

CC TROUGH THERMAL SWITCH SET-POINT TESTING

J.B. FITZPATRICK

7/6/88

D-ZERO ENGINEERING NOTE #3740.000-EN-164

APPROVED:

G.T. Mulholland 7/25/88

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INTRODUCTION:

This note summarizes the testing procedure and corresponding data for set-point testing that was conducted on two Asco compact pressure switch-Freon 22 charged bulb assemblies intended for use as temperature switches in the Spill Hazard Fan Operating System. (See EN-136,136A) These switches work from the condensation of the Freon 22 charge rather than contraction of the gas, thus providing a large pressure change when the bulb is exposed to a spill. These particular switches will be located in the CC trough area as depicted in drawing #3740.510-MD-255675.

SPECIFICATIONS:

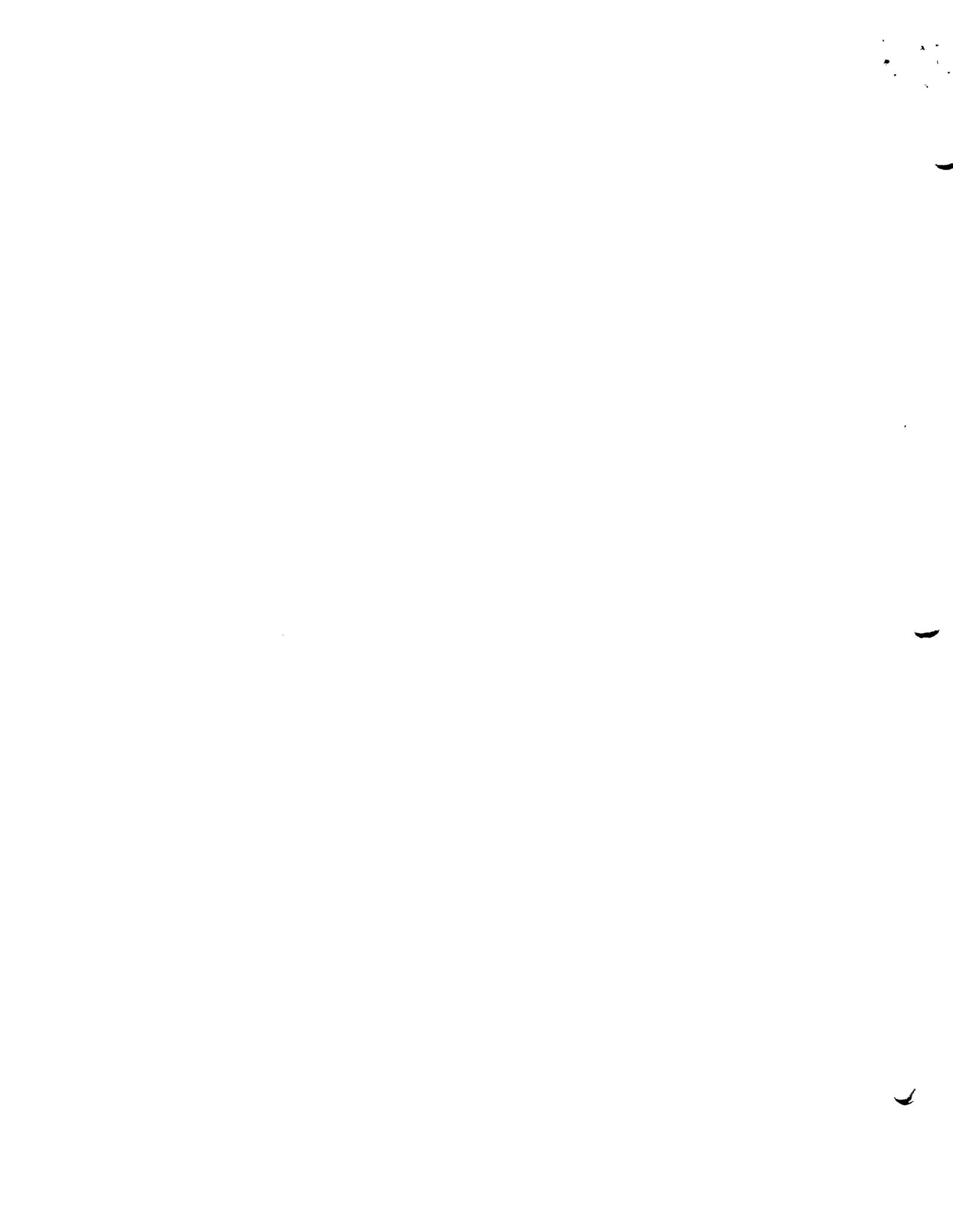
The specifications for the pressure switch units tested are as detailed on the manufacturers catalog page included in this report as figure 1. The switch unit is an epoxy-painted steel raintight enclosure #PB11A, and the transducer unit is all 316 stainless steel, #RF10A44. The adjustable operating range is 10 to 100 p.s.i.g. The bulbs were charged with Freon 22 to 116 p.s.i.g.

TEST PROCEDURE:

The principle purpose of this test was to note the set and reset points for each pressure switch in order to accept/reject the switch from consideration, based on their required operation. Following is the testing procedure, and a diagram of the testing set-up.

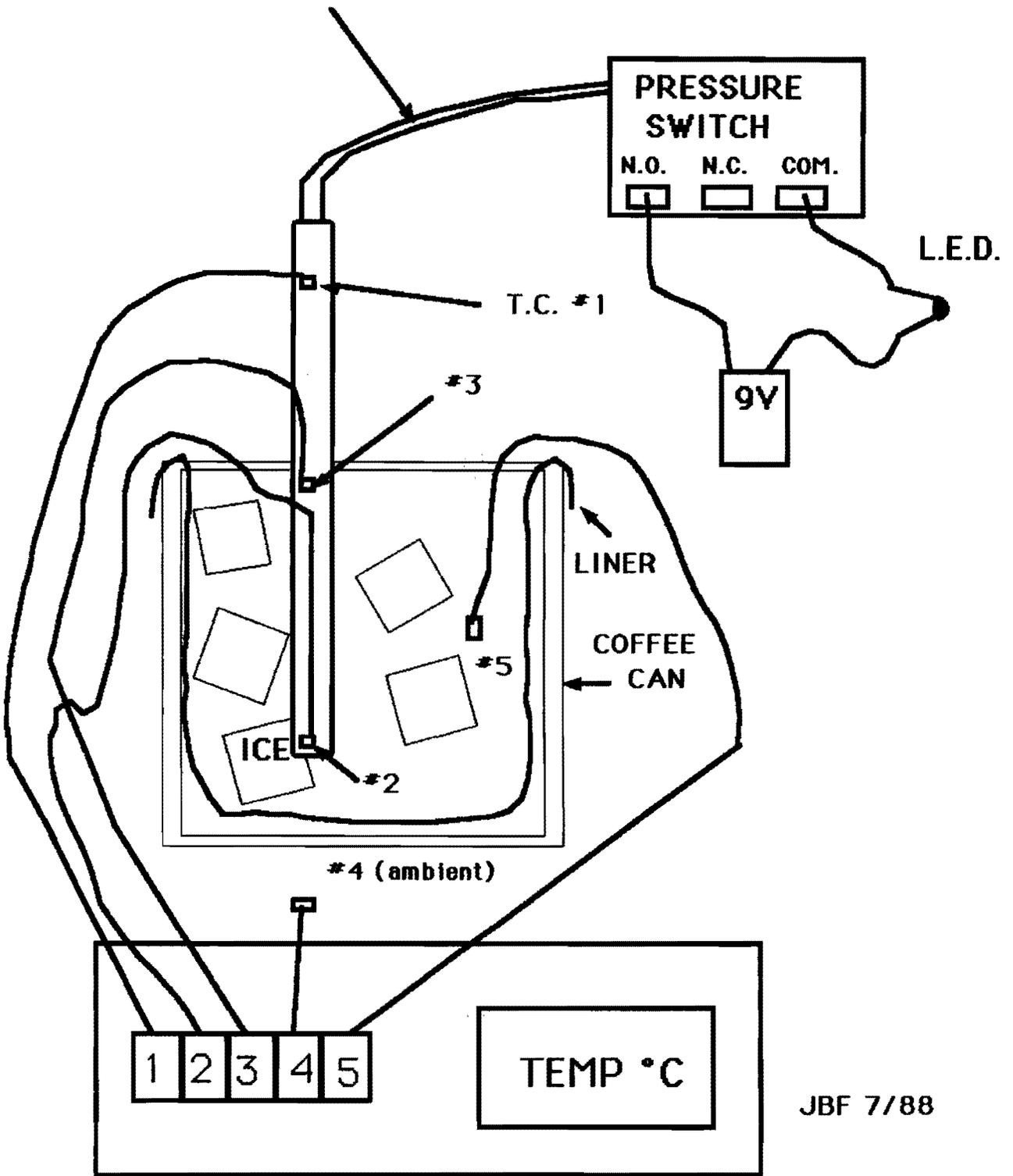
Test Procedure

1. Record all Thermocouples
2. Place bulb in ice
3. Wait for equilibrium on T.C. # 1,2,3
4. Record all T.C.'s
5. Watch for L.E.D. to go out
6. If L.E.D. does not go out, then spray Quick Freeze[®] near the bottom of the bulb to reduce the temp. to the set point. This should be done slowly as the Quick Freeze[®] changes the temperature very rapidly.
7. Record set point (T.C. #2 only)
8. Watch for reset temperature and record. (T.C. #2)
9. Allow bulb to warm up well past the reset point, then repeat steps 6 to 8 several times.
10. Record T.C.'s #4 and #5.
11. Repeat entire procedure for Switch #2.



TEST SET-UP

CHARGED WITH FREON 22



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DATA:

The data from this testing is attached as well as graphs of setpoint, reset point, and deadband.

RESULTS:

The data from this testing reveals that the set-points of both switches were near zero °C, which is the proposed set-point temperature for spill conditions.(see EN-136 &136-A) The switches are of the adjustable set point, fixed deadband type, so that they may be exactly calibrated to zero °C prior to installation. The deadbands (reset temp. - set temp.) for both switches tended to fluctuate, but were never larger than 2 C°.

EXPERIMENTAL ERROR:

Errors in the data that was obtained most probably exist due to the following reasons/causes:

1. Improperly calibrated thermocouple readout

The readout for the thermocouple that measured the ice temperature consistently registered between 7-8°C. The readout for the thermocouple that measured room temperature registered between 25-31°C (25°C with air conditioner on and 31°C without air on). If one considers room temperature about 75°F (24°C) and air conditioned room temperature about 65°F (18°C), then it is permissible that the error is due to a 7 C° calibration error in the thermocouple readout.

2. Rate of cooling of the probe with Quick Freeze®

It was noticed during the test that if the probe was cooled down too quick, the thermocouple readout would change rapidly. The exact set-point was then hard to decipher with the thermocouple readout making jumps of 5 C° at a time.

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CONCLUSION:

In every trial, the switches set near the desired temperature, and they reset within a reasonable temperature deadband ($< 2\text{ C}^\circ$, average 1 C°). It should be mentioned that, a $7\text{-}8\text{ C}^\circ$ calibration error in the thermocouple (set/reset graphs should be shifted down $7\text{-}8\text{ C}^\circ$) is an absolute error, and does not affect the calculation of the deadband, which most importantly reflects on the repeatability of these switches. To the accuracy that is required by these switches, it is felt that they will perform as desired to actuate the vent fans at D-Zero.

* At the time of this report it has been discovered that a company, Ashcroft, makes thermal switches with gas-filled bulbs (fills include, Propane, Butane, Freon 113, N. Propyl alcohol, and Xylene). Previously the only devices that had been researched and could be located were oil-filled pressure switch bulb assemblies. Attached is information on this line of switches. If these switches have proven reliability, then our preference is to go with this line, rather than our own modified version of the Asco switch. Should the Ashcroft device be appropriate, these tests, improved by the current experience, will be repeated to qualify the device and an addendum to this report written for documentation.

**CC TROUGH THERMAL SWITCH LN₂ TESTING
APPENDIX-A**

J.B. FITZPATRICK

7/26/88

D-ZERO ENGINEERING NOTE 3740.214-EN-164-A

APPROVED:

L. T. McAllister 7/27/88

TEST PROCEDURE AND SETUP:

The test setup is shown in the attached diagram. This test was designed to test the switches response to rapid spill conditions, and to evaluate reset responses over varied periods of submersion.

