

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 8707280083 DOC. DATE: 87/07/22 NOTARIZED: NO DOCKET #
 FACIL: 50-331 Duane Arnold Energy Center, Iowa Electric Light & Pow 05000331
 AUTH. NAME AUTHOR AFFILIATION
 PROBST, J. R. Iowa Electric Light & Power Co.
 HANNEN, R. L. Iowa Electric Light & Power Co.
 RECIP. NAME RECIPIENT AFFILIATION

SUBJECT: LER 86-024-01: on 861121, outboard HPCI sys valve closed due to signal from pressure differential indicating switch PDIS2245. Caused by switch compartment moisture. Compartment dried & switch calibr. W/870722 ltr.

DISTRIBUTION CODE: IE22D COPIES RECEIVED: LTR 1 ENCL 1 SIZE: 12
 TITLE: 50.73 Licensee Event Report (LER), Incident Rpt, etc.

NOTES:

	RECIPIENT ID CODE/NAME	COPIES LTR ENCL	RECIPIENT ID CODE/NAME	COPIES LTR ENCL
	PD3-1 LA	1 1	PD3-1 PD	1 1
	CAPPUCCI, A	1 1		
INTERNAL:	ACRS MICHELSON	1 1	ACRS MOELLER	2 2
	AEOD/DOA	1 1	AEOD/DSP/NAS	1 1
	AEOD/DSP/ROAB	2 2	AEOD/DSP/TPAB	1 1
	DEDRO	1 1	NRR/DEST/ADE	1 0
	NRR/DEST/ADS	1 0	NRR/DEST/CEB	1 1
	NRR/DEST/ELB	1 1	NRR/DEST/ICSB	1 1
	NRR/DEST/MEB	1 1	NRR/DEST/MTB	1 1
	NRR/DEST/PSB	1 1	NRR/DEST/RSB	1 1
	NRR/DEST/SGB	1 1	NRR/DLPQ/HFB	1 1
	NRR/DLPQ/QAB	1 1	NRR/DOEA/EAB	1 1
	NRR/DREP/RAB	1 1	NRR/DREP/RPB	2 2
	NRR/PMAS/ILRB	1 1	NRR/PMAS/PTSB	1 1
	<u>REG FILE</u> 02	1 1	RES DEPY GI	1 1
	RES TELFORD, J	1 1	RES/DE/EIB	1 1
	RGN3 FILE 01	1 1		
EXTERNAL:	EG&G GROH, M	5 5	H ST LOBBY WARD	1 1
	LPDR	1 1	NRC PDR	1 1
	NSIC HARRIS, J	1 1	NSIC MAYS, G	1 1

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Duane Arnold Energy Center (DAEC)	DOCKET NUMBER (2) 0 5 0 0 0 3 3 1	PAGE (3) 1 OF 1 1
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TITLE (4)
High Pressure Coolant Injection System Isolation from Steam Flow dP Switch Internal Leak

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES		
									None		
1	1	2	1	8	6	8	6	8			
			0	2	4	0	1	0			
						0	7	2			
						2	2	8			
						7					

OPERATING MODE (9) N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)									
POWER LEVEL (10) 01914	20.402(b)	20.406(c)	60.73(a)(2)(iv)	73.71(b)						
	20.406(a)(1)(i)	60.38(c)(1)	<input checked="" type="checkbox"/> 60.73(a)(2)(v)	73.71(c)						
	20.406(a)(1)(ii)	60.38(c)(2)	60.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)						
	20.406(a)(1)(iii)	60.73(a)(2)(i)	60.73(a)(2)(viii)(A)							
	20.406(a)(1)(iv)	60.73(a)(2)(ii)	60.73(a)(2)(vii)(B)							
	20.406(a)(1)(v)	60.73(a)(2)(iii)	60.73(a)(2)(ix)							

LICENSEE CONTACT FOR THIS LER (12)		TELEPHONE NUMBER	
NAME James R. Probst, Technical Support Engineer		AREA CODE 3 1 1 9	8 5 1 1 - 1 7 3 0 1 8

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)											
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		
X	BJ	PDIIS	I 2 0 4	Y							

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)		
<input type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO			MONTH	DAY	YEAR

ABSTRACT (Limit to 400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On November 21, 1986 at 0822 hours, with the reactor at 94% power, the outboard High Pressure Coolant Injection System (HPCI) isolation valve closed due to a signal from HPCI steam line high flow pressure differential indicating switch PDIS2245. The isolation was determined to be unwarranted, and the valve reopened. A small amount of moisture was found in the switch. The cause of the switch tripping and subsequent HPCI isolation was the switch compartment moisture, which likely momentarily shorted terminals within the switch. The source of the water intrusion is the seal through which the dial rod (torque tube shaft) penetrates. The switch is currently being visually monitored three times a week when required to be operable for further moisture intrusion, pending receipt of a like replacement. It will be examined and an update submitted following its removal. The investigation also revealed the setpoint of PDIS2245, an ITT Barton Model 288A, was out of tolerance in the lower steam flow direction. HPCI was then declared inoperable at 1528 hours, November 21, 1986. The setpoint remained above anticipated steam flow values; therefore, an inappropriate trip during HPCI operation would have been unlikely. The root cause of the setpoint drift is unknown, although the moisture found in the switch appears to have been a factor. PDIS2245 was recalibrated and HPCI declared operable on November 22, 1986.

