note

If the controller has the auto/manual station option, be sure the controller is in the automatic mode prior to performing calibration.

If the prestartup checks or startup procedures reveal faulty adjustment of the process indicator or flapper misalignment, perform the calibration described in this section. These instructions are valid for either shop or field calibration, provided that open process loop conditions exist. Unless otherwise noted, key numbers are shown in figure 6-16.

### Temperature Baths

The calibration procedure requires that the process temperature be simulated. A temperature bath (liquid or

sand, depending on temperature requirements) is recommended. Bath temperature should be able to cover 0 to 100 percent of the temperature element input range.

If available, two baths could be used to simplify and speed up the calibration process. The minimum bath should be preset at 0 percent of input range and the maximum bath should be set at 100 percent of input range.

Also, provide a means of measuring bath temperature. Use a thermometer or resistance temperature detector (RTD) accurate to within  $\pm 0.05$  percent of input span.

### Calibration: Process Pointer Zero and Span Adjustment

#### Note

**Any adjustment of the process pointer span adjustment screw will require readjustment of the process pointer zero adjustment screw.**

1. Refer to figure 3-1 for location of adjustments.
  2. Loosen two screws (key 6) and lift off the proportional band indicator cover (key 36).
  3. Set the proportional band between DIRECT and REVERSE.
  4. Place the temperature bulb in the 0 percent bath. Allow a minimum of 5 minutes for the controller to stabilize.
  5. Adjust the process indicator to the lowest limit of the input scale by loosening the zero adjustment locking screw and turning the zero adjustment screw.
  6. Place the temperature bulb in the 100 percent bath. Allow a minimum of 5 minutes for the controller to stabilize. Note whether the process pointer indication is above or below the upper limit of the process scale.
  7. Adjust the span screw as follows:
    - Clockwise to increase span for a low indication
    - Counterclockwise to decrease span for a high indication.
- Adjust the span screw to correct one-half the error.
8. Repeat steps 4 through 7 until the error is eliminated.

9. Turn the proportional band indicator knob to 400 percent in the desired controller action (either DIRECT or REVERSE).

10. Install the proportional band indicator cover (key 36) and tighten two screws (key 6).

### Calibration: Remote Set Point Zero and Span Adjustment (suffix letter M)

#### Note

**Any adjustment of the set point indicator span adjustment screw will require readjustment of the indicator zero adjustment screw.**

1. Refer to figures 3-1 and 3-2 for location of adjustments.
2. Loosen two screws (key 6) and lift off the proportional band indicator cover (key 36).
3. Set the proportional band between DIRECT and REVERSE.
4. Adjust the remote set point pressure to the lower limit of the input range.
5. Adjust the set point indicator to the lowest limit of the input scale by loosening the zero adjustment locking screw and turning the zero adjustment screw. Tighten the zero adjustment locking screw.
6. Adjust the remote set point pressure to the upper limit of the input span. Note whether the set point indicator is above or below the upper limit of the process scale.
7. Adjust the span screw as follows: Clockwise to increase span for a low indication; counterclockwise to decrease span for a high indication. Adjust the span screw to correct one-half the error.
8. Repeat steps 4 through 7 until the error is eliminated.
9. Install the proportional band indicator cover (key 36) and tighten two screws (key 36).

### Setting Switching Points

#### Direct-Acting Controllers

The controller output signal will switch from zero pressure to full supply pressure when increasing process temperature passes the upper switching point. The controller output signal will not return to zero pressure until

decreasing process temperature passes the lower switching point. When making adjustments as described in the following steps, keep in mind that:

- Changing the set point adjustment will move both switching points equally in the direction of adjustment.
- Changing the proportional band adjustment will widen or narrow the differential gap between the two switching points by moving the position of the lower switching point.

Figure 5-2 shows the relationship between the percent of sensor range between switching points and the proportional band setting on the controller. The following example illustrates how to use figure 5-2.

**Example:** The sensing element has a range of 100°F (38°C). The lower switching point is to be set at 30°F (-1°C) and the upper switching point is to be set at 80°F (27°C).

Proceed as follows:

- Divide the differential gap (the difference between the upper and lower switching points) by the sensing element range. Multiply the result by 100 as shown in the following equation:

$$\frac{\text{Differential Gap}}{\text{Sensing Element Range}} \times 100 = \frac{50^\circ\text{F} (10^\circ\text{C})}{100^\circ\text{F} (38^\circ\text{C})} \times 100 = 50\%$$

- Locate the 50 percent line on figure 5-2. Move along this line until you intersect the curve. Read the proportional band setting on the left hand axis. For this example, the setting is approximately 35 percent.

- Using the curve in figure 5-2 determine the correct proportional band setting for the desired gap (expressed as a percent of the input span) between the switching points.
- Set the proportional band knob to the desired setting determined in step 1.
- Adjust the set point to the desired upper switching point.
- Increase the process temperature until the controller output signal switches from zero pressure to full supply pressure.
- Decrease the process temperature to the desired switching point at which the controller output signal switches from full supply pressure to zero pressure.
- Narrow or widen the proportional band slowly until the output signal switches from full supply pressure to zero pressure.

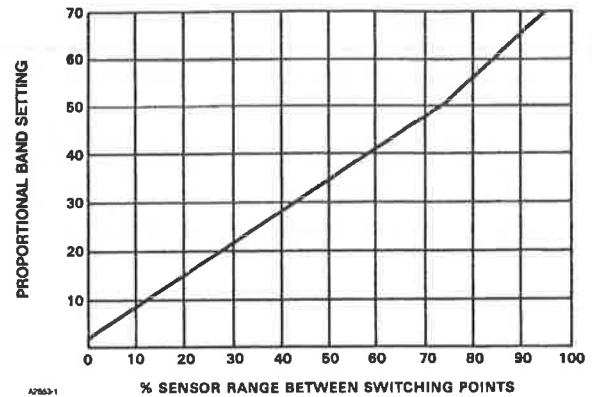


Figure 5-2. Curve for Determining Proportional Band Setting

7. Repeat steps 4 through 6 until the controller output switches at the desired points.

8. Observe the process pointer when the output switches at the upper switching point. The process pointer indication should be within  $\pm 2$  percent of the set point indication.

### Reverse-Acting Controllers

The controller output signal will switch from zero pressure to full supply pressure when decreasing process temperature passes the lower switching point. The controller output signal will not return to zero pressure until increasing process temperature passes the upper switching point. When making adjustments as described in the following steps, keep in mind that:

- Changing the set point adjustment will move both switching points equally in the direction of adjustment.
- Changing the proportional band adjustment will widen or narrow the differential gap between the two switching points by moving the position of the upper switching point.

Figure 5-2 shows the relationship between the percent of sensor range between switching points and the proportional band setting on the controller. The following example illustrates how to use figure 5-2.

**Example:** The sensing element has a range of 100°F (38°C). The lower switching point is to be set at 30°F (-1°C) and the upper switching point is to be set at 80°F (27°C).

Proceed as follows:

- Divide the differential gap (the difference between the upper and lower switching points) by the sensing element range. Multiply the result by 100 as shown in the following equation:



$$\frac{\text{Differential Gap}}{\text{Sensing Element Range}} \times 100 = \frac{50^{\circ}\text{F (10}^{\circ}\text{C)}}{100^{\circ}\text{F (38}^{\circ}\text{C)}} \times 100 = 50\%$$

● Locate the 50 percent line on figure 5-2. Move along this line until you intersect the curve. Read the proportional band setting on the left hand axis. For this example, the setting is approximately 35 percent.

1. Using the curve in figure 5-2 determine the correct proportional band setting for the desired gap (expressed as a percent of the maximum input element span) between the switching points.

2. Set the proportional band knob to the desired setting determined in step 1.

3. Adjust the set point to the lower desired switching point.

4. Decrease the process temperature until the controller output signal switches from zero pressure to full supply pressure.

5. Increase the process temperature to the desired switching point at which the controller output signal switches from full supply pressure to zero pressure.

6. Narrow or widen the proportional band slowly until the output signal switches from full supply pressure to zero pressure.

7. Repeat steps 4 through 6 until the controller output switches at desired points.

8. Observe the process pointer when the output switches at the lower switching point. The process pointer indication should be within  $\pm 2$  percent of the set point indication.

## Principle of Operation: Differential Gap Controllers

### Overall Operation

Refer to the schematic diagram in figure 5-1.

The input element is connected to the process pointer and to the flapper by connecting links. As the process temperature increases (in a direct-acting controller), the flapper moves toward the nozzle, restricting flow through the nozzle and increasing nozzle pressure. When this occurs, relay action increases the output pressure (delivery) of the controller. Output pressure is fed back to the positive feedback bellows. The action of this bellows is a positive feedback action that moves the flapper closer to the nozzle, increasing the nozzle pressure even higher, which in turn, increases the relay output. Thus, the output pressure to the final control element switches to full supply pressure.

As the process temperature decreases, approaching the lower switching point, the flapper moves away from the nozzle (in a direct-acting controller), reducing nozzle pressure. Through relay action, pressure to the positive feedback bellows is reduced, moving the flapper further away from the nozzle. Thus, the nozzle pressure falls even further. Output pressure to the final control element switches to zero.

The set point adjustment changes the proximity of the nozzle and flapper as does a change in process temperature except that, when the set point is changed, the nozzle moves with respect to the flapper. The set point adjustment moves both the upper and lower switching points.

The proportional band knob positions the nozzle on the flapper. Increasing (widening) the proportional band moves the nozzle away from the input connection. When the proportional band adjustment moves the nozzle across the feedback connection, the controller action changes between direct and reverse.

On a direct-acting controller, changing the proportional band adjustment will widen or narrow the differential gap between the two switching points. This is accomplished by changing the position of the lower switching point. On a reverse-acting controller, changing the proportional band adjustment will widen or narrow the differential gap between the two switching points. This is accomplished by changing the position of the upper switching point.

### Remote Set Point (suffix letter M)

The capability to adjust the controller set point from a remote location is available with all 4196 Series controllers. This option is designated by the suffix letter M in the type number.

### Auto/Manual Station Option (suffix letter E)

Controllers with the auto/manual station option (designated by the suffix letter E in the type number) have piping on the output side of the relay as shown in figure 3-4. Supply pressure to the relay is also applied to the manual loader. The manual loader, functioning as a regulator, applies pressure to one side of the plastic tube and to the auto/manual station switch. Output pressure from the relay registers on the other side of the plastic tube as well as in the auto/manual switch.

When the auto/manual switch is in the MANUAL position, the output of the manual loader is channelled through the auto/manual switch and becomes the output of the controller. When the auto/manual switch is in the AUTO position, the output of the relay is channelled through the switch to become the output of the controller.

Before the auto/manual switch is operated, the output of the relay must equal the output of the manual loader to avoid bumping the process. Adjusting the set point varies the pressure on the left-hand side of the plastic tube. Adjusting the manual loader knob varies the pres-

sure on the right-hand side. When the pressures are equal, the metal ball is centered in the tube. Pressure imbalance forces the ball to one end of the tube where it forms a seal, blocking air flow through the tube.

## Section 6 Maintenance

### WARNING

To avoid personal injury and property damage caused by uncontrolled process temperature, provide some temporary means of control for the process and then take the controller out of service.

#### Note

Unless otherwise noted, key numbers refer to figure 6-16. Figures 3-1 and 3-2 show the location of adjustments and major components. For maintenance on the indicator assembly, please refer to figure 6-21.

### Inspection and Maintenance

Parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and parts replacement depends upon the severity of the service conditions.

Due to the care Fisher takes in meeting all manufacturing requirements (heat treating, dimensional tolerances, etc.), use only replacement parts manufactured or furnished by Fisher. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job.

Figure 6-1 is a maintenance guide. It summarizes the information available in the maintenance section. Select the appropriate maintenance procedure, and perform the numbered steps. Each procedure requires that supply pressure be shut off before beginning maintenance.

Some procedures require temperature baths. Please refer to the appropriate calibration procedure for information on temperature baths.

### Troubleshooting

As an aid to troubleshooting, table 6-1 lists some common operating faults, their probable cause, and suggests procedures for correcting the fault.

### Changing Controller Action

The following steps describe changing controller action from direct (increasing process temperature produces increasing output pressure) to reverse (increasing process temperature produces decreasing output pressure) or vice versa.

1. Loosen two screws (key 6) in the proportional band indicator cover (key 36). The screws need not be removed.
2. Lift the proportional band indicator cover as shown in figure 6-2.
3. Rotate the proportional band knob (key 25) to the desired controller action.
4. Install the proportional band indicator (key 36), and tighten the two screws (key 6).

### Replacing Controller Parts

#### Process Temperature Scale

Key numbers refer to figure 6-16.

#### Note

If the controller contains a remote set point indicator which is located behind the scale, simply perform steps 2, 5, 6, and 7.

1. Please refer to figure 6-3. Adjust the set point adjustment to 50 percent of scale. Make the adjustment manually or with the remote set point pressure.
2. Remove four screws (key 37).

### CAUTION

The process indicator and set point adjustment can be easily damaged. Take care not to bend the process indicator or the set point adjustment while performing the following procedure.

3. Slide the process scale (key 61) downward so that the top of the slot touches the set point adjustment. Deflect the lower portion of the slot outward, and carefully slide the scale upward and off, clearing the set point adjustment as shown in figure 6-3.
4. To install the replacement scale, deflect the lower part of the slot slightly so that the scale slides downward over the set point adjustment and under the process pointer.
5. Install and tighten the four screws on the scale.
6. If the controller has the remote set point option, perform the appropriate remote set point calibration procedure.
7. Perform the appropriate process pointer zero and span adjustment and the flapper alignment in the calibration procedures.

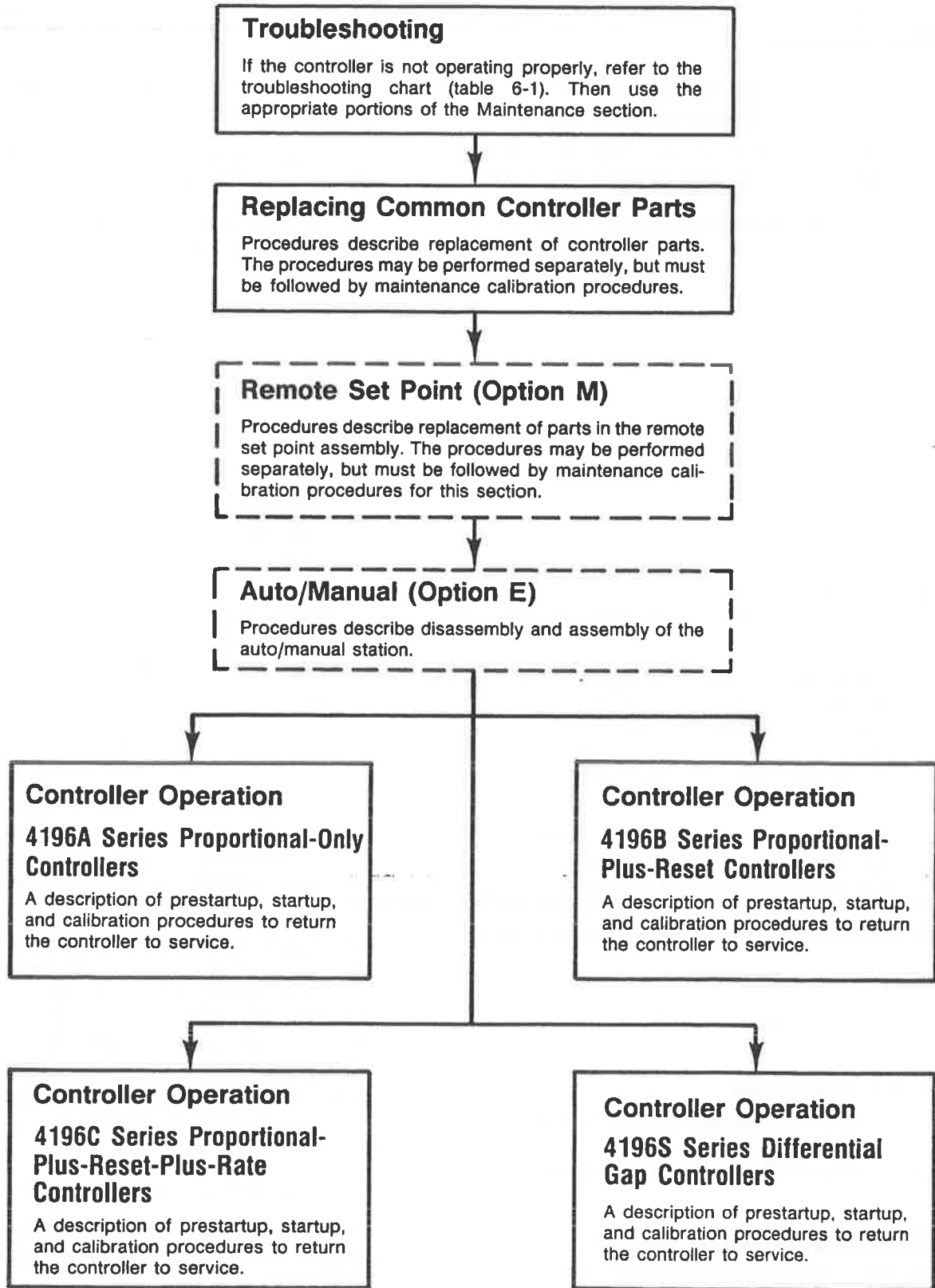


Figure 6-1. Maintenance Guide

Table 6-1. Troubleshooting Chart

Fault	Possible Cause	Check	Correction
1. Process wanders or cycles about set point	1.1 Proportional band and reset settings	1.1 Refer to the Start-up section for controller settings	1.1 If stable control cannot be attained, and all other elements of the loop are functionally correct, examine other possible causes related to the controller
	1.2 Supply pressure varying	1.2 Monitor the supply pressure with an external gauge. Ensure that it is set correctly and does not fluctuate. Note the number of instruments being supplied by the regulator	1.2 Correct as necessary. One regulator per instrument is recommended
	1.3 Process pointer rubbing on cover or scale	1.3 Note if the pointer is bent	1.3 Bend pointer to provide clearance
	1.4 Linkage failure	1.4 Check for links that are bent or not connected properly, flexures bent or broken, pivots broken	1.4 Replace or repair as necessary
	1.5 Relay malfunction	1.5 By changing the process set point and observing the output verify that the output will change at about the same rate in both directions	1.5 If the output changes quickly in one direction and sluggishly in the other, replace the relay
	1.6 Differential relief valve set too low	1.6 The minimum relief valve setting is dependent on the loop dynamics and the controller settings. If under normal load changes, the relief valve opens, instability can occur. Check by observing the controller reaction to a set point or load change under closed loop conditions	1.6 If the differential relief valve appears to be set too low, refer to the section of this instruction manual that covers the anti-reset windup option
2. Controller process indication and output do not change with a known process temperature change; or, set point and process indicators do not align  Note: Some offset is inherent with proportional only controllers (4196A Series). The amount of offset is a function of the proportional band setting	2.1 Supply pressure not set correctly	2.1 Check with an external source	2.1 Reset the supply pressure if necessary. If the condition occurs again, the regulator should be rebuilt or replaced
	2.2 Flapper not aligned	2.2 Refer to the Flapper alignment procedure	2.2 Align the flapper as necessary
	2.3 Loss of thermal system precharge	2.3 Note the process indication and the output pressure when the process temperature is at 100 percent of the input temperature. Vary the process temperature and observe the following: (a) If the process pointer does not move, system has likely lost precharge. (b) If the process pointer moves, but a faulty temperature element is suspected, recalibrate the zero and span as described in the Calibration section. Allow 48 hours for the system to continue to lose pressure. If the span is still short, the system is likely losing precharge pressure	2.3 Replace the temperature element as described in the Maintenance section
	2.4 Indicators out of calibration	2.4 Refer to the process (and remote set if applicable) zero and span adjustment procedures in this manual	2.4 Adjust as necessary
	2.5 Linkage not connected correctly	2.5 Inspect for loose screws and damaged flexures, links or pivots	2.5 Repair or replace parts as necessary
	2.6 Leak in feedback system	2.6 Open the reset valve to 0.1 minutes/ repeat. Adjust output pressure to 20 psig (1.4 bar). Using soap solution, check for leaks in the proportional and reset bellows in the tubing that connects these bellows	2.6 Repair as necessary

- Continued -

Table 6-1. Troubleshooting Chart (Continued)

Fault	Possible Cause	Check	Correction
2. Continued	2.7 Reset valve leaks	2.7 Adjust output to 15 psig (1.0 bar) for a 3 to 15 psig (0.2 to 1.0 bar) output or 30 psig (2.0 bar) for a 6 to 30 psig (0.4 to 2.0 bar) output. Close the reset valve. If the controller output varies as the reset valve is closed and no leaks were found in the rest of the feedback system (Step 2.6), the reset valve is leaking	2.7 Replace the reset valve (4196B Series) or the rate/reset valve (4196C Series)
	2.8 Leak in remote set point system	2.8 Adjust remote set point pressure to 15 psig (1.0 bar). Using soap solution, check for leaks in the remote set point and tubing assembly	2.8 Repair or replace parts as necessary
3. Controlling off set point but not reflected by process and set point indicators	3.1 Controller is out of calibration	3.1 Refer to the calibration and flapper alignment procedures	3.1 Adjust as necessary
4. No reset action (4196B and 4196C Series)	4.1 Reset valve is plugged	4.1 Turn the reset valve through its range several times to remove any restrictions	4.1 If reset action returns, no further action is necessary. If not, replace the reset valve (4196B Series) or rate/reset valve (4196C Series)
	4.2 Reset pressure leak	4.2 Adjust the output to 15 psig (1.0 bar) for a 3 to 15 psig (0.2 to 1.0 bar) output or 30 psig (2.0 bar) for a 6 to 30 psig (0.4 to 2.0 bar) output. Close the reset valve. If the output varies and no leaks were found in the rest of the feedback system (see Step 2.6), the reset valve is leaking	4.2 Replace the reset valve (4196B Series) or the rate/reset valve (4196C Series)
	4.3 Tubing leak	4.3 With reset valve positioned at .01 MIN/repeat put 15 psig (1.0 bar) to the output port. Using soap solution, check for leaks in the reset bellows and attached tubing assembly	4.3 Repair or replace parts as necessary
5. Abnormal control point shift when proportional band is changed	5.1 Flapper is dirty or pitted	5.1 Inspect the flapper	5.1 Clean, or replace flapper as necessary
	5.2 Flapper is out of alignment	5.2 Refer to flapper alignment procedure	5.2 Align flapper as necessary
6. Controller will not attain full output range	6.1 Output pressure gauge not functioning	6.1 Measure the output with an external pressure gauge	6.1 Replace the gauge if it is defective
	6.2 Supply pressure not correct	6.2 Check with an external source	6.2 Repair or replace the supply pressure regulator, if necessary. Replace the supply pressure gauge if necessary
	6.3 Proportional band setting too wide (4196A Series only)	6.3 Adjust proportional band setting to 10. Manually cap the nozzle. Output should increase	6.3 Use a narrower proportional band setting
	6.4 Input element or linkage failure	6.4 Inspect the element for alignment and loose screws	6.4 Repair or replace parts as necessary
	6.5 Leak in nozzle pressure tubing	6.5 Using soap solution, check for leaks in the nozzle tubing assembly	6.5 Replace faulty parts as necessary. Clean out the relay primary orifice with the cleanout wire attached to the relay to ensure the orifice is not clogged
	6.6 Relay malfunction	6.6 Manually push the flapper away from the nozzle. The output pressure should be zero. Cap the nozzle. The output should increase rapidly to within 0.5 psig (35 mbar) of the supply pressure	6.6 If the output does not change as described, remove the relay. Replace the O-rings if necessary. Replace relay if necessary

- Continued -

Table 6-1. Troubleshooting Chart (Continued)

Fault	Possible Cause	Check	Correction
7. Controller remains at full output	7.1 Supply pressure too high	7.1 Check with an external pressure gauge	7.1 Supply pressure regulator or gauge may have to be replaced
	7.2 Output gauge not functioning	7.2 Vary supply pressure to see if output gauge responds	7.2 If output gauge does not respond, replace it
	7.3 Sensor or linkage failure	7.3 Vary the process temperature and observe the flapper. Inspect the sensor and linkage for damage	7.3 Repair or replace parts as necessary
	7.4 Mechanical alignment	7.4 Move the set point and verify that the nozzle can be uncapped by the flapper. If not, inspect linkages and flexures for damage	7.4 Repair or replace parts as necessary
	7.5 Relay failure or restriction in nozzle passage	7.5 Manually move the flapper approximately 1/16-inch (1.6 mm) from the nozzle	7.5 If the output pressure remains at the supply pressure remove the controller frame from the controller case/cover assembly and test again with the relay nozzle tubing nut (key 18) loose. If the output is 0 psig, clean or replace the nozzle assembly. If the output remains at supply pressure, replace the relay
	7.6 Flapper misaligned	7.6 Manually push the flapper away from the nozzle. Controller output should go to 0 psig	7.6 Perform flapper alignment procedures
8. Controller remains at zero output	8.1 Gauge not functioning	8.1 Verify that the supply pressure is at its correct value and that the controller output is zero	8.1 Replace gauges as necessary
	8.2 Linkage failure	8.2 Inspect the sensor and linkage for damage	8.2 Repair or replace parts as necessary
	8.3 Mechanical alignment	8.3 Move the set point and verify that the nozzle can be capped by the flapper. If not, inspect linkages and flexures for damages	8.3 Repair or replace parts as necessary
	8.4 Relay malfunction	8.4 Check for air at the nozzle. Cap the nozzle and note that the controller output increases rapidly	8.4 Clean out the relay primary orifice with the cleanout wire attached to the relay to ensure the orifice is not clogged. If the problem persists, replace the relay
	8.5 Nozzle pressure leak	8.5 Check for nozzle tubing leaks with a water bottle and soap solution with the nozzle capped by the flapper. Press the nozzle cap (key 23) gently to ensure the nozzle assembly is sealing. Ensure the relay nozzle tubing nut (key 18) is tight and the manifold screws (keys 34 and 131) are tight	8.5 Tighten the relay nozzle tubing nut (key 18). Tighten the manifold screws (keys 34 & 131). Replace the nozzle assembly O-ring (key 24), or set point beam assembly as appropriate

## Relay

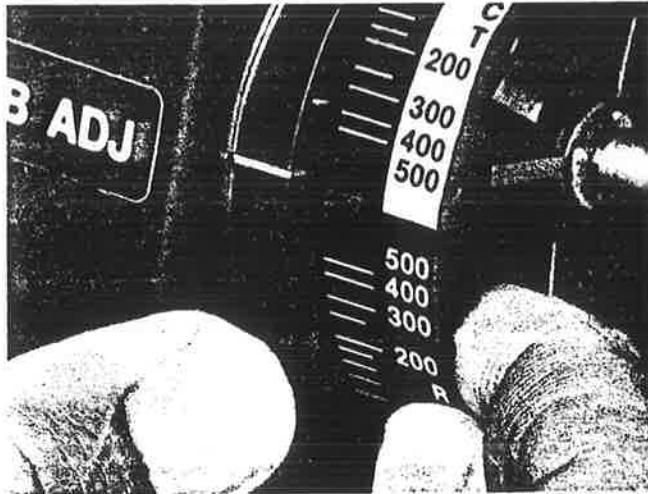
- Loosen the two captive screws that hold the relay (key 50, figure 6-16) in place.
- Tip the relay slightly toward the case to clear output pressure gauge, and lift out the relay.
- Make sure the replacement relay has three O-ring assemblies as shown in figure 6-4. The fourth port is for exhaust and must not contain an O-ring.
- Install the replacement relay, making sure the tabs on the relay (see figure 6-4) line up with the tab on the frame.