PROCEDURE:

- 1) WIRE SWITCH #1 TO BATTERY/L.E.D.
- 2) RECORD AMBIENT TEMPERATURE
- 3) SUBMERGE COPPER BULB AND CAPILLARY TUBE IN LN₂
(10" WORTH)
- 4) WATCH FOR L.E.D. TO GO OUT (SET POINT)/ RECORD RESPONSE TIME.
- 5) WAIT SPECIFIED PERIOD (1 MIN, 5 MIN, 20 MIN)
- 6) REMOVE BULB FROM LN₂ / WATCH FOR L.E.D. TO COME ON /RECORD RESPONSE TIME.
- 7) WARMUP TO AMBIENT EQUILIBRIUM (4 OR 5 MIN.)
- 8) REPEAT STEPS 3 TO 7 FOR SAME SPECIFIED PERIOD.
- 9) REPEAT STEPS 3 TO 7 NEXT SPECIFIED PERIOD.
- 10) REPEAT ENTIRE PROCEDURE FOR SWITCH #2

RESULTS/CONCLUSION:

The results of this testing show a constant set response of approximately 3 seconds, and an approximate reset response of 4.5 min. for all specified periods of submersion. Constant response times comment highly on continued switch performance in the spill environment. General conclusion is that the switches will function as required under spill conditions.

DATA TABLE:TRIAL 1TRIAL 2SWITCH #1

AMBIENT TEMP: 24°C

1) ONE MINUTE TEST

<u>SET TIME:</u>	3 SEC.	2 SEC.
<u>RESET TIME:</u>	255 SEC.	255 SEC.

2) FIVE MINUTE TEST

<u>SET TIME:</u>	3	4
<u>RESET TIME:</u>	255	260

3) TWENTY MINUTE TEST

<u>SET TIME:</u>	3	N/A
<u>RESET TIME:</u>	245	N/A

SWITCH #2

AMBIENT TEMP: 28°C

1) ONE MINUTE TEST

<u>SET TIME:</u>	3 SEC.	3 SEC.
<u>RESET TIME:</u>	270 SEC.	285 SEC.

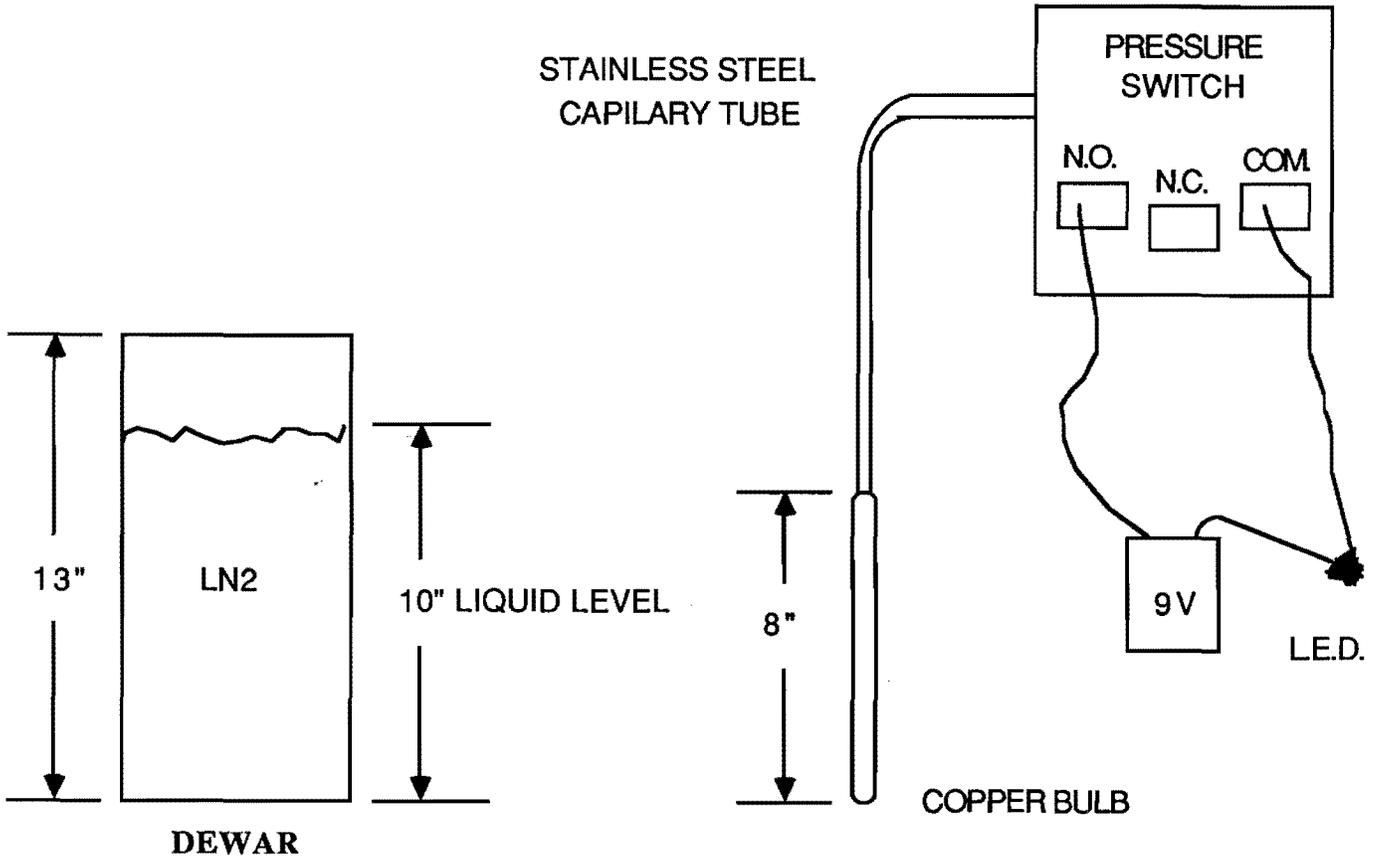
2) FIVE MINUTE TEST

<u>SET TIME:</u>	3	3
<u>RESET TIME:</u>	290	290

3) TWENTY MINUTE TEST

<u>SET TIME:</u>	3	N/A
<u>RESET TIME:</u>	275	N/A

LN2 TEST SETUP



**CC TROUGH THERMAL
SWITCH LN₂ TESTING
APPENDIX-B**

R. T. Krasa

10/25/88

**D-Zero Engineering Note
3740.214-EN-164-B**

APPROVED: *R. T. Krasa* 10/26/88

As of July, 1988 we proposed to use temperature switches assembled here at Fermi for the emergency switches to warn of a cryogen spill into the cradles of the cryostats. These two phase switches consist of a pressure switch and bulb charged with Freon 22. They meet all requirements for use in the spill trough.

Following the completion of the testing of these switches we came across a commercially available equivalent to our home made switch. Ashcroft Controls manufactures a temperature switch charged with Butane gas. Butane is analogous to Freon 22 as far as operating principals.

Earlier this month we obtained a switch for test purposes. Cold shocking in LN₂ for 14 hours did not appreciable change the set point or response time of this Ashcroft switch. The switch design and test results lead us to conclude that this switch model is operationally identical to the switches produced here at Fermi. Moreover, these switches are readily available at a reasonable price with a five year warranty. For these reasons we now propose to use Ashcroft series L pressure switches for spill hazard detection in the spill trough of the CC and EC vessels.

LN2 Cold Shock Testing-

- Cycled 10 times in ice bath at approx. 34°F.
- Cool down times were 25 ± 2 sec..
- Warm up times in air were 50 ± 4 sec..
- The bulb was then immersed in LN2 for
approximately 14 hours resulting in no
appreciable change in cycle times.

PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

L-Series pressure, differential pressure and vacuum switches utilize two different actuators, depending on set point requirements. For set points between 2 and 3000 psi, the simple, rugged diaphragm sealed piston actuator is used. This design features high reliability and choice of actuator seal materials for virtually every application. An optional welded design is also available for set points up to 600 psi* for maximum reliability. This design is

*Consult factory for special models up to 1000 psi.

available in AISI 316 or Monel. Differential pressure models utilize a unique dual diaphragm sealed piston design that features very high static operating pressures and small size.

For set points between 4.5 and 150 inches of H₂O a large diaphragm is used for increased sensitivity in both pressure and differential pressure designs with good choice of materials of construction.

All standard models feature ± 1 percent of range set point repeatability and a minimum of 400 percent of range proof pressures.

These standard designs perform well in applications where shock and vibration could be a problem and may be used in conjunction with Ashcroft diaphragm seals in extreme services such as slurries or abrasive process fluids.

PRESSURE / VACUUM SWITCHES

APPROXIMATE DEADBAND⁽²⁾ (BUNA-N DIAPHRAGM)

NOMINAL RANGE	OVERPRESSURE RATINGS		LPA	LPS					LPD			
	Proof psi	Min. Burst psi	J,H	S W I T C H E L E M E N T								
				G	J,H	K,F	P	GG	JJ,HH	KK,FF	PP	
VACUUM -30" Hg -760mm Hg.	250	400	6-24	2.5-4	4-6	1-2	1-2.5	3-5.5	4-6.5	1-2	1-2.5	
COMPOUND 30" Hg/ -760mm Hg/ 15 psi 1.0 Kg/cm ²	250	400	6-24 3-12	2.5-4 1-2.5	4-6 1-3.5	1-2 .5-1.5	1-2.5 .5-2	3-5.5 1.5-3.5	4-6.5 1.5-4	1-2 1-2	1-2.5 1-2	
PRESSURE 30" H ₂ O 750mm H ₂ O	20	35	4.0-27	1.5-3.5	2.0-4.0	.5-1.0	.7-2.0	2.1-4.9	2.8-5.6	.7-1.4	.7-2.8	
60" H ₂ O 1500mm H ₂ O	20	35	5.0-54	1.5-4.5	2.5-5.0	.5-1.4	1.0-2.5	3-5.6	3.5-7.0	.7-2.0	2-3.5	
100" H ₂ O 2500mm H ₂ O	20	35	8.5-90	2.0-5.5	4.0-8.5	1.0-2.0	1.4-3.0	4-7.7	5.6-12	1.4-2.8	2-4.2	
150" H ₂ O 3750mm H ₂ O	20	35	18-135	5.0-11	10-18	1.5-3.0	2.0-6.0	7.0-16	14-25	2.1-4.2	5-9	
15 psi 1.0 kg/cm ²	500	1500	2.5-13	1.0-1.5	1.0-2.5	.5-1.0	.75-1.5	1.4-2.1	1.4-3.5	.7-1.4	1-1.4	
20 psi 1.5 kg/cm ²	500	1500	3.0-18	1.0-2.5	1.0-3.0	.75-1.5	.75-1.5	1.4-3.5	1.4-4.2	1-2.1	1-2.1	
30 psi 2.0 kg/cm ²	500	1500	3.0-27	1.0-2.8	1.0-3.0	.75-1.5	1-1.8	1.4-4	3-6	1-2.1	1.4-2.5	
60 psi 4.0 kg/cm ²	500	1500	5.0-54	2.0-4.0	2.0-4.5	1.0-2.0	1.0-2.5	3-5.6	4-8	1.4-2.8	1.4-3.5	
100 psi 7.0 kg/cm ²	1000	3000	10-90	3-6	5.0-10	1.0-2.5	1.4-4.0	5-9	7.0-14	1.4-3.5	3-7	
200 psi 14 kg/cm ²	1000	3000	18-180	7-14	10-18	1.0-4.0	5.0-8.0	10-20	14-25	1.4-5.6	7.0-11	
400 psi 28 kg/cm ²	2400	3000	45-360	16-30	16-45	4.0-8.0	5.0-15	22-42	22-63	6.0-11	7.0-21	
600 psi 42 kg/cm ²	2400	3000	75-540	16-50	20-75	5.0-15	6.0-25	22-70	28-105	7.0-21	8.0-35	
1000 psi 70 kg/cm ²	12000	14000	160-900	75-130	50-160	7.0-30	10-85	70-180	70-223	10-42	14-119	
2000 psi 140 kg/cm ²	12000	14000	350-1800	150-200	150-350	20-50	25-110	209-279	209-488	28-70	35-153	
3000 psi 210 kg/cm ²	12000	14000	400-2600	180-250	180-400	30-70	30-90	251-348	251-558	42-98	42-126	

DIFFERENTIAL PRESSURE SWITCHES

APPROXIMATE DEADBAND⁽³⁾ (BUNA-N DIAPHRAGM)

NOMINAL RANGE	OVERPRESSURE RATINGS		LDA	LDS					LDD			
	Static Working Pressure	Proof psi	J,H	S W I T C H E L E M E N T								
				G	J,H	K,F	P	GG	JJ,HH	KK,FF	PP	
30" H ₂ O Diff. 750mm H ₂ O	5.4	21.6	4.0-27	1.5-3.5	2.0-4.0	.5-1.0	.7-2.0	2.0-4.9	2.8-5.6	.7-1.4	.7-2.8	
60" H ₂ O Diff. 1500mm H ₂ O	5.4	21.6	5.0-54	1.5-4	2.5-5.0	.5-1.4	1.0-2.5	2.5-6	3.5-7.0	.7-2.0	2-3.5	
100" H ₂ O Diff. 2500mm H ₂ O	5.4	21.6	8.5-90	4.0-5.5	4.0-8.5	1.0-2.0	1.4-3.0	5.6-7.7	5.6-11.9	1.4-2.8	2-4.2	
150" H ₂ O Diff. 3750mm H ₂ O	5.4	21.6	18-135	5.0-11	10-18	1.5-3.0	2.0-6.0	7.0-15	14-25	2.0-4.2	2.8-8.4	
30 psid 2.0 kg/cm ²	500	2000	3.0-27	1.0-2.5	1.0-3.0	1.0-1.5	1.0-1.8	2-4	3-6	1-2.1	1.4-2.4	
60 psid 4.0 kg/cm ²	500	2000	5.0-54	2.0-4	2.0-4.5	1.0-2.0	1.0-2.5	3-6.0	4-8	1.4-2.8	1.4-3.5	
200 psid 14 kg/cm ²	1000	4000	18-180	10-15	10-18	1.0-4.0	5.0-8.0	14-21	14-30	1.4-5.6	7.0-11	
400 psid 28 kg/cm ²	1000	8000	45-360	16-30	16-45	4.0-8.0	5.0-15	22-42	22-63	5.6-11	7.0-21	