Further investigation revealed the root cause of the HPCI isolation to be intrusion of water from a leaking manifold above the switch. The water passed between the pressure switch and attached bellows and entered the switch compartment through the non-watertight torque tube seal. The manifold has since been replaced and repaired.

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TEXT (If more space is required, use additional NRC Form 388A's) (17)

On November 21, 1986 at 0822 hours, with the reactor at 94% power, the outboard High Pressure Coolant Injection System (HPCI, EIIS System Code BJ) steam supply isolation valve (BJ-ISV-2239) closed on an isolation signal, rendering HPCI inoperable. Investigation revealed the source of the isolation signal to be a Steam Leak Detection System (SLDS, EIIS System Code JM) high steam flow pressure differential indicating switch (PDIS), PDIS2245 (BJ-PDIS-2245). Examination of process computer records revealed the isolation signal from PDIS2245 had been momentary, having cleared in four seconds. HPCI was unisolated approximately two minutes after the event occurred following the determination by control room personnel that the isolation was spurious in nature and not warranted. Examination of PDIS2245 was initiated. PDIS2245 is a Barton Model 288A, containing a model 224 Differential Pressure Unit (DPU, bellows type).

When PDIS2245 was examined on November 21, 1986, a small amount of water was found in the switch compartment. An amount approximately equal to one drop was seen in the area of the dial rod (torque tube shaft) seal, and on the terminal strip. Several drops were found to have accumulated in the lowest area of the switch compartment. (See Figure 1, 2, and 3.) The switch compartment was dried and PDIS2245 recalibrated successfully. The suspected point of water leakage into the switch compartment was the dial rod seal, as the rod extends into the Differential Pressure Unit behind the switch where the water filled bellows are located. However the rod seal area was observed for approximately two hours with no further leakage apparent.

From examination of PDIS2245, the cause of the automatic HPCI isolation at 0822 hours on November 2, 1986 was determined to be moisture within the switch compartment, which likely resulted in a momentary short of contacts at the terminal strip and the subsequent isolation signal. Further examination of PDIS2245 was planned to determine if continued leakage existed, and if so the source of that leakage.

On November 21, 1986 at 1528 hours, with the reactor at 94% power, the HPCI system was declared inoperable when the examination of PDIS2245 initiated due to the unwarranted HPCI isolation earlier in the day also revealed the high steam flow setpoint of the switch had drifted outside of the Technical Specification limit. The switch was found to trip at 80 inches differential pressure H2O versus the Surveillance Test Procedure limit of 99 +/- 7 inches. PDIS2245 and a like switch will signal for closure of the HPCI outboard and inboard steam supply line isolation valves respectively if steam line flow over 300% of rated is sensed. The low switch setpoint could have resulted in the switch tripping at a lower high steam flow value than the 300% steam flow design setpoint. An examination of the test results upon which this setpoint is based indicate the 80 inches H2O as found trip setpoint of PDIS2245 is greater than the maximum flow differential pressure which could be expected through this line under normal HPCI start and run conditions. The isolation which occurred on November 21, 1986 occurred under no flow conditions, as the HPCI turbine was not in operation at the time.

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Per Technical Specification Table 3.2B, inoperability of this switch requires the HPCI isolation valves be closed or the reactor brought to cold shutdown within twenty-four hours if the switch remains inoperable. Per Technical Specification 3.5.D.2, inoperability of the HPCI system is a seven day Limiting Condition for Operation (LCO), contingent upon the continuing operability of the Reactor Core Isolation Cooling System (RCIC, EIIS System BN), the Low Pressure Coolant Injection System (LPCI, EIIS System B0), the Automatic Depressurization System (ADS, EIIS System SB), and the Core Spray System (CS, EIIS System BM). Operability testing of these systems was promptly initiated.

Although moisture within the switch compartment may have been a factor, the root cause of the setpoint drift of PDIS2245 is unknown. This switch has been in operation for 10 years and has proven very reliable, having had its setpoint drift out of tolerance only once prior to November, 1986. In July of 1984, PDIS2245's setpoint was found at 83 inches H₂O. In addition, water was also found within the switch at that time due to a leaking equalizing valve above the switch. The switch was successfully recalibrated. Excessive instrument drift has occurred in some ITT Barton 288A switches while others have performed adequately, indicating such problems may be application oriented rather than generic in nature.

