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Edmonton

SERVICE MANUAL No. I-0043

GAS/HYDRAULIC

ADDITIONAL COMPONENTS

CUSTOMER:_____

P.O.#:_____

W.O.#:_____

TAG:_____

DATE:_____

APPLIES TO OPERATOR MODEL:_____

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I GENERAL SERVICE NOTES

Refer to applicable SCHEMATIC DRAWING(S).
THE ITEMS BELOW WILL HAVE BEEN SUPPLIED IF SPECIFIED. The comments are applicable across the range of makes and models.

ITEM COMPONENT

7 SPEED CONTROL VALVE
A variable orifice which allows for independent control of opening and/or closing speed.

8 CHECK VALVE
Permits flow in one direction only.

13 RELIEF
Signal gas overpressure protection.

14 PILOT (HI AND LOW)
Optional, if required, to switch signal gas depending on status of sensed pressure. Consult pilot bulletin for service and adjustments.

16 SIGNAL SELECTOR
Typically to switch from automatic to manual operation for start-up etc.

19 JUNCTION BOX
Provides additional terminals for wiring purposes.

20 SOLENOID VALVE(S)
Converts electrical signal (E/P) (I/P) to pneumatic signal. See manufacturer's service bulletin at end of this manual.

22 VOLUME TANK

Power gas storage for failsafe operation. Drain accumulated moisture and contaminants using pipe port provided.

23 RELIEF VALVE

Supply gas overpressure protection.

25 REVERSING RELAY

Bettis relay model (R324) N.O. relay. When reassembling, be careful to align body parts while bolts are just snug, before tightening completely.

27 PRESSURE SWITCH - static

Converts pipeline pressure to an electrical signal to provide a low pressure power gas warning or desired position of the line valve.

29 PRESSURE SWITCH - differential

Converts a pressure differential between two selected points to electrical signal.

30 PRESSURE SELECTOR VALVE

Allow selection of "HIGH" and "LOW" signals for devices

31 PRESSURE SWITCH - static

Monitors signal gas pressure.

32 DIFFERENTIAL PRESSURE PILOT

Monitors differential pressure between two selected points; applies or removes a signal to operator control package.

35 SHUTTLE VALVE

Common application of shuttle valve is "OR" circuit. Permits flow in one direction only.

36 LOW PRESSURE SELECTOR

Selects the lower of two pressures for input to a device.

39 PRE FILTER

Removes contaminants from supply gas.

79 PILOT (HI OR LOW)

Monitors pressure at a point; applies or removes a signal to operator control package.

82 4-WAY 2-POSITION SWITCHING RELAY

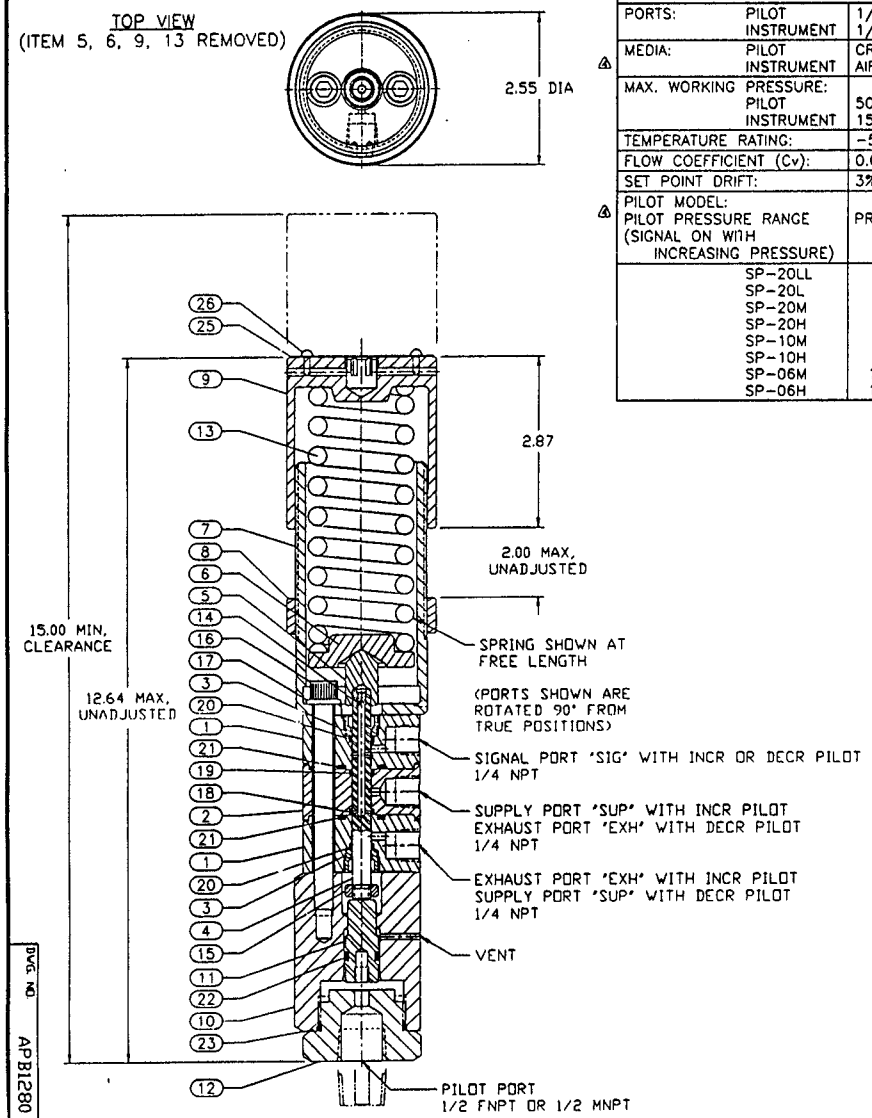
Reverses two signals.

85 MUFFLER

Reduces exhaust noise.

94 MOLECULAR SIEVE DEHYDRATOR

Removes water from instrument gas.



SPECIFICATIONS:		
PORTS:	PILOT	1/2 FNPT OR 1/2 MNPT
	INSTRUMENT	1/4 FNPT
MEDIA:	PILOT	CRUDE OIL, GAS
	INSTRUMENT	AIR, GAS, HYD. FLUID
MAX. WORKING PRESSURE:	PILOT	5000 PSI (340 BARg)
	INSTRUMENT	1500 PSI (102 BARg)
TEMPERATURE RATING:		-50°F TO +200°F (-46°C TO +93°C)
FLOW COEFFICIENT (Cv):		0.023
SET POINT DRIFT:		3%

PILOT MODEL: PILOT PRESSURE RANGE (SIGNAL ON WITH INCREASING PRESSURE)	PILOT PRESSURE RANGE (PSI)	MAXIMUM DEADBAND (PSI)	PISTON DIAMETER (INCHES)
SP-20LL	25 - 135	35	1.250
SP-20L	50 - 190	35	1.250
SP-20M	80 - 350	35	1.250
SP-20H	150 - 540	50	1.250
SP-10M	385 - 1450	120	0.625
SP-10H	585 - 2155	225	0.625
SP-06M	1070 - 3945	480	0.375
SP-06H	1505 - 5000	500	0.375

ITEM	PART NO.	DESCRIPTION	MATERIAL	QTY	NOTE
1	916-010	END BODY	AL 6061-T6 ANDZ	2	
2	916-020	CENTER BODY	AL 6061-T6 ANDZ	1	
3	916-030	SPOOL BUSHING	AL 7075-T651	2	
4	916-040	VALVE SPOOL	SS 304	1	
5	916-050	SPOOL CAP	AL 7075-T651	1	
6	916-061	SPRING SEAT, MEDIUM	SS 303	1	
7	916-070	SPRING HOUSING	AL 6061-T6 ANDZ	1	
8	916-080	LOCKNUT	AL 6061-T6 ANDZ	1	
9	916-090	SPRING CAP	AL 6061-T6 ANDZ	1	
10	916-100	BODY	AL 6061-T6 ANDZ	1	
11	916-110	PISTON, 0.625 DIA	17-4 PH	1	
12	916-120	ADAPTOR, 1/2 FNPT	AL 6061-T6 ANDZ	1	
13	916-132	SPRING, MEDIUM	SS 302	1	
14	916-170	LEE PLUG, SPOOL	AL 2024-T4 ANDZ	1	
15	650-282	JAM NUT, SPOOL	HEXJ SS 304	1	
16	650-259	CAPSCREW, SPRING HOUSING	HXSC SS 304	2	
17	650-284	LOCKWASHER, SPRING HOUSING	HLCK SS 304	2	
18	916-190	O-RING, SPOOL	URETHANE 90A	1	(Y)
19	620-011	O-RING, CENTER BODY	NITRILE 70A MOS2	1	(Y)
20	620-011	O-RING, END BODY	NITRILE 70A MOS2	2	(Y)
21	620-114	O-RING, END BODY	NITRILE 70A	2	(Y)
22	620-111	O-RING, PISTON	NITRILE 70A	1	(Y)
23	620-125	O-RING, ADAPTOR	NITRILE 70A	1	(Y)
24	623-106	BACKUP RING, PISTON (NOTE 2)	NITRILE 70A	1	(Y)
25	916-001	NAMEPLATE	AL 3003-H14	1	
26	700-099	DRIVE SCREW	SS 304	3	

NOTE:
1. (Y) RECOMMENDED SPARE PARTS/REPAIR KIT.
2. 0.375 DIAMETER PISTON O-RING USES A BACKUP RING (24) NOT SHOWN.
3. MAXIMUM DEADBANDS VALUES LISTED ARE FOR MAXIMUM PILOT AND SIGNAL PRESSURE, AT ROOM TEMPERATURE.
   ALLOW 10% DEVIATION DUE TO MANUFACTURING TOLERANCES AND TEMPERATURE AFFECTS.
4. SUPPLY, EXHAUST AND SIGNAL PORTS STAMPED WITH 0.12 [3 mm] CHAR AS INDICATED.
5. PART NUMBERS LISTED ARE FOR PRESSUREMATIC MODEL SP-10MA.

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES (mm)

UPDATE PILOT PRESURE RANGE
⚠ RB-1997-05-23@08052-4-R
GENERAL UPDATE
⚠ DY-1997-04-03@08052-4-R
GENERAL UPDATE
⚠ DY-1996-12-09@08052-4-R
UPDATE SPEC FOR 0.375 DIA PISTON
⚠ DY-1996-10-03@08052-4-R

REV BY-DATE+REF

TOLERANCES
XXX ±0.5 (±10)
XX ±0.2 (±5)
X ±0.1 (±2)

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Actuators & Controls

PRESSUREMATIC SERIES SP PRESSURE PILOT, TYPICAL ASSEMBLY AND SPECIFICATIONS, SIGNAL "ON" WITH INCREASING OR DECREASING PILOT PRESSURE, STANDARD TRIM

AP1280--.DWG
MAY-23-97

WEIGHT 6.0 LB
SCALE 1:2 | BY DY | CHK AC 1997-05-23 | DATE SEP-19-96
V.O. 08052-4-R | DWG. NO. APB1280 | REV 4-

(i-0043--.wpd)

SP SERIES	PISTON DIAMETER (IN)	SPRING WIRE DIAMETER (IN)	SPRING RATE (LB/IN)	INSTRUMENT SIGNAL PRESSURE (PSIG)	RANGE SCREW TURNS	INSTRUMENT SIGNAL ON WITH DECREASING PILOT PRESSURE			INSTRUMENT SIGNAL ON WITH INCREASING PILOT PRESSURE		
					MIN / MAX	PILOT SET POINT (PSIG)	PILOT RESET POINT (PSIG)	PILOT DEAD BAND (PSIG)	PILOT SET POINT (PSIG)	PILOT RESET POINT (PSIG)	PILOT DEAD BAND (PSIG)
SP-20LL	1.250	0.225	EXTRA LIGHT (83)	100	1	15	30	15	30	15	15
					18	100	130	30	130	100	30
				1500	1	10	30	20	30	10	20
					18	100	135	35	135	100	35
SP-20L	1.250	0.263	LIGHT (200)	100	1	40	60	20	60	40	20
					10	155	190	35	190	155	35
				1500	1	35	60	25	60	35	25
					10	155	195	40	195	155	40
SP-20M	1.250	0.312	MEDIUM (449)	100	1	70	80	10	80	70	10
					10	320	345	25	345	320	25
				1500	1	65	85	20	85	65	20
					10	315	350	35	350	315	35
SP-20H	1.250	0.331 △	HEAVY (631)	100	1	125	150	25	150	125	25
					10	490	530	40	530	490	40
				1500	1	120	155	35	155	120	35
					10	490	540	50	540	490	50
SP-10M	0.625	0.312	MEDIUM (449)	100	1	340	385	45	385	340	45
					10	1355	1440	85	1440	1355	85
				1500	1	320	395	75	395	320	75
					10	1330	1450	120	1450	1330	120
SP-10H	0.625	0.331	HEAVY (631)	100	1	525	585	60	585	525	60
					10	1970	2130	160	2130	1970	160
				1500	1	505	595	90	595	505	90
					10	1930	2155	225	2155	1930	225
SP-06M	0.375	0.312	MEDIUM (449)	100	1	895	1070	175	1070	895	175
					10	3515	3860	345	3860	3515	345
				1500	1	865	1110	245	1110	865	245
					10	3465	3945	480	3945	3465	480
SP-06H	0.375	0.331	HEAVY (631)	100	1	1255	1505	250	1505	1255	250
					10	4560	5000	440	5000	4560	440
				1500	1	1215	1560	345	1560	1215	345
					10	4500	5000	500	5000	4500	500

NOTE:

1) THE RANGE SCREW TURNS ARE COUNTED FROM A ZERO REFERENCE POSITION WITH INSTRUMENT SIGNAL AND PILOT PRESSURES AT ZERO. THE ZERO REFERENCE POSITION OCCURS WHEN CONTACT IS FIRST MADE BETWEEN THE SPRING CAP AND SPRING, WITH THE PISTON FULLY DOWN.

2) DATA BASED ON 0.25" PISTON TRAVEL AT ROOM TEMPERATURE, WITH PRECONDITIONED SPRING.

3) ALLOW 10% DEVIATION FROM TABULATED VALUES DUE TO MANUFACTURING TOLERANCES AND TEMPERATURE AFFECTS.

4) PILOT SET-POINTS MAY BE INTERPOLATED LINEARLY, BETWEEN MINIMUM AND MAXIMUM RANGE SCREW TURNS, AS WELL AS BETWEEN 100 PSIG AND 1500 PSIG INSTRUMENT SIGNAL PRESSURES.

5) REFER TO DWG AP-1299 FOR PRESSUREMATIC SP PILOT MODEL DESIGNATIONS AND DWG AP81280 FOR ASSEMBLY DETAIL.

DWG NO. 1B0211

0.331 WAS 0.311
UPDATE SP-20L & SP-20LL VALUES
△ RB-1997-12-15 @ 08052-4-R
UPDATE INSTRUMENT SIGNAL VALUES
△ RB-1997-05-23 @ 08052-4-R
REV BY-DATE-REF

BETTIS CANADA LTD.
Actuators & Controls

RANGE TABLE
FOR PRESSUREMATIC SP PILOT
SP-20, SP-10, SP-06

I-0211--.DVG_VIEW_00
DEC-15-97
SCALE N/A | BY ML | CHK AP 97-12-15 | DATE APR-03-97
W.O. 8052-4-R | DWG. NO. 1B0211 | REV 2-

II TESTING AND CALIBRATION OF SP PILOT

Refer to the typical assembly drawing on page 6. The SP pilot piston and spool must be cycle 20 times in order to seat the o-ring seals, prior to testing and calibration.

A. PISTON LEAKAGE TEST

1. Apply 100 psig air to the 1/2 NPT pilot port connection and maintain for 1 minute.

2. Using Snoop, check for leakage at the vent port. No visible leakage is permitted.

B. VALVE SPOOL LEAKAGE TEST

1. Apply 100 psig at the 1/4 NPT supply port connection on one end body (1) with the second end body (1) connection plugged, and maintain for 1 minute.

2. Using Snoop, check for leakage at the centre body (2) port, joints between body sections (1,2), and ends of body sections (1). No visible leakage permitted.

C. PILOT CALIBRATION

1. Adjust the spring compression according to the calibration table on page 7. Interpolation may be used to estimate spring compression for intermediate set-points.

2. Apply 100 psig supply pressure at the 1/4 NPT supply port connection, stamped "SUP", via a closed isolation valve.

3. Apply required pilot pressure at the 1/2 NPT pilot port, on the adapter, via a pressure regulator and closed isolation valve.

4. Install and adequately rated pressure gauge at the 1/4 NPT signal port, stamped "SIG".

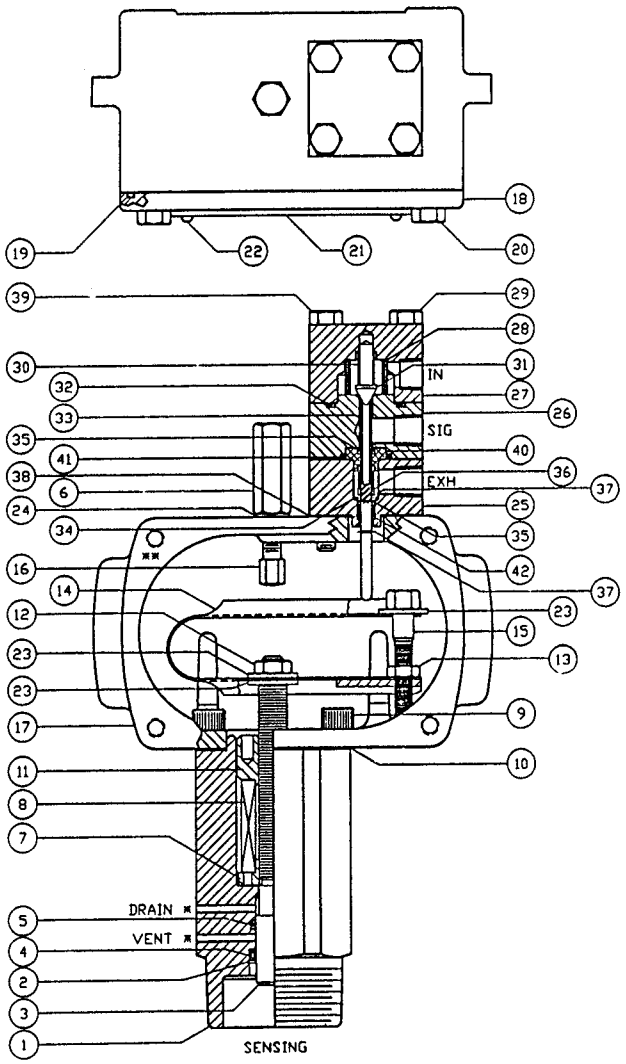
5. Open the supply and pilot isolation valves.

   a) For signal "ON" with increasing pilot pressure, using the pressure regulator, gradually increase pilot pressure at a rate of 20 psi/minute until signal pressure switches on. Record the actual set-point pressure.

   b) For signal "ON" with decreasing pressure, using the pressure regulator, gradually decrease pilot pressure at a rate of 20 psi/minute until signal pressure switches on. Record the actual set-point pressure.

6. Adjust the spring compression as required and repeat step 5, until the required set-point is reached. Hand tighten the locknut (8) to maintain set-point.

