

# LICENSEE EVENT REPORT

CONTROL BLOCK (PLEASE PRINT OR TYPE ALL REQUIRED INFORMATION)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

## EVENT DESCRIPTION AND PROBABLE CONSEQUENCES (10)

During refueling outage, while performing SI 4.2.B-7, setpoints for reactor low-pressure switches PS-3-74B, PS-68-95, and PS-68-96 were found to actuate outside of T.S. Tables 3.2.A and 3.2.B limits. The average out of tolerance was 2.92 percent. There was no danger to the health or safety of the public. Previous similar events: BPRO 50-259/78016, 79008, 80058, 81029, 81032; 260/78002, 79017, 79024, 80022, 80057, 81023; 296/79007, 79012, 79028, 80022, 80030, 80045, 80052, 81007.

SYSTEM CODE: C 11  
CAUSE CODE: E 12  
CAUSE SUBCODE: E 12  
COMPONENT CODE: INSTRU 14  
COMP SUBCODE: S 15  
VALVE SUBCODE: Z 16  
EVENT YEAR: 81 22  
SEQUENTIAL REPORT NO.: 038 26  
OCCURRENCE CODE: 03 29  
REPORT TYPE: L 30  
REVISION NO.: 0 32  
ACTION TAKEN: E 13  
FUTURE ACTION: F 19  
EFFECT ON PLANT: Z 20  
SHUTDOWN METHOD: Z 21  
HOURS: 0000 40  
ATTACHMENT SUBMITTED: Y 23  
NPRO-4 FORM SUB: N 24  
PRIME COMP. SUPPLIER: L 25  
COMPONENT MANUFACTURER: B069 26

## CAUSE DESCRIPTION AND CORRECTIVE ACTIONS (27)

Setpoint drift. The Barton Model 288 and Barksdale Model B2T-M12SS pressure switches were recalibrated to proper setpoint and SI 4.2.B-7 successfully completed. DCR 1398 replaces these switches with analog transmitters and trip units. A study of setpoint drift problems is attached.

FACILITY STATUS: 0000 17  
POWER: 0000 17  
OTHER STATUS: NA 44  
METHOD OF DISCOVERY: B 31  
DISCOVERY DESCRIPTION: Surveillance test. 32

IDENTITY: 0000 17  
CONTENTS: 0000 17  
PREVIOUS RELEASE: 0000 17  
AMOUNT OF ACTIVITY: NA 44  
LOCATION OF RELEASE: NA 36

PERSONNEL EXPERIENCE: 0000 17  
TYPE: 0000 17  
DESCRIPTION: NA 44

PERSONNEL INFORMATION: 0000 17  
DESCRIPTION: NA 44

OTHER INFORMATION: 0000 17  
DESCRIPTION: NA 44

PROPERTY: 0000 17  
DESCRIPTION: NA 44

8108040340 810728  
PDR ADOCK 05000259  
S PDR  
Gene Holder  
(205) 729-6134

1. SUPPLEMENTAL INFORMATION

Report No. 259 / 81038 Technical Specifications Involved Tables 3.2.A and 3.2.B

Based on Under Technical Specification 6.7.2.b.2 Date due NRC: 7/30/81

Date of Occurrence 6/30/81 Time of Occurrence 0900 Unit 1

Identification and Description of Occurrence:

Setpoints for reactor low-pressure switches PS-3- 74B, PS-68-95, and PS-68-96 were found to actuate outside of T.S. tables 3.2.A and 3.2. B limits. The average out of tolerance was 2.92 percent.

Conditions Prior to Occurrence:

Unit 1 in refueling outage.

Unit 2 at 99%.

Unit 3 at 91%.

Action specified in the Technical Specification Surveillance Requirements not applicable to inoperable equipment. Describe.

None

Apparent Cause of Occurrence:

Setpoint drift.

Analysis of Occurrence:

There was no danger to the health or safety of the public, no release of activity, no damage to the plant or equipment, and no resulting significant chain of events.

Corrective Action:

Switches were recalibrated to proper setpoint and SI 4.2.B-7 successfully completed. DCR 1398 replaces these switches with analog transmitters and trip units. A study of setpoint drift problems is attached.