PDIS2245 was returned to service at 1940 hours on November 21. Following successful completion of the HPCI operability test, the HPCI system was declared operable at 0119 hours on November 22, 1986, ending the seven day LCO. Testing of other safety systems due to HPCI inoperability was terminated at this time.

During the next reexamination of the switch on December 3, 1986, a small quantity of water (several drops) was again found within the switch compartment. The switch trip setpoint was found within calibration, however. The source of the leakage into the switch compartment was pinpointed as the dial rod seal. An examination of plant records and discussions with plant personnel indicate dial rod seal leakage has not been previously experienced at the Duane Arnold Energy Center. As a corrective action, surveillance on this instrument is being increased pending receipt of a qualified replacement switch. The seal area and switch compartment will be visually inspected three times per week during times which the switch is required to be operable. A qualified like replacement switch is on order. Following replacement of PDIS2245, it will be further examined to determine the root cause and source of the leakage. An update to this LER will be filed following completion of this examination. A check of PDIS2245's switch compartment on December 16, 1986, with the reactor in cold shutdown, found no water had entered the compartment since it was last inspected on December 3, 1986.

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The worst case effect of HPCI inoperability with the reactor in the run mode is to lose the ability to maintain reactor vessel water inventory after small line breaks which do not rapidly depressurize the vessel. Other systems, including ADS with low pressure Emergency Core Cooling Systems, provide full redundancy during HPCI inoperability. These events are being reported per 10CFR50.73 (a)(2)(v) as events or conditions which alone could have prevented the fulfillment of a safety function of a system needed to shut down the reactor or mitigate the consequences of an accident. This LER documents two time periods during which the HPCI system was considered unavailable to perform its design function. On November 21, 1986, the system was isolated for approximately two minutes due to a spurious signal. Later that day it declared inoperable and isolated when it was determined a pressure differential indicating switch which would isolate the system on high steam flow was out of calibration. Following successful calibration of the switch, the HPCI system was successfully tested and returned to operable status. The pressure differential indicating switch is being monitored on an increased basis due to leakage through a small seal, which may allow water to enter the switch compartment.

The thrice weekly checks found no water within PDIS2245 from December 16, 1986 until the plant reached cold shutdown for refueling in March, 1987. Some decrease in switch performance was seen in early 1987, as it twice failed to trip with the specified tolerances. In both cases it was successfully recalibrated at the time of the discovery, however. PDIS2245 and its accompanying bellows were disassembled and inspected following receipt of a replacement switch and bellows in June, 1987. Rust was noted in the area of the torque tube seal on PDIS2245 and on the torque tube, torque tube gland nut, and to a lesser degree on the outer edge of one of the two bellows base areas, outside of the gasket which seals in the instrument line water. (See attached figures). No evidence of a source of leakage of either bellows fluid (ethylene glycol-water) or water out of the bellows unit was noted. The manufacturer has indicated rust within these areas would be unlikely to affect operation of the switch. The switch is located in the first floor of the Reactor Building, which is not a high energy line break or potentially flooded area.

The instrument water line manifold directly above PDIS2245 was noted to be leaking during the 1987 refueling outage, and was replaced on April 1, 1987. A pathway exists for leakage from this manifold to the back side of PDIS2245 where the bellows assembly is attached. From there, the water could seep in between the PDIS and bellows assembly. Per discussions with the manufacturer the torque tube seal into the PDIS switch compartment is not a hermetic seal, and water introduced into this area on the back side of the PDIS could eventually work its way into the switch compartment.

The root cause of the HPCI isolation signal from PDIS2245 on November 21, 1986 is deemed to be the intrusion of water from the leaking manifold above the switch into the switch compartment via the torque tube seal. This is based on the visual evidence obtained during the inspection of PDIS2245 and its bellows assembly, which indicated an outside source for the water, the previous

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occurrence of water within the PDIS, and the fact that the manifold directly above the PDIS was noted to be leaking a short while later. The leakage from the manifold appears to have been sporadic, and a small amount of water in this area is not readily noticeable. The source of the water within PDIS2245 was further corroborated when leakage from the fittings of the newly installed manifold was noted and the manifold repaired in July, 1987. Although no water reached the PDIS switch compartment, the pathway for this to occur was readily apparent. The cause of the manifold leakage in 1986 is unknown, although the continuing problems in this area suggest fitting difficulties. The manifold area will be monitored for the next three months to ensure no leakage occurs, with any additional corrective measures to be taken if needed.

