



NUCLEAR POWER PLANT SYSTEM SOURCEBOOK

MILLSTONE 1

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CAUTION

The information in this report has been developed over an extended period of time based on a site visit, the Final Safety Analysis Report, system and layout drawings, and other published information. To the best of our knowledge, it accurately reflects the plant configuration at the time the information was obtained, however, the information in this document has not been independently verified by the licensee or the NRC.

NOTICE

This sourcebook will be periodically updated with new and/or replacement pages as appropriate to incorporate additional information on this reactor plant. Technical errors in this report should be brought to the attention of the following:

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Correction and other recommended changes should be submitted in the form of marked up copies of the affected text, tables or figures. Supporting documentation should be included if possible.

MILLSTONE 1
RECORD OF REVISIONS

REVISION	ISSUE	COMMENTS
0	1/89	Original report

MILLSTONE 1 SYSTEM SOURCEBOOK

This sourcebook contains summary information on Millstone 1. Summary data on this plant are presented in Section 1, and similar nuclear power plants are identified in Section 2. Information on selected reactor plant systems is presented in Section 3, and the site and building layout is illustrated in Section 4. A bibliography of reports that describe features of this plant or site is presented in Section 5. Symbols used in the system and layout drawings are defined in Appendix A. Terms used in data tables are defined in Appendix B.

1. SUMMARY DATA ON PLANT

Basic information on the Millstone 1 nuclear plant is listed below:

- Docket number	50-245
- Operator	Northeast Utilities
- Location	Waterford, CT
- Commercial operation date	12/70
- Reactor type	BWR/3
- NSSS vendor	General Electric
- Power (MWt/MWe)	2011/660
- Architect-engineer	Ebasco
- Containment type	Steel drywell and wetwell (Mark I)

2. IDENTIFICATION OF SIMILAR NUCLEAR POWER PLANTS

Millstone 1 has a General Electric BWR/3 nuclear steam supply system and a Mark I containment incorporating the drywell/pressure suppression concept. It also has a secondary containment structure of reinforced concrete. Other BWR/3 plants in the United States are as follows:

Dresden 2 and 3
 Pilgrim 1
 Monticello
 Quad Cities 1 and 2

Millstone 1 is one of the few plants with a Feedwater Coolant Injection System (FWCI) for core coolant injection at high pressure, a Low Pressure Coolant Injection (LPCI) System for injection at low pressure, and an isolation condenser. The LPCI system also performs the containment cooling function.

3. SYSTEM INFORMATION

This section contains descriptions of selected systems at Millstone 1 in terms of general function, operation, system success criteria, major components, and support system requirements. A summary of major systems at Millstone 1 is presented in Table 3-1. In the "Report Section" column of this table, a section reference (i.e. 3.1, 3.2, etc.) is provided for all systems that are described in this report. An entry of "X" in this column means that the system is not described in this report. In the "FSAR Section Reference" column, a cross-reference is provided to the section of the Final Safety Analysis Report where additional information on each system can be found. Other sources of information on this plant are identified in the bibliography in Section 5.

Several cooling water systems are identified in Table 3-1. The functional relationships that exist among cooling water systems required for safe shutdown are shown in Figure 3-1. Details on the individual cooling water systems are provided in the report sections identified in Table 3-1.

Table 3-1. Summary of Millstone 1 Systems Covered in this Report

<u>Generic System Name</u>	<u>Plant-Specific System Name</u>	<u>Report Section</u>	<u>UFSAR Section Reference</u>
Reactor Heat Removal Systems			
- Reactor Coolant System (RCS)	Same	3.1	5
- Isolation Condenser (IC) System	Same	3.2	5.4.15, 6.3
- Reactor Core Isolation Cooling (RCIC) Systems	None	-	-
- Emergency Core Cooling Systems (ECCS)	Same		
- High-Pressure Injection & Recirculation	Feedwater Coolant Injection (FWCI) System	3.3	6.3
- Low-pressure Injection & Recirculation	Core Spray (CS) System, Low-Pressure Coolant Injection (LPCI) System	3.3 3.3	6.3 6.3
- Automatic Depressurization System (ADS)	Automatic Pressure Relief System	3.3	5.4.13, 6.3
- Decay Heat Removal (DHR) System (Residual Heat Removal (RHR) System)	Reactor Shutdown Cooling System	X	5.1.8, 5.4.7
- Main Steam and Power Conversion Systems	Main Steam Supply System, Condensate System, Feedwater System, Circulating Water System	X X X X	10.3 10.4.4 10.4.5 10.4.3
- Other Heat Removal Systems	Reactor Vessel Head Cooling System	X	5.4.16

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Table 3-1. Summary of Millstone I Systems Covered in this Report (Continued)

<u>Generic System Name</u>	<u>Plant-Specific System Name</u>	<u>Report Section</u>	<u>UFSAR Section Reference</u>
Reactor Coolant Inventory Control Systems			
- Reactor Water Cleanup (RWCU) System	Same	X	5.1.9, 5.4.8
- ECCS	See above	-	-
- Control Rod Drive Hydraulic System (CRDHS)	Same	3.7	4.6
Containment Systems			
- Primary Containment	Same (drywell and pressure suppression chamber)	X	6.2.1
- Secondary Containment	Same	X	6.2.3
+ - Standby Gas Treatment System (SGTS)	None noted	-	-
Containment Heat Removal Systems			
- Suppression Pool Cooling System	Same (an operating mode of the LPCI system)	3.3	6.2.2
- Containment Spray System	Same (an operating mode of the LPCI system)	3.3	6.2.2
- Containment Fan Cooler System	Drywell Cooling and Ventilation System and Reactor Building Heating and Ventilation System	X	6.2.1, 9.4.3, 9.4.2
- Containment Normal Ventilation Systems	Drywell Cooling and Ventilation System and Reactor Building Heating and Ventilation System	X	6.2.1, 9.4.3, 9.4.2
- Combustible Gas Control Systems	None noted	-	-

Table 3-1. Summary of Millstone 1 Systems Covered in this Report (Continued)

<u>Generic System Name</u>	<u>Plant-Specific System Name</u>	<u>Report Section</u>	<u>UF/SAR Section Reference</u>
Reactor and Reactivity Control Systems			
- Reactor Core	Same	X	4
- Control Rod System	Control Rod Drive System	X	4.6
- Chemical Poison System	Standby Liquid Control System (SLCS)	X	9.3.5
Instrumentation & Control (I&C) Systems			
- Reactor Protection System (RPS)	Same	3.5	7.2
- Engineered Safety Feature Actuation System (ESFAS)	Engineered Safety Feature Systems	3.5	7.3
- Remote Shutdown System	Local control panels	3.5	7.4.4
- Other I&C Systems	Various other systems	X	7.4 to 7.7
Support Systems			
- Class 1E Electric Power System	Same	3.5	8.3
- Non-Class 1E Electric Power System	Same	3.6	8.2, 8.3
- Diesel Generator Auxiliary Systems	Same	3.5	8.3.1.1.5.1, 9.5.4 to 9.5.8
- Other Electrical System	Gas Turbine Generator System	3.6	8.3.1.1.5.2, 9.5.4 to 9.5.8
- Component Cooling Water (CCW) System	Reactor Building Closed Cooling Water (RBCCW) System	X	9.2.3

Table 3-1. Summary of Millstone 1 Systems Covered in this Report (Continued)

<u>Generic System Name</u>	<u>Plant-Specific System Name</u>	<u>Report Section</u>	<u>UFSAR Section Reference</u>
- Support Systems (continued)			
- Service Water System (SWS)	Same	3.9	9.2.1
- Residual Heat Removal Service Water (RHRSW) System	Emergency Service Water System (ESW) (supplies LPCI coolers)	X	9.2.2
- Other Cooling Water Systems	Turbine Building Closed Cooling Water (TBCCW) System	X	9.2.4
	Turbine Building Closed Secondary Cooling Water (SCCW) System	3.8	9.2.5
- Fire Protection Systems	Same	3.4	9.5.1
- Room Heating, Ventilating, and Air-Conditioning (HVAC) Systems	Air Conditioning, Heating, Cooling and Ventilation System	X	9.4
- Instrument and Service Air Systems	Plant Air System	X	9.3.1
- Refueling and Fuel Storage Systems	Fuel Storage and Handling Systems	X	9.1
- Radioactive Waste Systems	Radioactive Waste Management	X	11
- Radiation Protection Systems	Same	X	12

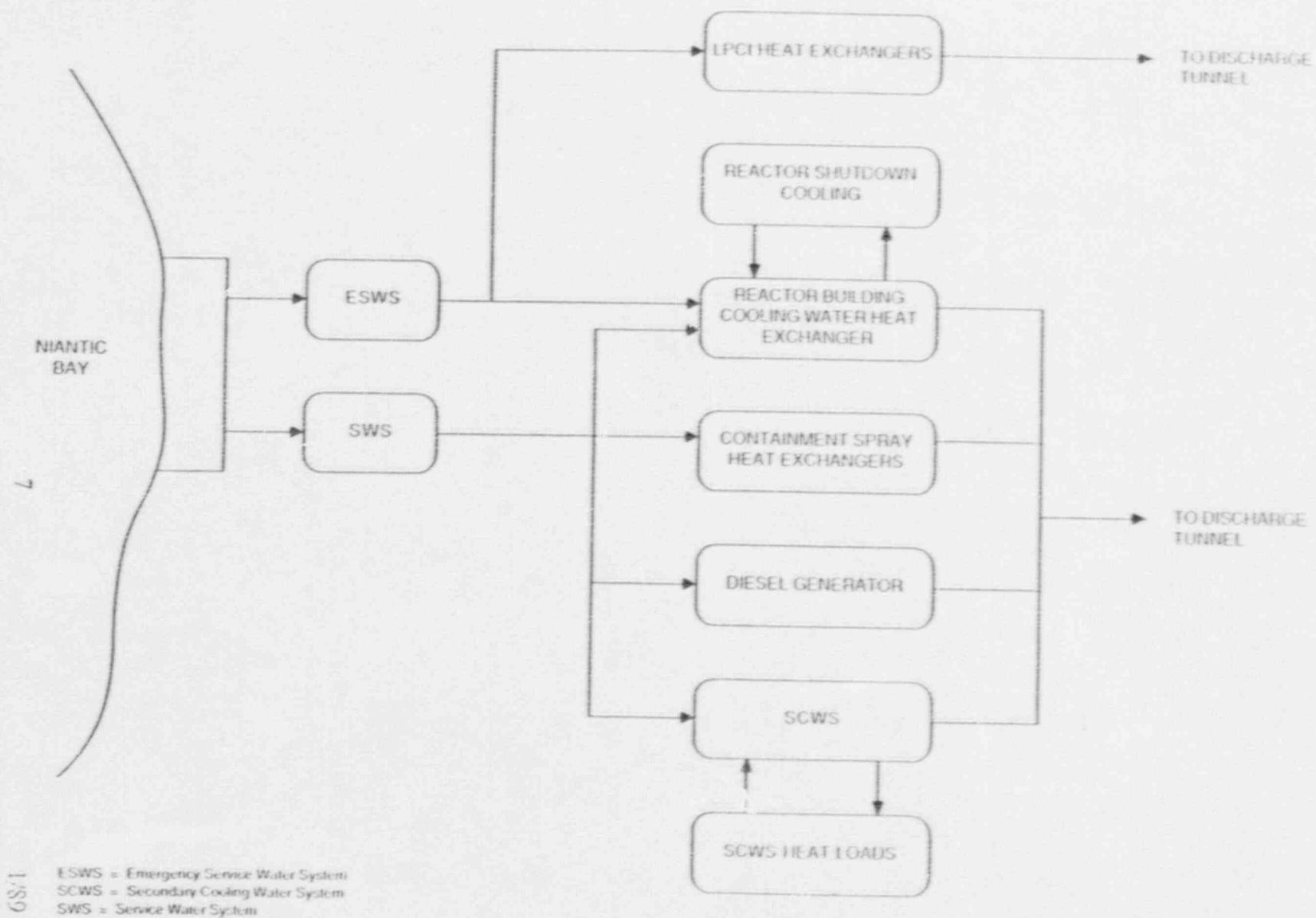


Figure 3-1. Cooling Water System's Functional Diagram for Millstone 1

3.1 REACTOR COOLANT SYSTEM (RCS)

3.1.1 System Function

The RCS, also called the Nuclear Steam Supply System (NSSS), is responsible for directing the steam produced in the reactor to the turbine where it is used to rotate a generator and produce electricity. The RCS pressure boundary also establishes a boundary against the uncontrolled release of radioactive material from the reactor core and primary coolant.

3.1.2 System Definition

The RCS includes: (a) the reactor vessel, (b) two recirculation loops, (c) recirculation pumps, (d) safety valves, and (e) connected piping out to a suitable isolation valve boundary. Simplified diagrams of the RCS and important system interfaces are shown in Figures 3.1-1 and 3.1-2. A summary of data on selected RCS components is presented in Table 3.1-1.

3.1.3 System Operation

During power operation, circulation in the RCS is maintained by one recirculation pump in each of the two recirculation loops and the associated jet pumps internal to the reactor vessel. The steam water mixture flows upward in the core to the steam dryers and separators where the entrained liquid is removed. The steam is piped through the main steam lines to the turbine. The separated liquid returns to the core, mixes with the feedwater and is recycled again.

The discharge of the recirculation pumps is returned to the inlet nozzles of the jet pumps at high velocity. As the liquid enters the jet pumps, the slow moving liquid in the upper region of the downcomer is induced to flow through the jet pumps, producing reactor coolant circulation.

The steam that is produced by the reactor is piped to the turbine via the main steam lines. There are two main steam isolation valves (MSIVs) in each main steam line. Condensate from the turbine is returned to the RCS as feedwater.

Following a transient that involves the loss of the main condenser or loss of feedwater, heat from the RCS is dumped to atmosphere via the isolation condenser (see Section 3.2) or to the suppression chamber via safety/relief valves on the main steam lines. There are a total of six pressure relief valves, four of which are actuated automatically. A LOCA inside containment also dumps heat to the suppression chamber. Makeup to the RCS is provided by the Emergency Core Cooling System (ECCS, see Section 3.3). Heat is transferred from the containment to the ultimate heat sink by the LPCI system (part of the ECCS) operating in the containment cooling mode. Actuation systems provide for automatic closure of the MSIVs and isolation of other lines connected to the RCS.

3.1.4 System Success Criteria

The RCS success criteria can be described in terms of LOCA and transient mitigation, as follows:

- An unmitigatable LOCA is not initiated.
- If a mitigatable LOCA is initiated, then LOCA mitigating systems are successful.
- If a transient is initiated, then either:
 - RCS integrity is maintained and transient mitigating systems are successful,
 - or
 - RCS integrity is not maintained, leading to a LOCA-like condition (i.e. stuck-open safety or relief valve, reactor coolant pump seal failure), and LOCA mitigating systems are successful.

3.1.5 Component Information

- A. RCS
 - 1. Total volume: Unknown
 - 2. Water volume: Unknown
 - 3. Steam volume: Unknown
 - 4. Steam flow: 7.56×10^6 lb/hr.
 - 5. Normal operating pressure: 965 psig
- B. Safety/Relief Valves (6)
 - 1. Set pressure: 1095 to 1125 psig
 - 2. Relief capacity: 4,860,000 lb/hr total
- C. Recirculation Pumps (2)
 - 1. Rated flow: 45,000 gpm
 - 2. Type: Vertical centrifugal
- D. Jet Pumps (20)

3.1.6 Support Systems and Interfaces

- A. Control Signals
 - 1. Automatic
The four automatically actuated safety/relief valves are actuated on coincident low-low water level, high drywell pressure, and ECCS pump running with 100 psig discharge pressure.
- B. Motive Power
 - 1. The recirculation pumps are supplied with Nonclass 1E power.
- C. MSIV Operating Power
The instrument air system and the Drywell Atmospheric Compressor system support normal operation of the outboard and inboard MSIVs, respectively. Valve operation is controlled by an AC and a DC solenoid pilot valve. Both solenoid valves must be deenergized to cause MSIV closure. This design prevents spurious closure of an MSIV if a single solenoid valve should fail. MSIVs are designed to fail closed if the pneumatic supply is lost or if both AC and DC control power is lost to the solenoid pilot valves. This is achieved by a local dedicated air accumulator for each MSIV and an independent valve closing spring.
- D. Recirculation Pump Cooling
The reactor building closed cooling water (RBCCW) system provides cooling water to the recirculation pump coolers.

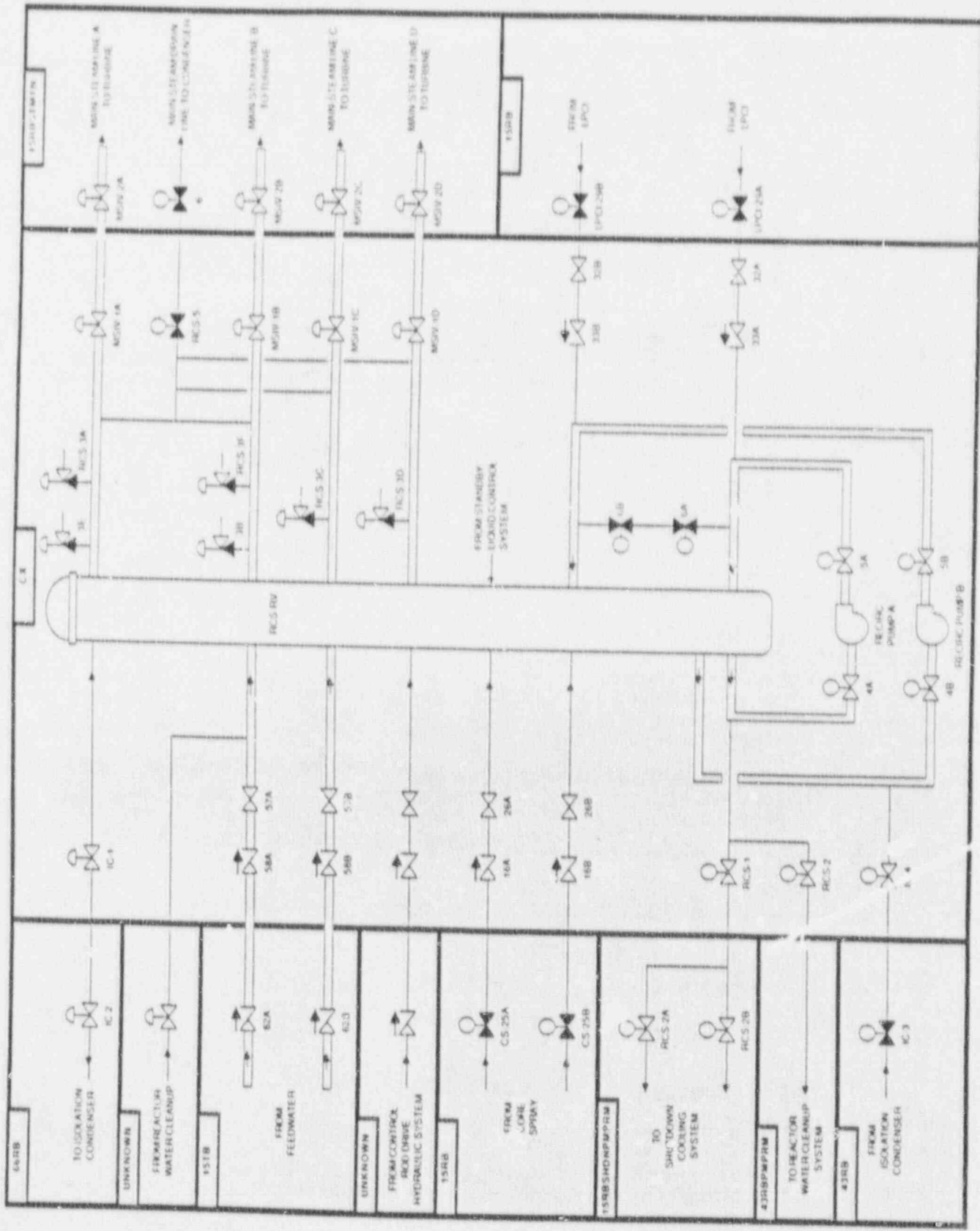


Figure 3.1-2. Millstone 1 Reactor Coolant System Showing Component Locations

Table 3.1-1. Millstone 1 Reactor Coolant System Data Summary
for Selected Component

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
IC-1	MOV	CX	MCC-2-3	480	15RB	AC/G
IC-4	MOV	CX	MCC-2-3	480	15RB	AC/G
MSIV-1A	NV	CX				
MSIV-1B	NV	CX				
MSIV-1C	NV	CX				
MSIV-1D	NV	CX				
MSIV-2A	NV	15RBSTMTN				
MSIV-2B	NV	15RBSTMTN				
MSIV-2C	NV	15RBSTMTN				
MSIV-2D	NV	15RBSTMTN				
RCS-1	MOV	CX	UNKNOWN			
RCS-2	MOV	CX	MCC-2A-3	480	15RB	AC/F
RCS-2A	MOV	15RBSDNPMPRM	UNKNOWN			
RCS-2B	MOV	15RBSDNPMPRM	MCC-11A-2	480	MCC11A2	AC/G
RCS-5	MOV	CX	MCC-2A-3	480	15RB	AC/F
RCS-RV	RV	CX				

3.2 ISOLATION CONDENSER (IC) SYSTEM

3.2.1 System Function

The isolation condenser transfers residual and decay heat from the reactor coolant system to the atmosphere (the ultimate heat sink) in the event that the main condenser is not available, or a high-pressure condition exists. The system employs natural circulation as the driving head through the isolation condenser tubes. Because of its role in emergency cooling the IC system is considered part of the Emergency Core Cooling System (ECCS, see Section 3.3).

3.2.2 System Definition

The IC system consists of a single isolation condenser with a closed-loop flow path to and from the reactor vessel and a vent to atmosphere. The primary-side inlet piping contains two normally open AC-powered motor-operated valves. The primary-side outlet piping contains one normally closed DC-powered MOV and one normally open AC-powered MOV. The use of a DC-powered isolation valve ensures successful operation of the system if there is a loss of AC power. Makeup to the isolation condenser is provided by the Fire Water System (see Section 3.4).

Simplified drawings of the IC system are shown in Figures 3.2-1 and 3.2-2. A summary of data on selected IC system components is presented along with other ECCS components in Section 3.3.

3.2.3 System Operation

The isolation condenser system is initiated by sustained (15 seconds) high reactor pressure (1085 psig) or sustained low-low water level (-48 inches). Normally, three of the four motor operated isolation valves are open, so that only one valve is required to open to begin operation. Steam passes through the tube side of the isolation condenser, condensing along the way. Water on the shell side is allowed to boil off as steam which is vented to atmosphere. Condensate returns by gravity to the reactor vessel. The inventory of the shell side lasts approximately 30 minutes, at which time makeup can be provided by the fire water system (see Section 3.4).

The isolation condenser can be operated manually by throttling the condensate return valve. An operator can use local pressure and temperature gauges and a plot of pressure versus temperature limits to control performance of the system. This can be accomplished under blackout conditions.

3.2.4 System Success Criteria

The isolation condenser can provide adequate RCS heat removal following a transient. DC power is required to open the isolation valve, which initiates IC operation. Makeup to the condenser from the fire water system is required after approximately 30 minutes of operation.

Due to normal RCS leakage and coolant shrinkage due to cooldown during IC system operation, makeup to the RCS is required. The Feedwater Coolant Injection System (see Section 3.3) and the Control Rod Drive Hydraulic System (see Section 3.7) can provide RCS makeup at high pressure.

3.2.5 Component Information

A. Isolation Condenser

1. Rated Capacity: 206×10^6 Btu/hr
2. Design Pressure: 1250 psig

3.2.6 Support Systems and Interfaces

A. Control Signals

1. Automatic

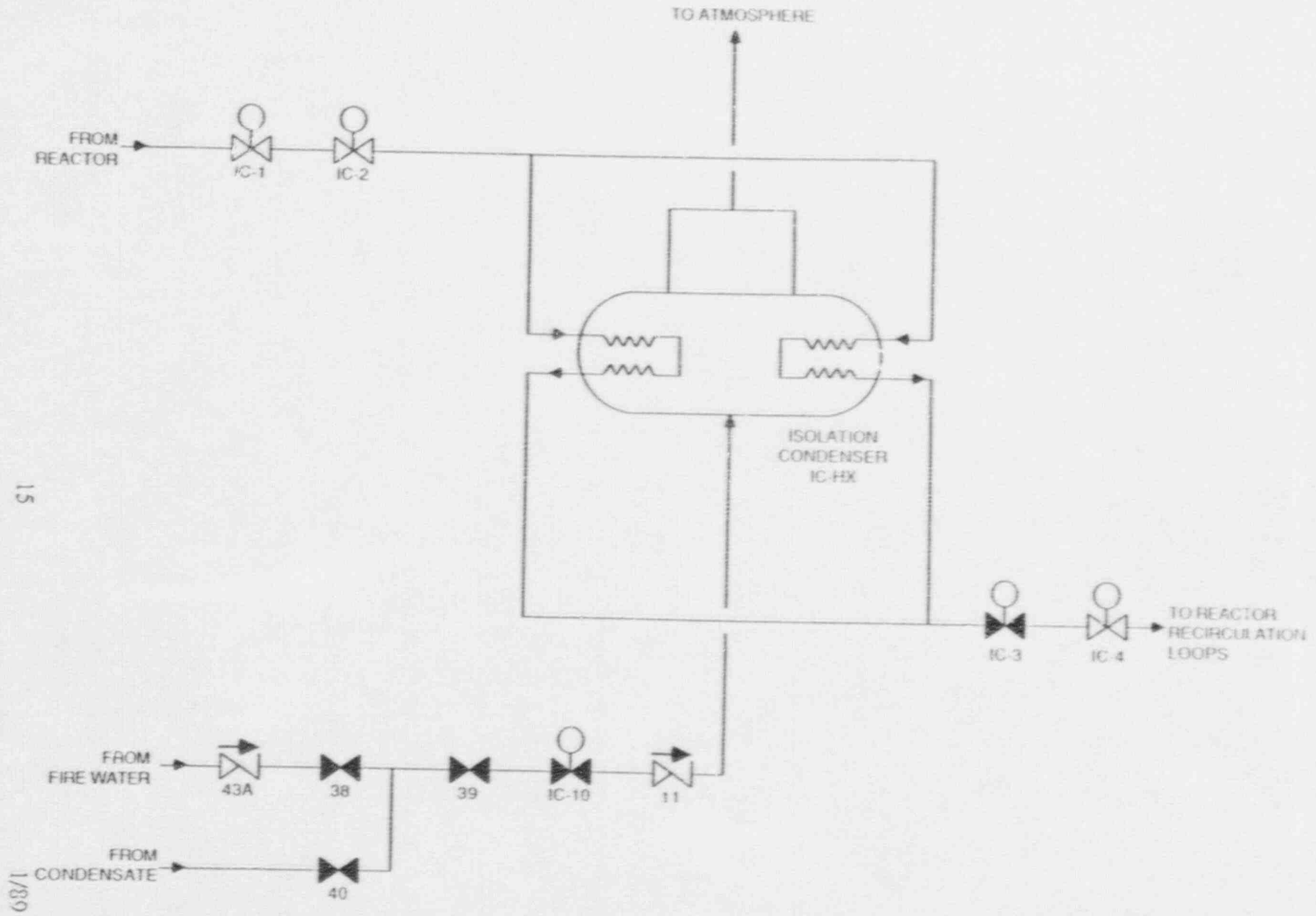
The isolation condenser system is automatically initiated on sustained high reactor pressure or sustained low-low reactor water level. Initiation takes the form of opening the outboard isolation valve on the condensate return line.

2. Remote Manual

The isolation condenser motor-operated valves can be actuated by remote manual means from the control room.

B. Motive Power

The IC system motor-operated valves are Class 1E AC or DC loads that can be supplied from the emergency diesel generator, gas turbine generator, or station batteries, as described in Section 3.6.



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Figure 3.2-1. Millstone 1 Isolation Condenser System

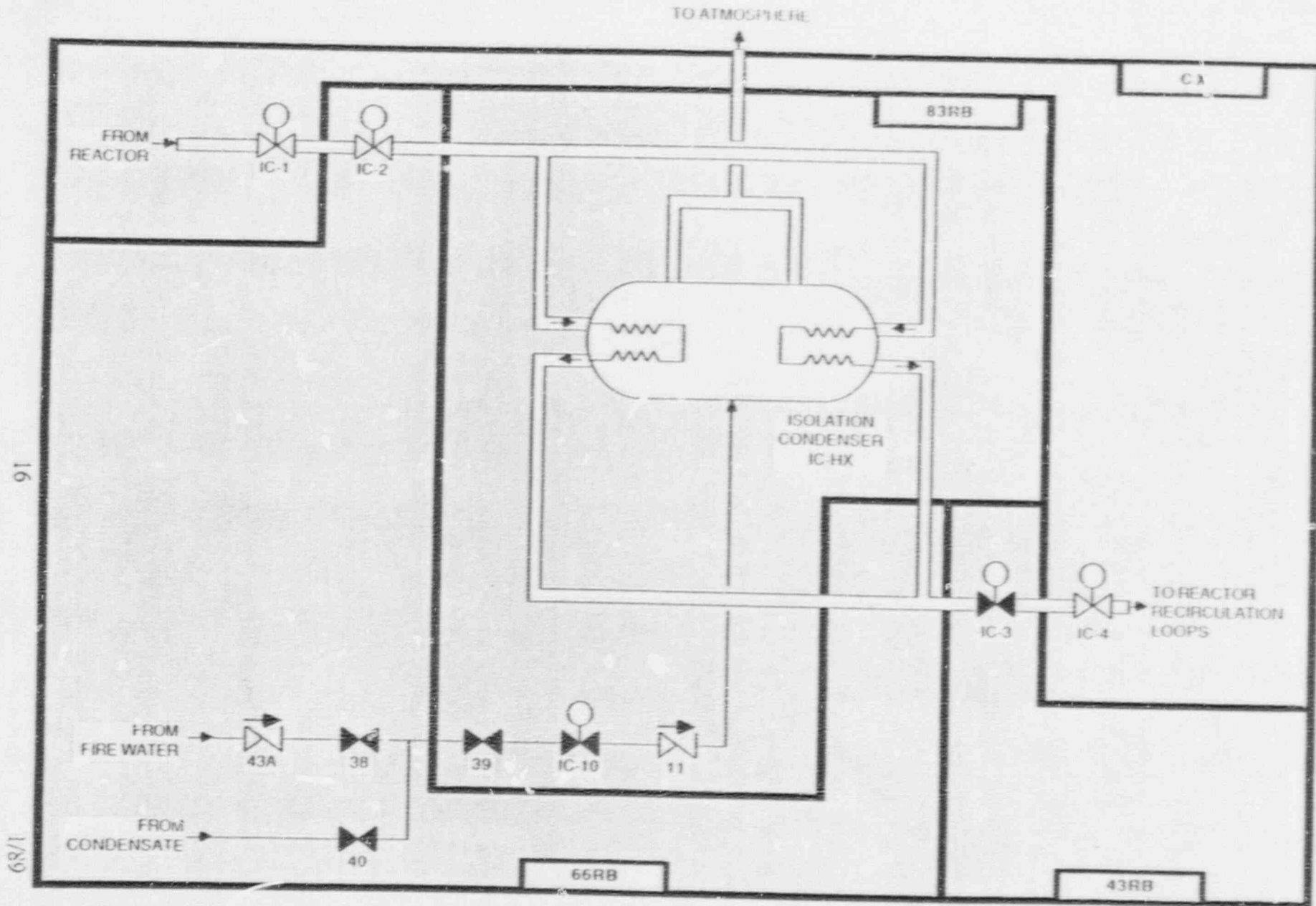


Figure 3.2-2. Millstone 1 Isolation Condenser System Showing Component Locations

3.3 EMERGENCY CORE COOLING SYSTEM (ECCS)

3.3.1 System Function

The ECCS is an integrated set of subsystems that perform emergency coolant injection and recirculation functions to maintain reactor core coolant inventory and adequate decay heat removal following a LOCA. The ECCS also performs suppression pool cooling and containment spray functions and has a capability for mitigating transients.

