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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

FEB 17 1988

MEMORANDUM FOR: Hubert J. Miller, Director  
Division of Reactor Safety  
Region III

FROM: Charles E. Rossi, Director  
Division of Operational Events Assessment  
Office of Nuclear Reactor Regulation

SUBJECT: TRANSFER OF OPERATING EVENT LONG-TERM FOLLOWUP

The Events Assessment Branch (EAB) has completed its short-term evaluation of an operating event at Brunswick 2 and has recommended certain long-term followup actions. These actions were based to a great extent on earlier followup by EAB on MSIV failures at Perry 1 for which Region III established an AIT. Copies of Event Followup Reports for Brunswick 2 and Perry 1 are enclosed. Because of the extensive work already done by your staff in evaluating operability of solenoid valves at Perry, we have concluded that additional long-term followup is warranted by your division. Thus, the purpose of this memorandum is to request your assistance to (1) confirm that the proposed activity in the Brunswick Report warrants your followup and (2) provide EAB with an expected completion date for completing that work.

We will monitor this activity until you inform us that your followup actions have been completed. To assist in this monitoring, the enclosed Technical Assignment Control (TAC) has been issued. We will extract data from the TAC/RITS data base to provide a weekly status of long-term followup activities to headquarters and regional offices. Therefore, please establish a scheduled completion date and keep the TAC data current. This followup activity has been coordinated with R. Lanksbury of your staff.

The EAB contact for this effort is Jerry Carter; please direct any questions to him (x21194).

*Charles E. Rossi*  
Charles E. Rossi, Director  
Division of Operational Events Assessment  
Office of Nuclear Reactor Regulation

Enclosures: EFR 87-172  
EFR 88-02  
TAC 67092

cc: E. Adensam  
E. Sylvester  
J. Carter  
M. Reardon  
R. Lanksbury  
M. Shymlock

FEB 19 1988

D-75

EVENT FOLLOWUP REPORT 87-172  
50.72 EVENT #10515, OCTOBER 30, 1987  
PLANT-PERRY 1  
PROJECT MANAGER- T. COLBURN  
COGNIZANT ENGINEER- J. CARTER

NOV 2 0 1987

PROBLEM

MSIVs did not close within the time allowed by Technical Specifications.

CAUSE

Initially unknown but subsequently determined that a higher than anticipated ambient temperature caused the main pilot control (solenoid valve) to hangup.

SAFETY SIGNIFICANCE

Reactor isolation or containment integrity may not be possible in the event of an accident or transient.

DISCUSSION

During full closure tests of individual MSIVs, three valves exceeded the 5 second closure time of the technical specifications. Times were 22, 12, and 77 seconds with the two slowest valves being in the "D" steam line. Subsequent testing of these valves resulted in closure times of 3-5 seconds.

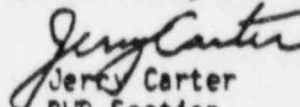
The licensee initially suspected that dirt in the air system caused the solenoid valve to hangup, thereby delaying the on-set of valve closure. Since there had been no previous instances of slow MSIV closure, the licensee continued power operation while reviewing maintenance records and preparing for their last pre-operational test, full MSIV isolation. The licensee and NRC regional and headquarters staff agreed with this approach.

Prior to running the full MSIV isolation test, the licensee again tested individual MSIVs for closure. Slow valve closure was observed again. The licensee shut down the reactor without performing their full MSIV isolation test.

NRC dispatched an AIT to the site to be present during disassembly of the solenoid valves and to evaluate the problem. Initial conclusions were that steam leaks in the vicinity of the MSIVs and the control circuit valves (includes the solenoid valves) had caused ambient temperatures in the vicinity of 300° F at the highest temperature location which also was the location of the "D" isolation valve. The elastomer seal in the solenoid valve had hardened and was believed to have held the solenoid in the closed position thereby preventing air from being vented, thereby keeping the MSIV open.

FOLLOWUP

The AIT will document their findings and present any followup to be done, plant specific or generic. No further action by EAB is necessary.