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(Front Scale Not
Identical to PDIS-2245)

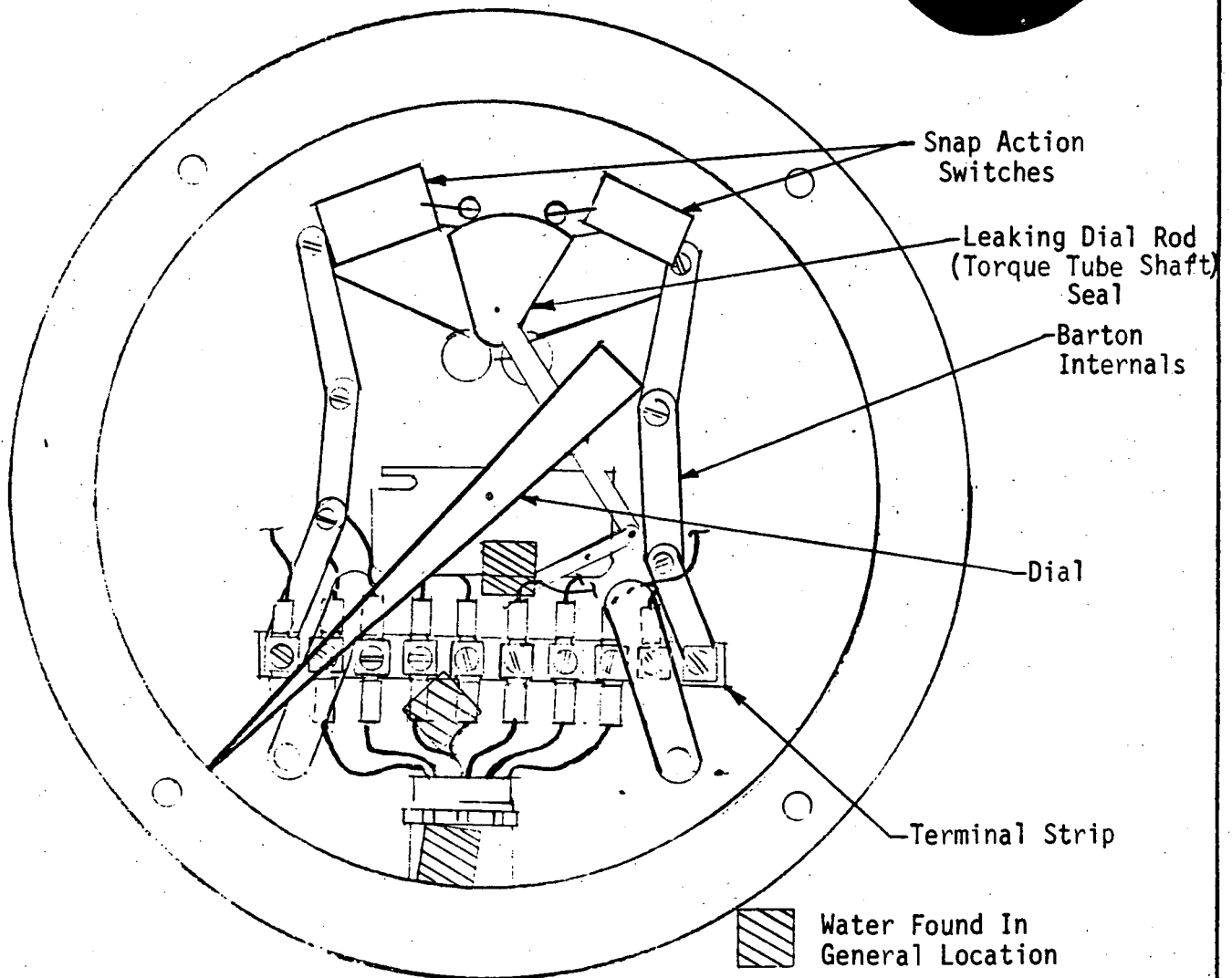
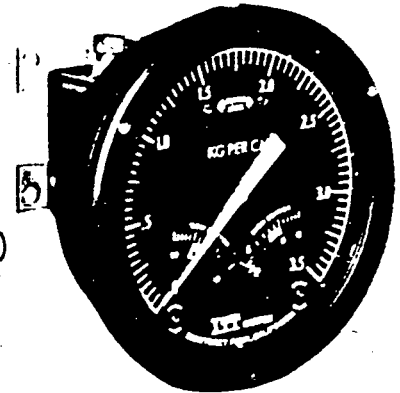
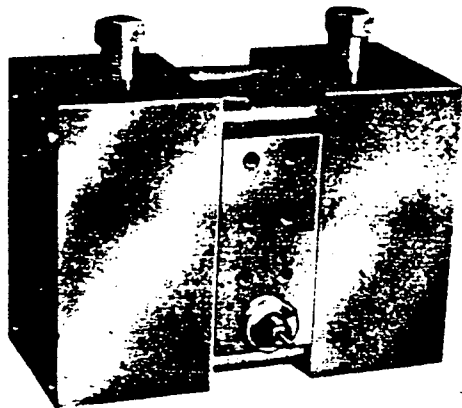


FIGURE 1. Barton 288A (PDIS-2245)
General Representation of Barton 288 Switch Internals

