



IES Utilities Inc.  
200 First Street S.E.  
P.O. Box 351  
Cedar Rapids, IA 52406-0351  
Telephone 319 398 8162  
Fax 319 398 8192

John F. Franz, Jr.  
Vice President, Nuclear

January 28, 1997  
NG-97-0106

Mr. Frank J. Miraglia, Director  
Office of Nuclear Reactor Regulation  
U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Mail Station P1-37  
Washington, DC 20555-0001

Subject: Duane Arnold Energy Center  
Docket No: 50-331  
Op. License No: DPR-49  
120 Day Response to Generic Letter 96-06, "Assurance of Equipment  
Operability and Containment Integrity During Design-Basis Accident  
Conditions"  
File: A-101b

Dear Mr. Miraglia:

The purpose of this letter is to provide IES Utilities Inc.'s 120 day response to Generic Letter (GL) 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions."

As requested by the GL, IES Utilities Inc. is providing a summary of the actions taken as recommended in the GL. Attached are our actions taken in response to the requested actions, conclusions reached relative to susceptibility for waterhammer and two-phase flow in the containment air cooling water system and overpressurization of piping that penetrates containment, and corrective actions that were implemented.

Corrective actions to address the concerns of GL 96-06 have been completed.

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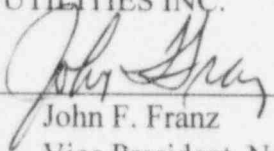
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This letter contains no new commitments.

Please contact this office if you have further questions regarding this matter.

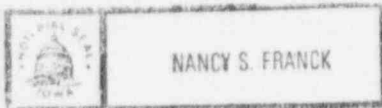
This letter is true and accurate to the best of my knowledge and belief.

IES UTILITIES INC.

By   
John F. Franz  
Vice President, Nuclear

State of Iowa  
County of Linn

Signed and sworn to before me on this 27<sup>th</sup> day of January, 1997,  
by John F. Franz.



Nancy S. Franck  
Notary Public in and for the State of Iowa

Sept 28, 1998  
Commission Expires

Attachment

cc: R. Murrell  
L. Root  
G. Kelly (NRC-NRR)  
A. B. Beach (Region III)  
NRC Resident Office  
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## ***Equipment Operability and Containment Integrity During Design-Basis Accident Conditions***

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### ***Introduction***

This report documents the results of evaluations performed by IES Utilities Inc. to determine:

- (1) if containment air cooling water systems are susceptible to either waterhammer or two-phase flow conditions during postulated accident conditions, and
- (2) if piping systems that penetrate the containment are susceptible to thermal expansion of fluid so that overpressurization of piping could occur.

These evaluations were performed in accordance with the recommendations of NRC Generic Letter 96-06 [1]. Corrective actions that have been implemented as a result of these evaluations are described. All required actions were completed and plant modifications were performed during Refueling Outage (RFO) 14, which was completed on November 16, 1996.

### ***Containment Air Cooling Water Systems***

Drywell cooling is provided by eight individual cooling units (Fig. 1). Drywell air is drawn through the cooling units via axial flow recirculating fans. Cooling water is provided by the well water system. The drywell air cooler fans and well water pumps are provided electrical power by the non-essential bus. The drywell air cooling system is not nuclear safety-related (as described in UFSAR Section 9.2.1.3).

The cooling water system is divided into two loops (A and B). Each loop is provided with pneumatic operated containment isolation valves on the supply and return lines. These valves are located outside the drywell. A check valve, also located outside the drywell, is provided on each supply line. In addition, cooling units 1A/B through 6A/B have motor operated isolation valves on the cooler inlet and outlet lines.

During a design-basis Loss Of Coolant Accident (LOCA), with or without loss of offsite power, containment isolation valves CV-5718A/B on the cooling water supply lines and CV-5704A/B on the cooling water return lines would close on a Group 7 (Reactor Building Closed Cooling Water and Well Water Containment Cooling) isolation. Overpressure protection for the isolated piping section is provided by pressure relief valves PSV-5718A/B on the supply headers and PSV-5704A/B on the return headers. A pressure relief valve, PSV-5736, is also provided on the supply line to the 7A and 7B coolers. These pressure relief valves have a set pressure of 220 psig except for PSV-5736 which has a set pressure of 250 psig. In addition, each cooling unit 1A/B-

6A/B has an individual pressure relief valve. The set pressure for these valves is also 220 psig. Design pressure for the cooling water system piping is 220 psig. These pressure relief valves protect the cooling water system to the drywell air coolers from thermally induced overpressurization during a design basis LOCA.

The drywell temperature responses for a design-basis LOCA and small break LOCA are shown in Fig. 2. The cooling water could heat up to a maximum of 340° F during a small break LOCA. The saturation temperature at the pressure relief valve set pressure of 220 psig is 396° F. Thus, boiling will not occur in the isolated cooling water piping during accident conditions. On this basis, the cooling water system serving the drywell air coolers is not subject to waterhammer or two-phase flow if the system is restarted following a design-basis LOCA.

## ***Overpressurization of Isolated Piping Sections***

### **Screening Criteria**

Isolated piping sections susceptible to thermally induced pressurization during design-basis accident conditions were identified as follows. A list was made of the primary containment isolation valves [2]. Each primary containment valve was subjected to the following screening questions.

1. Is the valve normally closed or closed during any postulated LOCA which would result in an increase in the temperature in the drywell?
2. Is any part of the isolated pipe section located inside the drywell?
3. Is the isolated pipe section filled with water?
4. Is the system provided with pressure relief?

If the answer to each of the first three questions was yes and the answer to the fourth question was no, then the isolated piping section associated with the valve was considered to be susceptible to thermally induced pressurization and a detailed evaluation was performed. However, if the answer to any of the first three questions was no or the answer to the fourth question was yes, then the isolated piping section was considered not susceptible to thermally induced pressurization and further evaluation was not required.

The screening criteria were applied to a total of 163 valves (Table 1). Four piping sections which penetrate containment were determined to be susceptible to thermally induced pressurization during design basis accident conditions: The Residual Heat Removal (RHR) shutdown cooling line between motor-operated valves MO-1908 and MO-1909, the condensate demineralized water supply to the drywell between manual valves V09-0065 and V09-0111, the drain line from the drywell equipment drain sump between check valves V37-0001 and V37-0003 and control

valve CV-3728, and the drain line from the drywell floor drain sump between check valves V37-0017 and V37-0019 and control valve CV-3704. These four lines were subjected to detailed evaluations described in the following section. All other lines which penetrate the primary containment were screened out (i.e., determined to be not susceptible to thermally induced pressurization).

### **Detailed Evaluations**

#### **RHR Shutdown Cooling**

The RHR shutdown cooling line provides a flow path between the B Recirculation Loop and the RHR pumps (Fig. 3). During normal operation, inboard isolation valve MO-1908 and outboard isolation valve MO-1909 are closed. These valves are closed during startup when the temperature of the water flowing through the shutdown cooling line is approximately 80° F.

During a postulated LOCA, the water trapped between MO-1908 and MO-1909 would be subject to heating. The drywell temperature responses for a design-basis and small break LOCA are shown in Fig. 2. The temperature of the water trapped between MO-1908 and MO-1909 was calculated to heat up to about 200° F for both the design-basis and small break LOCA. The resulting internal pressure increase could place excessive strain on the piping. Therefore, the decision was made to modify the RHR shutdown cooling line.

The modification consisted of a bypass line with a check valve which vents the section of pipe between MO-1908 and MO-1909 back to the upstream pipe (Fig. 4). The bypass line prevents the pressure in the isolated section of pipe from being higher than the reactor coolant system pressure. This provides overpressure protection for the isolated section of pipe and containment isolation valves MO-1908 and MO-1909. The bypass line tees into an existing vent line located upstream of MO-1908 and reconnects to the RHR shutdown cooling line between MO-1908 and MO-1909.

#### **Condensate Demineralized Water System**

The condensate demineralized water system provides a source of demineralized water to the drywell (Fig. 5). During normal operation, this system is isolated by inboard containment isolation valve V09-0111 and outboard containment isolation valve V09-0065. These manual valves are closed during startup when the temperature of the demineralized water flowing through the lines is approximately 80° F.

During a postulated LOCA, the water trapped between V09-0111 and V09-0065 would be subject to heating. Since the piping is not insulated, the water in the portion of the isolated pipe located inside the drywell would heat up to about 340° F, the maximum drywell temperature for a small break LOCA. The water in the portion of the isolated pipe located outside the drywell was assumed to stay at the ambient temperature of the steam tunnel, approximately 150° F.