7. Stamp the nameplate (25) as required and mount on the spring cap (9). The complete designation per AP-1299 must be stamped on the nameplate.



ITEM	DESCRIPTION	MATERIAL	QTY	NOTE
1	BODY	C1018	1	
2	RETAINING RING, BODY	SS 304	1	
3	PISTON	SS 316	1	
4	SEAL #1, PISTON	TFE	1	(Y)
5	SEAL #2, PISTON	NITRILE	1	(Y)
6	HIGH TRIP BLIND NUT	AL 2011-T3	1	
7	SPRING SEAT	CS PL	1	
8	RANGE SPRING	CR-V ALLOY	1	(V)
9	BOLT, BODY	SS 304	2	
10	GASKET, BODY	PLANT FIBRE	1	(Y)
11	RANGE SCREW	SS 416	1	
12	JAM NUT, TRIP SPRING	SS 304	1	
13	JAM NUT, LOW TRIP BOLT	SS 304	1	
14	TRIP SPRING ASSEMBLY	SS 301	1	
15	LOW TRIP ADJUSTMENT BOLT	AL 6061-T6	1	
16	HIGH TRIP BOLT	SS 316	1	
17	HOUSING	AL CAST	1	
18	COVER PLATE	AL CAST	1	
19	O-RING, COVER	NITRILE	1	(Y)
20	BOLT, COVER	SS 304	4	
21	NAMEPLATE	SS 304	1	
22	DRIVE SCREW, NAMEPLATE	SS 18-8	4	
23	WASHER, TRIP SPRING	SS 304	3	
24	STAT-O-SEAL	CS/NITRILE	1	(Y)
25	LOWER BODY, PILOT	AL 6061-T6	1	
26	UPPER BODY, PILOT	AL 6061-T6	1	
27	END CAP, PILOT	AL 6061-T6	1	
28	FILTER ELEMENT, PILOT	CELLULOSE/RESIN	1	(Y)
29	CAPSCREW, END CAP	SS 304	2	
30	SPRING, POPPET	SS 302	1	
31	POPPET, PILOT	TFE	1	(Y)
32	O-RING, UPPER BODY	NITRILE	1	(Y)
33	SPOOL, PILOT	SS 304	1	
34	RETAINING RING, SEAL	SS 304	1	(Y)
35	O-RING, SPOOL	NITRILE	2	(Y)
36	SPRING, SPOOL	SS 302	1	
37	RETAINING RING, SPOOL	SS 304	2	
38	GASKET, PILOT	PLANT FIBRE	1	(Y)
39	CAPSCREW, PILOT MOUNTING	SS 304	2	
40	SLEEVE, PILOT	DELRIN	1	(Y)
41	O-RING, SLEEVE	NITRILE	1	(Y)
42	BUSHING, SPOOL	TFE	1	

NOTE: (Y) RECOMMENDED SPARE PARTS/REPAIR KIT, (V) TO BE SPECIFIED
FASTENERS AND MAINTENANCE TOOLS ARE ANSI/INCH SIZE
* VENT AND DRAIN SHOWN -30° FROM TRUE POSITION
** SHOWN WITH COVER REMOVED

DWG. NO. APB0570

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES (mm)

UPDT HOUSING '17', BOLTS WERE CS
△ RS-1996-08-14 @ SALES REQ
UPDT STDS
△ RS-1995-12-13 @ SALES REQ
UPDT SPOOL, TFE POPPET
△ DY-1993-03-24 @ 9248
+TRIP SPRING NUT, WASHER
△ DY-1991-12-02 @ 8980

REV BY-DATE-REF

TOLERANCES
XXX ±0.5 (±10)
XX ±0.2 (±5)
X ±0.1 (±2)

BETTIS Actuators & Controls — BETTIS CANADA LTD.

PRESSUREMATIC ASSEMBLY
(P-AR2000 TYPICAL, CS BODY, STD TRIM)

AP0570--.DWG_VIEW_00
DEC-18-96

WEIGHT 11.0 LB
SCALE 1:2 | BY DY | CHK | DATE OCT-21-91
W.O. 8980-R&D | DWG. NO. APB0570 | REV 4-

III PRESSUREMATIC

SET POINT ADJUSTMENT; SERIES 2000, 2200, 2400

Refer to drawing APB0570 on page 8.

This is done with the assembly complete and supply air on the pilot valve for P-AR and P-MR models.

NOTE: In the field this requires a calibration kit able to supply high and low setpoint pressures (eg. nitrogen bottle with block & bleed valve).

1. Cases with low and high set points:
   THE LOW SET POINT MUST BE ADJUSTED FIRST. IT WILL NOT BE AFFECTED BY THE HIGH SET POINT ADJUSTMENT BUT, THE HIGH SET POINT IS AFFECTED WHEN THE LOW SET POINT IS ADJUSTED.

   a) Set the high trip bolt fully away from the trip spring.
   b) Repeatedly adjust the low trip bolt and decrease pressure through the low set point until the low trip occurs consistently at the low set point. Tighten the lock nut and recheck. Check that there is at least 0.02" piston travel from low trip to bottom stop.
      NOTE: When adjusting the low trip bolt, the upper arm of the trip spring must be pushed down. This unloads the bolt and allows it to be turned by hand.
   c) Repeatedly adjust the high trip bolt and increase pressure through the high set point until the high trip occurs consistently at the high set point. Tighten the lock nut and recheck.

2. Cases with low set point only:

   a) Set high trip bolt fully away from the trip spring.
   b) Adjust the low set point as described in item 1.b) above.
   c) To disable high trip: Increase pressure until the piston is at the upper stop. Adjust high trip bolt downward until high trip occurs, then retract 1/2 turn. Check that high trip does not occur when the piston travels to the upper stop. This high trip bolt adjustment is to prevent the trip spring from placing unnecessary force on the spool.

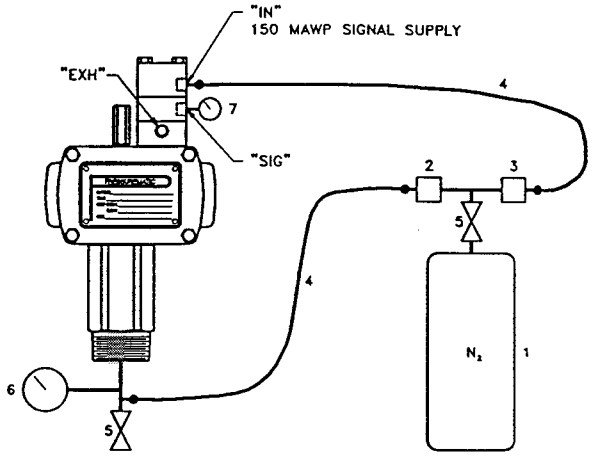
3. Cases with high set point only:

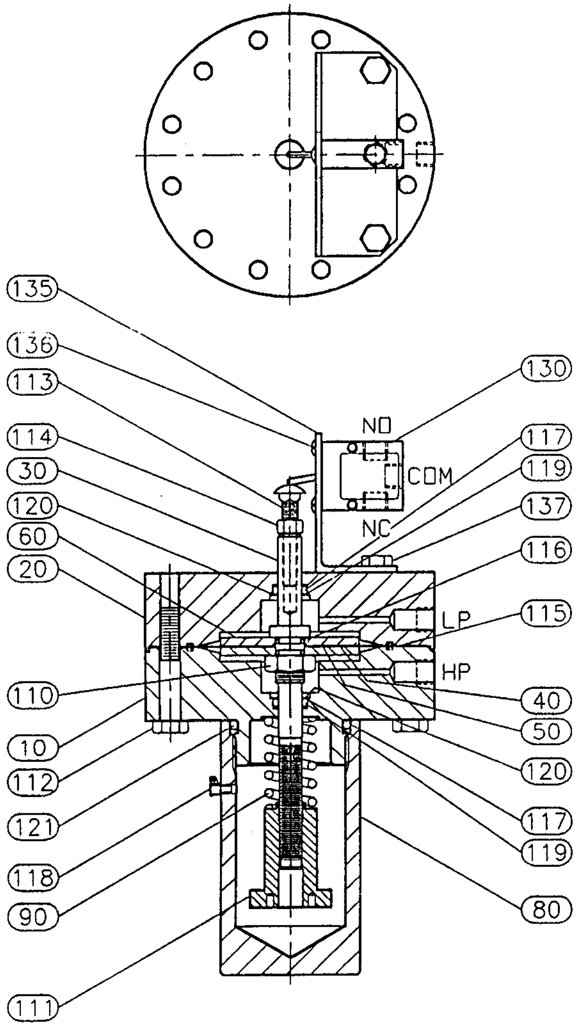
   a) To disable low trip: Adjust low trip bolt until low trip occurs when piston is within 0.02" of bottom stop. Then adjust 3 turns upward (ccw viewed from above). Tighten locknut and check that low trip does not occur when piston travels to bottom stop.
   b) Adjust the high set point as described in item 1.c) above.

Field/bench Setpoint Verification

Calibration Equipment:

1. N_2 bottle
2. HP regulator
3. LP regulator
4. hose
5. block and bleed valve
6. test gauge, 0-1500 psi range
7. test gauge, 0-150 psi range





ITEM	PART NO.	DESCRIPTION	MATERIAL	QTY	NOTE
10	930-010	BODY HALF, HP	AL 6061-T6	1	
20	930-020	BODY HALF, LP	AL 6061-T6	1	
30	930-030	STEM	SS 316	1	
40	930-040	DIAPHRAGM	FAIRPRENE	1	(Y)
50	930-050	DIAPHRAGM GASKET	TEFLON	1	
60	930-060	DIA. SUPPORT PLATE	AL 6061-T6	2	
80	930-080	SPRING COVER	AL 6061-T6	1	
90	930-090	SPRING	CR VAN	1	(S)
110	930-110	LOCKNUT, STEM	CS/NYLON	1	
111	930-111	ADJUSTING, NUT	AL 6061-T6	1	
112	930-112	CAPSCREW, BODY	HXHC GR 5 ZN.PL	12	
113	930-113	TRIGGER BOLT	RHSN GR 5 ZN.PL	1	
114	930-114	TRIGGER NUT	GR 5 ZN.PL	1	
115	930-115	O-RING, GASKET	NITRILE	2	(Y)
116	930-116	O-RING, SUPPORT PLATE	NITRILE	2	(Y)
117	930-117	O-RING, STEM	NITRILE	2	(Y)
118	930-118	VENT CAP	CS ZN.PL	1	
119	930-119	BACKUP, STEM	NITRILE	2	(Y)
120	930-120	RETAINING RING	SS PH 15-7 Mo	2	(Y)
121	930-121	O-RING, SPRING COVER	NITRILE	1	(Y)
130	930-130	MICROVALVE	AL/SS/NITRILE	1	
135	930-135	MOUNTING BRACKET	AL 6061-T6	1	
136	930-136	MOUNTING SCREW	SLRM GR 5 ZN.PL	2	
137	930-137	BRACKET BOLT	HXHC GR 5 ZN.PL	4	

NOTE: (S) SETUP, SPECIFY TO ORDER, OR SERVICE PART
(Y) RECOMMENDED SPARE PARTS, PART NO. SPRK-J1
FASTENERS AND MAINTENANCE TOOLS ARE ANSI/INCH SIZE

SPECIFICATIONS:
PORTS: 1/4 NPT Cv: 0.08 MASS: 15.0 LBm [6.8 kg]
SERVICE: AIR, SWEET GAS, <5% H2S SOUR GAS
TEMPERATURE RATING: -46°C TO 65°C
MAWP: 1500 PSIG [10,300 kPa]

BLACK SPRING RANGE 5 TO 20 PSID
BLUE SPRING RANGE 11 TO 40 PSID
RED SPRING RANGE 21 TO 70 PSID
GREEN SPRING RANGE 43 TO 100 PSID

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

UPDT STDS
5 RS-1996-01-31@SALES REQ
ADD BOM, SPRK UPDT
4 KN-1992-12-30@SALES REQ
UPDT STDS, ADD SPECS
3 KN-1992-07-18@SALES REQ
REV BY-DATE+REF

TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

BETTIS Actuators & Controls — BETTIS CANADA LTD.

MODEL J-1
DIFFERENTIAL PRESSURE PILOT
CUTAWAY ASSEMBLY

A-0316--.DWG_VIEW_00
JAN-31-96

SCALE	BY	CHK	DATE
1:4	TS	[illegible]	SEP-07-88

W.O.	DWG. NO.	REV
2019-1-N	A-0316	5-

DWG. NO. A-0316

IV J-1 TEST PROCEDURE

Following is: High Pressure Test, Leak/Blowby Test,
Microvalve Alignment, and Calibration

Check for correct port designations . . . H . . HIGH SIDE,
L . . LOW SIDE,
as per drawing

A. HIGH PRESSURE TEST

Without microvalve installed or if it is installed, adjust trigger bolt fully into stem so that over travel damage will not occur to microvalve.
Remove spring cover, adjust nut, and range spring.

H..port connect a regulated 1500 psi supply, and apply pressure in 100 psi increments checking for leaks at diaphragm, stem seals, and blowby at .. L.. port. Maintain the 1500 psi on H.. port and apply 100 psi supply to microvalve supply port for alignment following.

B. ALIGNMENT OF MICROVALVE

With supply pressure connected as above;

1. adjust trigger bolt until microvalve is fully triggered, signal is vented, and lock bolt in place with locking nut.
2. check for over travel allowance of microvalve lever should be 0.010" to 0.032" away from trigger bolt.

CAUTION: DO NOT FORCE LEVER AWAY FROM BOLT WITH MUCH FORCE.

MICROVALVE SHOULD BE ALIGNED FOR PROPER OPERATION

1. reduce H.. port supply to zero.
2. L.. port connect a second regulated supply of 1500 psi and apply in 100 psi increments 1500 psi to L.. port. Checking for leaks at diaphragm and stem seals.
3. Reduce L.. port supply to zero. Disconnect supply so that L.. will be at atmospheric pressure for calibration following.

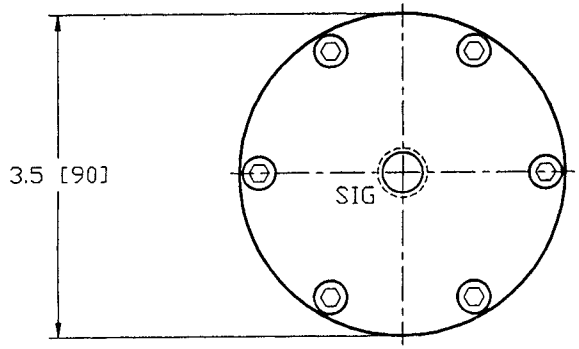
C. CALIBRATION PROCEDURE

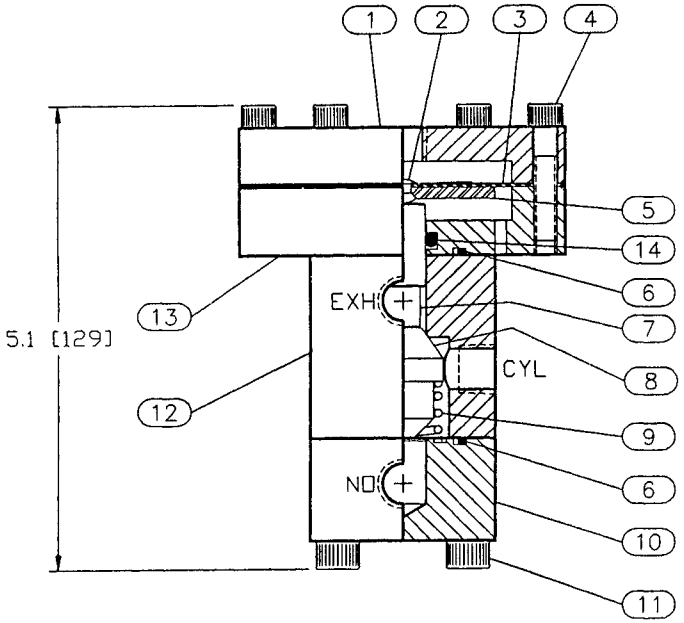
From range spring chart select proper range spring, record color code; spring O.D. and length on test check sheet.

1. Install range spring and adjust adjusting nut to hold the spring loosely in place. This can be your ZERO TURN POINT.
2. Apply pressure slowly to H.. port until unit trips. Note pressure on supply gauge, this is the differential pressure across the diaphragm of the J-1.
3. Reduce pressure to zero, adjust range spring preload.... increase spring tension for higher differential pressure.... decrease spring tension for lower differential pressure

D. OPERATIONAL TEST

Apply 600 psi then 900 psi to both port H.. and L.. at same time. Block and vent L.. supply slowly while maintaining H.. supply. When J-1 unit triggers note readings of H.. supply gauge and L.. supply gauge. The diff. should be calibrated differential pressure setting. Remove H.. supply, check for blowby by applying 1500 psi to L..