3.3.2 System Definition

The emergency core cooling system consists of the following subsystems:

- Core Spray (CS) System
- Low-pressure Coolant Injection (LPCI) System
- Feedwater Coolant Injection (FWCI) System
- Automatic Pressure Relief (APR)
- Isolation Condenser (IC) System (see Section 3.2)

The core spray system supplies make-up water to the reactor vessel at low pressure. The system consists of two independent trains, each of which has one motor-driven pump to supply water from the suppression pool to a spray sparger in the reactor vessel above the core.

The low-pressure coolant injection system provides high volume make-up water to the reactor vessel at low pressure. The LPCI system consists of two independent trains each with two motor-driven pumps which deliver water from the suppression pool to one of the RCS recirculation loops.

The feedwater coolant injection system provides high-pressure injection, utilizing existing feedwater and condensate components. The FWCI system consists of an emergency condensate transfer pump, three condensate pumps, three condensate booster pumps, and three reactor feedwater pumps. The condensate transfer pump draws suction from the Condensate Storage Tank (CST).

The automatic pressure relief system provides automatic RCS depressurization following a small LOCA or transient so that the low-pressure systems (CS and LPCI) can provide makeup. Four of the six pressure relief valves are part of the APR system.

The isolation condenser removes residual and decay heat from the reactor vessel in the event that the main condenser is not available, or a high-pressure condition exists. The system employs natural circulation as the driving head through the isolation condenser tubes. A more detailed description of the IC system is provided in Section 3.2.

Simplified drawings of the core spray system are shown in Figures 3.3-1 and 3.3-2, the LPCI system is shown in Figures 3.3-3 and 3.3-4, and the FWCI system is shown in Figures 3.3-5 and 3.3-6.

3.3.3 System Operation

All ECCS systems are normally in standby. The CS and LPCI pumps all start automatically at reactor water level equal to -48 inches and reactor pressure at 350 psig, or drywell pressure at 2 psig. The CS and LPCI pumps draw suction from the suppression pool. The CS pumps deliver water to spray spargers in the reactor vessel, while the LPCI pumps deliver water to one of the reactor recirculation loops. The LPCI pumps also provide the containment spray function, with heat transferred through one heat exchanger in each LPCI loop to the Service Water System.

The FWCI system is initiated at vessel level of -48 inches or drywell pressure of 2 psig. In the event of loss of normal AC power, all FWCI pumps loads will be momentarily shed to allow the emergency gas turbine generator to reach operating speeds. However, to prevent excessive loading on the gas turbine generator, only one train of the FWCI system is started. This train, or "string", is previously determined by the operator

by selecting either the "A" or "B" string through a switch. Each string consists of one reactor feed pump, one condensate booster pump, and one condensate pump. (It is unclear what role is played by the "C" pumps.) If the selected pump string fails to start the other string must be started manually, or the selector switch position must be changed. The condensate transfer pumps delivers water from the CST to the selected pump string (Ref. 1).

The automatic pressure relief valves open automatically to reduce RCS pressure on low-low reactor water level (-28 inches) and high drywell pressure (2 psig). Interlocks prevent APR initiation unless at least one CS or LPCI pump is running with 100 psig discharge pressure.

3.3.4 System Success Criteria

LOCA mitigation requires that both the emergency coolant injection (ECI) and emergency coolant recirculation (ECR) functions be accomplished. The ECI system success criteria for a large LOCA are the following (Ref. 2):

- 1 of 2 core spray pumps with a suction on the suppression pool, or
- 2 of the 4 low pressure coolant injection pumps with a suction on the suppression pool.

The ECI system success criteria for a small LOCA are the following (Ref. 12):

- 1 of 3 feedwater coolant injection (FWCI) trains with a suction on the condensate storage tank, or
- The pressure relief valves and 2 of 4 LPCI pumps with a suction on the suppression pool, or
- The pressure relief valves and 1 of 2 core spray pumps with a suction on the suppression pool.

The success criterion for the ADS is the use of any 1 of 2 ADS trains. It is possible that the coolant inventory control function for some small LOCAs can be satisfied by low-capacity high-pressure injection systems such as the control rod drive hydraulic system (see Section 3.7). This is not considered an ECCS function. The ECR success criteria for LOCAs are integrated with the ECI success criteria above. All injection systems essentially are operating in a recirculation mode when drawing water from the suppression pool.

For transients, the success criteria for reactor coolant inventory control involve the following:

- Either the isolation condenser system (see Section 3.2), or
- Small LOCA mitigating systems

For the suppression pool cooling function to be successful, one of two LPCI trains must be aligned for containment heat removal and the associated service water train must be operating to complete the heat transfer path from the containment spray heat exchangers to the ultimate heat sink. In a given LPCI train one of two LPCI pumps must operate.

3.3.5 Component Information

- A. Core Spray Pumps (A and B):
1. Rated Flow: 3600 gpm @ unknown head
 2. Rated Capacity: 100% (Ref. 1, 2)

3. Shutoff Head: 588 ft. head (255 psid)
 4. Type: vertical centrifugal
- B. Low-Pressure Coolant Injection Pumps (A, B, C, and D)
1. Rated Flow: 5000 gpm @ 240 ft. head (104 psid), 2500 gpm @ 475 ft. head (206 psid)
 2. Rated Capacity: 33-1/3% (Ref. 1, 2)
 3. Shutoff Head: 625 psig
 4. Type: vertical centrifugal
- C. FWCI Condensate Pumps (A, B, and C)
1. Rated Flow: 8000 gpm @ 375 ft. head (163 psid)
 2. Rated Capacity: 100% (Ref. 1, 2)
 3. Type: vertical
- D. FWCI Condensate Pumps (A, B, and C)
1. Rated Flow: 8000 gpm @ 830 ft. head (360 psid)
 2. Rated Capacity: 100% (Ref. 1, 2)
 3. Type: vertical centrifugal
- E. FWCI Reactor Feed Pumps (A, B, and C)
1. Rated Flow: 8000 gpm @ 2900 ft. head (1257 psid)
 2. Rated Capacity: 100% (Ref. 1, 2)
 3. Type: horizontal centrifugal
- F. FWCI Condensate Transfer Pump
1. Rated Flow: 3600 gpm @ 231 ft. head (100 psid)
 2. Rated Capacity: 100%
 3. Type: centrifugal single stage
- G. Automatic Pressure Relief Valves (4)
1. Rated Flow: 800,000 lb/hr each
 2. Set Pressure: 1095 to 1125 psig
- H. Suppression Pool
1. Water Volume: 630,000 gallons
- I. Condensate Storage Tank
1. Minimum Volume: 225,000 gallons

3.3.6 Support Systems and Interfaces

- A. Control Signals
1. Automatic
 - a. The CS and LPCI pumps are automatically actuated on low-low reactor water level coincident with low reactor pressure, or on high drywell pressure.
 - b. The pre-selected train of FWCI pumps is automatically actuated on low-low reactor water level or high drywell pressure.
 - c. The automatic pressure relief valves are actuated on low-low reactor water level coincident with high drywell pressure.
 2. Remote Manual

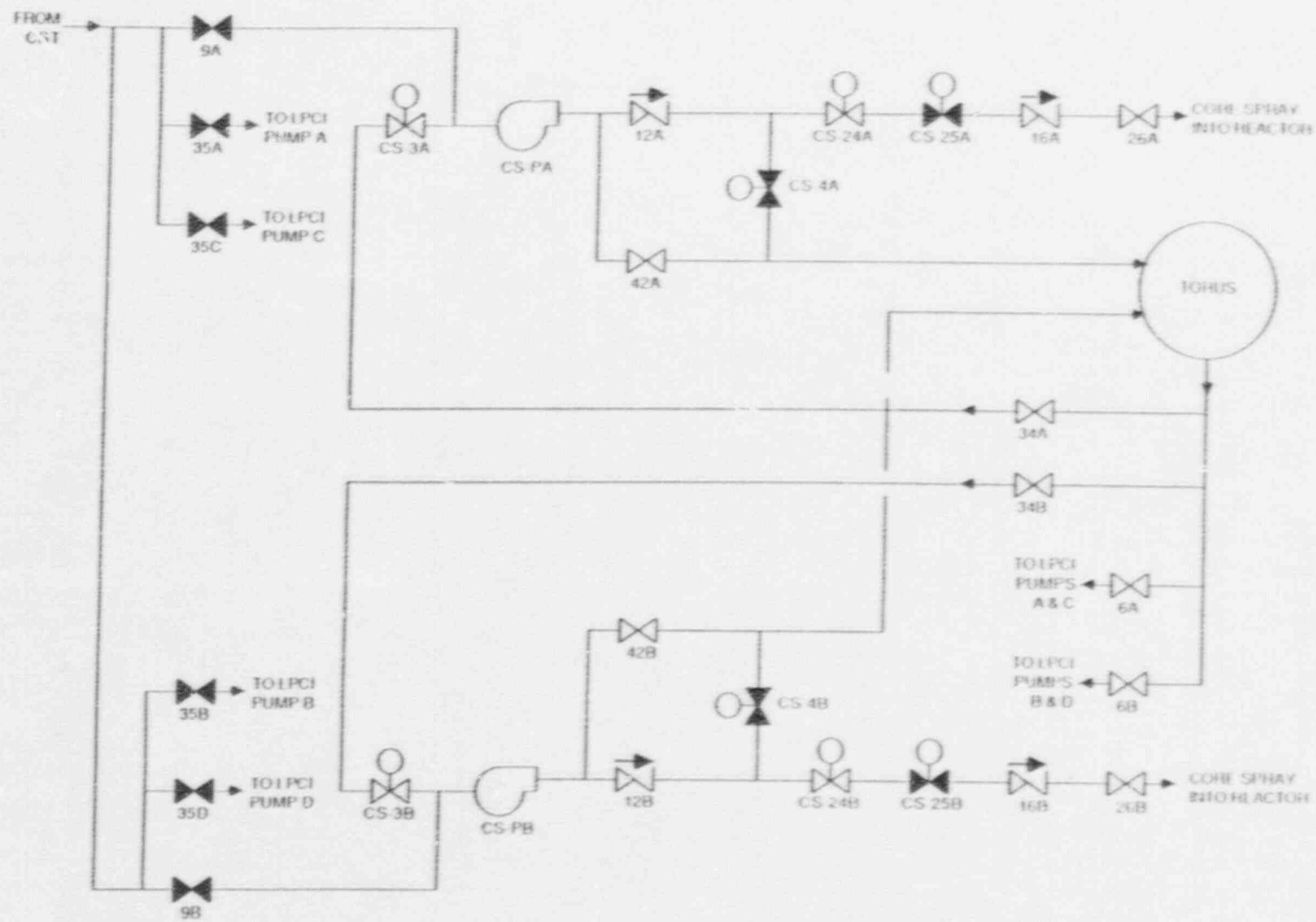
The ECCS can be actuated and controlled by remote manual means from the control room.

B. Motive Power

1. The ECCS motor-driven pumps and motor-operated valves are Class 1E AC and DC loads that can be supplied from the emergency diesel generator, gas turbine generator, or station batteries, as described in Section 3.6.

3.3.7 Section 3.3 References

1. Millstone Nuclear Power Station Unit No. 1, Updated Final Safety Analysis Report, Northeast Utilities, Hartford, CT, March 1987.
2. NUREG/CR-3085, Volume 1, "Interim Reliability Evaluation Program: Analysis of the Millstone Point Unit 1 Nuclear Power Plant", Sandia National Laboratories, Albuquerque, NM, February 1983.



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Figure 3.3-1. Millstone 1 Core Spray System

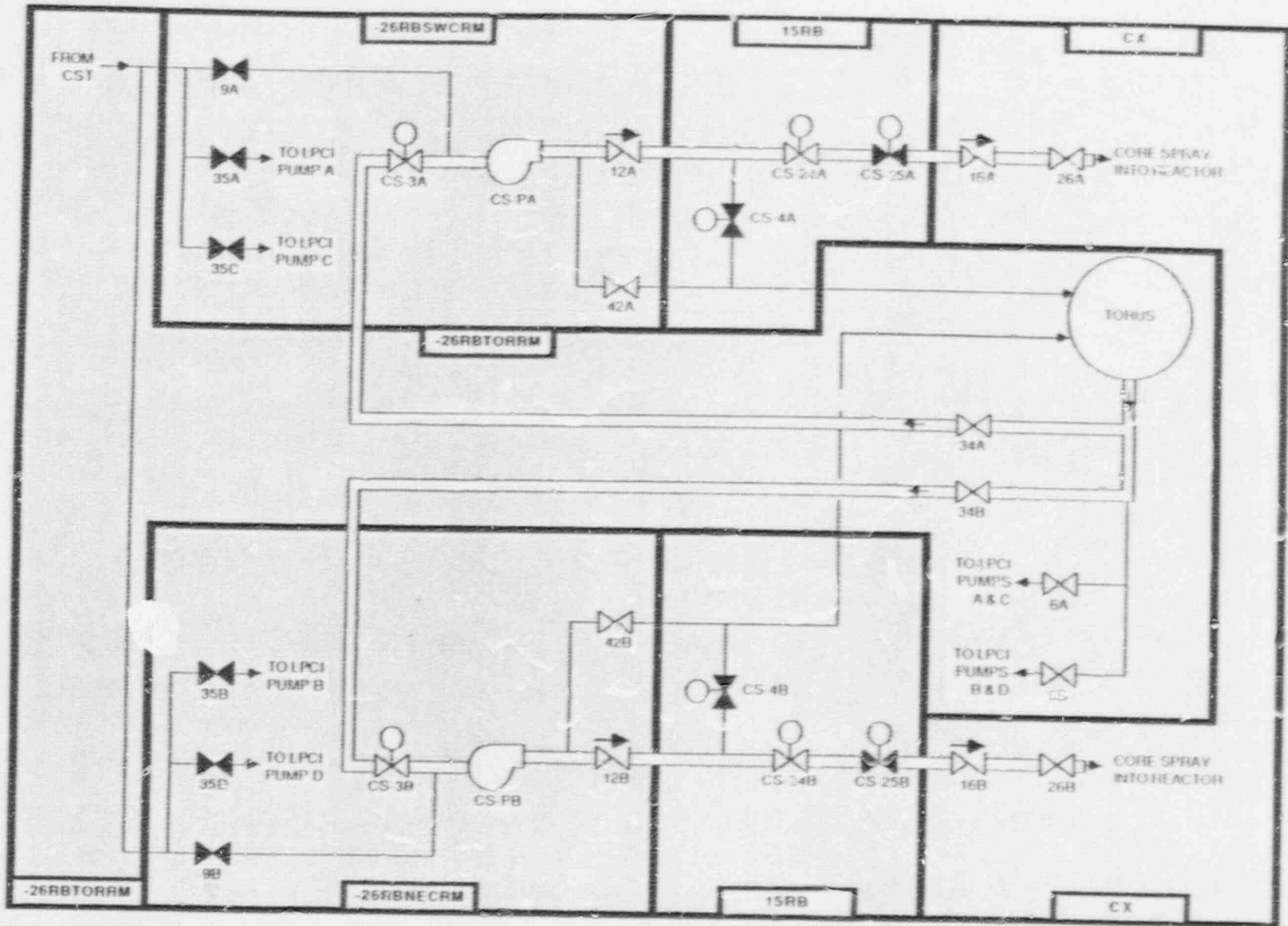


Figure 3.3-2. Millstone 1 Core Spray System Showing Component Locations

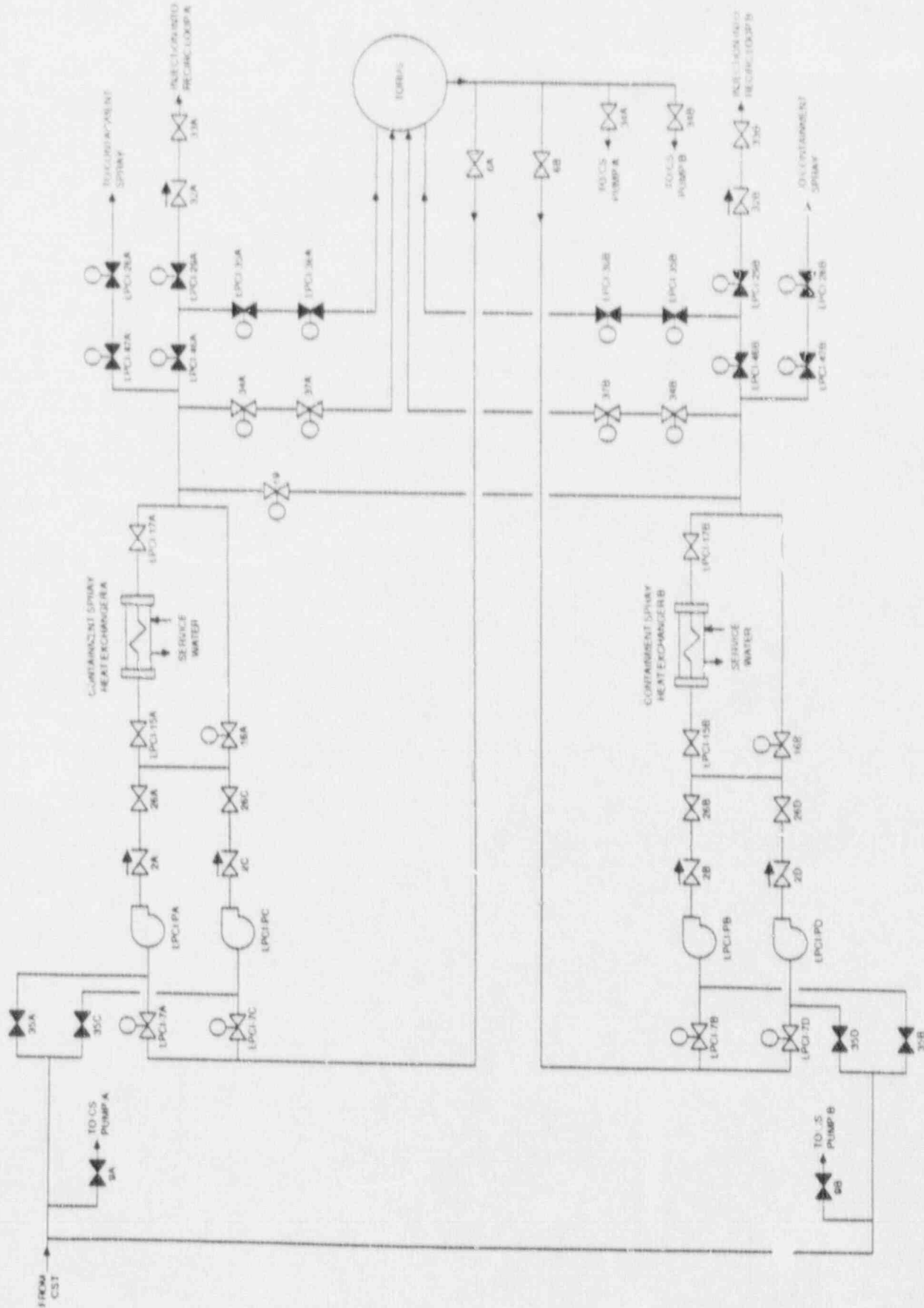


Figure 3.3-3. Millstone 1 Low Pressure Coolant Injection System

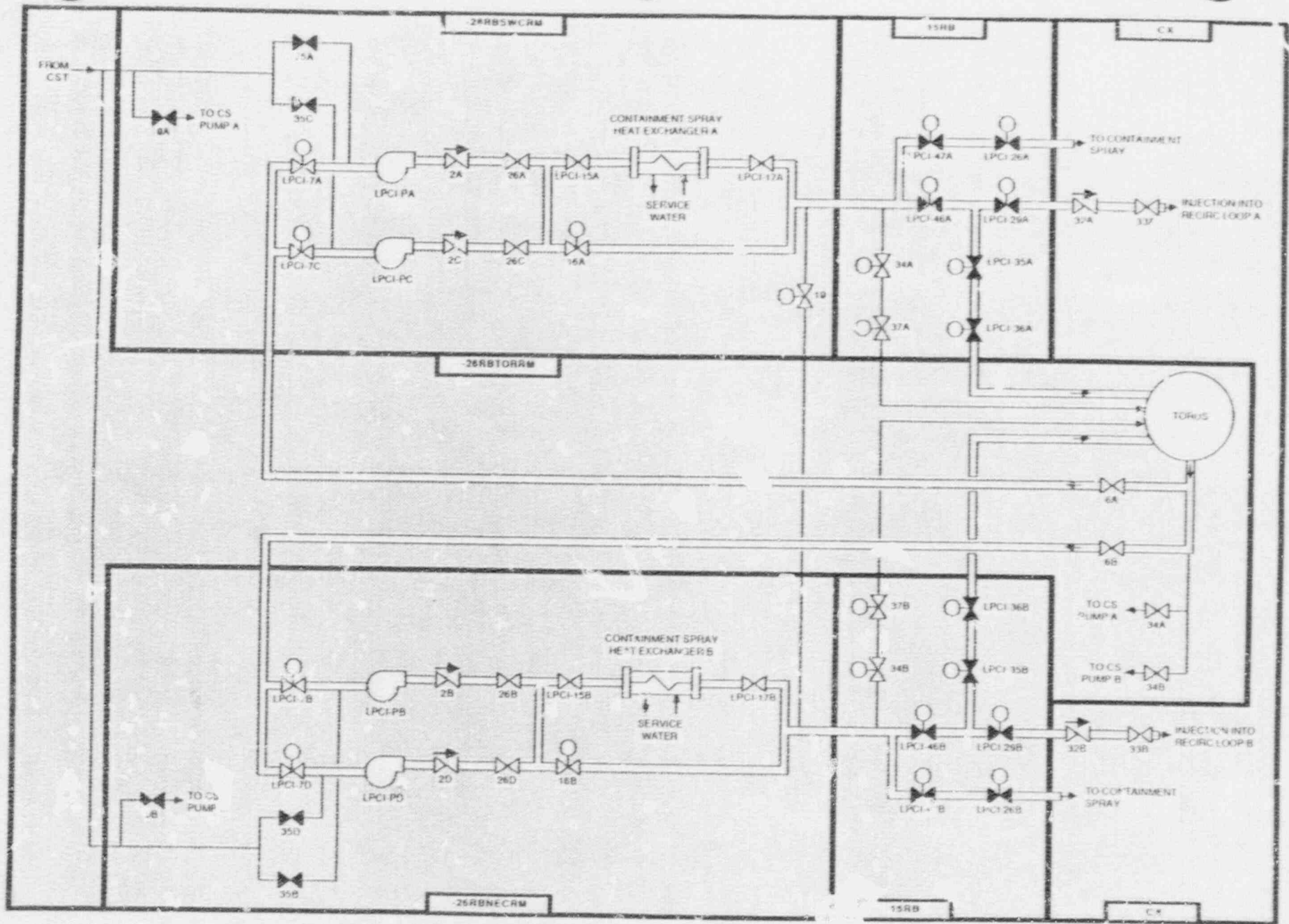


Figure 3.3-4. Millstone 1 Low Pressure Coolant Injection System Showing Component Locations

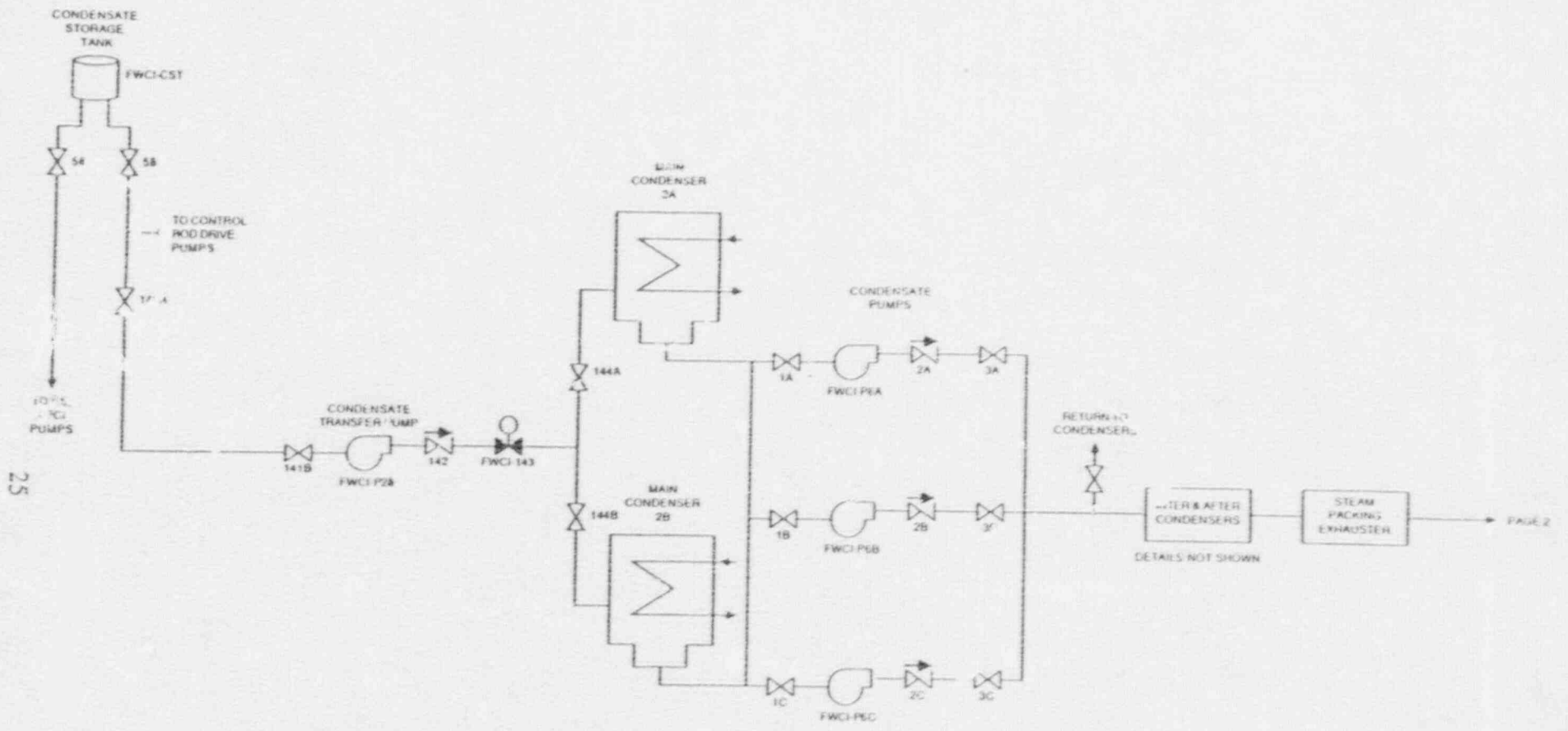
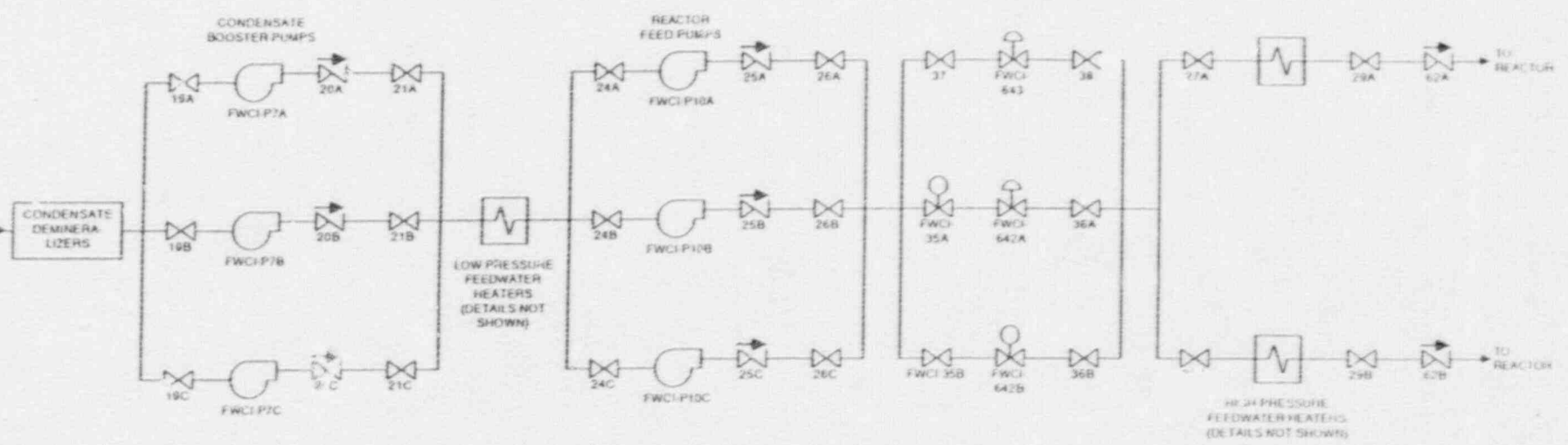