About 65 percent of the isolated pipe is located inside the drywell. On this basis, the average temperature of the water in the isolated section of pipe between V09-0111 and V09-0065 was calculated to be about 275° F. The resulting internal pressure increase could induce excessive strain on the piping. However, this line is not routinely used at Duane Arnold Energy Center. The line is pressurized for leak rate testing of containment isolation valves V09-0111 and V09-0065 and is left in the drained condition. This piping section is currently drained and procedural restrictions have been placed in the appropriate Operating Instruction to ensure that the line is drained after future use.

### **Drywell Equipment and Floor Drain Sumps**

The drywell equipment and floor drain sumps transfer leakage within the drywell to the radwaste system (Figs. 6 and 7). During transfer, the leakage passes through a flow element to determine the identified drywell leakage (from equipment drain sump) and unidentified drywell leakage (from floor drain sump). A check valve on the discharge leg of each pump and an inverted loop seal downstream of the flow elements keeps the piping full of water between the check valves and the inverted loop seal when the sump pumps are not running. The sump pumps are started approximately every four hours during normal plant operation. The pumps shut off automatically at a preset sump level.

During a postulated LOCA, containment isolation valves CV-3728 and CV-3729 on the equipment drain sump and CV-3704 and CV-3705 on the floor drain sump would automatically close on a Group 2 (Radwaste and Traversing In-Core Probe valves) isolation. This action would trap water between the containment isolation valves and the check valves on the pump discharge legs. This water would be subject to heating during a LOCA. Since the pipe is uninsulated and about 85 percent of the isolated pipe is located inside the drywell, the temperature of the water in the isolated pipe will approach 340° F, the maximum drywell temperature during a small break LOCA. The resulting internal pressure increase could induce excessive strain on the piping. Therefore, the decision was made to modify the drywell equipment and floor drain sumps.

The modification consisted of the installation of an expansion chamber in each system (Fig. 8). The expansion chamber provides an air volume to accommodate the thermal expansion of the water trapped in the isolated sections of the pipe.

During normal operation, the pressure in the expansion chamber will be approximately atmospheric pressure (14.7 psia). The water level will be the same as the high point of the inverted loop seal for the equipment drain sump and for the floor drain sump.

### **CONCLUSIONS**

All recommended actions for GL 96-06 have been completed.

## ***References***

1. NRC Generic Letter No. 96-06, Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions, September 30, 1996.
2. Administrative Control Procedure ACP 1410.7, Rev. 5, Guidelines for Primary Containment Valves and Penetrations.



Table 1  
General Screening of Piping Systems Which Penetrate Containment for  
Thermally Induced Pressurization During Design Basis Accident Conditions

| Valve        | Description                                    | P&ID        | Screening Criteria  |                          |                             |                  | Detailed Evaluation? |
|--------------|--|-------------|---------------------|--------------------------|-----------------------------|------------------|----------------------|
|              |  |             | Closed During LOCA? | Isolated Pipe Inside DW? | Isolated Pipe Water Filled? | Pressure Relief? |                      |
| 1S260A-BALL  | "A" TIP Drive Ball Valve                       | M143 & M130 | Yes                 | Yes                      | No Nitrogen                 | No               | No                   |
| 1S260A-SHEAR | "A" TIP Drive Shear Valve                      | M143 & M130 | Yes                 | Yes                      | No Nitrogen                 | No               | No                   |
| 1S260B-BALL  | "B" TIP Drive Ball Valve                       | M143 & M130 | Yes                 | Yes                      | No Nitrogen                 | No               | No                   |
| 1S260B-SHEAR | "B" TIP Drive Shear Valve                      | M143 & M130 | Yes                 | Yes                      | No Nitrogen                 | No               | No                   |
| 1S260C-BALL  | "C" TIP Drive Ball Valve                       | M143 & M130 | Yes                 | Yes                      | No Nitrogen                 | No               | No                   |
| 1S260C-SHEAR | "C" TIP Drive Shear Valve                      | M143 & M130 | Yes                 | Yes                      | No Nitrogen                 | No               | No                   |
| CV1804A      | "A" Recirc Pump Mini-Purge Supply Isolation    | M117        | Yes                 | Yes                      | Yes                         | Yes<br>V17-0096  | No                   |
| CV1804B      | "B" Recirc Pump Mini-Purge Supply Isolation    | M117        | Yes                 | Yes                      | Yes                         | Yes<br>V17-0083  | No                   |
| CV3704       | Drywell Floor Drain Sump Inboard Isolation     | M137-1      | Yes                 | Yes                      | Yes                         | No               | Yes                  |
| CV3705       | Drywell Floor Drain Sump Outboard Isolation    | M137-1      | Yes                 | Yes                      | Yes                         | No               | Yes                  |
| CV3728       | Drywell Equipment Drain Sump Inboard Isolation | M137-1      | Yes                 | Yes                      | Yes                         | No               | Yes                  |

Attachment to  
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Table 1



| Valve  | Description                                     | P&ID   | Screening Criteria  |                          |                             |                  | Detailed Evaluation? |
|--------|---|--------|---------------------|--------------------------|-----------------------------|------------------|----------------------|
|        |   |        | Closed During LOCA? | Isolated Pipe Inside DW? | Isolated Pipe Water Filled? | Pressure Relief? |                      |
| CV3729 | Drywell Equipment Drain Sump Outboard Isolation | M137-1 | Yes                 | Yes                      | Yes                         | No               | Yes                  |
| CV4300 | Torus Vent Line Inboard Isolation               | M143-1 | Yes                 | No                       | No                          | No               | No                   |
| CV4301 | Torus Vent Line Outboard Isolation              | M143-1 | Yes                 | No                       | No                          | No               | No                   |
| CV4302 | Drywell Vent Line Inboard Isolation             | M143-1 | Yes                 | No                       | No                          | No               | No                   |
| CV4303 | Drywell Vent Line Outboard Isolation            | M143-1 | Yes                 | No                       | No                          | No               | No                   |
| CV4306 | Containment Purge Supply Isolation Valve        | M143-1 | Yes                 | No                       | No                          | No               | No                   |
| CV4307 | Drywell Purge Inlet Isolation Valve             | M143-1 | Yes                 | No                       | No                          | No               | No                   |
| CV4308 | Torus Purge Inlet Isolation Valve               | M143-1 | Yes                 | No                       | No                          | No               | No                   |
| CV4309 | INBD Torus Vent Bypass Line Isolation           | M143-1 | Yes                 | No                       | No                          | No               | No                   |
| CV4310 | Inboard DW Vent CV-4302 Bypass                  | M143-1 | Yes                 | No                       | No                          | No               | No                   |
| CV4311 | Containment N2 Makeup Supply Isolation          | M143-1 | Yes                 | No                       | No                          | No               | No                   |
| CV4312 | Drywell Nitrogen Makeup Inlet Isolation         | M143-1 | Yes                 | No                       | No                          | No               | No                   |
| CV4313 | Torus Nitrogen Makeup Inlet Isolation           | M143-1 | Yes                 | No                       | No                          | No               | No                   |
| CV4357 | Torus Hard Pipe Vent Line Isolation             | M143-1 | Yes                 | No                       | No                          | No               | No                   |

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| Valve   | Description                                     | P&ID   | Screening Criteria  |                          |                             |                  | Detailed Evaluation? |
|---------|---|--------|---------------------|--------------------------|-----------------------------|------------------|----------------------|
|         |   |        | Closed During LOCA? | Isolated Pipe Inside DW? | Isolated Pipe Water Filled? | Pressure Relief? |                      |
| CV4371A | DW Valves N2 Supply Isolation (from 1T-12B)     | M143-1 | Yes                 | No                       | No                          | No               | No                   |
| CV4371C | Torus/DW Vacuum BKR N2 Supply Isolation         | M143-1 | Yes                 | No                       | No                          | No               | No                   |
| CV4378A | N2 Compressor 1K-14 DW Suction Isolation        | M143-1 | Yes                 | No                       | No                          | No               | No                   |
| CV4378B | N2 Compressor 1K-14 DW Suction Isolation        | M143-1 | Yes                 | No                       | No                          | No               | No                   |
| CV4412  | "A" Main Steam Line Inboard Isolation           | M114   | Yes                 | Yes                      | No<br>Cond. Steam           | No               | No                   |
| CV4413  | "A" Main Steam Line Outboard Isolation          | M114   | Yes                 | Yes                      | No<br>Cond. Steam           | No               | No                   |
| CV4415  | "B" Main Steam Line Inboard Isolation           | M114   | Yes                 | Yes                      | No<br>Cond. Steam           | No               | No                   |
| CV4416  | "B" Main Steam Line Outboard Isolation          | M114   | Yes                 | Yes                      | No<br>Cond. Steam           | No               | No                   |
| CV4418  | "C" Main Steam Line Inboard Isolation           | M114   | Yes                 | Yes                      | No<br>Cond. Steam           | No               | No                   |
| CV4419  | "C" Main Steam Line Outboard Isolation          | M114   | Yes                 | Yes                      | No<br>Cond. Steam           | No               | No                   |
| CV4420  | "D" Main Steam Line Inboard Isolation           | M114   | Yes                 | Yes                      | No<br>Cond. Steam           | No               | No                   |
| CV4421  | "D" Main Steam Line Outboard Isolation          | M114   | Yes                 | Yes                      | No<br>Cond. Steam           | No               | No                   |
| CV4639  | Recirc Sample Line Inboard Isolation            | M116   | Yes                 | Yes                      | Yes                         | No               | No (1)               |
| CV4640  | Rx Recirc System Sample Line Outboard Isolation | M116   | Yes                 | Yes                      | Yes                         | No               | No (1)               |