- Tighten the two screws that hold the relay in place.
- Perform the flapper alignment procedure.

## Case and Cover

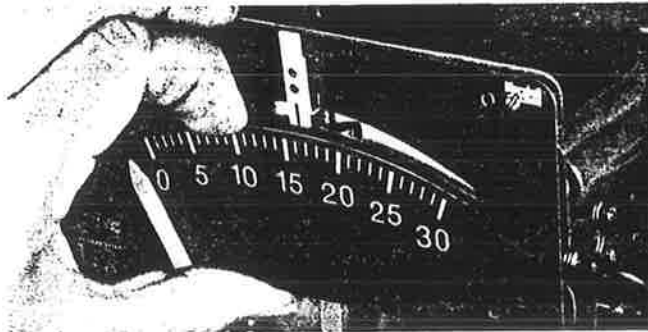
### CAUTION

The case and cover are an integral unit; attempting to separate them will damage the hinge. If the cover needs to be replaced, replace the case also.



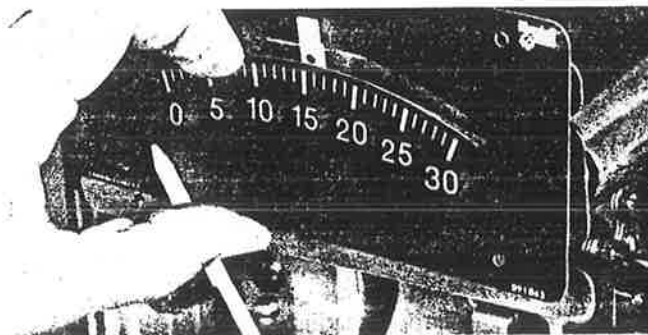
W3439

Figure 6-2. Changing Controller Action



W4295

DEFLECT LOWER PORTION OF THE SLOT



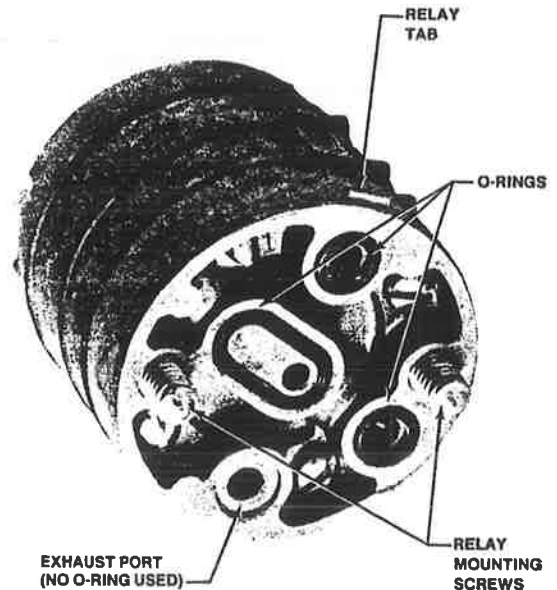
W4296

AND LIFT THE SCALE UP AND OFF

Figure 6-3. Changing the Scale

Key numbers refer to figure 6-16.

1. Remove external piping and fittings from the controller.



W3441-1\*

Figure 6-4. Relay Construction

2. If the temperature bulb is not in a thermowell, make provisions to ensure that the process fluid does not escape from the process vessel as the temperature bulb is removed.

3. Remove the controller from its mounting (see Installation section) to a maintenance area.

4. Remove the nine screws (key 38) from the case (key 1), and lift out the controller assembly. If the controller has remote set point (suffix letter M), it is necessary to pry the case slightly to remove the frame (key 3).

5. Carefully draw the capillary tube and the temperature bulb through the process connection opening in the case. Inspect the frame O-rings and replace as necessary.

6. Carefully feed the temperature bulb through the opening in the replacement case and pull the capillary tube all the way through.

7. Install the controller assembly in the replacement case.

8. Slide the controller frame (key 3) down to assure an O-ring seal at the pressure and thermal system connections. Hold the frame in place.

9. Tighten the nine mounting screws.

10. Remove the blow-out plug (key 72) from original case, and install in the replacement case.

11. Perform the process zero and span, remote set point zero and span (for suffix letter M only), and flapper alignment procedures.



12. Mount the controller as described in the Installation section.

13. Connect the external piping to the controller, and install the temperature bulb in the process fluid.

## Gauges

### CAUTION

Before performing this procedure, be sure the replacement gauges are the correct range so that they are not damaged by overpressure.

Key numbers refer to figure 6-16.

1. Unscrew the output gauge (key 46) or the supply gauge (key 47) from the frame (key 3).

2. Before installing the replacement gauge, coat the threads on the gauge with a suitable sealant (such as key 311).

3. Screw the replacement gauge into the frame.

4. Apply the correct supply pressure and check for leaks with the nozzle capped for full output pressure.

## Supply, Proportional, Reset, Reset Valve, and Relief Tubing Assemblies

### Note

The following procedure requires that the controller be removed from the case. Perform steps 1 through 5 of the case and cover replacement procedure.

Key numbers refer to figure 6-16.

1. Disengage the two nuts that hold the tubing assembly. Remove the tubing assembly.

2. Install the replacement tubing assemblies.

3. Adjust the reset valve to 0.01 (4196B and C Series) and set the rate valve to OFF (4196C Series).

4. Apply the correct supply pressure and check for leaks with the nozzle capped for full output pressure.

5. Perform steps 6 through 9 and steps 11 through 13 of the case and cover replacement procedure.

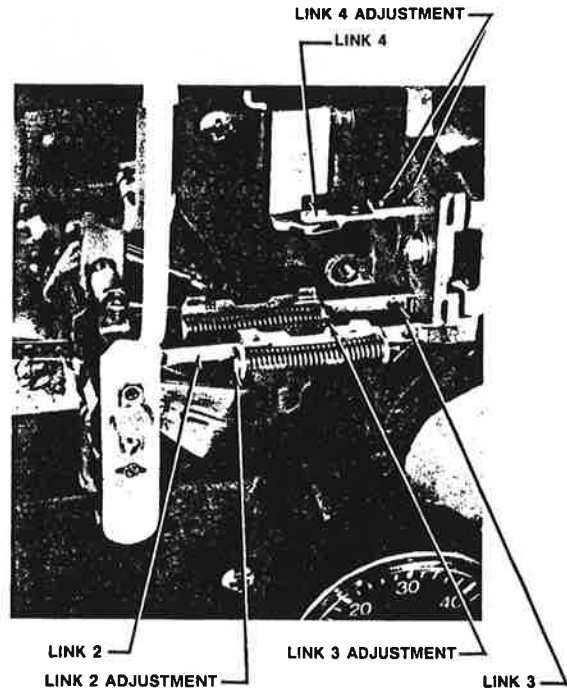


Figure 6-5. Link Location

## Proportional Band Knob, Nozzle Assembly, and Set Point Beam Assembly

### Note

The following procedure requires that the controller be removed from the case. Perform steps 1 through 5 of the case and cover replacement procedure.

Key numbers refer to figure 6-16.

1. Remove the two screws (key 6), and lift off the proportional band indicator cover (key 36).

2. Disconnect link number 3 from the set point beam assembly (key 23). Please refer to figure 6-5 for location of the link.

3. Remove the set point beam bias spring (key 28). Please refer to figure 6-6 for spring location.

4. Remove the screw and washer (keys 19 and 20) that hold the adjustable pivot assembly (key 17) to the frame, and remove the pivot assembly. Please refer to figure 6-16.

5. Disconnect the nut that holds relay nozzle tubing (key 18) into the frame manifold (key 135). Please refer to figure 6-6 for location of relay nozzle tubing assembly.

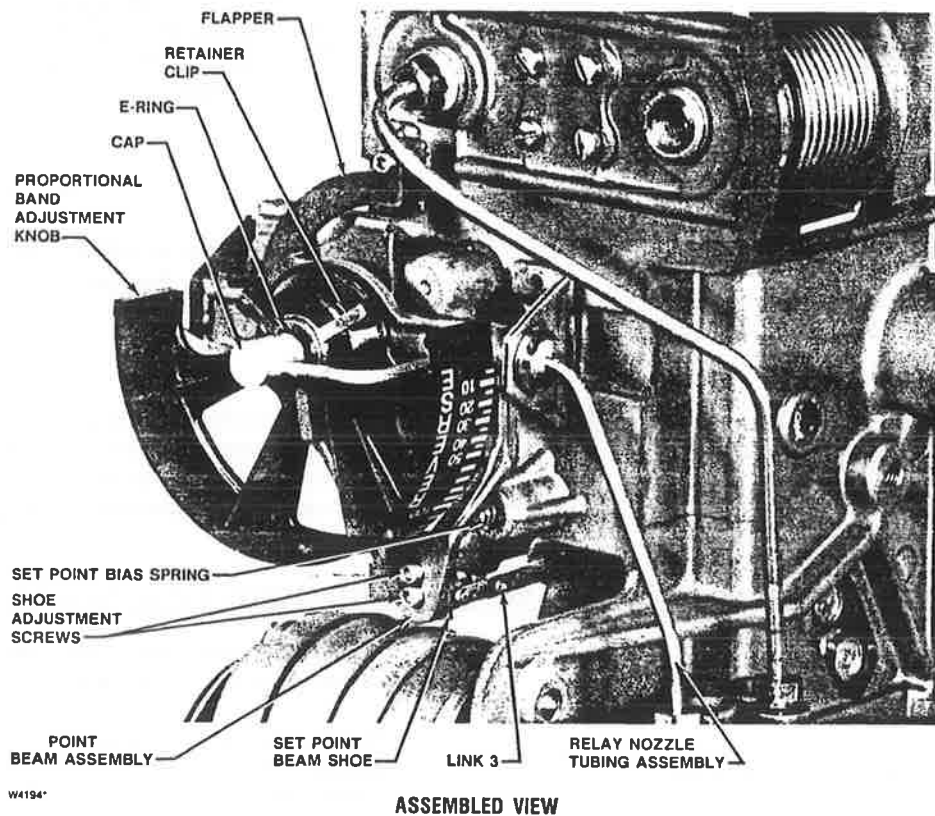
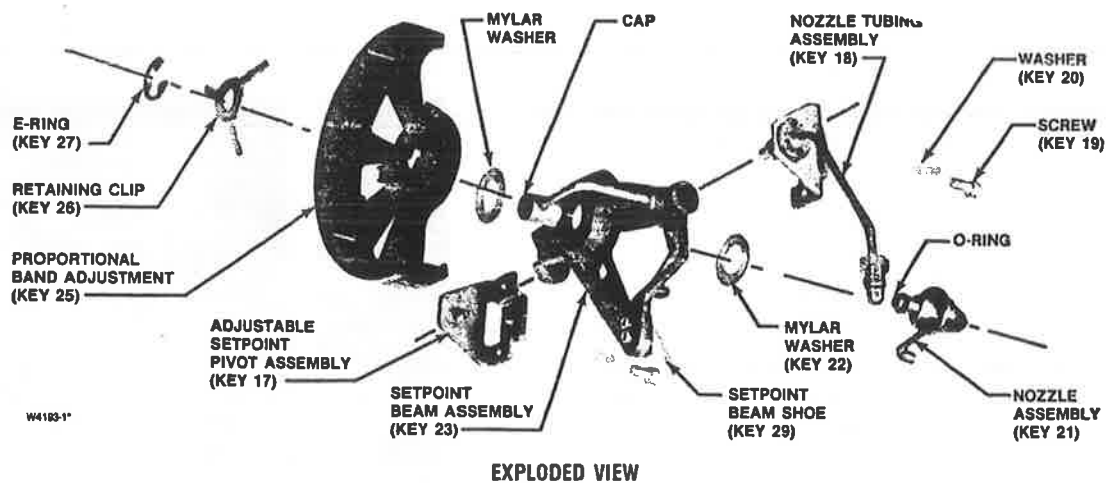


Figure 6-6. Proportional Band Knob and Set Point Beam Details

6. While holding the proportional band knob, remove the screw and washer (keys 19 and 20) that hold the relay nozzle tubing assembly (key 18) to the frame.

7. Remove the proportional band knob, nozzle assembly, and set point beam assembly from controller.

8. Remove the relay nozzle tubing assembly (key 18) from the set point beam assembly (key 23). See figure 6-6.

9. Remove the E-ring (key 27) from the nozzle assembly (key 21).

10. Remove the nozzle assembly (key 21) from the bottom of the set point beam assembly (key 23).

11. Remove the retaining clip (key 26).

12. Remove the proportional band knob (key 25) or replace it if necessary.

13. Inspect the nozzle assembly O-ring (key 24) and replace it if necessary.
14. Inspect the nozzle assembly (key 21), and replace if necessary. Inspect the nozzle orifice, and clean it if necessary. Inspect the washer (key 22) and replace it, if necessary.
15. Lubricate (key 318) and install the proportional band knob (key 25) on the set point beam assembly (key 23).
16. Install the retaining clip (key 26) on the three posts on the proportional band knob.
17. Sparingly apply a suitable lubricant (key 318) to the nozzle assembly O-ring and the mylar washer (key 22). Install the nozzle assembly (key 21) through the mylar washer, the set point beam assembly (key 23), the proportional band knob (key 25) and the retaining clip (key 26) into the cap, aligning the nozzle with the tab on the proportional band knob as shown in figure 6-7.
18. While holding the nozzle assembly (key 21) against the set point beam assembly (key 23), depress the retaining clip (key 26), and install the E-ring (key 27) into the E-ring groove on the nozzle assembly (key 21). Ensure that all three tabs of the E-ring are engaged.
19. Inspect the O-ring on the relay nozzle tubing assembly (key 18), and replace it, if necessary. Sparingly apply a suitable lubricant (key 318) to the O-ring.
20. Install the relay nozzle tubing assembly (key 18) into the set point beam assembly.
21. Adjust the proportional band between DIRECT and REVERSE. Do this by aligning the tab on the proportional band knob with the hole in the set point beam assembly as shown in figure 6-7.
22. Position the proportional band knob, nozzle assembly, and set point beam assembly on the frame. Install the relay nozzle tubing assembly nut loosely into the frame manifold.
23. Loosely install the screw and washer (keys 19 and 20) into the relay nozzle tubing assembly (key 18) as shown in figure 6-15.
24. Center the nozzle on the flapper as shown in figure 6-8 while squeezing the set point beam assembly firmly against the relay nozzle tubing assembly. With the nozzle centered on the flapper, tighten the screw (key 19). Ensure that the nozzle is still centered on the flapper.
25. Install the pivot of the adjustable pivot assembly (key 17) in the hole in the set point beam (key 23).
26. Install the washer (key 20) on the screw (key 19).
27. Install the screw (key 19) through the frame (key 3) into the set point pivot assembly (key 17). Do not tighten.
28. Squeeze the adjustable set point pivot firmly against the set point beam and tighten the screw (key 19). Ensure the nozzle is still centered on the flapper.
29. Turn the proportional band knob to 5 percent direct action. Loosen the locking nut on the adjustable set point pivot assembly (key 17) and back the set screw out slightly such that the set point beam assembly will fall under its own weight, with a minimum of sideplay between the pivots. Tighten the locking nut.
30. Tighten the nut on the relay nozzle tubing assembly (key 18) and reconnect supply pressure. With the nozzle capped for maximum output pressure, check for leaks. Disconnect supply pressure.
31. Install the set point beam bias spring (key 28) into frame (key 3) bore and onto the spring seat on the set point beam assembly (key 23) (see figure 6-6).
32. Attach link number 3 to the set point beam assembly (key 23). See figure 6-5.
33. For controllers with reset or rate (4196B and 4196C Series), first, disconnect the supply pressure. Then, adjust the RATE adjustment knob to the OFF position (4196C).

Controller output pressure must be 0 psig. Adjust the reset to .01 minutes per repeat and wait 30 seconds then adjust the RESET knob to the CLOSED position (4196B) or to the OFF position (4196C).
34. Connect the supply pressure. Provide an accurate means of measuring output pressure.
35. Perform the process pointer zero and span adjustments described in the calibration procedure. If the controller has a remote set point (suffix letter M), perform the remote set point zero and span adjustment procedure.

**Note**

**The following procedure (steps 36 through 43) matches the process pointer motion to the set point indicator motion so they will stay aligned everywhere on the scale.**

36. Adjust the proportional band to 40 percent direct or reverse action depending on the desired controller action.
37. Adjust the set point to the minimum value on the process scale.

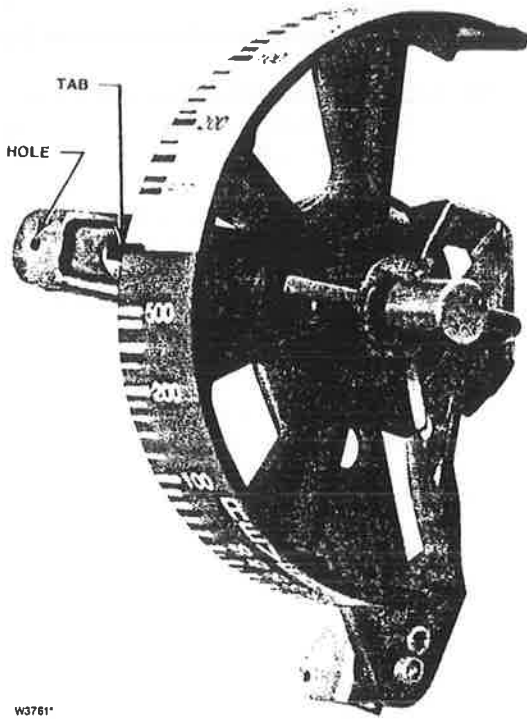


Figure 6-7. Proportional Band Knob Setting

38. Note to which hole link number 1 is connected. Disconnect link number 1 from the temperature element takeoff assembly (see figure 3-1) and tape the process pointer to the minimum scale value and record the controller output pressure. Output pressure reading can be anywhere from 3 to 15 psig (0.2 to 1.0 bar) for a 3 to 15 psig (0.2 to 1.0 bar) output or 6 to 30 psig (0.4 to 2.0 bar) for a 6 to 30 psig (0.4 to 2.0 bar) output.

39. If the output is not within the specified range, adjust the flapper leveling screw nearest the nozzle until the output is within the range specified. See figure 3-1 for the location of the flapper leveling screws.

40. Adjust the set point to the maximum value on the process scale.

41. Move the process pointer until the controller output equals the pressure recorded in step 38.

42. If the process temperature indication (in step 41) is greater than the maximum scale value by 2 percent, loosen the shoe adjustment screws (key 30) and move the set point beam shoe (key 29) slightly away from the center of the flapper assembly (see figure 6-6). If the process temperature indication (in step 41) is less than the maximum scale value by more than 2 percent of scale span, move the set point beam shoe (key 29) slightly toward the center of the flapper assembly.

43. Repeat steps 37 through 42 until error is less than 2 percent of the process scale span at maximum process scale value.

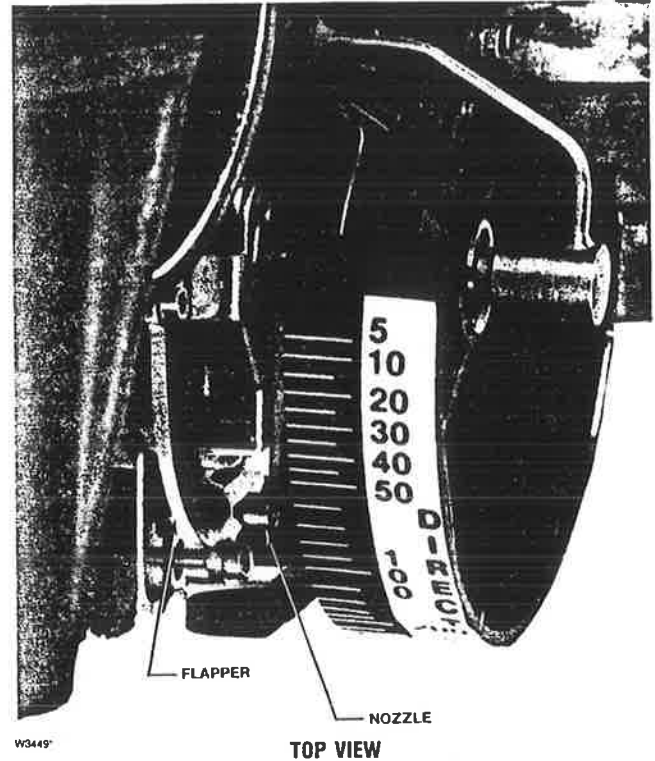


Figure 6-8. Nozzle-Flapper Positioning

44. Remove the tape from the process pointer and reattach link number 1 to the same hole in the takeoff assembly.

45. Please refer to steps 6 through 9 in the case and cover replacement procedure.

46. Please refer to the procedures for: Process pointer zero and span adjustment, remote set point zero and span adjustment (suffix letter M, only), and flapper alignment.

## Flapper Assembly And Flexure Pivot Assembly

### Note

The following procedure requires that the controller be removed from the case. Perform steps 1 through 5 of the procedure for case and cover replacement.

Key numbers refer to figure 6-16.