Figure 3.3-5. Millstone 1 Feedwater Coolant Injection System (page 1 of 2)

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Figure 3.3-5. Millstone 1 Feedwater Coolant Injection System (Page 2 of 2)

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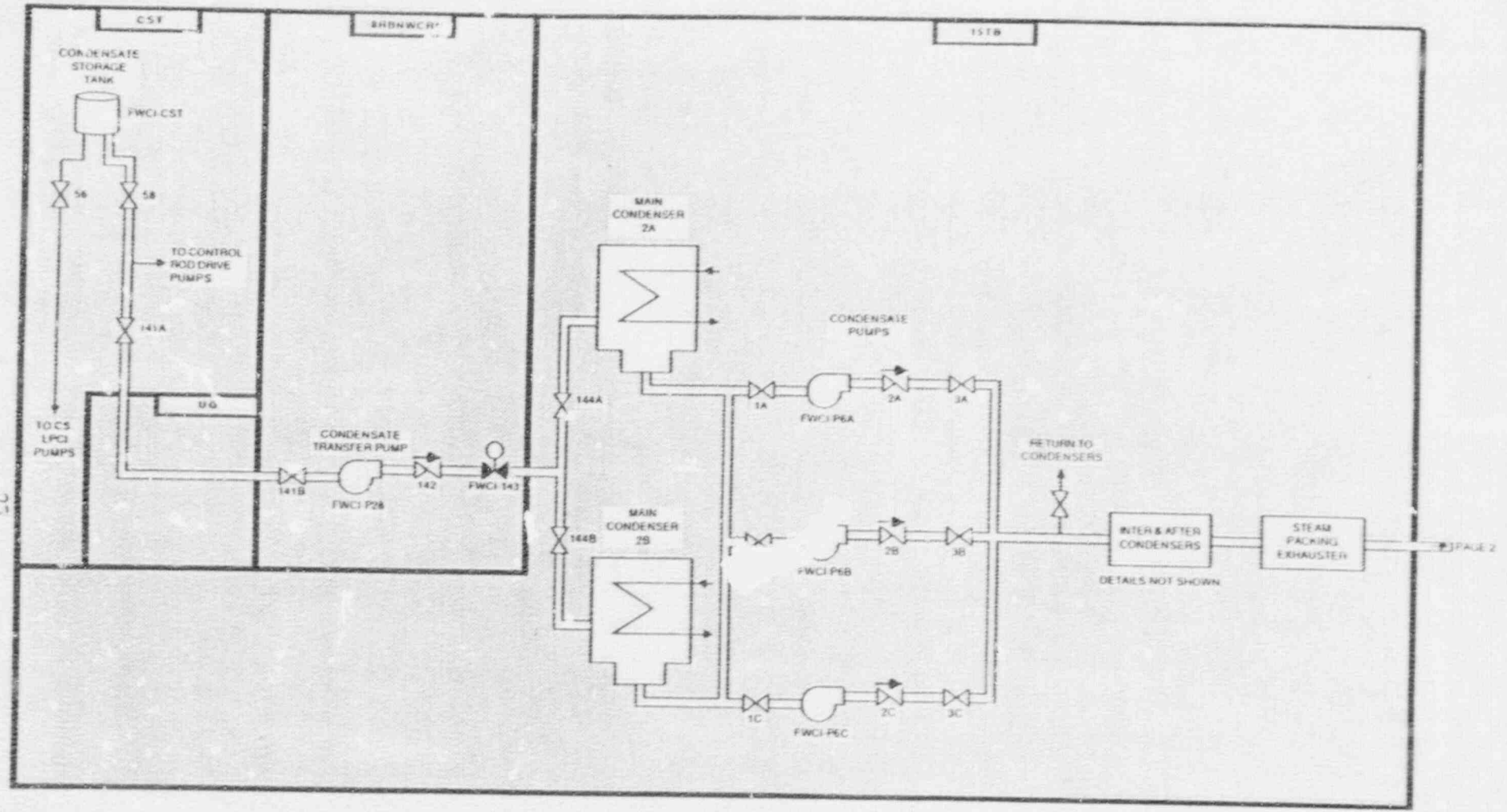
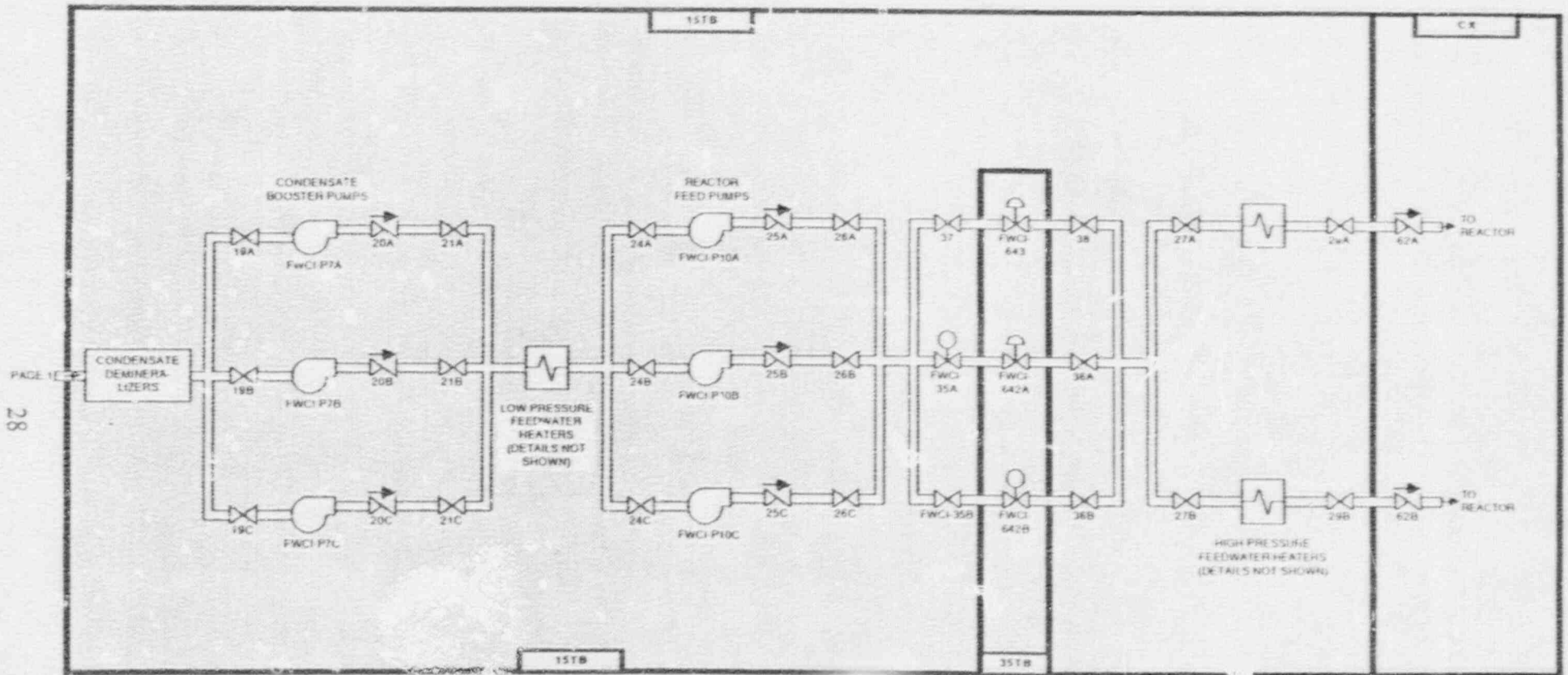


Figure 3.3-6. Millstone 1 Feedwater Coolant Injection System
 Showing Component Locations (Page 1 of 2)

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Figure 3.3-6. Millstone 1 Feedwater Coolant Injection System
Showing Component Locations (Page 2 of 2)

Table 3.3-1. Millstone 1 Emergency Core Cooling System Data Summary for Selected Component

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
CS-24A	MOV	15RB	MCC-2A-3	480	15RB	AC/F
CS-24B	MOV	15RB	MCC-2-3	480	15RB	AC/G
CS-25A	MOV	15RE	MCC-2A-3	480	15RB	AC/F
CS-25B	MOV	15RB	MCC-2-3	480	15RB	AC/G
CS-3A	MOV	15RB	MCC-2A-3	480	15RB	AC/F
CS-3B	MOV	15RB	MCC-2-3	480	15RB	AC/G
CS-4A	MOV	15RB	MCC-2A-3	480	15RB	AC/F
CS-4B	MOV	15RB	MCC-2-3	480	15RB	AC/G
CS-PA	MDP	-26RBSWCRM	BUS-14F	4160	35TBSWGRM	AC/F
CS-PB	MDP	-26RBNECRM	BUS-14E	4160	35TBSWGRM	AC/G
FWCI-143	MOV	-8RBNWCRM	MCC-2-3	480	15RB	AC/G
FWCI-35A	MOV	15TB	UNKNOWN			
FWCI-35B	MOV	15TB	UNKNOWN			
FWCI-642A	NV	35TB				
FWCI-642B	NV	35TB				
FWCI-643	NV	35TB				
FWCI-CST	TANK	CST				
FWCI-P10A	MDP	15TB	BUS-14A	4160	35TBSWGRM	AC/G
FWCI-P10B	MDP	15TB	BUS-14A	4160	35TBSWGRM	AC/G
FWCI-P10C	MDP	15TB	BUS-14B	4160	35TBSWGRM	AC/G
FWCI-P28	MDP	-8RBNWCRM	BUS-14C	4160	35TBSWGRM	AC/G
FWCI-P6A	MDP	15TB	BUS-14C	4160	35TBSWGRM	AC/G
FWCI-P6B	MDP	15TB	BUS-14C	4160	35TBSWGRM	AC/G
FWCI-P6C	MDP	15TB	BUS-14D	4160	35TBSWGRM	AC/G
FWCI-P7A	MDP	15TB	BUS-14C	4160	35TBSWGRM	AC/G

Table 3.3-1. Millstone 1 Emergency Core Cooling System Data Summary for Selected Component (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
FWCI P7B	MDP	15TB	BUS-14C	4160	35TBSWGRM	AC/G
FWCI P7C	MDP	15TB	BUS-14D	4160	35TBSWGRM	AC/G
IC-1	MOV	CX	MCC-2-3	480	15RB	AC/G
IC-2	MOV	66RB	UNKNOWN			
IC-3	MOV	43RB	MCC-101AB2	125	15RB	DC/1
IC-4	MOV	CX	MCC-2-3	480	15RB	AC/G
IC-HX	HX	83RB				
LPCI-15A	XV	-26RBSWCRM				
LPCI-15B	XV	-26RBNECRM				
LPCI-17A	XV	-26RBSWCRM				
LPCI-17B	XV	-26RBNECRM				
LPCI-26A	MOV	15RB	MCC-11A-2	480	MCC11A2	AC/G
LPCI-26B	MOV	15RB	UNKNOWN			
LPCI-29A	MOV	15RB	MCC-2A-3NE	480	15RB	AC/F
LPCI-29B	MOV	15RB	MCC-2-3NE	480	15RB	AC/G
LPCI-35A	MOV	15RB	MCC-2A-3	480	15RB	AC/F
LPCI-35B	MOV	15RB	MCC-2-3	480	15RB	AC/G
LPCI-36A	MOV	15RB	MCC-11A-2	480	MCC11A2	AC/G
LPCI-36B	MOV	15RB	UNKNOWN			
LPCI-46A	MOV	15RB	MCC-2A-3NE	480	15RB	AC/F
LPCI-46B	MOV	15RB	MCC-2-3NE	480	15RB	AC/G
LPCI-47A	MOV	15RB	MCC-2A-3	480	15RB	AC/F
LPCI-47B	MOV	15RB	MCC-2-3	480	15RB	AC/G
LPCI-7A	MOV	-26RBSWCRM	MCC-2A-3	480	15RB	AC/F
LPCI-7B	MOV	-26RBNECRM	MCC-2-3	480	15RB	AC/G

Table 3.3-1. Millstone 1 Emergency Core Cooling System Data Summary
for Selected Component (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
LPCI-7C	MOV	-26RBSWCRM	MCC-2A-3	480	15RB	AC/F
LPCI-7D	MOV	-26RBNECRM	MCC-2-3	480	15RB	AC/G
LPCI-PA	MDP	-26RBSWCRM	BUS-14F	4160	35TBSWGRM	AC/F
LPCI-PB	MDP	-26RBNECRM	BUS-14E	4160	35TBSWGRM	AC/G
LPCI-PC	MDP	-26RBSWCRM	BUS-14F	4160	35TBSWGRM	AC/F
LPCI-PD	MDP	-26RBNECRM	BUS-14E	4160	35TBSWGRM	AC/G
RCS-3A	SRV	CX				
RCS-3C	SRV	CX				
RCS-3D	SRV	CX				
RCS-3F	SRV	CX				
TORUS	TANK	-26RBTORRM				

3.4 FIRE WATER SYSTEM

3.4.1 System Function

The fire water system provides water to support fire suppression activities throughout the plant. The system also provides makeup to the isolation condenser to support its long-term operation.

3.4.2 System Definition

The fire water system services individually valved lines feeding fixed pipe water suppression systems (sprinklers, waterspray, and standpipes) throughout the plant and hydrants located around the exterior of the plant. The system consists of one motor-driven pump and one diesel-driven pump, and an electric jockey pump that maintains system pressure. The pumps are supplied by two 245,000 gallon ground level tanks.

Simplified drawings of the fire water system are shown in Figures 3.4-1 and 3.4-2. A summary of data on several fire water system components is presented in Table 3.4-1.

3.4.3 System Operation

During normal operation the jockey pump maintains system pressure by automatically starting when line pressure drops to 100 psig, and will run until pressure reaches 115 psig. The motor-driven fire pump is activated by a single pressure switch set at 85 psig. If this pump fails to start and line pressure continues to drop, the diesel-driven fire pump is activated at 75 psig. Both the motor-driven and diesel-driven pumps deliver 2000 gpm at 100 psi discharge pressure and remain in operation until they are manually shut down. Interlocks stop the jockey pump when either of the two fire pumps start.

3.4.4 System Success Criteria

For successful makeup to the isolation condenser either the motor-driven or diesel-driven fire pump, with a suction on either fire water tank, is sufficient.

3.4.5 Component Information

- A. Motor-Driven Pump P8
 - 1. Rated flow: 2000 gpm @ 100 psid
 - 2. Rated capacity: 100%
- B. Diesel-Driven Pump P7
 - 1. Rated flow: 2000 gpm @ 100 psid
 - 2. Rated capacity: 100%
- C. Fire Water Tanks (2)
 - 1. Volume: 245,000 gallons each

3.4.6 Support Systems and Interfaces

- A. Control Signals
 - 1. Automatic
 - a. The motor-driven fire pump is actuated automatically by a pressure switch set at 85 psig.
 - b. The diesel-driven fire pump is actuated automatically by a pressure switch set at 75 psig.

2. Remote Manual

The fire pumps cannot be actuated by remote manual means from the control room.

B. Motive Power

1. The motor-driven fire pump is a Class 1E AC load that can be supplied from the gas turbine generator, as described in Section 3.6.

C. Diesel Pump Auxiliary Systems

Information regarding diesel pump auxiliaries, such as cooling, fueling, lubrication, and starting was unavailable. It is believed that the diesel fuel tank and starting system are in the pump room. The diesel is cooled by a small water-to-air radiator.

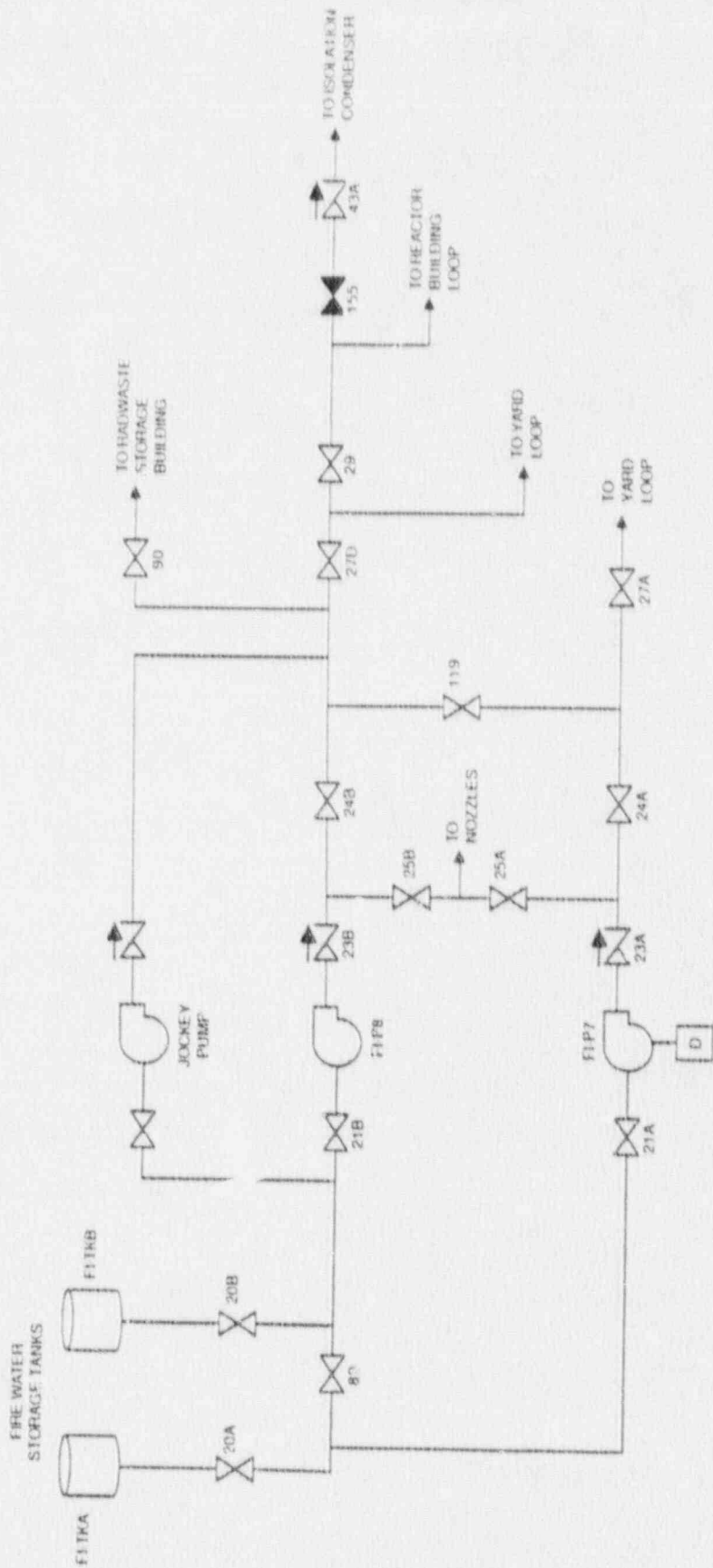


Figure 3.4-1. Millstone 1 Fire Water System

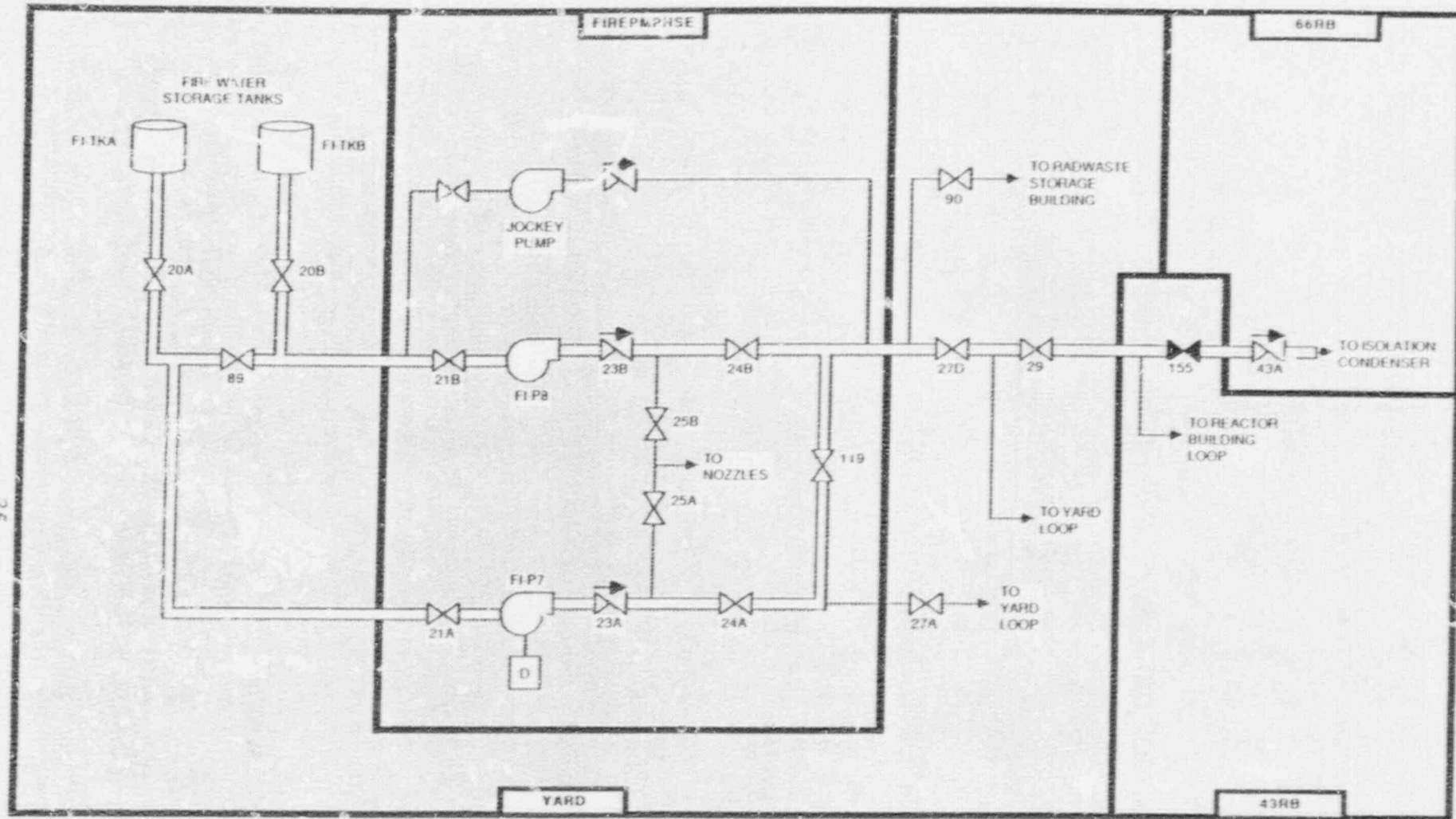


Figure 3.4-2. Millstone 1 Fire Water System Showing Component Locations

Table 3.4-1. Millstone 1 Fire Water System Data Summary
for Selected Component

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
FI-P7	DDP	FIREPMPHSE	FI-7-DSL	480	FIREPMPHSE	
FI-P8	MDP	FIREPMPHSE	MCC-22A-2	480	FIREPMPHSE	AC/G
IC-10	MOV	83RB	MCC-2-1	480	83RB	AC/G

3.5 INSTRUMENTATION AND CONTROL (I&C) SYSTEMS

3.5.1 System Function

The instrumentation and control systems consist of the Reactor Protection System (RPS), Engineered Safety Features (ESF), and systems for the display of plant information to the operators. The RPS monitors the reactor plant, and alerts the operator to take corrective action before specified limits are exceeded. The RPS will initiate an automatic reactor trip (scram) to rapidly shutdown the reactor when plant conditions exceed one or more specified limits. The ESF systems will automatically actuate various safety systems based on the specific limits or combinations of limits that are exceeded. A remote shutdown capability is provided to ensure that the reactor can be placed in a safe condition in the event that the main control room must be evacuated.

3.5.2 System Definition

The RPS includes sensor and transmitter units, logic units, and output trip relays that interface with the control circuits for components in the scram portion of the Control Rod Drive Hydraulic System (see Section 3.7). Other actuation and control systems include independent sensor and transmitter units and relay units that interface with the control circuits of many different components in safety systems. Operator instrumentation display systems consist of display panels that are powered from the instrumentation buses (see Section 3.6).

3.5.3 System Operation

A. RPS

The RPS has two separate trip systems (A and B), each of which consists of two separate trip logic channels. One channel in each of the two trip systems must trip to cause a full scram (one-out-of-two twice logic). There are two pilot scram valves and two scram valves for each control rod. RPS trip system A controls the "A" valves and RPS trip system B controls the "B" valves. The pilot scram valves are solenoid operated and normally energized. The solenoids de-energize to cause a scram. The system is therefore considered "fail safe" on loss of power. RPS inputs are listed below:

- Neutron monitoring system
- RCS high pressure
- Low water level in reactor vessel
- Turbine stop valve closure
- Turbine control valve fast closure
- Main steam line isolation signal
- High drywell pressure
- Main steam line high radiation
- Condenser low vacuum
- Scram discharge volume high water level
- Scram air header low pressure
- Manual
- Mode Switch in SHUTDOWN

B. ESF

The ESF systems cause the various safety systems to be started, stopped or realigned as needed to respond to abnormal plant conditions. Details regarding actuation logic are included in the system description of the actuated system. Control room displays are powered by the 120 V AC instrumentation buses.

C. Remote Shutdown

In the event that the Control Building must be evacuated, the reactor may be safely shut down by one of the following means:

- Operating the scram buttons at the control panel before the Main Control Room is evacuated
- Isolating and venting the scram air header low pressure sensing switches, which will place the reactor protection system (RPS) into operation.
- Opening the RPS motor generator set outlet breakers

Decay heat removal can be provided by local operation of the isolation condenser and fire water systems, as described in Section 3.2 and 3.3, respectively.

3.5.4 System Success Criteria

A. RPS

The RPS uses hindrance logic (normal = 1, trip = 0) in both the input and output logic. Therefore, a channel will be in a trip state when input signals are lost, when control power is lost, or when the channel is temporarily removed from service for testing or maintenance (i.e. the channel has a fail-safe failure mode). A reactor scram will occur upon loss of control power to the RPS. A reactor scram is implemented by the scram pilot valves in the control rod drive hydraulic system (see Section 3.7). Details of the RPS for Millstone 1 have not been determined.

B. ESF Actuation Systems

A single component usually receives a signal from only one ESF actuation system output train. Trains A and B must be available in order to automatically actuate their respective components. Actuation systems other than the RPS typically use hindrance input logic (normal = 1, trip = 0) and transmission output logic (normal = 0, trip = 1). In this case, an input channel will be in a trip state when input signals are lost, when control power is lost, or when the channel is temporarily removed from service for testing or maintenance (i.e. the channel has a fail-safe failure mode). Control power is needed for the ESF actuation system output channels to send an actuation signal. Note that there may be some ESF actuation subsystems that utilize hindrance output logic. For these subsystems, loss of control power will cause system or component actuation, as is the case with the RPS. Details of the ESF actuation systems for Millstone 1 have not been determined.

C. Manually-Initiated Protective Actions

When reasonable time is available, certain protective actions may be performed manually by plant personnel. The control room operators are capable of operating individual components using normal control circuitry, or operating groups of components by manually tripping the RPS or other actuation subsystem. The control room operators also may send qualified persons into

these judgments, data on key plant parameters must be available to the operators.

3.5.5 Support Systems and Interfaces

A. Control Power

1. RPS

The RPS is powered from the 120 VAC Class 1E electric power system.

2. ESF systems

The control power interfaces for the ESF actuation systems at Millstone 1 have not been identified.

3. Operator instrumentation

Operator instrumentation display systems are powered from the 120 VAC Class 1E electric power system.

3.5.6 Section 3.5 References

1. Millstone 1 Updated Final Safety Analysis Report, Section 7.4, 1986.

3.6 ELECTRIC POWER SYSTEM

3.6.1 System Function

The electric power system supplies power to various equipment and systems needed for normal operation and/or response to accidents. The onsite Class 1E electric power system supports the operation of safety class systems and instrumentation needed to establish and maintain a safe shutdown plant condition following an accident, when the normal electric power sources are not available.

3.6.2 System Definition

The onsite Class 1E AC electric power system consists of one diesel generator and one gas turbine generator which provide emergency power to a total of seven 4160 VAC buses. These buses distribute power to four 480 VAC load centers. In addition, there are many 480 VAC motor control centers. The Class 1E plant DC power system consists of two 125 VDC batteries. These batteries are connected to two 125 VDC distribution panels.

The 4160 and 480 VAC electric power distribution system at Millstone 1 is shown in Figures 3.6-1 and 3.6-2. The 125 VDC distribution system is shown in Figures 3.6-3 and 3.6-4. The 120 VAC instrumentation power system is shown in Figure 3.6-5 and 3.6-6. A summary of data on selected electric power system components is presented in Table 3.6-1. A partial listing of electrical sources and loads is presented in Table 3.6-2.

3.6.3 System Operation

During normal operation the normal station service transformer (auxiliary transformer 1) steps down 24kV from the main generator to 4160 volts for the six auxiliary buses 14A through 14F. These buses can also be supplied from the 345 kV switchyard through the reserve station service transformer (startup transformer 1). Bus 14G is normally supplied by shutdown transformer 1. An eighth bus, 24F, provides a means of cross-connecting Unit 1 and Unit 2 4160 volt systems (Ref. 1), however, this bus could not be located on available drawings.

The diesel generator and gas turbine generator start automatically upon loss of offsite power of ECCS initiation to provide emergency power. The diesel generator supplies power to 4160 VAC bus 14F, and the gas turbine generator supplies bus 14G. There are many bus interconnects, but in general bus 14G feeds buses 14A, 14C, and 14D. In turn, bus 14A feeds bus 14B, and bus 14C feeds bus 14E.