ITEM	PART NO.	DESCRIPTION	MATERIAL	QTY	NOTE
1	324-001	DIAPHRAGM CAP	AL 6061-T6	1	
2	324-015	RIVET, DIAPHRAGM	AL 6061-T6	1	(Y)
3a	324-010	DIAPHRAGM	FAIRPRENE	1	(Y)
3b	324-040	DIAPHRAGM PROTECTOR	TEFLON	1	(Y)
3c	324-041	DIAPHRAGM BACKUP	SS 302	1	
4	324-014	CAPSCREW, DIAPHRAGM	GR 8 ZN PL	6	
5	324-002	DIAPHRAGM PLATE	SS 304/A366 CF	1	(Y)
6	324-011	O-RING, BODY	NITRILE A70	2	(Y)
7	324-043	PLUNGER	SS 316	1	
8	424-009	POPPET	PVC	1	(Y)
9	324-009	SPRING	SS 302	1	
10	324-044	LOWER BODY	AL 6061-T6	1	
11	324-013	CAPSCREW, BODY	GR 8 ZN PL	4	
12	906-002	UPPER BODY	AL 6061-T6	1	
13	324-003	CYLINDER PLATE	AL 6061-T6	1	
14	324-012	O-RING, PLUNGER	NITRILE A70	1	(Y)

NOTE: ITEM 2, 3a, 3b, 3c AND 5 ARE A SUB ASSEMBLY
(Y) RECOMMENDED SPARE PARTS, PART NO. SPRK-R324-X
FASTENERS AND MAINTENANCE TOOLS ARE ANSI/INCH SIZE

SPECIFICATIONS:
PORTS: 1/4 NPT
SERVICE: AIR, SWEET GAS
TEMPERATURE RATING: -50°C THRU 120°C
MASS: 2.5 LBm [1.1 kg]
MAWP: BODY: 1500 PSIG [10,300 kPa]
MAX. SIGNAL: 150 PSIG [1,030 kPa]
NOMINAL RATIO 12:1

DWG. NO. C-0047

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

UPDT STDS
⚠ RS-1996-10-03@SALES REQ
UPDT BOM
⚠ KN-1993-01-05@SALES REQ
UPDT TITLEBLOCK
⚠ KN-1992-06-11@SALES REQ
REV BY-DATE+REF

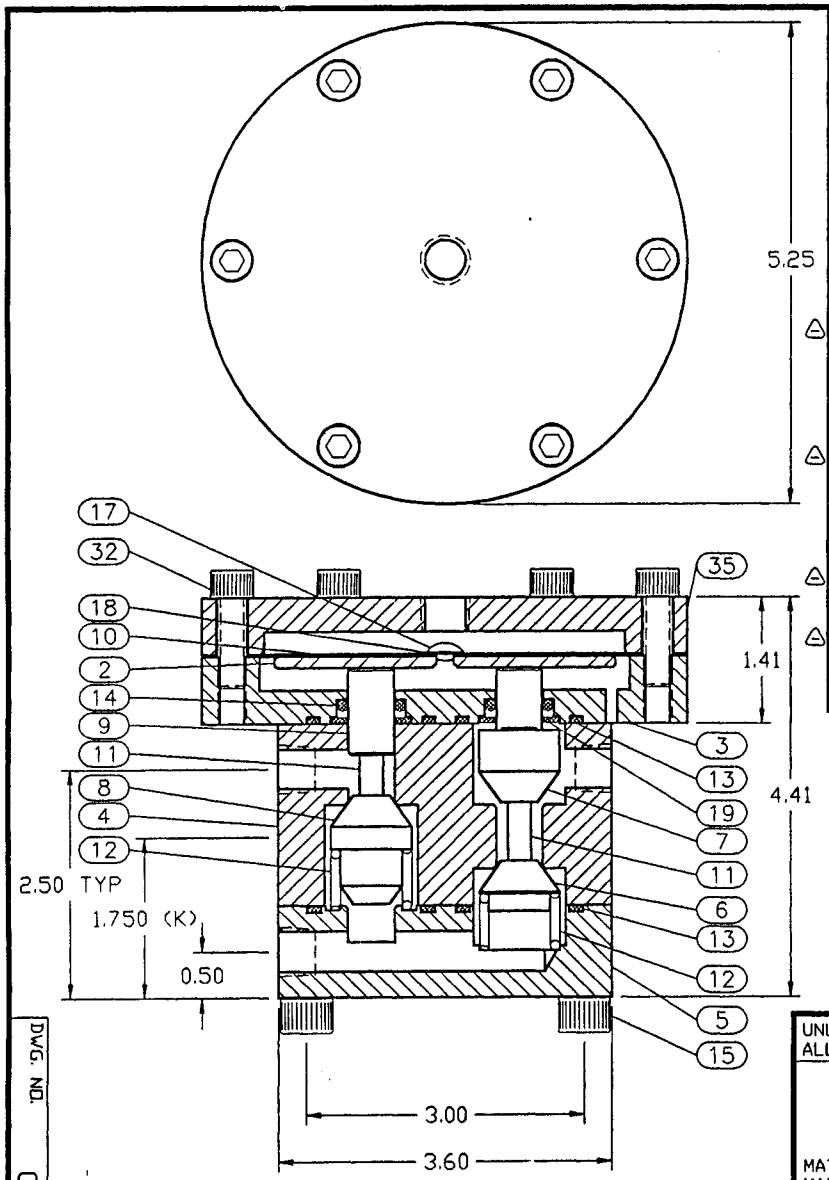
TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

BETTIS Actuators & Controls
BETTIS CANADA LTD.

SERIES R324
(3-WAY REVERSING RELAY)
ASSEMBLY, DATA AND DIMENSIONS

C-0047--.DWG_VIEW_00
OCT-03-96

SCALE 1:2 | BY GT | CHK [illegible] | DATE SEP-15-88
W.O. --- | DWG. NO. C-0047 | REV 3-



ITEM	PART NO.	DESCRIPTION	MATERIAL	QTY	NOTE
2		DIAPHRAGM PLATE	C1018 ZN.PL	1	(Y)
3		DIAPHRAGM CYL. PLATE	AL 6061-T6	1	
4		UPPER BODY	AL 6061-T6	1	
5		LOWER BODY	AL 6061-T6	1	
6		POPPET 1	PVC/NYL./TORLON	1	(Y)
7		POPPET 2	PVC/NYL./TORLON	1	(Y)
8		POPPET 3	PVC/NYL./TORLON	1	(Y)
9		POPPET 4	PVC/NYL./TORLON	1	(Y)
10		DIAPHRAGM	NYL. REIN. NITRILE	1	(Y)
△ 11		POPPET SPACER	SS 303/../316	2	
12		SPRING	SS	2	
13		O-RING, BODY	NITRILE	4	(Y)
14		O-RING, POPPET	NITRILE	2	(Y)
△ 15		CAPSCREW, BODY	HXSC GR 5 ZN.PL	4	
17		RIVET, DIAPHRAGM	AL-TRUSS HEAD	1	(Y)
18		WASHER, DIAPHRAGM	SS 302	1	(Y)
19		SNAP RING	TRUARC SS	2	(Y)
△ 32		CAPSCREW, DIAPHRAGM	HXSC SS 304	6	
35		DIAPHRAGM CAP	AL 6061-T6	1	
△ 44		NAMEPLATE	SS 304	1	(N)

NOTE:
- (Y) RECOMMENDED SPARE PARTS/REPAIR KIT
- (K) 2 HIDDEN PORTS ON BORE AXES AT ELEVATION SHOWN
- (N) NOT SHOWN

SPECIFICATIONS:
PORTS: 1/4 NPT
SERVICE: AIR, SWEET GAS, <5% H2S SOUR GAS
TEMP. RATING: -40°F THRU 104°F
MASS: 3.75 LBm [1.71 kg]
MAX. WORKING PRESSURE: 1500 PSIG
MAX. SIGNAL: 150 PSIG

DWG. NO. C-0370

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

MAT. WAS DOWEL PIN SS
MAT. WAS HXHC
+NAMEPLATE
△ LH-1996-08-23 @ PREPROD

REV BY-DATE+REF

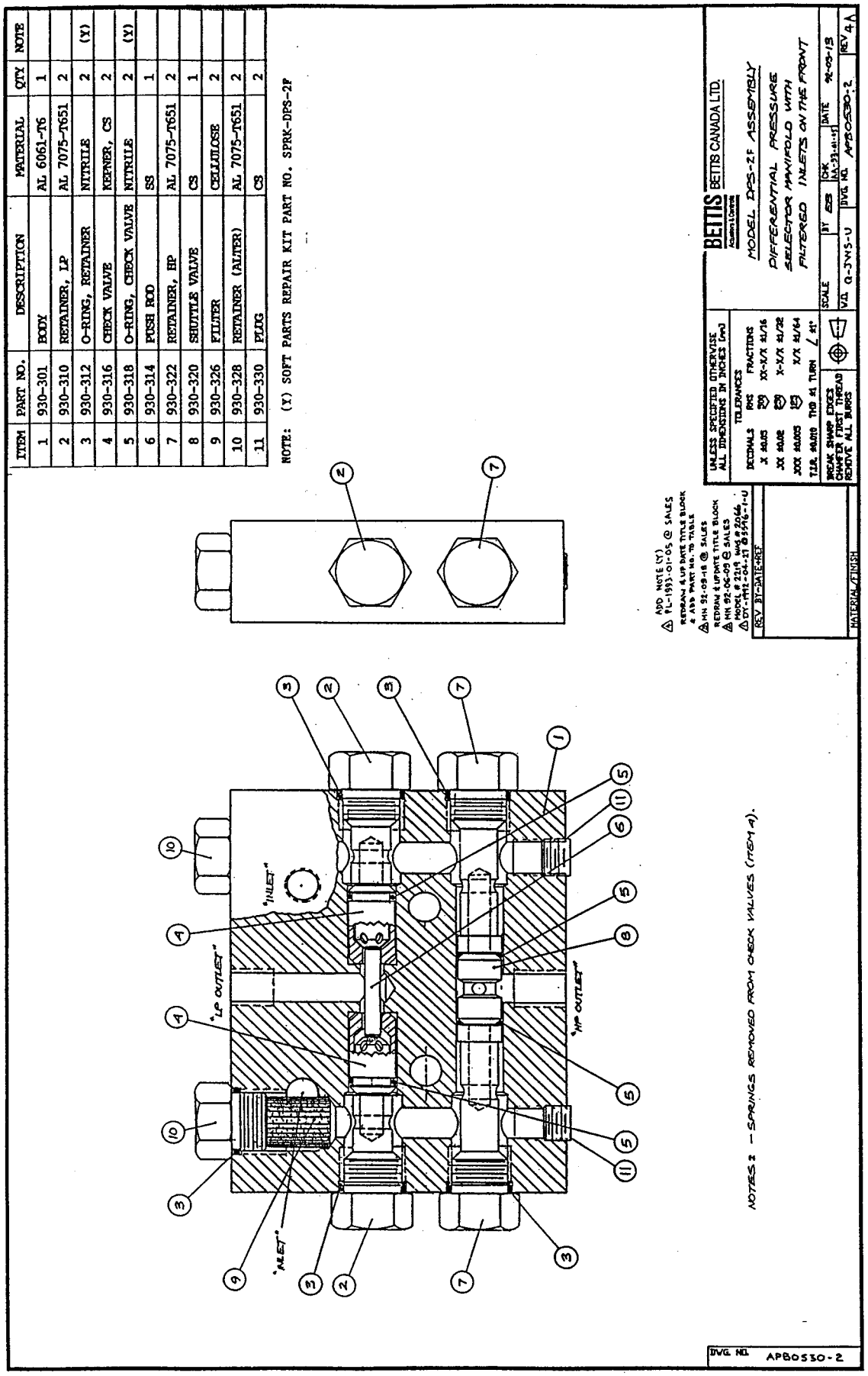
TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

BETTIS Actuators & Controls
BETTIS CANADA LTD.

A-424-HP
(4-WAY, 2-POSITION)
ASSEMBLY, DATA, AND DIMENSIONS

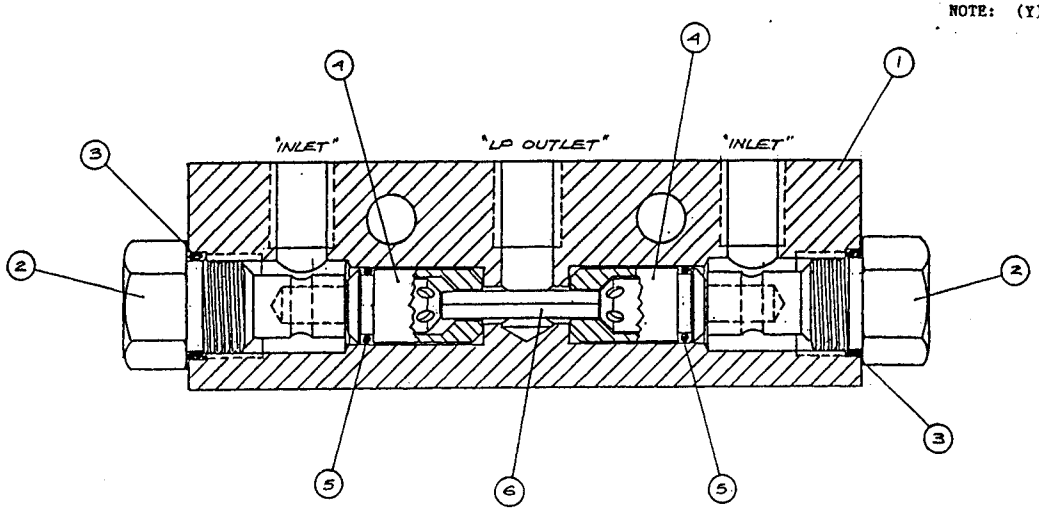
C-0370--.DWG_VIEW_00
AUG-23-96

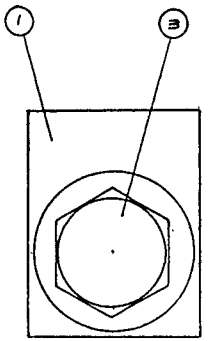
SCALE 1:2 | BY LH | CHK RO 96-08-26 | DATE AUG-22-96
W.O. 10586-1-C | DWG. NO. C-0370 | REV --


ITEM | PART NO. | DESCRIPTION | MATERIAL | QTY | NOTE
1 | 930-301 | BODY | AL 6061-T6 | 1 |
2 | 930-310 | RETAINER, LP | AL 7075-T651 | 2 |
3 | 930-312 | O-RING, RETAINER | NITRILE | 2 | (Y)
4 | 930-316 | CHECK VALVE | KEPNER, CS | 2 |
5 | 930-318 | O-RING, CHECK VALVE | NITRILE | 2 | (Y)
6 | 930-314 | PUSH ROD | SS | 1 |
7 | 930-322 | RETAINER, HP | AL 7075-T651 | 2 |
8 | 930-320 | SHUTTLE VALVE | CS | 1 |
9 | 930-326 | FILTER | CELLULOSE | 2 |
10 | 930-328 | RETAINER (ALTER) | AL 7075-T651 | 2 |
11 | 930-330 | PLUG | CS | 2 |
NOTE: (Y) SOFT PARTS REPAIR KIT PART NO. SPRK-DPS-2F
"LP OUTLET"
"INLET"
"MET"
"HP OUTLET"
NOTES: 1 - SPRINGS REMOVED FROM CHECK VALVES (ITEM 4).
BETTIS CANADA LTD.
MODEL DPS-2F ASSEMBLY
DIFFERENTIAL PRESSURE SELECTOR MANIFOLD WITH FILTERED INLETS ON THE FRONT
DWG. NO. APB0330-2
REV 4A

ITEM	PART NO.	DESCRIPTION	MATERIAL	QTY	NOTE
1	930-301	BODY	AL 6061-T6	1	
2	930-310	RETAINER	AL 7075-T651	2	
3	930-312	O-RING, RETAINER	NITRILE	2	(Y)
4	930-316	CHECK VALVE	KEPNER, CS	2	
5	930-318	O-RING, CHECK VALVE	NITRILE	2	(Y)
6	930-314	PUSH ROD	SS	1	

NOTE: (Y) SOFT PARTS REPAIR KIT PART NO. SPRK-LPS1





NOTE : " " INDICATES ⅛" HIGH LETTERS TO BE STAMPED ONTO THE BODY.

ADD NOTE (Y)
3 PL-1993-01-05 @ SALES
REDRAW & UPDATE TITLE BLOCK & ADD PART NO. TO TABLE
2 MN 92-09-17 @ SALES
LPS-1 WAS LPS-2
1 EB 89-09-04

REVISION/DATE

MATERIAL/FINISH

UNLESS SPECIFIED OTHERWISE ALL DIMENSIONS IN INCHES.

TOLERANCES:

DECIMALS		FRACTIONS	
.X	± 0.05	59°	XX - 1/2 ± 1/16
.XX	± 0.02	59°	X - 1/2 ± 1/32
.XXX	± 0.005	125	1/2 ± 1/64
T.I.R.	.010		∠ ± 1°

BREAK SHARP EDGES
CHAMFER FIRST THREAD
REMOVE ALL BURRS

BETTIS Actuators & Controls — BETTIS CANADA LTD.

ASSEMBLY - LOW PRESSURE SELECTOR VALVE

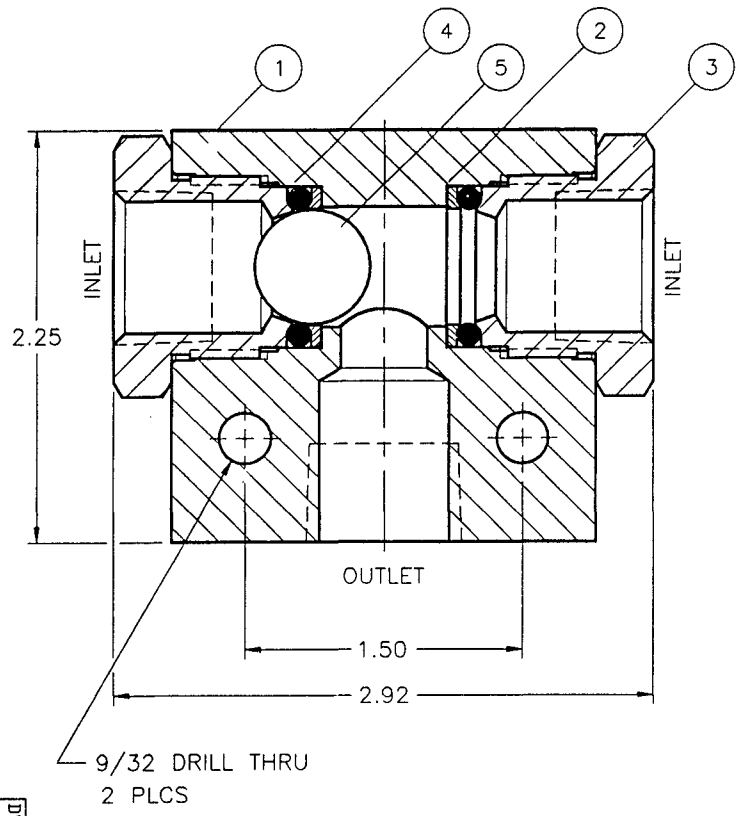
MODEL # LPS-1

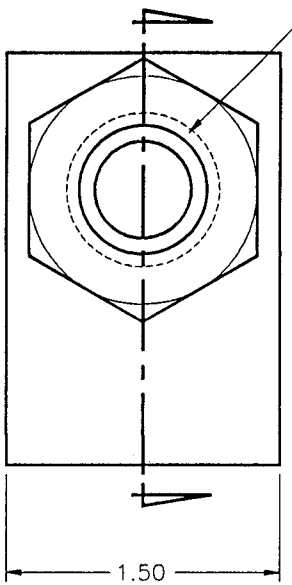
SCALE FULL | BY EB | CHK AA1573-01-05 | DATE 89-02-22

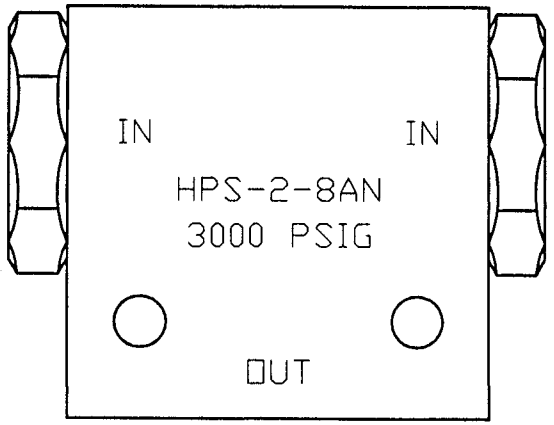
V.D. 2655-N | DWG. NO. APB 0527 | REV 3 A

ITEM	PART NO.	DESCRIPTION	MATERIAL	QTY	NOTE
1	910-450	SHUTTLE BODY	AL 6061-T6 ANDZ	1	
2	930-455	FERRULE	AL 6061-T6	2	
3	930-460	SEAT PLUG	AL 7075-T651 ANDZ	2	
4	620-208	O-RING	NITRILE	2	Y
5	930-465	SHUTTLE BALL	SS 440C	1	

NOTE:
- (Y) RECOMMENEND SPARE PARTS
- FASTENERS AND MAINTENANCE TOOLS ARE ANSI/INCH







SPECIFICATIONS:
PORTS: 1/2 NPT
SERVICE: AIR, SWEET GAS, <5% H2S SOUR GAS
TEMP. RATING: -40°F TO 170°F [-40°C TO 77°C]
MASS: 0.47 LBm [0.21 kg]
MAX. WORKING PRESSURE: 3000 PSIG [206 BARg]
CRACKING PRESSURE: 2 PSIG [0.14 BARg]

DWG. NO. AP-1393

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

ADD ANDZ
3 RB-1998-01-07 @ 6051
ADD RATING, UPDT STAMPING
2 RS-1997-09-02 @ 10373-1-R
1.50, 0.56 LB WAS 1.38, 0.50 LB
1 RB-1996-10-30 @ 10373-1-R

REV BY-DATE+REF

TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

BETTIS Actuators & Controls
BETTIS CANADA LTD.