1. Remove the two screws (key 6), and lift off the proportional band cover (key 36).

2. Disconnect link number 3 from the set point beam assembly (key 23). Please refer to figure 6-5 for link location.

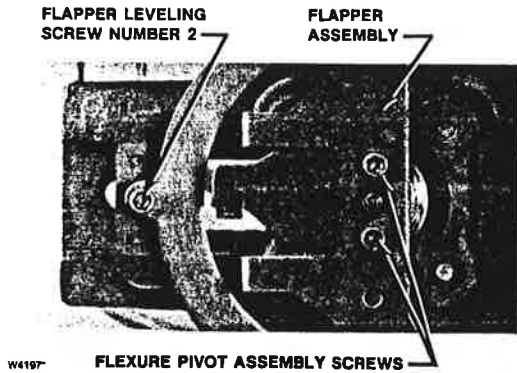


Figure 6-9. Leveling Screw Alignment

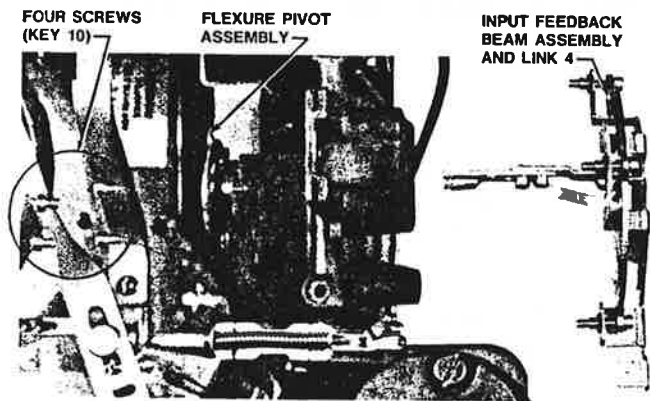


Figure 6-10. Exploded View of Flexure Pivot Assembly

3. Remove the set point beam bias spring (key 28), refer to figure 6-6 for the spring location.
4. Remove the screw and washer (keys 19 and 20) that hold the adjustable set point pivot assembly (key 17) to the frame. Please refer to figure 6-15.
5. Remove the adjustable set point pivot assembly (key 17).
6. Disconnect the nut that holds the relay nozzle tubing assembly (key 18) into the frame manifold (key 135). Please refer to figure 6-6 for location of the relay nozzle tubing assembly.
7. While holding the proportional band knob, remove the screw and washer (keys 19 and 20) that hold the relay nozzle tubing assembly (key 18) to the frame.
8. Remove the proportional band knob, nozzle assembly, and set point beam assembly from the controller.
9. Disconnect link number 2 from the flapper assembly (key 11). Please refer to figure 6-5 for location of link.

10. Disconnect link number 4 from the bellows bracket (key 31). Please refer to figure 6-5 for location of the link.

11. Remove the two screws (key 12) from the flexure pivot assembly (key 9). See figure 6-9 for screw location.

12. Remove the flapper assembly and link number 4 as shown in figure 6-10.

13. Remove the four screws (key 10) shown in figure 6-10 that hold the flexure pivot assembly (key 9) to the frame.

14. Remove the flexure pivot assembly (key 9). See figure 6-10.

15. Install the replacement flexure pivot assembly with the four screws (key 10). Do not tighten the screws.

16. With the controller in the upright position, slide the flexure pivot assembly down as far as possible, and tighten the four screws (key 10).

17. Place the flapper assembly (key 11) onto the flexure pivot assembly (key 9) with link number 4 through the square hole in the frame.

18. Install the two screws (key 12) through the flapper assembly (key 11) into the flexure pivot assembly (key 9). Do not tighten the screws.

19. Align flapper leveling screw number 2 (see figure 3-1 for screw location) with the centerline of the oblong hole in the frame as shown in figure 6-9. Tighten the screws (key 12).

#### Note

The following procedure (steps 20 through 22) adjusts link number 2 to ensure that it will always be in tension to eliminate possible instability due to lost motion.

20. Note to which hole link number 1 is connected and then disconnect link number 1 from the takeoff assembly, and manually position the process pointer to 100 percent of the scale. Tape the pointer in this position.

21. Adjust the length of link number 2 by turning the adjustment screw clockwise to increase the length or counterclockwise to decrease the length, so that the pin on the end of the link is approximately one-half of its diameter short of aligning with the hole in the flapper assembly, as shown in figure 6-11.

22. Connect link number 2 to the flapper assembly.

23. Adjust the proportional band between DIRECT and REVERSE. So this by aligning the tab on the proportional band knob with the hole in the set point beam assembly as shown in figure 6-7.

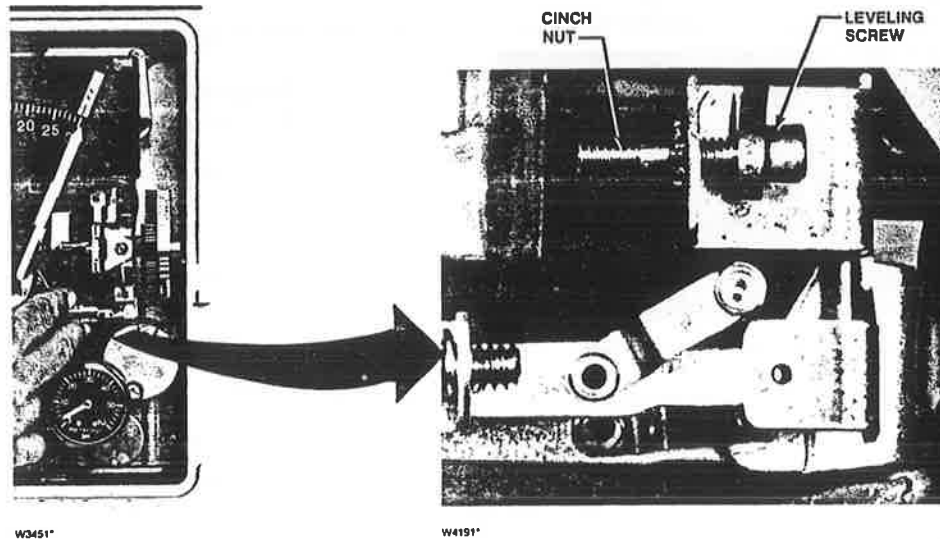


Figure 6-11. Link Number 2 Adjustment

24. Position the proportional band knob, nozzle assembly, and set point beam assembly on the frame, and install the relay nozzle tubing assembly (key 18) nut loosely into the frame manifold (key 135).

25. Loosely install the washer (key 20) and screw (key 19) into the relay nozzle tubing assembly (key 18) as shown in figure 6-15.

26. Center the nozzle on the flapper as shown in figure 6-8, while squeezing the set point beam assembly firmly against the relay nozzle tubing assembly. With the nozzle centered on the flapper, tighten the screw (key 19).

27. Ensure that the nozzle is still aligned with the center of the flapper.

28. Install the pivot of the adjustable set point pivot assembly (key 17) in the hole in the set point beam (key 23).

29. Install the washer (key 20) on the screw (key 19).

30. Install the screw (key 19) through the frame (key 3) into the adjustable set point pivot assembly (key 17). Do not tighten.

31. Squeeze the adjustable set point pivot firmly against the set point beam and tighten the screw (key 19). Ensure that the nozzle is still centered on the flapper.

32. Turn the proportional band to 5 percent direct action. Loosen the locking nut on the adjustable set point pivot assembly. With the controller upright, back the set screw out slightly so that the set point beam assembly will fall under its own weight when pivoted upward and released, with a minimum of sideplay between the pivots. Retighten the locking nut.

33. Tighten the relay nozzle tubing nut (key 18). Reconnect supply pressure and, with the nozzle capped for maximum output pressure, check for leaks. Disconnect the supply pressure.

34. Install the set point beam bias spring (key 28) into the frame (key 3) bore and onto the spring seat of the set point beam assembly (key 23). See figure 6-5.

35. Attach link number 3 to the set point beam assembly. See figure 6-5 for the location of link number 3.

#### Note

**The following procedure (steps 36 through 41) adjusts link number 4 so it will always be in compression to eliminate possible instability due to lost motion.**

36. For controllers with reset or rate (4196B and 4196C Series), first disconnect the supply pressure and adjust the RATE to OFF. Controller output must be 0 psig. Adjust the RESET knob to .01 minutes per repeat and wait 30 seconds. Then, adjust the RESET knob to CLOSED (4196B) or OFF (4196C).

37. Reconnect proper supply pressure to the controller, and provide an accurate means of measuring the controller output.

38. Adjust the proportional band to 5 percent reverse-action, and adjust the set point to the maximum value on the process scale.

39. With link number 1 still disconnected, tape the process pointer at the minimum process scale value.

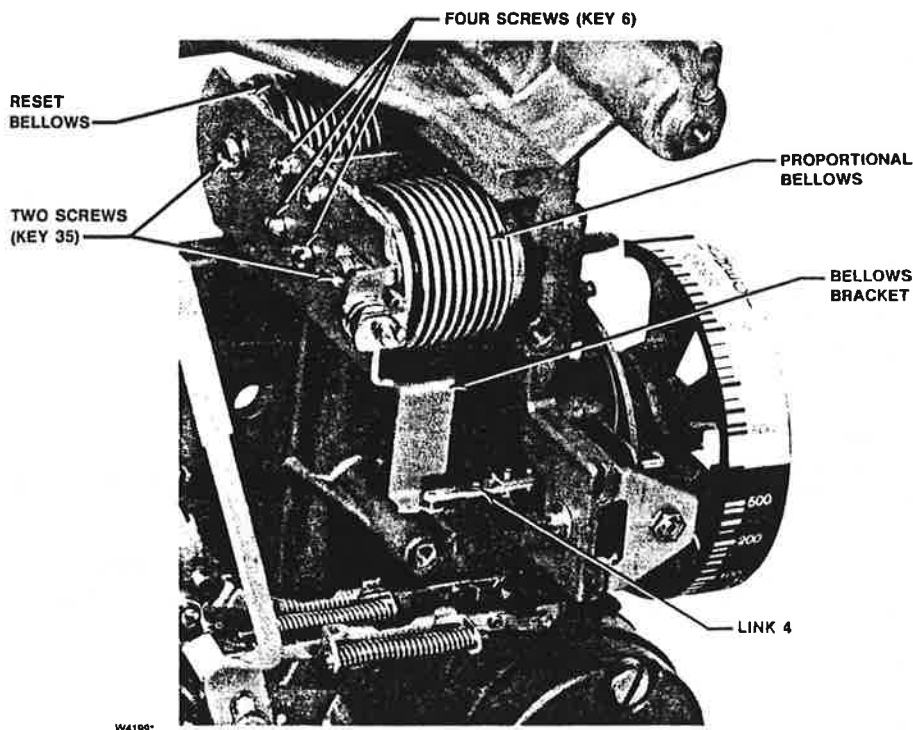


Figure 6-12. Cutaway View of Bellows Assembly

The minimum process scale value is the last mark on the left side of the scale. The output pressure must be within two psi of the supply pressure. If not, adjust flapper leveling screw number 1 until the output is within 2 psi of supply pressure.

40. Loosen the two adjusting screws on link number 4, and connect the link to the bellows bracket assembly, allowing the link to find its free length.

41. Tighten the two adjusting screws.

42. With the controller in the upright position, raise link number 4 out of the hole in the bellows bracket (key 31) and ensure that it drops back into the hole under its own weight. If it does not drop back, repeat steps 40 and 41.

43. Perform steps 35 through 44 in the procedure to replace the proportional band knob, nozzle assembly, and set point beam assembly.

44. Please refer to steps 6 through 9 in the case and cover replacement procedure.

45. Please refer to the process pointer zero and span adjustment procedure, the remote set point zero and span procedure (suffix letter M, only), and the flapper alignment procedure.

## Proportional or Reset Bellows

### Note

The following procedure requires that the controller be removed from the case. Perform steps 1 through 5 of the case and cover replacement procedure. Both bellows need not be removed if only one requires replacement.

1. Remove the two screws (key 6), and lift off the proportional band indicator cover (key 36).

2. Disconnect link number 4 (key 65) from the bellows bracket (key 31). See figure 6-5 for location of link number 4.

3. Please refer to figure 6-12 to locate the bellows assembly screws (key 31). Remove two screws (key 31) and washers (key 362) from the bellows assemblies.

4. Remove the four screws (key 6) from the bellows beam (key 49), and remove the bellows bracket (key 31).

5. Determine which bellows are to be replaced. Remove the proportional tubing assembly (key 40) from the proportional bellows and/or remove the reset tubing assembly (key 43) from the reset bellows.

6. Remove the four screws (key 71) from the bellows beam and remove the bellows beam from the frame (key 3).

**CAUTION**

**When removing and replacing the proportional or reset bellows, keep in mind that the bellows has left-hand threads. Overtightening could damage the threads or bellows assembly.**

7. Unscrew the bellows (key 48). If the bellows assembly cannot be removed by hand, thread a machine screw (key 35) into the bellows until tight, then apply a clockwise torque to the machine screw to loosen the bellows assembly.

8. Before installing the replacement bellows, coat the threads with a suitable lubricant (key 310). Screw in the replacement bellows until it is finger tight against the frame (key 3).

9. Reinstall the bellows beam (key 49) and tighten the four screws (key 71).

10. Install — but do not tighten — the two screws (key 35) and washer (key 362) through the bellows bracket (key 31) into the bellows. The washer must be under the screw that is threaded into the reset bellows (see figure 6-12 for the location of the reset bellows).

11. Compress the bellows and install — but do not tighten — the four screws (key 6) through the bellows bracket (key 31) into bellows beam (key 49). Ensure that the bellows bracket is aligned such that it does not rub on the frame (key 3) at any point. Tighten the screws (keys 6 and 35).

12. Replace the proportional and/or reset tubing assembly on the bellows base (key 48).

13. Adjust the RESET valve to 0.01 minutes/repeat (4196B and C). Adjust the RATE valve to OFF (4196C).

14. Connect the correct supply pressure and, with the nozzle capped for maximum output pressure, check for leaks. Disconnect the supply pressure.

15. Replace link number 4 (key 65) on the bellows bracket. Ensure that the link does not contact the frame (key 3). If it does, loosen the four screws (key 6) which attaches the bellows bracket (key 31) and reposition the bracket to provide clearance. If repositioning is necessary, make sure that the bellows bracket also does not touch the frame.

16. Please refer to steps 4 through 10 in the procedure for replacing link number 4.

17. If the controller is proportional only (4196A Series) go the step 29. If the controller has reset (4196B Series) or rate (4196C Series) continue with the following Note and steps 18 through 28.

**Note**

**The following procedure (steps 17 through 27) adjusts the reset gain of the controller to minimize steady-state offset.**

18. Adjust the proportional band to 100 percent direct-action.

19. Adjust the set point to 50 percent of process scale range.

20. Adjust the RESET valve (4196B and 4196C Series) to 0.01 minute per repeat and the RATE valve (4196C Series) to OFF.

21. Remove the tape from the process pointer and move it to the right until the output pressure stabilizes at 3 psig (0.2 bar) for a 3 to 15 psig (0.2 to 1.0 bar) output or 6 psig (0.4 bar) for a 6 to 30 psig (0.4 to 2.0 bar) output. Record the process pointer (temperature) reading.

**Note**

**When the RESET valve is at 0.01, the controller is very sensitive to any process pointer movement. Only small changes to the process pointer may be necessary.**

22. Move the process pointer very slowly until the output pressure stabilizes at 15 psig (1.0 bar) for a 3 to 15 psig (0.2 to 1.0 bar) output or 30 psig (2.0 bar) for a 6 to 30 psig (.04 to 2.0 bar) output. Record the process pointer (temperature) reading.

23. If the difference between the recorded process pointer (temperature) reading in step 21 and the process pointer (temperature) reading in step 22 is larger than 1 percent of the process scale span, proceed with step 24. If the difference is less than 1 percent, go to step 29.

24. Loosen the proportional bellows screw (key 35).

25. Adjust the gain screw (key 34) one-half turn in, if the reading recorded in step 22 is greater than in step 21. Adjust the gain screw (key 34) one-half turn out if the reading in step 22 is less than in step 21.

26. Tighten the proportional bellows screw (key 35).

27. Repeat steps 21 through 25 until the difference is less than 1 percent of the process scale range.



28. If 1 percent of process scale span cannot be achieved by adjusting the gain screw (key 34), loosen the screw (key 35) attaching the reset bellows and slide to the left if the reading in step 22 is greater than in step 21, or to the right if the reading in step 22 is less than in step 21. Repeat steps 21 through 27.

29. To install the frame (key 3) into the case, refer to steps 6 through 9 in the case and cover replacement procedure.

30. Please refer to the procedures for process pointer zero and span adjustment, remote set point zero and span (suffix letter M, only), and flapper alignment.

### Reset Restriction Valve (4196B Series)

#### Note

**The following procedure requires that the controller be removed from the case. Perform steps 1 through 5 of the case and cover replacement procedure.**

1. Please refer to the 4196B Series portion of figure 6-16 for key number locations.
2. Remove the reset valve tubing assembly (key 42) from the RESET valve.
3. Remove the reset tubing assembly (key 43) from the RESET valve.
4. Remove the relief tubing assembly (key 44) from the RESET valve (suffix letter F, only).
5. Remove the screw (key 162) and lockwasher (key 363) that fastens the reset restriction valve to the frame (key 3).
6. Install the replacement reset restriction valve, and secure it with the screw and lockwasher removed in step 5.
7. Install the reset valve tubing assembly (key 42), the reset tubing assembly (key 43), the relief tubing assembly (key 44, only with suffix letter F), and tighten.
8. Set the RESET valve to 0.01 minute per repeat.
9. Apply the proper supply pressure to the controller, cap the nozzle to drive the controller output to supply pressure, and check all tubing connections for leaks.
10. To install the frame (key 3) into the case, refer to steps 6 through 9 in the case and cover replacement procedure.

11. Perform the process pointer zero and span adjustment, remote set point zero and span adjustment (suffix letter M, only), and flapper alignment procedures.

### Rate/Reset Valve Assembly (4196C Series)

#### Note

**Read this entire procedure before removing any parts.**

**The following procedures require removing the controller from the case. Perform steps 1 through 5 of the case and cover replacement procedures.**

1. Please refer to the 4196C portion of figure 6-16 for key number locations.
2. Loosen the two screws (key 71) on the side of the rate/reset assembly.
3. Remove the nut holding the proportional tubing assembly (key 40) into the valve assembly.
4. Remove the nut holding the reset tubing assembly (key 43) into the valve assembly.
5. Loosen the valve assembly mounting screw (key 162) from the back of the frame (key 3).
6. Remove the two screws (key 72) from the side of the valve assembly. Retain the gasket (key 5).
7. While holding the rate/reset valve assembly, remove the mounting screw (key 162) and lockwasher (key 363) from the frame.
8. Remove the rate/reset valve assembly from the frame.
9. Inspect, repair or obtain a replacement rate/reset valve assembly. Inspect or replace the gasket (key 5).
10. To install the rate/reset valve assembly, insert the assembly into its position on the frame (key 3).
11. Insert and start the valve assembly mounting screw (key 162) and lockwasher (key 363) into the valve assembly.
12. Insert the gasket (key 5) and hold it in place while inserting the two screws (key 71) that hold the tubing assembly (key 137) to the valve assembly. Finger-tighten the screws.
13. Tighten the mounting screw (key 162).

14. Tighten the two screws (key 71) into the valve assembly.
15. Insert the reset tubing assembly (key 43) into the valve assembly and tighten the nut.
16. Insert the proportional tubing assembly (key 40) into the valve assembly and tighten the nut.
17. Please refer to steps 6 through 9 in the case and cover replacement procedure.
18. Perform process pointer zero and span adjustment, remote set point zero and span (suffix letter M, only) adjustment, and flapper alignment procedures.

### Differential Relief Valve Assembly (suffix letter F)

1. Please refer to the 4196B or 4196C Series (suffix letter F) portion of figure 6-16 for key number locations.
2. Loosen the two screws in the differential relief valve (key 55) and remove the relief valve.
3. Inspect the O-rings on the replacement differential relief valve. Sparingly apply a suitable lubricant (key 318) to the O-rings.
4. Install the replacement relief valve into the controller frame, keeping in mind that:
  - When the arrow points up, the valve relieves with decreasing output pressure.
  - When the arrow points down, the valve relieves with increasing output pressure.
5. Tighten the two screws that hold the relief valve to the frame.
6. Differential relief pressure is factory-set at 5 psi (0.3 bar). Maximum pressure is 7 psi (0.5 bar); minimum pressure is 2 psi (0.1 bar). If a different differential relief pressure is desired, please refer to the anti-reset wind-up valve calibration procedures.

### Relief Valve Tubing Assembly (suffix letter F)

#### Note

The following procedure requires that the controller be removed from the case. Perform steps 1 through 5 of the case and cover replacement procedure.

1. Please refer to the 4196B or 4196C Series, suffix letter F portion of figure 6-16 for tubing connections.

2. Loosen the nuts at both ends of the relief valve tubing (key 44), and remove the tubing.
3. Install the replacement relief valve tubing, and tighten the tubing nuts at both ends.
4. Apply the proper supply pressure to the controller.
5. With the controller developing full output pressure, check for leaks.
6. To install the frame (key 3) into the case, refer to steps 7 through 12 in the case and cover replacement procedure.
7. Perform the process zero and span adjustment procedure and the flapper alignment procedure.

### Temperature Element

1. Note to which hole link number 1 (key 128) is connected and disconnect link number 1 from the temperature element takeoff assembly.
2. Remove the three screws (key 127) from the temperature element assembly.
3. Remove the two screws (key 129) at the bottom of the controller case.
4. Lift off the temperature element assembly and withdraw the capillary tube and temperature bulb through the opening in the bottom of the case.
5. Thread the bulb and capillary tube of the replacement assembly into the opening and out through the bottom of the case.
6. With the assembly in position, replace and tighten the three screws (key 127).
7. Tighten the screws (key 129) at the bottom of the controller case.
8. Connect link number 1 (key 128) to the temperature element takeoff assembly.
9. Perform the process zero and span adjustment, travel stop, and flapper alignment procedures.

### Links

#### Section Description

This section describes the separate replacement of four links in the controller. Figure 3-1 shows the location of link number 1. Figure 6-5 shows the location of links 2, and 4.

To clarify the location of each link, the links are numbered as follows:

- Link number 1 connects the temperature element takeoff assembly and the process pointer;
- Link number 2 connects the process pointer and the flapper assembly (key 11);
- Link number 3 connects the set point adjustment and the set point beam assembly (key 23);
- Link number 4 (key 65) connects the flapper assembly and the bellows bracket assembly (key 31).

#### Link Number 1

1. Note the hole position of link number 1 in the temperature element takeoff assembly and the process pointer assembly. Disconnect the link from the temperature element takeoff assembly (see figure 3-1) and from the process pointer assembly. Remove the link. Adjust the length of the replacement link to the same length as the link being replaced.

2. Attach the replacement link to the process pointer assembly and takeoff assembly.

3. Remove the two screws (key 6) and lift off the proportional band indicator cover (key 36).

4. Move set point adjustment to 100 percent of the scale range, and set the proportional band between DIRECT and REVERSE.

5. The process pointer should be lined up with the pointer subassembly (as shown in figure 6-13). If not, release the zero lock and adjust the fine zero adjustment to align the process pointer and pointer subassembly.

6. Place the temperature bulb in the 50 percent bath. The process pointer should be at the 50 percent position on the scale. If not, loosen the screws in the link, move the pointer to 50 percent of process scale, and tighten the screws.

7. Please refer to the maintenance calibration procedure and to the flapper alignment procedure.

#### Link Number 2

1. Remove the two screws (key 6), and lift off the proportional band indicator cover (key 36).

2. Disconnect link number 2 from the process pointer assembly and from the flapper assembly (key 11).

3. Install the replacement link with the screw head nearest the process pointer as shown in figure 6-5. Connect the link to the process pointer assembly only.

4. The process pointer should be lined up with the pointer subassembly as shown in figure 6-13. If the pointer is not properly aligned, loosen the zero adjustment locking screw and adjust the process pointer zero adjustment to align the pointer with the process pointer subassembly.

5. Move the set point adjustment to 0 percent on the scale. Set the proportional band to 5 percent reverse acting.

6. Note the hole position of link number 1, disconnect link number 1 from the temperature element takeoff assembly, and manually position the process pointer to 100 percent of the scale. Tape the pointer in place.

#### Note

**The nozzle should not be touching the flapper. If it is, adjust the flapper leveling screw number 1 until clearance is obtained.**

7. Adjust the length of link number 2 (by turning the adjusting screw clockwise to increase length, counter-clockwise to decrease length) so that the pin on the end of the link is approximately one-half of its diameter short of aligning with the hole in the flapper assembly as shown in figure 6-11. The adjustment provides the proper tension on the link.