  
Jerry Carter  
BWR Section  
Events Assessment Branch

cc: T. Colburn  
E. Rossi

FEB 10 1988

BRUNSWICK 2 ISOLATION VALVES IN DRAIN LINES FAIL TO CLOSE

EVENT FOLLOWUP REPORT 88-02  
50.72 11109 JANUARY 2, 1988  
PLANT-BRUNSWICK 2  
PROJECT MANAGER-E. SYLVESTER  
COGNIZANT ENGINEER-J. CARTER

PROBLEM

Automatically operated isolation valves in both the equipment drain line and floor drain line from the drywell did not close upon demand.

CAUSE

Currently unknown; however, the solenoid valves venting air from the isolation valve pistons are suspected of sticking.

SAFETY SIGNIFICANCE

Two flow paths from primary containment to the environment existed after automatic isolation was required.

DISCUSSION

The facility was at 51% power and in the process of shutting down to refuel when a decreasing condenser vacuum led to a manual scram. Groups 2, 6 and 8 isolation on low level 1 were received as expected following the scram. All systems functioned as required except for the two automatic isolation valves in the drywell floor drain system (F-003 and F-004) and two automatic isolation valves in the drywell equipment drain system (F-019 and F-020). (See the attached schematic). These 4 valves did not close. The valves in the floor drain system were subsequently shut when a switch was placed in the closed position. The valves in the equipment drain line closed at different times after cycling the close switch. Subsequent to these closures, the valves were operated successfully when the drain sumps were pumped. An AIT was sent to the site to investigate the event.

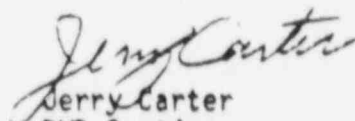
Early investigation revealed that these valves use a single coil solenoid to vent and supply air to the piston which closes or opens the isolation valve. The solenoid valve design is different than the solenoid used in the control air system for MSIVs. Isolation valve failures in drain lines had been observed previously at Brunswick Unit 2; no failure of the corresponding valves at Unit 1 had been recorded. No known differences can explain why Unit 2 experienced failures. Disassembly of one solenoid valve believed to be sticking did not provide any apparent cause of failure or sticking.

FOLLOWUP

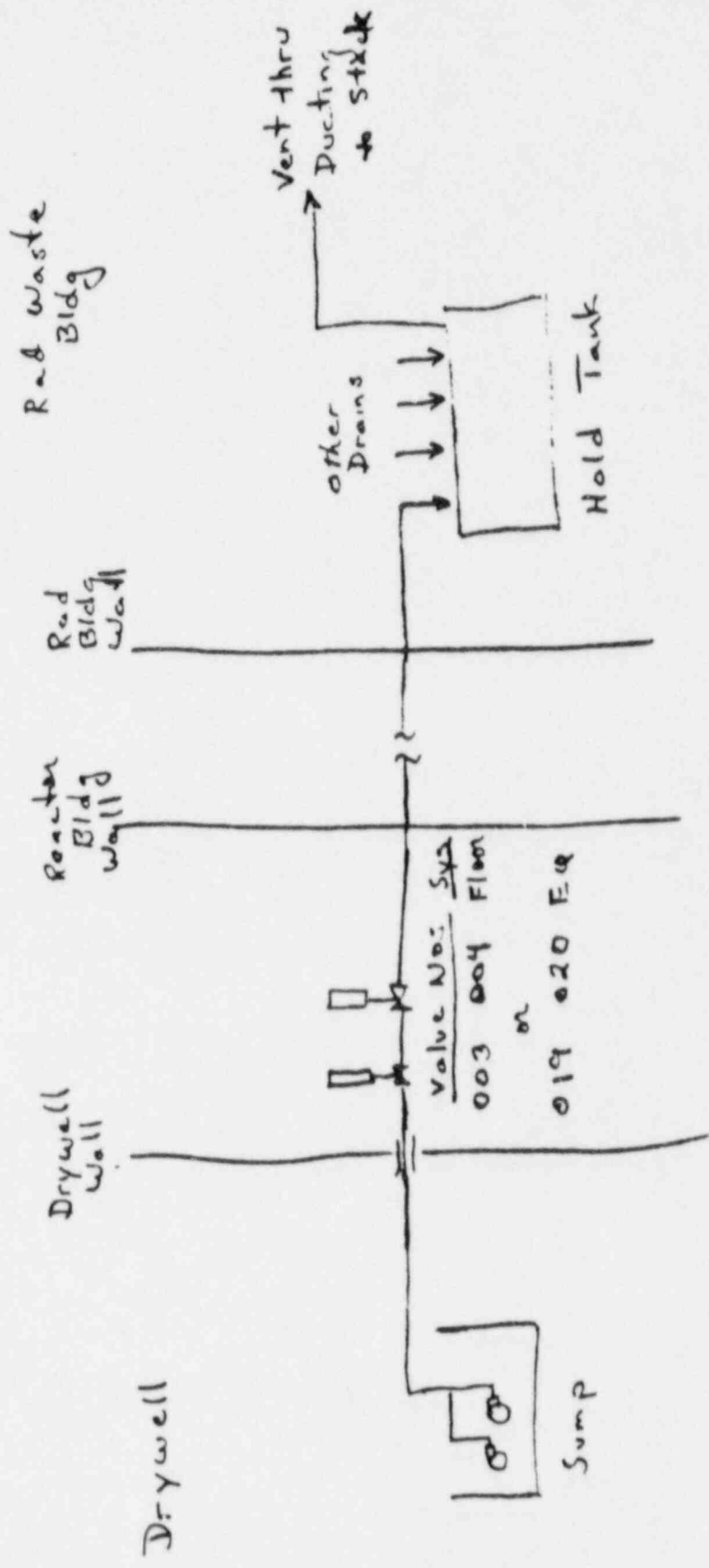
(1) The AIT documented the facts associated with their investigation of the event, and identified steps that the licensee could take to improve the plant specific problem. (AIT Report issued January 27, 1988).