Bus loads are arranged so that all equipment considered essential for safe shutdown are fed from buses 14A, 14C, 14E, 14F, and 14G. Loads having the same function are not placed on the same bus. Buses 14A and 14B supply only the reactor feed pumps and the reactor recirculation pump M-G sets, thereby confining the large voltage drops associated with starting this equipment to just two buses.

There are two 125 VDC distribution panels. These panels are each powered by a 125 VDC battery. Each battery has its own battery charger, and they share a third battery charger. Battery capacity is sufficient to support essential loads for about 8 hours (Ref. 1).

The 120 VAC system provides power for essential instrumentation and for the RPS. This system is powered from 480 VAC MCCs or from a 125 VDC MCC.

Redundant safeguards equipment such as motor driven pumps and motor operated valves are supplied by different buses. For the purpose of discussion, this equipment has been grouped into "load groups". Load group AC/F contains components powered either directly or indirectly from the diesel generator through 4160 VAC bus 14F. Load group AC/G contains components powered either directly or indirectly from the gas turbine generator through 4160 VAC bus 14G. Components receiving DC power are assigned to load groups DC/1 or DC/1A, based on the battery power source.

3.6.4 System Success Criteria

Basic system success criteria for mitigating transients and loss-of-coolant accidents are defined by front-line systems, which then create demands on support systems. Electric power system success criteria are defined as follows, without taking credit for cross-ties that may exist between independent load groups:

- Each Class 1E DC load group is supplied initially from its respective battery (also needed for diesel starting)
- Each Class 1E AC load group is isolated from the non-Class 1E system and is supplied from its respective emergency power source (i.e. diesel generator or gas turbine generator)
- Power distribution paths to essential loads are intact
- Power to the battery chargers is restored before the batteries are exhausted

3.6.5 Component Information

- A. Diesel Generator
 1. Maximum continuous rating: 3000 kW
 2. Rated voltage: 4160 VAC
 3. Manufacturer: Fairbanks Morse
- B. Gas Turbine Generator
 1. Power rating: unknown
 2. Rated voltage: 4160 VAC
- C. Station Batteries (1, 1A)
 1. Rated voltage: 125 VDC
 2. Capacity: 8 hours with design loads

3.6.6 Support Systems and Interfaces

- A. Control Signals
 1. Automatic

The standby diesel generator and gas turbine generator are automatically started on the following signals:

 - Loss of offsite power
 - ECCS initiation
 2. Remote manual

The diesel generator and gas turbine generator can be started, and connected to the emergency buses from the main control room.
- B. Diesel Generator Auxiliary Systems

The following auxiliaries are provided for the emergency diesel generator:

 1. Cooling

The service water system provides for diesel cooling (see Section 3.8).
 2. Fueling

A 1600 gallon day tank is provided for the diesel generator. The day tank has a capacity for 8 hours of diesel generator operation at full load. A total of 154 full-load hours of diesel fuel is available on site.
 3. Lubrication

4. Starting
Dual air receivers are provided for diesel generator starting. The system is capable of storing air for a minimum of three cold diesel engine starts without recharging.
5. Control power
The diesel generator is dependent on 125 VDC power from either station battery for control power.
6. Diesel room ventilation
The diesel room is provided with a ventilation system.

3.6.7 Section 3.6 References

1. Millstone Nuclear Power Station Unit No. 1, Updated Final Safety Analysis Report, Northeast Utilities, Hartford, CT, March 1987.

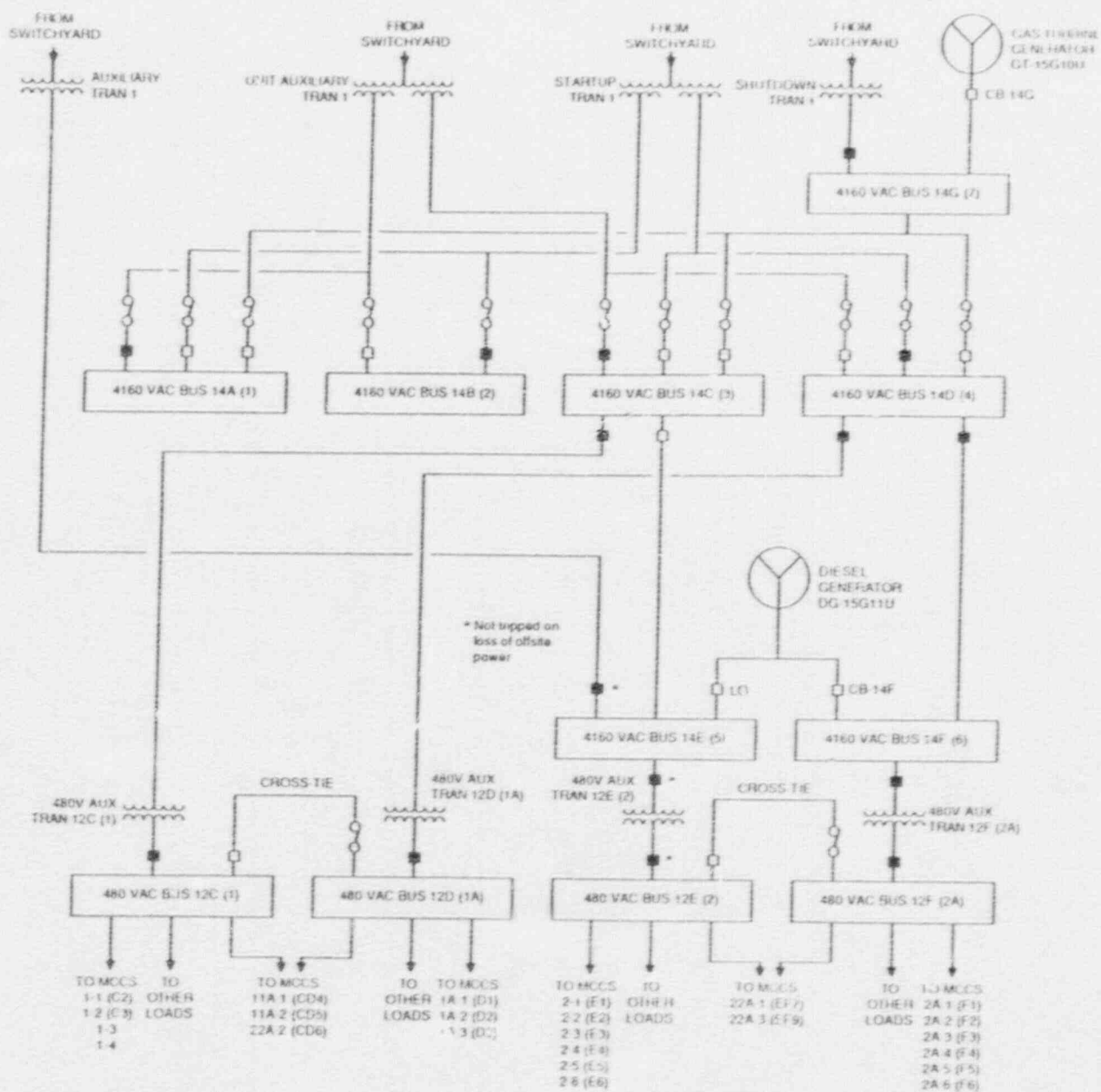
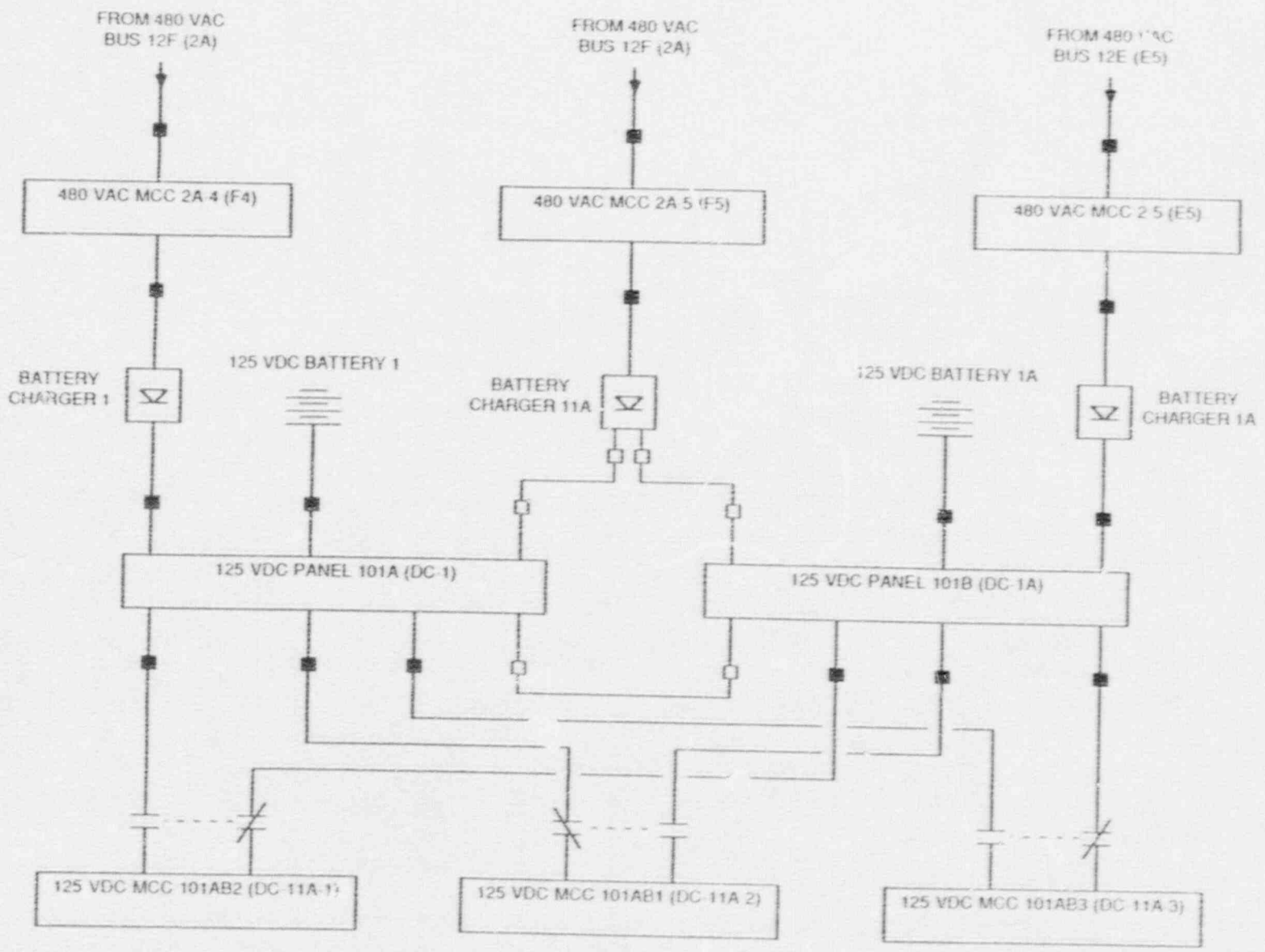


Figure 3.6-1. Millstone 1 4160 and 480 VAC Electric Power Distribution System



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Figure 3.6-3. Millstone 1 125 VDC Electric Power Distribution System

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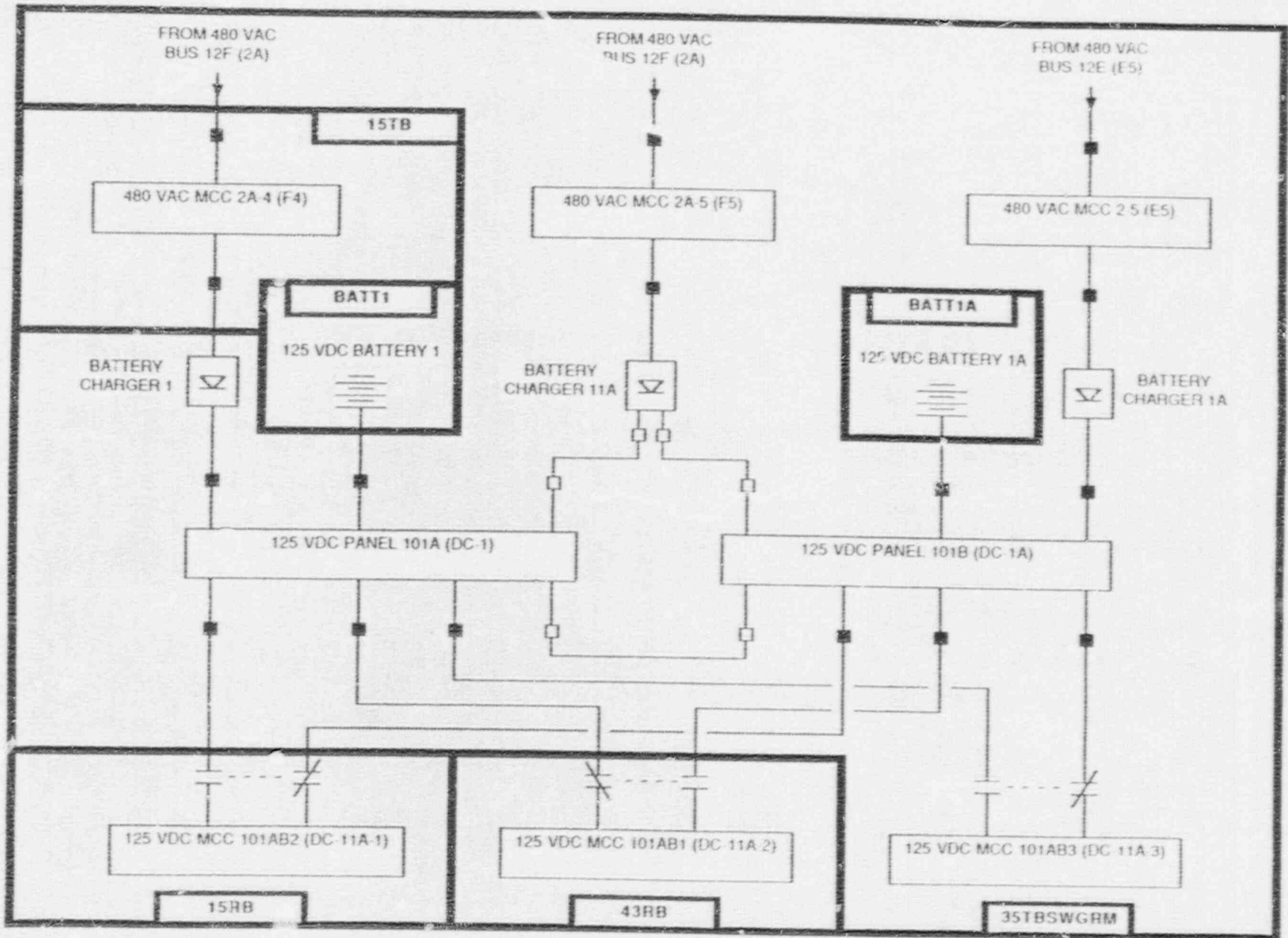


Figure 3.6-4. Millstone 1 125 VDC Electric Power Distribution System Showing Component Locations

L17

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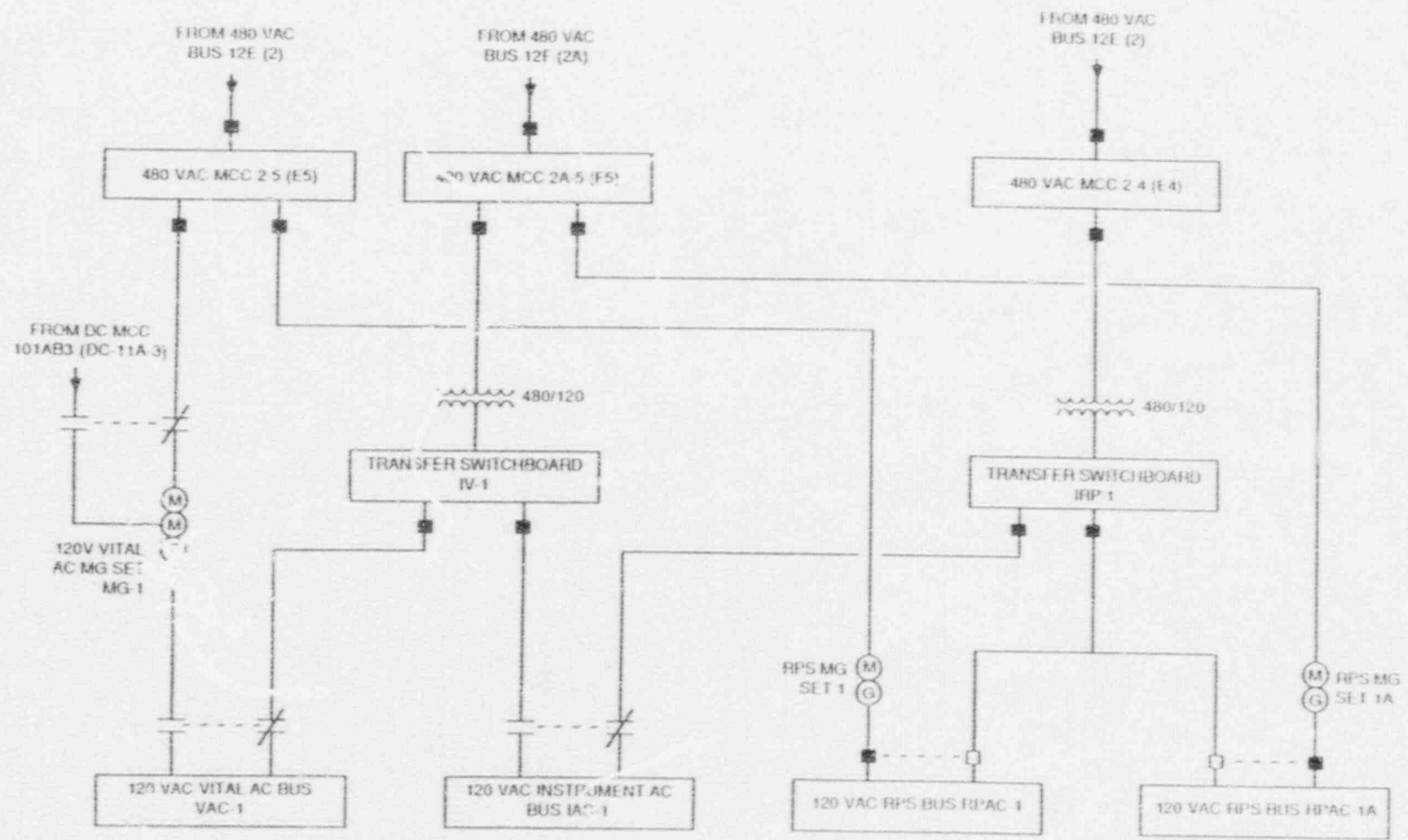
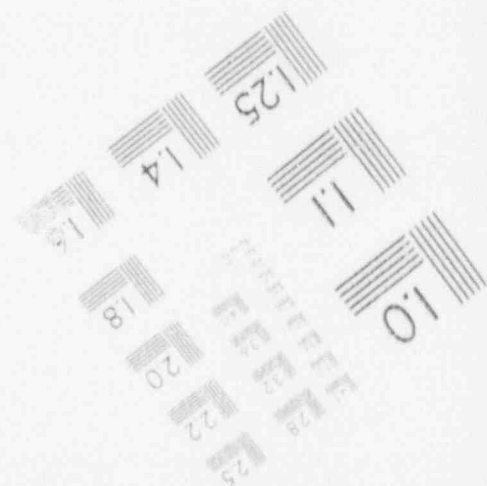
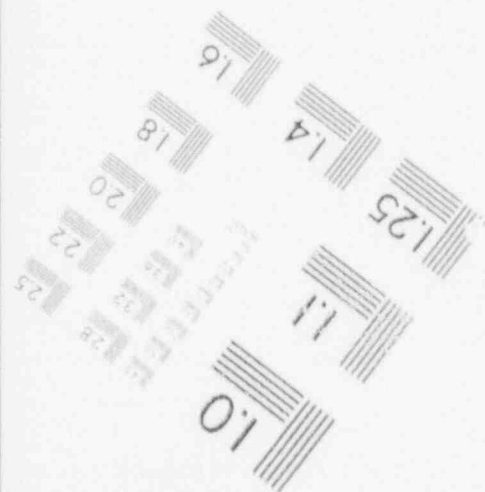
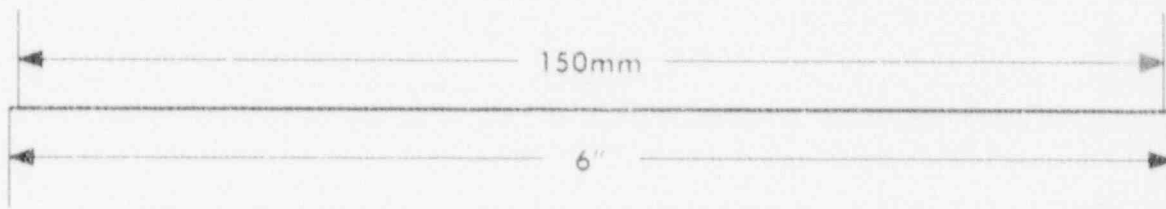
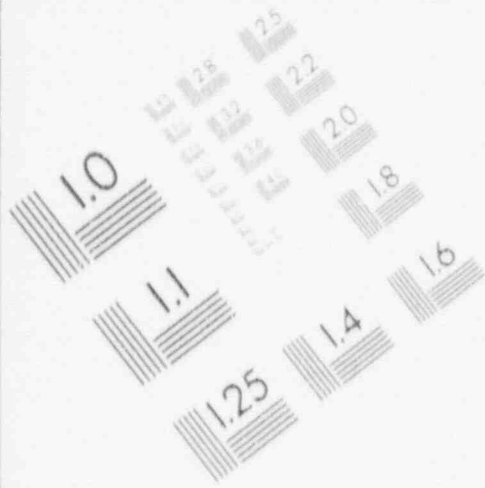


Figure 3.6-5. Millstone 1 120 VAC Electric Power Distribution System

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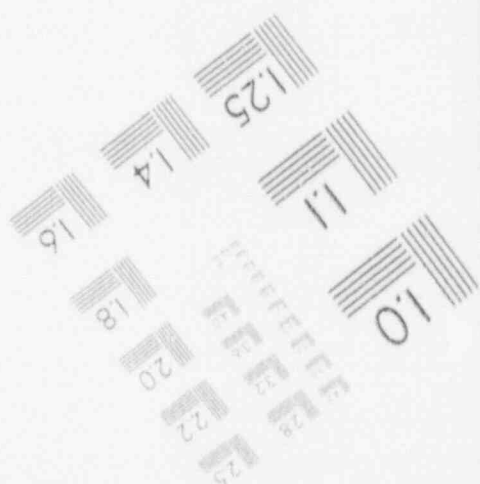
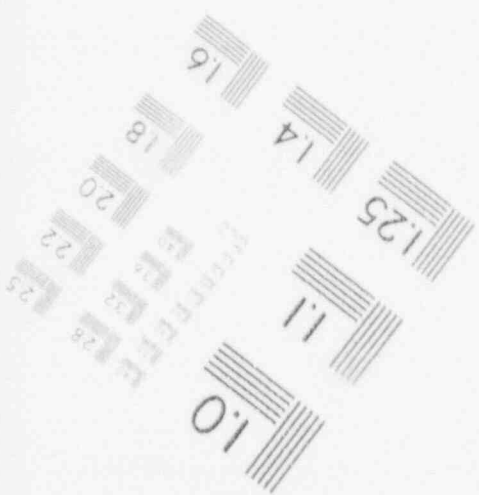
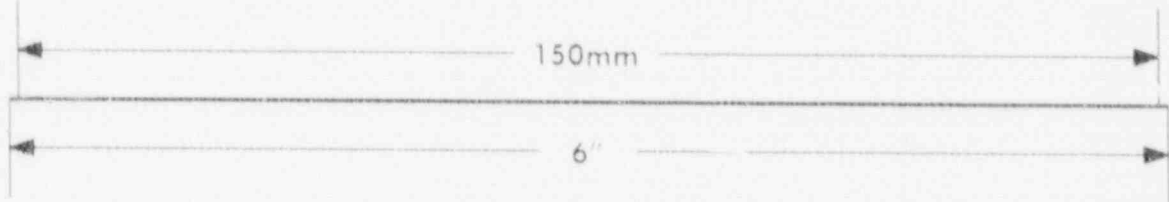
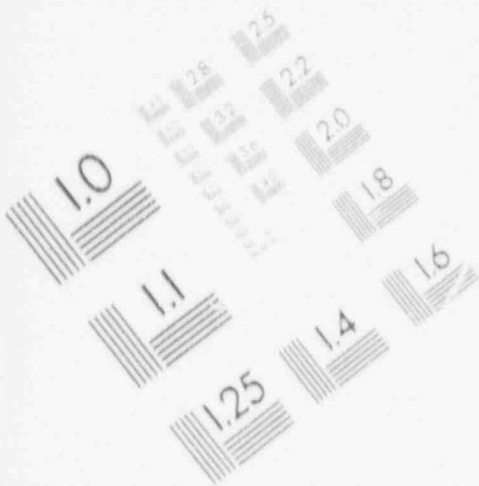
IMAGE EVALUATION TEST TARGET (MT-3)



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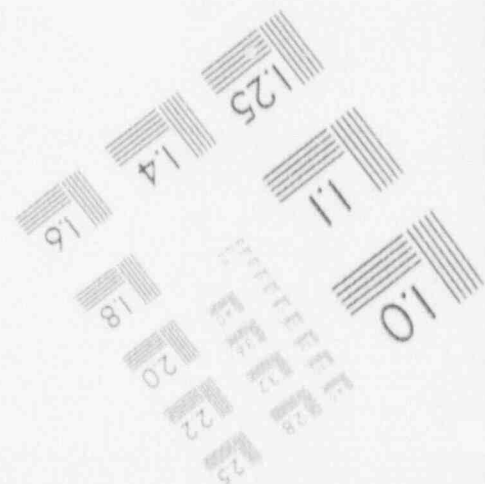
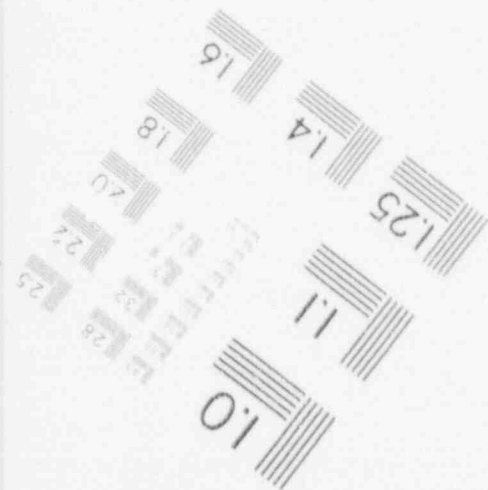
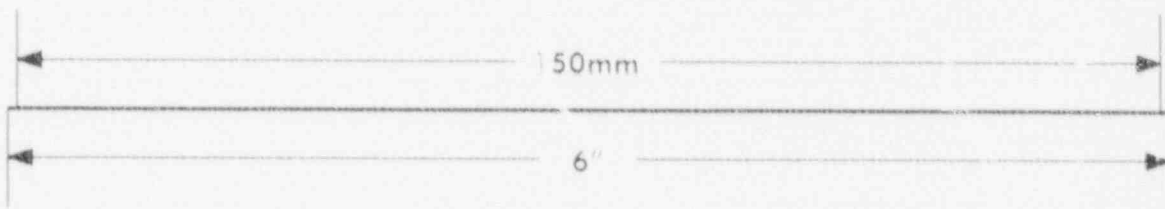
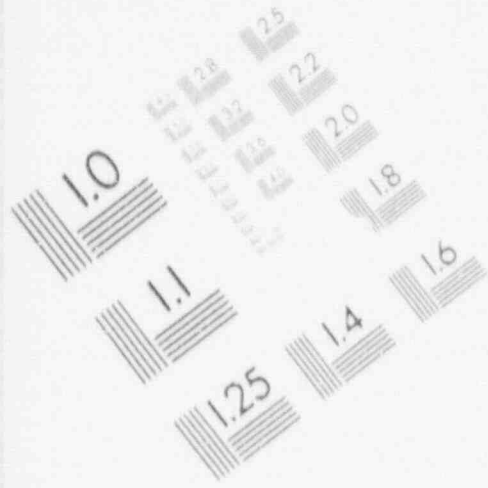
IMAGE EVALUATION TEST TARGET (MT-3)