8. Connect the link to the flapper assembly.

9. Remove the tape and connect link number 1 to the same hole in the temperature element takeoff assembly.

10. Perform the calibration procedure.

#### Link Number 3

1. Remove the two screws (key 6), and lift off the proportional band indicator cover (key 36).

2. Disconnect link number 3 from the set point adjustment assembly and the set point beam assembly (key 23).

3. Adjust the replacement link to the same length as the current link.

4. Install the replacement link with the screw head toward set point beam assembly as shown in figure 6-5.

5. Check that set point beam bias spring (key 28) is correctly located in frame bore and spring seat on the set point beam assembly as shown in figure 6-6.

6. Move the set point indicator to 50 percent of scale range.

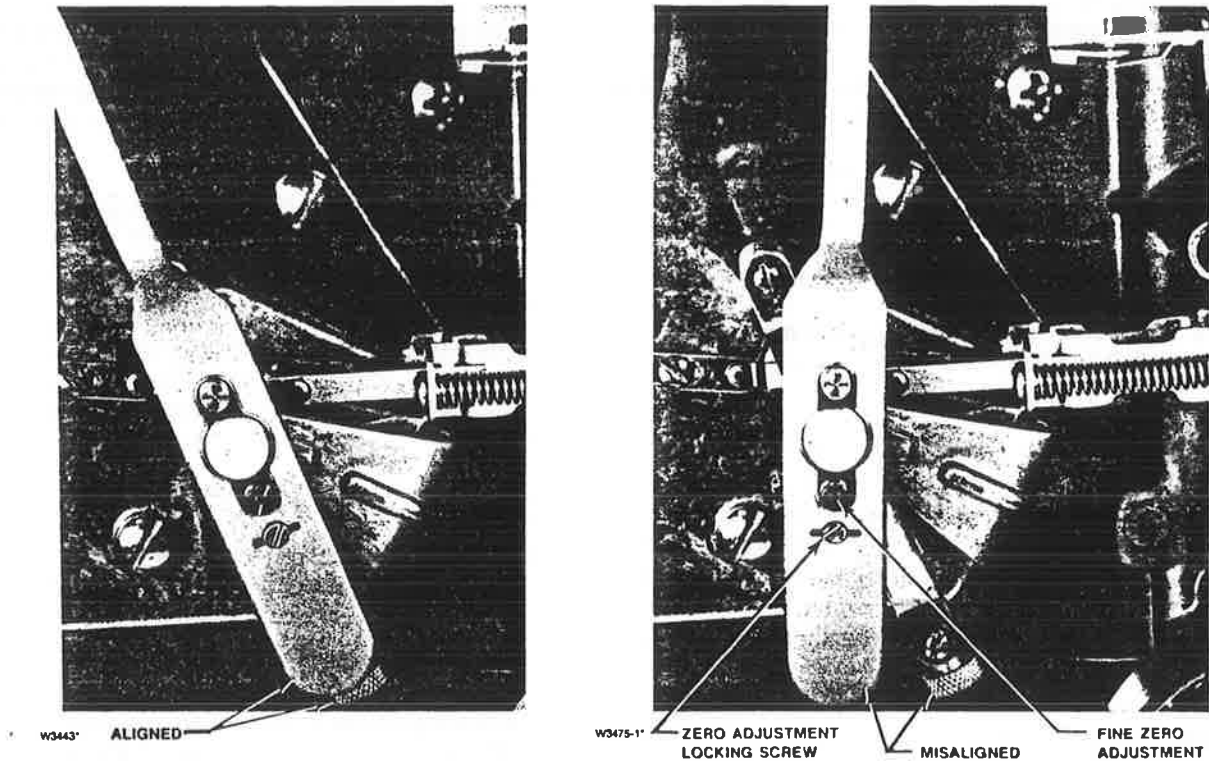


Figure 6-13. Process Pointer Alignment

7. Disconnect link number 1 from the temperature element takeoff assembly and tape the process pointer at 50 percent of scale range.

8. Adjust the proportional band to 5 percent direct action. Turn flapper leveling screw number 3 until the nozzle just touches the flapper.

9. Adjust the proportional band to 5 percent reverse action. Turn flapper leveling screw number 1 until the nozzle just touches the flapper.

10. Flapper leveling screws 1 and 3 should protrude the same distance from the clinch nuts (see figure 6-11).

a. If screw number 1 protrudes further than screw number 3, turn the adjusting screw in link number 3 counterclockwise.

b. If screw number 3 protrudes further than screw 1, turn the adjusting screw in link number 3 clockwise. See figure 6-14 for adjustment.

11. Repeat steps 8 through 10 until screws 1 and 3 protrude an equal distance from the clinch nuts with the flapper just touching the nozzle.

12. Remove the tape and reconnect link number 1 to the same hole in the takeoff assembly.

13. Perform the calibration procedure.

#### Link Number 4

1. Remove the screws (key 36), and lift off the proportional band indicator cover (key 36).

2. Disconnect link number 4 from bellows bracket assembly (key 31) and the flapper assembly (key 11). Figure 6-5 shows the location of link number 4.

3. Connect the replacement link to the flapper assembly so that the two adjusting screws on the link are nearest to the feedback bellows bracket (key 31) and so that the screw heads are facing the bottom of the controller as shown in figure 6-15.

4. For controllers with reset (4196B) or rate/reset (4196C), first disconnect the supply pressure and then adjust the rate (4196C, only) to OFF. The controller output pressure must be 0 psig. Adjust the reset to .01 min/repeat and wait 30 seconds. Then, turn the RESET adjustment to the CLOSED position (4196B) or OFF position (4196C).

5. Adjust the proportional band to 5 percent reverse action, and move the set point adjustment to 100 percent of the scale range.

6. Apply the correct supply pressure to the controller. The output of the controller should be within 2 psig of the supply pressure. If not, adjust the flapper leveling screw number 1 until the output is within 2 psig of the supply pressure.

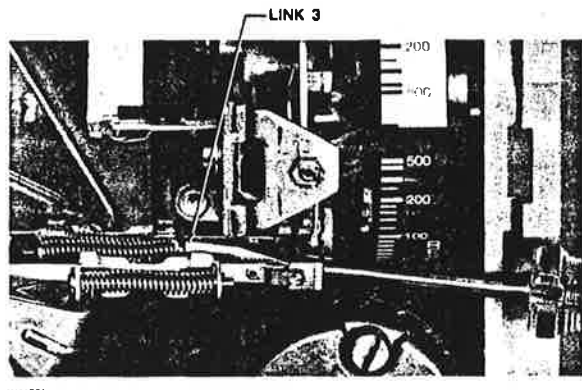


Figure 6-14. Link Number 3 Adjustment

7. Loosen the two adjusting screws on the link. Connect the free end of the link to the bellows bracket assembly, and allow the link to find its free length.

8. Tighten the two adjusting screws on the link.

9. With the controller in the upright position, raise link number 4 out of the hole in the bellows bracket (key 31) and ensure that it drops back into the hole under its own weight. If it does not drop back, repeat steps 7 and 8.

10. Please refer to the maintenance calibration portion of this section and to the flapper alignment procedure.

## Process Pointer Zero and Span Adjustment

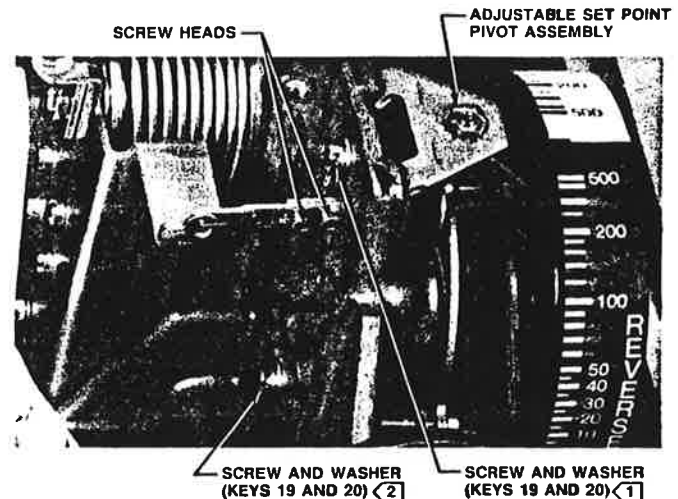
### Note

For routine zero and span calibration, please refer to the appropriate procedures. Use the following maintenance zero and span procedure only if difficulty is encountered with the routine procedure or if non-linearity occurs.

Any adjustment of the process pointer span adjustment screw will require readjustment of the process pointer zero adjustment screw. When checking the zero and span adjustments, ensure that the temperature element take-off assembly does not contact the travel stops.

1. Please refer to figure 3-1 for location of adjustments. Please refer to figure 6-16 for the locations of various key numbers.

2. Remove the two screws (key 6) and lift off the proportional band indicator cover (key 36).



### NOTES:

- 1 SCREW INSERTED INTO THE SET POINT ASSEMBLY.
- 2 SCREW INSERTED INTO THE RELAY NOZZLE TUBING ASSEMBLY.

W4195\*

Figure 6-15. Position of Link Number 4 Adjustment Screw

3. Adjust the reset valve (4196B and 4196C Series, only) to 0.1 minutes/repeat.

4. Adjust the rate valve (4196C Series, only) to OFF.

5. Set the proportional band adjustment to between DIRECT and REVERSE.

### Note

Temperature baths are required for the following steps. Please refer to the appropriate section of this manual for more information on temperature baths.

6. Immerse the temperature bulb in the 50 percent bath. Allow a minimum of 5 minutes for the controller to stabilize.

7. The takeoff assembly should be vertical. If not, loosen the temperature element adjusting screw and reposition the assembly so it is vertical. Tighten the adjusting screw.

8. The process pointer should be aligned with the pointer subassembly as shown in figure 6-13. If not, loosen the zero locking screw and adjust the fine zero adjustment to align the process pointer and pointer subassembly.

9. The process pointer should indicate 50 percent of the process scale. If not, loosen the screws in link number 1 and adjust the pointer to 50 percent,  $\pm 3$  percent, of scale span. Tighten the two screws.

10. The controller output pressure should be one of the following values.

- **For the 4196A Series:**  $9 \pm 1$  psig ( $0.6 \pm 0.1$  bar) for a 3 to 15 psi (0.2 to 1 bar) output or  $18 \pm 2$  psig ( $1.2 \pm 0.1$  bar) for a 6 to 30 (0.4 to 2 bar) output.

- **For the 4196B and 4196C Series:** 0 psig (0.0 bar).

11. Immerse the temperature bulb in the 0 percent bath. Allow a minimum of 5 minutes for the controller to stabilize.

12. Check for 0.03 to 0.04 inch (0.80 to 1.0 mm) clearance between the temperature element takeoff assembly and the travel stop located farthest from the process pointer. See figure 3-1. If the clearance is incorrect, loosen the travel stop locking nut and readjust. Retighten the locking nut.

13. Adjust the process pointer to the lowest limit of the input scale by loosening the zero adjustment locking screw and turning the zero adjustment screw.

14. Place the temperature bulb in the 100 percent bath. Allow a minimum of 5 minutes for the controller to stabilize.

15. Check for 0.03 to 0.04 inch (0.80 to 1.0 mm) clearance between the temperature element takeoff assembly and the right-hand travel stop. See figure 3-1. If the clearance is incorrect, loosen the travel stop locking nut and readjust. Retighten the locking nut.

16. Note whether the process pointer indication is above or below the upper limit of the process scale.

17. Adjust the span screw as follows: Clockwise to increase the span for a low indication; counterclockwise to decrease span for a high indication. Adjust the span screw to correct one-half the error.

18. Repeat steps 11 through 17 until the error is eliminated.

19. Immerse the temperature bulb in the 50 percent bath. Allow a minimum of 5 minutes for the controller to stabilize.

20. If the process pointer indicates the 50 percent mark,  $\pm 1$  percent, of process scale span, tighten the zero adjustment locking screw and proceed to the appropriate flapper alignment procedure. If the error is greater the  $\pm 1$  percent but less than  $\pm 2$  percent, correct for half of the error with the zero adjustment screw.

21. Immerse the temperature bulb in the 0 percent bath. Allow a minimum of 5 minutes for the controller to stabilize.

22. The process pointer should indicate a 0 scale reading  $\pm 1$  percent of scale span.

23. Immerse the temperature bulb in the 100 percent bath. Allow a minimum of 5 minutes for the controller to stabilize.

24. The process pointer should indicate a full scale reading within  $\pm 1$  percent of process scale range.

25. If error is greater than  $\pm 1$  percent, repeat steps 11 through 24.

26. Perform the appropriate flapper alignment procedure.

## Remote Set Point (suffix letter M)

### Replacing the Remote Set Point Assembly

#### Note

**Remove the supply pressure gauge before attempting to remove the remote set point assembly.**

1. Decrease the remote set point pressure to 0 psig.
2. Remove the supply pressure gauge.
3. Disconnect the union (key 93) from the pedestal assembly (key 105).
4. Disconnect link B (key 126) from the connecting hole on the set point indicator assembly.
5. Remove the three mounting screws (keys 120 and 140) that attach the remote set point assembly to the process/set point indicator assembly.

#### CAUTION

**In the following step, do not lift out the capsular element assembly by holding the capsule or the linkages. These parts are easily damaged.**

6. Lift out the capsular element assembly by holding the plate (key 111), travel stop (key 83), or pedestal assembly (key 105).
7. Align the replacement assembly with the mounting screw holes. Replace the mounting screws.
8. Reconnect the remote set point pressure connection union (key 93). Apply full remote set point pressure and check for leaks.

9. Connect link B (key 126) to the connecting hole on the set point indicator assembly.

10. Replace the supply pressure gauge.

11. Please refer to the remote set point maintenance calibration procedures in this section. Also, perform the appropriate controller calibration procedures.

## Replacing Remote Set Point Parts

### Note

**After part replacement, perform the maintenance calibration procedures.**

Figure 3-2 shows the location of the parts. Key numbers refer to figure 6-17.

### Pivot Assembly A (Key 114)

1. Decrease the remote set point pressure to 0 psig.
2. Remove the two screws (key 103) and the tie bar (key 106).
3. Note where the link is connected. Disconnect link A (key 116) from the lever arm on the pivot assembly.
4. Disconnect the drive flexure (key 79) from the adjustment arm of the pivot assembly. Be careful not to bend or kink the drive flexure.
5. Remove the screw (key 122), the washer (key 123) and the nut (key 124) that attach the guide flexure (key 119) to the top of the pivot assembly.
6. Remove the pivot screw and spring washer (keys 109 and 112) and the mounting screw (key 102) attaching the pivot assembly to the mounting plate (key 111). Lift out the pivot assembly.
7. Loosen the adjustment screw (key 118) on the adjustment arm of the replacement pivot assembly and set the arm to the same length as the arm on the pivot assembly being replaced. Tighten the screw.
8. To replace the pivot assembly, first put the spring washer (key 112) on the pivot screw (key 109). Then, install the screw through the replacement pivot assembly into the mounting plate and tighten. Install the mounting screw (key 102) and tighten.
9. Connect the guide flexure (key 119) to the top of the replacement pivot assembly with the screw (key 122), the washer (key 127), and the nut (key 124) as it was before. The guide flexure should be straight and hori-

zontal as shown in figure 3-2. If not, loosen the screws (key 122) and retighten to eliminate bowing. Loosen the screws (key 139) and raise or lower the pedestal assembly (key 105) to get the link horizontal. Retighten the screws (key 139) and ensure the capsular element assembly extension (key 134) is centered in the upper travel stop (key 83) hole.

10. Increase the remote set point pressure to 50 percent,  $\pm 1$  percent, of set point range.

11. Connect the drive flexure (key 79) to the arm on the new pivot assembly, making sure it stays straight and vertical. Adjust the length of the pivot arm if necessary until the flexure is vertical. Before tightening down the drive flexure (key 79), set the pivot A shaft in the middle of the shaft's end play. Tighten down the drive flexure to hold the pivot shaft in that position. Do not kink or twist the flexure when tightening the screws.

12. Decrease the remote set point pressure to 0 psig.

13. Connect the end of link A (key 116) to the pivot lever arm in the same position it was in before.

14. Replace the tie bar (key 106).

15. Please refer to the remote set point maintenance calibration procedure in this section.

### Pivot Assembly B (Key 115)

1. Please refer to figure 6-17 for the key numbered assembly.
2. Decrease remote set point to 0 psig.
3. Note the holes where links A and B are connected. Disconnect links A and B (keys 116 and 126) from the arms of pivot assembly B (key 115).
4. Remove the two screws (key 102) attaching the pivot assembly to the mounting plate (key 111). Remove the pivot assembly.
5. Loosen the linearity adjustment screw on the replacement pivot assembly, and set it in the same position as the adjustment on the original pivot assembly. Tighten the screw.
6. Set the replacement pivot assembly on the mounting plate, and attach it with the two machine screws.
7. Attach links A and B (keys 116 and 126) to the same holes in the arms of the new pivot assembly.
8. Please refer to the remote set point maintenance calibration procedure in this section.

### Drive Flexure

1. Disconnect the flexure (key 79) from the drive bracket (key 121) and from the adjustment arm of pivot assembly A (key 114). Remove the screws and the washers (keys 12 and 13). Then, remove the flexure.

2. Set the remote set point pressure at 50 percent,  $\pm 1$  percent, of set point range.

3. Connect the new flexure making sure it stays straight and vertical. Adjust the length of the pivot arm if necessary until the flexure is straight. Before tightening down the drive flexure, set the pivot A shaft in the middle of the shaft's end play. Tighten down the drive flexure to hold the pivot shaft in that position. Do not kink or twist the flexure when tightening the screws.

4. Decrease the remote set point pressure to 0 psig.

5. Please refer to the maintenance calibration procedure in this section.

### Remote Set Point Tubing Assembly

1. Decrease the remote set point pressure to 0 psig.

2. Using two, open-end wrenches, disconnect the union (key 93) from the pedestal assembly (key 105). Then, disconnect the tubing assembly (key 104) from the pressure block (key 57) at the top of the case.

3. Remove the tubing assembly (key 104).

4. Install the replacement tubing assembly and reconnect the two pressure connections.

5. Apply full remote set point pressure, and check for leaks.

### Link A

This procedure describes the replacement of the link designated A (key 116) in the remote set point assembly. Figure 3-2 shows the location of the link.

1. Note the holes where link A is connected. Disconnect both ends of the link (key 116) from the lever arms on the A and B pivot assemblies.

2. Loosen the screw in the replacement link, and adjust the length to match the link being replaced. Tighten the screw. Please refer to figure 6-17 for correct orientation of the link.

3. Attach the replacement link to the same holes in the two lever arms in the same position as the original link.

Please refer to the remote set point maintenance calibration procedure in this section.

### Link B

This procedure describes the replacement of the link designated B (key 126) in the remote set point assembly. Figure 3-2 shows the location of the link.

1. Note the hole where link B is connected. Disconnect both ends of link B (key 126) from the pivot arm and from the process/set point indicator assembly.

2. Loosen the screw in the replacement link, and adjust the length to match the link being replaced. Tighten the screw.

3. Attach both ends of the replacement link. Please refer to figure 6-17 for correct orientation of the link.

4. Please refer to the remote set point maintenance calibration adjustment procedure in this section.

## Remote Set Point Maintenance Calibration

### Note

**For routine remote set point zero and span adjustment, see the procedure in the appropriate section. Use the following maintenance calibration procedures only if difficulty or non-linearity occurs or if directed to do so following parts replacement procedures.**

Please refer to figure 3-2 for parts location. Key numbers refer to figure 6-17.

### Precalibration Procedure

1. Remove the two screws (key 6) and lift off proportional band indicator cover (key 36).

2. Set the proportional band adjustment between DIRECT and REVERSE.

3. Remove the two screws (key 103) and the tie bar (key 106).

4. Apply 50 percent of the remote set point pressure range.

5. The guide flexure (key 119) should be straight and horizontal. If it is not straight, loosen the screw (key 122) on the end of the flexure that is attached to the top of pivot A (key 114), and allow the flexure to straighten itself. Tighten screw on the flexure. If it is not horizontal, loosen two screws (key 139) and raise or lower the pedestal assembly (key 105) until the guide flexure is horizontal. Retighten screws (key 139) and ensure the diaphragm assembly extension (key 134) is centered in the upper travel stop (key 83) hole.



6. The drive flexure (key 79) should be straight. If not, proceed as follows:

a. Loosen the screw (key 118) on the adjustment arm on pivot assembly A (key 114) and the screws (key 12) holding the drive flexure.

b. Set the length of the adjustment arm so that the drive flexure is parallel to the centerline of the capsular assembly.

c. Tighten the screw (key 118) on the adjustment arm.

d. Set the pivot A shaft in the middle of the shaft's end play.

e. Tighten the screws (key 12) that hold the drive flexure in place.

### Setting the Travel Stops

1. Loosen the set screw (key 87) in the lower travel stop nut (key 86).

2. Upper range stop—Adjust the remote set pressure to 2-1/2 percent of span greater than the upper range limit. Loosen the two screws (key 139 and key 140) mounting the travel stop (key 83) to the mounting plate. Slide the travel stop until it is just touching the end of the capsule stack. Tighten the travel stop mounting screws to lock it into that position.

3. Zero stop—Adjust remote set point pressure to 2-1/2 percent below the lower limit. Then, slide the travel stop nut (key 86) along the diaphragm capsule extension (key 134) until it is just touching the travel stop (key 83). Tighten the set screw to lock the travel stop nut in that position.

### Aligning the Linkage

1. Adjust the remote set point pressure to 50 percent,  $\pm 1$  percent, of remote set point range.

2. Set the linearity adjustment screw in the center of the slot of the lever arm of pivot clevis assembly B (key 115). See figure 3-2 for location of linearity adjustment.

3. Set the length of link A (key 116) so that the lever arms of pivot assemblies A and B are parallel and link A is perpendicular to them.

4. Set the length of link B (key 126) so that the set point indicator indicates 50 percent,  $\pm 3$  percent, of process scale range.

5. Replace the two screws (key 103) and the tie bar (key 106).

### Remote Set Point Zero and Span Adjustment

#### Note

**For routine remote set point zero and span adjustment, see the procedure in the appropriate section. Use the following maintenance calibration procedures only if difficulty or non-linearity occurs or if directed to do so following parts replacement procedures.**

1. Decrease remote set point pressure to the lower range limit.

2. Loosen the screw on link A (key 116), and adjust the length so that the set point indicator points to the lower limit of the process scale. Tighten the screw.

3. Make fine zero adjustments by loosening the zero adjustment locking screw (key 102) and turning the zero adjustment screw (key 108). Tighten the locking screw. Please refer to figure 3-2 for location of the screws.

4. Increase the remote set point pressure to the upper range limit.

5. To increase the span, proceed as follows:

a. Turn the span adjustment screw clockwise.

b. To increase the span further than the adjustment will allow, move both ends of link A to the right. Please refer to figure 3-2 for link location.

c. Make fine adjustments with the span adjustment screw.

6. To decrease the span, proceed as follows:

a. Turn the span adjustment screw counterclockwise.

b. To decrease the span further than the adjustment will allow, move both ends of link A to the left. Please refer to figure 3-2 for link location.

c. Make fine adjustments with the span adjustment screw.

7. Repeat the adjustments until the upper and lower indications are aligned with the 0 and 100 percent markings on the process scale.

8. Adjust the remote set point pressure to 50 percent of the remote set point range.

9. The remote set point indicator should be accurate to within  $\pm 2$  percent of the process scale span. If the

accuracy is outside  $\pm 2$  percent of the process scale span, proceed to the following linearity adjustment procedure.

10. Adjust the set point indicator to 50 percent  $\pm 1$  percent of the process scale range by loosening the zero adjustment locking screw. Then, turn the zero adjustment screw. After turning the screw, tighten the locking screw.

11. Adjust the remote set point pressure to the upper and lower limits of the the remote set point range and verify that the set point indicator is still within  $\pm 1$  percent at the 0 percent process scale mark and at the 100 percent process scale mark.

12. Perform the appropriate flapper alignment procedure and, if necessary, perform the process pointer zero and span calibration procedure in the appropriate section of this manual.

#### Remote Set Point Linearity Adjustment

Adjust the linearity by loosening and repositioning the linearity adjustment screw in the curved slot on the lever arm of pivot assembly B (key 115). Adjusting the linearity affects the zero and span adjustment.

1. Adjust the remote set point pressure to 50 percent of remote set point range. The set point indicator should indicate 50 percent,  $\pm 1$  percent, on the scale. If not, adjust the set point indicator to 50 percent by loosening the zero adjustment locking screw and turning the adjustment screw.

2. Adjust the remote set point pressure to 0 percent and note the indicator position relative to the process scale 0 percent marking.