(2) Solenoid valve problems have been the cause of numerous isolation valve failures at many different facilities. As a result, many generic communications related to solenoid valve failures have been issued (most recently Circular 81-41, IN 85-17, IN 86-57 and INPO SER 57-85); yet, isolation valve failures attributed to solenoids continue to occur (Perry, LaSalle and Brunswick). For these reasons, the following additional long term actions should be taken:

- (a) Region III in conjunction with Region II should prepare, as they have been planning, an Information Notice which summarizes the problems with solenoids, what to look for during inspections of solenoids, and suggests precautions and surveillance that should improve solenoid reliability.
- (b) AEOD should determine the extent of Asco solenoid valve failures as indicated by a review of operating reactor data (LERs and NPRDS). Of particular interest are failures related to inadequacies of Asco solenoid valve design, air system quality inadequacies, and maintenance related deficiencies which might be indicative of inadequate training of technicians or poor technical information exchange between licensee and the vendor. The data should be used to develop conclusions on failure frequency, causes of failures, safety systems/functions impacted by these failures and identification of plants affected. A safety assessment of the failures should also be performed. This safety assessment should evaluate plant safety degradations which have occurred in comparison to the design basis and should consider the risk significance of systems impacted, including the potential for common cause failure. This work should be completed and sent to NRR/EAB by early summer 1988.
- (c) AEOD should evaluate the results of the ASCO solenoid valve test program which was initiated by Cleveland Electric as a result of the numerous MSIV problems at Perry. This information, used in conjunction with the evaluation identified in (b) above, should help in the formulation of any longer term follow up activities or additional regulatory recommendations. At an appropriate point during their evaluation AEOD should consider contacting INPO, or other appropriate industry group, to obtain early industry involvement in taking action to improve solenoid valve reliability.

  
Jerry Carter  
BWR Section  
Events Assessment Branch

cc: E. Sylvester  
C. Rossi



BRUNSWICK DRYWELL DRAIN  
SCHEMATIC  
FOR  
EQUIPMENT and FLOOR DRAINS

Reportable Event number 11109 .

Facility : BRUNSWICK  
Unit : 2  
Region : 2  
Vendor : GE,GE  
Operations Officer : Ray Smith  
NRC Notified By : L. JOHNSON  
Rad Release : No  
Cause : Unknown  
Component :

Date Notified : 01/02/88  
Time Notified : 04:10  
Date of Event : 01/02/88  
Time of Event : 00:17  
Classification : 10 CFR 50.72  
Category 1 : SCRAM  
Category 2 : ESF Actuation  
Category 3 :  
Category 4 :

EVENT DESCRIPTION :