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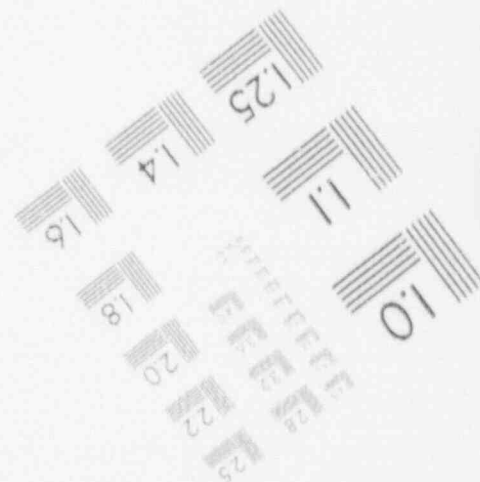
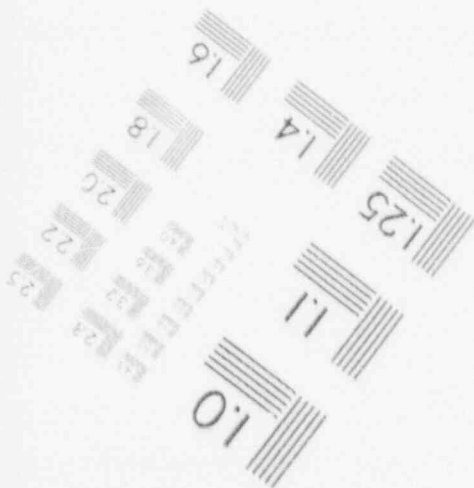
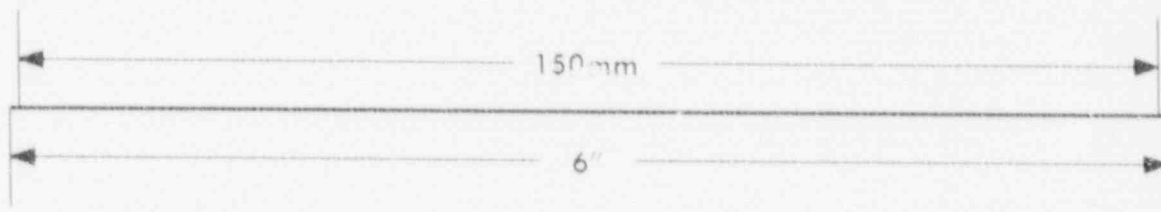
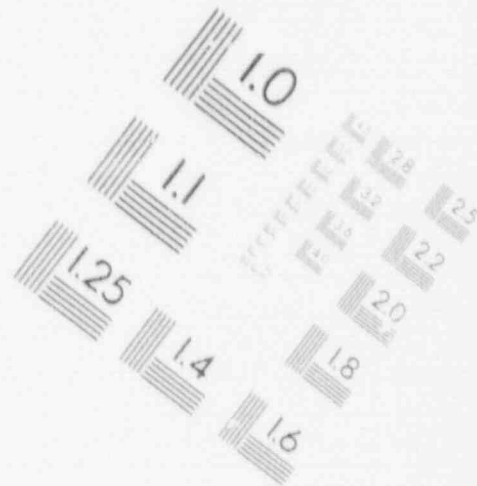
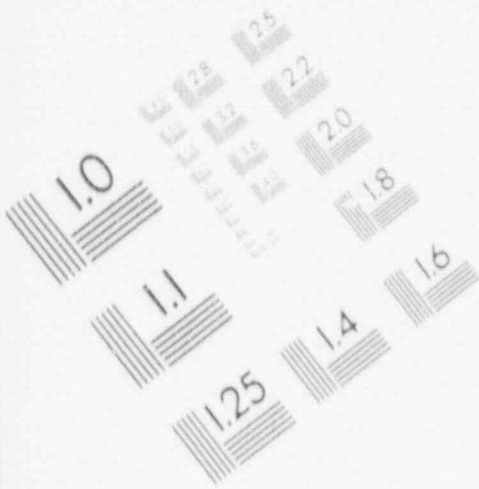
IMAGE EVALUATION TEST TARGET (MT-3)



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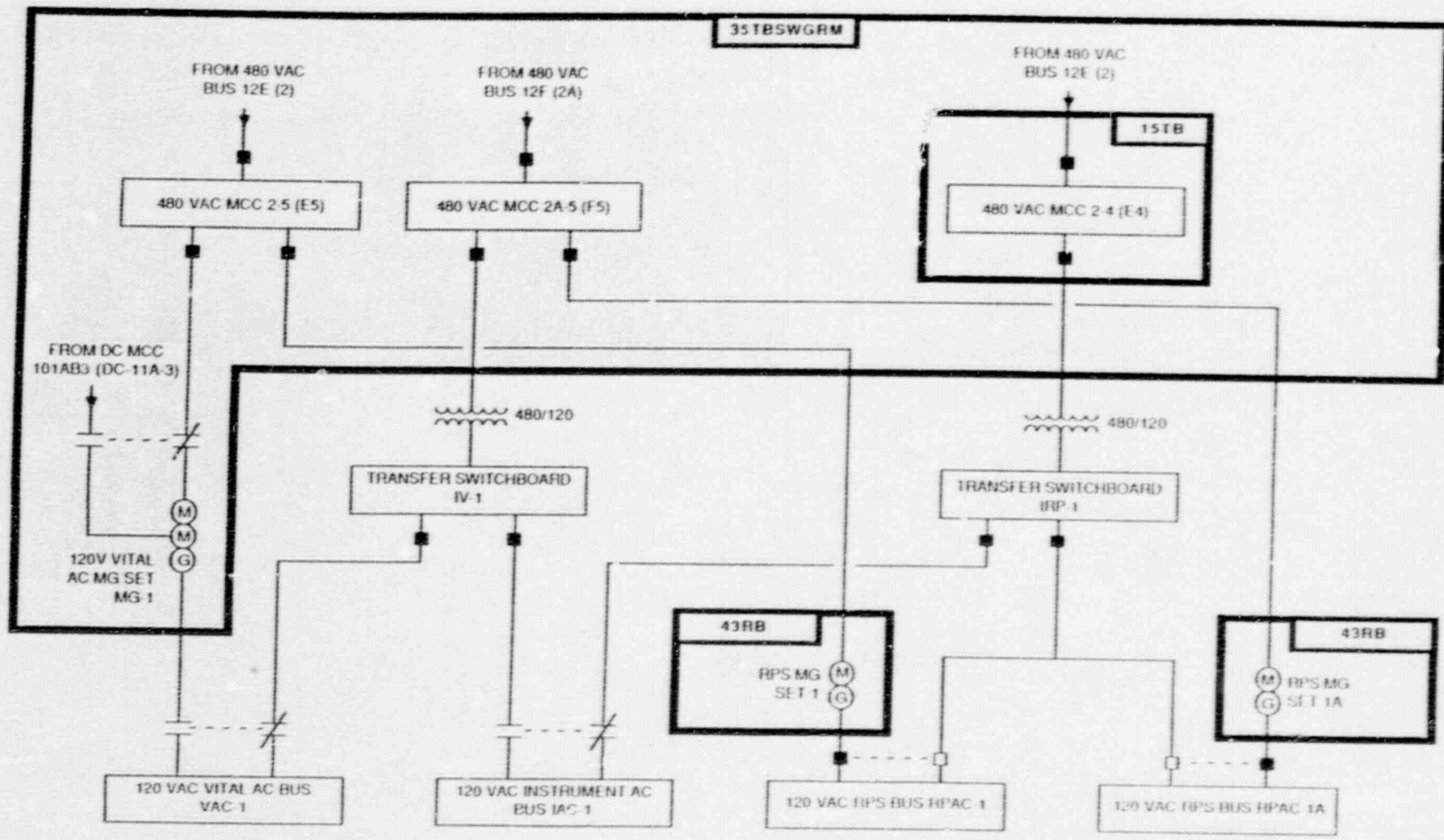
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IMAGE EVALUATION TEST TARGET (MT-3)



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NOTE: LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS

Figure 3.6-6. Millstone 1 120 VAC Electric Power Distribution System Showing Component Locations

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Table 3.6-1. Millstone 1 Electric Power System Data Summary
for Selected Component

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP
BATT-1	BATT	BATT1		125		DC/1
BATT-1A	BATT	BATT1A		125		DC/1A
BC-1	BC	35TBSWGRM	MCC-2A-4	480	15TB	AC/F
BC-1A	BC	35TBSWGRM	MCC-2-5	480	35TBSWGRM	AC/G
BUS-12C	BUS	35TBSWGRM	TRAN-12C	480	35TBSWGRM	AC/G
BUS-12D	BUS	35TBSWGRM	TRAN-12D	480	35TBSWGRM	AC/G
BUS-12E	BUS	35TBSWGRM	TRAN-12E	480	35TBSWGRM	AC/G
BUS-12F	BUS	35TBSWGRM	TRAN-12F	480	35TBSWGRM	AC/F
BUS-14A	BUS	35TBSWGRM	BUS-14G	4160	35TBSWGRM	AC/G
BUS-14B	BUS	35TBSWGRM	BUS-14A	4160	35TBSWGRM	AC/G
BUS-14C	BUS	35TBSWGRM	BUS-14G	4160	35TBSWGRM	AC/G
BUS-14D	BUS	35TBSWGRM	BUS-14G	4160	35TBSWGRM	AC/G
BUS-14E	BUS	35TBSWGRM	BUS-14C	4160	35TBSWGRM	AC/G
BUS-14F	BUS	35TBSWGRM	DC-15G11U	4160	15TBDGRM	AC/F
BUS-14G	BUS	35TBSWGRM	GT-15G10U	4160	GTBLDG	AC/G
BUS-IAC-1	BUS	35TBSWGRM	TR-IV-1	120	35TBSWGRM	AC/F
BUS-IAC-1	BUS	35TBSWGRM	TR-IRP-1	120	35TBSWGRM	AC/G
BUS-VAC-1	BUS	35TBSWGRM	MG-1	120	35TBSWGRM	AC/G
BUS-VAC-1	BUS	35TBSWGRM	TR-IV-1	120	35TBSWGRM	AC/F
CB-14F	CB	35TBSWGRM	DG-15G11U	4160	15TBDGRM	AC/F
CB-14G	CB	GTBLDG	GT-15G10U	4160	GTBLDG	AC/G
DC-1	BUS	35TBSWGRM	BATT-1	125	BATT1	DC/1
DC-1	BUS	35TBSWGRM	BC-1	125	35TBSWGRM	DC/1
DC-1	BUS	35TBSWGRM	BC-11A	125	35TBSWGRM	DC/1
DC-1A	BUS	35TBSWGRM	BATT-1A	125	BATT1A	DC/1A

Table 3.6-1. Millstone 1 Electric Power System Data Summary
for Selected Component (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
DC-1A	BUS	35TBSWGRM	BC-1A	125	35TBSWGRM	DC/1A
DC-1A	BUS	35TBSWGRM	BC-11A	125	35TBSWGRM	DC/1A
DG-15G11U	DG	15TBDGRM		4160		AC/F
GT-15G10U	GT	GTBLDG		4160		AC/G
MC-22A-2	MCC	FIREPMPHSE	TR-12C	480	35TBSWGRM	AC/G
MCC-101AB2	MCC	15RB	DC-1	125	35TBSWGRM	DC/1
MCC-101AB2	MCC	15RB	DC-1A	125	35TBSWGRM	DC/1A
MCC-101AB3	MCC	35TBSWGRM	DC-1A	125	35TBSWGRM	DC/1A
MCC-101AB3	MCC	35TBSWGRM	DC-1	125	35TBSWGRM	DC/1
MCC-11A-2	MCC	MCC11A2	BUS-12C	480	35TBSWGRM	AC/G
MCC-11A-2	MCC	MCC11A2	BUS-12D	480	35TBSWGRM	AC/G
MCC-2-1	MCC	83RB	BUS-12E	480	35TBSWGRM	AC/G
MCC-2-3	MCC	35TBSWGRM	BUS-12E	480	35TBSWGRM	AC/G
MCC-2-3NE	MCC	15RB	MCC-2-3	480	15RB	AC/G
MCC-2-4	MCC	15TB	BUS-12E	480	35TBSWGRM	AC/G
MCC-2-5	MCC	35TBSWGRM	BUS-12E	480	35TBSWGRM	AC/G
MCC-2-5	MCC	35TBSWGRM	BUS-12E	480	35TBSWGRM	AC/G
MCC-2A-3	MCC	35TBSWGRM	BUS-12F	480	35TBSWGRM	AC/F
MCC-2A-3NE	MCC	15RB	MCC-2A-3	480	15RB	AC/F
MCC-2A-4	MCC	15TB	BUS-12F	480	35TBSWGRM	AC/F
MCC-2A-5	MCC	35TBSWGRM	BUS-12F	480	35TBSWGRM	AC/F
MG-1	MG	35TBSWGRM	MCC-101AB3	120	35TBSWGRM	DC/1A
MG-1	MG	35TBSWGRM	MCC-2-5	120	35TBSWGRM	AC/G
TR-III-1	ATS	35TBSWGRM	MCC-2-4	120	15TB	AC/G
TR-IV-1	ATS	35TBSWGRM	MCC-2A-5	120	35TBSWGRM	AC/F

Table 3.6-1. Millstone 1 Electric Power System Data Summary
for Selected Component (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
TRAN-12C	TRAN	35TBSWGRM	BUS-14C	480	35TBSWGRM	AC/G
TRAN-12D	TRAN	35TBSWGRM	BUS-14D	480	35TBSWGRM	AC/G
TRAN-12E	TRAN	35TBSWGRM	BUS-14E	480	35TBSWGRM	AC/G
TRAN-12F	TRAN	35TBSWGRM	BUS-14F	480	35TBSWGRM	AC/F

TABLE 3.6-2. PARTIAL LISTING OF ELECTRICAL SOURCES AND LOADS
AT MILLSTONE 1

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BATT-1	125	DC/1	BATT1	EP	DC-1	BUS	35TBSWGRM
BATT-1A	125	DC/1A	BATT1A	EP	DC-1A	BUS	35TBSWGRM
BC-1	125	DC/1	35TBSWGRM	EP	DC-1	BUS	35TBSWGRM
BC-11A	125	DC/1	35TBSWGRM	EP	DC-1	BUS	35TBSWGRM
BC-11A	125	DC/1A	35TBSWGRM	EP	DC-1A	BUS	35TBSWGRM
BC-1A	125	DC/1A	35TBSWGRM	EP	DC-1A	BUS	35TBSWGRM
BUS-12C	480	AC/G	35TBSWGRM	EP	MCC-11A-2	MCC	MCC11A2
BUS-12D	480	AC/G	35TBSWGRM	EP	MCC-11A-2	MCC	MCC11A2
BUS-12E	480	AC/G	35TBSWGRM	EP	MCC-2-1	MCC	83RB
BUS-12E	480	AC/G	35TBSWGRM	EP	MCC-2-3	MCC	35TBSWGRM
BUS-12E	480	AC/G	35TBSWGRM	EP	MCC-2-4	MCC	15TB
BUS-12E	480	AC/G	35TBSWGRM	EP	MCC-2-5	MCC	35TBSWGRM
BUS-12E	480	AC/G	35TBSWGRM	EP	MCC-2-5	MCC	35TBSWGRM
BUS-12E	480	AC/G	35TBSWGRM	SCCW	SCCW-P15A	MDP	15TB
BUS-12F	480	AC/F	35TBSWGRM	EP	MCC-2A-3	MCC	35TBSWGRM
BUS-12F	480	AC/F	35TBSWGRM	EP	MCC-2A-4	MCC	15TB
BUS-12F	480	AC/F	35TBSWGRM	EP	MCC-2A-5	MCC	35TBSWGRM
BUS-12F	480	AC/F	35TBSWGRM	SCCW	SCCW-P15B	MDP	15TB
BUS-14A	4160	AC/G	35TBSWGRM	ECCS	FWCI-P10A	MDP	15TB
BUS-14A	4160	AC/G	35TBSWGRM	ECCS	FWCI-P10B	MDP	15TB
BUS-14A	4160	AC/G	35TBSWGRM	EP	BUS-14B	BUS	35TBSWGRM
BUS-14B	4160	AC/G	35TBSWGRM	ECCS	FWCI-P10C	MDP	15TB
BUS-14C	4160	AC/G	35TBSWGRM	ECCS	FWCI-P2B	MDP	8RBWGRM
BUS-14C	4160	AC/G	35TBSWGRM	ECCS	FWCI-P6A	MDP	15TB
BUS-14C	4160	AC/G	35TBSWGRM	ECCS	FWCI-P6B	MDP	15TB
BUS-14C	4160	AC/G	35TBSWGRM	ECCS	FWCI-P7A	MDP	15TB
BUS-14C	4160	AC/G	35TBSWGRM	ECCS	FWCI-P7B	MDP	15TB
BUS-14C	4160	AC/G	35TBSWGRM	EP	BUS-14E	BUS	35TBSWGRM

TABLE 3.6-2. PARTIAL LISTING OF ELECTRICAL SOURCES AND LOADS
AT MILLSTONE 1 (CONTINUED)

POWER SOURCE	VOLTAGE	EMERG LOAD GPP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BUS-14C	480	AC/G	35TBSWGRM	EP	TRAN-12C	TRAN	35TBSWGRM
BUS-14C	4160	AC/G	35TBSWGRM	SW	SW-P7A	MDP	SCREENHS
BUS-14D	4160	AC/G	35TBSWGRM	ECCS	FWCI-P6C	MDP	15TB
BUS-14D	4160	AC/G	35TBSWGRM	ECCS	FWCI-P7C	MDP	15TB
BUS-14D	480	AC/G	35TBSWGRM	EP	TRAN-12D	TRAN	35TBSWGRM
BUS-14D	4160	AC/G	35TBSWGRM	SW	SW-P7B	MDP	SCREENHS
BUS-14E	4160	AC/G	35TBSWGRM	CRD	CRD-1A	MDP	15RB
BUS-14E	4160	AC/G	35TBSWGRM	ECCS	CS-PB	MDP	-26RBNECRM
BUS-14E	4160	AC/G	35TBSWGRM	ECCS	LPCI-PB	MDP	-26RBNECRM
BUS-14E	4160	AC/G	35TBSWGRM	ECCS	LPCI-PD	MDP	-26RBNECRM
BUS-14E	480	AC/G	35TBSWGRM	EP	TRAN-12E	TRAN	35TBSWGRM
BUS-14E	4160	AC/G	35TBSWGRM	SW	SW-P7C	MDP	SCREENHS
BUS-14F	4160	AC/F	35TBSWGRM	CRD	CRD-1B	MDP	15RB
BUS-14F	4160	AC/F	35TBSWGRM	ECCS	CS-PA	MDP	-26RBSWCRM
BUS-14F	4160	AC/F	35TBSWGRM	ECCS	LPCI-PA	MDP	-26RBSWCRM
BUS-14F	4160	AC/F	35TBSWGRM	ECCS	LPCI-PC	MDP	-26RBSWCRM
BUS-14F	480	AC/F	35TBSWGRM	EP	TRAN-12F	TRAN	35TBSWGRM
BUS-14F	4160	AC/F	35TBSWGRM	SW	SW-P7D	MDP	SCREENHS
BUS-14G	4160	AC/G	35TBSWGRM	EP	BUS-14A	BUS	35TBSWGRM
BUS-14G	4160	AC/G	35TBSWGRM	EP	BUS-14C	BUS	35TBSWGRM
BUS-14G	4160	AC/G	35TBSWGRM	EP	BUS-14D	BUS	35TBSWGRM
DC-1	125	DC/1	35TBSWGRM	EP	MCC-101AB2	MCC	15RB
DC-1	125	DC/1	35TBSWGRM	EP	MCC-101AB3	MCC	35TBSWGRM
DC-1A	125	DC/1A	35TBSWGRM	EP	MCC-101AB2	MCC	15RB
DC-1A	125	DC/1A	35TBSWGRM	EP	MCC-101AB3	MCC	35TBSWGRM
DG-15G11U	4160	AC/F	15TBDGRM	EP	BUS-14F	BUS	35TBSWGRM
DG-15G11U	4160	AC/F	15TBDGRM	EP	CB-14F	CB	35TBSWGRM
FI-7-DSL	480		FIREMPHSE	FIRE	FI-P7	DOP	FIREMPHSE

TABLE 3.6-2. PARTIAL LISTING OF ELECTRICAL SOURCES AND LOADS AT MILLSTONE 1 (CONTINUED)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	CC TYPE	COMPONENT LOCATION
GT-15G10U	4160	AC/G	GTBLDG	EP	BUS-14G	BUS	35TBSWGRM
GT-15G10U	4160	AC/G	GTBLDG	EP	CB-14G	CB	GTBLDG
MCC-101AB2	125	DC/H	15RB	ECCS	IC-3	MOV	43RB
MCC-101AB3	120	DC/A	35TBSWGRM	EP	MG-1	MG	35TBSWGRM
MCC-11A-2	480	AC/G	MCC11A2	ECCS	LPCI-26A	MOV	15RB
MCC-11A-2	480	AC/G	MCC11A2	ECCS	LPCI-36A	MOV	15RB
MCC-11A-2	480	AC/G	MCC11A2	RCS	RCS-2B	MOV	15RBSDHNPMPRM
MCC-2-1	480	AC/G	83RB	FIRE	IC-10	MOV	83RB
MCC-2-3	480	AC/G	15RB	ECCS	CS-24B	MOV	15RB
MCC-2-3	480	AC/G	15RB	ECCS	CS-25B	MOV	15RB
MCC-2-3	480	AC/G	15RB	ECCS	CS-3B	MOV	15RB
MCC-2-3	480	AC/G	15RB	ECCS	CS-4B	MOV	15RB
MCC-2-3	480	AC/G	15RB	ECCS	FWCI-143	MOV	8RBNWCRM
MCC-2-3	480	AC/G	15RB	ECCS	IC-1	MOV	CX
MCC-2-3	480	AC/G	15RB	ECCS	IC-4	MOV	CX
MCC-2-3	480	AC/G	15RB	ECCS	LPCI-35B	MOV	15RB
MCC-2-3	480	AC/G	15RB	ECCS	LPCI-47B	MOV	15RB
MCC-2-3	480	AC/G	15RB	ECCS	LPCI-7B	MOV	-26RBNECRM
MCC-2-3	480	AC/G	15RB	ECCS	LPCI-7D	MOV	-26RBNECRM
MCC-2-3	480	AC/G	15RB	EP	MCC-2-3NE	MCC	15RB
MCC-2-3	480	AC/G	15RB	RCS	IC-1	MOV	CX
MCC-2-3	480	AC/G	15RB	RCS	IC-4	MOV	CX
MCC-2-3NE	480	AC/G	15RB	ECCS	LPCI-29B	MOV	15RB
MCC-2-3NE	480	AC/G	15RB	ECCS	LPCI-46B	MOV	15RB
MCC-2-4	120	AC/G	15TB	EP	TR-IRP-1	ATS	35TBSWGRM
MCC-2-5	480	AC/G	35TBSWGRM	EP	BC-1A	BC	35TBSWGRM
MCC-2-5	120	AC/G	35TBSWGRM	EP	MG-1	MG	35TBSWGRM
MCC-22A-2	480	AC/G	FIREPMPHSE	FIRE	FI-P8	MDP	FIREPMPHSE

TABLE 3.6-2. PARTIAL LISTING OF ELECTRICAL SOURCES AND LOADS AT MILLSTONE 1 (CONTINUED)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC-2A-3	480	AC/F	15RB	ECCS	CS-24A	MOV	15RB
MCC-2A-3	480	AC/F	15RB	ECCS	CS-25A	MOV	15RB
MCC-2A-3	480	AC/F	15RB	ECCS	CS-3A	MOV	15RB
MCC-2A-3	480	AC/F	15RB	ECCS	CS-4A	MOV	15RB
MCC-2A-3	480	AC/F	15RB	ECCS	LPCI-35A	MOV	15RB
MCC-2A-3	480	AC/F	15RB	ECCS	LPCI-47A	MOV	15RB
MCC-2A-3	480	AC/F	15RB	ECCS	LPCI-7A	MOV	-26RBSWCRM
MCC-2A-3	480	AC/F	15RB	ECCS	LPCI-7C	MOV	-26RBSWCRM
MCC-2A-3	480	AC/F	15RB	EP	MCC-2A-3NE	MCC	15RB
MCC-2A-3	480	AC/F	15RB	RCS	RCS-2	MOV	CX
MCC-2A-3	480	AC/F	15RB	RCS	RCS-5	MOV	CX
MCC-2A-3NE	480	AC/F	15RB	ECCS	LPCI-29A	MOV	15RB
MCC-2A-3NE	480	AC/F	15RB	ECCS	LPCI-46A	MOV	15RB
MCC-2A-4	480	AC/F	15TB	EP	BC-1	BC	35TBSWGRM
MCC-2A-5	120	AC/F	35TBSWGRM	EP	TR-IV-1	ATS	35TBSWGRM
MG-1	120	AC/G	35TBSWGRM	EP	BUS-VAC-1	BUS	35TBSWGRM
TR-12C	480	AC/G	35TBSWGRM	EP	MC-22A-2	MCC	FIREPMHSE
TR-IRP-1	120	AC/G	35TBSWGRM	EP	BUS-IAC-1	BUS	35TBSWGRM
TR-IV-1	120	AC/F	35TBSWGRM	EP	BUS-IAC-1	BUS	35TBSWGRM
TR-IV-1	120	AC/F	35TBSWGRM	EP	BUS-VAC-1	BUS	35TBSWGRM
TRAN-12C	480	AC/G	35TBSWGRM	EP	BUS-12C	BUS	35TBSWGRM
TRAN-12D	480	AC/G	35TBSWGRM	EP	BUS-12D	BUS	35TBSWGRM
TRAN-12E	480	AC/G	35TBSWGRM	EP	BUS-12E	BUS	35TBSWGRM
TRAN-12F	480	AC/F	35TBSWGRM	EP	BUS-12F	BUS	35TBSWGRM
UNKNOWN				ECCS	FWCI-35A	MOV	15TB
UNKNOWN				ECCS	FWCI-35B	MOV	15TB
UNKNOWN				ECCS	IC-2	MOV	66RB
UNKNOWN				ECCS	LPCI-26B	MOV	15RB

TABLE 3.6-2. PARTIAL LISTING OF ELECTRICAL SOURCES AND LOADS
AT MILLSTONE 1 (CONTINUED)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
UNKNOWN				ECCS	LPCI-36B	MOV	157.B
UNKNOWN				RCS	RCS-1	MOV	CX
UNKNOWN				RCS	RCS-2A	MOV	15RBSHDNPMPRM

3.7 CONTROL ROD DRIVE HYDRAULIC SYSTEM (CRDHS)

3.7.1 System Function

The CRDHS supplies pressurized water to operate and cool the control rod drive mechanisms during normal operation. This system implements a scram command from the reactor protection system (RPS) and drives control rods rapidly into the reactor. The CRDHS also can provide makeup water to the RCS.

3.7.2 System Definition

The CRDHS consists of high-head, low-flow pumps, piping, filters, control valves, one hydraulic control unit for each control rod drive mechanism, and instrumentation. Water is supplied from condensate and from the condensate storage tank. The CRDHS also includes scram valves, scram accumulators, and a scram discharge volume (dump tank).

Simplified drawing of the CRDHS are shown in Figures 3.7-1 and 3.7-2. Details of the scram portion of typical BWR CRDHS are shown in Figure 3.7-3 (adapted from Ref. 1). A summary of data on selected CRDHS components is presented in Table 3.7-1.

3.7.3 System Operation

During normal operation the CRDHS pumps provide a constant flow for drive mechanism cooling and system pressure stabilization. Excess water not used for cooling is discharged to the RCS. Control rods are driven in or out by the coordinated operation of the direction control valves. Insertion speed is controlled by flow through the insert speed control valve. Rod motion may be either stepped or continuous.

A reactor scram is implemented by pneumatic scram valves in the CRDHS. An inlet scram valve opens to align the insert side of each control rod drive mechanism (CRDM) to its scram accumulator. An outlet scram valve opens to vent the opposite side of each CRDM to the dump tank (or discharge volume). This coordinated action results in rapid insertion of control rods into the reactor.

Although not intended as a makeup system, the CRDHS can provide a source of cooling water to the RCS during vessel isolation. It is noted in NUREG-0626 (Ref. 2), that this function is particularly important for some BWR/1 and BWR/2 plants for which the CRDHS is the primary source of makeup on vessel isolation. In later model BWR plants RCS makeup at high pressure is performed by other systems. At Millstone 1 this function is normally provided by the FWCI system (see Section 3.3).

3.7.4 System Success Criteria

For the scram function to be accomplished, the following actions must occur in the CRDHS:

- A scram signal must be transmitted by the RPS to the actuated devices (i.e., pilot valves) in the CRDHS.
- The pneumatic inlet scram valve and outlet scram valve must open in the hydraulic control units (HCUs) for the individual control rod drives. This is accomplished by venting the instrument air supply to each valve as follows:
 - Both scram pilot valves in each HCU must be deenergized, or
 - Either backup scram pilot valve must be energized.
- A high-pressure water source must be available from the scram accumulator in each HCU.

- A hydraulic vent path to the scram discharge volume must be available and sufficient collection volume must exist in the scram discharge volume.
- A specified number of control rods must respond and insert into the reactor core (specific number needed is not known).

During isolation condenser operation, RCS makeup can be provided by one of two control rod drive pumps taking suction on the condensate storage tank.

3.7.5 Component Information

- A. Control rod drive pumps (1A, 1B)
 - 1. Rated capacity: 100% (for control rod drive function)
 - 2. Flow rate: unknown
 - 3. Type: centrifugal
- B. Condensate Storage Tank
 - 1. Minimum Volume: 225,000 gallons

3.7.6 Support Systems and Interfaces

- A. Control Signals
 - 1. Automatic
The RPS transmits scram commands to solenoid pilot valves which control the pneumatic scram valves.
 - 2. Remote Manual
 - a. A reactor scram can be initiated manually from the control room.
 - b. The CRDHS can be operated manually from the control room to insert and withdraw rods, or to inject water into the RCS.
- B. Motive Power
 - 1. The CRDHS pumps are Class 1E AC loads that can be powered from the diesel generator and gas turbine generator as described in Section 3.6.

3.7.7 Section 3.7 References

- 1. NEDO-24708A, "Additional Information Required for NRC Staff Generic Report on Boiling Water Reactors," General Electric Company, December 1980.
- 2. NUREG-0626, "Generic Evaluation of Feedwater Transients and Small Break Loss-of-Coolant-Accidents in GE-designed Operating Plants and Near-term Operating License Applications," USNRC, January 1980.