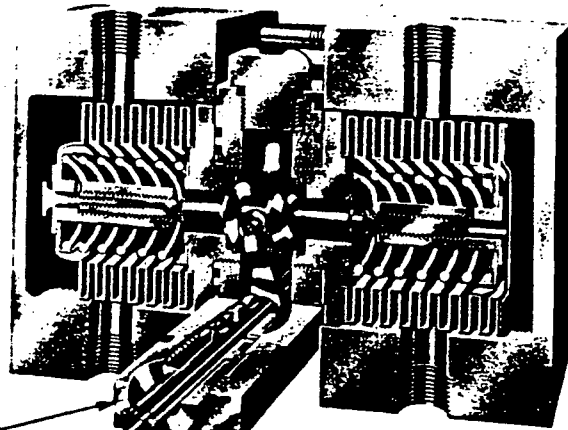
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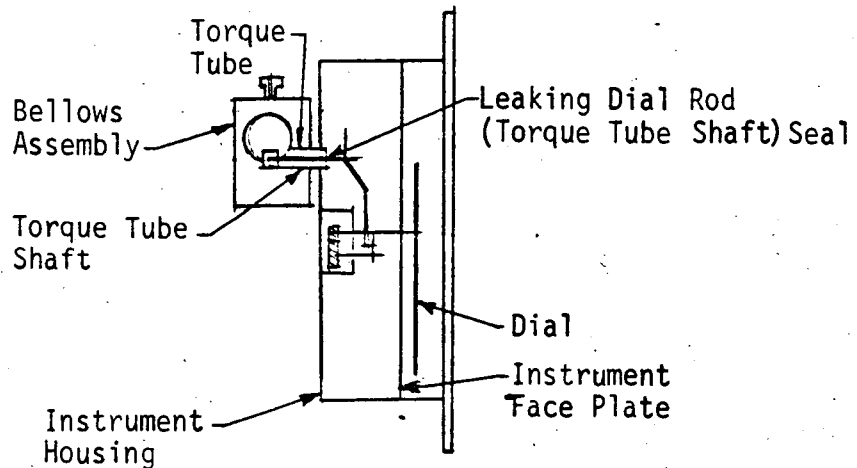
DPU 224



Torque Tube

Torque Tube Shaft

DPU 224 Bellows Unit



Cutaway View
(Not to Scale)

Figure 2. DPU 224 and Mounting Schematic

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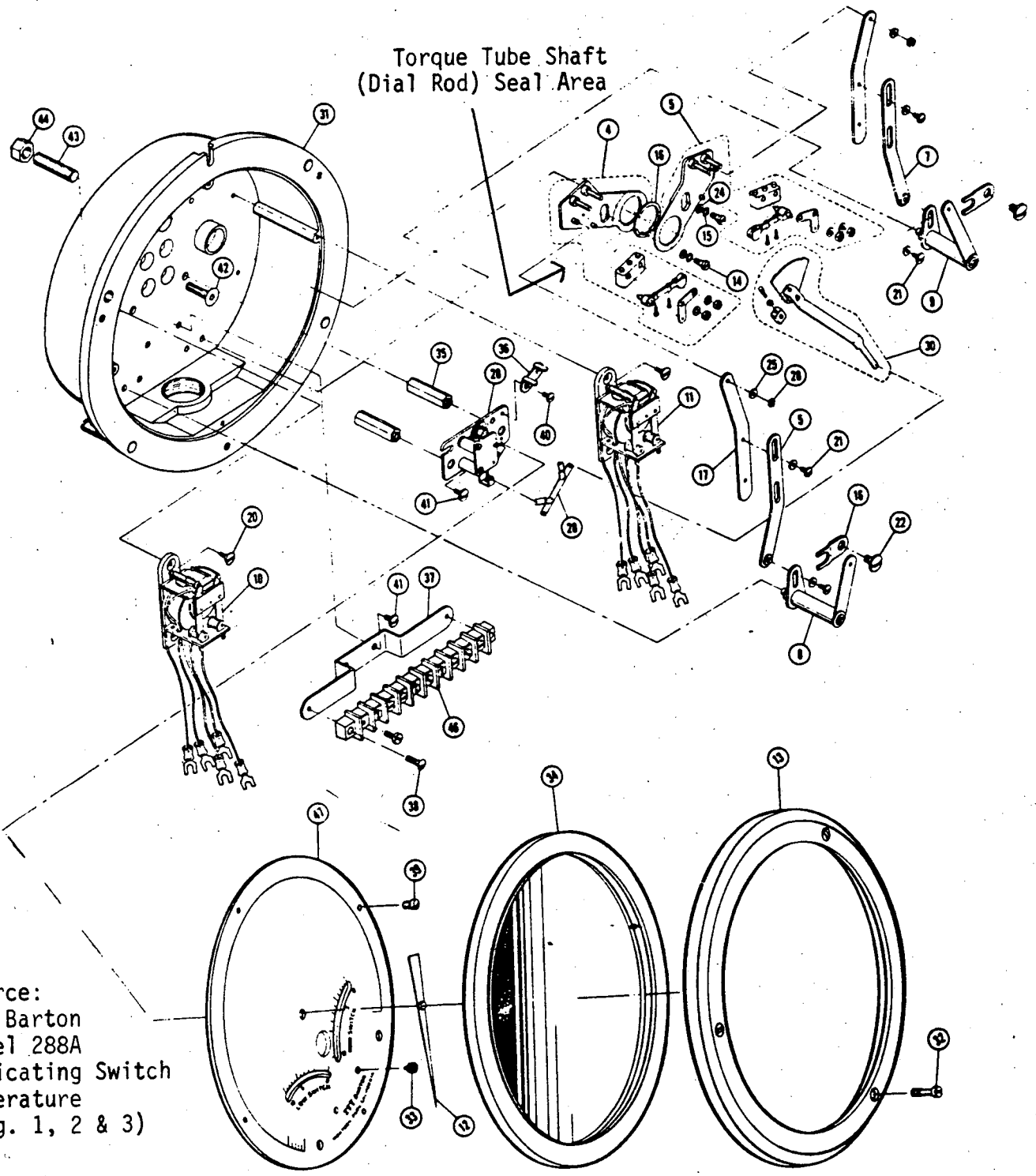