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| Valve   | Description                                      | P&ID | Screening Criteria  |                          |                             |                  | Detailed Evaluation? |
|---------|--|------|---------------------|--------------------------|-----------------------------|------------------|----------------------|
|         |  |      | Closed During LOCA? | Isolated Pipe Inside DW? | Isolated Pipe Water Filled? | Pressure Relief? |                      |
| CV5704A | Drywell Cooling Loop A Well Water Return Isol    | M157 | Yes                 | Yes                      | Yes                         | Yes<br>PSV5704A  | No                   |
| CV5704B | Drywell Cooling Loop B Well Water Return Isol    | M157 | Yes                 | Yes                      | Yes                         | Yes<br>PSV5704B  | No                   |
| CV5718A | Drywell Cooling Loop A Well Water Supply Isol    | M157 | Yes                 | Yes                      | Yes                         | Yes<br>PSV5718A  | No                   |
| CV5718B | Drywell Cooling Loop B Well Water Supply Isol    | M157 | Yes                 | Yes                      | Yes                         | Yes<br>PSV5718B  | No                   |
| MO1902  | RHR Loop B Inboard Drywell Spray Isolation       | M119 | Yes/No              | No                       | Yes                         | No               | No                   |
| MO1903  | RHR Loop B Drywell Spray HDR Outboard Isolation  | M119 | Yes/No              | No                       | Yes                         | No               | No                   |
| MO1905  | RHR Loop B LPCI Inboard Injection Isolation      | M119 | Yes/No              | Yes                      | Yes                         | Yes<br>V19-0149  | No                   |
| MO1908  | RHR Shutdown Cooling Suction Isolation           | M119 | Yes                 | Yes                      | Yes                         | No               | Yes                  |
| MO1909  | RHR Shutdown Cooling Outboard Suction Isol       | M119 | Yes                 | Yes                      | Yes                         | No               | Yes                  |
| MO1932  | RHR Loop B Torus Spray & Cooling Supply HDR Isol | M119 | Yes/No              | No                       | Yes                         | No               | No                   |
| MO1933  | RHR Loop B Torus Spray Header Isolation          | M119 | Yes/No              | No                       | Yes                         | No               | No                   |
| MO1934  | RHR Loop B Torus Cooling & Test Return HDR Isol  | M119 | Yes/No              | No                       | Yes                         | No               | No                   |
| MO1949A | RHR Hx 1E-201B Shell Side Outboard Vent          | M119 | Yes                 | No                       | Yes                         | No               | No                   |
| MO1949B | RHR Hx 1E-201B Shell Side Inboard Vent           | M119 | Yes                 | No                       | Yes                         | No               | No                   |

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| Valve   | Description                                      | P&ID | Screening Criteria  |                          |                             |                      | Detailed Evaluation? |
|---------|--|------|---------------------|--------------------------|-----------------------------|----------------------|----------------------|
|         |  |      | Closed During LOCA? | Isolated Pipe Inside DW? | Isolated Pipe Water Filled? | Pressure Relief?     |                      |
| MO1970  | RHR Hx 1E-201B Drain to Torus                    | M119 | Yes                 | No                       | Yes                         | No                   | No                   |
| MO2000  | RHR Loop A Inboard Drywell Spray Valve           | M120 | Yes/No              | No                       | Yes                         | No                   | No                   |
| MO2001  | RHR Loop A Drywell Spray HDR Outboard Isolation  | M120 | Yes/No              | No                       | Yes                         | No                   | No                   |
| MO2003  | RHR Loop A LPCI Inboard Injection Isolation      | M120 | Yes/No              | Yes                      | Yes                         | Yes<br>V20-0082      | No                   |
| MO2005  | RHR Loop A Torus Spray & Cooling Supply HDR Isol | M120 | Yes/No              | No                       | Yes                         | No                   | No                   |
| MO2006  | RHR Loop A Torus Spray Header Isolation          | M120 | Yes/No              | No                       | Yes                         | No                   | No                   |
| MO2007  | RHR Loop A Torus Cooling & Test Return HDR Isol  | M120 | Yes/No              | No                       | Yes                         | No                   | No                   |
| MO2038  | RHR Hx 1E-201A Drain to Torus                    | M120 | Yes                 | No                       | Yes                         | No                   | No                   |
| MO2044A | RHR Hx Shell Side Outboard Vent                  | M120 | Yes                 | No                       | Yes                         | No                   | No                   |
| MO2044B | RHR Hx Shell Side Inboard Vent                   | M120 | Yes                 | No                       | Yes                         | No                   | No                   |
| MO2112  | Core Spray Loop A Test Bypass Valve              | M121 | Yes                 | No                       | No                          | Yes<br>Open to Torus | No                   |
| MO2117  | Core Spray Inboard Injection Valve               | M121 | Yes/No              | Yes                      | Yes                         | Yes<br>V21-0072      | No                   |
| MO2132  | Core Spray Loop B Test Bypass Valve              | M121 | Yes                 | No                       | No                          | Yes<br>Open to Torus | No                   |
| MO2137  | Core Spray Loop B Inboard Injection Valve        | M121 | Yes/No              | Yes                      | Yes                         | Yes<br>V21-0073      | No                   |

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| Valve   | Description                                       | P&ID | Screening Criteria  |                          |                             |                  | Detailed Evaluation? |
|---------|---|------|---------------------|--------------------------|-----------------------------|------------------|----------------------|
|         |   |      | Closed During LOCA? | Isolated Pipe Inside DW? | Isolated Pipe Water Filled? | Pressure Relief? |                      |
| MO2238  | HPCI Steam Supply Inboard Isolation               | M122 | Yes/No              | Yes                      | No<br>Cond. Steam           | No               | No                   |
| MO2239  | HPCI Steam Supply Outboard Isolation              | M122 | Yes/No              | Yes                      | No<br>Cond. Steam           | No               | No                   |
| MO2290A | HPCI/RCIC Turb Stm Exhst Vacuum Breaker Line Isol | M122 | Yes                 | No                       | No                          | No               | No                   |
| MO2290B | HPCI/RCIC Turb Stm Exhst Vacuum Breaker Line Isol | M122 | Yes                 | No                       | No                          | No               | No                   |
| MO2312  | HPCI Feedwater Injection Isolation                | M123 | Yes/No              | Yes                      | Yes                         | Yes<br>V14-0003  | No                   |
| MO2400  | RCIC Steam Supply Inboard Isolation               | M124 | Yes/No              | Yes                      | No<br>Cond. Steam           | No               | No                   |
| MO2401  | RCIC Steam Supply Outboard Isolation              | M124 | Yes/No              | Yes                      | No<br>Cond. Steam           | No               | No                   |
| MO2512  | RCIC Injection Header Isolation                   | M125 | Yes/No              | Yes                      | Yes                         | Yes<br>V14-0001  | No                   |
| MO2700  | RWCU Inlet Inboard Isolation                      | M127 | Yes                 | Yes                      | Yes                         | No               | No (1)               |
| MO2701  | RWCU Suction Outboard Isolation                   | M127 | Yes                 | Yes                      | Yes                         | No               | No (1)               |
| MO2740  | RWCU Return Header Outboard Isolation             | M127 | Yes                 | Yes                      | Yes                         | Yes<br>V14-0001  | No                   |
| MO4423  | Main Steam Line Drain Inboard Isolation           | M114 | Yes                 | Yes                      | Yes                         | No               | No (1)               |
| MO4424  | Main Steam Line Drain Outboard Isolation          | M114 | Yes                 | Yes                      | Yes                         | No               | No (1)               |
| MO4441  | Rx Feedwater Loop A Inlet Stop Check              | M114 | Yes                 | Yes                      | Yes                         | Yes<br>V14-0003  | No                   |
| MO4442  | Rx Feedwater Loop B Inject Stop Check             | M114 | Yes                 | Yes                      | Yes                         | Yes<br>V14-0001  | No                   |