Failure Data: BFRO 50-259/78016, 79008, 80058, 81029, 81032; 260/78002, 79017, 79024, 80022, 80057, 81023; 296/79007, 79012, 79028, 80022, 80030, 80045, 80052, Retention: Period - Indefinite; Responsibility - Document Control Supervisor 81007.

Revision: *AM*

Subject: SETPOINT DRIFT - BARKSDALE PRESSURE SWITCHES

Recently there has been a number of LERs on Barksdale pressure switches: six during 1981, 21 since January 1978. Our commitment to training on these switches has been strong and continuous; therefore, we do not believe this is the problem.

Our attention was turned to the switch and the application to which it was being used. Attachment 1 plots the setpoint drift of 4 of these switches for a period of 4 years. It is readily obvious these switches are cyclic, being high in the warm months and low in the cold months. Attachments 2 and 3 provide the specifications for the Barksdale B21-A1280 switch. The important characteristics for PS-1-81, 91 are:

Element type: Bourdon Tube  
Proof Pressure: 1800 psig  
Rated Accuracy:  $\pm 1\%$  or 12 psig  
Setpoint: 154 psig - recently changed from 160 psig  
Adjustable Range: 77-1200 psig

It would appear based on Attachments 2 and 3, the switch would perform very reliably. However, the reason it does not becomes apparent when Attachment 4 is reviewed. The following conclusions can be drawn from Attachment 4:

1. For our application, a piston switch is better than a diaphragm or bourdon tube. Our experience indicates the piston type Static-O-Ring to be a very reliable and accurate switch.
2. Bourdon tube switches are extremely sensitive to process surges. In our application, snubbers have been installed to help alleviate this deficiency.
3. For greatest accuracy, the setpoint should fall in the upper 65% of the adjustable range. For the most favorable life factor the setpoint should be in the lower 65% of the adjustable range. For PS-1-81, 91:

$$\text{Span} = 1123 \text{ and Setpoint } (\% \text{ Span}) = 13.7\%$$

This places these switches in the lower portion of Zone C, which is FAIR accuracy and EXCELLENT life.

Our experience proves this correct. Other switches we have drift problems with are PS-68-93, 94. They have setpoints of 108 psig or setpoint (% span) is 9.6%.

In the final analysis, one can only conclude a misapplication of these switches, both in switch type and % of adjustable range. We recognized this years ago and DCR 1398 (12/7/77) was initiated. EN DES does not have an implementation date for DCR 1398 as it now is tied to 79-01B and environmental qualifications. In the interim we are investigating an improved switch and will keep you informed.