Figure 3. ITT Barton Model 288A Indicating Switch - Exploded View

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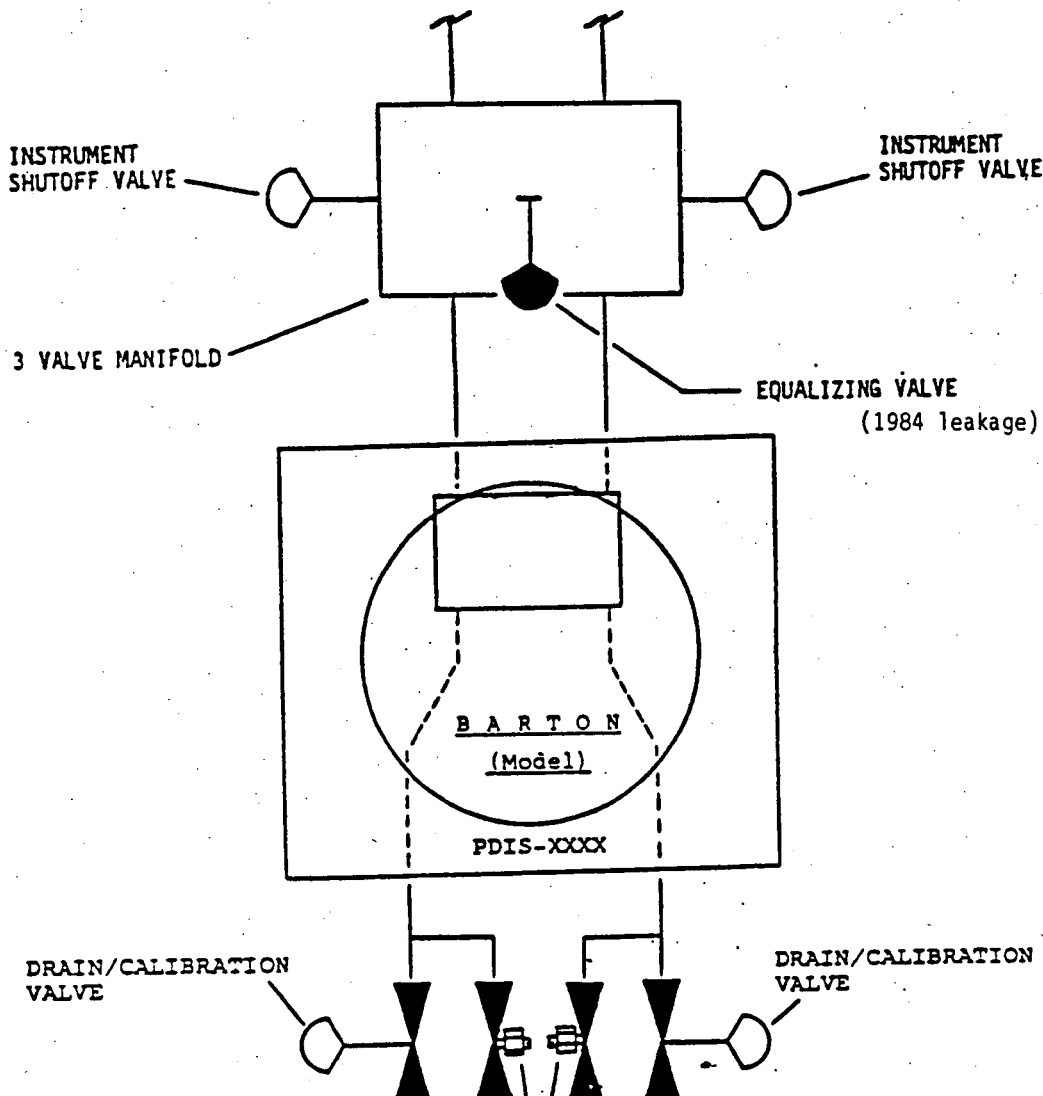