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| Valve    | Description  | P&ID   | Screening Criteria  |                          |                             |                  | Detailed Evaluation? |
|----------|--|--------|---------------------|--------------------------|-----------------------------|------------------|----------------------|
|          |  |        | Closed During LOCA? | Isolated Pipe Inside DW? | Isolated Pipe Water Filled? | Pressure Relief? |                      |
| MO4841A  | Drywell RBCCW Return Header Isolation              | M112   | Yes                 | Yes                      | Yes                         | Yes<br>PSV4842   | No                   |
| MO4841B  | Drywell RBCCW Supply Header Isolation              | M112   | Yes                 | Yes                      | Yes                         | Yes<br>PSV4842   | No                   |
| PSV1952  | RHR Hx 1E-201B Inlet Press Relief                  | M119   | N/A (2)             | N/A (2)                  | N/A (2)                     | N/A (2)          | No                   |
| PSV1953  | RHR Hx 1E-201B Shell Side Pressure Relief          | M119   | N/A (2)             | N/A (2)                  | N/A (2)                     | N/A (2)          | No                   |
| PSV2042  | RHR Hx 1E-201A Shell Side Pressure Relief          | M120   | N/A (2)             | N/A (2)                  | N/A (2)                     | N/A (2)          | No                   |
| PSV2043  | RHR Hx 1E-201A Inlet Pressure Relief               | M120   | N/A (2)             | N/A (2)                  | N/A (2)                     | N/A (2)          | No                   |
| PSV2109  | Core Spray Pump 1P-211A Discharge HDR Press Relief | M121   | N/A (2)             | N/A (2)                  | N/A (2)                     | N/A (2)          | No                   |
| PSV 2129 | Core Spray Pump 1P-211B Discharge HDR Press Relief | M121   | N/A (2)             | N/A (2)                  | N/A (2)                     | N/A (2)          | No                   |
| SV4331A  | Lower Drywell Spray CAD N2 Inboard Isolation       | M143-3 | Yes                 | No                       | No                          | No               | No                   |
| SV4331B  | Lower Drywell Spray CAD N2 Outboard Isolation      | M143-3 | Yes                 | No                       | No                          | No               | No                   |
| SV4332A  | Upper Drywell Spray CAD N2 Inboard Isolation       | M143-3 | Yes                 | No                       | No                          | No               | No                   |
| SV4332B  | Upper Drywell Spray CAD N2 Outboard Isolation      | M143-3 | Yes                 | No                       | No                          | No               | No                   |
| SV4333A  | West Torus Spray HDR CAD N2 Supply Inboard Isol    | M143-3 | Yes                 | No                       | No                          | No               | No                   |
| SC4333B  | West Torus Spray HDR CAD N2 Supply Outboard Isol   | M143-3 | Yes                 | No                       | No                          | No               | No                   |

Attachment to  
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Table 1

| Valve   | Description                                       | P&ID   | Screening Criteria  |                          |                             |                  | Detailed Evaluation? |
|---------|---|--------|---------------------|--------------------------|-----------------------------|------------------|----------------------|
|         |   |        | Closed During LOCA? | Isolated Pipe Inside DW? | Isolated Pipe Water Filled? | Pressure Relief? |                      |
| SV4334A | North Torus Spray Header CAD N2 Supply Inbd Isol  | M143-3 | Yes                 | No                       | No                          | No               | No                   |
| SV4334B | North Torus Spray Header CAD N2 Supply Outbd Isol | M143-3 | Yes                 | No                       | No                          | No               | No                   |
| SV4594A | Loop A Jet Pump Sample Line Inboard Isolation     | M115   | Yes                 | No                       | Yes                         | No               | No                   |
| SV4594B | Loop B Jet Pump Sample Line Inboard Isolation     | M115   | Yes                 | No                       | Yes                         | No               | No                   |
| SV4595A | Loop A Jet Pump Sample Line Outboard Isolation    | M115   | Yes                 | No                       | Yes                         | No               | No                   |
| SV4595B | Loop B Jet Pump Sample Line Outboard Isolation    | M115   | Yes                 | No                       | Yes                         | No               | No                   |
| SV8101A | Drywell #1 Sample Line Isolation                  | M181   | Yes                 | No                       | No                          | No               | No                   |
| SV8101B | Drywell #1 Sample Line Isolation                  | M181   | Yes                 | No                       | No                          | No               | No                   |
| SV8102A | Drywell #1 Sample Line Isolation                  | M181   | Yes                 | No                       | No                          | No               | No                   |
| SV8102B | Drywell #1 Sample Line Isolation                  | M181   | Yes                 | No                       | No                          | No               | No                   |
| SV8103A | Drywell #2 Sample Line Isolation                  | M181   | Yes                 | No                       | No                          | No               | No                   |
| SV8103B | Drywell #2 Sample Line Isolation                  | M181   | Yes                 | No                       | No                          | No               | No                   |
| SV8104A | Drywell #2 Sample Line Isolation                  | M181   | Yes                 | No                       | No                          | No               | No                   |
| SV8104B | Drywell #2 Sample Line Isolation                  | M181   | Yes                 | No                       | No                          | No               | No                   |

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Table 1



| Valve    | Description                                    | P&ID | Screening Criteria  |                          |                             |                  | Detailed Evaluation? |
|----------|--|------|---------------------|--------------------------|-----------------------------|------------------|----------------------|
|          |  |      | Closed During LOCA? | Isolated Pipe Inside DW? | Isolated Pipe Water Filled? | Pressure Relief? |                      |
| SV8105A  | Drywell Sample Return Line Isolation           | M181 | Yes                 | No                       | No                          | No               | No                   |
| SV8105B  | Drywell Sample Return Line Isolation           | M181 | Yes                 | No                       | No                          | No               | No                   |
| SV8106A  | Drywell Sample Return Line Isolation           | M181 | Yes                 | No                       | No                          | No               | No                   |
| SV8106B  | Drywell Sample Return Line Isolation           | M181 | Yes                 | No                       | No                          | No               | No                   |
| SV8107A  | CAM Sys A Torus Sample Line Inboard Isolation  | M181 | Yes                 | No                       | No                          | No               | No                   |
| SV8107B  | CAM Sys B Torus Sample Line Inboard Isolation  | M181 | Yes                 | No                       | No                          | No               | No                   |
| SV8108A  | CAM Sys A Torus Sample Line Outboard Isolation | M181 | Yes                 | No                       | No                          | No               | No                   |
| SV8108B  | CAM Sys B Torus Sample Line Outboard Isolation | M181 | Yes                 | No                       | No                          | No               | No                   |
| SV8109A  | CAM Sys A Torus Sample Return Outboard Isol    | M181 | Yes                 | No                       | No                          | No               | No                   |
| SV8109B  | CAM Sys B Torus Sample Return Outboard Isol    | M181 | Yes                 | No                       | No                          | No               | No                   |
| SV8110A  | CAM Sys A Torus Sample Return Inboard Isol     | M181 | Yes                 | No                       | No                          | No               | No                   |
| SV8110B  | CAM Sys B Torus Sample Return Inboard Isol     | M181 | Yes                 | No                       | No                          | No               | No                   |
| V09-0065 | Demin Water Supply to Drywell                  | M109 | Yes                 | Yes                      | Yes                         | No               | Yes                  |
| V09-0111 | Drywell Demin Water Supply HDR Isolation       | M109 | Yes                 | Yes                      | Yes                         | No               | Yes                  |