3. Adjust the remote set point pressure to 100 percent and note the indicator position relative to the process scale 100 percent marking.

4. If the greatest misalignment is positive (the set point indicator is to the right of the process scale markings), loosen the linearity screw and move it clockwise in the slot. If the misalignment is negative, move the linearity screw counterclockwise in the slot.

5. If misalignment is greater than 1 percent of process scale span at both the 0 and 100 percent markings, with one positive and the other negative, perform the zero and span adjustment procedure to correct a span error.

6. Repeat steps 1 through 4 until lower, middle, and upper indications are within  $\pm 1$  percent of the process scale markings.

## Replacing the Auto/Manual Station (suffix letter E)

### Note

Each of the following procedures requires that the controller frame be removed from the case. Refer to the case and cover replacement procedure.

### Note

This procedure also permits replacement of the switch manifold O-rings (key 312), the auto/manual tubing assembly (key 138), and the frame gaskets (keys 4 and 5).

## Disassembly

1. Please refer to figure 6-16, 6-18, and 6-19 for key number location.

2. Loosen the screw (key 316) that holds the auto/manual station (key 273) to the controller frame.

3. Loosen the two screws (keys 314 and 315) that hold the auto/manual station to the auto/manual tubing assembly (key 138).

4. Remove the auto/manual station from the controller frame (key 3).

5. Remove the switch manifold O-rings (key 312).

6. Carefully loosen the nut on the relay nozzle tubing assembly (key 18) where it connects to the auto/manual tubing assembly (key 138). Loosen three screws (keys 34 and 131), and remove the tubing assembly and body gaskets (keys 4 and 5).

7. Inspect the gaskets (keys 4 and 5) and O-rings (key 312) for wear. Replace if necessary.

## Assembly

1. Install the gaskets and the tubing assembly to the frame. Start, but do not tighten, the three screws (keys 34 and 131) and the nut on the nozzle tubing assembly (key 18).

2. Install the three O-rings (key 312), and secure the auto/manual station to the controller frame with the screw (key 316) and to the tubing assembly (key 138) with two screws (keys 314 and 315). Do not tighten any

**CAUTION**

In the next step, take care to tighten the two screws (keys 314 and 315) evenly. Uneven tightening could damage the tubing assembly.

3. Press the auto/manual station as far down on the frame and toward the scale as possible. Carefully tighten the two screws (keys 314 and 315) so that the auto/manual station contacts the three pads on the tubing assembly.
4. Carefully tighten the remaining screws and nuts.
5. Plug the controller output connection and apply correct supply pressure to the controller. With the auto/manual station in the AUTO position, cap the controller nozzle to drive the output toward supply pressure and check for leaks. Change the auto/manual station to MANUAL, adjust the controller output to within 2 psi of supply pressure and again check for leaks.
6. To install the frame (key 3) into the case, refer to the case and cover replacement procedure.
7. Perform the appropriate calibration procedure.

### Replacing the Auto/Manual Switch Body Assembly, Lever O-Ring, Switch Body O-Ring, and the Tubing Assembly

#### Disassembly

1. Please refer to figure 4-19 for key number location.
2. Remove the auto/manual station from the controller frame as described in steps 1 through 4 of the replacing the auto/manual station procedure.
3. Loosen the two screws (key 288), and remove the switch lever cover plate (key 305).

**WARNING**

The lever spring (key 302) is under preload. The uncontrolled release of spring tension could cause personal injury or damage to controller parts. Slowly release spring tension during disassembly.

4. Using a 1/16-inch (1.6 mm) punch, push the groove pin (key 303) out toward the surface of the switch lever cover plate.
5. Remove the switch lever (key 304), lever spring (key 302), and lever spring seat (key 301).

6. Remove the tubing assembly (key 309).

**WARNING**

The switch body springs (key 295) are under preload. The uncontrolled release of spring tension could cause personal injury or damage to controller parts. Slowly release spring tension during disassembly.

7. Loosen the two screws (key 290), and separate the switch body assembly (key 291) from the loader assembly (key 282).
8. Remove the O-rings (keys 292, 293, and 294), switch body springs (key 295), and balls (key 296).
9. Loosen two screws (key 308), and remove the closing plate (key 307) and the closing plate gasket (key 306).
10. Pull the clip (key 300) from its engagement with the shaft of the lever assembly (key 297).
11. Pull the lever assembly from the switch body assembly (key 291) and rocker (key 299).
12. Remove the O-ring (key 298).
13. Inspect the O-ring and the gaskets for damage or wear, and replace if necessary.

#### Assembly

1. Insert the lever assembly (key 297) into the switch body assembly (key 291), and hold the rocker (key 299) with the flats on the lever assembly shaft.
2. Insert the clip (key 300) in the groove of the lever assembly shaft to hold the lever assembly (key 297) in the switch body assembly (key 291).
3. Position the closing plate gasket (key 306) and the closing plate (key 307). Secure with two screws (key 308).

#### Note

After assembly in step 3, be sure the side of the closing plate marked OUT is visible.

4. Place the balls (key 296), switch body springs (key 295), and O-rings (keys 292, 293, and 294) in the switch body (key 291).

**Note**

In the following step, the ends of the springs must be in the counterbored spring seats before compression.

5. Compress the switch body springs with the loader assembly (key 282), and bolt the switch (key 291) to the loader assembly using the two screws (key 290).

6. Reconnect the tubing assembly (key 309).

7. Locate the lever spring (key 302) and the spring seat (key 301) on the switch lever (key 304), and position these parts in the opening of the loader assembly (key 282).

8. Push the switch lever down, using the lever spring seat (key 301) and the lever assembly (key 297) to preload the spring. Make sure the notch of the switch lever engages the pin of the lever assembly.

9. Drive in the groove pin (key 303) to hold the switch lever.

10. Replace the switch lever cover plate (key 305), and attach with two screws (key 288).

11. Perform the assembly procedure in the replacing the auto/manual station procedure.

### Replacing the Loader Range Spring, Diaphragm Assembly, Ball Seat, Tubing, and Ball

#### Disassembly

1. Please refer to figure 6-19 for key number location.
2. Remove the auto/manual station from the controller frame as described in steps 1 through 4 of the replacing the auto/manual station procedure.
3. Remove the tubing assembly (key 309).

#### **WARNING**

The range spring (key 283) is under preload. The uncontrolled release of spring tension could cause personal injury or damage to controller parts. To avoid personal injury as a result of the uncontrolled release of the range spring preload, turn the loader knob (key 287) counterclockwise (opposite to the arrow) to relieve pressure on the spring.

4. Loosen the four screws (key 289), and separate the loader assembly (key 282) and the lower loader assembly (key 274).

5. Remove the loader range spring (key 283), range spring cup (key 284), and diaphragm assembly (key 281).

6. Remove the tube (key 278), ball seats (key 280) and ball (key 279).

#### Assembly

1. Turn the loader knob (key 287) counterclockwise to back the spring adjusting screw (key 285) all the way out to eliminate loading the range spring.

2. Position the range spring cup (key 284), the range spring (key 283), and the diaphragm assembly (key 281) on the loader assembly (key 282).

3. Position the ball (key 279), the tube (key 278), and the ball seats (key 280) between the ears of the loader assemblies (keys 282 and 274); position the diaphragm assembly (key 281) between the main halves of the loader assemblies.

**Note**

The tube (key 278) must be well seated in the cups of the ball seats (key 280).

4. Bolt the loader assembly halves together using the four screws (key 289).

#### **CAUTION**

Be sure that the supply and exhaust seats of the loader are correctly aligned. Misalignment will impair loader performance.

5. Attach the tubing assembly (key 309).

6. Perform the assembly procedure in the replacing the auto/manual station procedure.

### Replacing the Loader Valve Plug and Valve Plug Spring

1. Please refer to figure 6-19 for key number location.

2. Loosen the spring seat screw (key 275).

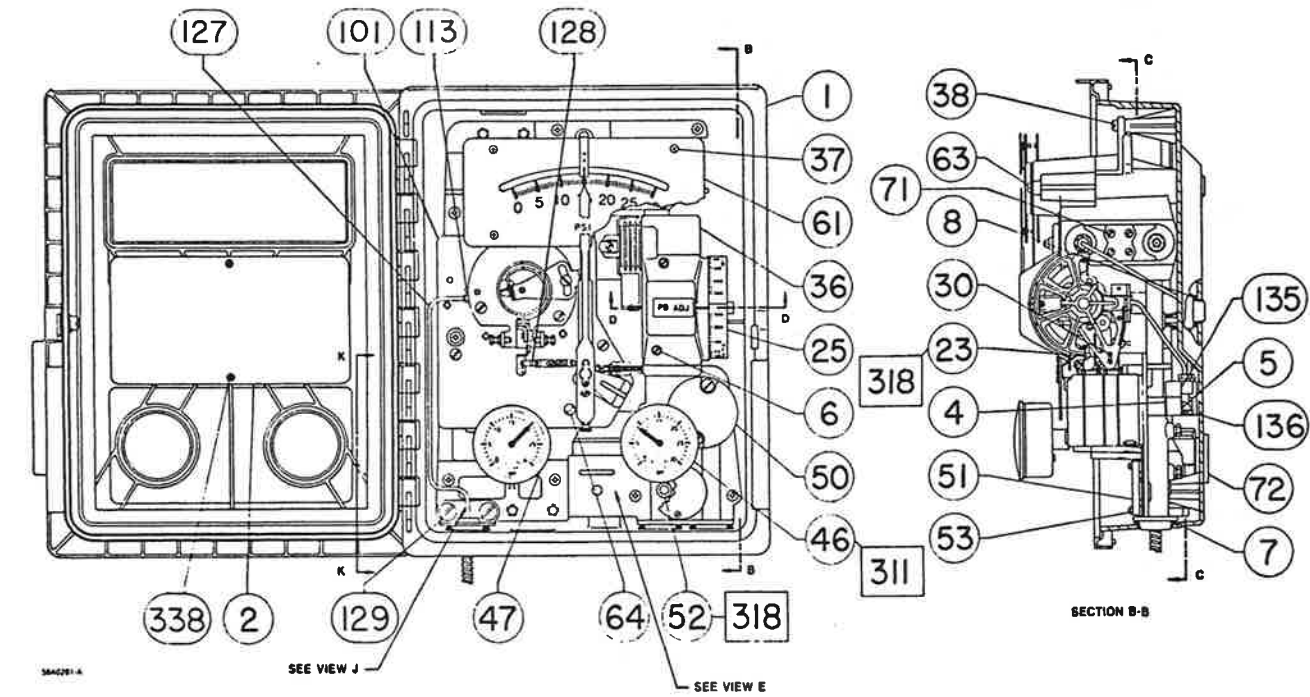
3. Remove the valve plug spring (key 276) and the valve plug (key 277).

4. Inspect the parts, and replace as necessary.

5. Install the valve plug spring and valve plug.

6. Tighten the spring seat screw.

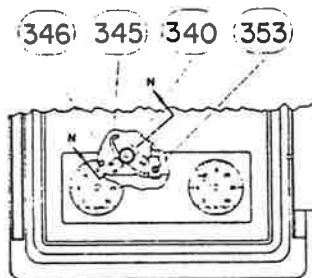
7. Plug the controller output connection, apply correct supply pressure, and check for leaks.



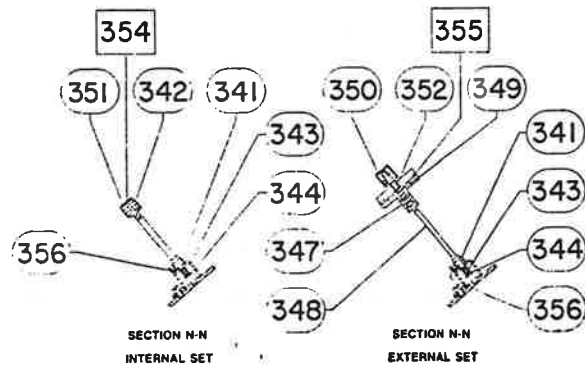
504281-A

SEE VIEW J

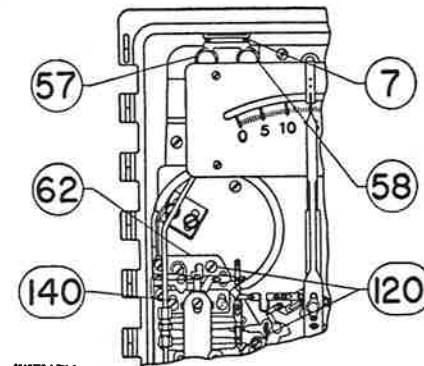
SEE VIEW E



504282-1 Set B



INTERNAL AND EXTERNAL SET POINT OPTION

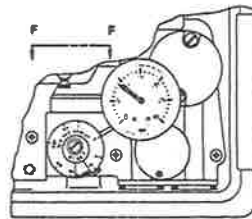
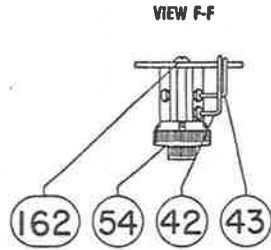


504283-J Set A

TYPICAL REMOTE SET POINT ASSEMBLY MOUNTING—4190 SERIES CONTROLLERS

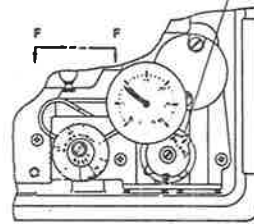
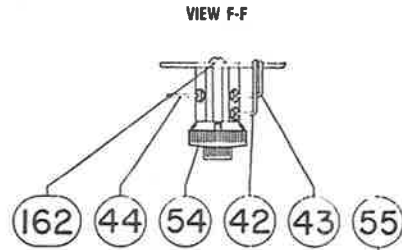
Figure 6-16. Controller Assembly Drawing

4196A, B, C, and S Series

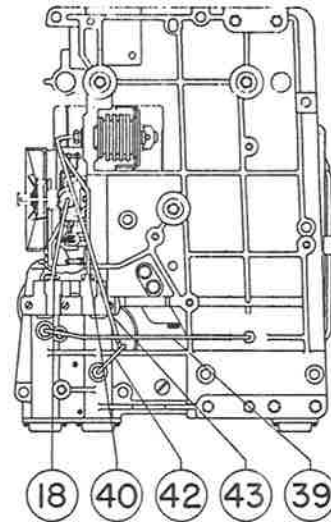


VIEW E, 4196B SERIES

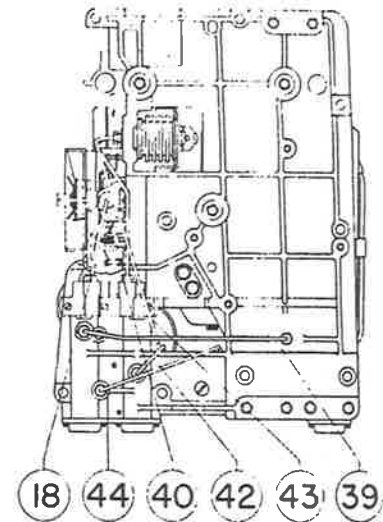
30A732-J Dwg 2



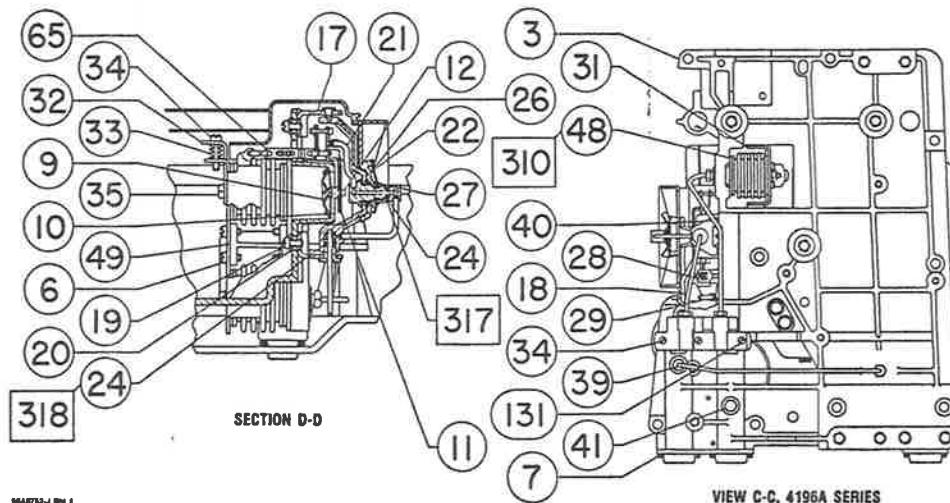
VIEW E, 4196B SERIES, OPTION F



VIEW C-C, 4196B SERIES



VIEW C-C, 4196B SERIES, OPTION F



VIEW C-C, 4196A SERIES

30A732-J Dwg 1

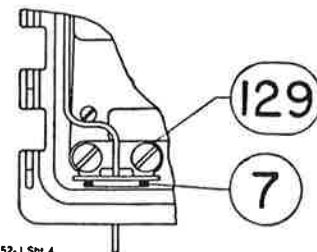
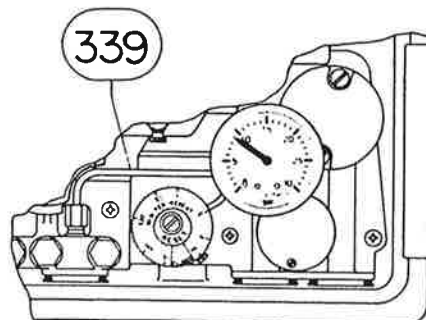
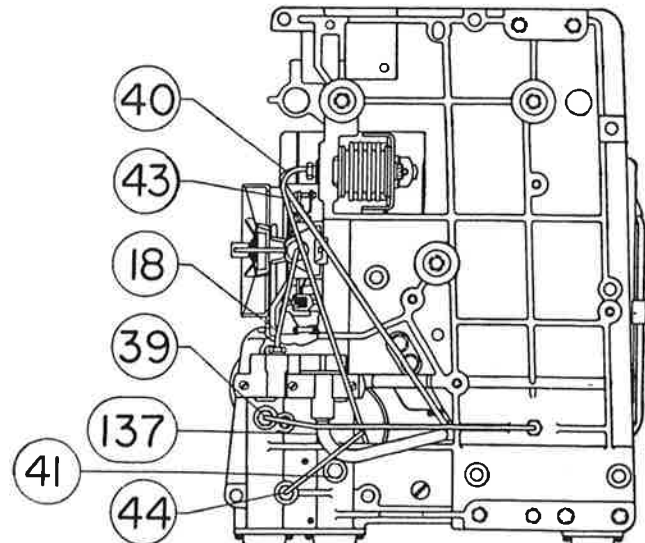
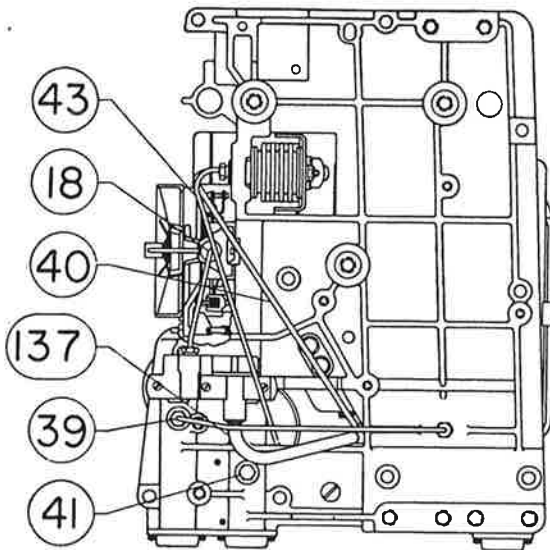
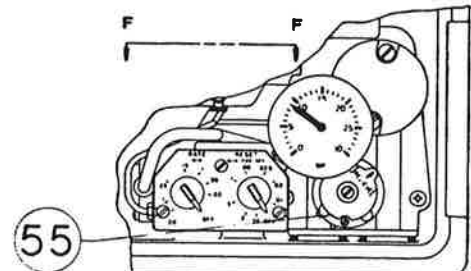
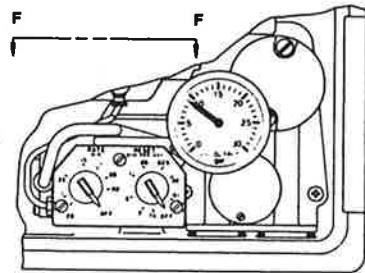
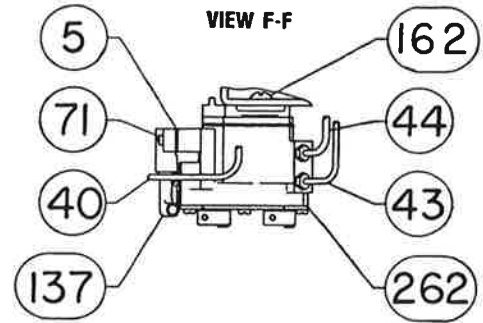
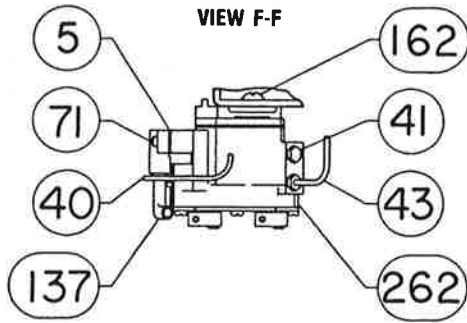


Figure 6-16. Controller Assembly Drawing (Continued)

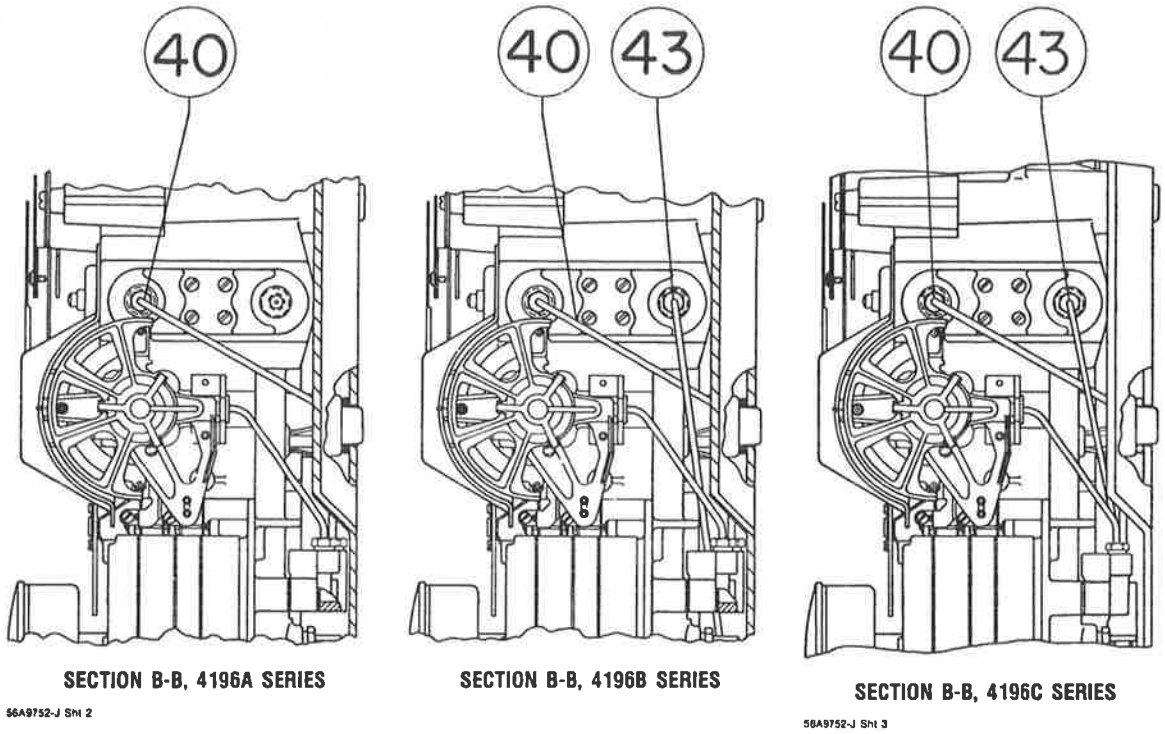


Figure 6-16. Controller Assembly Drawing (Continued)