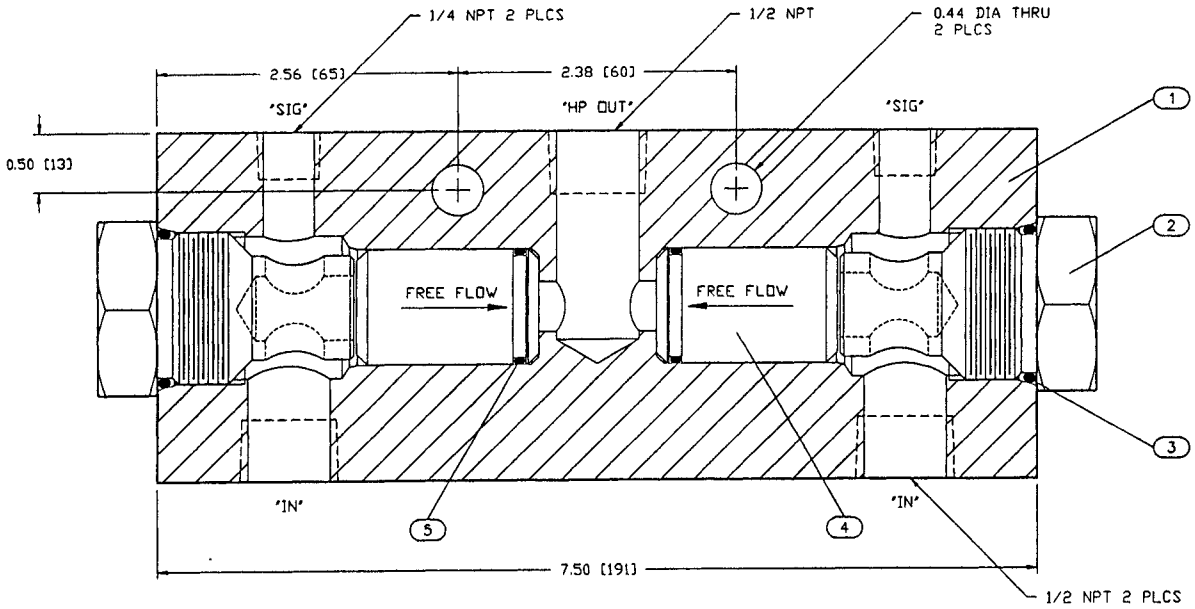
HPS-2
SHUTTLE VALVE
ASSEMBLY AND SPECIFICATIONS

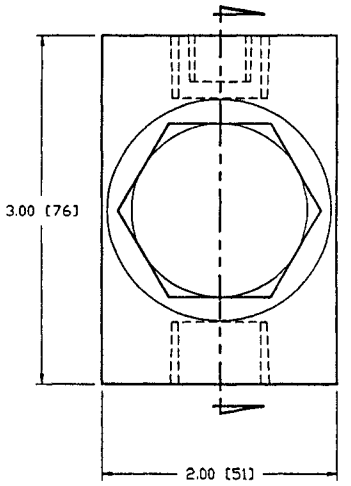
AP1393--.DWG_VIEW_00
JAN-07-98

WEIGHT 0.56 LB
SCALE 1:1 | BY RB | CHK AP 1998-01-08 | DATE JUL-16-96
W.O. 10373-1-R | DWG. NO. AP-1393 | REV 3-

ITEM	PART NO.	DESCRIPTION	MATERIAL	QTY	NOTE
1	930-401	BODY	AL 6061-T6	1	
2	930-410	RETAINER	AL 7075-T651	2	
3	930-412	O-RING, RETAINER	NITRILE	2	(Y)
4	930-416	CARTRIDGE CHECK VALVE	SS/NITRILE	2	
5	930-418	O-RING, CHECK VALVE	NITRILE	2	(Y)

NOTE: (Y) RECOMMENDED SPARE PARTS, PART NO. SPRK-HPS-1F
FASTENERS AND MAINTENANCE TOOLS ARE ANSI/INCH SIZE
SERVICE: AIR, SWEET GAS, <5% H2S SOUR GAS
MAWP: 1500 PSIG [10,300 kPa] Cv: 3.5





UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

+DIMENSIONS, UPDT STDS
INVERT TO SHOW OUTLET UPWARDS
RS-1995-11-208A,S REQ

REV BY-DATE+REF

TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

BETTIS Actuators & Controls — BETTIS CANADA LTD.

MODEL HPS-1 ASSEMBLY AND DIMENSIONS
HIGH PRESSURE SELECTOR VALVE

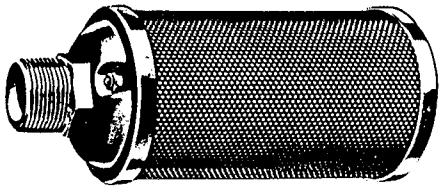
APB0537--.DWG_VIEW_00
NOV-30-95

WEIGHT 5.30 LB
SCALE 1:1 | BY DY | CHK | DATE SEP-08-92
W.O. 5596-1-U | DWG. NO. APB0537 | REV 1-

Special Mufflers
High Pressure • Thru-Flow

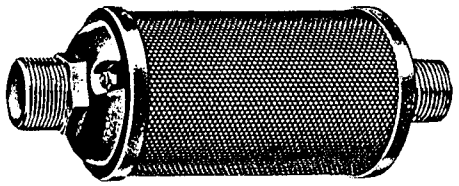
HIGH PRESSURE MUFFLER—PH TYPE

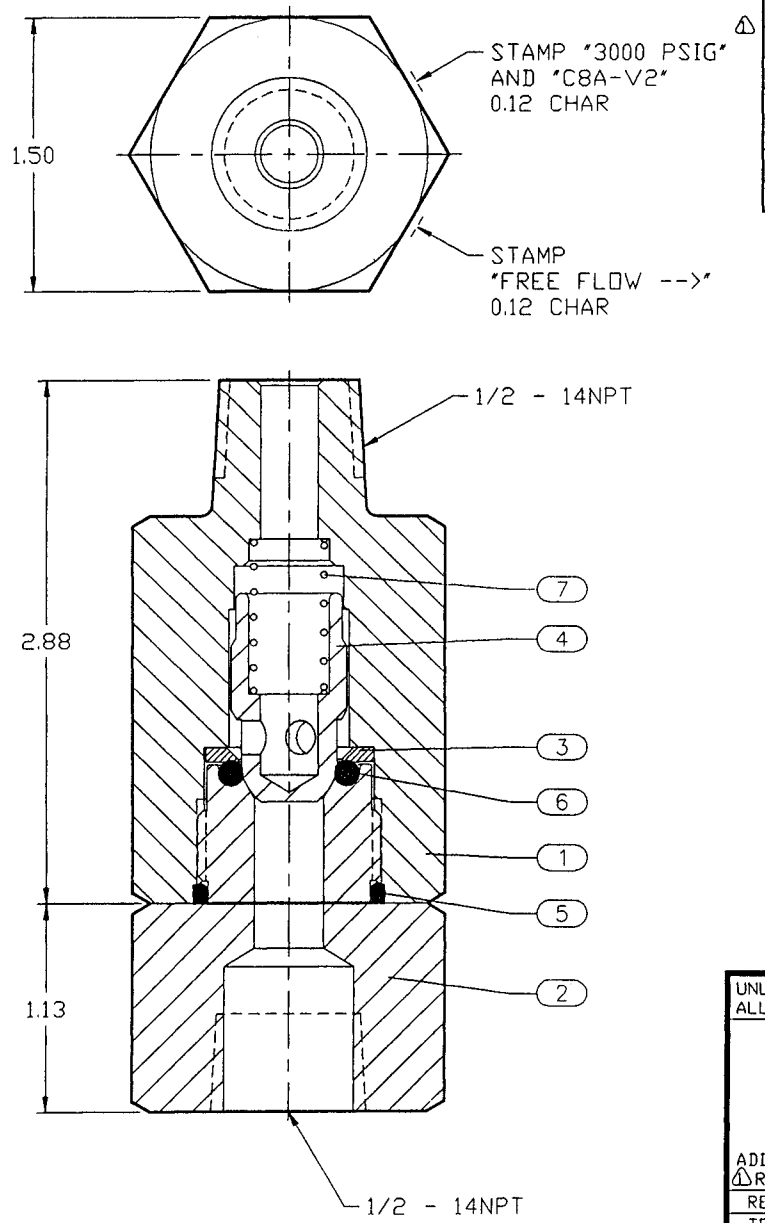
PH Type Mufflers are engineered for silencing high pressure exhaust noise; models available for service up to 9,000 P.S.I.G. Units are made to meet specific requirements.



THRU-FLOW MUFFLER—TF TYPE

TF Type Mufflers are recommended for applications where compressed air is being used on heavy slurries and such; mufflers reduce the exhaust noise and allow "carry out" to pass through freely. They can be arranged in series or tandem to accomplish any desired results.





ITEM	PART NO.	DESCRIPTION	MATERIAL	QTY	NOTE
1		BODY	AL 7075-T651 ANDZ	1	
2	903-155	CONNECTOR	AL 7075-T651 ANDZ	1	
3	903-160	SEAT WASHER	AL 7075-T651	1	
4	903-175	POPPET	AL 6061-T6	1	
5	620-118	O-RING, CONNECTOR	NITRILE 70A	1	(Y)
6	620-206	O-RING, BODY	NITRILE 90A	1	(Y)
7	903-165	SPRING, POPPET	SS 302	1	

NOTE:
- (Y) RECOMMENDED SPARE PARTS/REPAIR KIT

SPECIFICATIONS:
PORTS: 1/2 NPT
SERVICE: AIR, SWEET GAS, <5% H2S SOUR GAS
TEMP. RATING: -40°F TO 170°F (-40°C TO 77°C)
MAX. WORKING PRESSURE: 3000 PSI (206 BARg)
CRACKING PRESSURE: 10 PSID (0.69 BARg)
WEIGHT: 0.60 LB

DWG. NO. AP-1109-10

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

ADD ANDZ
△RB-1998-01-07@06051
REV BY-DATE+REF

TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

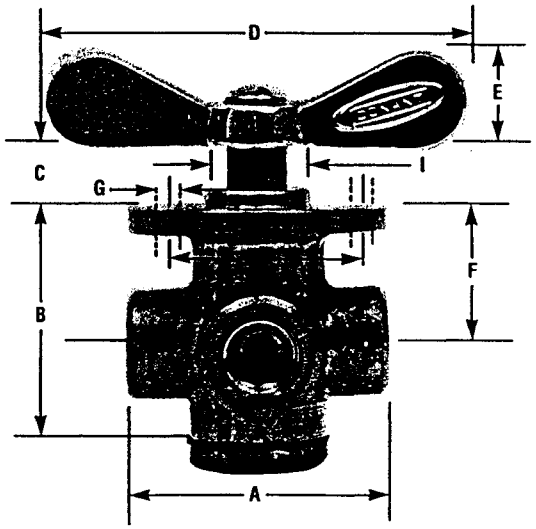
BETTIS Actuators & Controls
BETTIS CANADA LTD.

MODEL C8A CHECK VALVE, VERSION 2
ASSEMBLY AND SPECIFICATIONS

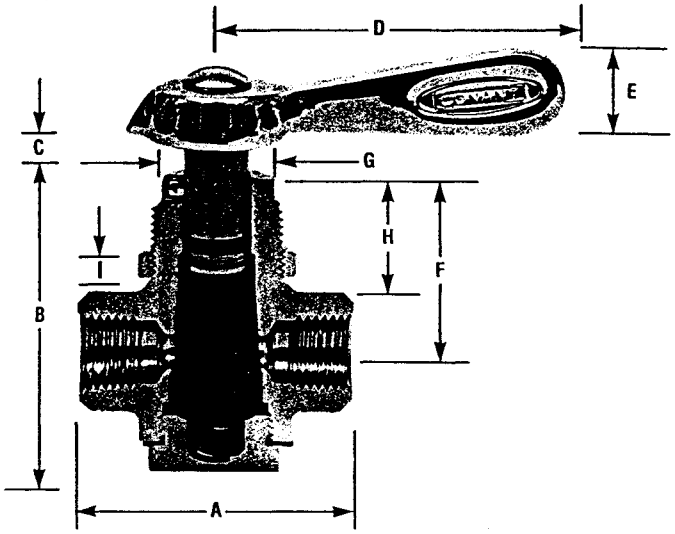
AP1109--.DWG_VIEW_10 JAN-07-98		WEIGHT	0.62 LB
SCALE 1:1	BY RB	CHK AP (1998-04-08)	DATE DEC-01-97
W.O. 08052-5-R	DWG. NO. AP-1109-10		REV 1-

2 • 3 • 4 • 5 WAY • 1/8" or 1/4" I.P.S TEFLON® ROTOR

STANDARD MOUNT



LOCKNUT PANEL MOUNT WITH #250 LEVER HANDLE

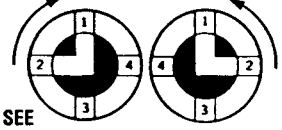
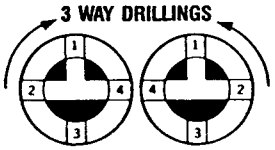
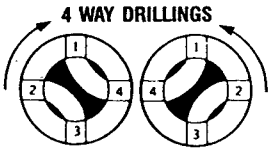
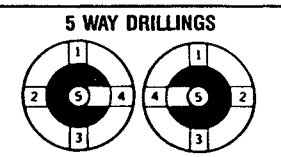


Conant Controls' Precision Selector Valves with Forged Bodies are primarily designed for standard duty. The TEFLON® rotor eliminates the need for lubrication and contributes to long valve life. These valves are particularly well-suited for instrument air and other similar applications.

MATERIALS
Brass or Aluminum

PRESSURE RANGE
Brass and Aluminum . . . . . 0–250 PSI

STANDARD MOUNT AND LOCKNUT PANEL MOUNT WITH #250 LEVER HANDLE

REAR VIEW / FRONT VIEW	MODEL NO	PIPE TAPD	DIMENSIONS (INCHES) A	B	C	D	E	F	G	H	I	DESCRIPTION
2 WAY DRILLINGS  SEE NOTE HANDLE TURN 90°	38358T 38358ALT	1/8	1 7/8	1 7/8	7/16	3	3/4	1	1/4–20TH'D	1 3/8	3/4 O.D. x 1/8	**Series 38358T, 38359T, 38360T, 38361T** – Forged brass body, TEFLON® rotor, precision fit. **Series 38358ALT, 38359ALT, 38360ALT, 38361ALT** – Forged aluminum body, TEFLON® rotor, precision fit. **Series B2L, B3L, B4L, B5L** – Forged brass body, TEFLON® rotor, precision fit.
		1/4	1 7/8	1 7/8	7/16	3	3/4	1	1/4–20TH'D	1 3/8	3/4 O.D. x 1/8	
	B2L	1/8	1 7/8	1 7/8	7/16	2 1/4	9/16	1	7/8 O.D.	9/16	1 Hex x 3/16	
		1/4	1 7/8	1 7/8	7/16	2 1/4	9/16	1	7/8 O.D.	9/16	1 Hex x 3/16	
3 WAY DRILLINGS  HANDLE TURN 90°	38359T 38359ALT	1/8	1 7/8	1 7/8	7/16	3	3/4	1	1/4–20TH'D	1 3/8	3/4 O.D. x 1/8	
		1/4	1 7/8	1 7/8	7/16	3	3/4	1	1/4–20TH'D	1 3/8	3/4 O.D. x 1/8	
	B3L	1/8	1 7/8	1 7/8	7/16	2 1/4	9/16	1	7/8 O.D.	9/16	1 Hex x 3/16	
		1/4	1 7/8	1 7/8	7/16	2 1/4	9/16	1	7/8 O.D.	9/16	1 Hex x 3/16	
4 WAY DRILLINGS  HANDLE TURN 90°	38360T 38360ALT	1/8	1 7/8	1 7/8	7/16	3	3/4	1	1/4–20TH'D	1 3/8	3/4 O.D. x 1/8	
		1/4	1 7/8	1 7/8	7/16	3	3/4	1	1/4–20TH'D	1 3/8	3/4 O.D. x 1/8	
	B4L	1/8	1 7/8	1 7/8	7/16	2 1/4	9/16	1	7/8 O.D.	9/16	1 Hex x 3/16	
		1/4	1 7/8	1 7/8	7/16	2 1/4	9/16	1	7/8 O.D.	9/16	1 Hex x 3/16	
5 WAY DRILLINGS  HANDLE TURN 360°	38361T 38361ALT	1/8	1 7/8	2 1/16	7/16	3	3/4	1	1/4–20TH'D	1 3/8	3/4 O.D. x 1/8	
		1/4	1 7/8	2 1/16	7/16	3	3/4	1	1/4–20TH'D	1 3/8	3/4 O.D. x 1/8	
	B5L	1/8	1 7/8	2 1/16	7/16	2 1/4	9/16	1	7/8 O.D.	9/16	1 Hex x 3/16	
		1/4	1 7/8	2 1/16	7/16	2 1/4	9/16	1	7/8 O.D.	9/16	1 Hex x 3/16	

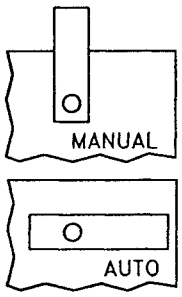
Note: 2-Way valves normally furnished ELL-drilled but may be had with straight-through porting at no extra charge when specified.

Conant Controls, Inc.

0.005

0.12 RAD

INSTRUCTIONS FOR MANUAL OPERATION WITH MODE SELECTOR



1. SWITCH TO "MANUAL" POSITION TO LOCK OUT REMOTE SWITCHING SIGNAL BEFORE PROCEEDING WITH LOCAL MANUAL OPERATION.

2. WITH POWER GAS:
   (A) PRESS UPPER LEFT RELAY HANDLE AND HOLD TO CLOSE LINE VALVE.
   (B) PRESS UPPER RIGHT RELAY HANDLE AND HOLD TO OPEN LINE VALVE.

3. WITH HANDPUMP (NO POWER GAS):
   (A) TURN LOWER LEFT VALVE HANDLE AND OPERATE HANDPUMP TO CLOSE LINE VALVE. RETURN VALVE HANDLE TO VERTICAL.
   (B) TURN LOWER RIGHT VALVE HANDLE AND OPERATE HANDPUMP TO OPEN LINE VALVE. RETURN VALVE HANDLE TO VERTICAL.

4. TO DISARM OPERATOR:
   (A) SHUT OFF POWER GAS SUPPLY.
   (B) PRESS EITHER UPPER RELAY HANDLE PARTWAY TO BLEED POWER GAS.

5. SWITCH TO "AUTO" POSITION AND ENSURE LOWER VALVE HANDLES VERTICAL AND GAS SUPPLY VALVE OPEN TO RESUME UNATTENDED AUTOMATIC OPERATION.