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Table 1

| Valve            | Description                                    | P&ID | Screening Criteria  |                          |                             |                      | Detailed Evaluation? |
|------------------|--|------|---------------------|--------------------------|-----------------------------|----------------------|----------------------|
|                  |  |      | Closed During LOCA? | Isolated Pipe Inside DW? | Isolated Pipe Water Filled? | Pressure Relief?     |                      |
| V-14-0001        | Feedwater Loop B Reactor Inlet Check Isolation | M114 | Yes                 | Yes                      | Yes                         | Yes<br>V14-0001      | No                   |
| V14-0003         | Feedwater Loop A Reactor Inlet Check Isolation | M114 | Yes                 | Yes                      | Yes                         | Yes<br>V14-0003      | No                   |
| V17-0052         | Valve, CHK, CRD, HYD                           | M117 | Yes                 | Yes                      | Yes                         | Yes<br>V17-0053      | No                   |
| V17-0053         | Valve, CHK, CRD, HYD                           | M117 | Yes                 | Yes                      | Yes                         | Yes<br>V17-0053      | No                   |
| V17-0083         | Valve, CHK, Rx Recirc                          | M117 | Yes                 | Yes                      | Yes                         | Yes<br>Recirc Pump   | No                   |
| V17-0096         | Valve, CHK, Rx Recirc                          | M117 | Yes                 | Yes                      | Yes                         | Yes<br>Recirc Pump   | No                   |
| V18-1008 (XX-XX) | Insert Isolation                               | M118 | No<br>Normally Open | N/A                      | N/A                         | N/A                  | No                   |
| V18-1275 (XX-XX) | Withdraw Isolation                             | M118 | No<br>Normally Open | N/A                      | N/A                         | N/A                  | No                   |
| V19-0018         | RHR/CS Keep Fill Pump 1P-70 Section Isol       | M119 | No                  | No                       | Yes                         | Yes<br>Open to Torus | No                   |
| V19-0028         | "B" RHR Test Outbd Isol from Sump Pump 1P-76A  | M119 | Yes                 | No                       | Yes                         | No                   | No                   |
| V19-0029         | "B" RHR Test Inbd Isol from Sump Pump 1P-76A   | M119 | Yes                 | No                       | Yes                         | No                   | No                   |
| V19-0047         | Hx 1E-201B Inlet Header Vent                   | M119 | Yes                 | No                       | Yes                         | Yes<br>PSV1952       | No                   |
| V19-0149         | Valve, Check, RHR, LPCI Inject Loop B          | M119 | Yes/No              | Yes                      | Yes                         | Yes<br>V19-0149      | No                   |
| V20-0028         | Hx 1E-201A Inlet Header Vent                   | M120 | Yes                 | No                       | Yes                         | Yes<br>PSV2043       | No                   |

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Table 1

| Valve    | Description                                    | P&ID | Screening Criteria  |                          |                             |                  | Detailed Evaluation? |
|----------|--|------|---------------------|--------------------------|-----------------------------|------------------|----------------------|
|          |  |      | Closed During LOCA? | Isolated Pipe Inside DW? | Isolated Pipe Water Filled? | Pressure Relief? |                      |
| V20-0082 | Valve, Check, RHR, LPCI Inject Loop A          | M120 | Yes/No              | Yes                      | Yes                         | Yes<br>V20-0082  | No                   |
| V21-0072 | Valve, Check, LPCS A                           | M121 | Yes/No              | Yes                      | Yes                         | Yes<br>V21-0072  | No                   |
| V21-0073 | Valve, Check, LPCS B                           | M121 | Yes/No              | Yes                      | Yes                         | Yes<br>V21-0073  | No                   |
| V22-0016 | Valve, CHK, HPCI, 1S201, EXH Line              | M122 | Yes/No              | No                       | Yes<br>Partial              | Yes<br>V22-0017  | No                   |
| V22-0017 | HPCI Turbine Steam Exhaust Line Isolation      | M122 | Yes/No              | No                       | Yes<br>Partial              | Yes<br>V22-0017  | No                   |
| V22-0021 | Valve, CHK, HPCI, EXH DRN Pot Drain Line       | M122 | Yes/No              | No                       | No                          | Yes<br>V22-0022  | No                   |
| V22-0022 | HPCI Turb Stm Exhst Ccnd DRN Pot Drain Line    | M122 | No<br>Normally Open | No                       | No                          | Yes<br>V22-0022  | No                   |
| V22-0063 | Valve, CHK, HPCI, Vac Breaker Line             | M122 | Yes                 | No                       | No                          | Yes<br>V22-0063  | No                   |
| V22-0064 | Valve, CHK, HPCI, Vac Breaker Line             | M122 | Yes                 | No                       | No                          | Yes<br>V22-0063  | No                   |
| V24-0008 | RCIC Turbine Steam Exhaust to Torus Stop-Check | M124 | Yes/No              | No                       | Yes<br>Partial              | Yes<br>V24-0008  | No                   |
| V24-0023 | Valve CHK, RCIC, 1S203 EXH Line                | M124 | Yes/No              | No                       | Yes<br>Partial              | Yes<br>V24-0008  | No                   |
| V24-0046 | Valve, CHK, RCIC, 1S203 EXH Vac Breaker        | M124 | Yes                 | No                       | No                          | Yes<br>V24-0046  | No                   |
| V24-0047 | Valve, CHK, RCIC, 1S203 EXH Vac Breaker        | M124 | Yes                 | No                       | No                          | Yes<br>V24-0046  | No                   |
| V26-0008 | Valve, CHK, SBLC Outboard                      | M126 | Yes                 | Yes                      | Yes                         | Yes<br>V26-0009  | No                   |