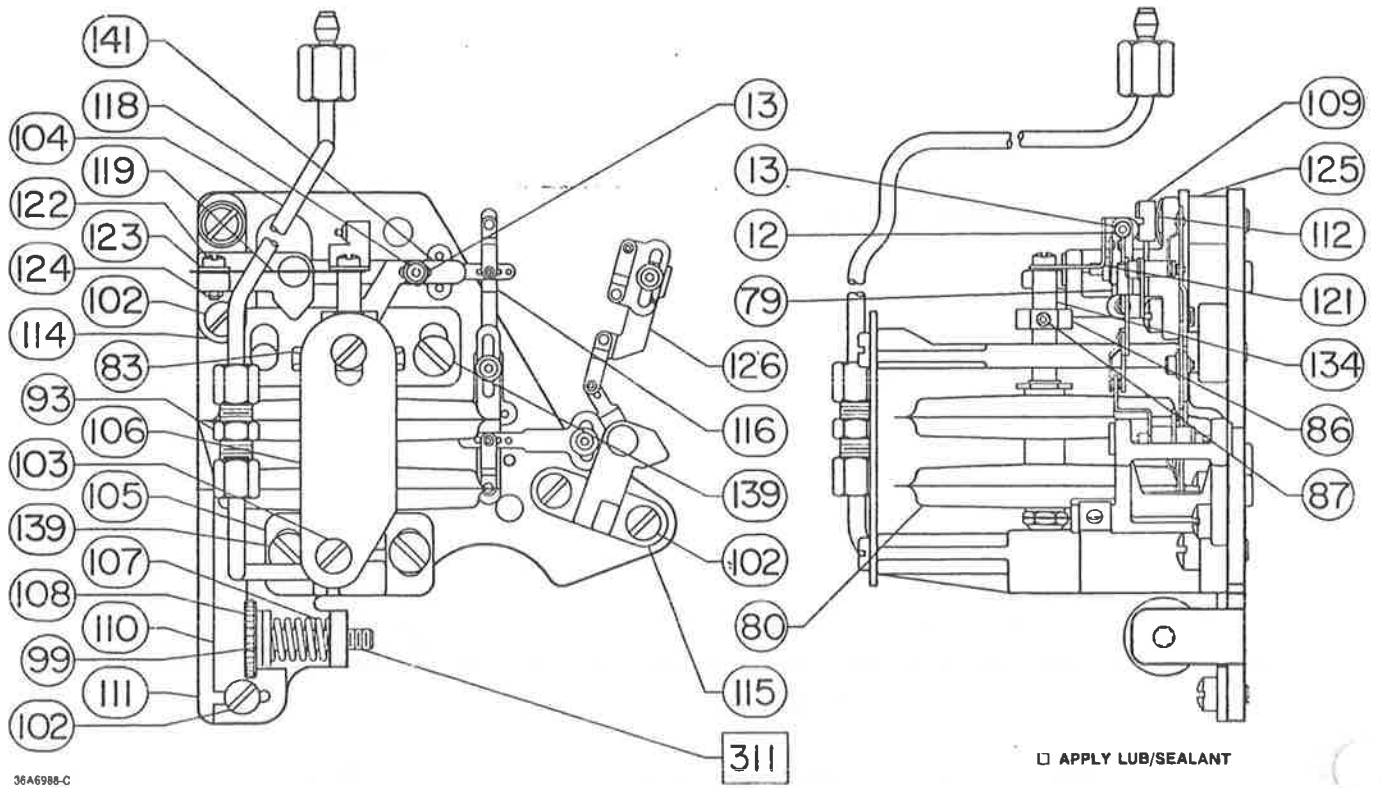
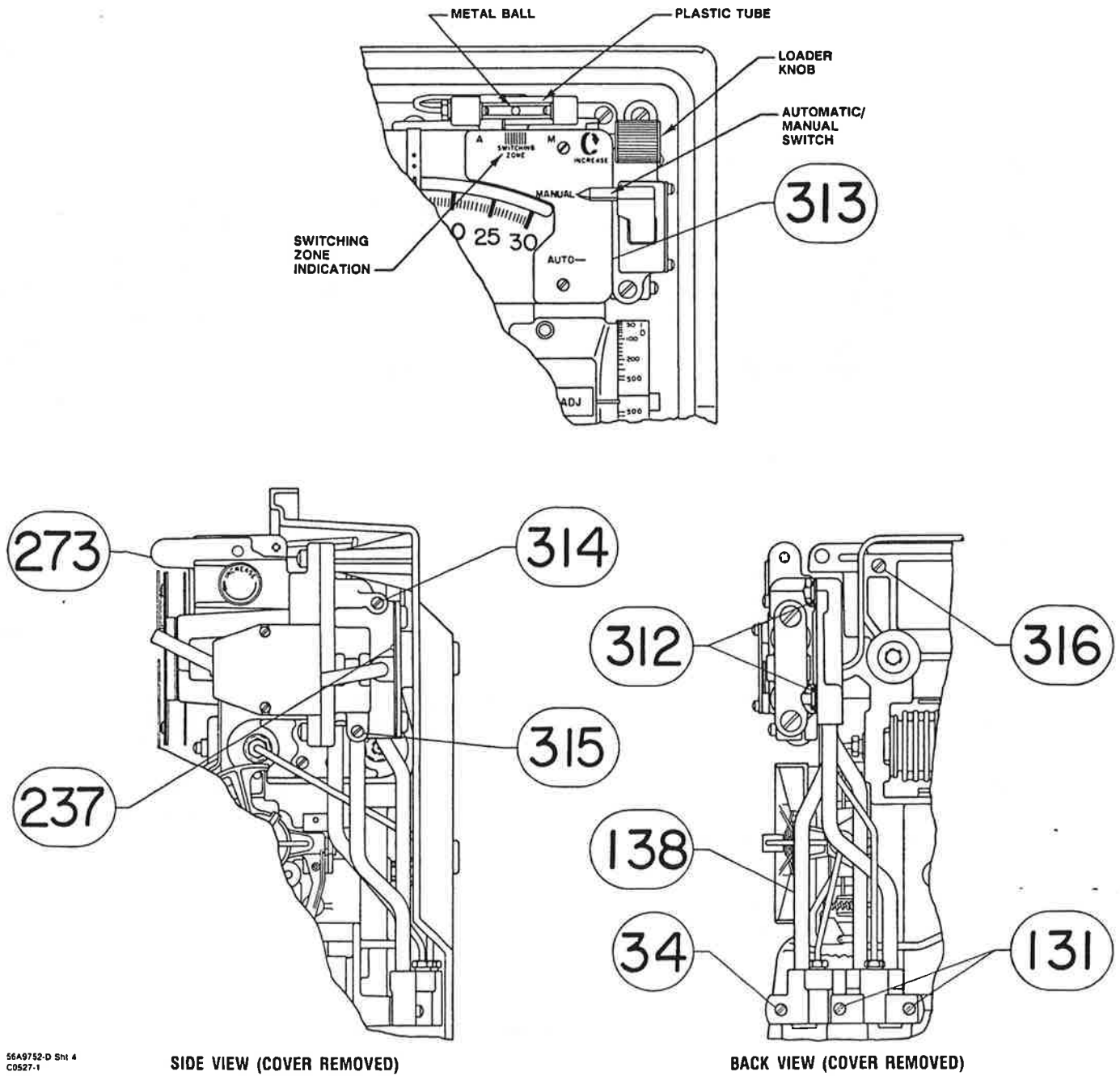


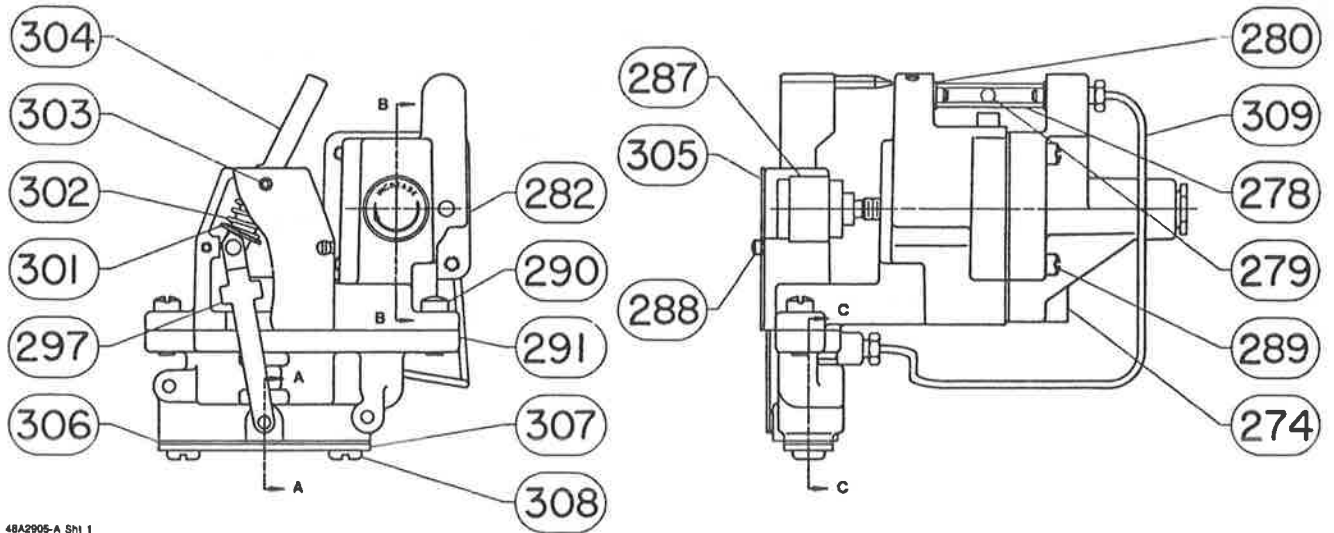
Figure 6-17. Remote Set Point Assembly Drawing



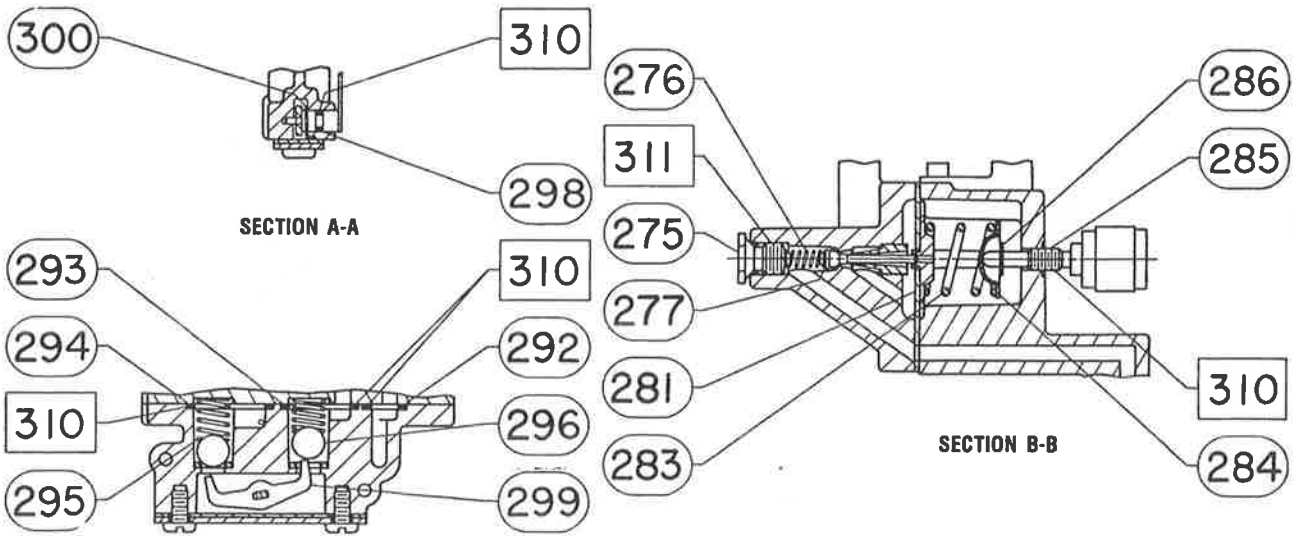


56A9752-D Sht 4  
C0527-1

Figure 6-18. Auto/Manual Station Parts Location



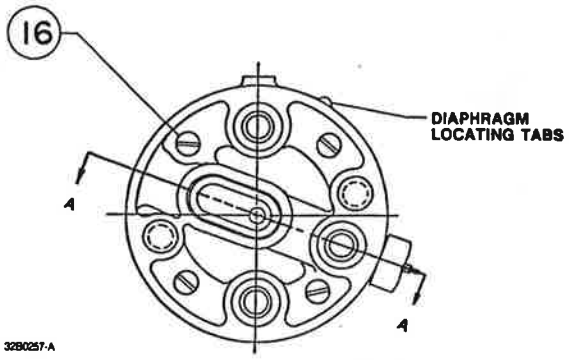
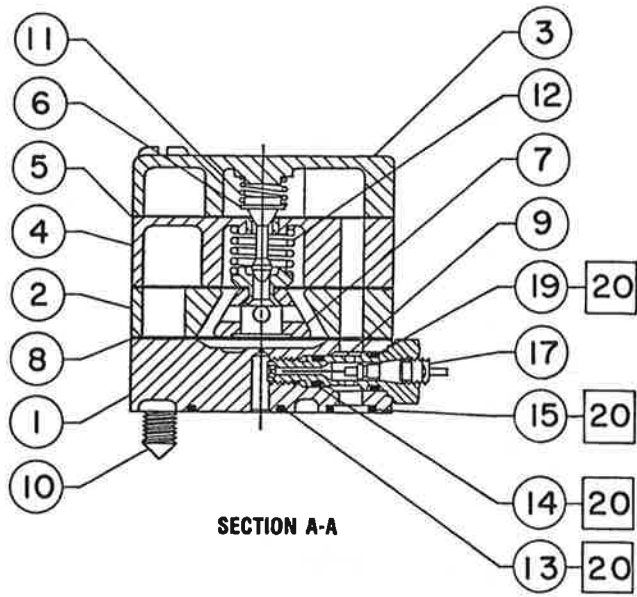
48A2905-A Sm 1



48A2905-A Sm 2

□ APPLY LUB/SEALANT

Figure 6-19. Auto/Manual Station Assembly Drawing



3280257-A

Figure 6-20. Type 83U Relay Construction

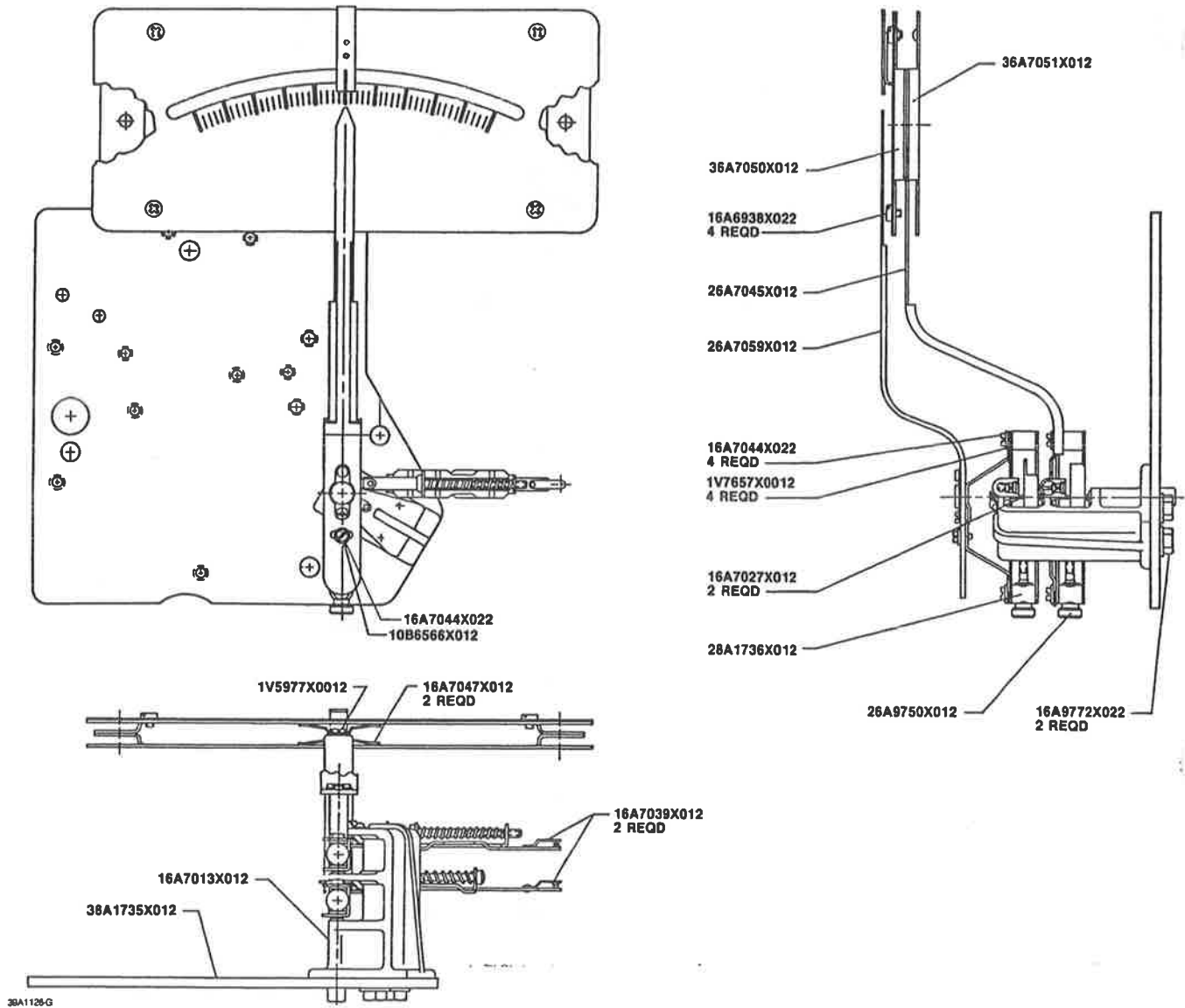
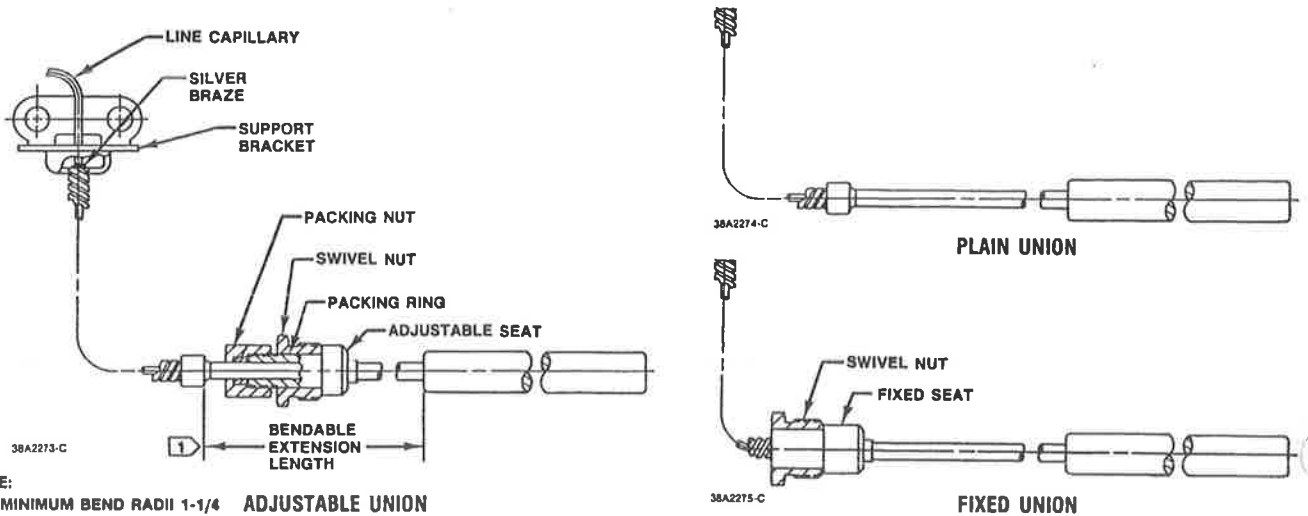


Figure 6-21. Set Point Indicator Assembly (Manual Set Point)



NOTE:  
 1 MINIMUM BEND RADII 1-1/4" **ADJUSTABLE UNION**  
 A5434

Figure 6-22. Temperature Element Assembly

## Section 7 Parts List

### Parts Ordering

Whenever corresponding with the Fisher sales office or sales representative about this equipment, always mention the controller serial number. When ordering replacement parts, refer to the 11-character part number of each required part as found in the following parts list.

### Parts Kits

Repair kit for controller (kit contains keys 4, 5, 7, 8, 24, and 52)	R4190X0 0C12
Repair kit for Type 83U Relay (kit contains keys 5, 6, 7, 8, 11, 13, 14, 15, and 19)	R83LX00 0012
Repair kit for auto/manual option (kit contains keys 277, 278, 279, 281, 292, 293, 294, 298, 306, and 312)	R4190X0 AM12
Repair kit for case handle assembly (kit contains lever and mounting hardware)	R4190X0 0H12
Repair kit for pointer (kit contains pointer and bracket assembly, machine screws, and washers)	R4190X0 0P12
Retrofit kit for auto/manual option (kit contains keys 138, 273, 312, 313, 314, 315, and 316)	R4190X0 0B12 R4190X0 0S12
Retrofit kit for anti-reset windup option (kit contains keys 44 and 45)	
For 4196B Series	
Copper tubing	R4190X0 0B22
SST tubing	R4190X0 0S22
For 4196C Series	
Copper tubing	R4190CX 0B22
SST tubing	R4190CX 0S22

### Controller Parts (figure 6-16)

Key	Description	Part Number
1	Case and cover assembly	
	Without remote set pt and w/o ext set pt	46A5903 X012
	With remote set pt	46A5902 X012
	With external set pt	46A5900 X012
2	Nameplate, aluminum	18A2276 X012
3	Frame, aluminum	56A7001 X012
4	Frame gasket, neoprene	18A0749 X012
5	Gasket, neoprene	18A0742 X012
6	Machine Screw, SST (6 req'd)	1P4373 X0012
7*	O-Ring, nitrile	
	(3 req'd w/o remote set pt and w/o ext feedback)	
	4 req'd w/remote set pt or w/ext feedback	
	5 req'd w/remote set pt and ext feedback)	1C3762 06992
8*	O-Ring, nitrile (3 req'd)	16A6903 X012
9	Flexure pivot assembly, sapphire/SST	29A4340 X012

Key	Description	Part Number
10	Machine screw, SST (4 req'd)	14A7797 X012
11	Flapper assembly	29A9518 X012
12	Machine screw, SST (2 req'd)	10B0700 X012
17	Adjustable set pt pivot assembly, SST	19A1121 X012
18	Relay nozzle tubing assembly, SST	18A0765 X012
19	Machine screw, SST (3 req'd)	1C8990 X0012
20	Plain washer, SST (2 req'd)	610003 50X12
21	Nozzle assembly, SST	26A6904 X012
22	Washer, plastic (1 req'd)	16A9767 X012
23	Set pt beam assembly, aluminum/SST	16A6939 X012
24*	O-ring, nitrile, (2 req'd)	1E2226 06992
25	Proportional band knob, polycarbonate	36A6911 X012
26	Retaining clip, SST	16A6913 X012
27	E-ring, SST	1V5929 X0012
28	Set pt beam bias spring, pl steel	16A6909 X012
29	Set pt beam shoe, pl steel	16A6910 X012
30	Machine screw, SST (2 req'd)	19A1155 X022
31	Bellows bracket, aluminum	26A6932 X012
32	Bellows adjustment bracket, pl steel	16A6933 X012
33	Bellows adjustment spring, pl steel	16A6934 X012
34	Machine screw, SST (2 req'd)	1B9925 X0012
35	Machine screw, SST (2 req'd)	16A6935 X022
36	Proportional band indicator cover, ABS w/polyester label	36A6936 X012
37	Self-tapping screw, SST (6 req'd)	16A6938 X022
38	Self-tapping screw, SST (9 req'd)	16A6959 X022
39	Supply gauge tubing assembly	
	Copper/brass	16A6952 X012
	SST	16A6952 X022
40	Proportional tubing assembly	
	For 4196A or 4196B Series	
	Copper/brass	28A0766 X012
	SST	28A0766 X022
	For 4196C Series	
	Copper/brass	27A3217 X012
	SST	27A3217 X022
41	Plug, SST	
	(1 req'd for 4196A Series, 4196B Series, 4196C Series w/anti-reset, 4196S Series; 2 req'd for 4196C Series w/o anti-reset)	1P2796 X0012
42	Reset valve tubing assembly (for 4196B Series w/o external feedback)	
	Copper/brass	16A6949 X012
	SST	16A6949 X022
43	Reset tubing assembly	
	For 4196B Series	
	Copper/brass	26A6950 X012
	SST	26A6950 X022
	For 4196C Series	
	Copper	28A0764 X012
	SST	28A0764 X022
44	Relief tubing assembly	
	For 4196BF, BFE, BFM, and BFME only	
	Copper/brass	16A6951 X012
	SST	16A6951 X022
	For 4196CF, CFE, CFM and CFME only	
	Copper/brass	18A0763 X012
	SST	18A0763 X022
45	Positive feedback tubing assembly (for 4196S Series only)	
	Copper/Brass	18A0769 X012
	SST/Brass	18A0769 X022

\*Recommended spare part.