NOTES:

- Switches may generally be set between 15% and 100% of nominal range on increasing pressure. Consult factory for applications where set points must be lower.
- All deadbands are given in English units as shown in the nominal range column. Deadbands shown are for switches with

Buna N diaphragm. Approximate deadbands for optional diaphragms:

- Viton: Multiply Buna N value by 1.4
- Teflon: Multiply Buna N value by 1.2
- Stainless Steel: Multiply Buna N value by 1.7
- Monel: Multiply Buna N value by 1.7

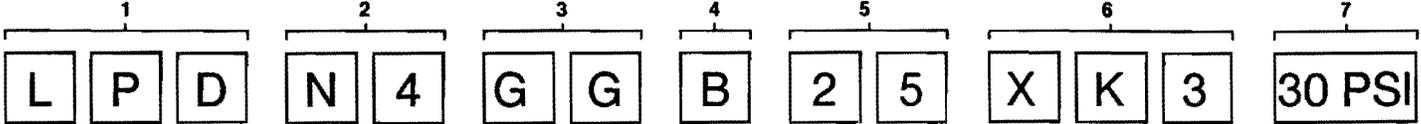
3 Deadbands for LPA and LDA models are adjustable between the values shown.

4 Deadbands for LPS, LPD, LDS and LDD models are fixed within the range of values shown. Manufacturing and parts variances result in variation from one unit to another as shown.

ORDER INFORMATION

L-SERIES PRESSURE AND DIFFERENTIAL PRESSURE SWITCH MODEL NUMBER:

To specify the exact switch desired select entries from appropriate tables as shown in example below.



1 FUNCTION
LPA - Pressure Control, single set point, adjustable deadband
LPD - Pressure Control, two independently adjustable set points, fixed deadband
LPS - Pressure Control, single set point, fixed deadband
LDA - Differential Pressure Control, single set point, adjustable deadband
LDD - Differential Pressure Control, two independently adjustable set points, fixed deadband
LDS - Differential Pressure Control, single set point, fixed deadband

2 ENCLOSURE
N4-NEMA 4, 4X (watertight and corrosion resistant)

5 PRESSURE PORT ⁽¹⁾	
CODE	
25	1/4" NPT Female
06 ⁽¹¹⁾	1/4" NPT Female and 1/2" NPT Male Combination AISI 316 Stainless Steel Only
07 ⁽¹¹⁾	1/2" NPT Female AISI 316 Stainless Steel Only

4 ACTUATOR SEAL ⁽¹⁾				
Code & Material	Process Temp. Limits °F ⁽²⁾	Range		
		VAC "H ₂ O	0-600 psi	1000 psi
B - Buna-N	0 to 150	•	•	•
V - Viton	20 to 300	•	•	•
T - Teflon	0 to 150	•	•	•
S - St. St. ⁽¹¹⁾	0 to 300	•	•	•
P - Monel ⁽¹¹⁾	0 to 300	•	•	•

6 L-SERIES OPTIONS					
CODE	DESCRIPTION	Pressure		Differential Pressure	
		psi	"H ₂ O	psi	"H ₂ O
XCH	Chained Cover	•	•	•	•
XFH	Brass Pressure Conn.	•	N/A	N/A	N/A
XFP	Fungus Proofing	•	•	•	•
XFS ⁽⁶⁾	Factory Adjusted Set Points	•	•	•	•
XG5 ⁽¹²⁾	UL Limit Control to 150" H ₂ O	N/A	N/A	•	N/A
XG6 ⁽¹³⁾	UL Limit Control to 600 psi	•	N/A	N/A	N/A
XG8 ⁽¹⁴⁾	Steam Limit Control to 300 psi	•	N/A	N/A	N/A
XG9 ⁽⁷⁾	Fire Safe Actuator	•	N/A	N/A	N/A
XHX	40 psi Static Press. (D/P Only)	N/A	•	N/A	•
	160 psi Proof Press. (D/P Only)	N/A	•	N/A	•
	100 psi Proof Press. (Press. Only)	N/A	•	N/A	•
XJL	3/4" to 1/2" Reducing Bushing	•	•	•	•
XK3	Terminal Blocks	•	•	•	•
XL9	Low Hardness St. St. Pressure Conn.	•	N/A	N/A	N/A
XNH	Tagging Stainless Steel	•	•	•	•
XPK	Pilot Light(s)	•	•	•	•
XTA	316 St. St. Press. Conn. for "H ₂ O Ranges	N/A	•	N/A	•
XUD	316 St. St. Press. Conn. for psid Ranges	N/A	N/A	•	N/A
X2C ⁽⁹⁾	DPDT with Single Set Point Adjustment	•	•	•	•
X6B ⁽⁸⁾	Cleaned for Oxygen Service	•	N/A	•	N/A

3 SWITCH ELEMENTS FOR LPA & LDA CONTROLS			
CODE	S.P.D.T. Switch Elements UL/CSA Listed		
H	General Purpose	10A, 125/250 VAC 1/2A, 125 VDC 1/4A, 250 VDC	
J	Hermetically Sealed Switch, General Purpose	5A, 125/250 VAC 5A, 30 VDC	
SWITCH ELEMENTS FOR LPD, LPS, LDD AND LDS CONTROLS			
CODE	Switch Elements UL/CSA Listed		
	Single (LS)	Dual (LD)	
K ⁽⁴⁾	KK	Narrow Deadband	15A, 125/250 VAC
F ⁽⁴⁾	FF	Sealed Environment Proof	15A, 125/250 VAC
G ⁽⁵⁾	GG	General Purpose	15A, 125/250/480 VAC 1/2A, 125 VDC 1/4A, 250 VDC
P ⁽³⁾	PP	Hermetically Sealed Switch, Narrow Deadband	5A, 125/250 VAC
J	JJ	Hermetically Sealed Switch, General Purpose	5A, 125/250 VAC 5A, 30 VDC

7 RANGE
Select from Table on Page 3

NOTES:

- These items are wetted by process fluid.
- Ambient operating temperature limits -20 to 150°F, all styles. Set point shift of ±1% of range per 50°F temperature change is normal.
- Estimated D.C. rating, 2.5A, 28 VDC (not UL listed).
- Estimated D.C. rating, .4A, 120 VDC (not UL listed).
- Not UL listed at 480 VAC.
- Supply static pressure for D/P switches.
- St. St. diaphragm only.
- Not available with Buna-N diaphragm.
- Available with LPS and LDS models. G element only.
- U.L. listed to 600 PSI.
- Available on pressure only.
- LDS only.
- LPS only - N/A St. St. diaphragm.
- LPS only - Viton and St. St. diaphragm.

TEMPERATURE SWITCHES

L-Series temperature switches feature a SAMA Class II vapor pressure thermal system. This system provides quick, accurate response to process temperature changes with negligible ambient temperature effects. This is inherent in the design due to the precise relationship that exists between temperature and pressure according to the vapor pressure

laws. A wide selection of sensing bulb and armored capillary lengths are available. The vapor pressure system design features small bulb sizes, making installation easy and cost-effective.

All models feature ± 1 percent of span set point repeatability with very high over-temperature ratings.

These standard designs perform well in applications where shock and vibration could be a problem and should be used with Ashcroft thermowells for bulb protection and ease of installation and maintenance.

STANDARD TEMPERATURE RANGE SELECTION

NOMINAL RANGE		MAX. TEMP.	APPROXIMATE DEADBAND ⁽¹⁾								
			LTA ⁽³⁾	LTS ⁽⁴⁾			LTD ⁽⁴⁾				
°F	°C	°F	SWITCH ELEMENT								
			J,H	G	J,H	K,F	P	GG	JJ,HH	KK,FF	PP
-40 to 60	-40 to 16	400	18 - 90	4.0 - 1.0	9.0 - 18	1 - 3	2 - 5	4 - 10	9.0 - 18	1 - 3	2 - 5
0 to 100	-20 to 40	400	30 - 90	5.0 - 15	10 - 30	1 - 4.5	3 - 7	5 - 15	10 - 30	1.5 - 4.5	3 - 7
75 to 205	20 to 95	400	34 - 120	6.0 - 18	10 - 34	3 - 5.5	3 - 8	6 - 17	10 - 34	3 - 5.5	3 - 8
150 to 260	60 to 125	400	25 - 100	3 - 13	9.0 - 25	1 - 4	3 - 7	3 - 12	9.0 - 25	1 - 4	3 - 7
235 to 375	110 to 190	500	35 - 130	6 - 19	10 - 35	2 - 5.5	3.5 - 8	6 - 18	10 - 35	2 - 5.5	3 - 8
350 to 525	175 to 275	700	40 - 165	5 - 27	15 - 40	3 - 7	3.5 - 11	5 - 25	15 - 40	3 - 7	3.5 - 11
500 to 750	200 to 400	900	50 - 200	20 - 36	36 - 60	5 - 10	6 - 21	20 - 36	36 - 60	5 - 10	6 - 21

NOTES:

- 1 All deadbands are in °F.
- 2 Switches can be set at increase or decrease throughout the nominal range.

- 3 Deadbands for LTA models are adjustable between the values shown.
- 4 Deadbands for LTS and LTD models are

fixed within the range of values shown. Manufacturing and parts variances result in variation from one unit to another as shown.

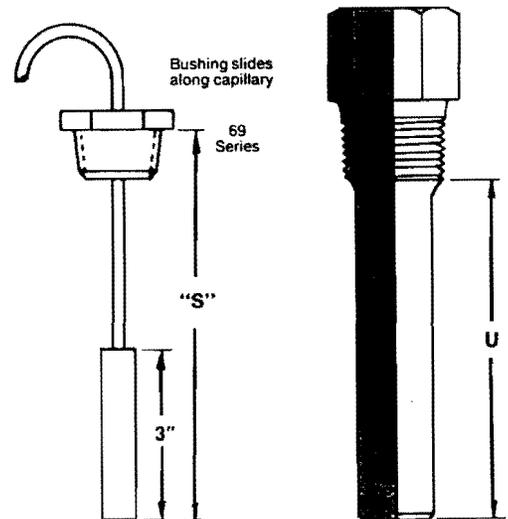
THERMOWELLS

Thermowells must be used on any application where the bulb of the temperature switch may be exposed to pressure, corrosive fluids or high velocity. Additionally, the use of a thermowell permits instrument interchange or calibration check without disturbing or closing down the process.

Ashcroft temperature switches have bulb diameters to match $\frac{3}{8}$ " nominal bore thermowells. The bulbs have a sensitive portion length of $2\frac{1}{4}$ " which can be used with $2\frac{1}{2}$ " "U" dimensioned thermowells or longer. For maximum accuracy a thermowell "U" dimension should be selected to permit complete immersion of the sensitive portion plus 1" when measuring the temperature of liquids; an extra $\frac{1}{2}$ " should be allowed when measuring the temperature of gases.

Thermowell bushings should be used with remote mount temperature switches. We recommend the standard 3" bulb and code 69 Series bushings for use with any thermowell "U" dimension. A split rubber grommet allows easy installation and "S" dimension adjustment.

To order a thermowell, refer to catalog TH-1 and Data/Price sheets for complete information.



ORDER INFORMATION

L-SERIES TEMPERATURE SWITCH MODEL NUMBER:

To specify the exact switch desired select entries from appropriate tables as shown in example below.

1	2	3	4	5	6	7	8
L	T	A	N	4	H	0	5
				-	A	7	030
					X	N	H
							150°-260°F

1 FUNCTION
LTA - Temperature Control, single set point, adjustable deadband
LTD - Temperature Control, two independently adjustable set points, fixed deadband
LTS - Temperature Control, single set point, fixed deadband

4 LINE LENGTH ⁽²⁾		
Direct Mount		
ORDER CODE	Line Length	Style
00	Not Applicable	Rigid
Remote Mount		
05	5'	Capillary with Armor (Std.)
10	10'	
15	15'	
20	20'	
25	25'	

5 THERMAL SYSTEM SELECTION ⁽¹⁾	
LINE MATERIAL	
Direct Mount	
ORDER CODE	DESCRIPTION
	No Entry Required for Direct Mount
Remote Mount	
A7	St. St. Armor (Std.)