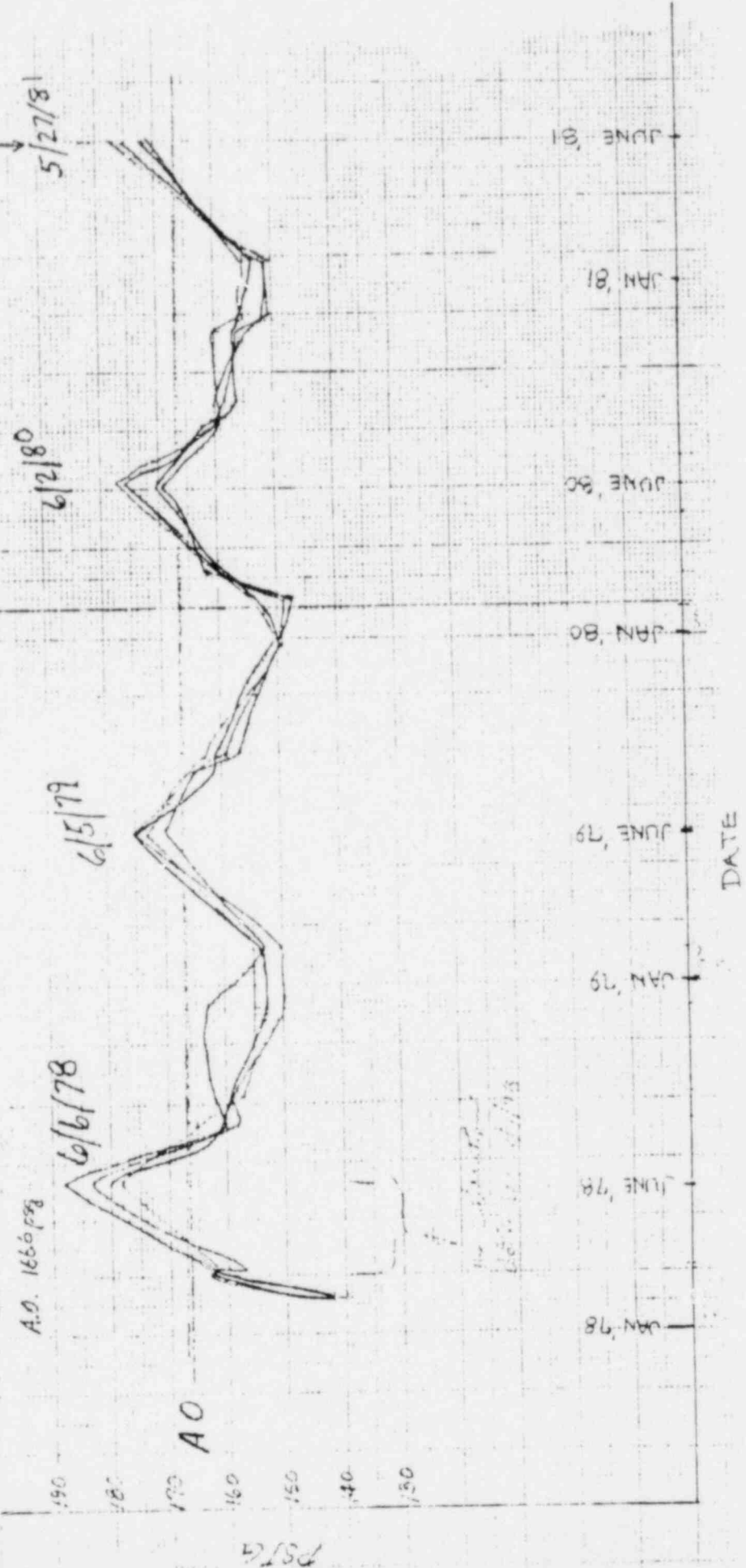
dia - 91A  
- 91B  
T 3

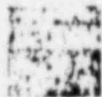
# ATTACHMENT 1

Setpoint  
Changed To  
154 psig

Setpoint 150 psig

A.O. 1666 psig





Increased Bourdon Tube Models  
 Water-Tight Housing (NEMA 4)  
 1/2" Terminal Strip  
 Temperature-Resistant Materials



**B1T SINGLE SETTING**

**B2T DUAL CONTROL**

**OPERATING CHARACTERISTICS • ORDERING DATA**

**PRESSURE SWITCHES** — All values given in P.S.I. (Gauge)

Proof (Test) Pressure	Adjustable Range				Approx. Actuation Value (Differential)	Wetted Material*	B1T Catalog Number	B2T Catalog Number
	Decreasing		Increasing					
	Min	Max	Min	Max				
1800	50	1180	70	1200	10 to 20	Bronze	B1T H12	B2T H12
1800	50	1173	77	1200	11 to 27	316	B1T-A12SS	B2T-A12SS
4800	160	3170	190	3200	15 to 30	Bronze	B1T H32	B2T H32
4800	160	3161	199	3200	16 to 39	316	B1T H32SS	B2T H32SS
7200	240	4715	325	4800	40 to 85	316	B1T-A48SS	B2T-A48SS
**9750	325	6385	440	6500	54 to 115	316	B1T-A65SS	B2T-A65SS
**18000	600	11450	1150	12000	275 to 550	316	B1T-A120SS	B2T-A120SS
**24000	600	17450	1150	18000	275 to 550	316	B1T-A180SS	B2T-A180SS

\*"Bronze" represents Phosphor Bronze Tube with SAE 88 Brass Socket

"316" represents 316 Stainless Steel Tube & Socket

\*\*"AMINCO" female opening for 1/4" OD tube connection. To change -A65SS and -A120SS switches to 1/4" npt, add -P4 suffix to model number. Price addition required.