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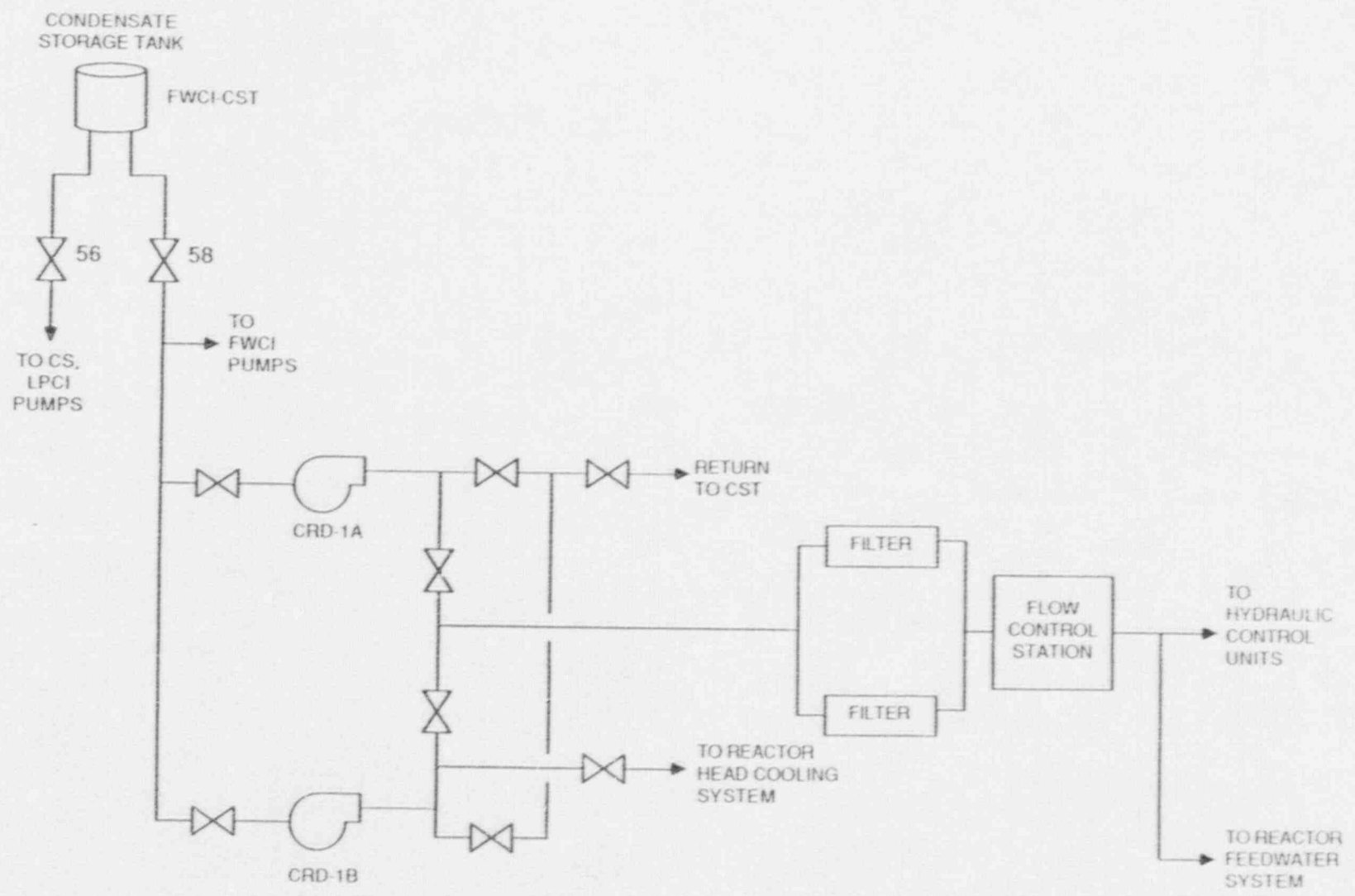
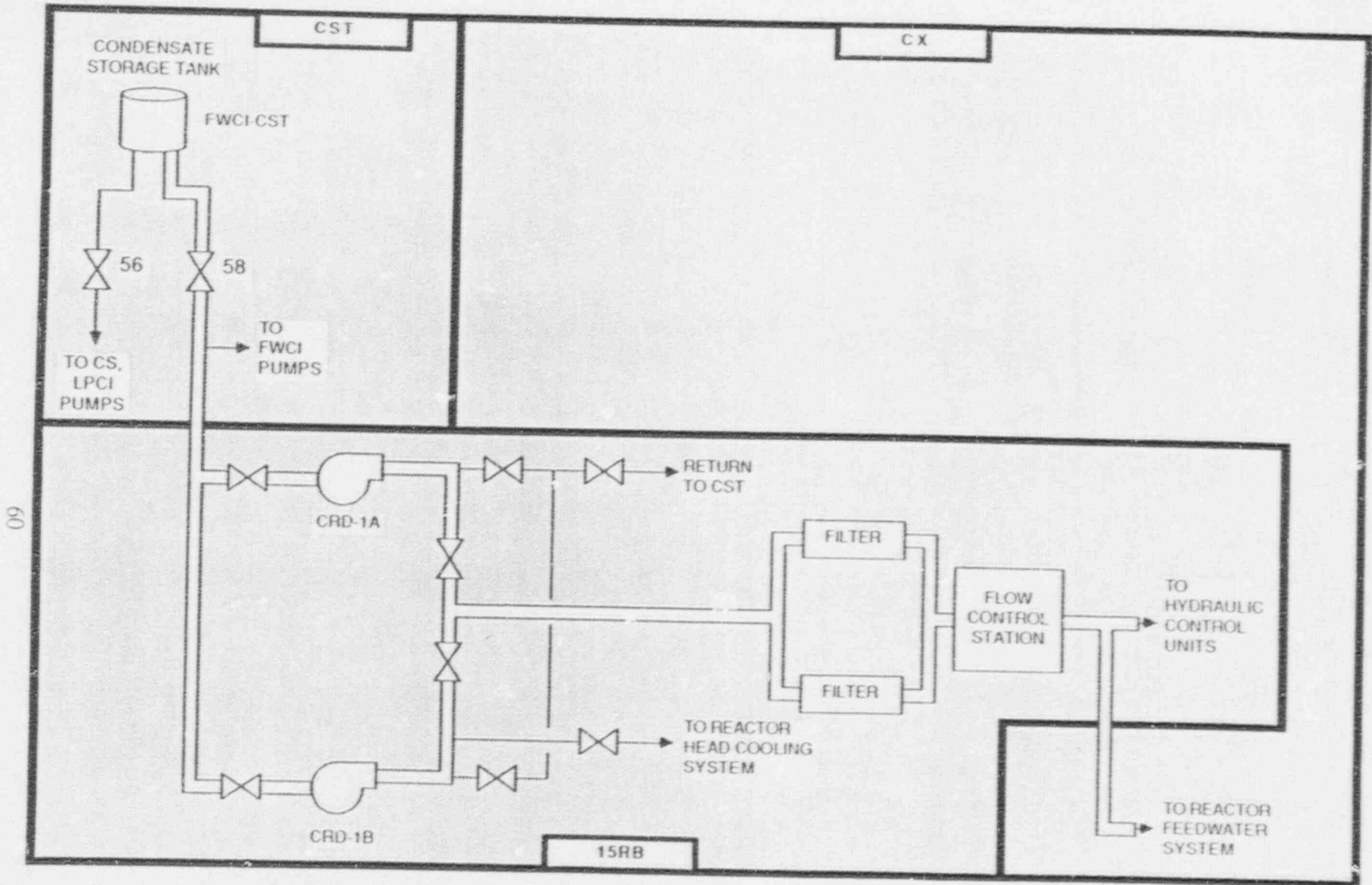


Figure 3.7-1. Millstone 1 Control Rod Drive Hydraulic System



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Figure 3.7-2. Millstone 1 Control Rod Drive Hydraulic System Showing Component Locations

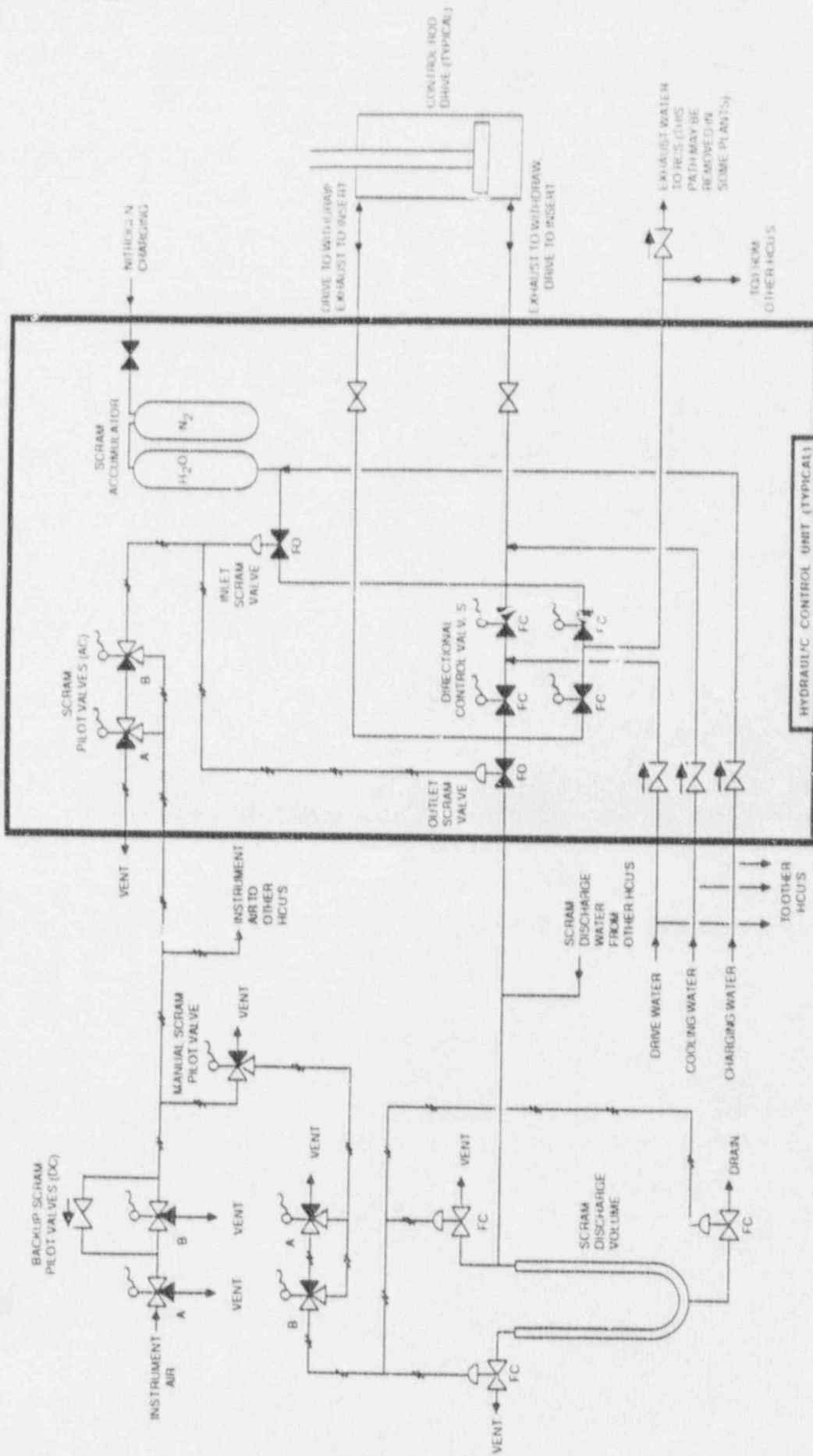


Figure 3.7-3. Simplified Diagram Of Portions Of The Control Rod Drive Hydraulic System That Are Related To The Scram Function

Table 3.7-1. Millstone 1 Control Rod Drive Hydraulic System Data Summary
for Selected Component

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
CRD-1A	MDP	15RB	BUS-14E	4160	35TBSWGRM	AC/G
CRD-1B	MDP	15RB	BUS-14F	4160	35TBSWGRM	AC/F

3.8 TURBINE BUILDING SECONDARY CLOSED COOLING WATER (SCCW) SYSTEM

3.8.1 System Function

The SCCW system provides a continuous supply of cooling water to auxiliary equipment in the Reactor Building and Turbine Building, including the pumps in the FWCI system.

3.8.2 System Definition

The SCCW system is a closed loop system consisting of two motor-driven pumps, two heat exchangers, a chemical feeder, and a surge tank. Each pump is designed to provide 100% of system flow capacity. Heat is removed from the heat exchangers by the Service Water System (see Section 3.9).

Simplified system drawings of the SCCW system are shown in Figures 3.8-1 and 3.8-2. A summary of data on selected SCCW system components is presented in Table 3.8-1.

3.8.3 System Operation

The SCCW system operates continuously during normal operation. One SCCW pump and both heat exchangers are needed to provide cooling flow to critical plant equipment in the event of an AC power failure. The SCCW pumps are supplied power from either the diesel generator or gas turbine generator. The heat exchangers are cooled by the Service Water System. The surge tank is located above the highest point in the system to handle system fluctuations and to supply makeup water when necessary. A chemical feeder is provided for periodic injection of a corrosion inhibitor into the system.

Critical heat loads of the SCCW system are the FWCI pumps (reactor feed, condensate, condensate booster) and the space coolers in the FWCI and diesel generator areas.

3.8.4 System Success Criteria

Adequate heat removal from the components served by the SCCW system can be provided by one of two SCCW pumps and both heat exchangers (Ref. 1).

3.8.5 Component Information

- A. SCCW Pumps (15A, 15B)
 - 1. Rated flow: 1850 gpm @ 346 ft. head (150 psid)
 - 2. Rated capacity: 100%
 - 3. Type: centrifugal

- B. SCCW Heat Exchangers (A, B)
 - 1. Rated capacity: 4.9×10^6 Btu/hr

3.8.6 Support Systems and Interfaces

- A. Control Signals
 - 1. Automatic
 - a. Automatic actuation capabilities for the SCCW system could not be determined. The system operates continuously during normal operation.
 - b. Temperature indication and control on major lines is used to regulate flow.

2. Remote manual
The SCCW pumps can be actuated by remote manual means from the control room.

- B. Motive Power
The SCCW pumps are Class 1E AC loads that can be powered from the diesel generator or gas turbine generator as described in Section 3.5.

3.8.7 Section 3.8 References

1. NUREG/CR-3085, Volume 1 "Interim Reliability Evaluation Program: Analysis of the Millstone Point Unit 1 Nuclear Power Plant", Sandia National Laboratories, Albuquerque, NM, February 1983.

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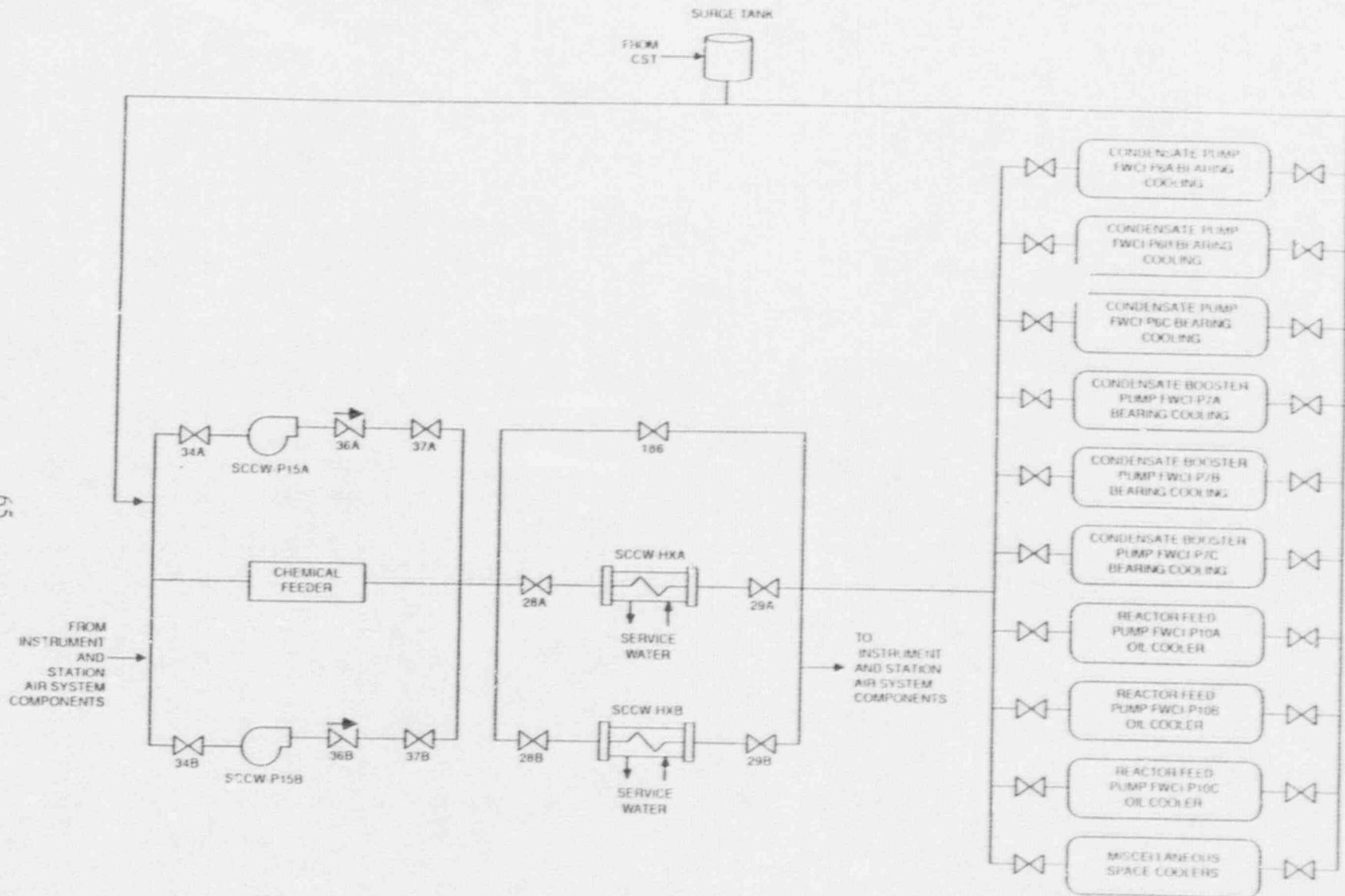


Figure 3.8-1. Millstone 1 Secondary Closed Cooling Water System

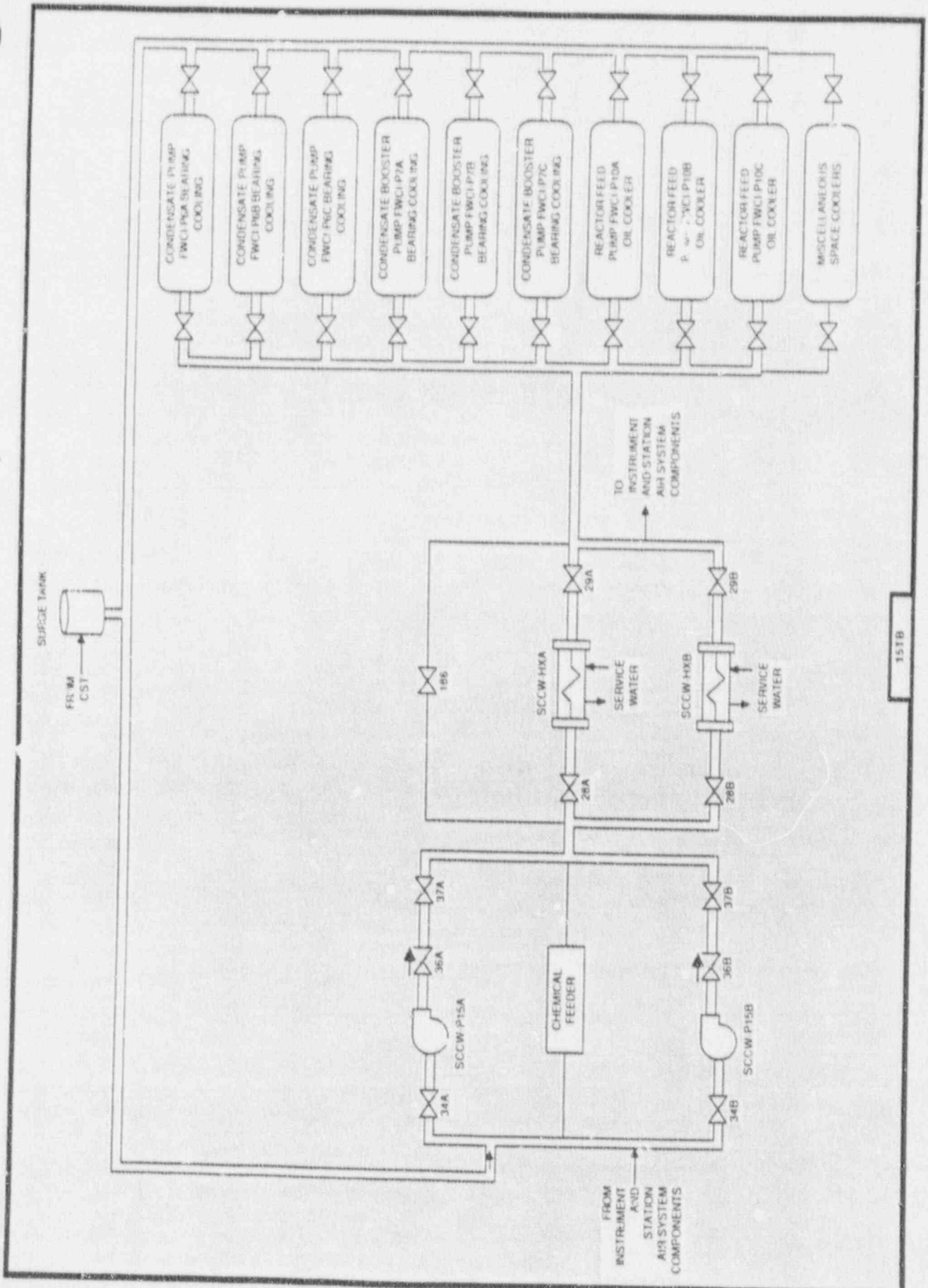


Figure 3.8-2. Millstone 1 Secondary Closed Cooling Water System Showing Component Locations

Table 3.8-1. Millstone 1 Turbine Building Secondary Closed Cooling Water System
Data Summary for Selected Component

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
SCCW-HXA	HX	15TB				
SCCW-HXB	HX	15TB				
SCCW-P15A	MDP	15TB	BUS-12E	480	35TBSWGRM	AC/G
SCCW-P15B	MDP	15TB	BUS-12F	480	35TBSWGRM	AC/F

3.9 SERVICE WATER (SW) SYSTEM

3.9.1 System Function

The SW system provides strained seawater for equipment cooling. It provides cooling water to various systems and components, keeps the Emergency Service Water system pressurized, and supplies seal water to the circulating water and service water pumps. The SW system is required to operate during accident conditions to provide cooling to the SCCW heat exchangers and the diesel generator.

3.9.2 System Definition

The SW system consists of four motor-driven pumps. Seawater is pumped through strainers to cool various systems and components.

Simplified system drawings of the SW system are shown in Figures 3.9-1 and 3.9-2. A summary of data on selected SW system components is presented in Table 3.9-1.

3.9.3 System Operation

The SW system is in continuous operation during all phases of plant operation. The SW system removes heat from the Turbine Building Closed Cooling Water System, the Reactor Building Closed Cooling Water System, and the Turbine Building Secondary Closed Cooling Water (SCCW) System. During normal operation two or three pumps are in service.

3.9.4 System Success Criteria

During accident or abnormal conditions only one SW pump is required to cool the diesel generator and the SCCW system (Ref. 1).

3.9.5 Component Information

- A. SW Pumps (7A, 7B, 7C, 7D)
 1. Rated flow: 10,000 gpm @ 231 ft. head (100 psid)
 2. Rated capacity: 100% (Ref. 1)
 4. Type: vertical centrifugal

3.9.6 Support Systems and Interfaces

- A. Control Signals
 1. Automatic

Automatic actuation capabilities for the SW system could not be determined. At least two pumps are operating during normal operation.
 2. Remote manual

The SW pumps can be actuated by remote manual means from the control room.

- B. Motive Power

The SW pumps are Class 1E AC loads that can be powered from the diesel generator or gas turbine generator as described in Section 3.5.

3.9.7 Section 3.9 References

1. Millstone Nuclear Power Station Unit No. 1, Updated Final Safety Analysis Report, Northeast Utilities, Hartford, CT, March 1987.

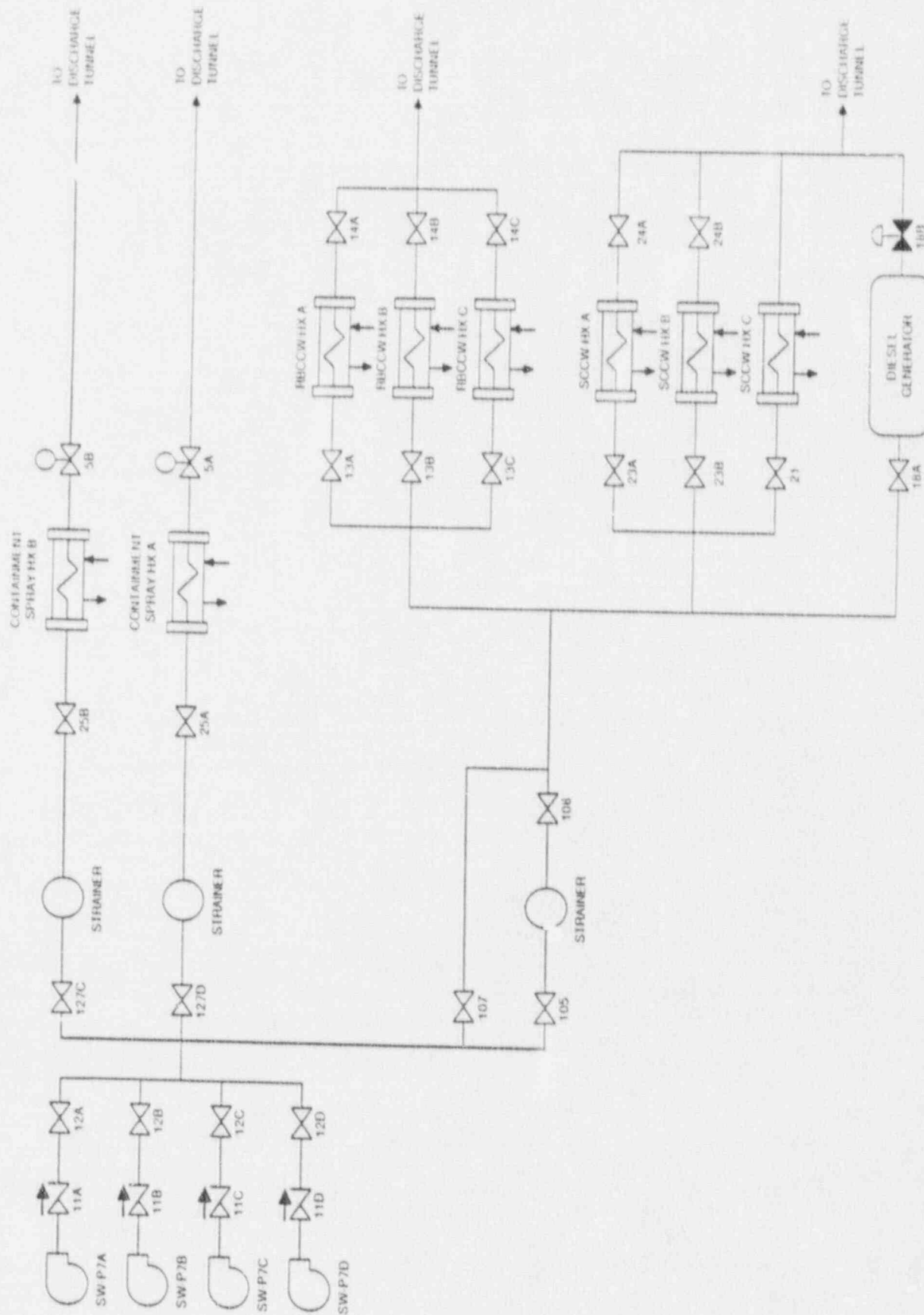


Figure 3.9-1. Millstone 1 Service Water System

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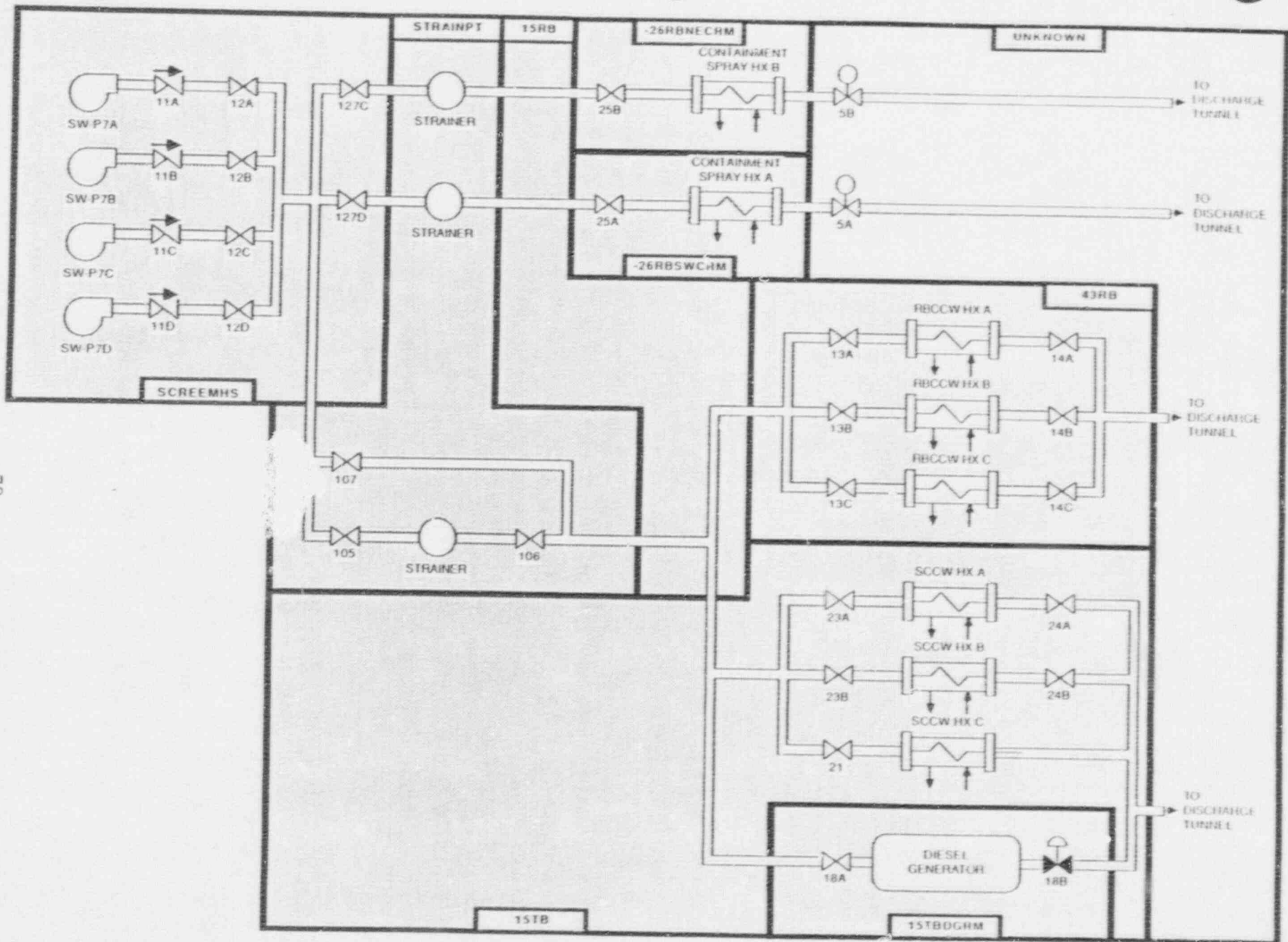


Figure 3.9-2. Millstone 1 Service Water System Showing Component Locations

Table 3.9-1. Millstone 1 Service Water System Data Summary
for Selected Component

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
SW-P7A	MDP	SCREENHS	BUS-14C	4160	35TBSWGRM	AC/G
SW-P7B	MDP	SCREENHS	BUS-14D	4160	35TBSWGRM	AC/G
SW-P7C	MDP	SCREENHS	BUS-14E	4160	35TBSWGRM	AC/G
SW-P7D	MDP	SCREENHS	BUS-14F	4160	35TBSWGRM	AC/F

4. PLANT INFORMATION

4.1 SITE AND BUILDING SUMMARY

The Millstone Nuclear Power Station is located in the town of Waterford, New London County, Connecticut, on the north shore of Long Island Sound. The site occupies 500 acres on the tip of Millstone Point between Niantic Bay to the west and Jordan Cove to the east. The site is situated 3.2 miles west-southwest of New London and 40 miles southeast of Hartford.