SP-9245-01 REV 2

5.75

4.50

NOTE:
1. RED CHARACTERS ON WHITE BACKGROUND, EASY-RELEASE BACKING
2. LETTERING IS 0.14 [3.6mm], 0.08 [2.1mm] & 0.06 [1.5mm] HEIGHT
3. PACKAGE IN LOTS OF 50 OR LESS; IDENTIFY MANUFACTURER AND DATE FOR EACH LOT
4. BORDER IS 0.10 [2.5mm] LINE WIDTH

REDRAW, UPDT STDS
⚠ RS-1996-04-11 @ MRP REQ
WAS 'TO PARTWAY' IN ERROR
⚠ DH-1984-02-25 @ 374-SHELL
REV BY-DATE+REF

PART TO:
MANIFOLD BLOCK SP-9173

B) MFR'S STD EQUAL OR BETTER UV AND WEATHER RESISTANT
A) PRESSURE SENSITIVE ADHESIVE VINYL
/NONE
MATERIAL/FINISH

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

TOLERANCES

DECIMALS	RMS	FRACTIONS
.X ±0.05	500	XX-X/X ±1/16
.XX ±0.02	250	X-X/X ±1/32
.XXX ±0.005	125	X/X ±1/64
T.I.R. ±0.010	THD ±1 TURN	∠ ±1°

BREAK SHARP EDGES
CHAMFER FIRST THREAD
REMOVE ALL BURRS

BETTIS Actuators & Controls — BETTIS CANADA LTD.

STICKER FOR GAS/HYDRAULIC OPERATION WITH L.P. MANUAL SELECTOR

SP9245--.DWG_VIEW_01
APR-11-96

WEIGHT 0.0047 LB

SCALE 1:1 | BY DH | CHK DA 1996-04-15 | DATE FEB-01-84

W.O. 374-SHELL | DWG. NO. SP-9245-01 | REV 2-

MERCER 9100 SERIES

"D" ORIFICE SAFETY RELIEF VALVES

UV ASME NB

INTRODUCTION

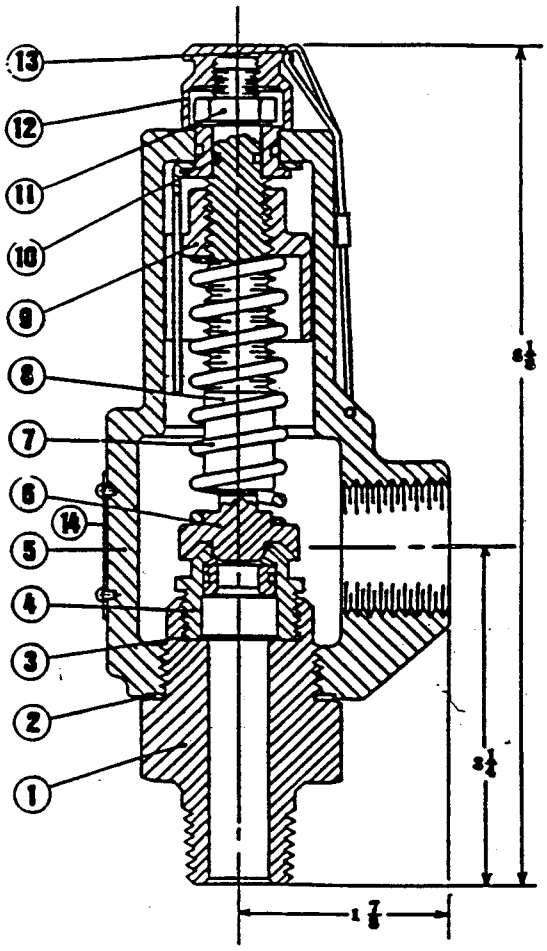
Mercer Valve 9100 Series Safety Relief Valves are the "State of the Art" in soft seat, high flow rate, pressure relieving devices. This unique design concept provides the user with the following advantages:

- HIGH FLOW RATES
- PREMIUM QUALITY
- LOW COST
- EXTENDED SEAT LIFE
- ACCURATE SETTINGS
- LOW BLOW DOWN

All 9100 Series Valves are built in accordance with the requirements of the ASME Boiler and Pressure Vessel Code. Capacity ratings were established by testing performed at the National Board of Boiler and Pressure Vessel Inspectors, Columbus, Ohio.

SPECIFICATIONS

Inlet Valve Size	1/2"FNPT, 3/4" MNPT, 1" MNPT
Outlet Size	1" FNPT
Orifice Diameter	.394 IN.
Orifice Area	.122 SQ. IN
Pressure Ranges	15-4500 PSIG
Temp. Ranges	
Standard	-20°F TO +400°F
Extended	-100°F TO +450°F
EQUIV. ASME SLOPE (90%)	1.83
Flow Coefficient "K" (90%)	.818
Weight	4.5 LBS



PARTS AND MATERIALS

Item No.	Part Name	Standard Materials
1	INLET BASE	CARBON ST'L
2	BASE SEAL	•
3	NOZZLE SEAL	VITON
4	NOZZLE	STNLS ST'L/VITON
5	BODY ASSM	DUCT. IRON OR ST'L
6	DISK ASSM	STNLS ST'L
7	SPRING	STNLS ST'L
8	ADJUSTMENT SCR.	STNLS ST'L
9	GUIDE BUSHINGS	CARBON ST'L
10	O RING	BUNAN
11	LOCK NUT	CARBON ST'L
12	CAP	ALUMINUM
13	LOCKWIRE	STEEL
14	NAME PLATE	ALUMINUM

MERCER VALVE CO. INC.

7211 Northwest 3rd Street • Post Office Box 22487 • Oklahoma City, Oklahoma 73127

MERCER VALVE CO., INC.

91 SERIES SAFETY RELIEF VALVES

INSTALLATION AND OPERATION INSTRUCTIONS

INSTALLATION

The safety relief valve should always be installed on a tank or piping run in a vertical position with the outlet pointing in a horizontal direction. When screwing the valve into the inlet piping, always use a wrench on the inlet connection hex, never wrench on the relief valve body.

One of the most common causes of early failure of relief valves is dirt trapped on the valve seat. Welding slag and/orpiping teflon tape are among the more common items that cause difficulty. It is recommended that all piping and tank systems be cleaned prior to installation of the relief valve.

A relief valve mounted on a tank should be connected with the minimum amount of piping between the tank and the valve. Further, all piping used must be equal or larger than the inlet pipe size of the relief valve, never smaller. Any restriction of the inlet to a relief valve may cause unusual valve chatter or relief capacities below the design rating of the valve which could result in serious damage. Outlet piping from the relief valve should be less than four (4) feet in length and never of a pipe size smaller than the outlet pipe size of the relief valve. Long runs of small diameter pipe on the outlet size of a releif valve will create a serious hazard to life and property.

Extreme caution is required in the outlet piping if installed outdoors where the liquids,if present, could form an ice block in the piping of the relief valve body in below freezing weather. Discharge lines must be "weather capped" and provided with a drain hole to prevent any liquid collection in the relief valve body or outlet piping. If these precautions are not taken, serious damage and injury will result.

Additional, important installation factors are contained in paragraph UG-135, Section VIII of the ASME Code.

OPERATION

Best performance in process work is usually obtained by setting the safety relief valve to open at least 10% above the operating pressure where possible. A greater margin of 20-30% is desirable, however, this setting must not exceed the maximum working pressure of the vessel. All Mercer Safety Relief Valves are checked for bubble-tight seat closures at 90% of set pressure.

In addition to checking the set pressure vs. the maximum allowable working pressure of the vessel, also check to insure that back pressure and temperature limitations of the process are consistant with valve ratings. Note that the Mercer 91 Series Valve with a viton seat is suitable for the temperature range of -20° to +400°F. Service outside of these ranges will require special materials. Further, carefully check the process, fluid input capacities to insure that the relief valve, relieving capacity is greater than the process capability.

DO NOT BREAK THE SEAL WIRE, to do so invalidates the Manufacturer's warranty to repair or replace the valve. Should resetting be required in a field emergency situation, it should be performed by qualified personnel with calibrated instrumentation. Note that the ASME Section VIII Code prohibits resetting a relief valve more than ±10% of the original setting up to 250 PSI set pressures and ±5% above 250 PSI set pressures. Consult the factory for additional resetting information.

WARRANTY

Mercer warrants the goods delivered hereunder to be free from defects in material and workmanship, under normal use and service, for a period of one year after date of shipment. Mercer's obligation under this warranty is limited to repair or replacement, at Mercer's sole option, of any defective item. Mercer's liability under this warranty is conditioned upon Purchaser giving Mercer immediate written notice of any such defect. Mercer shall have the option of requiring the return of the defective part, transportation prepaid, to establish the claim. Any repair or replacement of defective goods or parts will occur at Mercer's plant in Oklahoma City, Oklahoma and Purchaser shall bear all freight costs incurred in transporting defective goods or parts to and from Mercer's plant. Mercer shall not be held liable for damages caused by delays in repair or replacement of any defective items. The provisions in the Mercer literature and specifications are descriptive only, unless expressly stated as warranties. EXCEPT FOR THE FOREGOING, MERCER EXPRESSLY DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. MERCER'S liability to the Purchaser, arising out of the supplying of the said goods or their use, weather based upon warranty, contract or negligence, shall not in any case exceed the cost of correcting defects in, or replacing, the equipment as herein provided and upon the expiration of said one year all such liability shall terminate. Mercer shall not in any event be held liable for any special, indirect or consequential damages.

MERCER VALVE CO., INC.
7211 N.W. 3rd
Oklahoma City, OK 73127

HONEYWELL INC.
SKINNER VALVE
95 Edgewood Avenue
New Britain, CT 06051
Telephone (203) 827-2300

IOM 7304

INSTALLATION, OPERATING & MAINTENANCE INSTRUCTIONS 3-WAY N.C., N.O., M.P., QUICK EXHAUST, AND DIVERTING SOLENOID VALVES 1/8" AND 1/4" NPT VALVE TYPES: 71313, 71315, 71335, 71385, 71395, 7131V, 7133V

DESCRIPTION

These valves are 3-way, direct operated models. They are available in normally closed (N.C.), normally open (N.O.), multipurpose (M.P.), quick exhaust, and diverting versions. The 71313, 71315, 71335, 71385, and 71395 bodies are offered in 430F stainless steel construction, while the 7131V and 7133V bodies are offered in 303 stainless steel. Valves may be ordered with either NEMA 2, 4, 4X integrated coils for ordinary locations or NEMA 4, 4X, 7, and 9 for hazardous locations: Divisions I and II; Class I, Groups A, B, C, and D; Class II, Groups E, F, and G. Additional solenoid coils and enclosures are offered as described in our catalog.

PRINCIPLES OF OPERATION

Normally closed type: 71313, 71315

De-energized: Pressure is connected to Port 1 and is blocked by the plunger seal pressing on the body orifice. The cylinder port 2 is open to the exhaust port 3. The 71313 Quick Exhaust valve has two exhaust ports, one in the sleeve and one in the valve body.

Energized: The plunger is lifted off the orifice, sealing off the exhaust port 3 and allowing flow through the valve from Port 1 to 2. In the 71313, the top plunger seal blocks the exhaust port in the sleeve, while a piston and seal assembly close the exhaust port in the body.

Normally closed type: 7131V

De-energized: Pressure is connected to Port 2 and is blocked by the plunger seal pressing on the body orifice. The cylinder port 1 is open to the exhaust port 0.

Energized: The plunger is lifted off the orifice, sealing the exhaust port 0 and allowing flow through valve from Port 2 to 1.

Normally open type: 71395

De-energized: Pressure is connected to Port 3 and fluid is free to flow out Port 2. The exhaust Port 1 is blocked by the plunger seal.

Energized: The plunger moves causing the seal to close the normally open orifice, Port 3. Flow is then permitted from Port 2 to 1.

Multipurpose type: 71335, 7133V

De-energized: Pressure may be connected to any one of the three ports, depending on the valve function desired. Multipurpose valves may be piped to function as normally closed, normally open, or diverting valves. The port identification for each valve is listed below.

Energized: The plunger assembly is lifted off the orifice to open the N.C. port and seal the N.O. port. If pressure is applied to the diverting port, flow is diverted from the N.O. port to the N.C. port when the plunger assembly is moved.

Diverting type: 71385

De-energized: Pressure is applied to Port 2. Flow passes from Port 2 to the normally open port, Port 3. Flow is blocked from Port 2 to the normally closed port, Port 1, by the plunger seal.

Energized: The plunger assembly lifts off the orifice, opening Port 1 and blocking Port 3. As a result, flow is diverted from Port 3 to Port 1.

FLUID CODES

Listed below are the codes utilized by Underwriters Laboratories (UL) and the Canadian Standards Association (CSA) for various common fluids. The codes for those fluids that are approved or certified by the agencies for use with each valve are printed on the outside of the individual packaging.

CODE		FLUID
A	-	Air or nontoxic, nonflammable gases
AC	-	Acetylene
F	-	Common refrigerants except ammonia
G	-	City gas supplied by public utilities
GA	-	Gasoline
HO	-	Petroleum based hydraulic oils having viscosities of up from 125 to 400 SSU aT 38°C
LP	-	Liquid propane gas
02	-	Nos. 1 and 2 fuel oils, oils having viscosi ties not more than 40 SSU at 38°C
02 - 06	-	No. 2 through No. 6 oil
OX	-	Oxygen
S	-	Steam
W	-	Water or other aqueous nonflammable liquids

For the maximum fluid temperatures, as well as valve ambient limitations, check the valve part number on the nameplate and refer to the catalog or the outside of the shipping package.

INSTALLATION INSTRUCTIONS

Mounting position and pressure limits: Valves can be mounted directly on piping or by using the threaded holes in the bottom of the valve body. Valves 71313, 71315, 71395, 71335, and 71385 have two #10-32 NF mounting holes, while valves 7131V and 7133V have four M5 holes. Mounting brackets are available for those valves having #10-32 NF mounting holes and may be ordered separately.

All these valves are designed to be multi-poised and so will perform properly when mounted in any position. However, for optimum life and performance the valves should be mounted vertically upright so as to minimize wear and reduce the possibility of foreign matter accumulating inside the sleeve area.

Line pressure must conform to nameplate rating.

Piping: Remove protective closures from the ports. Connect line pressure to the inlet port. Use of Teflon tape, thread compound or sealants is permissible, but should be applied sparingly to male pipe threads only. Loctite primer #764 and pipe sealant #567 are recommended when using stainless steel fittings with stainless steel valve bodies.

CAUTION: *Do not allow foreign particles, Teflon tape, or thread compound to enter valve. Tightening torque should not exceed the following values for each port size: 1/8" NPT - 100 in-lbs., 1/4" NPT - 175 in-lbs. Do not use the sleeve or enclosure as a lever when applying torque.*

Media filtration: Normally filtration is not required, but dirt or foreign material in the media may cause excessive leakage, wear, or in exceptional cases, malfunction. If filtration is used, install the filter on the inlet side as close to the valve as possible. Clean periodically depending on service conditions.

Lubrication: Lubrication is not required although air line lubrication will substantially increase valve life.

CAUTION: *Valves which have seals or other components made from ethylene propylene rubber must not be exposed to petroleum based lubricants or other hydrocarbons.*

Electrical connection: Electrical supply must conform to nameplate rating. Connect coil leads or terminals to the electrical circuit using standard electrical practices in compliance with local authorities and the National Electrical Code.

WARNING: *Valves to be installed in Hazardous Locations, must be outfitted with Hazardous Location coils only. Verify nameplate data and coil part number before installing the valve.*

WARNING: *Turn off electrical power before connecting the valve to the power source.*

If the coil assembly is located in an inconvenient orientation, it may be reoriented to facilitate installation. Loosen coil assembly nut, rotate coil assembly to desired position, then retighten the nut with an input torque of 43-53 in-lbs.

DIN Coil and Terminal Box Assembly (Coil Code D400 or D500; Option Code TB): Loosen cover screws and swing cover 90° toward the conduit hub in order to access the interior space. Separate the plastic block containing the screw terminals from the metal enclosure using a small flat head screwdriver. Feed the lead wires through the conduit hub and attach them to the appropriate screw terminal. For electrical connection within the terminal box, use field wire that is rated for 90° C or greater. Snap the plastic block back into place inside the metal enclosure. Replace the cover and hand-tighten the cover screws. Place the gasket over the DIN spades on the coil and press the terminal box and coil together. Secure the terminal box to the coil using the mounting screw provided. Apply 20 to 30 in-lbs. torque to the mounting screw.

Screw Terminal Coil and Terminal Box Assembly (Coil Code S100, S200, or S300; Option Code TB): Loosen cover screws and swing cover 90° toward the conduit hub in order to access the interior space. Feed the lead wires through the conduit hub and attach them to the appropriate screw terminal. For electrical connection within the terminal box, use field wire that is rated for 90° C or greater. Replace the cover and hand-tighten the cover screws. Press the terminal box and coil together. Secure the terminal box to the coil using the mounting screw provided. Apply 20 to 30 in-lbs. torque to the mounting screw.

CAUTION: *When the DIN and Screw Terminal coils are used with the Terminal Box Assembly, be sure to apply a wrench to the wrench flats on the conduit hub when installing electrical conduit.*

Coil/enclosure temperature: Standard valves are supplied with coils designed for continuous duty service. Normal free space must be provided for proper ventilation. When the coil is energized continuously for long periods of time, the coil assembly will become hot. The coil is designed to operate permanently under these conditions. Any excessive heating will be indicated by smoking and/or odor of burning coil insulation.

For the maximum valve ambient conditions, as well as the fluid temperatures, check the valve part number on the nameplate and refer to the catalog to determine the maximum temperatures.

MAINTENANCE

Note: Depending on service conditions, fluid being used, filtration, and lubrication, it may be required to periodically clean and/or replace worn components. See Disassembly Instructions.

CAUTION: *Do not expose plastic or elastomeric materials to any type of commercial cleaning fluid. Parts should be cleaned with a mild soap and water solution.*

DISASSEMBLY INSTRUCTIONS

WARNING: *Depressurize system and turn off electrical power to the valve before attempting repair.*

If the pipe connection is made to the sleeve port, or if exhaust air out the sleeve port is to be piped away, disconnect piping prior to commencing repair.

To remove the coil assembly:

Sleeve exhaust to atmosphere - For both ordinary and hazardous location constructions, unscrew the nut on the top of the coil assembly. The wave washer and coil assembly can now be removed.

Piped sleeve exhaust - First unscrew the sleeve adapter and remove. Then follow the same instructions as for normally closed and multi-purpose valves stated above.

To disassemble the pressure vessel:

CAUTION: *If the sleeve assembly does not have a hex style flange, do not use a pipe wrench directly on the sleeve. Instead, use a Skinner U99-011 wrench nut to remove and install the sleeve assembly.*

Normally Closed, Normally Open, and Multipurpose Valves - For models 71313, 71315, 71395, 71335, and 71385, slide the Skinner U99-011 wrench nut over the sleeve tube. To unscrew the sleeve assembly, mate the wrench nut to the sleeve flange and turn the wrench nut. The plunger, return spring, and flange seal may now be removed. The 7131V and 7133V valves contain a hex style flange in the sleeve assembly. In this case, a wrench may be applied directly to the hex flange in order to loosen the sleeve assembly.