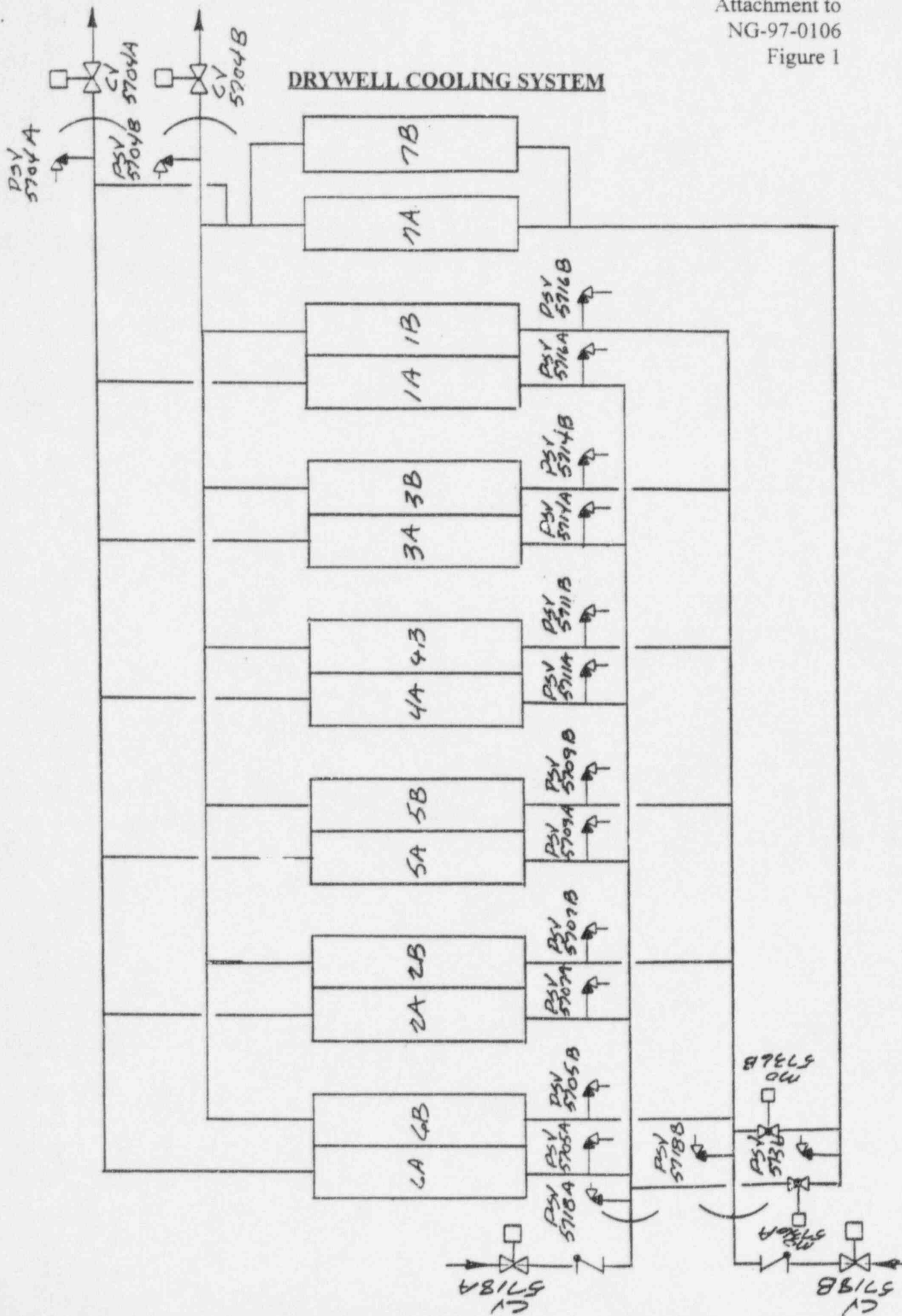
Attachment to  
NG-97-0106  
Table 1

| Valve    | Description                                      | P&ID   | Screening Criteria  |                          |                             |                      | Detailed Evaluation? |
|----------|--|--------|---------------------|--------------------------|-----------------------------|----------------------|----------------------|
|          |  |        | Closed During LOCA? | Isolated Pipe Inside DW? | Isolated Pipe Water Filled? | Pressure Relief?     |                      |
| V26-0009 | Valve, CHK, SBLC Inboard                         | M126   | Yes                 | Yes                      | Yes                         | Yes<br>V26-0009      | No                   |
| V30-0287 | Drywell Breathing Air Supply Outboard Isol       | M130-9 | Yes                 | Yes                      | No                          | No                   | No                   |
| V30-0288 | Drywell Breathing Air Supply Inboard Isol        | M130-9 | Yes                 | Yes                      | No                          | No                   | No                   |
| V43-0214 | Drywell Nitrogen Supply Header Isolation         | M143-1 | NA (3)              | NA (3)                   | No                          | NA (3)               | No                   |
| V43-0503 | Tip Indexer N2 Purge supply Check Valve          | M143-1 | NA (3)              | NA (3)                   | No                          | NA (3)               | No                   |
| V57-0075 | DW Cing Loop A Backwash Supply Downstream Isol   | M157   | Yes                 | Yes                      | Yes                         | Yes<br>PSV5704A      | No                   |
| V57-0076 | DW Cing Loop B Backwash Supply Downstream Isol   | M157   | Yes                 | Yes                      | Yes                         | Yes<br>PSV5704B      | No                   |
| V57-0077 | DW Cing Loop A Backwash Return to Equip Drn Sump | M157   | Yes                 | Yes                      | Yes                         | Yes<br>PSV5718A      | No                   |
| V57-0078 | DW Cing Loop B Backwash Return to Equip Drn Sump | M157   | Yes                 | Yes                      | Yes                         | Yes<br>PSV5718B      | No                   |
| V86-0001 | Torus Drain Line Isolation                       | M186   | Yes                 | No                       | Yes                         | Yes<br>Open to Torus | No                   |
| V86-0002 | 1P-136 Suction Torus Penetration Isolation       | M186   | Yes                 | No                       | Yes                         | Yes<br>Open to Torus | No                   |

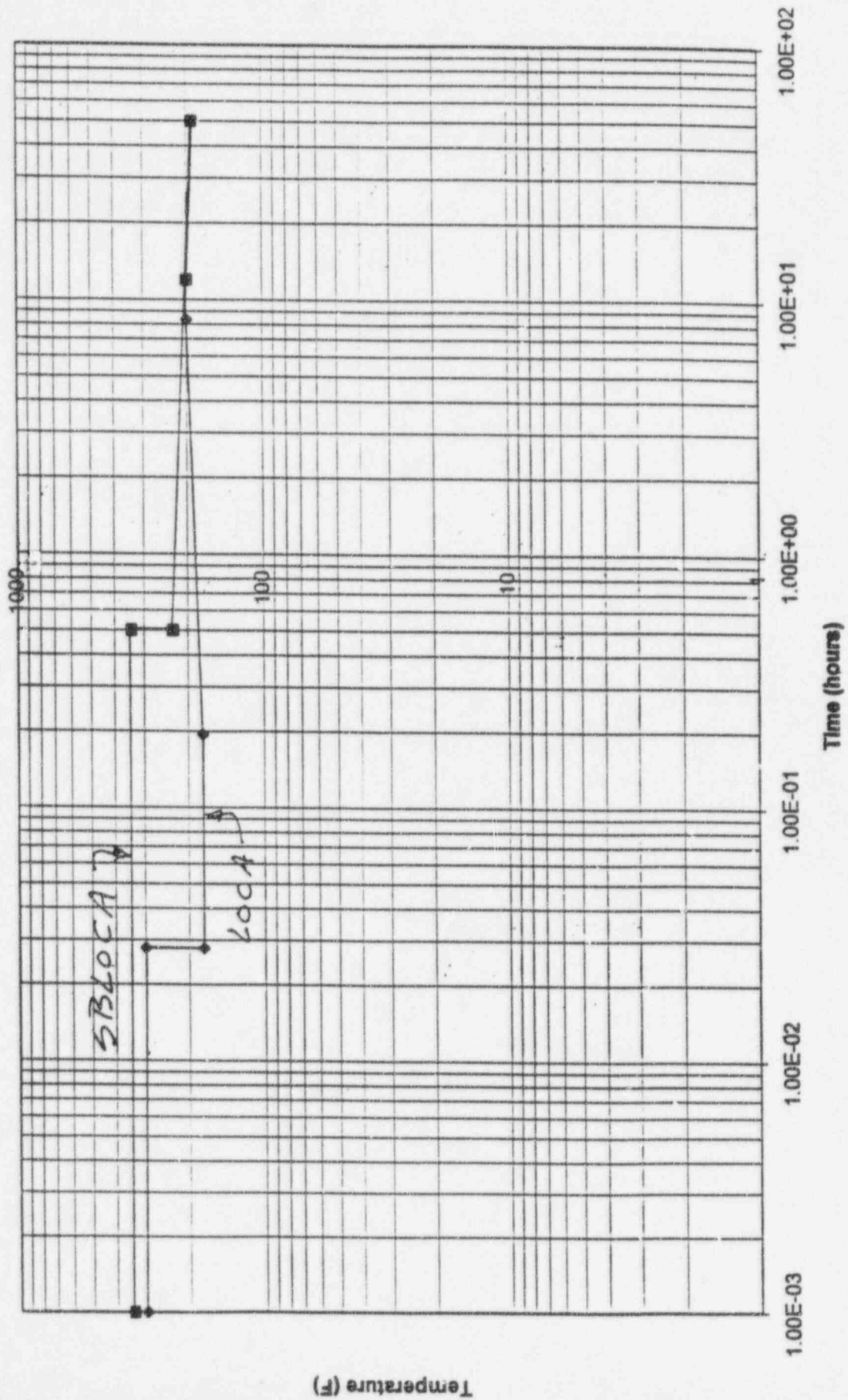
<sup>1</sup> Containment isolation valves are open and passing flow during normal operation. Water trapped between isolation valves during LOCA will be at a higher temperature than the post-LOCA temperature. Therefore, no thermal expansion of water during post-LOCA.

<sup>2</sup> These pressure relief valves are located outside the drywell and do not trap water during a LOCA.

<sup>3</sup> These lines are gas filled.