2 ENCLOSURE
N4-NEMA 4, 4X (watertight and corrosion resistant)

3 SWITCH ELEMENTS FOR LTA CONTROLS			
CODE	S.P.D.T. Switch Elements UL/CSA Listed		
H	General Purpose	10A, 125/250 VAC 1/2A, 125 VDC 1/4A, 250 VDC	
J	Hermetically Sealed Switch, General Purpose	5A, 125/250 VAC 5A, 30 VDC	
SWITCH ELEMENTS FOR LTD & LTS CONTROLS			
CODE		Switch Elements UL/CSA Listed	
Single (LS)	Dual (LD)		
K ⁽⁶⁾	KK	Narrow Deadband	15A, 125/250 VAC
F ⁽⁶⁾	FF	Sealed Environment Proof	15A, 125/250 VAC
G ⁽⁷⁾	GG	General Purpose	15A, 125/250/480 VAC 1/2A, 125 VDC 1/4A, 250 VDC
P ⁽⁵⁾	PP	Hermetically Sealed Switch, Narrow Deadband	5A, 125/250 VAC
J	JJ	Hermetically Sealed Switch, General Purpose	5A, 125/250 VAC 5A, 30 VDC

6 BULB LENGTH SELECTION ⁽³⁾		
Direct Mount		
ORDER CODE	"S" DIM.	MIN. ⁽⁹⁾ THERMOWELL "U" DIM.
027	2¾"	—
040	4"	2½"
060	6"	4½"
090	9"	7½"
120	12"	10½"
Remote Mount		
030	3"	2½"

7 L-SERIES OPTIONS	
CODE	DESCRIPTION
XCH	Chained Cover
XFP	Fungus Proof
XFS	Factory Adjusted Set Points
XJL	¾" to ½" Reducing Bushing
XK3	Terminal Blocks
XNH	Tagging Stainless Steel
XPK	Pilot Light(s)
X2C ⁽⁸⁾	DPDT with Single Set Point Adjustment

8 STANDARD TEMPERATURE RANGE SELECTION ⁽⁴⁾
Select from Table on Page 5

NOTES:

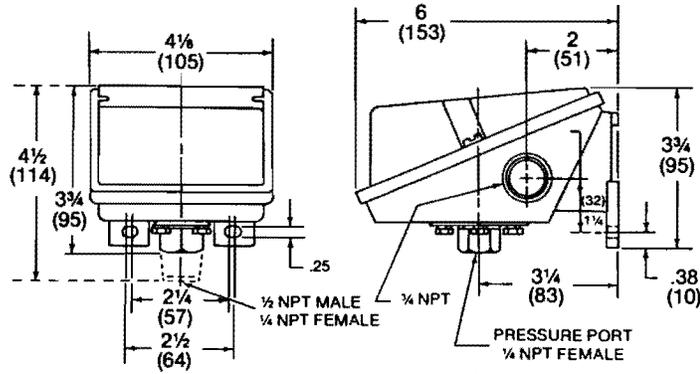
- All thermal systems are 316 St. St.
- Additional line lengths available, consult factory.
- Additional bulb lengths available, consult factory.

- Additional ranges available, consult factory.
- Estimated D.C. rating, 2.5A, 28VDC (not UL listed).
- Estimated D.C. rating, .4A, 120 VDC (not UL listed).

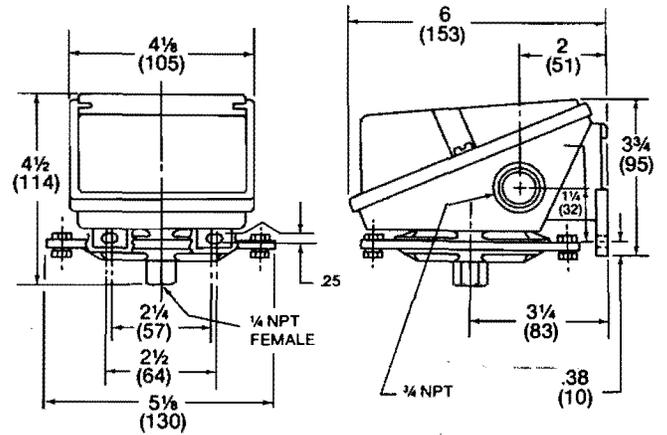
- Not UL listed at 480 VAC.
- Available with LTS and G element only.
- See page 5 for thermowell application information.

DIMENSIONS

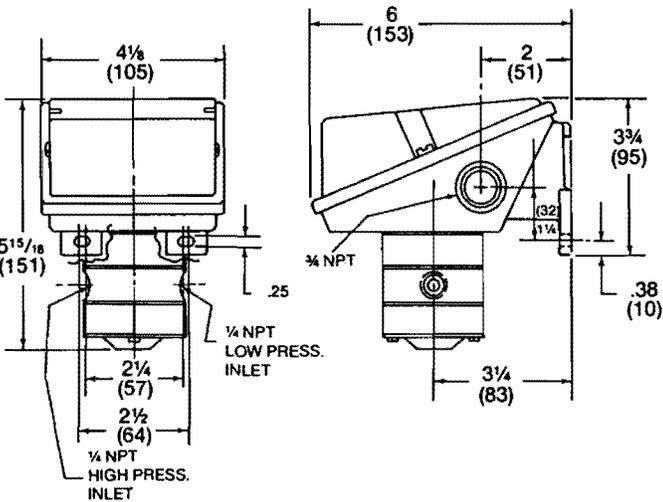
PRESSURE SWITCH — PSI RANGES



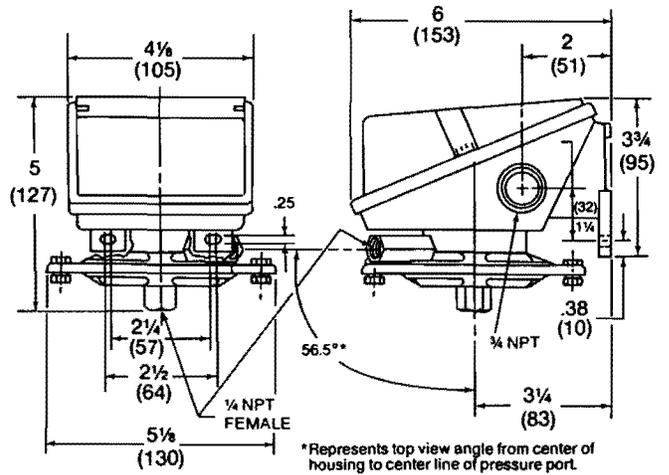
PRESSURE SWITCH — INCHES OF WATER RANGES



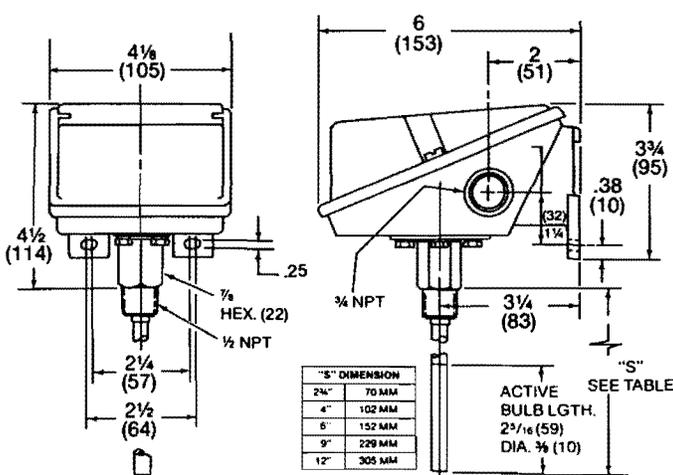
DIFFERENTIAL PRESSURE SWITCH — PSI DIFFERENTIAL RANGES



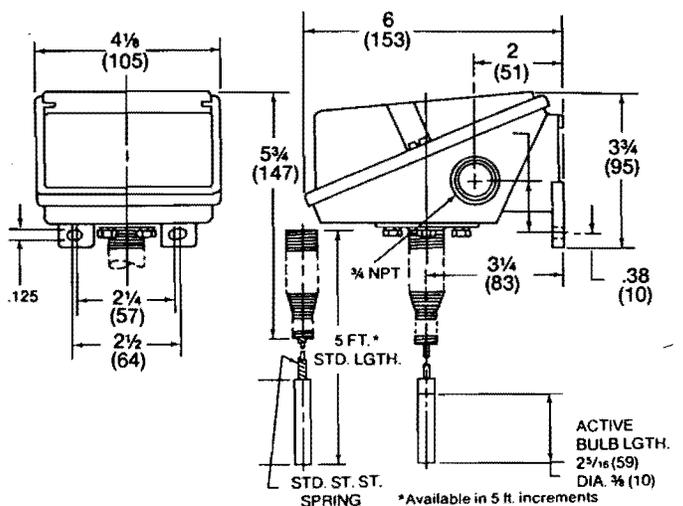
DIFFERENTIAL PRESSURE SWITCH — INCHES OF WATER RANGES



TEMPERATURE SWITCH — DIRECT MOUNT



TEMPERATURE SWITCH — REMOTE MOUNT



Dimensions in () are millimeters.

**CC TROUGH THERMAL SWITCH TESTING
APPENDIX C**

J.B. FITZPATRICK

2/89

D-ZERO ENGINEERING NOTE 3740.214-EN-164-C

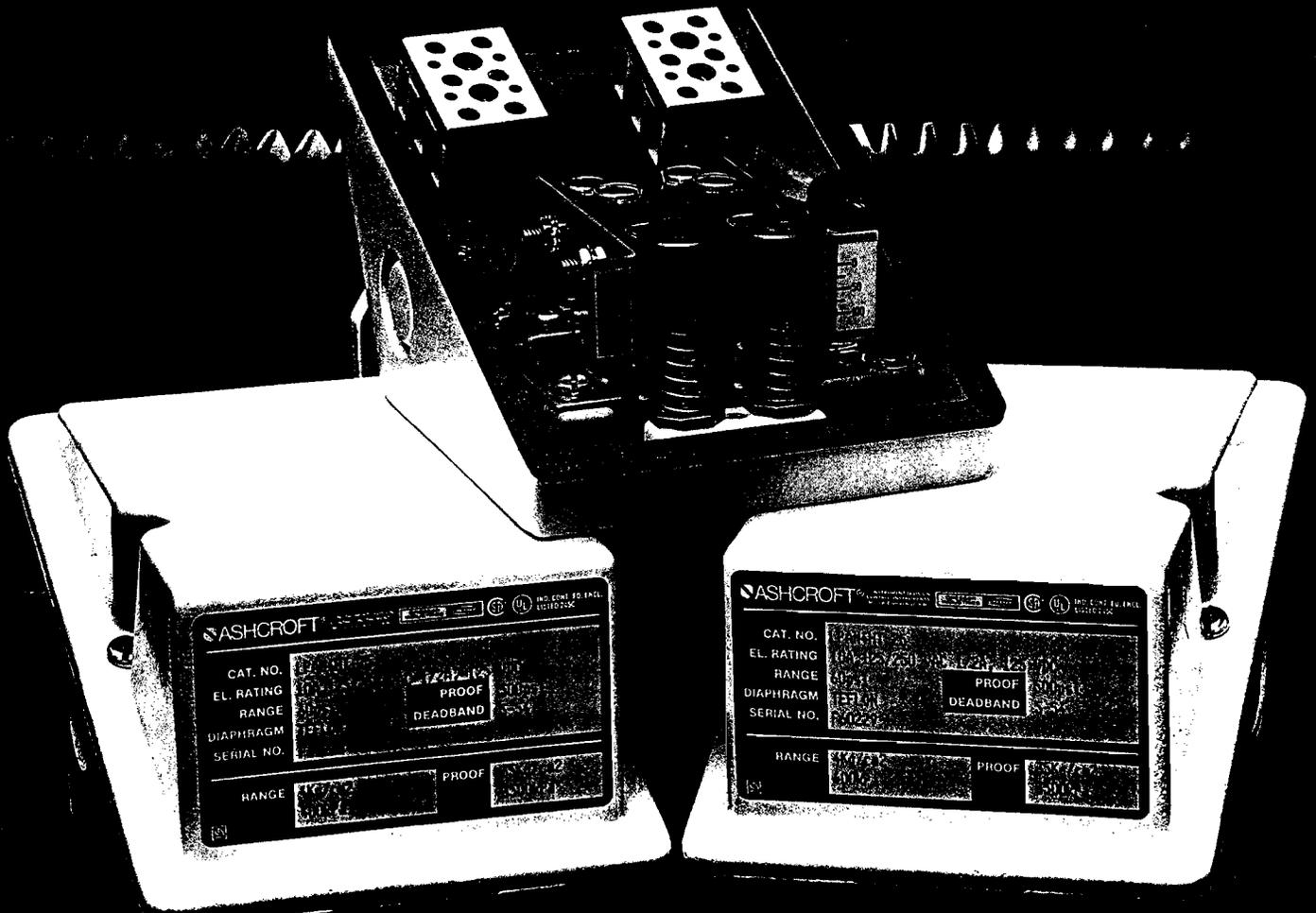
APPROVED:

A handwritten signature in black ink, appearing to read "G.T. McCall", is written over a horizontal line. The signature is cursive and includes a long horizontal stroke at the end.