Approximate shipping weight 2.5 lbs.

**DETAIL DATA**

**ELECTRICAL CHARACTERISTICS.** All models incorporate Underwriters' Laboratories, Inc. listed single or double throw snap action switching elements. Electrical rating (continuous duty): 10 amp 125 or 250 volts AC, 3 amp 480 volts AC. Automatically reset by snap action of switch. For more details and other switch classes, see pages 33-35.

**ELECTRICAL CONNECTION:** To screw terminals on covered terminal strip through 1/2" nps conduit connection.

**PRESSURE CONNECTION:** 1/2" N.P.T. internal thread, except as noted\*\*. models with proof pressures above 8100 P.S.I. have "AMINCO" female opening for 1/4" O.D. tube connection.

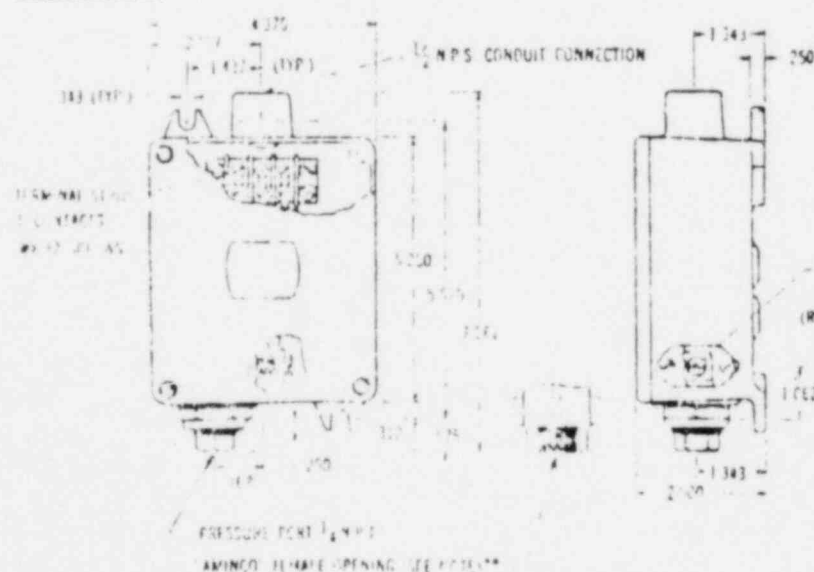
**ADJUSTMENT INSTRUCTIONS**

Turn adjustment screw clockwise to lower actuation point (switch setting).

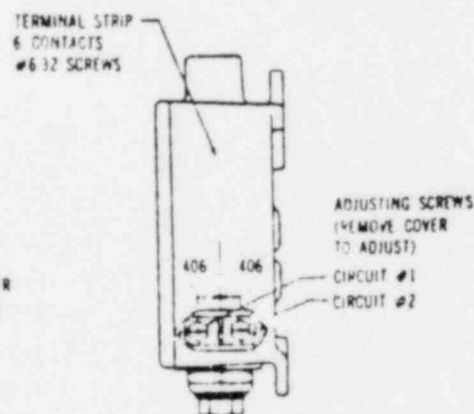
**WIRE CODING — PRESSURE**

Circuit #1: Common — Purple  
 Normally Closed — Blue  
 Normally Open — Red  
 Circuit #2: Common — Brown  
 Normally Closed — Orange  
 Normally Open — Yellow

**B1T**



**B2T**



Note: All other dimensions for B2T are the same as B1T (left)

## HOW TO SELECT A PRESSURE SWITCH FOR YOUR APPLICATION

### STEP 1

#### SERVICE LIFE OF THE SWITCH

Expected service life is the first consideration to be made in selecting a pressure switch, regardless of the pressure sensitivity desired. If the service life (the number of cycles the switch is expected to operate) is one million or more, use of either a bourdon tube or diaphragm switch is indicated. If a service life of more than one million cycles is required, a piston switch should be used. An exception to this rule may be made when pressure change in a system is very slow (20% or less of the adjustable range). Under such conditions a bourdon tube or diaphragm switch can be used up to 2.5 million cycles before initial failure.