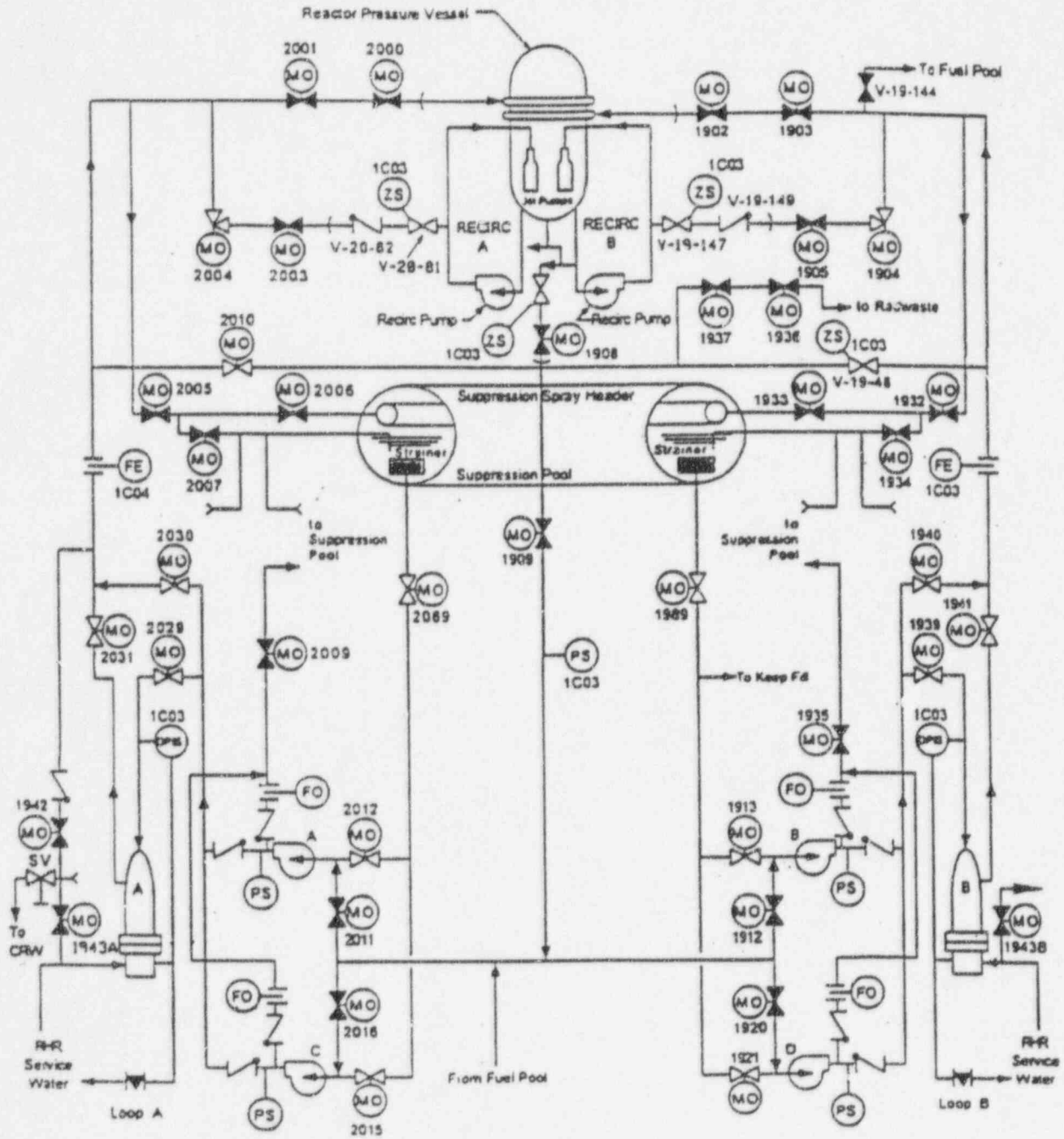


DRYWELL TEMPERATURE RESPONSE



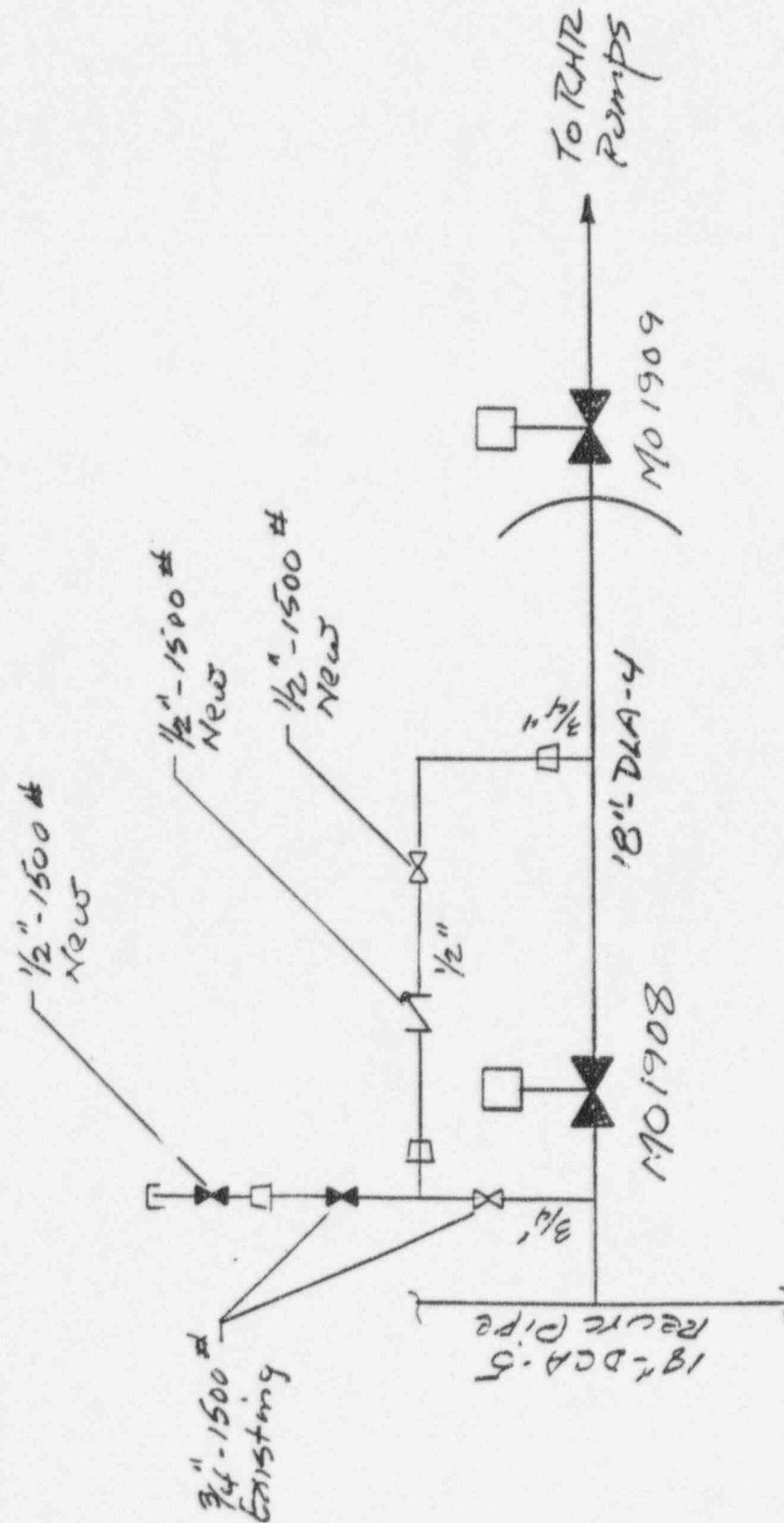


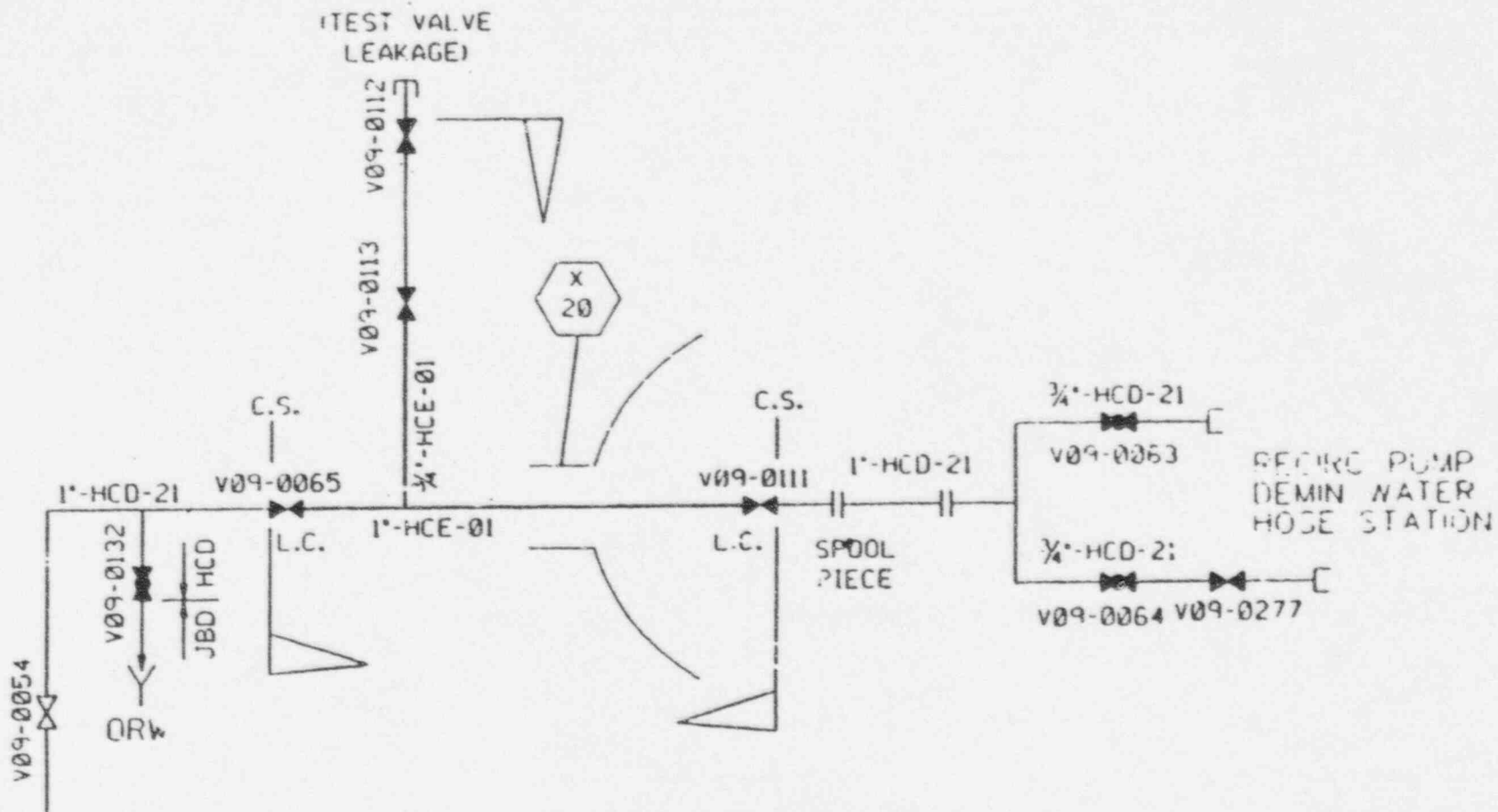
**RHR SYSTEM-STANDBY READY CONDITION**





MODIFICATION TO RHR SHUTDOWN COOLING LINE

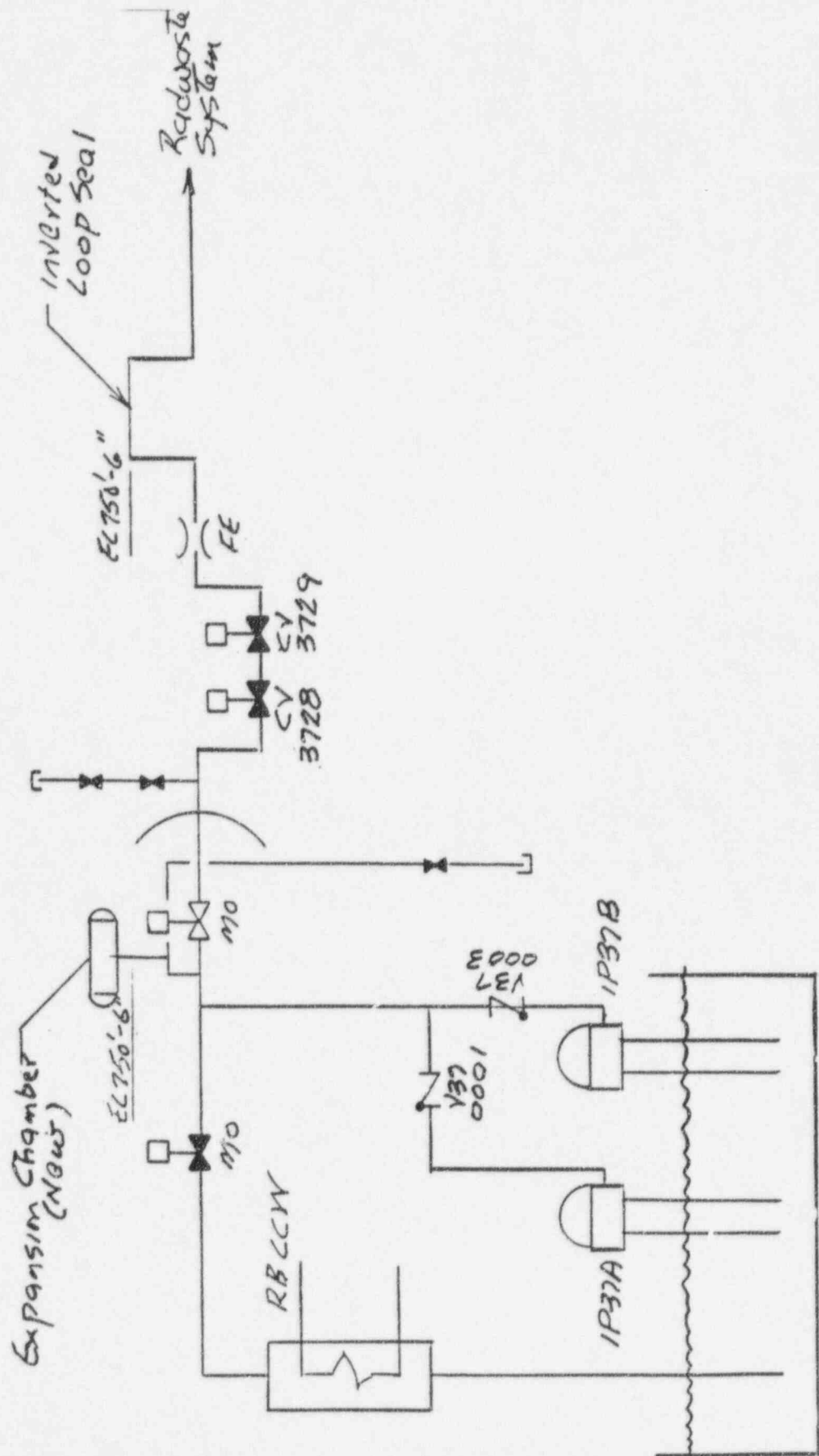