ASHCROFT®

L SERIES SWITCHES
PRESSURE
DIFFERENTIAL PRESSURE
TEMPERATURE



DRESSER INDUSTRIES 
INSTRUMENT DIVISION
BULLETIN SW-12

	trial	set point #1	reset pt. #1	set point #2	reset pt. #2	deadband #1	deadband #2
1	1	2.9	4.5	4.2	6.1	1.600	1.900
2	2	2.9	3.4	5.6	7.5	0.500	1.900
3	3	3.2	3.7	6.5	7.3	0.500	0.800
4	4	2.9	3.6	6.6	7.0	0.700	0.400
5	5	2.6	3.3	7.7	9.1	0.700	1.400
6	6	2.1	3.3	8.1	9.6	1.200	1.500
7	7	1.7	2.6	8.3	9.7	0.900	1.400
8	8	.1	1.7	8.6	9.7	1.600	1.100
9	9	1.1	2.0	8.2	9.6	0.900	1.400
10	10	1.1	2.1	8.1	8.8	1.000	0.700
11	11	.7	2.2	8.1	9.1	1.500	1.000
12	12	1.2	1.9	8.0	8.4	0.700	0.400

Above #s ARE in °C, & ARE T.C. #2 READINGS. DEADBAND = Reset - set

SWITCH #1

THERMOCOUPLES AFTER ICE equilibrium Reached (Before Readings)

#1 20.1 °C

#2 7.3 °C

#3 11.4 °C

#4 29.7 °C

#5 7.5 °C

After Readings

#4 30.9 °C

#5 7.9 °C

SWITCH #2

THERMOCOUPLES AFTER ICE equilibrium Reached (Before Readings)

#1 23.0 °C

#2 5.6 °C

#3 14.0 °C

#4 24.5 °C (Air conditioner WAS put on in testing environment just before switch #2 was tested.)

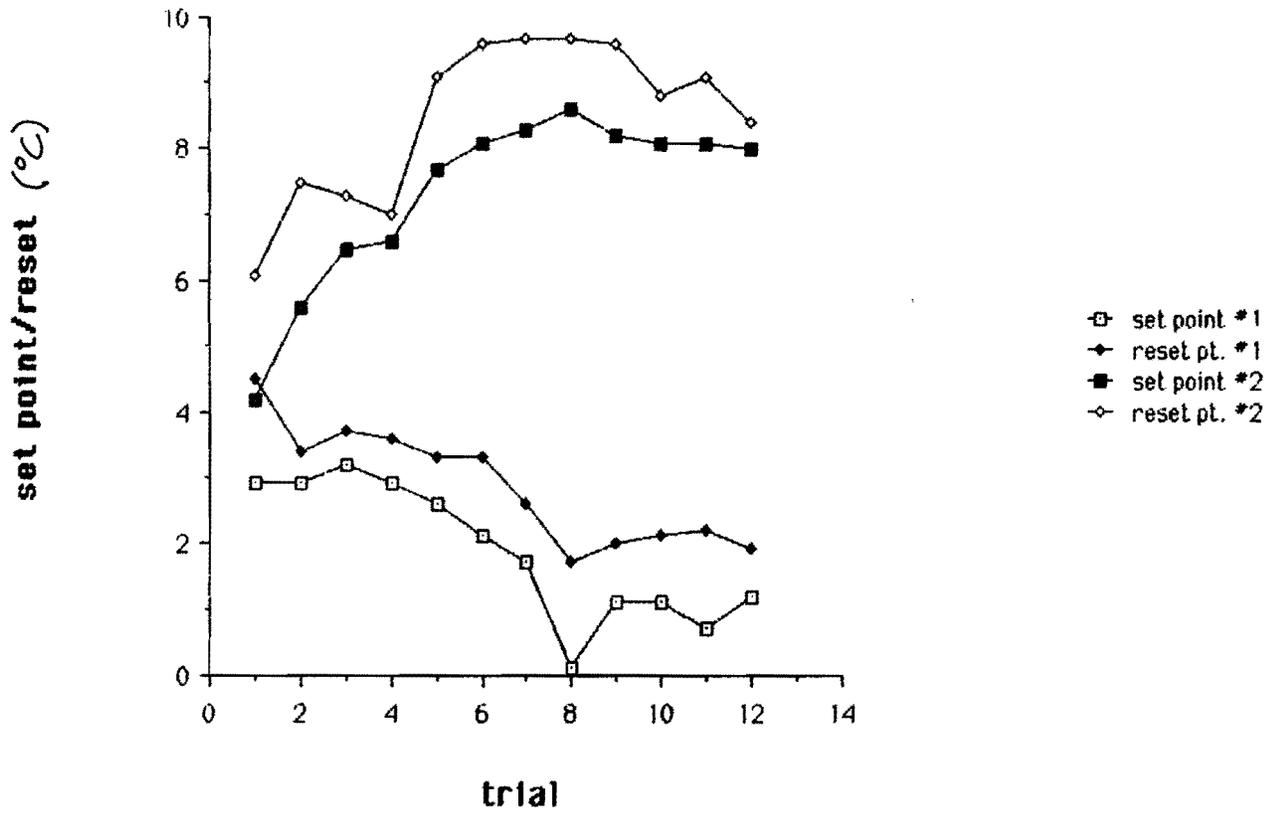
#5 7.9 °C

After Readings

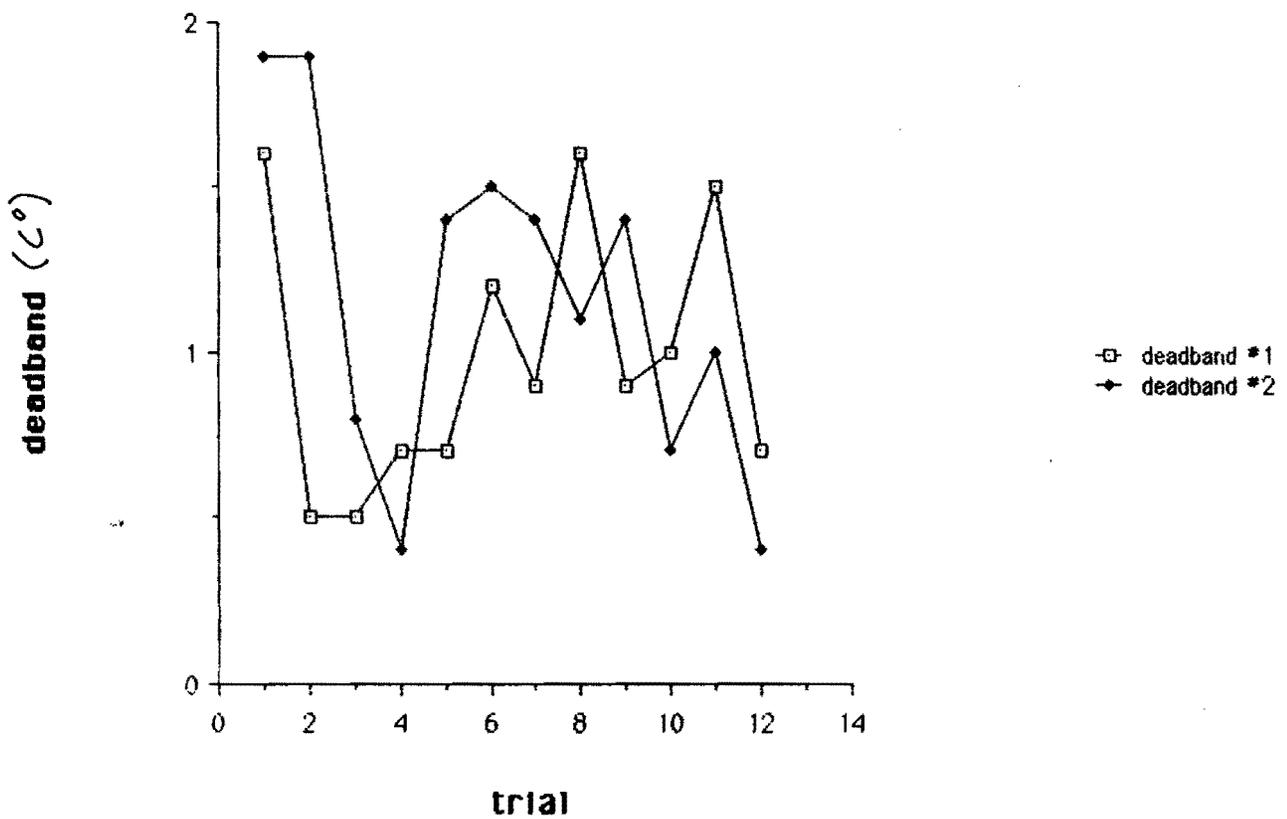
#4 27.5 °C

#5 7.2 °C

Data from "t-switch test data"



Data from "t-switch test data"



Fixed Deadband Type

Series PB



SPECIFICATIONS

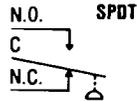
Fixed deadband units have an adjustable set point and a non-adjustable automatic reset point.

HOW TO SELECT

1. Determine the pressure range required.
2. Check that rated overrange pressure rating is sufficient.
3. Read across and select a switch unit with the type of enclosure required.
4. Continue across the same line and select the transducer.
5. See Page 6 for "How to Order."

STANDARD ELECTRICAL RATINGS

5 Amps Res., 125, 250 VAC
 ½ HP 125 VAC, ¼ HP 250 VAC
 ½ Amp Res., 125 VDC
 ¼ Amp Res., 250 VDC



Open Frame Type



Types RD thru RQ
 ¼" N.P.T.

TEMPERATURE RATINGS

Ambient: -4°F. (-20°C.) to 122°F. (50°C.)

Fluid: For Buna "N" or Neoprene Diaphragm
 -4°F. (-20°C.) to 180°F. (82°C.)
 For Viton Diaphragm
 -4°F. (-20°C.) to 250°F. (121°C.)
 For 316 S.S. Diaphragm
 -50°F. (-45°C.) to 300°F. (149°C.)
 For all Polyester Transducers
 Maximum Temperature 180°F. (82°C.)
 except water service where
 maximum is 130°F. (55°C.)

SPECIFICATIONS			SWITCH UNITS				PRESSURE TRANSDUCER UNITS				
Adjustable Operating Range	Rated Overage Pressure (P.S.I.G.) ^①	Fixed Deadband As Listed Below ^①	General Purpose Enclosure	Epoxy-Painted Steel Raintight Enclosure	316 S.S. Raintight Enclosure ^② ③	Open Frame	Aluminum and Buna "N"	Polyester with Threaded Brass Insert and Buna "N"	Brass and Buna "N"	303 S.S. and Viton ^④	All 316 S.S.
			Catalog No.	Catalog No.	Catalog No.	Catalog No.	Catalog No.	Catalog No.	Catalog No.	Catalog No.	Catalog No.
0 - 4 P.S.I.G.	60	.05 P.S.I.G.	PB40A	PB41A	PB44A	PB46A	RD40A11	RD40A71	RD40A21	RD40A32	—
0 - 9 P.S.I.G.	60	.4 P.S.I.G.	PB30A	PB31A	PB34A	PB36A	RD30A11	RD30A71	RD30A21	RD30A32	—
2 - 18 P.S.I.G.	60	.4 P.S.I.G.	PB20A	PB21A	PB24A	PB26A	RD20A11	RD20A71	RD20A21	RD20A32	—
2 - 18 P.S.I.G.	100	.6 P.S.I.G.	PB30A	PB31A	PB34A	PB36A	—	—	—	—	RE30A44
4 - 36 P.S.I.G.	150	.7 P.S.I.G.	PB20A	PB21A	PB24A	PB26A	RE20A11	RE20A71	RE20A21	RE20A32	RE20A44
6 - 60 P.S.I.G.	150	.9 P.S.I.G.	PB10A	PB11A	PB14A	PB16A	RE10A11	RE10A71	RE10A21	RE10A32	RE10A44
10 - 100 P.S.I.G.	200 ^⑤	1.5 P.S.I.G.	PB10A	PB11A	PB14A	PB16A	RF10A11	RF10A71 ^⑤	RF10A21	RF10A32	RF10A44
20 - 200 P.S.I.G.	400 ^⑤	3 P.S.I.G.	PB10A	PB11A	PB14A	PB16A	RG10A11	RG10A71 ^⑤	RG10A21	RG10A32	RG10A44
30 - 300 P.S.I.G.	450	5 P.S.I.G.	PB10A	PB11A	PB14A	PB16A	RH10A11	—	RH10A21	RH10A32	RH10A44
40 - 400 P.S.I.G.	500	6 P.S.I.G.	PB10A	PB11A	PB14A	PB16A	RJ10A11	—	RJ10A21	RJ10A32	RJ10A44
60 - 600 P.S.I.G.	2000	12 P.S.I.G.	PB20A	PB21A	PB24A	PB26A	—	—	RL20A21	RL20A42 ^⑤	—
100 - 1000 P.S.I.G.	2000	15 P.S.I.G.	PB10A	PB11A	PB14A	PB16A	—	—	RL10A21	RL10A42 ^⑤	—
180 - 1800 P.S.I.G.	4500	36 P.S.I.G.	PB20A	PB21A	PB24A	PB26A	—	—	RN20A21	RN20A42 ^⑤	—
300 - 3000 P.S.I.G.	4500	45 P.S.I.G.	PB10A	PB11A	PB14A	PB16A	—	—	RN10A21	RN10A42 ^⑤	—
0 - 6000 P.S.I.G.	7500	90 P.S.I.G.	PB10A	PB11A	PB14A	PB16A	—	—	—	RQ10A42 ^⑤	—

Notes:

- ① Approximate deadband values are given for the midpoint of the range. Many production units will have smaller deadbands than shown.
- ② Raintight units are designed to Types 3 and 3S with 7/16" clearance hole to accept standard hubs and connectors. Units will meet Watertight Type 4 (also 4X and 6 for stainless

steel units) when ordered with suffix "1" conduit hub (see Page 45).