Manual override removal (where applicable) - Extract the override retention pin. Rotate override stem until it is free to remove. Withdraw override lever, or the spring and roller in the case of larger size valves (1/8" orifice diameter or greater).

Replacement Parts: When ordering replacement parts kits, specify valve number and voltage from nameplate. Parts kits are available for each valve. Parts included in each kit are marked with an **asterisk (*)**. See exploded views.

REASSEMBLY INSTRUCTIONS

WARNING: *When replacing coils, valves equipped with Hazardous Location coils must use Hazardous Location replacement coils only. Verify nameplate data and coil part number before installing the replacement coil.*

To reassemble the pressure vessel:

Refer to exploded view drawings. Parts must be replaced in the order shown.

Assemble manual override (where available) prior to assembly of sleeve to body. Insert override lever into body. Replace the override stem. Orient

stem so that the arrow stamped on the override is pointing up towards the sleeve. Insert the override retention pin and O-ring into body insuring that the pin fits into the override stem groove. Install the plunger and spring in the sleeve. Tighten sleeve assembly in the body with an input torque of 130-150 in-lbs (260-270 in-lbs for 7131V and 7133V).

For valves with orifice sizes greater than 1/8", place the spring on the override pin. Assemble roller on the pin. Carefully insert assembly into valve body. Orient stem so that the arrow stamped on the override is pointing up towards the sleeve. Insert override retention pin and O-ring into body insuring that the pin fits into the override stem groove. Install the plunger and spring in the sleeve. Tighten sleeve assembly in the body with an input torque of 130-150 in-lbs (260-270 in-lbs for 7131V and 7133V).

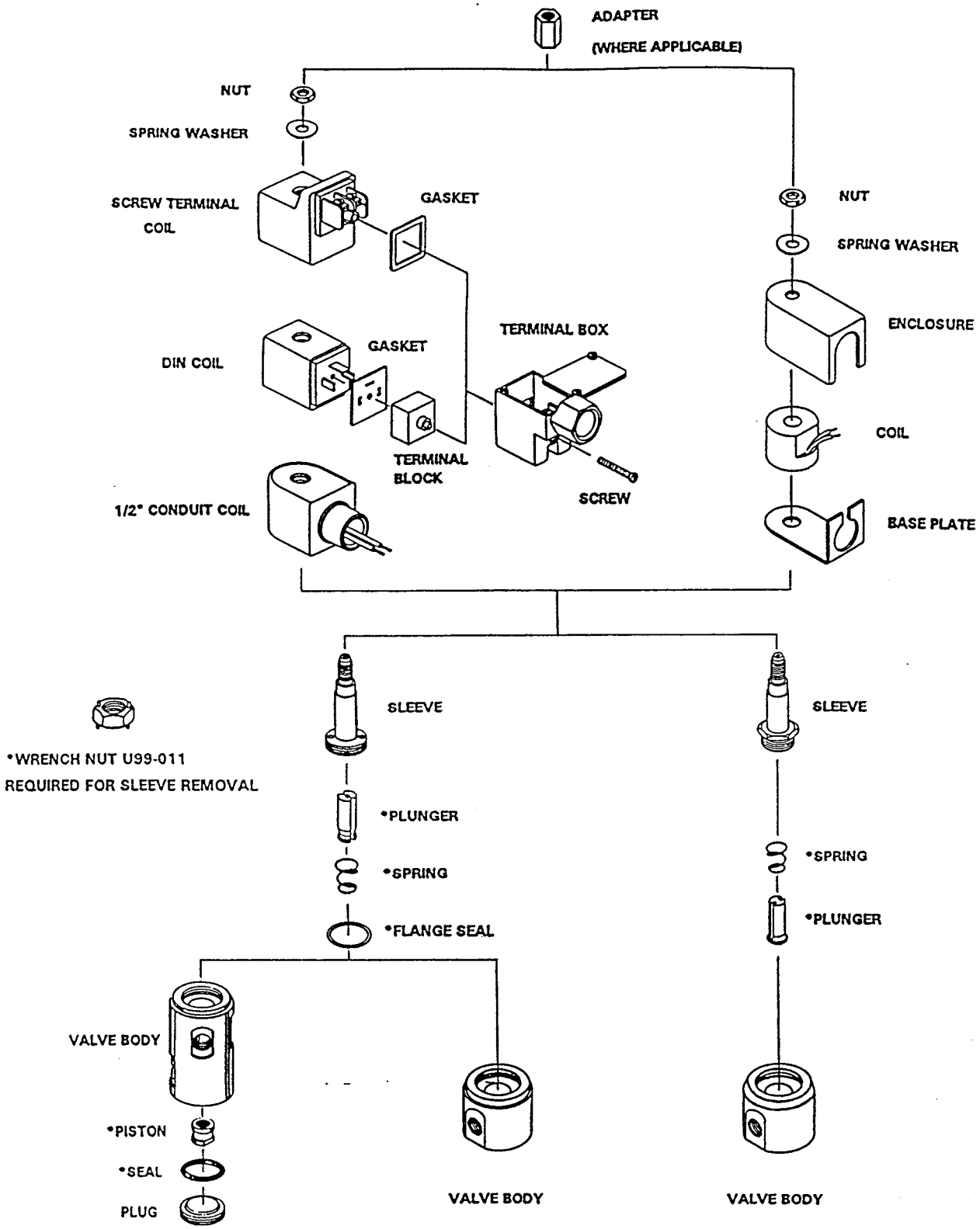
CAUTION: *Failure to properly insert override retention pin into override stem could allow the override stem to blow out when valve is pressurized and cause damage.*

With coil assembly repositioned on the sleeve, slide the wave washer over the sleeve and tighten coil assembly nut with an input torque of 43-53 in-lbs.

Refer to the Installation Instructions for remaining installation procedures.

TROUBLE SHOOTING

PROBLEM	PROCEDURE
Valve fails to operate.	1. Check electrical supply with voltmeter. Voltage must agree with nameplate rating. 2. Check coil with ohmmeter for shorted or open coil. 3. Make sure that pressure complies with nameplate rating.
Valve is sluggish or inoperative - electrical supply and pressure check out.	1. Disassemble valve as per the Disassembly Instructions. Clean out extraneous matter. The plunger must be free to move without binding. 2. The plunger spring must not be broken. Replace spring if necessary.
External leakage at sleeve flange to body joint.	1. Check that sleeve is torqued to 130-150 in-lbs (260-270 in-lbs for 7131V and 7133V). 2. If leakage persists, remove sleeve and check flange seal for damage. Replace if defective.
External leakage at exhaust adaptor to sleeve joint.	1. Check that adaptor is torqued at 10-20 in-lbs.2. If leakage persists, remove adaptor and check adaptor seal for damage. Replace seal if necessary.
External leakage at manual override (where available).	1. Remove sleeve. Rotate override until free to remove. Check O-ring and the surface it contacts. Clean or replace worn or damaged O-ring as required.
Internal leakage at body port or at sleeve port.	1. Disassemble valve as per the Disassembly Instructions. Remove extraneous matter. Clean parts in a mild soap and water solution. 2. Examine surface of the plunger seal. If damaged, replace plunger. 3. Inspect orifice in the body/stop for nicks. Damage may require a new valve or replacement parts.



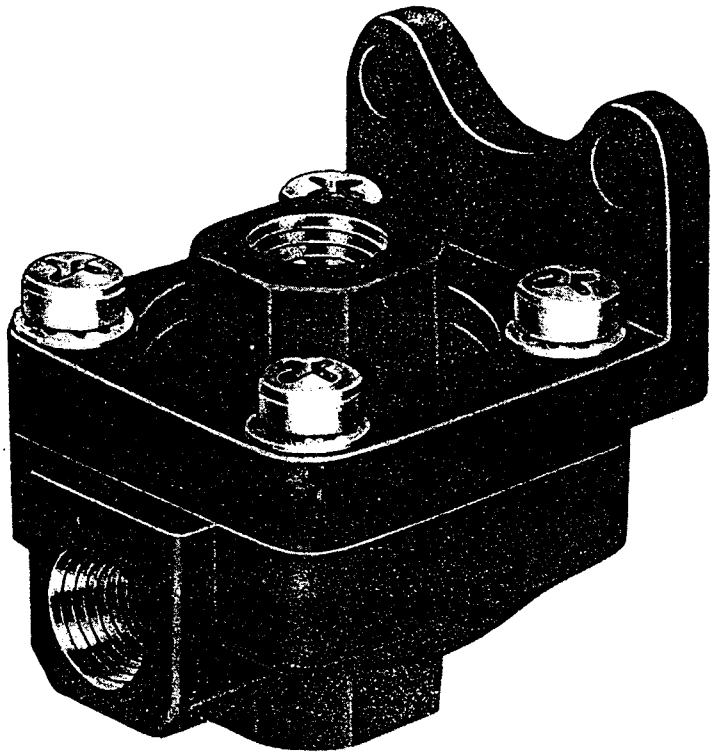
TYPE 71313

TYPES 71315, 71335, 71385, 71395

TYPES 7131V, 7133V

REXROTH SHUTTLE VALVES

The Shuttle Valve automatically selects and directs the flow of air from one or the other of two controlling devices to a common outlet. It serves to connect two independent lines to a common line without destroying the segregation.



SIMPLE

Contains only one moving part—an easily replaceable fabric reinforced synthetic rubber diaphragm. Two body segments, a gasket and four screws complete the assembly. It has no springs; nothing can bind or stick. Its compact size presents no installation problems.

LIGHTWEIGHT

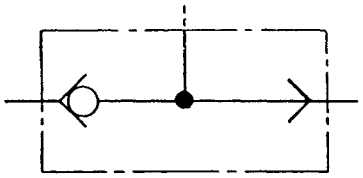
The Shuttle Valve can easily be supported by piping alone. Mounting feet are included, however, for installations with vibration or long pipe runs.

SENSITIVE

Will seal off the opposite inlet line with less than one psi pressure differential.

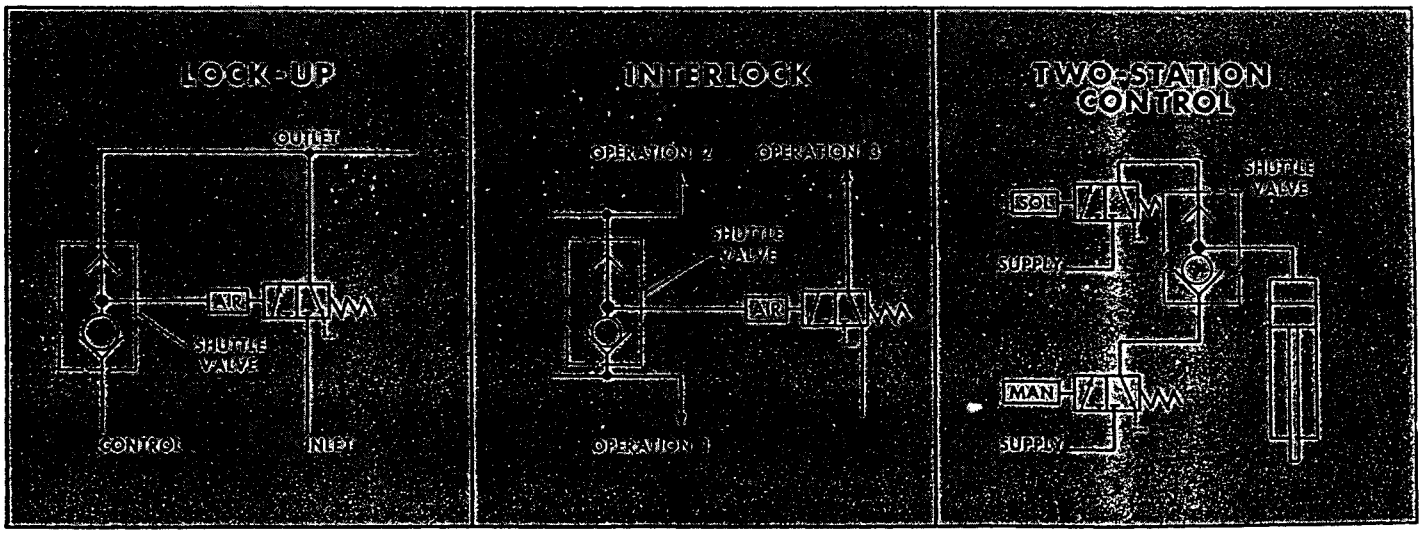
LONG LIFE

Tests have shown no diaphragm wear after hundreds of thousands of cycles.



GRAPHIC SYMBOL

TYPICAL APPLICATIONS



Ensures an operation is held constant once initiated. Outlet line must be vented by another means to unlock the system. ("Memory" Circuit)

Prevents operation 3 when operation 1 or 2 is in process. ("Not" Circuit)

Either of two controlling devices may operate the cylinders. Inoperative controlling device is sealed from the line. ("Or" Circuit)

REXROTH SHUTTLE VALVES

OPERATION

When a pressure differential of one psi or more exists at either inlet port, the higher pressure forces the diaphragm to seal against the opposite side of the valve and flows out the common outlet. The low (or zero) pressure inlet port is sealed from both the outlet and the opposite inlet port.

SPECIFICATIONS

PRESSURE

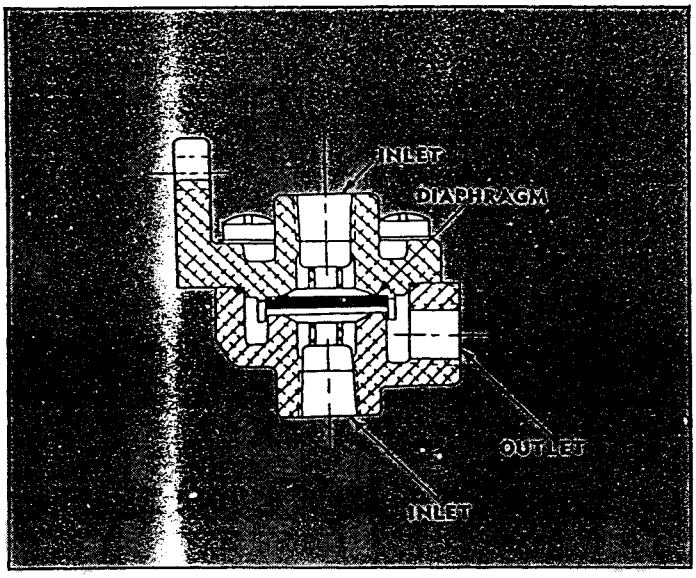
200 psi maximum pneumatic pressure.

TEMPERATURE

Maximum operating temperature is -40°F to +160°F. Intermittent temperature of +200°F is permissible.

MATERIAL

Body segments are corrosion-resistant, die-cast aluminum. The diaphragm and gasket are Buna N rubber.



ORDERING REFERENCE

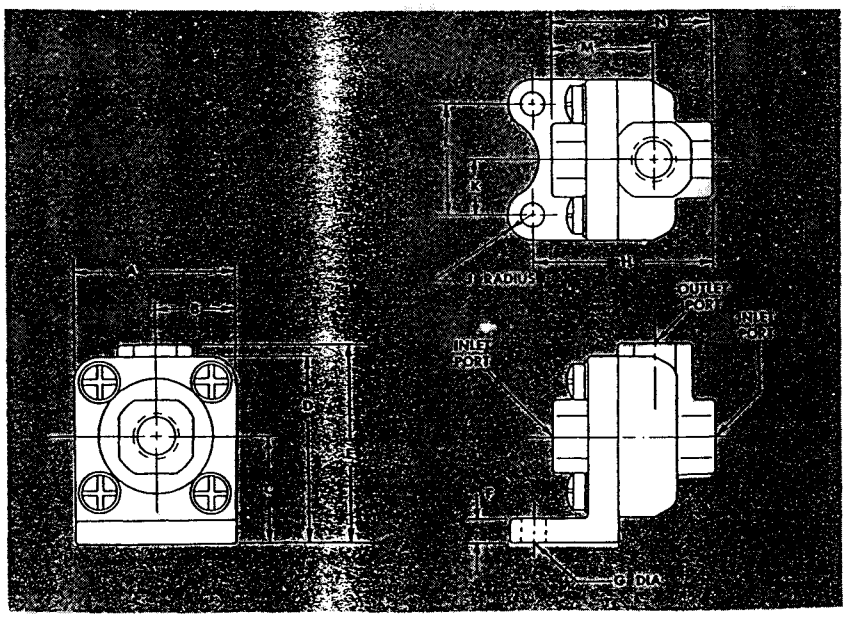
To order Shuttle Valves, give piece number and description.

Port Size	Piece Number	Approximate Weight	Repair Kit	CV	Port Size	Piece Number	Approximate Weight	Repair Kit	CV
1/8"	P54350-1	7 oz.	P60918	1.25	3/8"	P54350-3	1 lb., 3 oz.	P60919	3.61
1/4"	P54350-2	7 oz.		1.58	1/2"	P54350-4	1 lb., 3 oz.		5.12

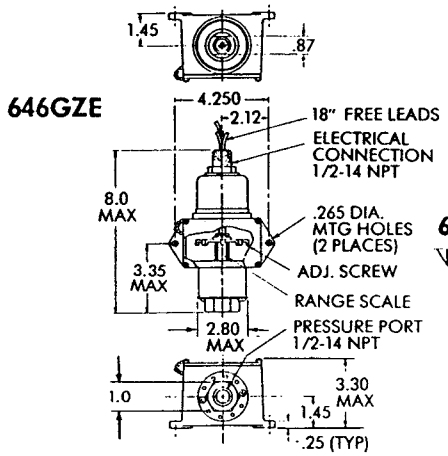
NOTE: Kits include diaphragm and gasket.