Key	Description	Part Number	Key	Description	Part Number
46	Output gauge	See Key 46 table	136	Rate/reset manifold (for 4196A, 4196B, and 4196S Series only), aluminum	28A0747 X012
47	Supply gauge	See Key 47 table	137	Rate tubing assembly (for 4196C Series only)	
48	Bellows assembly, (2 req'd)			Copper/aluminum	28A0762 X012
	Brass	16A6953 X012		SST/aluminum	28A0762 X022
	SST/aluminum	16A6953 X022			
49	Bellows beam, aluminum		138	Automatic/manual tubing assembly (for 4196AE, AME, 4196BE, BME, BFE, BFME, 4196CE, CME, CFE, CFME, 4196SE, and SME only)	
	3 to 15 psig (0.2 to 1.0 bar)	16A6957 X012		Copper/aluminum	38A2859 X012
	6 to 30 psig (0.4 to 2.0 bar)	16A6958 X012		SST/aluminum	38A2859 X022
50	Relay assembly <sup>(1)</sup>		162	Machine screw, SST (for 4196B, 4196C Series only)	11B1999 X012
	3 to 15 psig (0.2 to 1.0 bar)	BV5997 X00A2	262	Rate/reset valve assembly (for 4196C Series only)	
	6 to 30 psig (0.4 to 2.0 bar)	BV5997 X00B2		Brass bellows	
51	Relief valve cover plate, aluminum (For 4196A Series, 4196B, BE, BM, BME, 4196C, CE, CM, CME, and 4196S Series only)	2V5973 08012		3 to 15 psig (0.2 to 1.0 bar)	39A6013 X052
52*	O-ring, nitrile (for 4196A Series, 4196B, BE, BM, BME, 4196C, CE, CM, CME, 4196S, SE, SM, and SME only)	1C8538 06992		6 to 30 psig (0.4 to 2.0 bar)	39A6013 X072
53	Machine screw, SST (5 req'd for 4196A Series, 4196B, BE, BM, BME, 4196C, CE, CM, CME, 4196S, SE, SM, and SME only)	1U8842 X0012		SST bellows	
54	Reset restriction valve (For 4196B, BE, BM, and BME only)	19A4361 X032		3 to 15 psig (0.2 to 1.0 bar)	39A6013 X062
	For 4196BF, BFE, BFM, and BFME only	19A4361 X042	310	Lubriplate Mag-1 lubricant <sup>(4)</sup> , 14 oz (0.396 kg) can (not furnished with controller)	1M1100 X0012
55	Differential relief valve (for 4196BF, BFE, BFM, BFME, CF, CFE, CFM, and CFME only)	21A6447 X0A2	311	Led-Plate No. 250 Sealant <sup>(5)</sup> , 5 pound (2.27 kg) can (not furnished with controller)	1M5240 06992
57	Pressure control block, 316 SST (1 req'd w/remote set pt; 2 req'd w/remote set pt and external feedback)	26A6962 X012	317	Molykote No. 33 Grease Lubricant <sup>(6)</sup> , 5.3 oz (0.150 kg) tube (not furnished with controller)	1M5964 X0012
58	Cap screw, SST (2 req'd w/remote set pt or external feedback; 4 req'd w/remote set pt and external feedback)	1A3525 38992	318	Dow Corning 111 Lubricant <sup>(6)</sup> , 5.3 oz. (0.150 kg) tube (not furnished with controller)	1M5282 06992
61	Process scale, aluminum	See Key 61 table	339	External feedback assembly	
62	Remote set pt assembly <sup>(2)</sup> (for 4196AM, AME, 4196BFM, BFME, BM, BME, 4196CFM, CFME, CM, CME, 4196SM, and SME)			Brass tubing	28A7285 X012
	Ni-Span-C <sup>(3)</sup>			SST tubing	28A7285 X022
	3 to 15 psig (0.2 to 1.0 bar)	36A6988 X032	362	Washer, SST	1B1961 38992
	6 to 30 psig (0.4 to 2.0 bar)	36A6988 X042	363	Lock Washer (for 4196B, C Series only)	1C2256 X0012
	SST				
	3 to 15 psig (0.2 to 1.0 bar)	36A6988 X012			
	6 to 30 psig (0.4 to 2.0 bar)	36A6988 X022			
63	Machine screw, SST (2 req'd)	590611 60X12			
64	Machine screw, SST (4 req'd)	1J8415 X0012			
65	Feedback link assembly aluminum/SST	16A7036 X012			
71	Machine screw, SST (4 req'd)	1P4743 X0012			
72	Blow out plug, silicone	2V7660 05312			
101	Indicator assembly (see figure 6-21 for part numbers)				
	Manual set pt	39A1126 X012			
	For use w/remote set pt	39A1127 X012			
127	Machine screw, SST (3 req'd)	1D9561 X0012			
128	Connecting link assembly, aluminum/SST	18A2278 X012			
129	Machine screw, SST (2 req'd)	1J8302 X0012			
131	Machine screw, SST (2 req'd)	1C1015 35042			
135	Frame manifold, aluminum (not for use with Auto/Manual station, suffix letter E)	28A0756 X012			

## Temperature Element Assembly (figure 6-16)

113	Temperature element assembly and mounting parts	See Key 113 tables
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## Internal/External Set Point Assembly (figure 6-16)

340	Bracket, pl steel	26A5893 X012
341	Pinion gear, Rytan <sup>(7)</sup>	16A5892 X012
342	Pinion shaft, (internal only), Rytan	26A5894 X012
343	Spring, SST	19A2333 X012
344	E-ring, SST	1E2143 X0012
345	Pinion rack,	36A5895 X012
346	Machine screw, SST	1E6453 X0022
347	Drive coupler, (external only)	26A5897 X012
348	Flexible drive (external only)	36A5896 X012
349	O-ring (external only), nitrile	15A1283 X012
350	Knob (external only) plastic	26A5901 X012
351	Insert (internal only) aluminum	16A5904 X012
352	Spring (external only) SST	16A5898 X012
353	Machine screw, SST	16A7044 X022
356	Rack support, pl steel	16A5905 X012

\*Recommended spare part.

- See the Type 83U relay section and figure 6-20 for individual parts.
- See the remote set point assembly section and figure 6-17 for individual parts.
- Trademark of International Nickel Co.
- Trademark of Fiske Brothers Refining Co.
- Trademark of Armite Laboratories.
- Trademark of Dow Corning Corp.
- Trademark of Phillips Petroleum Co.

Key	Description	Part Number
<b>Remote Set Point Assembly (figure 6-17)</b>		
12	Machine screw, SST (2 req'd)	1U6213 32982
13	Plain washer, SST (2 req'd)	610003 10X12
79	Drive flexure, SST	16A9794 X012
80	Diaphragm capsule assembly 3 to 15 psig, SST	28A2848 X022
	3 to 15 psig, Ni-Span-C	26A9776 X032
	6 to 30 psig, SST	28A2850 X022
	60 to 30 psig, Ni-Span-C	26A9778 X022
83	Travel stop, SST	16A9797 X012
86	Travel stop nut, SST	16A9799 X012
87	Set screw, SST	1J8406 X0012
93	Union, SST	1A5782 X0022
99	Washer, SST	610003 70X12
102	Machine screw, SST (4 req'd)	1H2675 X0012
103	Machine screw, SST	18A0703 X022
104	Tubing Assembly, SST	28A0697 X012
105	Pedestal assembly, SST	18A0669 X012
106	Tie bar, pl steel	16A9789 X012
107	Spring, pl steel	18A0704 X012
108	Zero adjustment screw, aluminum	18A1737 X012
109	Pivot screw, aluminum	18A1738 X012
110	Zero adjustment bracket, SST	28A0661 X012
111	Mounting plate, pl steel	38A0668 X012
112	Spring washer, pl steel	17A2700 X012
114	Pivot clevis assembly, plastic/SST	18A0658 X012
116	Connecting link assembly, aluminum/ bronze/brass	18A0666 X012
118	Machine screw, SST (2 req'd)	1U6213 32982
119	Guide flexure	18A0660 X012
120	Machine screw <sup>(8)</sup> , SST (2 req'd, for 4196AM, AME, 4196BFM, BFME, BM, BME, 4196CFM, CFME, CM, CME, 4196SM, and SME)	1D9561 X0012
121	Drive bracket, steel	28A0662 X012
122	Machine screw, SST (2 req'd)	1U3737 X0012
123	Washer, SST	1P7524 38982
124	Nut, SST	600004 10X12
125	Spacer, aluminum	18A0702 X012
126	Connecting link assembly, aluminum/ bronze/brass	18A0676 X012
134	Diaphragm assembly extension, aluminum	18A1739 X012
139	Machine screw, SST (3 req'd)	1J8415 X0012
140	Machine screw <sup>(8)</sup> , SST (for 4196AM, AME, 4196BFM, BFME, BM, BME, 4196CFM, CFME, CM, CME, 4196SM, and SME only)	16A7007 X022
141	Adjustment arm, SST	28A0663 X012

**Internal Auto/Manual Station  
(figures 6-18 and 6-19)**

For 4196AE, AME, 4196BE, BFE, BFME, BME, 4196CE, CFE,  
CFME, CME, 4196SE, and SME

138	Manual/automatic tubing assembly Aluminum/brass	38A2859 X012
	Aluminum/SST	38A2859 X022
273	Auto/manual station	48A2905 X012
274	Lower loader assembly, aluminum	18A2892 X012
275	Spring seat screw, aluminum	18A2876 X012

Key	Description	Part Number
276	Valve plug spring, pl steel	18A2877 X012
277	Valve plug, SST	18A2878 X012
278	Tube, plastic	18A2880 X012
279	Ball, SST	18A2902 X012
280	Ball seat, nitrile (2 req'd)	18A2881 X012
281	Diaphragm assembly, nitrile/aluminum	18A2884 X012
282	Upper loader assembly, aluminum/plastic	18A2893 X012
283	Range spring, SST	18A2885 X012
284	Range spring cup, SST	18A2869 X012
285	Spring adjustment screw, pl steel	18A2886 X012
286	Retaining ring, pl steel	18A2903 X012
287	Loader knob, plastic	18A2891 X012
288	Machine screw, SST (2 req'd)	1C2082 35072
289	Machine screw, SST (4 req'd)	1C8969 X0012
290	Machine screw, SST (2 req'd)	1K3188 38992
291	Switch body/assembly, aluminum/nitrile	28A2890 X012
292*	O-ring, nitrile	1U2398 X0032
293*	O-ring, nitrile	11A8741 X052
294*	O-ring, nitrile	13A1584 X012
295	Switch body spring, pl steel (2 req'd)	18A2889 X012
296	Ball, SST (2 req'd)	1J1550 X0012
297	Lever assembly, SST	18A2866 X012
298	O-ring, nitrile	1E2226 X0032
299	Rocker, aluminum	18A2871 X012
300	Clip, SST	18A2872 X012
301	Lever spring seat, SST	18A2870 X012
302	Lever spring, pl steel	18A2895 X012
303	Groove pin, SST	16A6380 X012
304	Switch lever, polycarbonate/SST	38A2897 X012
305	Switch lever cover plate, aluminum	18A2873 X012
306*	Closing plate gasket, neoprene	18A2898 X012
307	Closing plate, SST	18A2875 X012
308	Machine screw, SST (2 req'd)	18A2899 X022
309	Tubing assembly, SST	28A2863 X012
310	Lubriplate Mag-1 lubricant, 14 oz. (0.396 kg) can (not furnished with the Internal Auto/Manual Station assembly)	1M1100 X0012
311	Led-Plate No. 250 Sealant, 5 pound (2.27 kg) can (not furnished with Internal Auto/Manual Station assembly)	1M5240 06992
312*	O-ring, nitrile (3 req'd)	1P8453 X0022
313	Auto/Manual Scale, polycarbonate	38A2901 X012
314	Machine screw, SST	1C1015 35042
315	Machine screw, SST	1B9925 X0012
316	Machine screw, SST	1U8841 X0012

**Type 83U Relay (figure 6-20)**

1	Relay base, aluminum	42B0245 X012
2	Exhaust block, aluminum	2U9002 08012
3	Relay cap, aluminum	3U9019 08012
4	Output block assembly, SST/aluminum	1U9006 000A2
5	Gasket, nitrile	1V5579 02032
6	Inner valve, steel	1U9016 35032
7	Diaphragm assembly, nitrile/aluminum/SST	1U9018 000A2
8	Diaphragm, nitrile	1V5578 02032

\*Recommended spare part.  
8. Use to mount the remote set point assembly to the indicator assembly.



Key	Description	Part Number
9	Nozzle and adaptor assembly, aluminum/sapphire 3 to 15 psig (0.2 to 1.0 bar) output 6 to 30 psig (0.4 to 2.0 bar) output	12B0250 X012 12B0251 X012
10	Relay mounting screw, SST (2 req'd)	1U9012 38982
11	Spring, SST	1P4204 37022
12	Spring, pl steel	19A8907 X012
13	O-ring, nitrile	17A6891 X012
14	O-ring, nitrile	1D1346 06992
15	O-ring, nitrile, (2 req'd)	1D6875 06992
16	Machine screw, SST (4 req'd)	1A8176 X0012
17	Core and wire assembly, SST 3 to 15 psig (0.2 to 1.0 bar) output 6 to 30 psig (0.4 to 2.0 bar) output	1V5992 X0012 1V5992 X0022
19	O-ring, nitrile	1D1347 06992
20	Dow Corning 111 Lubricant <sup>(6)</sup> , 5.3 oz. (0.150 kg) tube (not furnished with controller)	1M5282 06992

**Mounting Parts**

**Pipestand Mounting (figure 2-1)**

66	Cap screw, pl steel (3 req'd)	1A3526 24052
67	Lock Washer, pl steel (7 req'd)	1C2257 28982
68	Bracket, pl steel	36A6990 X012
69	Clamp, (2 req'd)	1P4270 28982

**Pipestand Mounting with Regulator (figure 2-1)**

362	Cap screw, pl steel	1B1961 38992
363	Lockwasher, pl steel	1C2256 X0012
364	Hex nut, pl steel	1A3527 24122
365	Washer	11B6501 X012
366	Tubing	

**Panel Mounting (figure 2-2)**

66	Cap screw, pl steel (3 req'd)	1A3526 24052
67	Lock Washer, pl steel (3 req'd)	1C2257 28982
68	Bracket, pl steel	36A6990 X012
70	Machine Screw, pl steel (4 req'd)	16A9763 X012

**Wall Mounting (figure 2-3)**

66	Cap screw, pl steel (3 req'd)	1A3526 24052
67	Lockwasher, pl steel (3 req'd)	1C2257 28982
68	Bracket, pl steel	36A6990 X012

Key 46 Output Gauge  
Key 47 Supply Gauge

RANGE	OUTPUT		SUPPLY	
	Brass	SST	Brass	SST
0 to 30 psig	16A6983 X012	16A6983 X172	16A6983 X022	16A6983 X182
0 to 60 psig	16A6983 X032	16A6983 X192	16A6983 X042	16A6983 X202
0 to 30 psig/0 to 2 bar	16A6983 X332	---	16A6983 X342	---
0 to 30 psig/0 to 200 kPa	16A6983 X372	---	16A6983 X382	---
0 to 60 psig/0 to 4 bar	16A6983 X352	---	16A6983 X362	---
0 to 60 psig/0 to 400 kPa	16A6983 X392	---	16A6983 X402	---
0 to 200 kPa	16A6983 X052	16A6983 X212	16A6983 X062	16A6983 X222
0 to 400 kPa	16A6983 X072	16A6983 X232	16A6983 X082	16A6983 X242
0 to 2 kg/cm <sup>2</sup>	16A6983 X092	16A6983 X252	16A5983 X102	16A6983 X262
0 to 4 kg/cm <sup>2</sup>	16A6983 X112	16A6983 X272	16A6983 X122	16A6983 X282
0 to 2 bar	16A6983 X132	16A6983 X292	16A6983 X142	16A6983 X302
0 to 4 bar	16A6983 X152	16A6983 X312	16A6983 X162	16A6983 X322

**Actuator Casing Mounting**

Spacer Spool, steel (3 req'd)	1C5590 24092
Cap screw, pl steel (3 req'd)	1B7624 24052
Lockwasher, pl steel (5 req'd)	1C2257 28982
Mounting bracket, pl steel	36A9754 X012
Cap screw, pl steel (2 req'd)	1C3791 24052
Mounting bracket, pl steel	1F4012 25072
Cap screw, pl steel (2 req'd)	1A3683 24052
Hex nut, pl steel (2 req'd)	1E9440 24112
Washer (2 req'd)	1B8659 28982
Washer (2 req'd)	1H7231 25072

**Actuator Yoke Mounting**

Spacer spool, steel (3 req'd)	1C5590 24092
Cap screw, pl steel (3 req'd)	1B7624 24052
Lockwasher, pl steel (5 req'd)	1C2257 28982
Mounting bracket, steel	
Type 1061	36A6991 X012
All others	36A9754 X012
Spacer spool, steel (2 req'd)	1J8307 24092
Cap screw, pl steel (2 req'd)	1A3525 24052

**Tubing**

**Note**

Specify quantity of fittings and length of tubing required.

For 1/4 inch OD, copper 05000 91701W  
For 3/8 inch OD, copper 05002 01701W

**Fittings**

For 1/4 inch tubing  
Connector, brass, (2 req'd) 1A6368 14012  
Elbow, brass, (2 req'd) 1A3971 18992

For 3/8 inch tubing  
Connector, brass, (2 req'd) 1B8856 18992  
Elbow, brass, (2 req'd) 1B8846 18992



Key 61 Process Scales, aluminum

Temperature Range, Degrees		Part Number
Fahrenheit	- 100 to 200	1R0003 X2522
	0 to 150	1R0003 X2512
	0 to 100	1R0003 X0382
	0 to 200	1R0003 X0762
	0 to 300	1R0003 X0802
	0 to 400	1R0003 X0812
	0 to 500	1R0003 X1122
	0 to 600	1R0003 X0822
	50 to 150	1R0003 X0722
	50 to 200	1R0003 X0742
	50 to 250	1R0003 X0772
	100 to 200	1R0003 X0732
	100 to 300	1R0003 X0782
	100 to 400	1R0003 X2532
Celsius	- 20 to 40	1R0003 X2542
	- 15 to 85	1R0003 X1462
	- 75 to 75	1R0003 X2572
	0 to 60	1R0003 X2552
	0 to 100	1R0003 X0852
	0 to 150	1R0003 X0862
	0 to 200	1R0003 X0872
	0 to 250	1R0003 X0882
	0 to 300	1R0003 X0892
	60 to 120	1R0003 X2652
	50 to 150	1R0003 X1472
50 to 200	1R0003 X2582	
Per Cent	0 to 100	1R0003 X1042

Key 113 Temperature Element Assembly, adjustable union

TEMPERATURE RANGE, DEGREES		CAPILLARY LENGTH		
		15 ft (4.5 m)	25 ft (7.5 m)	
Fahrenheit	0 to 100	38A2270 X182	38A2270 X192	
	50 to 150	38A2270 X182	38A2270 X192	
	100 to 200	39A2955 X012	39A2955 X022	
	50 to 200	38A2270 X162	38A2270 X172	
	0 to 150	38A2270 X162	38A2270 X172	
	- 100 to 200	39A2955 X052	39A2955 X062	
	0 to 200	38A2273 X162	38A2273 X172	
	50 to 250	38A2273 X162	38A2273 X172	
	100 to 300	38A2273 X162	38A2273 X172	
	100 to 400	39A2955 X072	39A2955 X082	
	0 to 300	38A2273 X182	38A2273 X192	
	0 to 400	39A2955 X092	39A2955 X102	
	0 to 500	39A2955 X112	39A2955 X122	
	0 to 600	39A2955 X132	39A2955 X142	
	Celsius	- 20 to 40	38A2270 X182	38A2270 X192
		0 to 60	38A2270 X182	38A2270 X192
		60 to 120	39A2955 X012	39A2955 X022
		- 15 to 85	38A2273 X162	38A2273 X172
0 to 100		38A2273 X162	38A2273 X172	
50 to 150		38A2273 X162	38A2273 X172	
50 to 200		39A2955 X072	39A2955 X082	
0 to 150		38A2273 X182	38A2273 X192	
- 75 to 75		39A2955 X052	39A2955 X062	
0 to 200		39A2955 X092	39A2955 X102	
0 to 250		39A2955 X112	39A2955 X122	
0 to 300		39A2955 X132	39A2955 X142	

Key 113 Temperature Element Assembly, plain union

TEMPERATURE RANGE, DEGREES		CAPILLARY LENGTH	
		15 ft (4.5 m)	25 ft (7.5 m)
Fahrenheit	0 to 100	38A2271 X172	38A2271 X182
	50 to 150	38A2271 X172	38A2271 X182
	100 to 200	39A2956 X012	39A2956 X022
	50 to 200	38A2271 X152	38A2271 X162
	0 to 150	38A2271 X152	38A2271 X162
	- 100 to 200	39A2956 X052	39A2956 X062
	0 to 200	38A2274 X152	38A2274 X162
	50 to 250	38A2274 X152	38A2274 X162
	100 to 300	38A2274 X152	38A2274 X162
	100 to 400	39A2956 X072	39A2956 X082
	0 to 300	38A2274 X172	38A2274 X182
	0 to 400	39A2956 X092	39A2956 X102
	0 to 500	39A2956 X112	39A2956 X122
	0 to 600	39A2956 X132	39A2956 X142
Celsius	- 20 to 40	38A2271 X172	38A2271 X182
	0 to 60	38A2271 X172	38A2271 X182
	60 to 120	39A2956 X012	39A2956 X022
	- 15 to 85	38A2274 X152	38A2274 X162
	0 to 100	38A2274 X152	38A2274 X162
	50 to 150	38A2274 X152	38A2274 X162
	50 to 200	39A2956 X072	39A2956 X082
	0 to 150	38A2274 X172	38A2274 X182
	- 75 to 75	39A2956 X052	39A2956 X062
	0 to 200	39A2956 X092	39A2956 X102
	0 to 250	39A2956 X112	39A2956 X122
	0 to 300	39A2956 X132	39A2956 X142

Key 113 Temperature Element Assembly, fixed union

TEMPERATURE RANGE, DEGREES		CAPILLARY LENGTH		
		15 ft (4.5 m)	25 ft (7.5 m)	
Fahrenheit	0 to 100	38A2272 X172	38A2272 X182	
	50 to 150	38A2272 X172	38A2272 X182	
	100 to 200	39A2957 X012	39A2957 X022	
	50 to 200	38A2272 X152	38A2272 X162	
	0 to 150	38A2272 X152	38A2272 X162	
	- 100 to 200	39A2957 X052	39A2957 X062	
	0 to 200	38A2275 X152	38A2275 X162	
	50 to 250	38A2275 X152	38A2275 X162	
	100 to 300	38A2275 X152	38A2275 X162	
	100 to 400	39A2957 X072	39A2957 X082	
	0 to 300	38A2275 X172	38A2275 X182	
	0 to 400	39A2957 X092	39A2957 X102	
	0 to 500	39A2957 X112	39A2957 X122	
	0 to 600	39A2957 X132	39A2957 X142	
	Celsius	- 20 to 40	38A2272 X172	38A2272 X182
		0 to 60	38A2272 X172	38A2272 X182
		60 to 120	39A2957 X012	39A2957 X022
		- 15 to 85	38A2275 X152	38A2275 X162
0 to 100		38A2275 X152	38A2275 X162	
50 to 150		38A2275 X152	38A2275 X162	
50 to 200		39A2957 X072	39A2957 X082	
0 to 150		38A2275 X172	38A2275 X182	
- 75 to 75		39A2957 X052	39A2957 X062	
0 to 200		39A2957 X092	39A2957 X102	
0 to 250		39A2957 X112	39A2957 X122	
0 to 300		39A2957 X132	39A2957 X142	

Key 113 Table, Mounting Parts for Temperature Element Assembly, appears on the next page.