Figure 4 - Barton PDIS with Manifold

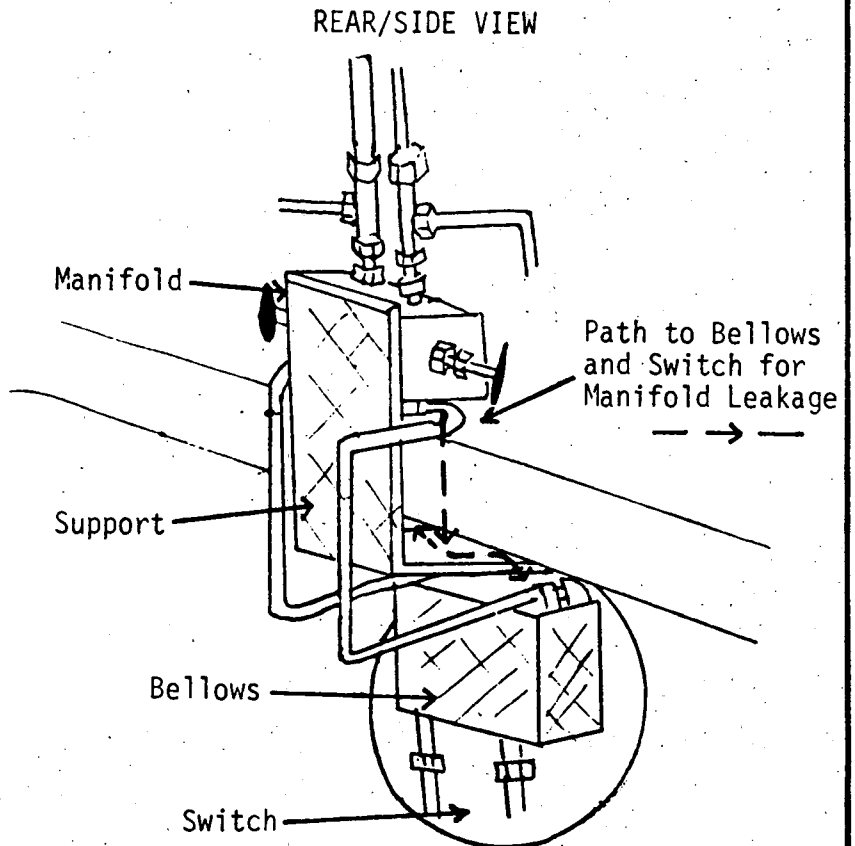
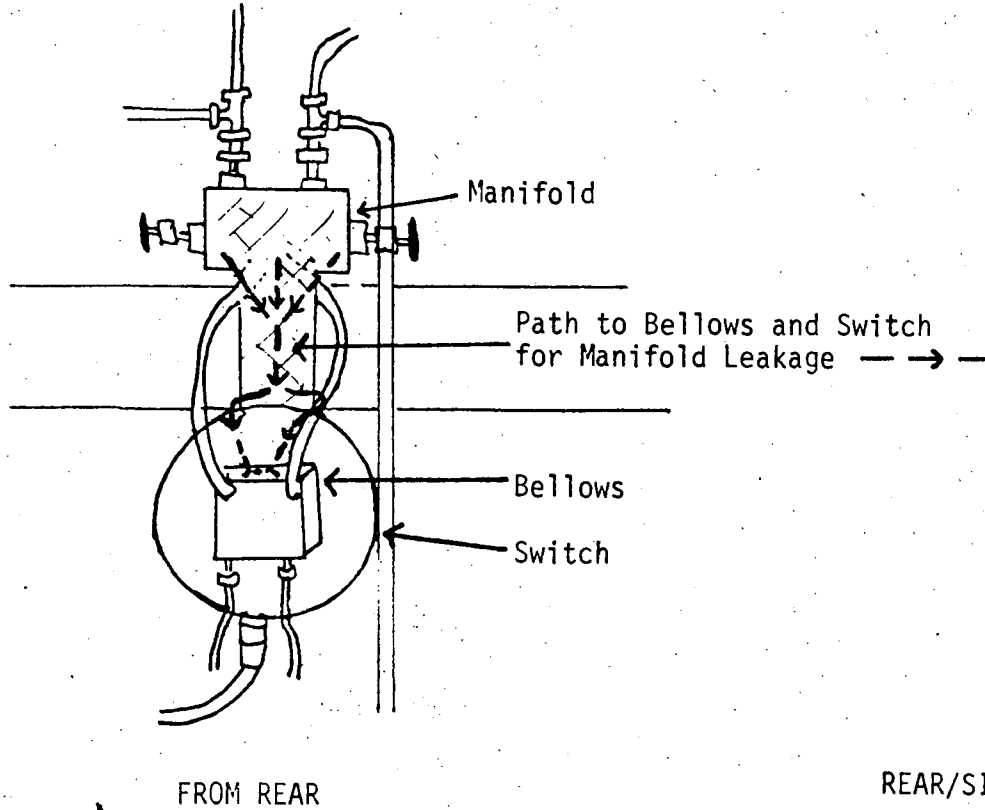
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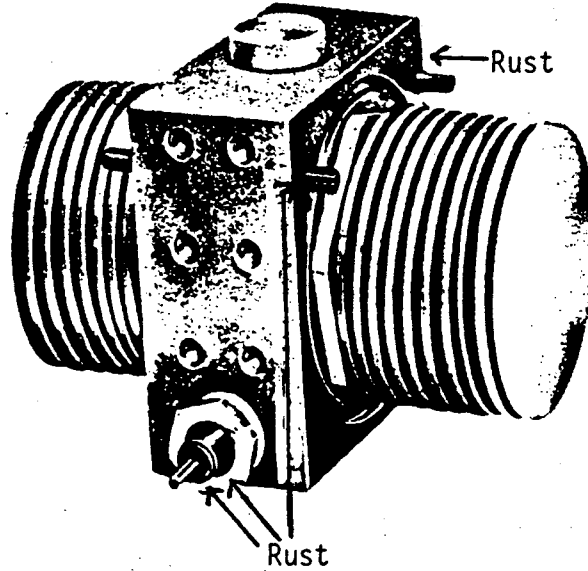
FIGURE 5