WHILE SHUTTING DOWN FOR A PLANNED OUTAGE, THE UNIT WAS MANUALLY SCRAMMED FROM 51% POWER DUE TO DECREASING CONDENSER VACUUM. IT IS SUSPECTED THAT THE DECREASING VACUUM WAS DUE TO EXISTING STEAM LEAKS BECOMING VACUUM LEAKS AS TURBINE LOAD WAS DECREASED. GROUPS 2, 6 AND 8 ISOLATIONS WERE RECEIVED FOLLOWING THE SCRAM AS EXPECTED ON LOW LEVEL 1. ALL SYSTEMS FUNCTIONED AS REQUIRED EXCEPT TWO DRYWELL FLOOR DRAIN CONTAINMENT ISOLATION VALVES (#2G16-F003 & F004) AND TWO DRYWELL EQUIPMENT DRAIN CONTAINMENT ISOLATION VALVES (#2G16-F019 & F020) DID NOT AUTOMATICALLY CLOSE AS EXPECTED. THE UNIT IS NOW IN COND 3 (HOT S/D) AND WILL BE PROCEEDING TO COND 4 (COLD S/D) FOR THE OUTAGE. THE NRC RESIDENT WILL BE NOTIFIED. (NOTIFIED R2 POTTER).  
\* \* \* UPDATE @ 1251 BY COOPER \* \* \* THE F003 & F004 VALVES CLOSED UPON RECEIPT OF A MANUAL CLOSE SIGNAL (SWITCH POSITION) BUT THE F019 & F020 VALVES CLOSED ONLY AFTER CYCLING THE VALVE SWITCH TO THE CLOSED POSITION SEVERAL TIMES. THE CORRESPONDING UNIT 1 VALVES (#1G16-F003, F004, F019 & F020) WERE TESTED & MANUALLY CLOSED (SWITCH POSITION) SATISFACTORILY. LICENSEE WILL TROUBLESHOOT / REPAIR THE UNIT 2 VALVES. WRITTEN REPORT TO FOLLOW. LICENSEE INFORMED RI. NOTIFIED R2DO POTTER.

January 4, 1988

PRELIMINARY NOTIFICATION OF EVENT OR UNUSUAL OCCURRENCE PNO-II-88-01

This preliminary notification constitutes EARLY notice of events of POSSIBLE safety or public interest significance. This information is as initially received without verification or evaluation, and is basically all that is known by the Region II staff on this date.

FACILITY:	Licensee Emergency Classification:
Carolina Power & Light company	Notification of Unusual Event
Brunswick Unit 2	Alert
Docket No. 50-324	Site Area Emergency
Southport, North Carolina	General Emergency
	X Not Applicable

SUBJECT: REGION II DISPATCHES AUGMENTED INSPECTION TEAM (AIT) TO BRUNSWICK.

Following consultation with the Office of Nuclear Reactor Regulation (NRR) and the Office of Analysis and Evaluation of Operational Data (AEOD), Region II is dispatching an Augmented Inspection Team to Carolina Power and Light Company's Brunswick nuclear power plant, located near Southport, North Carolina, to make an in-depth determination of why primary containment isolation valves for the Unit 2 drywell equipment drains and drywell floor drains failed to automatically close after receipt of valid Group 2 isolation signal on January 2, 1988.

A manual scram had been initiated at 12:17 a.m. (EST) on January 2, when condenser vacuum reached 22" Hg (decreasing) during an planned shutdown for a refueling outage. Subsequently, a valid low level 1 signal (vessel level (162.5 inches) caused the group 2, 6 and 8 isolation signals. A total of four valves in both divisions failed to close as designed.

The two floor drains were subsequently closed from the control room, but the equipment drain valves did not close. One equipment drain valve was found closed approximately 5 minutes after the event, and the other at approximately 10 minutes after the event. During this time, the auto close signal for the valve was sealed in.

The licensee cycled all four valves successfully later that morning when the drains had to be pumped. A licensee team has been investigating the event, but thus far no definitive cause has been found.

The NRC senior resident inspector responded to the site on January 3 and continues to monitor the licensee's activities, augmented by regional staff.

Unit 2 will be in a scheduled refueling and maintenance outage until April, 1988.

The State of North Carolina has been informed.

There was no injury to personnel, no release of radioactivity and no danger to public health and safety as a result of this event. The NRC's AIT is being dispatched to the site to provide an in-depth regulatory analysis of the event to assure that its cause is fully understood prior to restart of the unit.