- ③ Rated overrange pressure on RF10A71 is 150 P.S.I.G. and on RG10A71 is 300 P.S.I.G.
- ④ Transducers ending in 42 have 316 S.S. bodies, not 303 S.S.
- ⑤ Available only as assembled switches.

figure 1

Standard Specifications



ELECTRICAL — The standard electrical snap acting switching element is a single-pole, double-throw switch which has three terminals: common, normally closed, and normally open. The action of the switch is such that the common is connected to either the normally closed or the normally open contact. The snap action switches which are used in the TRI-POINT pressure switches are manufactured by several different companies. Generally, these have at least

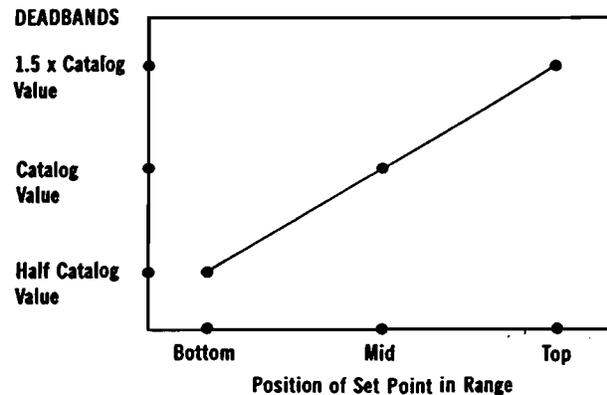
a 15 amp, 250 VAC electrical rating. As a result of extensive life testing and the submittal of TRI-POINT switches to Underwriters' Laboratories, Inc. for limit control listing (requiring 100,000 cycles of electrical life), the switches have been derated to a 5 amp rating at 125 or 250 VAC. The individual electrical ratings of each switch are published on the catalog pages.

TEMPERATURE — Standard ambient and fluid temperatures have been established in accordance with recognized rating procedures. These temperature ratings are published on the individual listing pages for each switch. Ambient temperature ranges both above and below the standard ambient temperature

are available. For higher ambient temperatures, special constructions are listed in the Options and Accessories Section (Page 45). Constructions for ambient and fluid temperatures down to -40°F. are available for special applications. Consult ASCO for specific recommendations.

DEADBANDS — The deadband is the difference between the values at which the switch sets and resets. Deadbands are listed in the specification tables at nominal values. They are representative of the deadbands of the units at the middle of the range. These deadband values are approximate and, although some individual switch units have wider deadbands, most units will have narrower deadbands. The deadband values for the full range adjustable deadband switches and limited adjustable deadband switches indicate the values through which the deadband may be adjusted. Generally, as the set point is adjusted through the operating range, the deadband will vary. Normally, it will become narrower as the set point is towards the bottom of the range, and will become wider when the set point is towards the top of the range. The

graph shown below indicates representative trends of this type of deadband variation.



Temperature switch deadbands are a result of the characteristics of the vapor pressure curve as well as other factors. Normally, this results in a deadband which is narrower in the top third of the range than in the bottom third of the range. The values published are nominal and representative of mid-range set points.

figure 2

PRO-QUIP, INCORPORATED
418 Shawmut Avenue
La Grange, Illinois 60525
312-352-5732

ASHCROFT

P-Series Industrial Controls



DRESSER INDUSTRIES 
INSTRUMENT DIVISION
Bulletin SW-11

Introduction	2
Product Selection	2-3
Features and Benefits	4-5
Pressure Controls	6
Differential Pressure Controls	7
Temperature Controls	8-9
Options & Dimensions	10-11

Introduction

Over the past 125 years, the Ashcroft trademark has meant quality, versatility and reliability in the instrumentation marketplace. Pressure control instruments in service for many years still provide dependable measurements. This standard of performance continues in the Ashcroft "P" Series control.

P-Series offers uncompromising end user reliability and safety. For maximum protection against corrosion, a rugged die cast aluminum enclosure with watertight gaskets and two separate chambers is featured. The upper chamber allows easy access to the switches and

wiring. The lower enables easy set point adjustment. There is no possibility of accidentally changing the set point while wiring, saving on down-time and installation dollars. A wide variety of precision switch elements are available to meet every application requirement, including hermetically sealed contacts for added reliability and safety. The actuators we use have been proven in more than twenty years of service in the world's plants and mills. Multiple features such as dual set points and adjustable deadbands are offered. Special designs are available for fire safety, corrosive environment (process and ambient) and other stringent requirements. Ease of use is stressed to improve reliability of the installation.

P-Series switches are currently being successfully used in pulp and paper mills, refineries, chemical and petrochemical plants, water and sewage treatment plants, steel mills, utility plants and other tough environments. Typical applications are on compressors, pumps, boilers and burners, turbines, blowers, reverse osmosis systems, filters and presses.

Product Selection Information

WARNING: All controls should be selected considering the media and ambient operating conditions. Improper application can be detrimental to the switch, cause failure and possibly personal injury or property damage.

The information in this catalog is offered as a guide to assist in making the proper selection of Ashcroft controls.

Additional information is available from Dresser Instrument Sales. Offices are listed on the back cover.

Actuator

The actuator is normally exposed to process fluid and must therefore be chemically compatible with it. The following may be used to help select actuator type: **Sealed Piston/Cylinder Pressure Actuator (page 5)**

This actuator consists of a calibrated piston and cylinder. Process pressure on the piston area causes it to overcome the adjustment spring force, and actuates a snap-action switch through the push rod. A diaphragm and O-ring seal the process media from this mechanism. These seals are available in Buna N[®] Teflon, and Viton. The standard process connection is AISI 304 stainless steel.

Low Range Pressure and Differential Pressure Actuator (30" to 150" H₂O Diff.) (Not Shown)

The low range actuator is the diaphragm type. The process connections, diaphragm, O-ring and housings are exposed to the process media and must be compatible with it. All hardware, housing and process connections are carbon steel. Diaphragms are available in Buna N, Viton and Teflon. Optional stainless steel housings are available. (Option XTA)

High Range Differential Pressure Actuator (15 to 400 psid) (page 5)

This actuator is designed to withstand vibration, high static and overpressure situations. The standard pressure connections are nickel-plated brass. A dual piston and cylinder mechanism is sealed from process fluids by diaphragm and O-rings. These are available in Viton, Buna N and Teflon. Optional stainless steel pressure connections are available. (Option XUD)

Temperature Actuator — Remote Shown (page 5)

Ashcroft temperature controls operate on the vapor pressure principle: The vapor pressure produced is applied to a sensing element, which in turn actuates a switch. This is known as a SAMA Class II system. Various filling materials are used, including Propane, Butane, Freon 113, N. Propyl alcohol and Xylene. Since the system is limit filled, high overtemperature capability is possible. At high temperature the fluid is completely vaporized.

The interface between liquid and vapor is the point at which sensing occurs. This is the "sensitive" portion of the bulb. Bulb extensions and capillary length have little effect on the set point, regardless of ambient temperature variations; therefore, no ambient compensation is required. For best results, the bulb should be mounted within 60° of vertical.

Repeatability

All P-Series controls feature ±1% of range repeatability. For best results, select a range so that setpoint is in the upper two-thirds of range.

Enclosure

The enclosure protects the switch element and mechanism from the environment. It is important that switch covers be replaced and electrical connections are made properly to keep moisture and environment out.

Two enclosure types are offered:

NEMA 4 enclosures are fully gasketed and epoxy coated with two ¾" NPT electrical connections. These enclosures meet NEMA 3, 4, and 13 requirements.

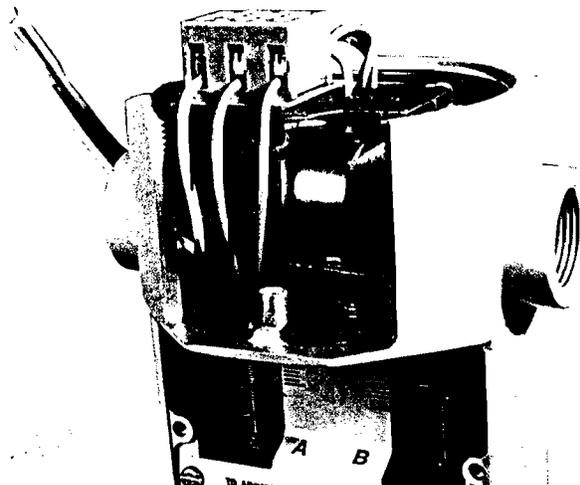
NEMA 7 enclosures are epoxy coated with two ¾" NPT electrical connections. When installed properly, these enclosures meet the requirements of the National Electrical Code for Class 1, Division 1 & 2, Groups B, C & D and Class II, Division 1 & 2, Groups E, F & G.

Optional fungus-proofing (XFP), chained cover (XCH) and breather drain (X2B), are available with both enclosures.

Wiring is brought into each type through the conduit connector and connections are made directly to terminals on the snap-action switch. The enclosure serves as a junction box as well. An optional separate terminal block is available (Option XK3). This permits quicker and more convenient wiring.

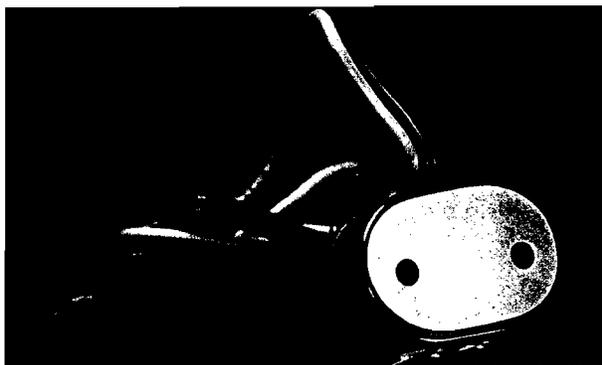
Switch Element

The electrical switches are Underwriters Laboratories (UL) listed S.P.D.T. snap-acting switches. They are available in many variations which are compatible with most electrical loads. The application should be reviewed to verify the electrical ratings are suitable for the intended use. Dresser will test a switch with a customer's electrical load if there is a question of compatibility.



Hermetically Sealed Switch

P-Series is available with hermetically sealed switch elements for improved reliability. The Ashcroft hermetically sealed module provides uncompromising contact protection in harsh or corrosive environments. It also satisfies the safety requirements for installation in Division II hazardous areas.



Features:

- UL® recognized component, Guide WSQ2, File E85076.
- All stainless steel welded construction.

Deadband

Deadband (Switch Differential, Hysteresis, Actuation, Value) is the difference between switch actuation point on increasing pressure and switch deactuation point on decreasing pressure. There is always a small difference which varies with diaphragm material and switch element type. In addition, for a given combination, deadband will vary slightly from unit to unit because of normal tolerances in parts and materials. For a given switch, values tend to increase slightly with higher setpoints within the range.

Values given in the table on page 5 are approximate values for Buna N diaphragms. Other diaphragm materials usually produce wider deadbands. For additional information, please contact the factory.

P-Series Deadbands

The P-Series Controls have different deadband characteristics:

PA series controls feature a single setpoint with adjustable deadband. The set and reset points are adjustable throughout at least 80% of range.

PD and PS series controls feature fixed deadbands. PD series controls feature two independently adjustable setpoints while the PS series controls feature one adjustable setpoint. Each setpoint has a fixed deadband associated with it. The deadband cannot be adjusted, but varies with range, diaphragm, switch element and parts as discussed above.

For minimum deadband, Code K switch element and Buna-N diaphragm should be specified where compatible with process fluid.