A second consideration in choosing a pressure switch is the speed of cycling, or effects of the service life. If a switch is expected to cycle more than once every three seconds, a piston type switch should be specified. The action of any bourdon tube or diaphragm acts as a spring which with heat and fatigue is extremely fast cycling or starting, thus shortening the life of the switch. The inertia to be controlled must always be considered when selecting a pressure switch and, to simplify selection, selected materials for each type of switch are noted on applicable catalog pages.

### STEP 2

#### PROOF PRESSURES

Choice of the type of pressure switch to be used — diaphragm, bourdon tube or piston — also must be governed by the proof pressure to which it will be subjected. (Proof pressure is the highest surge pressure that will ever be experienced in a system.) It must be remembered that, although a pressure switch may register a constant operating pressure, there may be surges going through a system that are dampened out by the action in the surge diaphragm and bourdon tube pressure switches are extremely sensitive and would be affected by these surges.

Barkdale diaphragm switches are available in an adjustable range from vacuum to 150 psi with proof pressures to 200 psi. Barkdale bourdon tube switches are adjustable to 10,000 psi with proof pressures of 20,000 psi. Barkdale piston switches have an adjustable range to 12,000 psi with a proof pressure of 20,000 psi.

### STEP 3

#### FUNCTION OF THE SWITCH

The function of the switch is the determining factor in making a selection. Three types of Barkdale pressure switches, based on function, are described below:

- (1) Single setting pressure switches sense a single pressure change and open or close a single electrical circuit by means of one snap action electrical switch.
- (2) Pressure difference switches sense a change in relationship between two variable continuous pressures and open or close a single electrical circuit by means of one snap action electrical switch.
- (3) Dual control pressure switches sense two pressure levels from a single pressure source and open or close two independent electrical circuits by means of two snap action electrical switches.

### STEP 4

#### TYPES OF HOUSING AVAILABLE

Stripped pressure switches are basic Barkdale pressure switches without housings. They may be used wherever electrical enclosures are already available and are favored by original equipment manufacturers for use in common enclosures. Naturally, stripped switches may be purchased at a lower cost.

Housed pressure switches are completely enclosed to protect the switch from damage when exposed to a hostile

environment. Terminal block pressure switches are housed and, in addition, are equipped with enclosed terminal blocks, thus eliminating the expense of buying and installing external junction boxes.

Explosion proof pressure switches are designed with heavy housings built to conform to accepted electrical standards in locating the units from explosive atmosphere. All explosion proof models are equipped with terminal blocks for convenience in wiring.

### STEP 5

#### SELECTION OF ADJUSTABLE RANGE

The term "working range" defines the pressure range a switch may see under normal working conditions. This is normally the adjustable range.

For greatest accuracy the set point should fall in the upper 15% of the adjustable range. For the most favorable life factor the set point should lie in the lower 60% of the adjustable range. Therefore, the most favorable combination of accuracy and life factor lies in the middle 30% of the adjustable range (see diagram). This general rule applies both to diaphragm and bourdon tube pressure switches.



## HOW TO READ CATALOG NUMBERS OF DIAPHRAGM, BOURDON TUBE AND DIA-SEAL PISTON PRESSURE SWITCHES

**EXAMPLE CATALOG NUMBER:**  
 1. Type of switch: Diaphragm, Bourdon Tube, or Dia-Seal Piston.  
 2. Function: Single Setting, Pressure Difference, or Dual Control.  
 3. Material: Stainless Steel, Brass, or Aluminum.  
 4. Housing: Stripped, Housed, or Explosion Proof.  
 5. Terminal Block: Yes or No.  
 6. Pressure Range: 0 to 100 psi, 0 to 200 psi, etc.  
 7. Accuracy: ±1%, ±2%, etc.  
 8. Life Factor: 1,000,000 cycles, 2,500,000 cycles, etc.