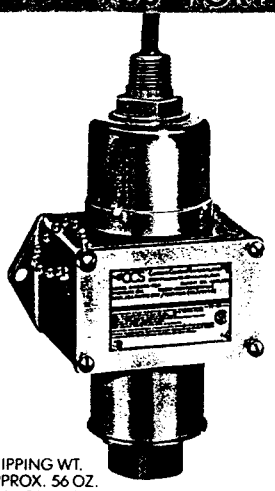
DIMENSIONS

All Ports	DRYSEAL NPTF	
	1/8"-27 and 1/4"-18	3/8"-18 and 1/2"-14
A	1 7/8"	2 1/2"
B	15/16"	1 1/4"
C	1 1/4"	1 7/8"
D	2 3/16"	3 1/8"
E	2 3/8"	3 3/4"
F	9/32"	5/16"
G	9/32"	9/32"
H	2 1/8"	3 1/4"
J	9/32"	21/64"
K	21/32"	29/32"
L	1 5/16"	1 13/16"
M	1 7/32"	2 1/8"
N	1 29/32"	3 3/8"



INSTALLATION DRAWING





SHIPPING WT. APPROX. 56 OZ. (1587 GRAMS)

Press. .4 to 5000 psi
Vac. 1.0 to 28.5" Hg

SERIES: 646GZE 646GZE-7011 646VZE

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:

PRESSURE SWITCHES MODEL 646GZE • ½" STAINLESS STEEL PRESSURE PORT AND POLYIMIDE DIAPHRAGM

Max. Sys. Press. psi	Proof (Test) Press. psi	Adj. Set-Point Range On Incr. Press. psi	Adj. Set-Point Range On Decr. Press. psi	Approx. Dead-band psi	Polyimide Diaphragm Model Number and Wetted Parts MODEL SPDT-Std.	MODEL DPDT "M"	Wetted Parts
500	750	1.2–18	.4–17.2	.8	646GZE1	646GZEM1	316 SS Polyimide Viton
3000	4500	6–75	2–71	4	646GZE2	646GZEM2	
3000	4500	12–150	4–142	8	646GZE11	646GZEM11	
3000	4500	30–375	10–355	20	646GZE3	646GZEM3	
3000	4500	300–1000	245–945	55	646GZE5	646GZEM5	
3000	4500	900–2300	750–2150	150	646GZE7	646GZEM7	

PRESSURE SWITCHES MODEL 646GZE-7011 • ½" STAINLESS STEEL PRESSURE PORT AND DIAPHRAGM

500	750	1.4–18	.4–17	1	646GZE1-7011	646GZEM1-7011	316 SS Viton
3000	4500	9–75	3–69	6	646GZE2-7011	646GZEM2-7011	
3000	4500	18–150	6–138	12	646GZE11-7011	646GZEM11-7011	
3000	4500	45–375	15–345	30	646GZE3-7011	646GZEM3-7011	
3000	4500	300–1000	225–925	75	646GZE5-7011	646GZEM5-7011	
3000	4500	900–2300	720–2120	180	646GZE7-7011	646GZEM7-7011	
5000	7500	2000-3400	1725-3125	275	646GZE9-7011	646GZEM9-7011	
5000	7500	2800-5000	2350-4550	450	646GZE10-7011	646GZEM10-7011	

VACUUM SWITCHES MODEL 646VZE • ½" STAINLESS STEEL PRESSURE PORT AND POLYIMIDE DIAPHRAGM

Max. Sys. Press. psi	Proof (Test) Press. psi	Adj. Set-Point Range On Incr. Vacuum In. Hg	Adj. Set-Point Range On Decr. Vacuum In. Hg	Approx. Dead-band In. Hg	Polyimide Diaphragm Model Number and Wetted Parts MODEL SPDT-Std.	MODEL DPDT "M"	Wetted Parts
150	250	3.5–28.5	1.0–26.0	2.5	646VZE1	646VZEM1	316 SS Polyimide Viton

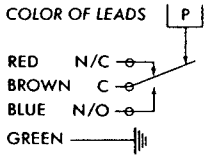
ELECTRICAL CHARACTERISTICS:

Rating of Switch Element

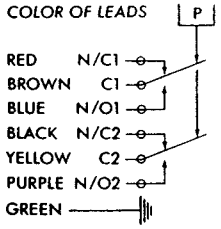
VOLTS	AMPERES SPDT Res.	AMPERES DPDT "M" Res.
125 AC–50/60 Hz	15	5
250 AC–50/60 Hz	15	5
480 AC–50/60 Hz	15	—
125 DC	.4	.5

SCHEMATIC AND WIRING CODE

SPDT–Standard



DPDT "M"



HOW TO ORDER:

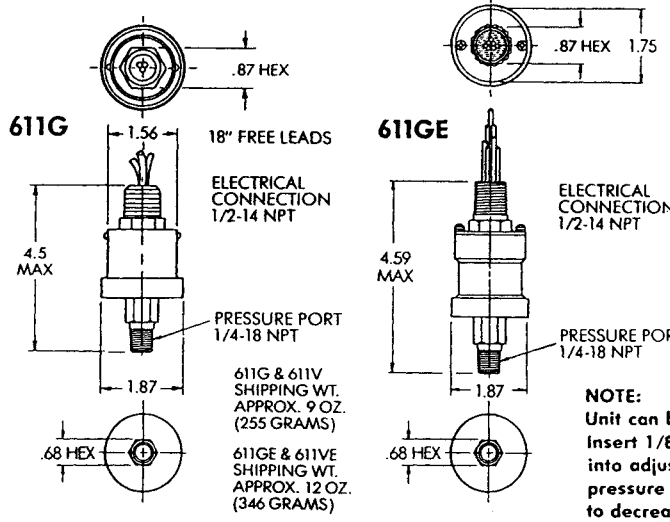
1. Specify model number.
2. Specify optional feature by inserting the letter designation of the optional feature after the last letter in the model number. Example: 646GZEF1

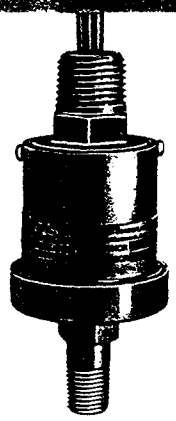
OPTIONAL FEATURES:

"F" = Ethylene Propylene O-ring

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.

INSTALLATION DRAWING





NOTE:
Unit can be set prior to installation. Insert 1/8" Allen wrench into adjustment screw (located in pressure port) and turn clockwise to decrease setting.

Press. .75 to 180 psi
Vac. 1.5 to 28.5" Hg.

SERIES:
611G 611V
611GE 611VE

Standard Features:
- **NEMA: 4, 13**
- **Weatherproof**
- **Model 611GE**
  U.L./CSA — See Note
  Explosion Proof: Div. 1, 2
  NEMA: 4, 7, 9, 13

AMBIENT TEMP. RANGE
−30° to 160° F
−34° to 71° C

OPERATING AND ORDERING DATA:

PRESSURE SWITCHES MODEL 611G • 1/4" ALUMINUM PRESSURE PORT AND POLYIMIDE DIAPHRAGM

Max. Sys. Press. psi	Proof (Test) Press. psi	Adj. Set-Point Range: On Incr. Press. psi	Adj. Set-Point Range: On Decr. Press. psi	Approx. Dead band psi	Model No. and Wetted Parts: MODEL SPDT-Std.	MODEL DPDT "M"	Wetted Parts
250	500	1.5–12.1	.75–11.35	.75	611G8001	611GM8001	Aluminum Buna N, Polyimide Cadmium Plated Steel, 300 SS
500	1000	12.1–30	10.1–28	2.0	611G8003	611GM8003	
500	1000	30.1–70	27.1–67	3.0	611G8005	611GM8005	
500	1000	70.1–180	63.1–173	7.0	611G8007	611GM8007	

PRESSURE SWITCHES MODEL 611GE • 1/4" ALUMINUM PRESSURE PORT AND POLYIMIDE DIAPHRAGM • EXPLOSION PROOF

250	500	1.5–12.1	.75–11.35	.75	611GE8001	611GEM8001	Aluminum Buna N, Polyimide Cadmium Plated Steel, 300 SS
500	1000	12.1–30	10.1–28	2.0	611GE8003	611GEM8003	
500	1000	30.1–70	27.1–67	3.0	611GE8005	611GEM8005	
500	1000	70.1–180	63.1–173	7.0	611GE8007	611GEM8007	

VACUUM SWITCHES MODEL 611V • 1/4" ALUMINUM PRESSURE PORT AND POLYIMIDE DIAPHRAGM

Max. Sys. Press. psi	Proof (Test) Press. psi	Adj. Set-Point Range: On Incr. Vacuum In. Hg	Adj. Set-Point Range: On Decr. Vacuum In. Hg	Approx. Dead-band In. Hg	Model No. and Wetted Parts: MODEL SPDT-Std.	MODEL DPDT "M"	Wetted Parts
150	250	4–28.5	1.5–26	2.5	611V8000	611VM8000	Aluminum Buna N, Polyimide Cadmium Plated Steel, 300 SS

VACUUM SWITCHES MODEL 611VE • 1/4" ALUMINUM PRESSURE PORT AND POLYIMIDE DIAPHRAGM • EXPLOSION PROOF

150	250	4–28.5	1.5–26	2.5	611VE8000	611VEM8000	Aluminum Buna N, Polyimide Cadmium Plated Steel, 300 SS

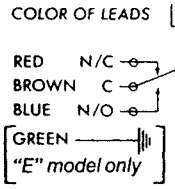
ELECTRICAL CHARACTERISTICS:

Rating of Switch Element

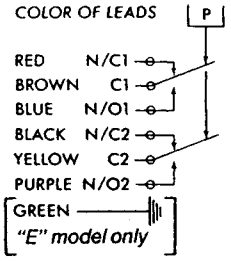
VOLTS	AMPERES SPDT Res.	AMPERES DPDT "M" Res.
125 AC-50/60 Hz	11	11
250 AC-50/60 Hz	11	11
30DC	5	5
125DC	.5	.5

SCHEMATIC AND WIRING CODE

SPDT–Standard



DPDT "M"



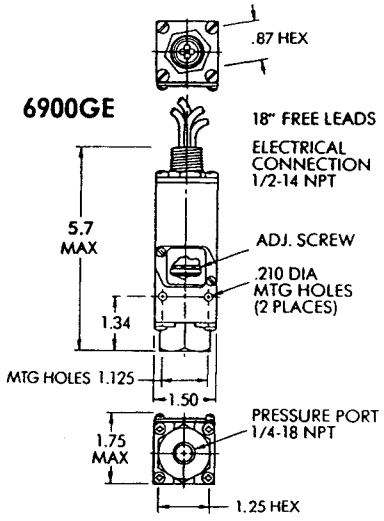
MODEL 611GE
EXPLOSION PROOF

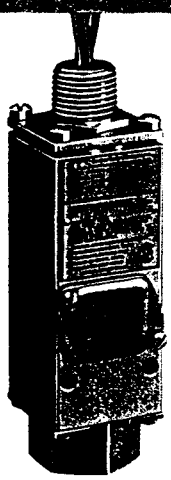
NOTE:
Div. 1 explosion-proof and hermetically sealed electrical assembly Part No. 46-1058 (46-1061 for "M" model option), listed by both Underwriter's Laboratories, Inc. (File No. E32961) and CSA Testing Laboratories (File No. 22921) for hazardous locations, Class 1, Groups A, B, C, and D; Class 2 Groups E, F, and G.

HOW TO ORDER:

1. Specify model number.

INSTALLATION DRAWING





6900GE & 6900PE SHIPPING WT. APPROX. 16 OZ. (467 GRAMS)

Press. 1 to 6500 psi

SERIES: 6900GE 6900PE

Standard Features:

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

AMBIENT TEMP. RANGE
−30° to 160° F
−34° to 71° C

OPERATING AND ORDERING DATA:

PRESSURE SWITCHES MODEL 6900GE • 1/4" ALUMINUM PRESSURE PORT AND POLYIMIDE DIAPHRAGM

Max. Sys. Press. psi	Proof (Test) Press. psi	Adj. Set-Point Range On Incr. Press. psi	Adj. Set-Point Range On Decr. Press. psi	Approx. Dead band psi	Model No. and Wetted Parts MODEL SPDT-Std.	MODEL DPDT "M"	Wetted Parts
500	750	3–20	1–18	2	6900GE12	6900GEM12	Aluminum Polyimide Buna N
500	750	6–75	2–71	4	6900GE14	6900GEM14	
1500	2000	12–150	4–142	8	6900GE16	6900GEM16	
1500	2000	30–375	10–355	20	6900GE18	6900GEM18	
2000	3000	300–1000	250–950	50	6900GE20	6900GEM20	
3000	4500	700–2500	600–2400	100	6900GE22	6900GEM22	

PRESSURE SWITCHES MODEL 6900PE • PISTON PRESSURE SWITCH WITH 1/4" ALUMINUM PRESSURE PORT • FOR HIGH CYCLING—LONG LIFE—HYDRAULIC APPLICATIONS

Hyd. psi	Hyd. psi						
2000	3000	15–200	5–190	10	6900PE32	6900PEM32	Aluminum 400 SS Buna N Teflon
3000	5000	150–1600	40–1490	110	6900PE34	6900PEM34	
5000	7500	500–3200	330–3030	170	6900PE36	6900PEM36	
10,000	13,000	2000–6500	1500–6000	500	6900PE38	6900PEM38	

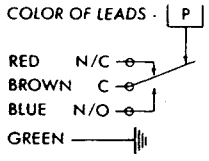
ELECTRICAL CHARACTERISTICS:

Rating of Switch Element

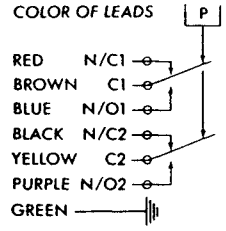
VOLTS	AMPERES SPDT Res.	AMPERES DPDT "M" Res.
125 AC—50/60 Hz	11	11
250 AC—50/60 Hz	11	11
30 DC	5	5
125 DC	.5	.5

SCHEMATIC AND WIRING CODE

SPDT–Standard



DPDT "M"



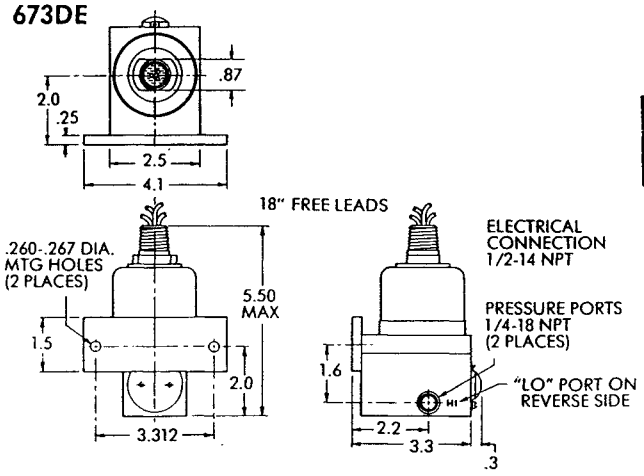
NOTE:
Div. 1 explosion-proof and hermetically sealed electrical assembly Part No. 46-1058 (46-1061 for "M" model option), listed by both Underwriter's Laboratories, Inc. (File No. E32961) and CSA Testing Laboratories (File No. 22921) for hazardous locations, Class 1, Groups A, B, C, and D; Class 2 Groups E, F, and G.

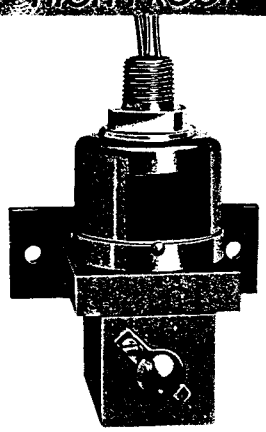
HOW TO ORDER:

1. Specify model number.

INSTALLATION DRAWING

673DE





TO ADJUST LOOSEN SCREW LIFT CAP TURN ADJ SCREW CLOCKWISE TO DECREASE

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

Diff. 2 to 60 psid

SERIES: 673DE

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:

DIFFERENTIAL SWITCHES
MODEL 673DE8011
- **1/4" STAINLESS STEEL PRESSURE PORTS AND DIAPHRAGM**

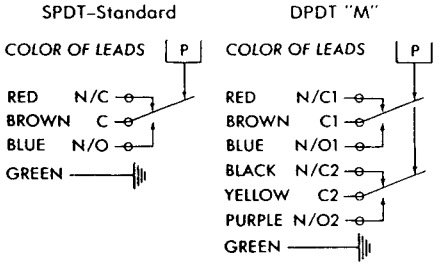
Maximum System Pressure psi		Proof (Test) Pressure psi			Adjustable Set-Point Range		Approx. Dead band psi	Model Number and Wetted Parts		
High Press. Port	Low Press. Port	Both Ports Simul-taneous	High Over Low Low Over High		On Increasing Pressure psid	On Decreasing Pressure psid		MODEL SPDT-Std.	MODEL DPDT "M"	Wetted Parts
			High	Low						
3000		4500	2000	1000	7 to 60	2 to 55	5	673DE8011	673DEM8011	300 SS Viton

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.

NOTE:
Model 673DEM8011 has an approximate dead band of 7 psi.

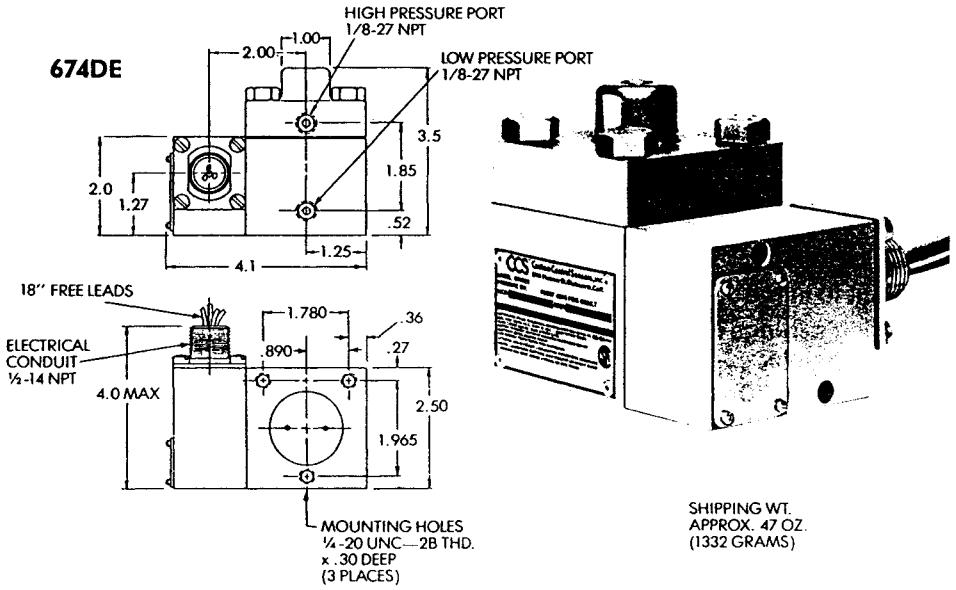
HOW TO ORDER:

1. Specify model number.
2. Specify optional feature by inserting the letter designation of the optional feature after the last letter in the model number. Example: 673DEF8011

OPTIONAL FEATURES:

"F" =Ethylene Propylene O-ring

INSTALLATION DRAWING



Diff. 2 to 800 psid

SERIES: 674DE

Standard Features:

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

AMBIENT TEMP. RANGE
−30°F to +160°F
−34°C to 71°C

OPERATING AND ORDERING DATA:

DIFFERENTIAL SWITCHES
MODEL 674DE

- **⅛" ALUMINUM**
- **PRESSURE PORT AND POLYIMIDE DIAPHRAGM**

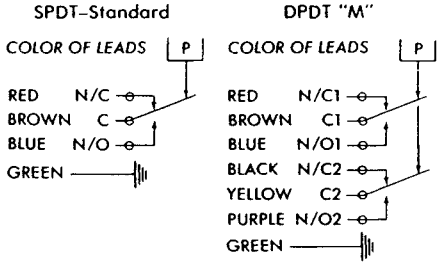
Maximum System Pressure psi	Proof (Test) Pressure			Setting Ranges— For Customer Specified Set Points				Model No. and Wetted Parts		
				Fixed Set Point Range		Approx. Dead Band				
	Both Ports Simultaneous psi	High Over Low Low Over High		On Increasing Pressure psi	On Decreasing Pressure psi	At Bottom of Range psi	At Top of Range psi	MODEL SPDT-Std.	MODEL DPDT "M"	Wetted Parts
		High psi	Low psi							
3000	4500	2500	2500	7 to 80	2 to 68	5	12	674DE1	674DEM1	Aluminum Polyimide Viton, 300 SS
				81 to 350	66 to 297	14	52	674DE2	674DEM2	
				351 to 800	291 to 680	6	120	674DE3	674DEM3	

ELECTRICAL CHARACTERISTICS:

Rating of Switch Element

VOLTS	AMPERES	
	SPDT	DPDT "M"
	Res.	Res.
125 AC—50/60 Hz	11	11
250 AC—50/60 Hz	11	11
30 DC	5	5
125 DC	.5	.5

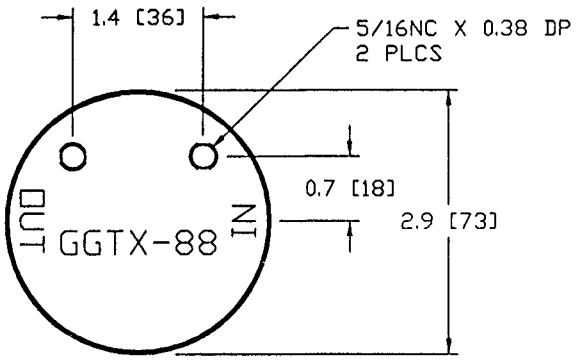
SCHEMATIC AND WIRING CODE

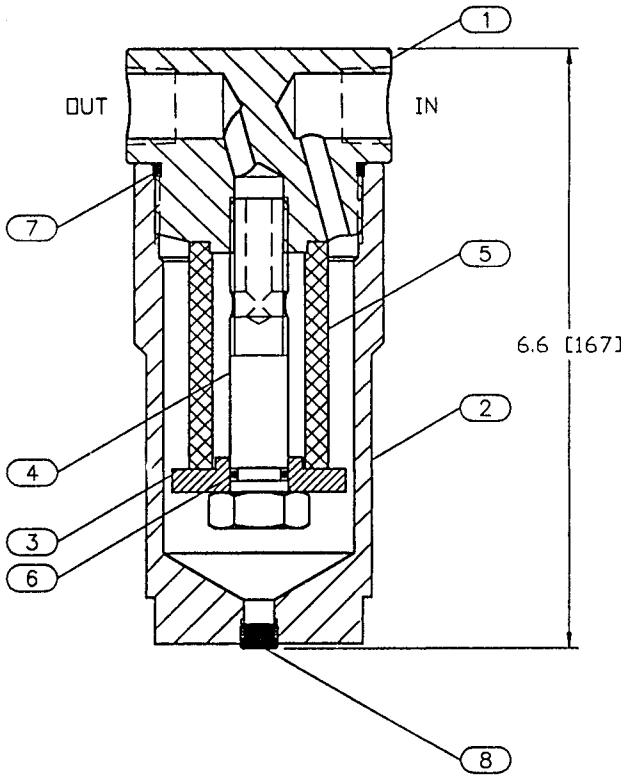


NOTE:
Div. 1 explosion-proof and hermetically sealed electrical assembly Part No. 46-1058 (46-1061 for "M" model option), listed by both Underwriter's Laboratories, Inc. (File No. E32961) and CSA Testing Laboratories (File No. 22921) for hazardous locations, Class 1, Groups A, B, C, and D; Class 2 Groups E, F, and G.