Electrical Switches:

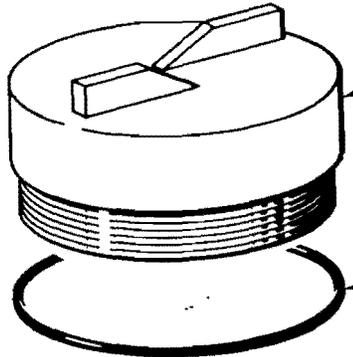
Switch Elements for PA Controls		
ORDER CODE	S. P.D.T. Switch Elements UL/CSA LISTED	
H	General purpose	10A, 125/250/277 VAC ½A, 125 VDC ¼A, 250 VDC
J	Hermetically sealed switch, general purpose	5A, 125/250 VAC 5A, 30 VDC

Switch Elements for PD and PS Controls

ORDER CODE	Switch Elements UL/CSA LISTED		
Single (PS)	Dual (PD)		
⁽²⁾ K	KK	Narrow deadband	15A, 125/250 VAC
⁽²⁾ F	FF	Sealed environment proof	15A, 125/250 VAC
⁽³⁾ G	GG	General purpose	15A, 125/250/480 VAC ½A, 125 VDC ¼A, 250 VDC
⁽¹⁾ P	PP	Hermetically sealed switch, narrow deadband	5A, 125/250 VAC
J	JJ	Hermetically sealed switch, general purpose	5A, 125/250 VAC 5A, 30 VDC

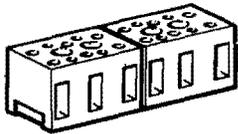
1. Estimated D.C. rating, 2.5A, 28 VDC. (Not UL listed)
 2. Estimated D.C. rating, 4A, 120 VDC. (Not UL listed)
 3. Not UL listed at 480 VAC

4 Features and Benefits, Enclosure and Switch Element

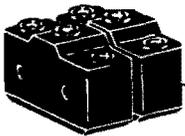


Epoxy-Coated Aluminum Enclosure and Cover for Corrosion Resistance
Available in NEMA 4 or NEMA 7/9 Explosion-Proof Construction

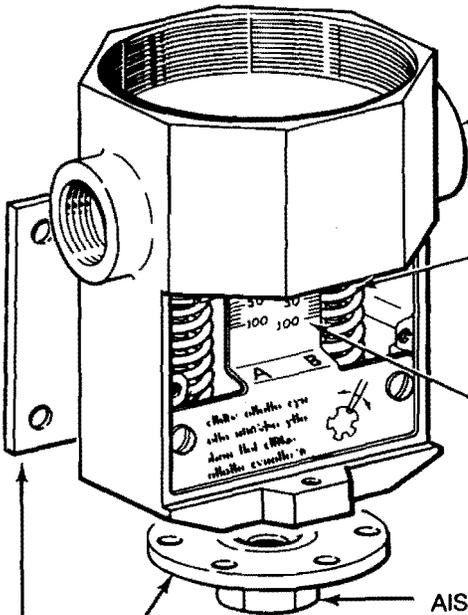
Buna N O-Ring for Sealing Switch Chamber



Ready Access to Switch Terminals for Easy Wiring (Terminal Block Optional)



U.L. and CSA Listed Instrument Quality Snap Action Switch for Reliable Operation



Two 3/4" Electrical Conduit Hubs for Ease of Wiring

Easy Setpoint Adjustment(s)

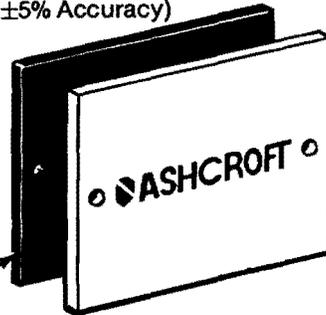
Single Switch —
B = Setpoint Adjustment
A = Resetpoint Adjustment
Dual Switch — (5% to 90% of Range Separation)
A = Setpoint Adjustment, Switch 1
B = Setpoint Adjustment, Switch 2

Easy to Read Scale for Approximate Setpoint Indication (±5% Accuracy)

AISI 304 Pressure Port

Rugged diaphragm sealed piston actuator for long life is standard for most ranges

Mounting Bracket for Surface Mount Std.
Pipe Mount Available



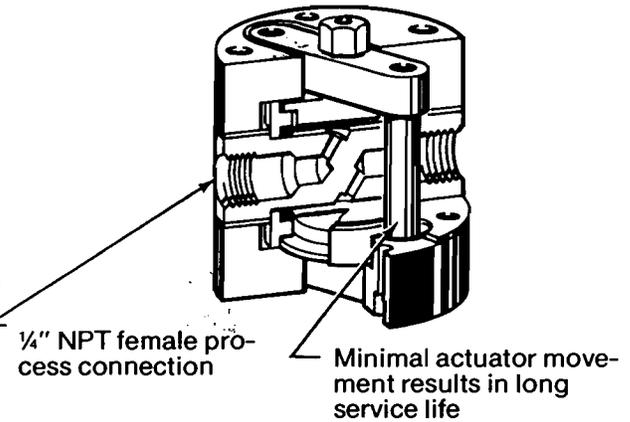
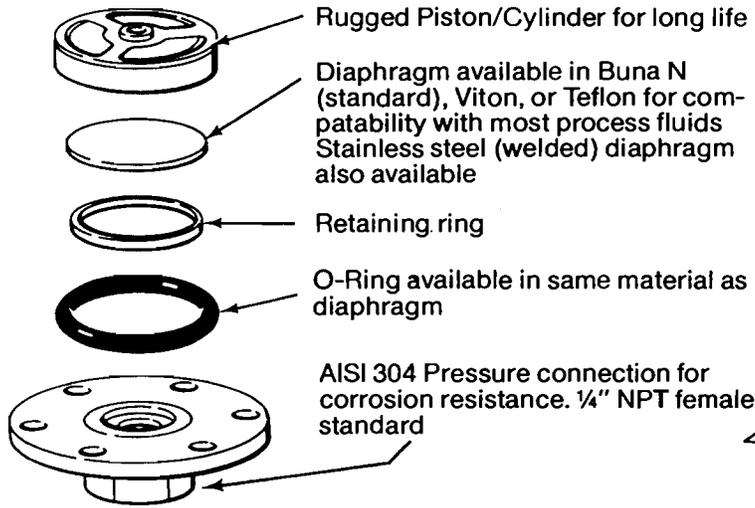
Cover and Neoprene Gasket for Adjustment Chamber Protection

Typical Diaphragm Sealed Piston Actuator

Fourteen pressure ranges from vacuum to 2000 psi

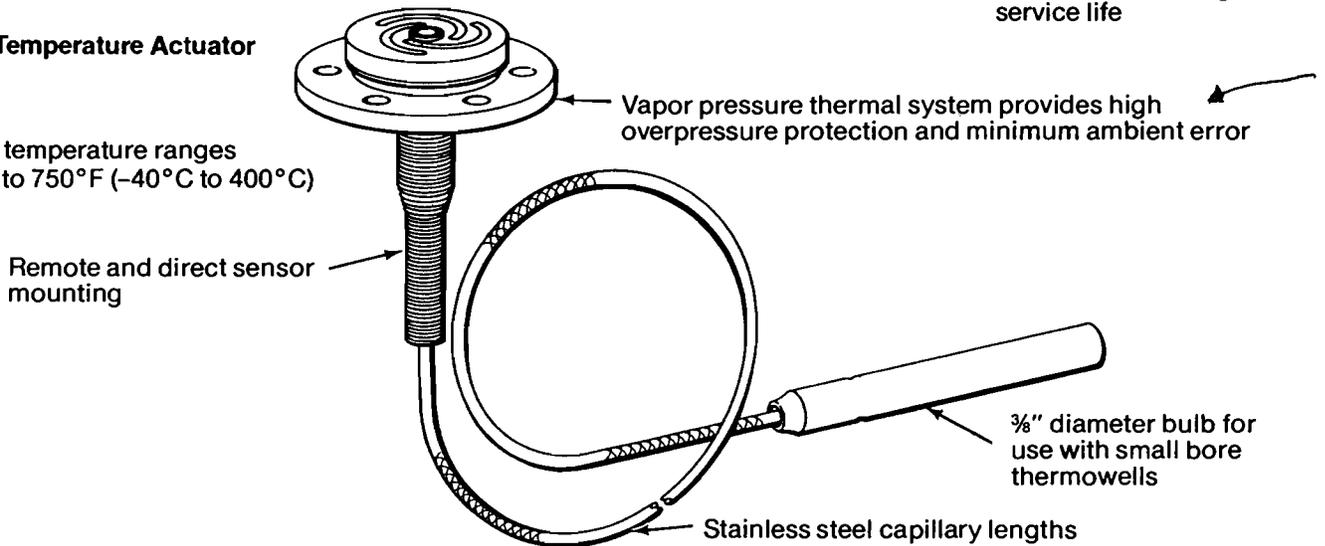
Typical High Range Differential Pressure Actuator

Ten different pressure ranges from 3-30 inches H₂O to 60-400 psid working pressure to 2000 psi



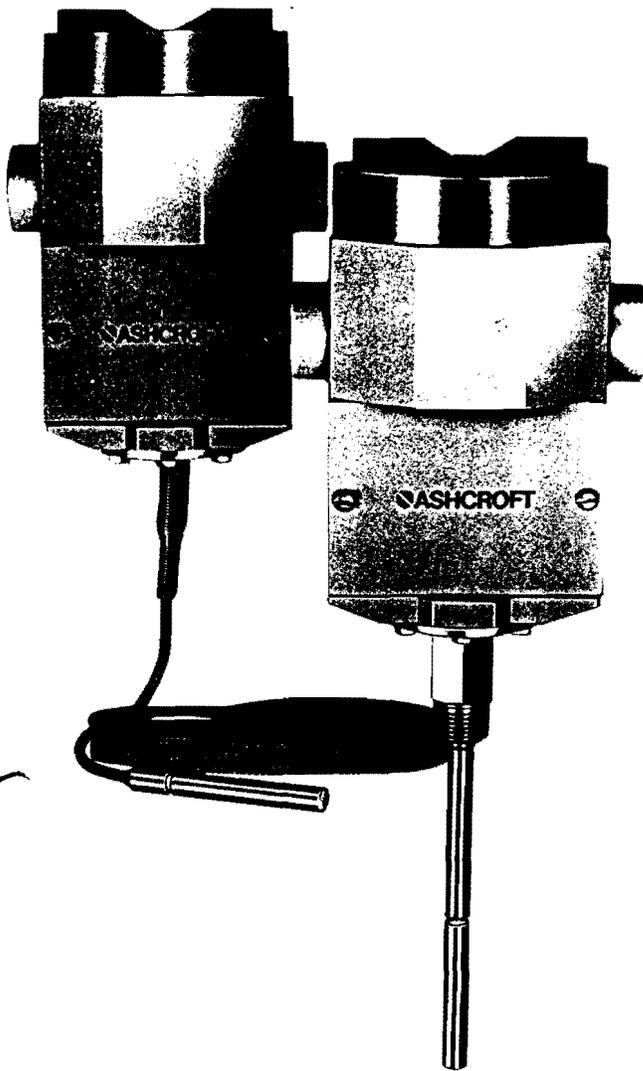
Typical Temperature Actuator

Seven temperature ranges -40°F to 750°F (-40°C to 400°C)



	Pressure		Differential Pressure		Temperature
	psi Ranges	in. H ₂ O Ranges	psid Ranges	in. H ₂ O Ranges	
Connection (Std.)	1/4" NPT female	1/4" NPT female	1/4" NPT female	1/4" NPT female	1/2" NPT (For Use With Thermowells)
Ranges	10 Ranges VAC thru 3000 psi	4 Ranges 15" H ₂ O VAC thru 150" H ₂ O	6 Ranges 0 thru 400 psid	4 Ranges 30" thru 150" H ₂ O Diff.	7 Ranges (-40 thru 750°F -40 thru 400°C)
Repeatability (% of Range)	±1	±1	±1	±1	±1
Actuator Type	Diaphragm Sealed Piston	Diaphragm	2 Opposed Diaphragm Sealed Pistons	Diaphragm	SAMA Class II Thermal System
Proof Pressure	500-1200 psi	20 psi Standard 160 psi Optional	2000-18,000 psi	20 psi Standard 160 psi Optional	—
Wetted Materials Pressure Port	AISI 304	Carbon Steel AISI 316 (optional)	Brass AISI 316 (optional)	Carbon Steel AISI 316 (optional)	AISI 316
Diaphragm and O-Ring	Buna N (standard) Viton, ⁽¹⁾ Teflon ⁽¹⁾ AISI 316 ⁽¹⁾	Buna N (standard) Viton, ⁽¹⁾ Teflon ⁽¹⁾	Buna N (standard) Viton, ⁽¹⁾ Teflon ⁽¹⁾	Buna N (standard) Viton, ⁽¹⁾ Teflon ⁽¹⁾	N/A
UL Listing (File)	E34743-(N4) E38812-(N7)	E34743-(N4) E38812-(N7)	E34743-(N4) E38812-(N7)	E34743-(N4) E38812-(N7)	E66894-(N4) E78208-(N7)

1. Optional materials — See tables on pages 6 & 7 for application information.



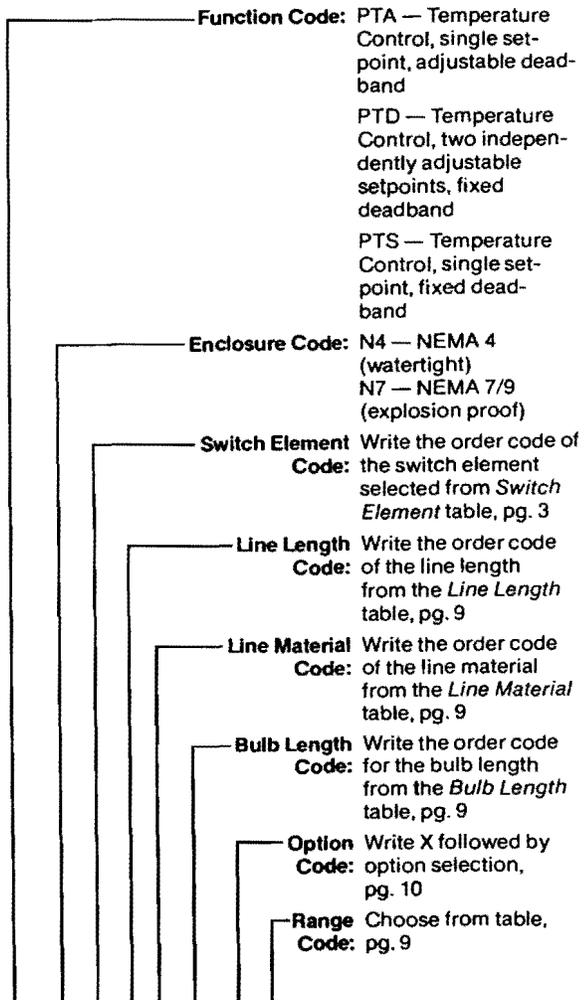
Description Ashcroft Temperature Controls are designed to maintain temperatures at a desired set point, actuate signals and alarms and for high or low, cut-in/out service.