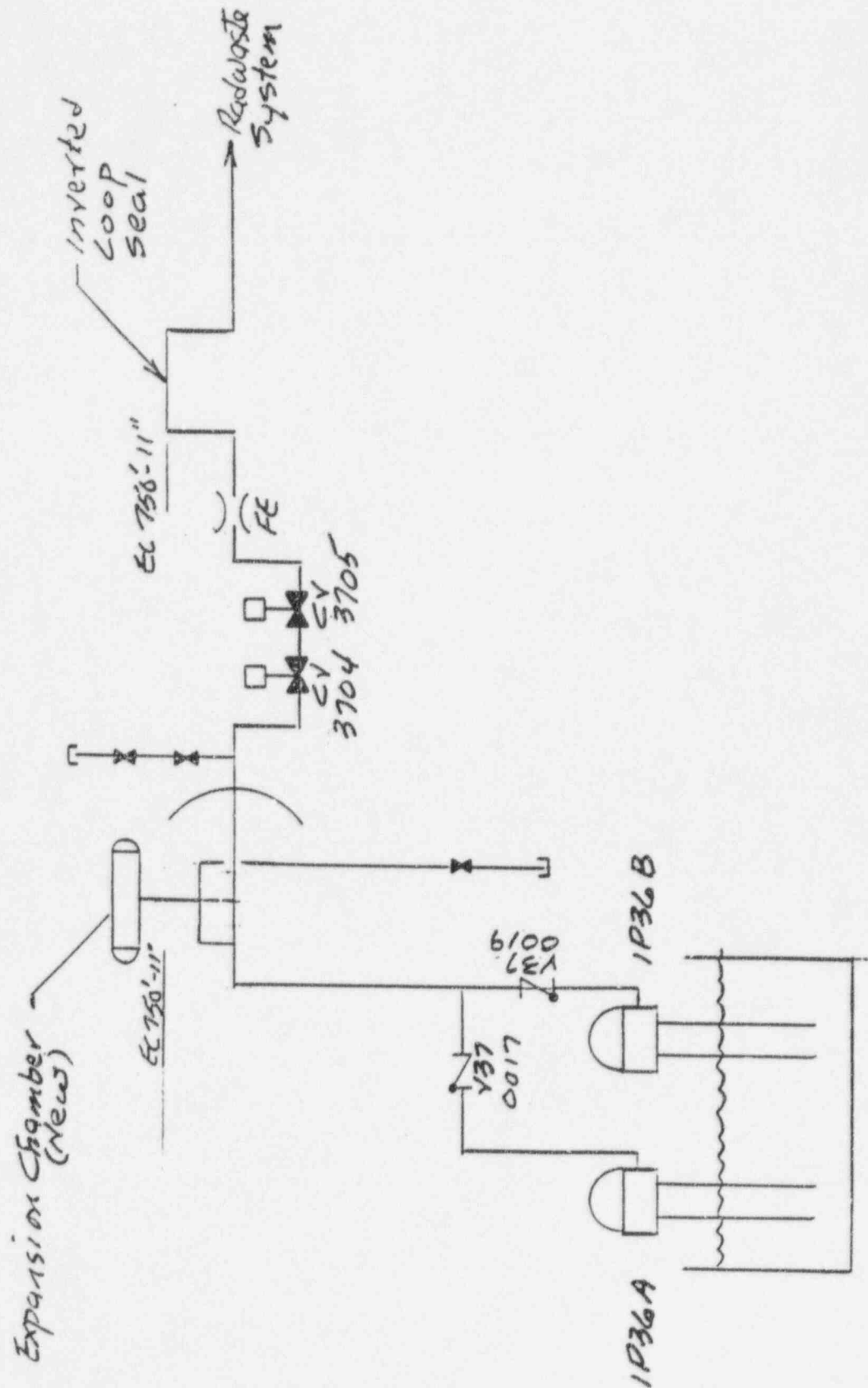
CONDENSATE DEMIN WATER SYSTEM TO DRYWELL

Attachment to  
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Figure 5

DRYWELL EQUIPMENT DRAIN SUM:



DRYWELL FLOOR DRAIN SUMP



**EXPANSION CHAMBER MODIFICATION FOR DRYWELL EQUIPMENT  
AND FLOOR DRAIN SUMPS**