Water Intrusion into
Barton 288 From Leaking
Overhead Manifold:
Two Views



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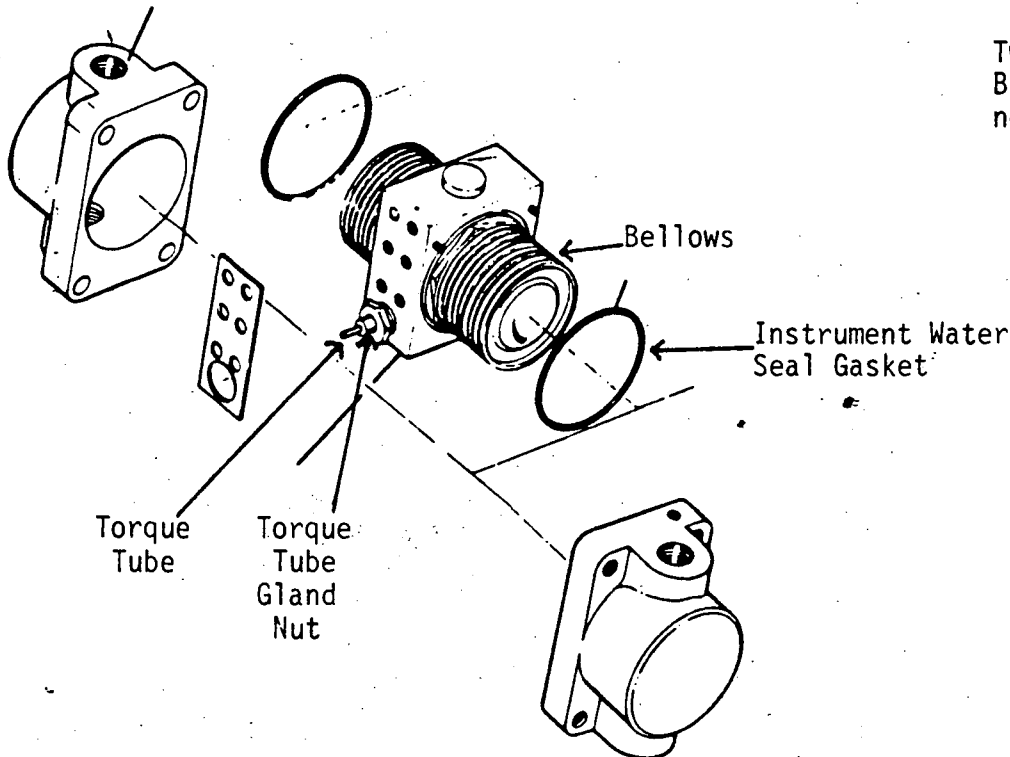
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1 5/8-inch Bellows

FIGURE 6

Two views of ITT Barton 224 DPU, noting rust sites.



Iowa Electric Light and Power Company

July 22, 1987
DAEC-87- 0811

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Subject: Duane Arnold Energy Center
Docket No. 50-331
Op. License DPR-49
Licensee Event Report No. 86-024, Revision 1

Gentlemen:

In accordance with 10 CFR 50.73 please find attached a copy of the subject revised Licensee Event Report.

Very truly yours,



Rick L. Hannen
Plant Superintendent - Nuclear

RLH/JRP/go

Attachment - LER 86-024, Rev 1

cc: Mr. A. Bert Davis
Regional Administrator
Region III
U. S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

NRC Resident Inspector - DAEC

File A-118a

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