Ruggedness and reliability are inherent in the design of these compact snap-action switches, with shock and vibration resistance providing long service life. Temperature controls are available in remote and direct mounting styles. Armor is standard on remote mount controls.

A wide temperature range selection from -40°F to 525°F is offered to meet many applications. The vapor pressure thermal system provides quick response as well as $\pm 1\%$ of range repeatability.

Applications include: pumps, compressors, washers, degreasers, evaporators, fluid power systems, film processing, food processing, ground support equipment, heat exchangers, hydraulic systems, lubrication systems, marine equipment, textile machinery, heating and air conditioning equipment.

How to order P Series Temperature Controls



PTD N4 GG 10 A7 030 XNH 75/205°F

- Notes:
 1. Additional line lengths available, consult factory
 2. Additional bulb stem lengths available, consult factory.

Thermal System Selection

Line Material	
Direct Mount	
Order Code	Description
Leave Blank	No Entry Required for Direct Mount
Remote Mount	
A7	St. St. Armor (Std.)

All Thermal Systems are 316 St. St.

Line Length		
Direct Mount		
Order Code	Line Length	Style
00	Not Applicable	Rigid
Remote Mount		
05	5'	Capillary with Armor (Std.)
10	10'	
15	15'	
20	20'	
25	25'	

Bulb Length Selection

Direct Mount		
Order Code	"S" Dim.	Min. Thermowell "U" Dim.
027	2 1/4"	—
040	4"	2 1/2"
060	6"	4 1/2"
090	9"	7 1/2"
120	12"	10 1/2"
Remote Mount		
030	3"	2 1/2"

Accessories

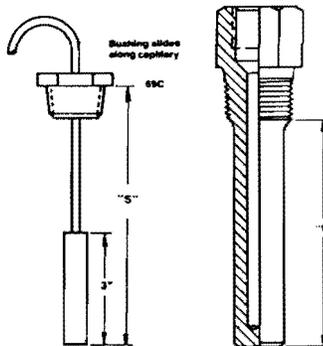
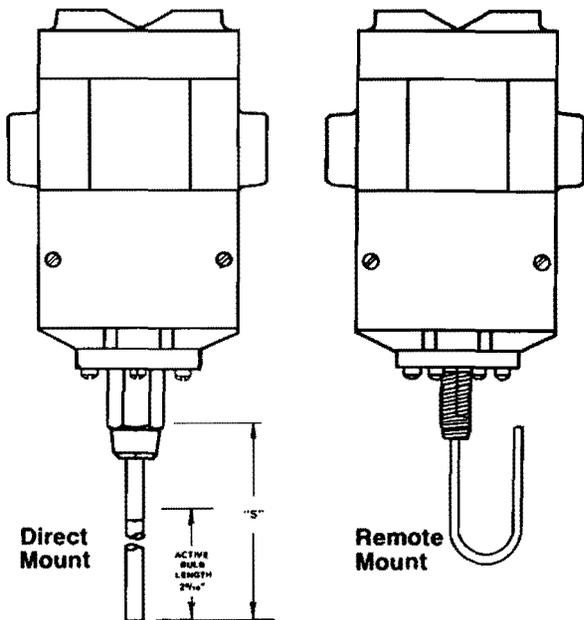
Thermowell Bushing		
Order Code	Conn.	Material
69C	1/2 NPT	St. St.

Thermowells

Ashcroft temperature switches have bulb diameters to match 3/8" nominal bore thermowells. The bulbs have a sensitive portion length of 2 1/4" which can be used with 2 1/2" "U" dimensioned thermowells or longer. For maximum accuracy a thermowell "U" dimension should be selected to permit complete immersion of the sensitive portion plus 1" when measuring the temperature of liquids; an extra 3" should be allowed when measuring the temperature of gases.

Optional thermowell bushings should be used with remote mount temperature switches. We recommend the standard 3" bulb and code 69 Series bushings for use with any thermowell "U" dimension. A split rubber grommet allows easy installation and "S" dimension adjustment.

To order a thermowell, refer to catalog TH-1 and Data/Price sheets for complete information.



Temperature Range Selection

Nominal Range		Max. Temp.	Approximate Deadband				
			PTA ⁽²⁾		PTS and PTD ⁽³⁾		
°F	°C	°F	G, J	K, KK	G, GG	P, PP	J, JJ
-40 to 60	-40 to 16	400	18-90	1.0-2.0	2.0-10.0	1.0-5.0	9.0-18.0
0 to 100	-20 to 40	400	30-90	1.0-3.0	2.0-15.0	1.5-7.0	10.0-30.0
75 to 205	20 to 95	400	34-120	1.5-3.5	2.0-17.0	1.5-8.0	10.0-34.0
150 to 260	60 to 125	400	25-100	1.0-2.5	2.5-12.0	1.0-7.0	9.0-25.0
235 to 375	110 to 190	500	35-130	1.0-3.5	2.0-18.0	1.5-8.0	10.0-35.0
350 to 525	175 to 275	700	40-165	2.0-4.5	3.0-25.0	2.5-11.0	15.0-40.0
500 to 750	200 to 400	900	50-200	4.0-9.0	6.0-50.0	5.0-22.0	30-80

Notes:

- 1. All deadbands listed in °F.
- 2. Adjustable deadband limits.
- 3. Fixed deadband tolerance.

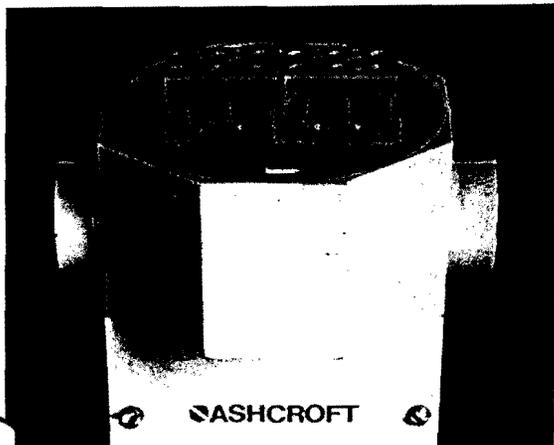
P-Series Switch Options

Code	Description	Applicable Control Type				
		Pressure		Diff. Pres.		Temp.
		psi	in. H ₂ O	psid	in. H ₂ O	
XNH	Tagging Stainless Wired	•	•	•	•	•
X06	Pressure Connection 1/2" NPT Male, 1/2" NPT Female	• ²	• ³		• ³	
XCH	Chained Cover	•	•	•	•	•
XHX	High Pressure, 40 psi static, 160 psi proof		•		•	
XTA	316 Stainless Steel Process Conn.		•		•	
XK3	Terminal Block	•	•	•	•	•
X6B	Cleaned for Oxygen Service	•		•		
XFS	Factory Adjusted Set Point	•	•	•	•	•
XFP	Fungus Proofing	•	•	•	•	•
X2B	Breather Drain	•	•	•	•	•
	Diaphragm Seal	•	•	•	•	•
XTM	Pipe Mount Bracket	•	•	•	•	
XPK	Pilot Light	•	•	•	•	•
X07	1/2" Female Pressure Conn.	•				
XUD	316 St. St. Pressure Conn.			•		
XG9	Fire Safety Actuator	• ⁴				
XC8	CSA Approval	• ⁵	•	•	•	•

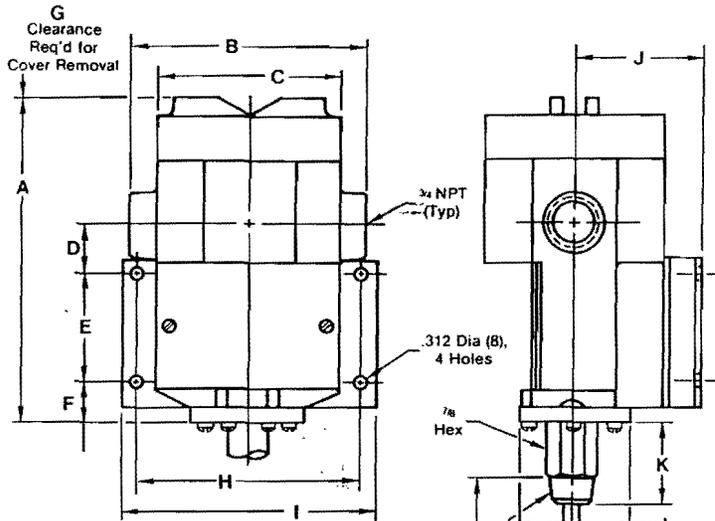
- Notes:
1. Advise Static or Working Pressure for Differential Pressure Switches.
 2. Standard on 1000, 2000 and 3000 psi ranges.
 3. High Pressure (bottom connection) only.
 4. St. St. Diaphragm only.
 5. Standard on N4 enclosure.

Terminal Block

P-Series enclosures may include terminal blocks. For fast, reliable connections, a clamping style block is used. To order terminal blocks, add option XK3.



Temperature Switch — Direct Mount



A	B	C	D	E	F	G
7 1/16	5	3 3/8	1 1/16	2 5/16	1 5/16	1 1/16
(179)	(127)	(98)	(27)	(59)	(24)	(17)
H	I	J	K	L	M	N
4 3/4	5 1/2	2 3/4	1 13/16	2 5/16	2 5/16	3/8
(121)	(140)	(70)	(46)	(59)	(59)	(9.5)

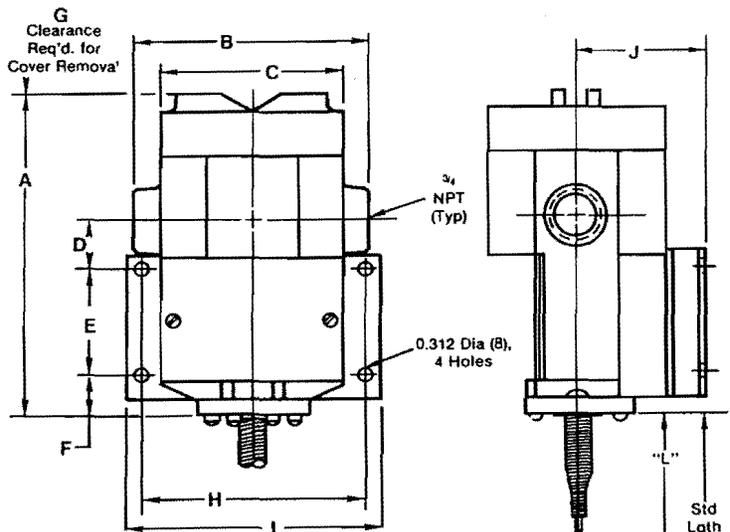
N4 — 5.8 lb. (2.6)
N7 — 6.4 lb. (2.9)

"S" See Table

4"	(102)
6"	(152)
9"	(229)
12"	(305)
24"	(70)

Active Bulb Lgth.

Temperature Switch — Remote Mount



"G" Dimension

3"	(76)
6"	(152)
7 1/2"	(191)
10 1/2"	(267)
13 1/2"	(343)

N4 — 6.8 lb. (3.1)
N7 — 7.4 lb. (3.4)

A	B	C	D	E	F	G	H	I	J	K	L
7 1/16	5	3 3/8	1 1/16	2 5/16	1 5/16	1 1/16	4 3/4	5 1/2	2 3/4	2 5/16	3/8
(179)	(127)	(98)	(27)	(59)	(24)	(17)	(121)	(140)	(70)	(59)	9.5