# 4196A, B, C, and S Series



## Key 113 Mounting Parts for Temperature Element Assembly

Temperature Element		Mounting Parts			
Part Number <sup>(1)</sup>	Union Type, Bulb Size	Packing Nut	Packing Ring	Swivel Nut	Seat
38A2270X...	Adjustable Union, 9/16-inch bulb	18A3823 X012	18A2283 X012 <sup>(3)</sup>	18A7271 X012	18A3825 X012 <sup>(4)</sup>
38A2271X...	Plain Union, 9/16-inch bulb	Not Req'd.	Not Req'd.	Not Req'd.	Not Req'd.
38A2272X...	Fixed Union, 9/16-inch bulb	Not Req'd.	Not Req'd.	18A7271 X012	18A2288 X012 <sup>(5)</sup>
38A2273X...	Adjustable Union, 3/8-inch bulb	18A3815 X012	18A2283 X012 <sup>(3)</sup>	18A3817 X012	18A3816 X012 <sup>(4)</sup>
38A2274X...	Plain Union, 3/8-inch bulb	Not Req'd.	Not Req'd.	Not Req'd.	Not Req'd.
38A2275X...	Fixed Union, 3/8-inch bulb	Not Req'd.	Not Req'd.	18A3817 X012	18A2287 X012 <sup>(5)</sup>
39A2255X... <sup>(2)</sup>	Adjustable Union, 9/16-inch bulb	18A3823 X012	18A2283 X012 <sup>(3)</sup>	18A7271 X012	18A3825 X012 <sup>(4)</sup>
39A2956X... <sup>(2)</sup>	Plain Union, 9/16-inch bulb	Not Req'd.	Not Req'd.	Not Req'd.	Not Req'd.
39A2957X... <sup>(2)</sup>	Fixed Union, 9/16-inch bulb	Not Req'd.	Not Req'd.	18A7271 X012	18A2288 X012 <sup>(5)</sup>

1. See other Key 113 tables for complete temperature element part numbers.  
 2. Temperature element with compensation.  
 3. Two packing rings required for process conditions to 800°. Use 18A3814 X012 for process conditions above 800°.  
 4. Adjustable seat.  
 5. Fixed seat.

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**Errata Sheet**  
**for**  
**4196A, B, C, AND S SERIES TEMPERATURE INDICATING CONTROLLERS**  
**INSTRUCTION MANUAL**  
**Form 5216, November 1989**

This errata sheet provides new Anti-Reset Windup Calibration procedures. This errata sheet also provides revised figure and part information in support of design changes in the controller and controller subassemblies.

1. On page 4-6, under the Flapper Alignment: Proportional-Plus-Rest or Proportional-Plus-Reset-Plus-Rate title, write a note that reads: **"Note: If the differential relief valve (key 55, for Option F) is installed, remove the valve (key 55) and install the O-ring, relief valve cover, and machine screws (keys 52, 51, and 53, in the instruction manual)."**

Because the differential relief valve can cause difficulty in completing the flapper alignment procedure, it is necessary to remove the valve and install the cover. When flapper alignment procedures are complete, re-install the differential relief valve (key 55).

2. On page 4-8, following step 21, write a step that reads: **"22. If necessary, remove the relief valve cover (key 51) and re-install the differential relief valve (key 55, for option F)."**

3. On page 4-8, in the left column, below step 21, write a note that reads: **"See Anti-Reset Windup Calibration procedures in the errata sheet."** Refer to the Anti-Reset Windup Calibration procedure below.

4. On page 6-27/6-28, in figure 6-16, cross out the top left hand drawing. Write a note near the drawing that reads: **"See figure 6-16, Controller Assembly Drawing in the errata sheet."** Also, in figure 6-16, in the lower left view, cross-out the Bourdon tube in the (TYPICAL REMOTE SET POINT ASSEMBLY MOUNTING-4190 SERIES CONTROLLERS) view."

Bourdon tubes are not used with 4196 Series Controller Constructions.

5. On page 6-35, in figure 6-20, change the drawing reference number from 32B0257-A to 38A2279-A.

6. On page 6-36, in figure 6-21, cross out the drawing of the Set Point Indicator Assembly (Manual Set Point). Write a note near the drawing that reads: **"See figure 6-21, Indicator Assembly in the errata sheet."**

7. On page 7-2, for key 101, cross out the part numbers. Write a note near key 101 that reads: **"For key 101, see Parts List section in the errata sheet."**

8. On page 7-4, cross out the table for Key 46 Output Gauge, key 47 Supply Gauge. Write a note near the table that reads: **"See Key 46/47 Pressure Gauge table in the errata sheet."**

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## Anti-Reset Windup Calibration

### For Rising Controller Output Pressure:

The following procedure is for controllers equipped with the anti-reset windup valve and with the valve positioned to relieve on rising output pressure:

1. Plug the controller output connection or connect it to a pressure gauge if desired (open-loop conditions must exist).
2. Adjust the reset valve to 0.01 minutes per repeat (wide open).
3. For controllers with manual set point, move the set point adjustment to 50 percent of the scale range. For controllers with remote set point (option M), adjust the remote set point pressure until the set point indicator is at 50 percent of the scale range.
4. Adjust the proportional band to 100 percent in either the DIRECT or REVERSE action depending on the application requirements.
5. On page 6-31, figure 6-16, VIEW E, 4196C SERIES, OPTION F, in the instruction manual for the location of the anti-reset windup valve. For the anti-reset valve to relieve on rising controller pressure, install the valve so the arrow on the valve points down. If it is necessary to change the direction of the arrow, loosen the two mounting screws, pull the valve out, and reinstall with the arrow direction reversed. Tighten the two mounting screws.
6. Turn on the supply pressure to the recommended value in table 1-4 (in the instruction manual).

#### Note

**Because of the high controller gain with the reset valve at 0.01 minutes per repeat, the controller output will not balance perfectly in the following step. If the controller output is stable for approximately 5 seconds, it is adequately balanced.**

7. Increase the input pressure (or vacuum for a vacuum controller) to the process element until the controller output pressure balances at 6 psig for a 3 to 15 psig output range (0.4 bar for a 0.2 to 1 bar output range), or 12 psig for a 6 to 30 psig output range (0.8 bar for a 0.4 to 2 bar output range).
8. Adjust the reset valve to the CLOSED position.
9. Increase the controller output pressure in small steps [approximately 0.5 psig (0.03 bar)] by changing the input to the controller process sensing element or by changing the controller set point. After each change in controller input or set point, the controller output pressure should quickly change, and then stabilize at the new value.
10. Continue to change the controller output pressure in 0.5 psi (0.03 bar) steps and monitor the output pressure after each step to verify that it stabilizes. At some point, the controller will start to ramp upward to supply pressure without further change to the controller input or set point. Record the controller output pressure where this ramping action begins because this is the point at which the anti-reset windup valve has relieved.
11. To obtain the anti-reset windup valve differential setting, calculate the difference between the original controller output pressure in step 7 and the controller output recorded in step 10.
12. If the differential pressure calculated in step 11 is incorrect for the application, the differential valve can be adjusted by turning the anti-reset windup valve adjustment screw (see figure 6-16). Turning the screw clockwise will decrease the differential pressure. Turning the screw counterclockwise will increase the differential pressure. The anti-reset valve is factory set at approximately 5 psi (0.34 bar) differential pressure.
13. Repeat steps 7 through 12 until the required differential pressure is obtained.

**For Falling Controller Output Pressure:**

The following procedure is for controllers equipped with the anti-reset windup valve and with the valve positioned to relieve on falling output pressure:

1. Plug the controller output connection or connect it to a pressure gauge if desired (open-loop conditions must exist).
2. Adjust the reset valve to 0.01 minutes per repeat (wide open).
3. For controllers with manual set point, move the set point adjustment to 50 percent of the scale range. For controllers with remote set point (option M), adjust the remote set point pressure until the set point indicator is at 50 percent of the scale range.
4. Adjust the proportional band to 100 percent in either the DIRECT or REVERSE action depending on the application requirements.
5. On page 6-31, figure 6-16, VIEW E, 4196C SERIES, OPTION F, in the instruction manual for the location of the anti-reset windup valve. For the anti-reset valve to relieve on falling controller pressure, install the valve so the arrow on the valve points up. If it is necessary to change the direction of the arrow, loosen the two mounting screws, pull the valve out, and reinstall with the arrow direction reversed. Tighten the two mounting screws.
6. Turn on the supply pressure to the recommended value in table 1-4 (in the instruction manual).

**Note**

**Because of the high controller gain with the reset valve at 0.01 minutes per repeat, the controller output will not balance perfectly in the following step. If the controller output is stable for approximately 5 seconds, it is adequately balanced.**

7. Increase the input pressure (or vacuum for a vacuum controller) to the process element until the controller output pressure balances at 12 psig for a 3 to 15 psig output range (0.8 bar for a 0.2 to 1 bar output range), or 24 psig for a 6 to 30 psig output range (1.7 bar for a 0.4 to 2 bar output range).
8. Adjust the reset valve to the CLOSED position.
9. Decrease the controller output pressure in small steps [approximately 0.5 psig (0.03 bar)] by changing the input to the controller process sensing element or by changing the controller set point. After each change in controller input or set point, the controller output pressure should quickly change, and then stabilize at the new value.
10. Continue to change the controller output pressure in 0.5 psi (0.03 bar) steps and monitor the output pressure after each step to verify that it stabilizes. At some point, the controller will start to ramp downward to 0 psig without further change to the controller input or set point. Record the controller output pressure where this ramping action begins because this is the point at which the anti-reset windup valve has relieved.
11. To obtain the anti-reset windup valve differential setting, calculate the difference between the original controller output pressure in step 7 and the controller output recorded in step 10.
12. If the differential pressure calculated in step 11 is incorrect for the application, the differential valve can be adjusted by turning the anti-reset windup valve adjustment screw (see figure 6-16). Turning the screw clockwise will decrease the differential pressure. Turning the screw counterclockwise will increase the differential pressure. The anti-reset valve is factory set at approximately 5 psi (0.34 bar) differential pressure.
13. Repeat steps 7 through 12 until the required differential pressure is obtained.

(End of Anti-Reset Windup procedure)

### Parts List

101 Indicator Assembly

Note

Key 101 is the indicator assembly without a sensing element. Individual parts for the indicator assembly are listed in the Indicator Assembly subsection of this parts list. Key numbers locations are shown in figure 6-21 in this errata sheet.

- Use w/o remote set point                      39A1126 X012    1
- Use w/remote set point                        39A1126 X022    1

Indicator Assembly Individual Parts (figure 4-21)

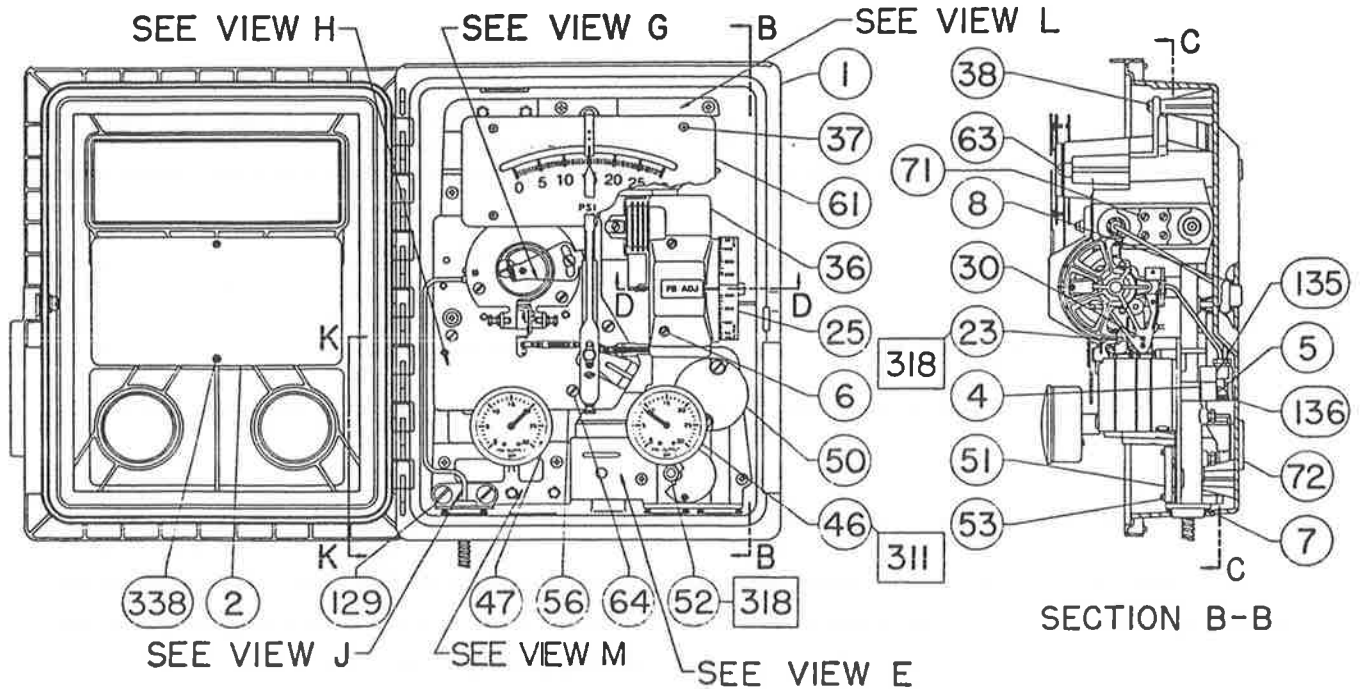
Key	Description	Part No.	Qty.
61	Process Scale, aluminum	See general controller part list in the instruction manual	
353	Machine screw, SST	16A7044 X022	4
366	Mounting plate, SST	38A1735 X012	1
367	Support bracket assembly, zinc/brass	16A7013 X012	1
368	Link assembly, SST/brass	16A7039 X012	2
369	Process pointer adjustment assembly aluminum/SST/brass	28A1736 X012	1
370	Set point pointer and bracket assembly, aluminum/SST/brass	26A9750 X012	1
371	Pivot pin, S30200 SST	16A7027 X012	2
372	Washer, SST	1V7657 X0012	4

Key	Description	Part No.	Qty.
374	Pointer and bracket assembly, aluminum/steel	26A7059 X012	1
375	Set point indicating assembly		
	With remote set point	31B2241 X012	1
	Without remote set point	26A7045 X012	1
376	Dial bracket, carbon steel/zinc plated	36A7050 X012	1
377	Dial bracket, Steel	36A7051 X012	1
378	Screw, SST	16A9772 X022	2

Key 46/47 Pressure Gauge<sup>(1)</sup>

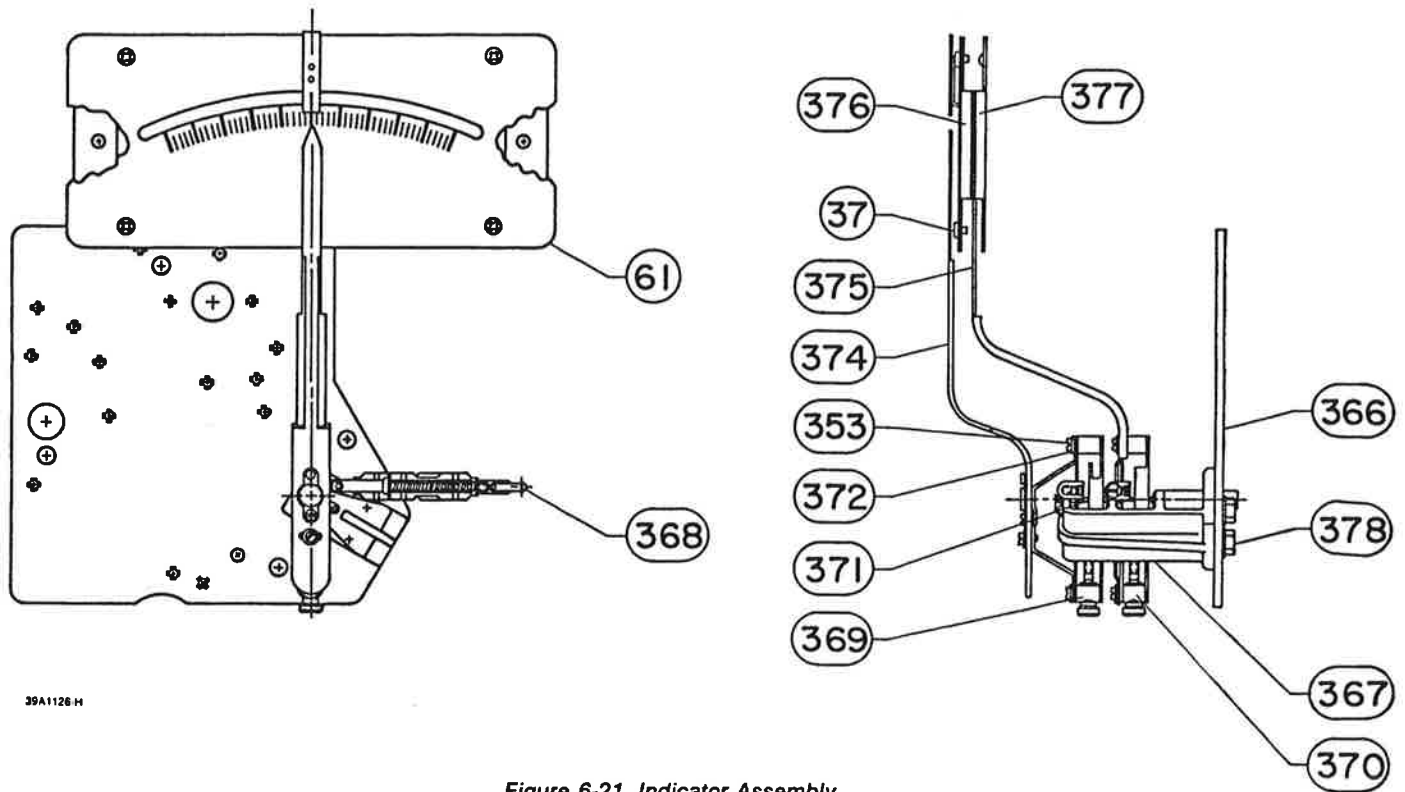
RANGE	GAUGE MATERIAL	
	Brass	SST
<b>Dual Scale Gauge</b>		
0 to 30 psig/ 0 to 2 kg/cm <sup>2</sup>	11B8577 X042	11B8583 X032
0 to 60 psig/ 0 to 4 kg/cm <sup>2</sup>	11B8577 X052	---
<b>Triple Scale Gauge</b>		
0 to 30 psig/ 0 to 200 kPa/ 0 to 2 bar	11B8577 X012	11B8583 X012
0 to 60 psig/ 0 to 400 kPa/ 0 to 4 bar	11B8577 X022	11B8583 X022

1. One type of pressure gauge is used for both output pressure and supply pressure indication.



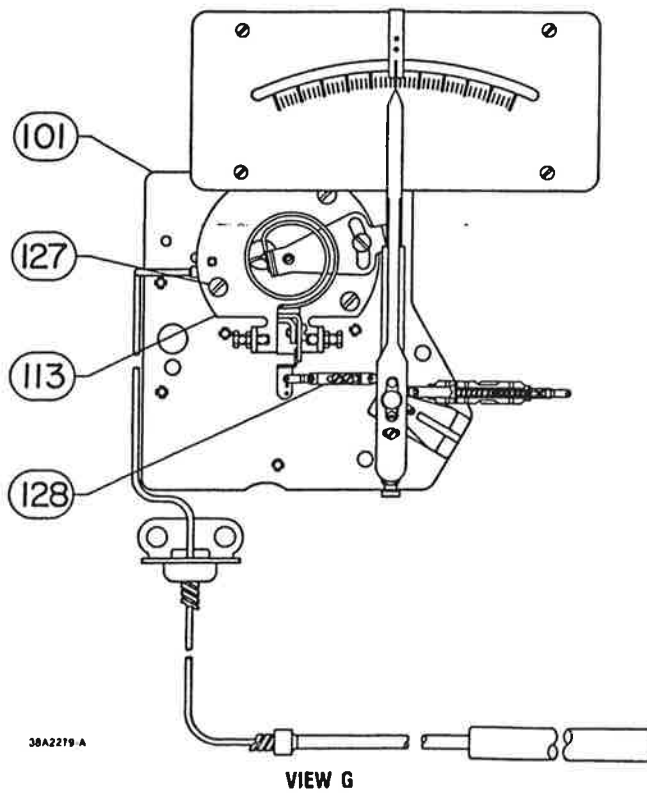
59A0261 A

Figure 6-16. Controller Assembly Drawing



39A1128 H

Figure 6-21. Indicator Assembly



38A2219 A

VIEW G

Figure 6-16. Temperature Element (Continued)





# MINIATURE 2 WIRE VIBRATION TRANSMITTER MODELS 5484 & 5491

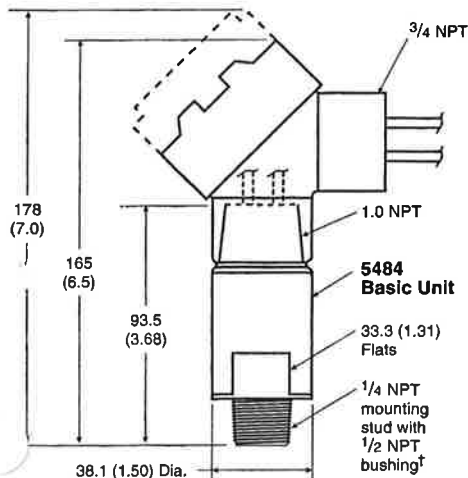
**Reduce the cost and complexity of vibration monitoring with these two wire, loop powered vibration transmitters**

Two models are available. The Model 5484 is the non-indicating version and can be supplied with a screw cover elbow fitting for connecting field wiring. The Model 5491 is the indicating version and comes with an integral 2 1/2 digit LCD indicator for local vibration readout.

Simply mount either transmitter into a single tapped hole in the machine case, connect its two wires into a 4-20 mA current loop, and it will transmit the machine's vibration level directly to your analog or  $\mu$ P based monitor.

Employing no moving parts, the basic transmitter is all solid state and epoxy encapsulated in a zinc plated steel housing.† The LCD indicator is packaged in a sealed module that can be positioned in 90° increments within the elbow fitting to allow proper viewing when the transmitter is installed.

Each transmitter is factory calibrated to the nameplate sensitivity. However, when necessary the span control can be field adjusted.



† other case materials and mountings available.



**Model 5491B**  
**Indicating**  
**Transmitter**  
 Wt.: .82 kg (1.8 lbs.)

**Model 5484C**  
**Non-Indicating**  
**Transmitter**  
 Shown with optional  
 elbow fitting.



MSHA Approved\*



Wt.: .64 kg (1.4 lbs.)

## SPECIFICATIONS

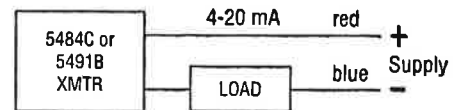
**Vibration Range:** see table  
**Output Current:** 4 to 20 mA  
**Frequency Range:** 5 Hz to 1500 Hz  
**Axis Orientation:** any  
**Supply Voltage (Vs):**  
 Model 5484: 10 to 60 vdc  
 Model 5491: 12 to 62 vdc  
**Maximum Load Resistance:**  
 Model 5484: 50 (Vs-10) ohms  
 Model 5491: 50 (Vs-12) ohms  
**Isolation:** 500 V, circuit to case.  
**Electrical Connection:** 2 wires,  
 AWG #18, 610 mm (24 inches) long  
**Temperature Range:** see table  
**Enclosure:** NEMA 3R, IP 63  
**Approvals:**

5484C transmitters are CSA certified explosion-proof, Class I (B, C & D); Class II (E, F & G).

5484C-121 and -123 are also

BASEEFA certified intrinsically safe EEx ia IIB T4.

5491B is CSA certified explosion-proof Class I (C & D); Class II (F & G).



## HOW TO ORDER

Model	Temp. Range	Vibration Range
5484C-021	-10°C to +70°C	0 to 1.0 ips (25 mm/s), pk
5484C-121	-40°C to +100°C	
5484C-023	-10°C to +70°C	0 to 2.0 ips (50 mm/s), pk
5484C-123	-40°C to +100°C	
5491B-021	-10°C to +70°C	0 to 1.0 ips, pk
5491B-022	-10°C to +70°C	0 to 19.9 mm/s, pk
8200-001	Conduit Elbow - aluminum, Class I (C & D), Class II (E, F & G) - for use with 5484.	

\*Consult factory for details for MSHA approved model.

## ACCESSORIES:

See last page of Section 2 for mounting and wiring accessories.

Dimensions in mm (inches)