This information is current as of 4:00 p.m. (EST) on January 4, 1988.

CONTACT\* P. FREDRICKSON - 242-5649

Licensee/Facility  
 CP&I/Brunswick 1

Notification/Subject  
 Resident Inspector  
 HPCI Valve Motor Failure

Event  
 Event No. N/A

On December 31, 1987, with Unit 1 at full power, the HPCI steam admission valve motor failed during routine surveillance testing. The licensee found the motor armature grounded and the shunt field open. No mechanical problem was found with the valve or actuator. Cause of the motor failure is unknown at this time. The licensee replaced the motor, tested the valve and declared the system operable on January 2, 1988, at 8:45 p.m.

Regional Action: The resident inspector will follow this event

Licensee/Facility  
 CP&I/Brunswick 2

Notification/Subject  
 Duty Officer  
 Multi-Train Containment  
 Isolation Valve failure

Event  
 Event No. 11109

On January 2, 1988, primary containment isolation valves for the Unit 2 drywell equipment drains and drywell floor drains (4 valves total, both divisions) failed to auto close after receipt of a valid group 2 isolation signal. A manual scram from 5IX had been initiated at 12:17 a.m. on January 2, 1988, when condenser vacuum reached 22" Hg decreasing during a planned shutdown for a refueling outage. At 12:23 a.m., a valid low level 1 signal (vessel level less than 162.5 inches) caused the Group 2 and 4 isolation signals. The two floor drain valves were subsequently closed from the control room, but the equipment drain valves did not close. One equipment drain valve was found closed 5 minutes after the event and the other at 10 minutes after the event. During this time, the auto close signal for the valve was sealed-in. The licensee cycled all four valves successfully later that morning when the drains had to be pumped. The licensee assembled a team to investigate the event. No definitive cause has yet been found. Troubleshooting efforts to date have included visual verification of control room wiring, re-verification of 18 month logic function test and disassembly of one of the equipment drain valves solenoid. The licensee has verified that the Unit 1 valves shut using the control room switches. The licensee continues their troubleshooting activities. Unit 2 will be in an outage until April 1988.

Regional Action: The senior resident inspector responded to the site on January 3 and continues to monitor the licensee's activities. The resident staff will be augmented by regional specialists to review this event.



MORNING REPORT - REGION II January 5, 1988

PRIORITY ATTENTION REQUIRED

Licensee/Facility  
RMI/Brunsalek 2

Notification/Subject  
Region II  
Update of REM 11109

Event

Event No 11109

An Augmented Investigation Team (AIT) has been dispatched to the Carolina Power and Light Company's Brunswick site to review the events and licensee actions related to a multi-train failure of drilled equipment and floor drain containment isolation valves subsequent to a reactor scram of Unit 2 on January 2, 1988. At present, the licensee has not determined the failure mechanism, but has been able to verify valve operability on the operating unit. A PM has been issued on this event.

Licensee/Facility  
CPR/Malch 2

Notification/Subject  
Resident/Low Reactor  
Water Level

Event

Event No N/A

Information: A low reactor water level occurred when the feedwater controller failed high. The operator took manual control and restored the water level before the reactor screamed. The water level reached a level of 12.5 inches as indicated by the SPDS system while the scram setpoint is at 12.38 inches. One recorder in the Control Room indicated that the level was 10.5 inches. The licensee checked the setpoints and found them to be properly set and functioning properly. The licensee is continuing to investigate this event and the Resident Inspector is also following the investigation.

CAROLINA POWER & LIGHT COMPANY  
BRUNSWICK STEAM ELECTRIC PLANT  
PLANT OPERATING MANUAL  
VOLUME XII

UNIT 0

PROCEDURE TYPE: CORRECTIVE MAINTENANCE INSTRUCTION (CM)  
PROCEDURE NUMBER: OCM-SV004  
PROCEDURE TITLE: ASCO 206-832 SERIES SOLENOID VALVES  
WITH RESILIENT SEATING