The Millstone Station consists of three operating units. Unit 1 is located immediately south of Unit 2, which in turn is south of Unit 3. Except for electrical bus 24F, which can supply 4160 VAC power from Unit 2, no systems are shared between Unit 1 and the other two units. No credit was taken for bus 24F in this analysis. Figure 4-1 (from Ref. 1) is a general view of the plant and vicinity.

The major structures of the unit include the Reactor Building, Turbine Building, Radwaste and Control Building, Gas Turbine Building, and the intake structure. A site plan is shown in Figure 4-2.

The reactor and its auxiliaries are located in the Reactor Building. The Reactor Building encloses the primary containment and serves as a secondary containment. The primary containment system consists of a pressure suppression containment, vent pipes, and a suppression chamber which is partially filled with water. Fresh and spent fuel storage facilities, refueling equipment, and other auxiliary equipment are also housed in the Reactor Building.

The Turbine Building, located west of the Reactor Building, houses the power conversion system and related auxiliaries. Located in this building are the turbine generator, exciter, condenser, diesel generator, switchgear, feedwater heaters, and feedwater, condensate and condensate booster pumps. The Turbine Building also contains the area for controlling access to the radioactive locations and the main control room.

The Radwaste and Control building is located north of the Reactor Building and contains the control processing, packaging, and storage areas for liquid waste processing equipment.

The Gas Turbine Building is located south of the Reactor Building and contains the gas turbine generator.

The intake structure is located south of the Reactor Building on Long Island Sound and contains the service water pumps.

The Condensate Storage Tank (CST) is located east of the Reactor Building.

4.2 FACILITY LAYOUT DRAWINGS

Figures 4-3 and 4-4 show elevation views of the Millstone 1 Reactor and Turbine Buildings. Figures 4-5 through 4-19 show simplified layout drawings for the main Millstone 1 buildings. Major rooms, stairways, elevators, and doorways are shown in the simplified layout drawings, however, many interior walls have been omitted for clarity. Labels printed in uppercase correspond to the location codes listed in Table 4-1 and used in the component data listings and system drawings in Section 3. Some additional labels are included for information and are printed in lowercase type.

A listing of components by location is presented in Table 4-2. Components included in Table 4-2 are those found in the system data tables in Section 3, therefore this table is only a partial listing of the components and equipment that are located in a particular room or area of the plant.

4.3 SECTION 4 REFERENCES

1. Heddleson, F.A., "Design Data and Safety Features of Commercial Nuclear Power Plants.", ORNL-NSIC-55, Volume 1, Oak Ridge National Laboratory, Nuclear Safety Information Center, December 1973.

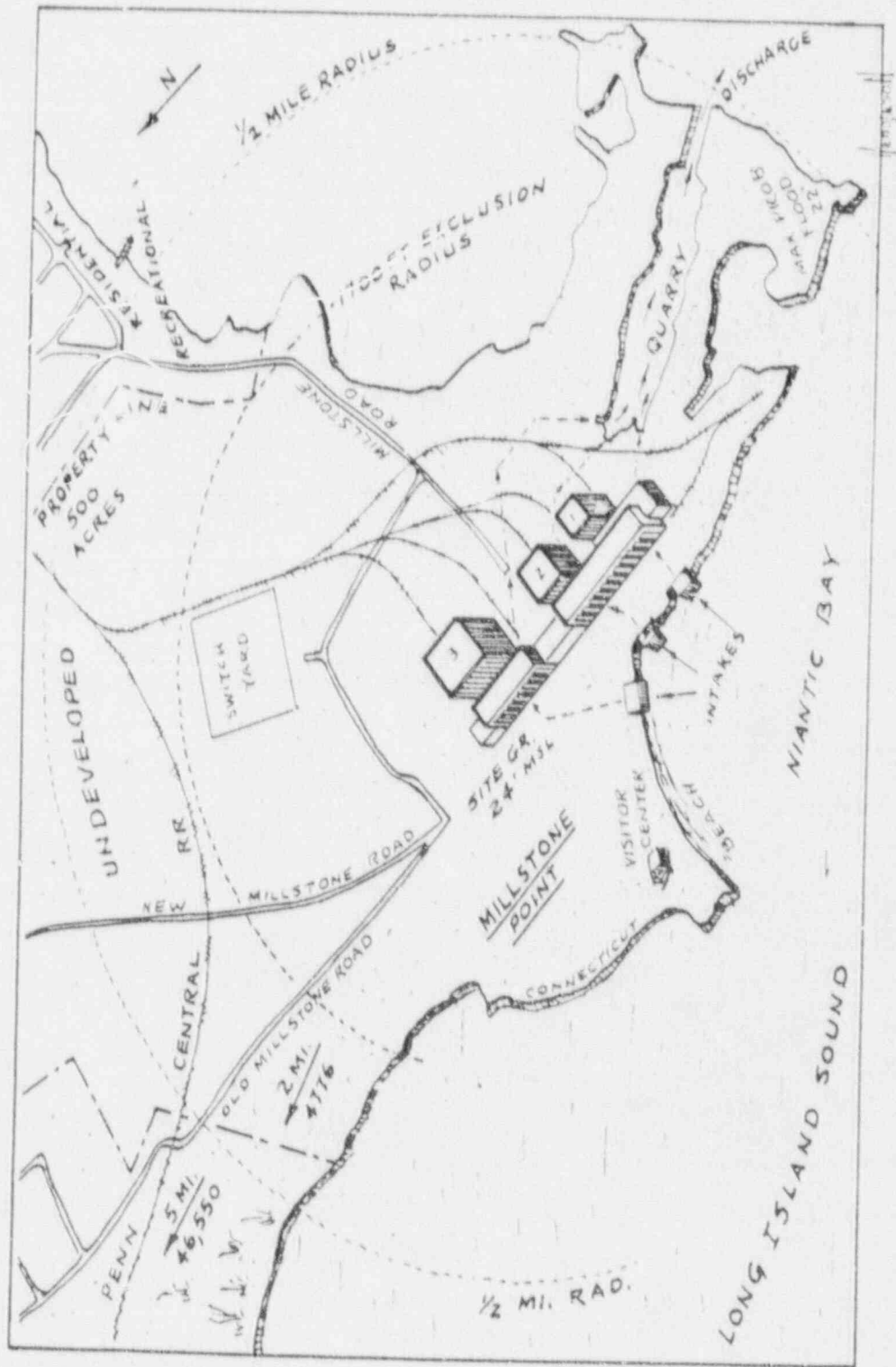


Figure 4-1. General View of the Millstone Site and Vicinity

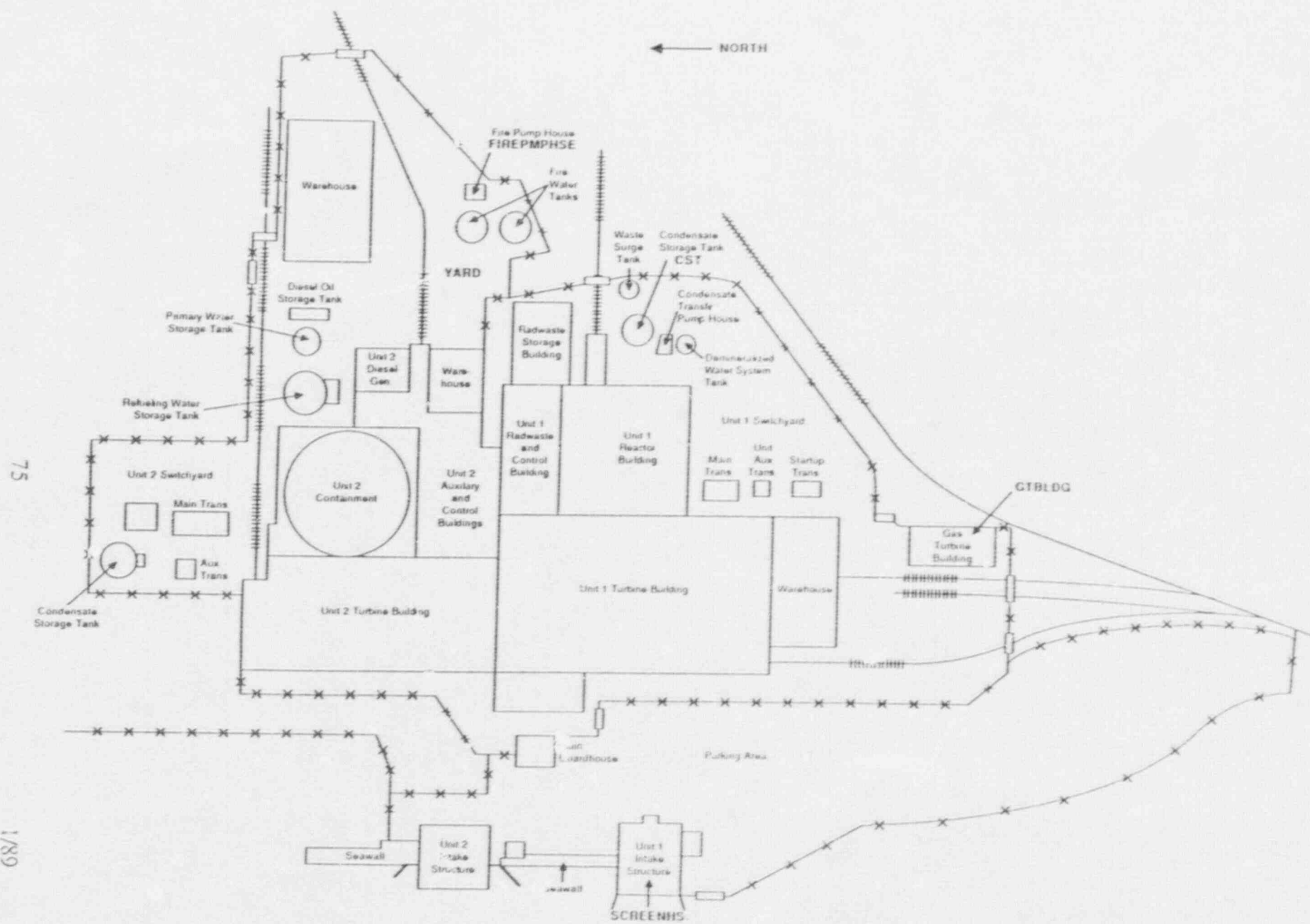


Figure 4-2. Simplified Site Plan for Millstone 1 and 2

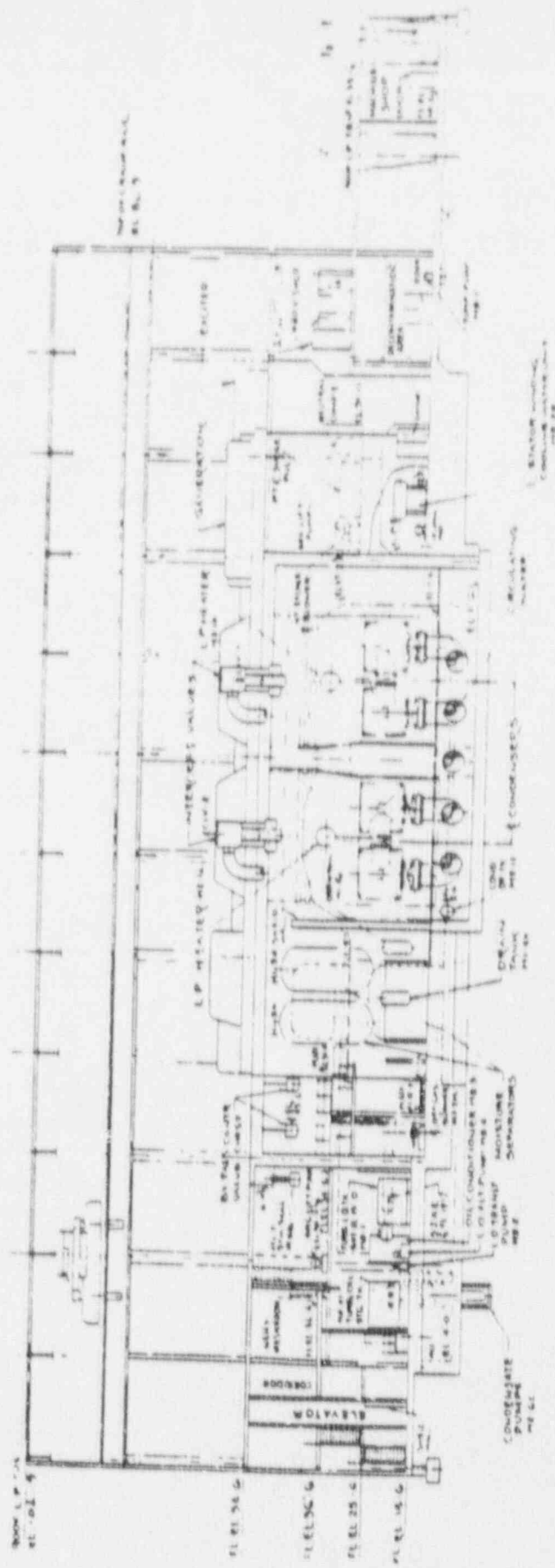


Figure 4-3. Elevation Views of Millstone 1 Reactor and Turbine Buildings, Looking East (page 3 of 3)

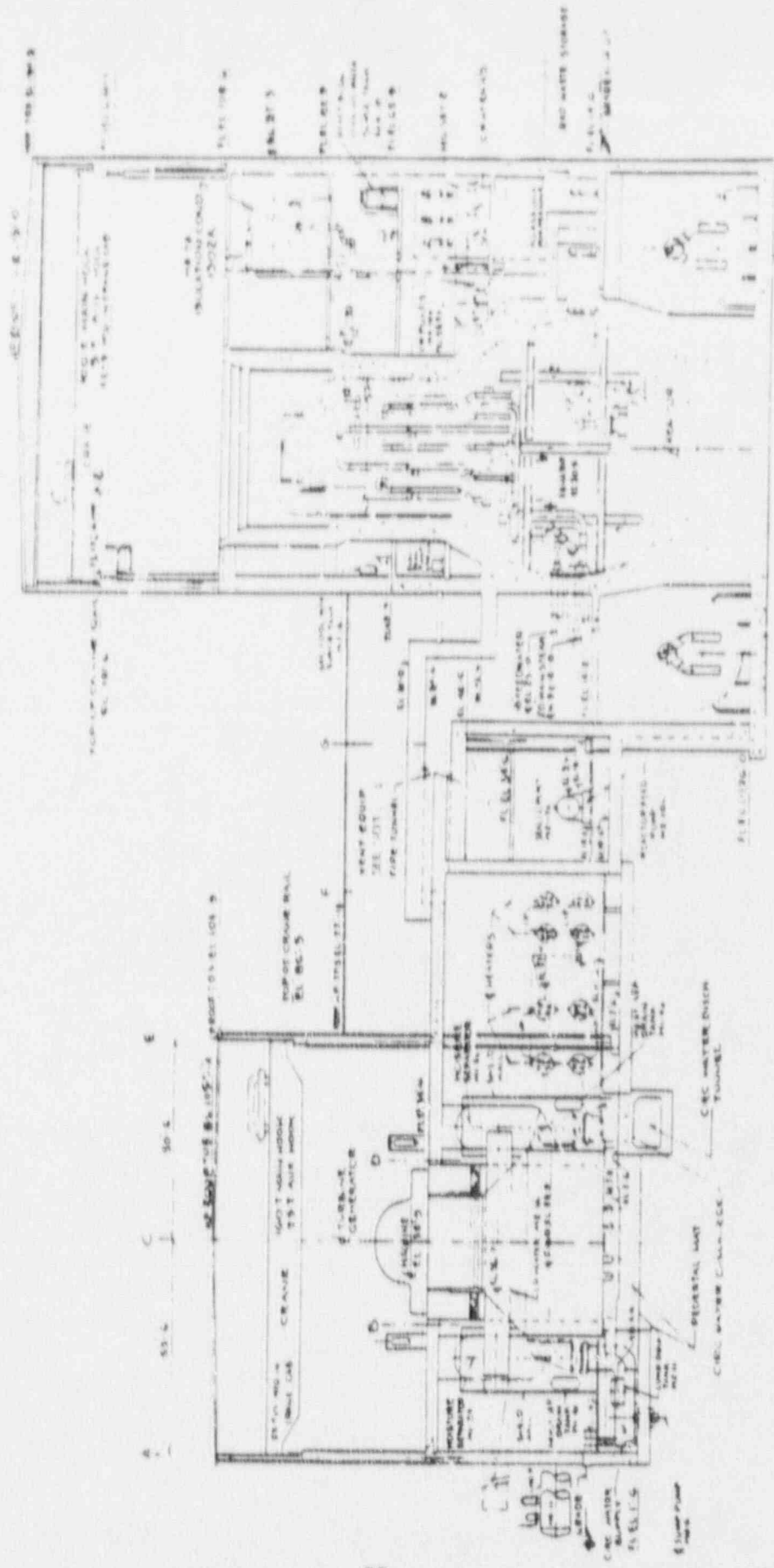


Figure 4-4. Elevation Views of Millstone 1 Reactor and Turbine Buildings, Looking North (page 1 of 2)

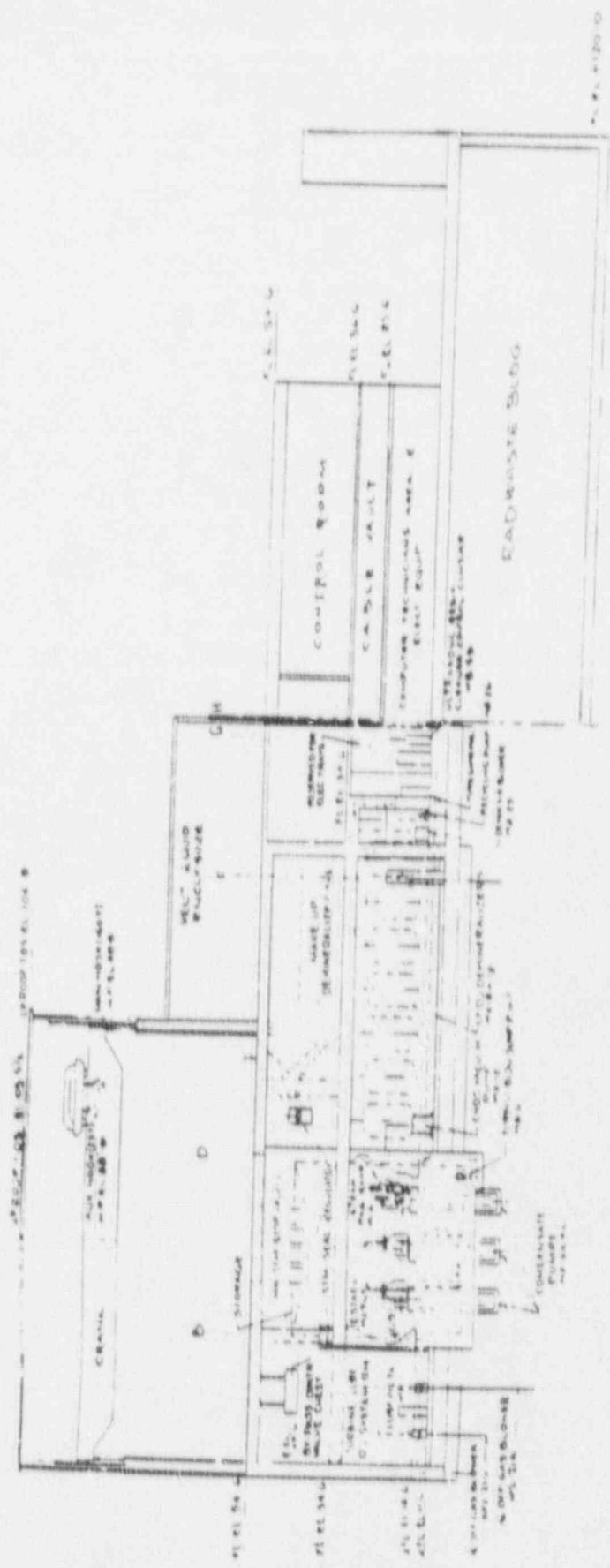
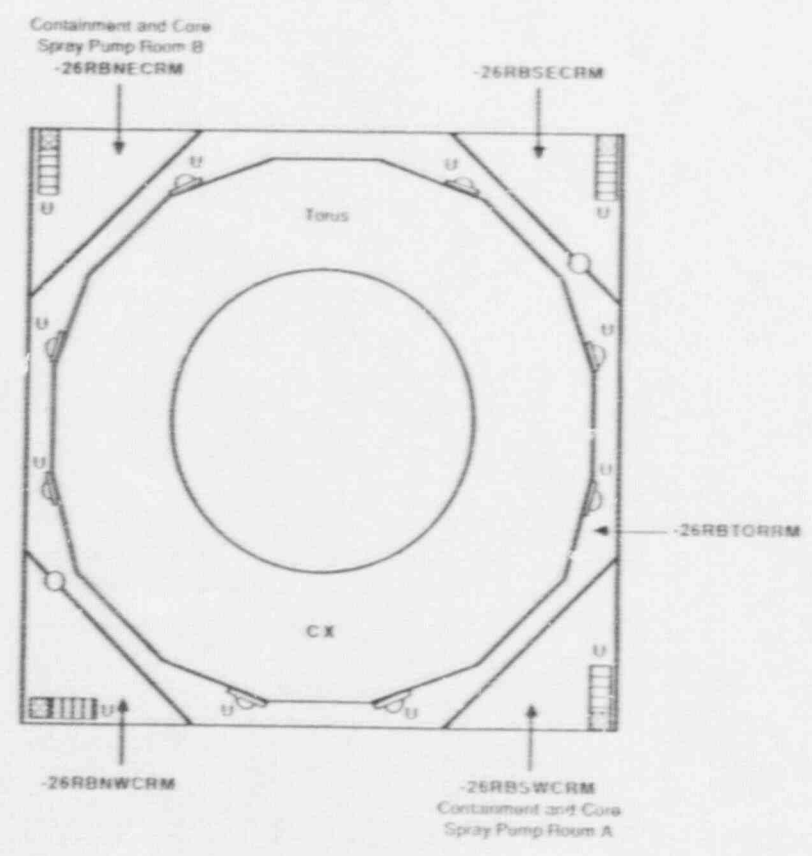


Figure 4-4. Elevation Views of Millstone 1 Reactor and Turbine Buildings, Looking North (page 2 of 2)

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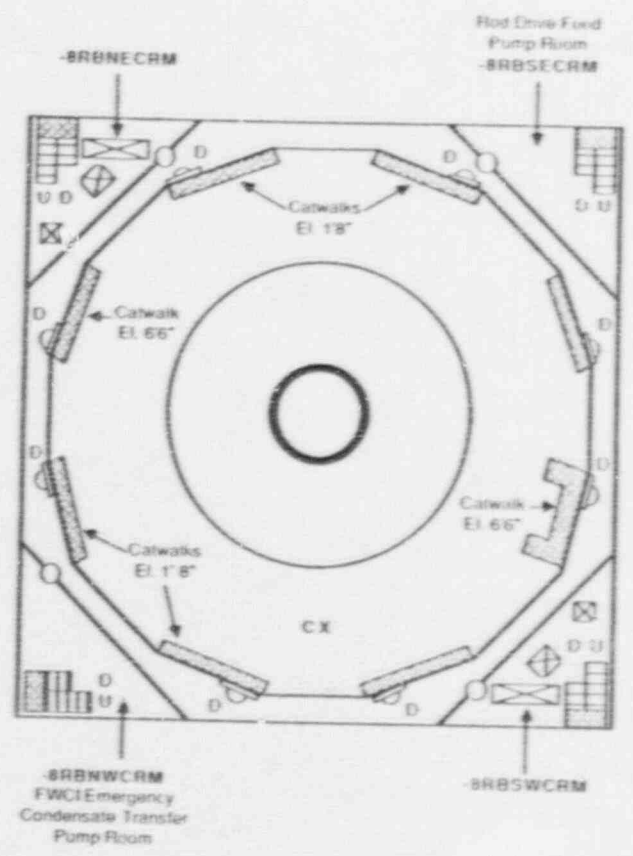


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Figure 4-5. Millstone 1 Reactor Building, Elevation -26' 0"

← NORTH



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Figure 4-6. Millstone 1 Reactor Building, Elevation -8' 2"

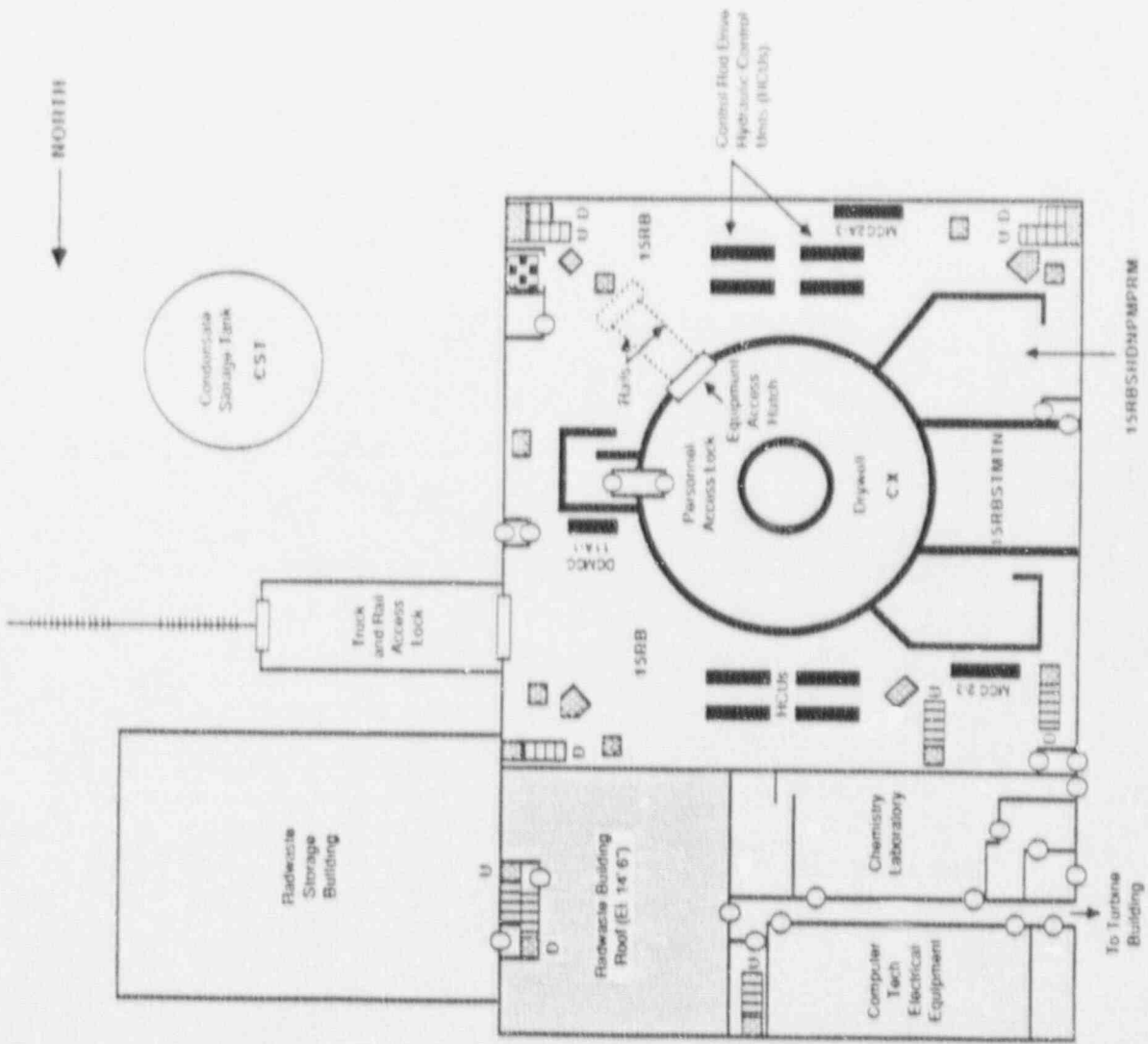


Figure 4-7. Millstone 1 Reactor and Radwaste Buildings, Elevation 14' 6" (Grade Level)