HOW TO ORDER:

1. Specify model number.
2. Specify critical set point and specify if it is on "increasing pressure" or on "decreasing pressure."





ITEM	PART NO.	DESCRIPTION	MATERIAL	QTY	NOTE
1	907-101	BODY	CARBON STEEL	1	
2	907-102	BOWL	AL 6061-T6	1	
3	907-103	ELEMENT RETAINER	AL 6061-T6	1	
4	907-104	RETAINER BOLT	SS 304	1	
5	907-105	ELEMENT	MICROBON, 140 TYP	1	(Y)
6	907-106	O-RING, BOLT	VITON	1	(Y)
7	907-107	O-RING, HEAD	VITON	1	(Y)
8	907-108	PLUG	SS 18-8	1	

NOTE: (Y) RECOMMENDED SPARE PARTS, PART NO. SPRK-GGTA-XX
REPLACES AND SUPERSEDES SERIES GGTA-88 IN ALL LISTED SERVICES
FASTENERS AND SERVICE TOOLS ARE ANSI/INCH SIZE

SPECIFICATIONS:
PORTS: 1/2 NPT EFFECTIVE Cv: 1.3
SERVICE: AIR, SWEET GAS, H2S SOUR GAS
TEMP. RATING: -50°C THRU 120°C
MASS: 4.9 LBm [2.2 kg]
MAX. WORKING PRESSURE: 1500 PSIG
STD ELEMENT 140 MICRON

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

UPDATE LOGO, +Cv
⚠RS-1995-10-30 @ Q-HF-TW
REV BY-DATE+REF

TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

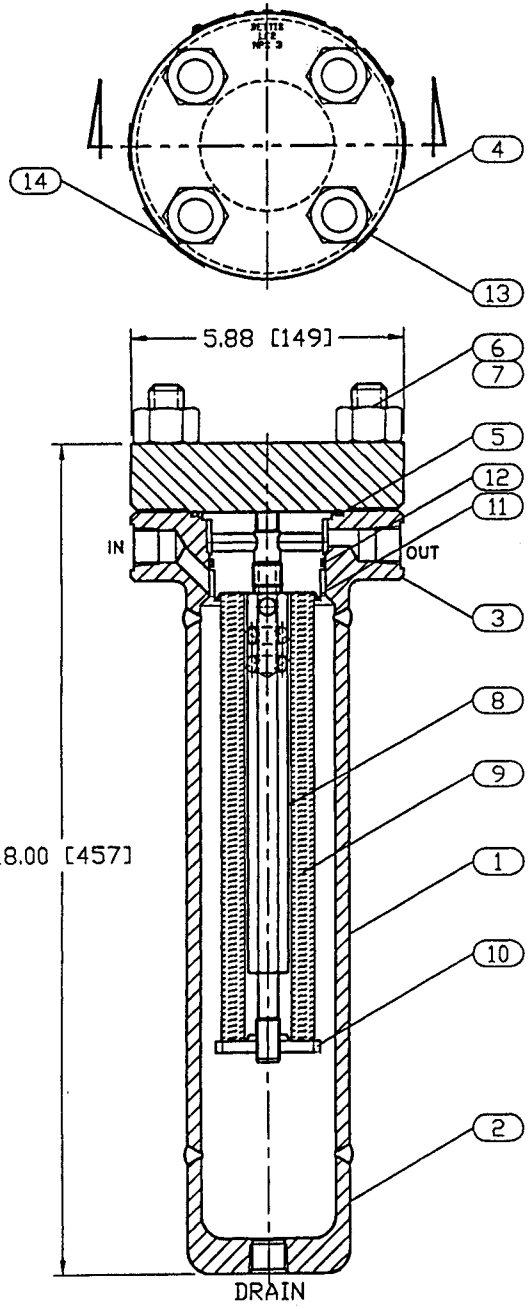
BETTIS Actuators & Controls
BETTIS CANADA LTD.

CUTAWAY ASSEMBLY
GGTX-88
HIGH PRESSURE GAS FILTER
PER NACE MR-01-75

C-0290--.DWG_VIEW_00
OCT-30-95

SCALE 1:2 | BY VL | CHK | DATE SEP-16-94
W.O. 7833-1-A | DWG. NO. C-0290 | REV 1-

DWG. NO. C-0290



ITEM	DESCRIPTION	MATERIAL	QTY	NOTE
1	NPS 3 SMLS PIPE	SA-333-6	1	
2	NPS 3 FLAT HEAD	SA-350-LF2	1	
3	NPS 3 WELD NECK FLANGE	SA-350-LF2	1	
4	CAP	SA-350-LF2	1	
5	O-RING, CAP	VITON 70A	1	(Y)
6	STUD	SA-320-L7M	4	
7	NUT	SA-194-7M	4	
8	SUPPORT ROD	C1018	1	
9	FILTER ELEMENT	FIBRE	1	(Y)
10	RETAINER NUT	AL 6061-T6	1	
11	ELEMENT HANGER	AL 6061-T6	1	
12	O-RING, HANGER	VITON 70A	1	(Y)
13	DECAL (eg. 40 MICRON)	VINYL	1	
14	DECAL (DE-PRESSURIZE BEFORE ...)	VINYL	1	
15	SHIPPING PLUG (LOOSENED)	A105	2	(H)
16	TEST PLUG (SEALED DRAIN)	A105	1	(H)

NOTE: (Y) RECOMMENDED SPARE PARTS, PART NO. SPRK-FD-1F
(H) NOT SHOWN

SPECIFICATIONS:
PORTS: 1/2 NPT X 1/2 NPT X 1/2 NPT
SERVICE: AIR, SWEET GAS, H2S SOUR GAS
TEMP. RATING: -46°C THRU 65°C
OPTION: DRAIN VALVE
MAWP: 1500 OR 2220 PSIG, AS SPEC'D
STD ELEMENT 40 MICRON
EQUIVALENT Cv: 3.0 AT 1000 PSIG INLET
COMPLIANCE WITH NACE MR-01-75, AND
APPLICABLE PARTS OF ASME VIII-1

DWG. NO. C-0229

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

UPDT NPS 3 NECK FLANGE, PIPE
⚠4 GS-1996-11-18 @ 09097-1-R
UPDT SPECIFICATIONS
⚠3 RS-1996-03-14 @ 09097-1-R
REVISED HANGER FOR O-RING
⚠2 RB-1995-07-20 @ 09097-1-R
PORTS WERE IN BODY, OUT CAP
⚠1 RB-1995-06-20 @ 09097-1-R

REV BY-DATE+REF

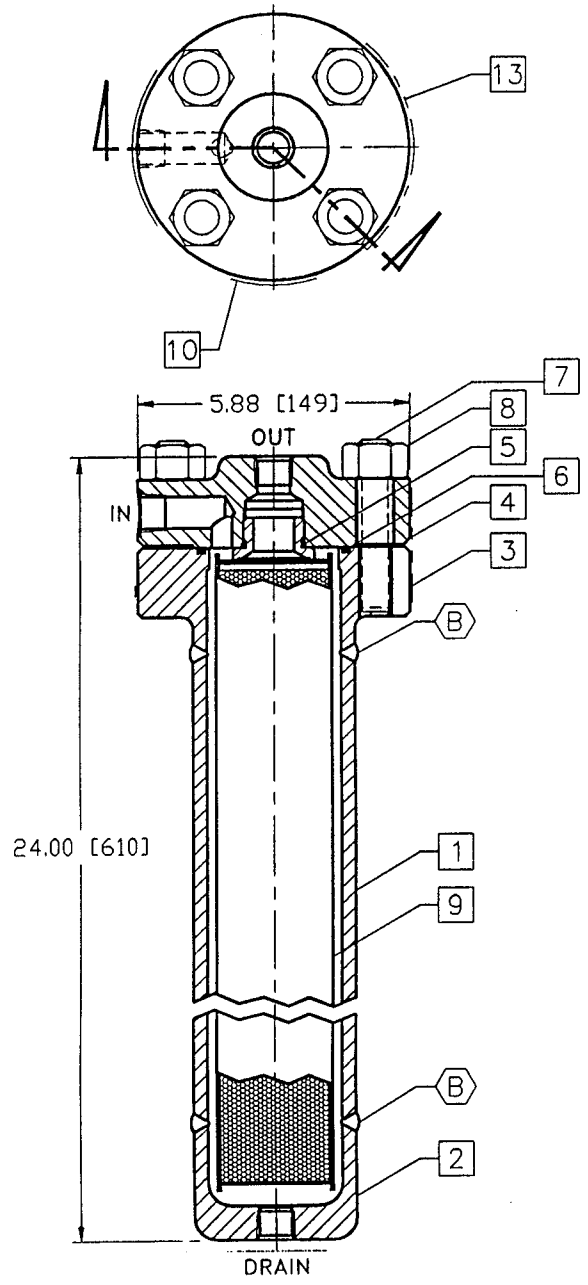
TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

BETTIS Actuators & Controls
BETTIS CANADA LTD.

CUTAWAY ASSEMBLY
FD-1F V2 (PORTS IN BODY)
HIGH PRESSURE GAS FILTER
AND CONDENSATE KNOCK-OUT

C-0229--.DWG_VIEW_02
NOV-18-96

WEIGHT 41.9 LB
SCALE 1:4 | BY GS | CHK [illegible] | DATE MAY-17-95
W.O. Q-JE-WES | DWG. NO. C-0229 | REV 4-



ITEM	DESCRIPTION	MATERIAL	QTY	NOTE
1	NPS 3 SMLS PIPE	SA-333-6	1	
2	NPS 3 FLAT HEAD	SA-350-LF2	1	
3	NPS 3 WELD NECK FLANGE	SA-350-LF2	1	
4	NPS 3 THD. RED. CAP	SA-350-LF2	1	
5	O-RING, FITTING	VITON 70A	1	(Y)
6	O-RING, CAP	VITON 70A	1	(Y)
7	STUD	SA-320-L7M	4	
8	NUT	SA-194-7M	4	
9	DESICCANT CARTRIDGE	SS 304	1	(Y)
10	DECAL (DE-PRESSURIZE BEFORE ...)	VINYL	1	
11	SHIPPING PLUG (LOOSENED)	A105	2	(H)
12	TEST PLUG (SEALED DRAIN)	A105	1	(H)
13	ASME NAMEPLATE (OPTIONAL)	AL/SS	1	

NOTE: (Y) RECOMMENDED SPARE PARTS, PART NO. SPRK-DD-1F
(H) NOT SHOWN

SPECIFICATIONS:
PORTS: 1/2 NPT X 1/2 NPT X 1/2 NPT
SERVICE: AIR, SWEET GAS, H2S SOUR GAS
TEMP. RATING: -46°C THRU 65°C
OPTION: DRAIN VALVE
MAWP: 1500 OR 2220 PSIG, AS SPEC'D
STD CARTRIDGE: 4A
EFFECTIVE Cv: 3.5 AT 1000 PSIG INLET
COMPLIANCE WITH NACE MR-01-75, AND
APPLICABLE PARTS OF ASME VIII-1

DWG. NO. C-0222

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

REDRAWN CAD PER VSB03011 REV 2
GS-1997-01-09 @ 06051-1-B
REDRAWN CAD PER VSB03011 REV 1
GS-1995-02-28@7482-1-G
UPFLOW, THREADED CARTRIDGE
DH-1994-04-29@ENG. REQ

REV BY-DATE+REF

TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

BETTIS Actuators & Controls
BETTIS CANADA LTD.

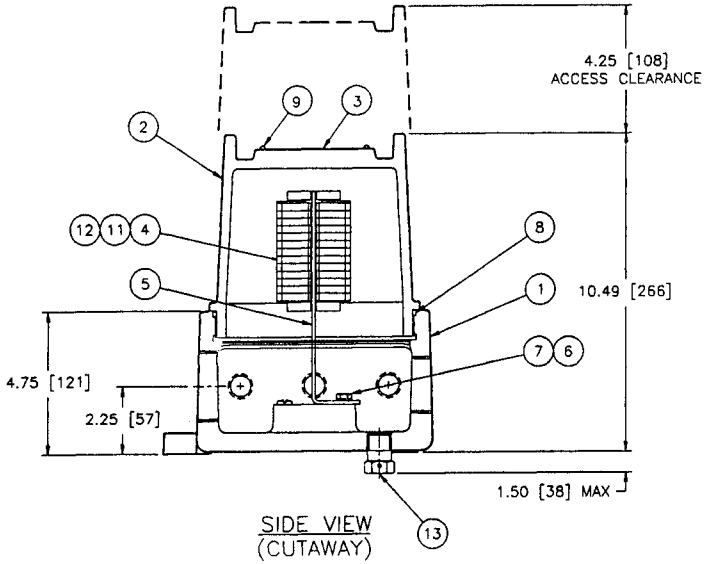
CUTAWAY ASSEMBLY
DD-1F MOLECULAR SIEVE DESICCANT DEHYDRATOR
FLANGED BODY

C-0222--.DWG_VIEW_00
JAN-09-97

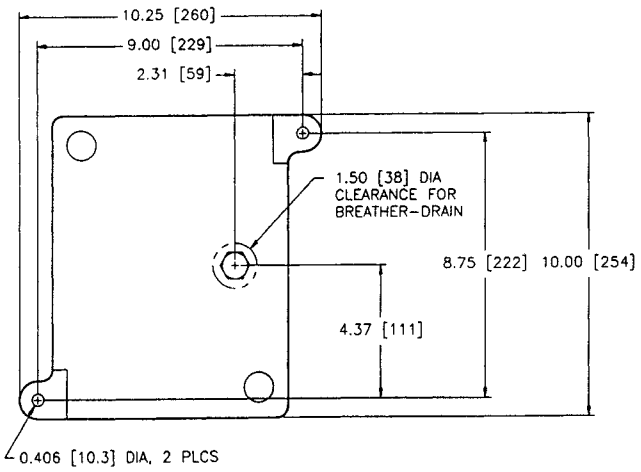
WEIGHT 50.8

SCALE 1:4 | BY JJ | CHK AA1557-02-94 | DATE JUN-24-92

W.O. EC940429 | DWG. NO. C-0222 | REV 3-



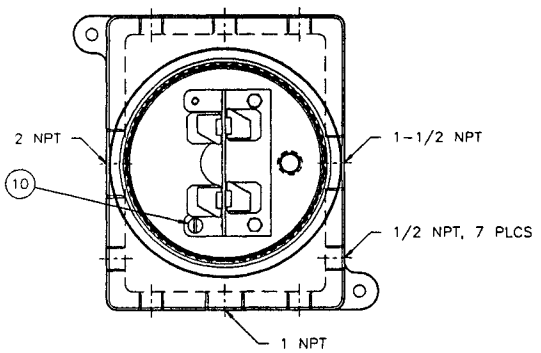
SIDE VIEW
(CUTAWAY)



BOTTOM VIEW

ITEM	DESCRIPTION	MATERIAL	QTY	NOTE
1	HOUSING	AL	1	
2	COVER	AL	1	
3	NAMEPLATE	AL	1	
4	TERMINAL BLOCK	POLYAMID	52	(V)
5	L-PAN	AL	1	
6	CAPSCREW	SS	2	
7	WASHER, LOCK	SS	2	
8	O-RING	NITRILE	1	
9	DRIVE SCREW	SS	4	
10	GROUND TERMINAL	SS	1	
11	SCREW, RAIL	SS	4	
12	NUT, RAIL	SS	4	
13	BREATHER-DRAIN	SS	1	

NOTE:
(V) DENOTES QTY VARIES/TO BE SPECIFIED.
CONDUIT ENTRIES SHOWN ARE TYPICAL. PERMISSIBLE SIZES AND SPACINGS ARE SHOWN IN DWG AP-0778, CONDUIT ENTRIES FOR SJ3 TERMINAL BOX



TOP VIEW
(COVER REMOVED)

UNLESS SPECIFIED OTHERWISE
ALL DIMENSIONS INCHES [mm]

UPDATE TB
Δ DY-1998-04-21 @ 09600-2-R
REV BY-DATE+REF

TOLERANCES
XXX ±0.5 [±10]
XX ±0.2 [±5]
X ±0.1 [±2]

BETTIS CANADA LTD.
Actuators & Controls
A Dorot Industries Company

TERMINAL BOX SJ31-B
w/ AKZ4 TERMINAL BLOCKS
ASSEMBLY AND DIMENSION

C-0168--.DWG
APR-21-98

21 LB

SCALE 1:4 | BY AG | CHK AP-1778-04-21 | DATE APR-19-94
W.O. 9212-1-R | DWG. NO. CB0168 | REV 1-

DWG. NO. CB0168

V NOTES