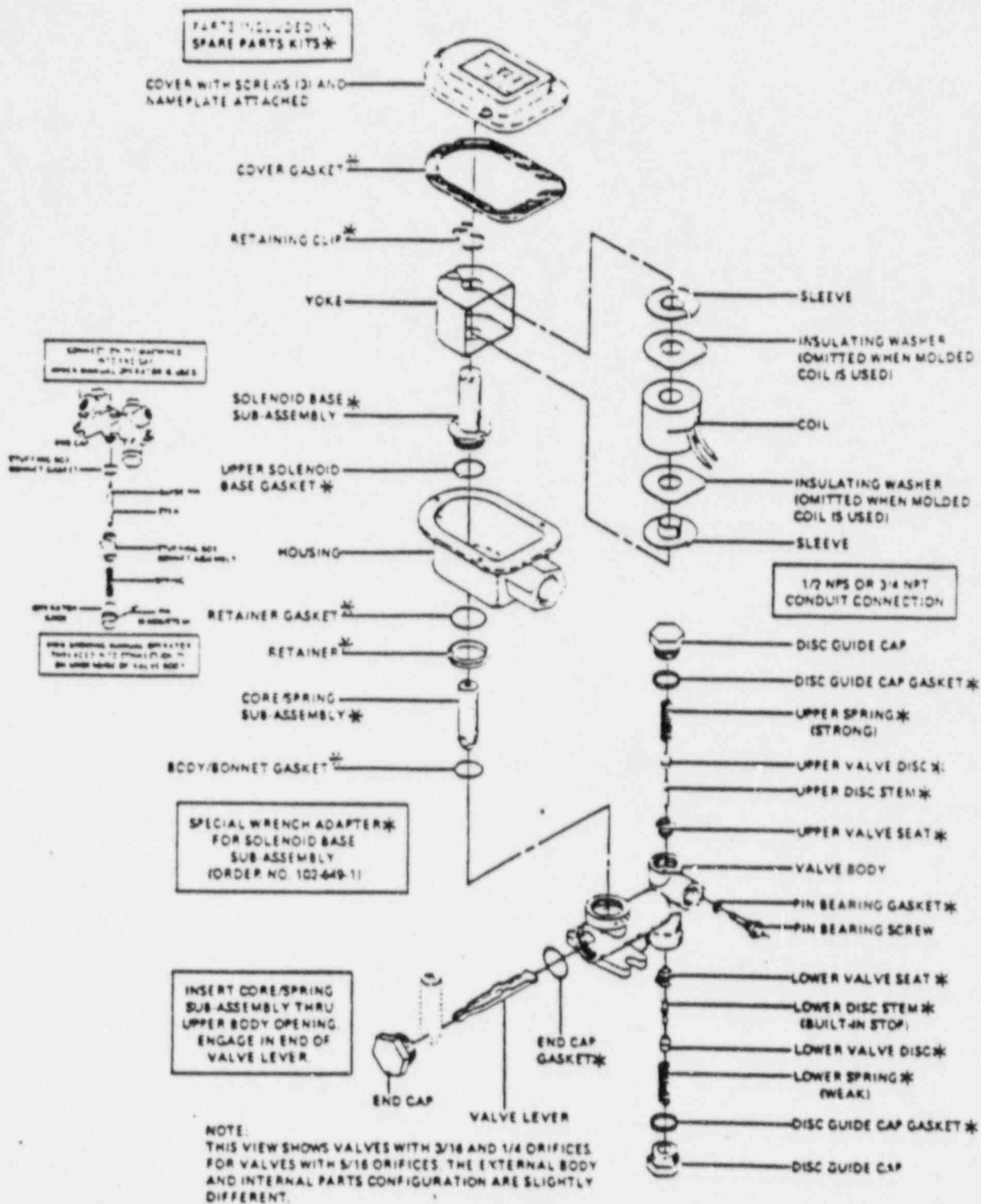
REVISION 1

APPROVED BY:

John Sullivan  
General Manager/Manager - Maintenance

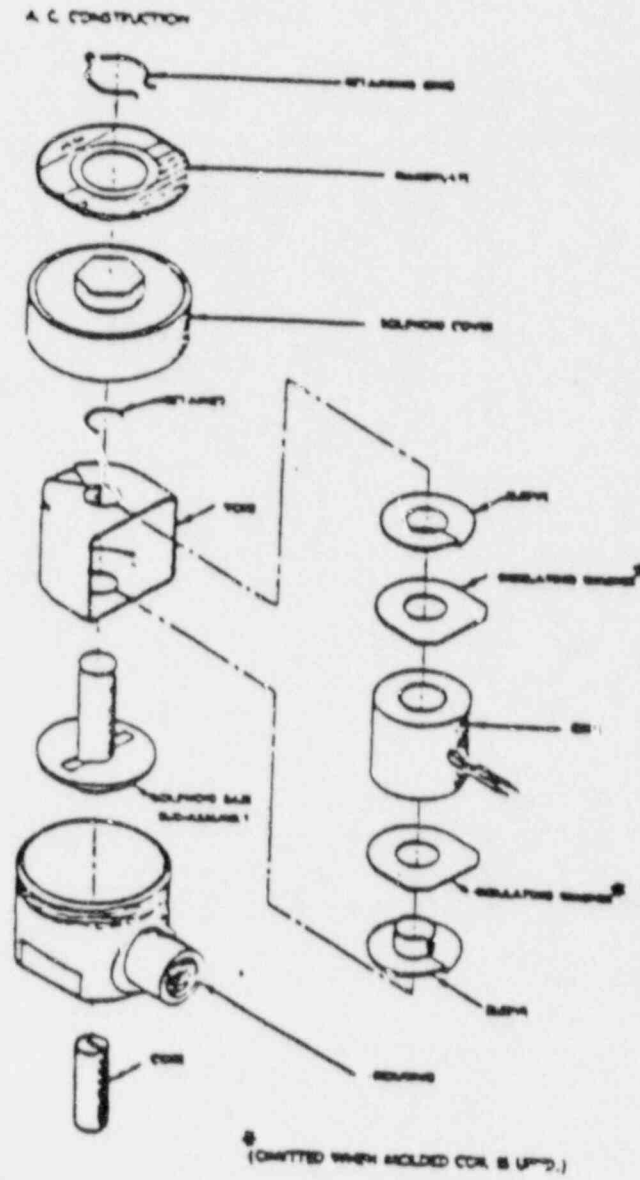
8/11/87  
Date

FIGURE 1



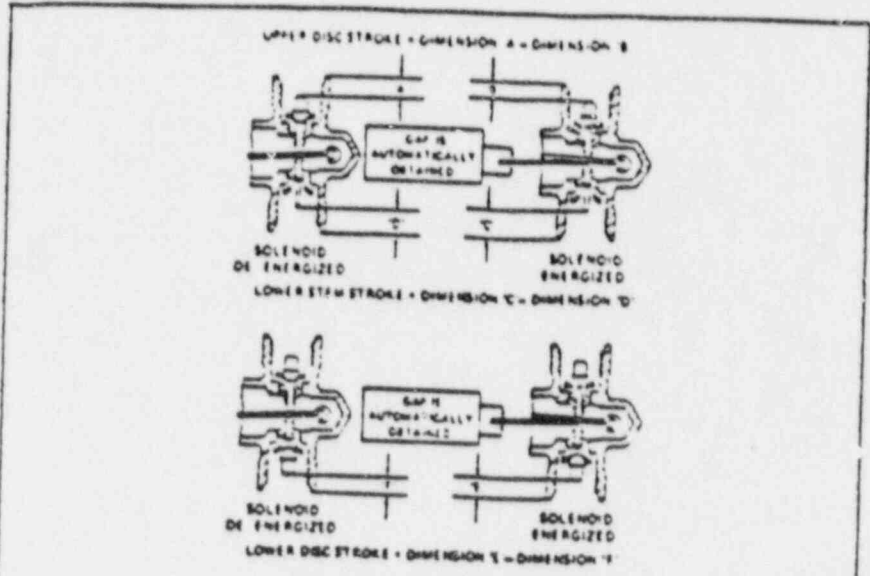
Bullius 206-380  
 Resistant Sealing - A-C Service  
 Watertight Solenoid Enclosure Shows  
 For Explosion-Proof/Watertight Solenoid Enclosure Used On Bullius 206-432. See Form No. V5381

FIGURE 2

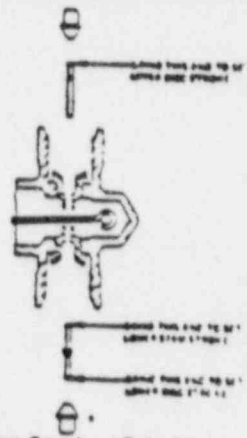


CATALOG 80173  
EXPLOSION PROOF AND WATERTIGHT

FIGURE 3



Method of Stroke Measurement



Setting Stroke (Grinding)

"STROKE CHART"

Pipe Size NPT	Catalog Number	Orific Size	Stroke	
			Upper Disc	Lower Disc
1/8	206-380-1R & -1RV	3/16	.060 <sup>+.005</sup> -.000	.040 <sup>+.005</sup> -.000
	206-832-1R & -1RV	3/16		
1/4	206-380-2R & -2RV	3/16		
	206-832-2R & -2RV	3/16		
	206-380-3R & -3RV	1/4		
3/8	206-832-3R & -3RV	1/4		
	206-380-4R & -4RV	3/16		
	206-832-4R & -4RV	3/16		
	206-380-5R & -5RV	1/4		
1/2	206-832-5R & -5RV	1/4	.070 <sup>+.005</sup> -.000	.050 <sup>+.005</sup> -.000
	206-380-6R & -6RV	5/16		
1/2	206-832-6R & -6RV	5/16		
	206-380-7R & -7RV	5/16		
1/2	206-832-7R & -7RV	5/16		
	206-380-7R & -7RV	5/16		

TACS NUMBER \* **67092**  
NEW ASSIGNMENT  
NEW INFORMATION

TECHNICAL ASSIGNMENT CONTROL  
OFFICE OF NUCLEAR REACTOR REGULATION

SECTION I. REQUEST DATA

PREPARED BY (Name): <b>Mary Lynn Reardon</b>			MAIL STOP <b>416</b>	IA1 DATE PREPARED * <b>102 10 88</b>
IA2/AF1 FACILITY NAME AND ASSIGNMENT TITLE * (Limit to 120 characters) <b>SOLENOID VALVE FAILURES - Brunswick 1 - Longterm Followup</b>				IA1 DOCKET NUMBER * <b>50-</b>
				IA2 PLANNED ACCOMPLISHMENT NUMBER <b>1   2   1   3   1  </b>
				IA3 REQUESTING TARGET DATE MONTH DAY YEAR
IA4 REQUEST CONTACT * <b>M.L. Reardon</b>	IA5 REQUESTER'S INITIALS * <b>MQR</b>	IA6 REQUESTING ORGANIZATION * <b>OEAB</b>	IA7 MULTIPLANT ACTION NUMBER	IA8 REVIEW BY REGION 1 <input type="checkbox"/> 2 <input checked="" type="checkbox"/> 3 <input checked="" type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>
				ACCESSION NUMBER OR COPY OF INCOMING ATTACHED

SECTION II. SYSTEMS CONTROL DATA

A. OPERATING REACTOR ACTIONS				
PRIORITY * <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3 N/A	IFB: FEE RECOVERABLE * <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	IFP: APPLICATION FEE RECEIVED * <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	IA9 APPLICATION DATE * <b>2 10 88</b>	
B. TOPICAL REPORT REVIEWS				
VENDOR'S NAME				REPORT IDENTIFICATION SYMBOL IA10 P-PROPRIETARY
IA11 REPORT DATE MONTH DAY YEAR	IA12 ADDITIONAL INFORMATION REQUEST DATE MONTH DAY YEAR	IA13 SUBMIT DATE MONTH DAY YEAR	IA14 DATE LETTER TO VENDOR MONTH DAY YEAR	IA15 NP-NONPROPRIETARY VERSION IA16 NONPROPRIETARY REPORT
IA17 STATUS ACCEPTED		NOT ACCEPTED WITHDRAWN		
IA18/IA19 REQUESTING REMARKS (Limit to 120 characters) <b>Prepare Information Notice that summarizes what to look for when inspecting solenoids. maintenance, precautions, and problems to avoid. AEOD will assess failure data of solenoids, results of Perry testing and initiate discussions with industry.</b>				

SECTION III. REVIEW DATA

REVIEWER'S SURNAME	ICA: REVIEWER'S INITIALS *	ICB: ESTIMATED HOURS	COMPLETION DATE	
			ICD: ESTIMATED MONTH DAY YEAR	ICE: ACTUAL MONTH DAY YEAR
Lanksbury (Region III)				
J. Carter	<b>JFC</b>			

\* REQUIRED ENTRIES