NORTH

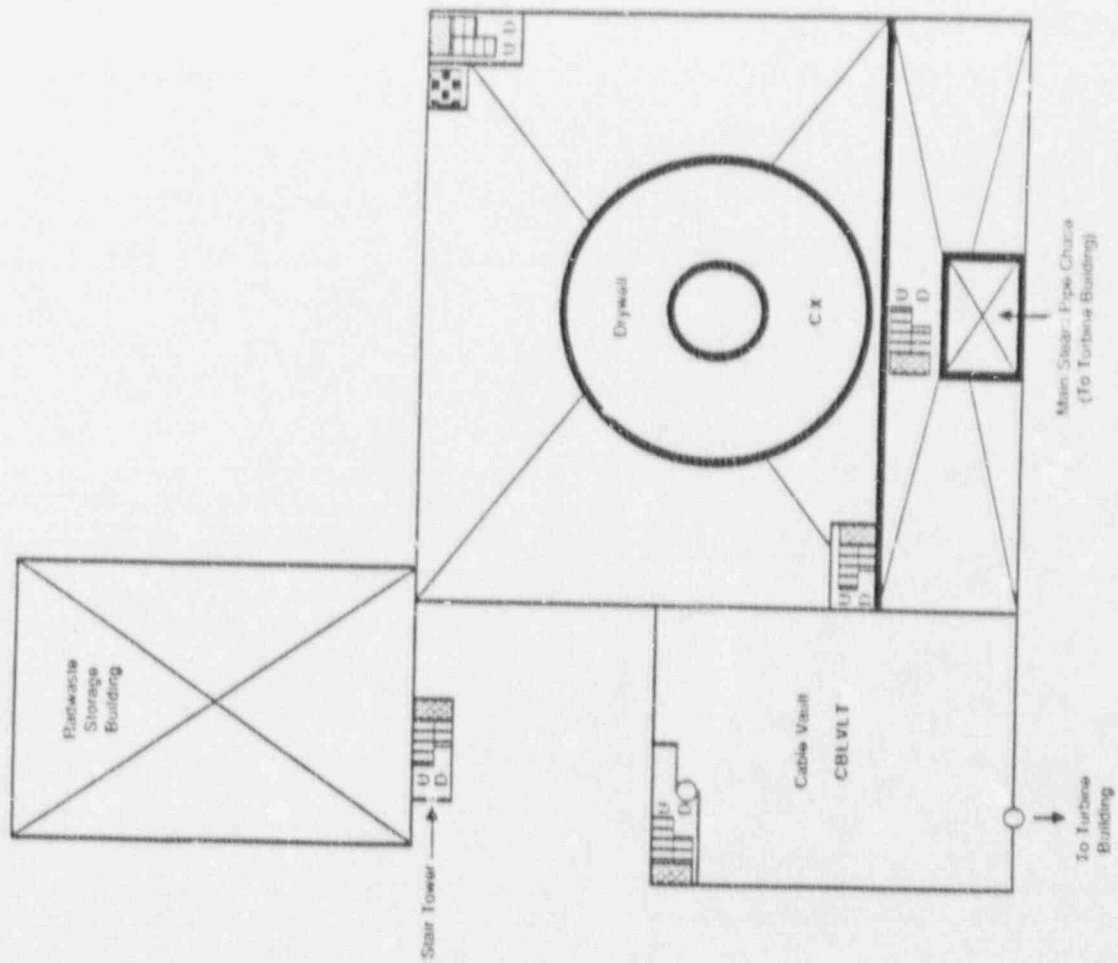


Figure 4-8. Millstone 1 Reactor and Radwaste Buildings, Elevation 25'6"

NORTH

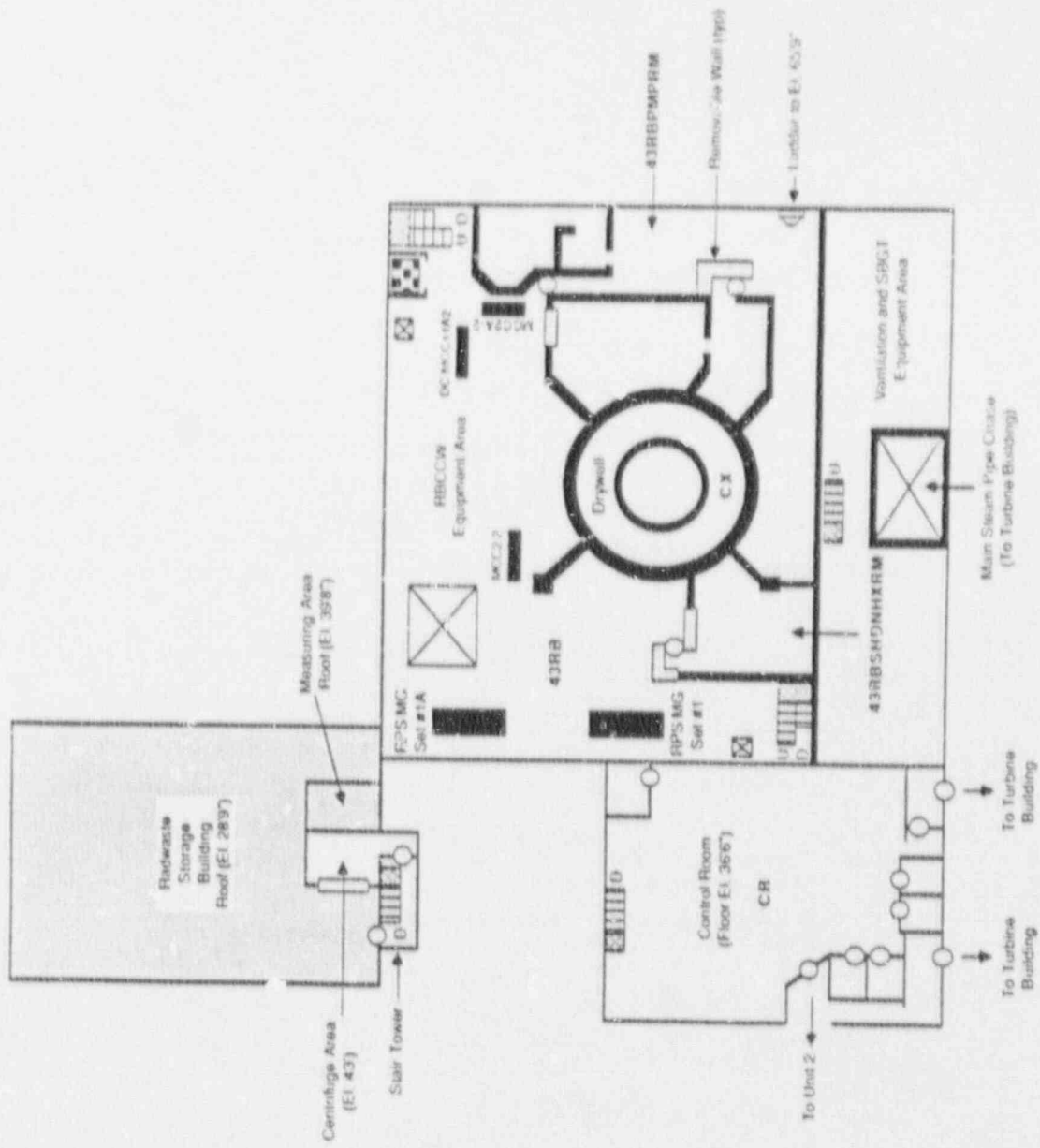


Figure 4-9. Millstone 1 Reactor and Radwaste Buildings, Elevations 36' 6" and 42' 6"

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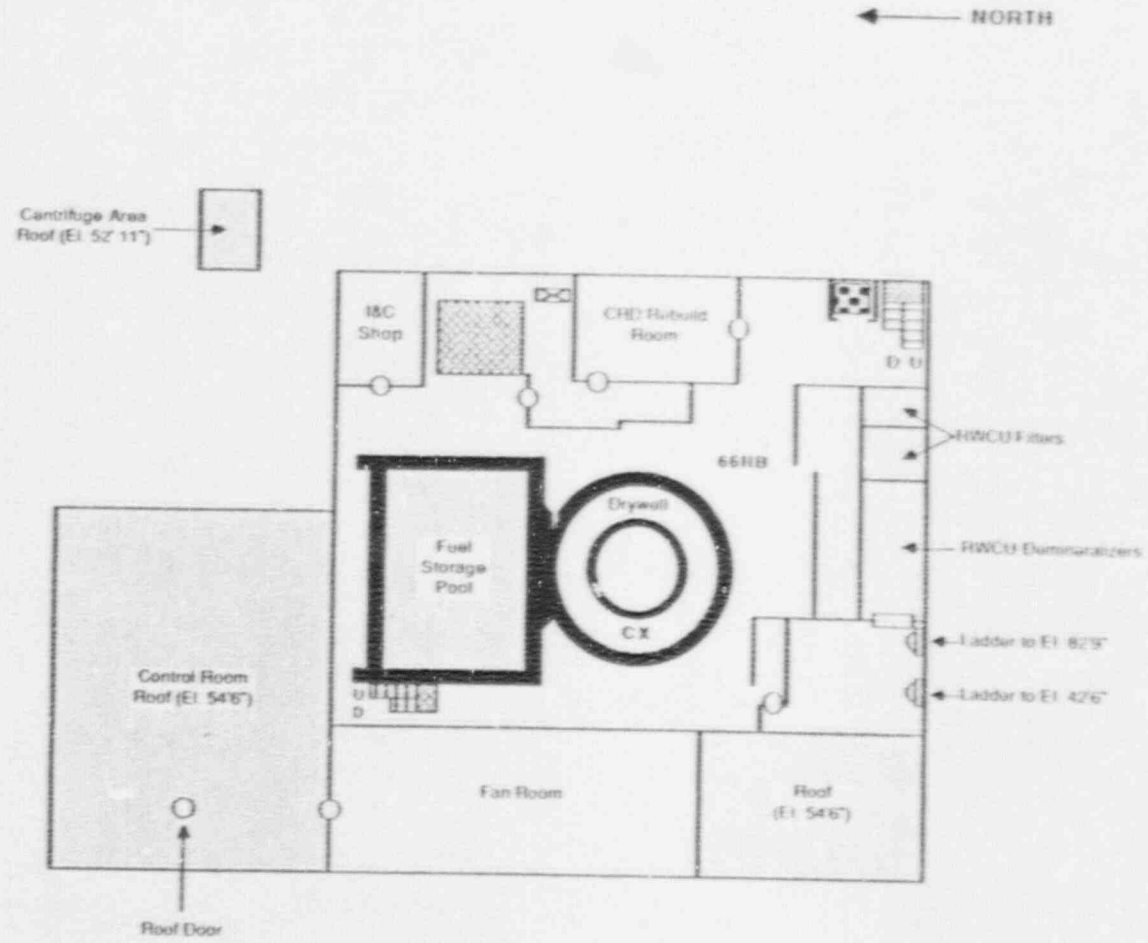
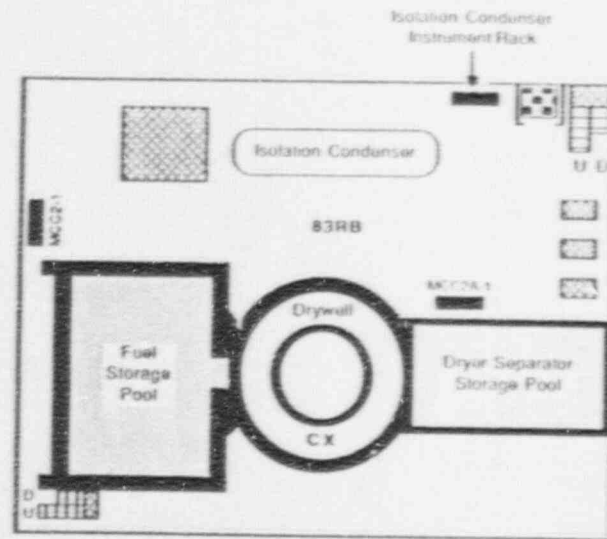


Figure 4-10. Millstone 1 Reactor and Radwaste Buildings, Elevation 65' 9"

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Figure 4-11. Millstone 1 Reactor Building, Elevation 82' 9"

NORTH

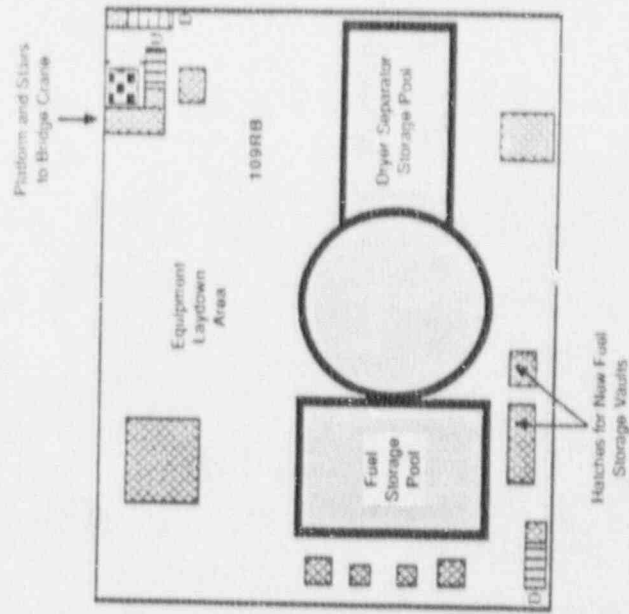
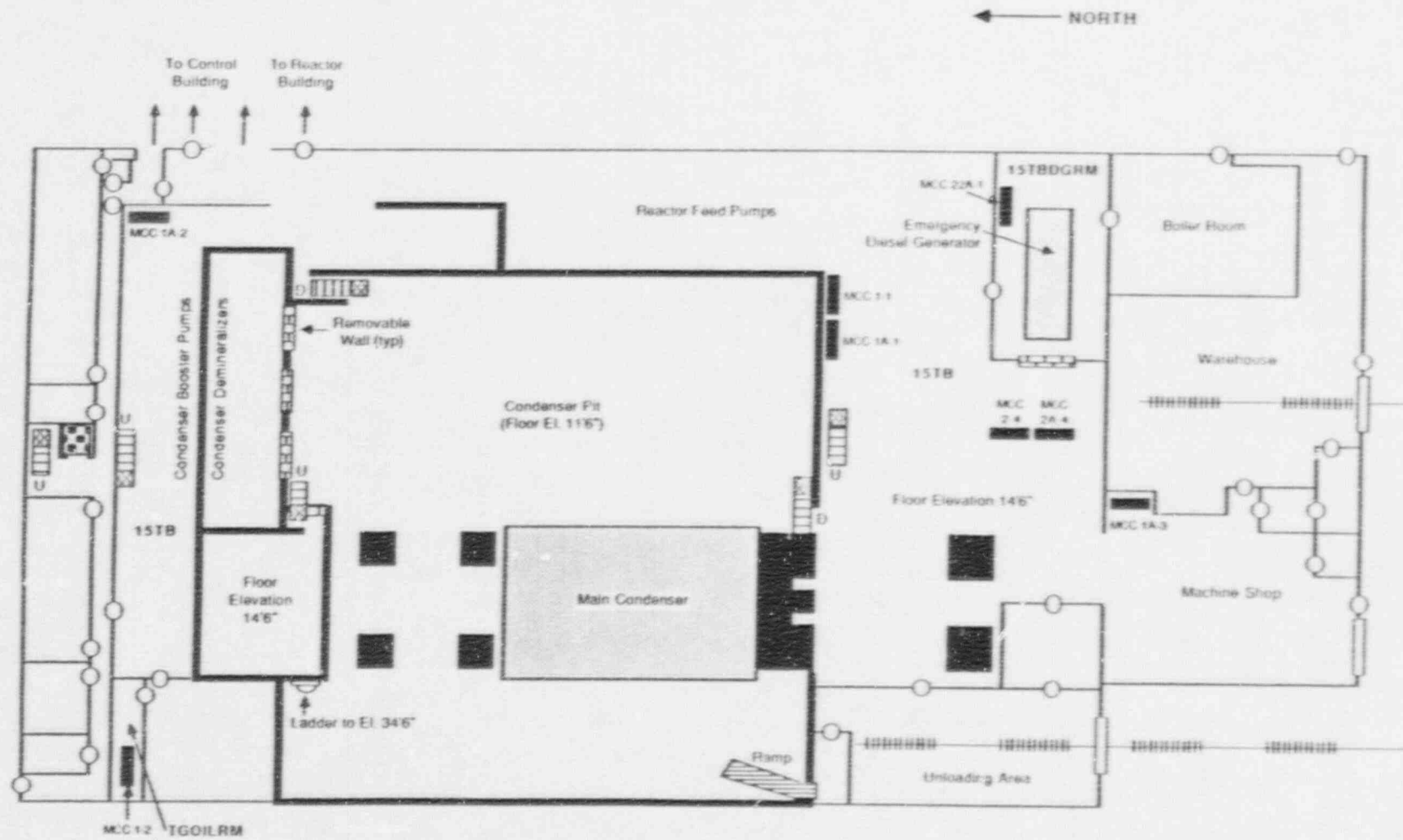


Figure 4-12. Millstone 1 Reactor Building, Elevation 108' 6" (Refueling Floor)

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Figure 4-13. Millstone 1 Turbine Building, Elevation 14'6" (Grade Level)

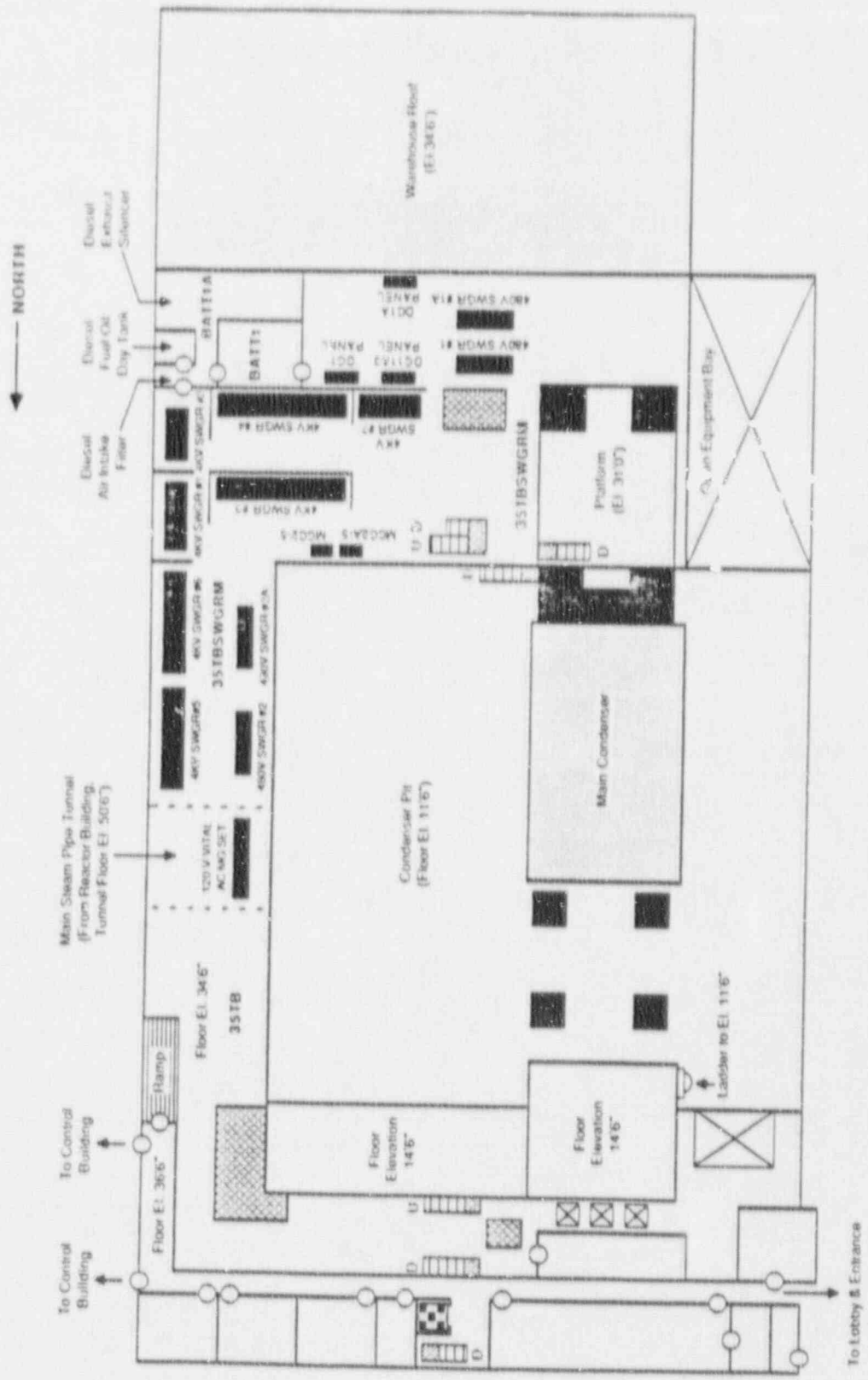


Figure 4-14. Millstone 1 Turbine Building, Elevation 34'6"

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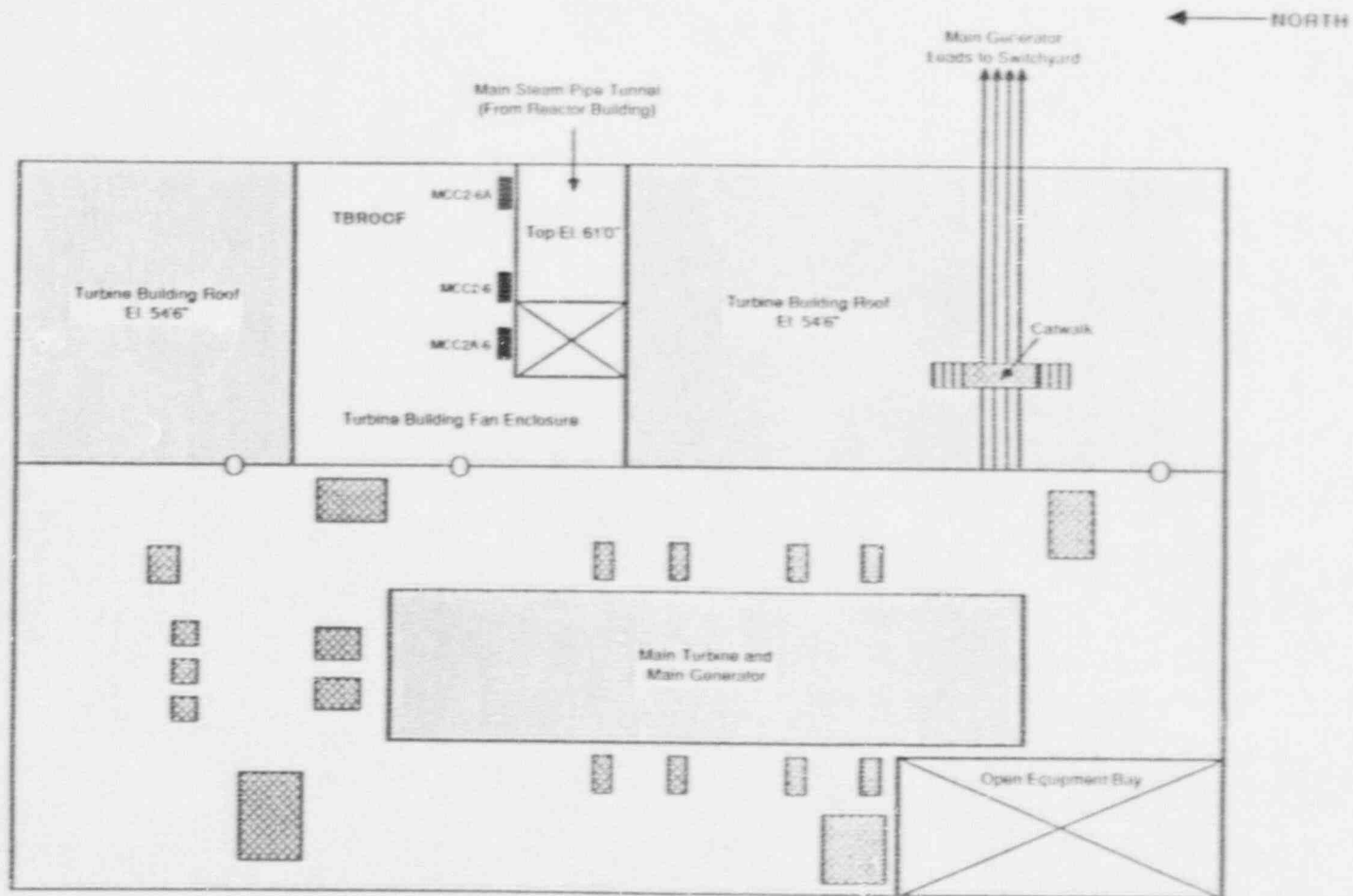


Figure 4-15. Millstone 1 Turbine Building, Elevation 54'6"

NORTH

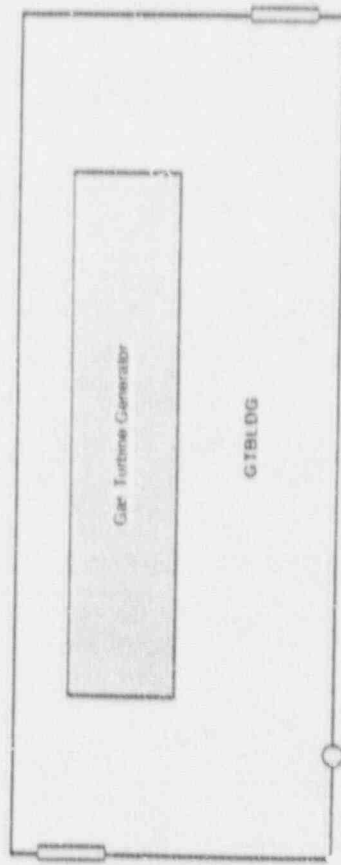
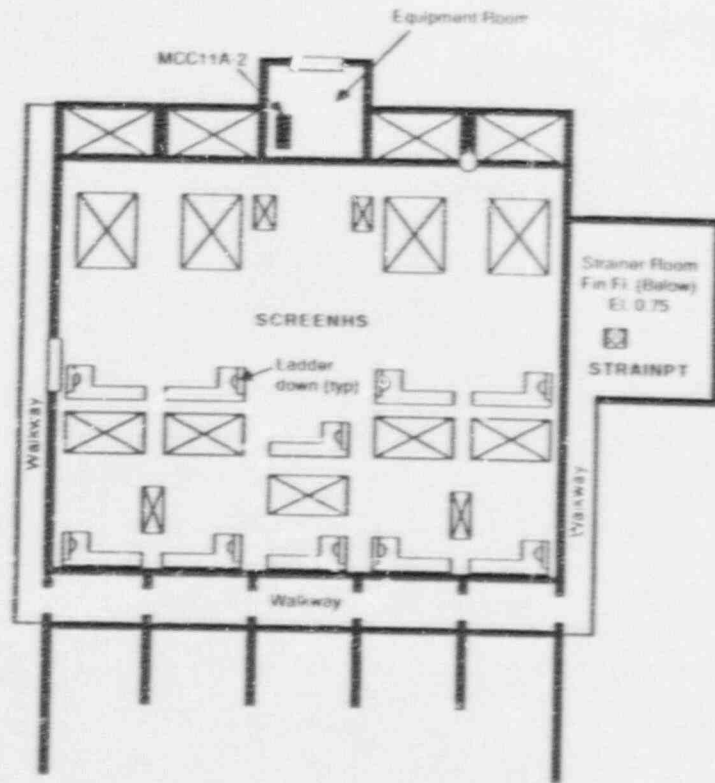


Figure 4-16. Millstone 1 Gas Turbine Building

← NORTH



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Figure 4-17. Millstone 1 Intake Structure, Elevation 14'0" (Grade Level)

NORTH
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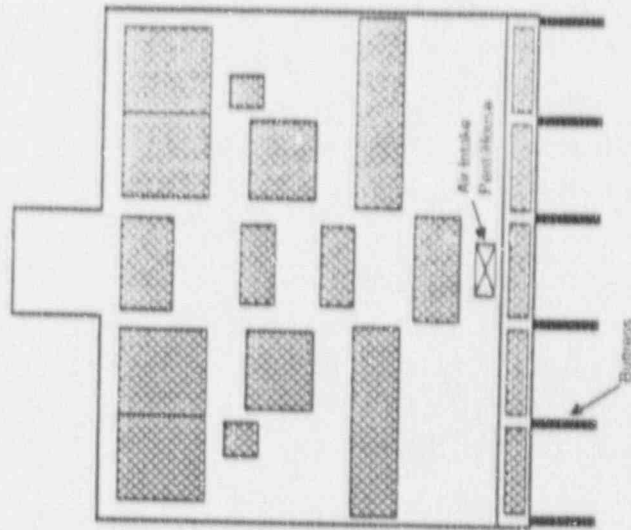
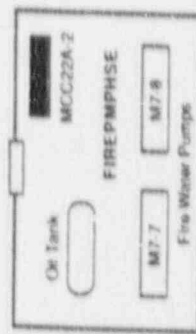
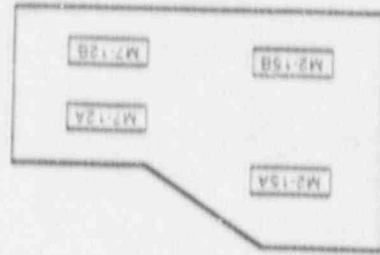


Figure 4-18. Millstone 1 Intake Structure Roof, Elevation 42'0"



Fire Pump House
EI 146

Note: Fire water pump house serves both units
1 and 2 at the Millstone site



Condensate Transfer
Pump House EI 110

Figure 4-19. Millstone 1 Fire Water Pump House and Condensate Transfer Pump House

Table 4-1. Definition of Millstone 1 Building and Location Codes

<u>Codes</u>	<u>Descriptions</u>
1. -26RBNECRM	-26' elevation - Northeast Corner Room of the Reactor Building
2. -26RBSWCRM	-26' elevation - Southwest Corner Room of the Reactor Building
3. -26RBTORRM	Torus Room located at the -26' elevation of the Reactor Building
4. -8RBNWCRM	-8' elevation - Northwest Corner Room of the Reactor Building
5. 15RB	15' elevation Reactor Building, contains MCC E3, 11A1, F3, E4, FE3, and EF3
6. 15RBELPEN	Electrical Penetrations, located on the 15' elevation of the Reactor Building
7. 15RBSHDNPMPRM	Shutdown Pump Room, located on the 15' elevation of the Reactor Building
8. 15RBSTMTN	Steam Tunnel, located on the 15' elevation of the Reactor Building
9. 15TB	15' elevation of the Turbine Building
10. 15TBDGRM	Diesel Generator Room, located on the 15' elevation of the Turbine Building
11. 35TB	35' elevation of the Turbine Building
12. 35TBDGTK	Diesel Generator Day Tank, located on the 35' elevation of the Turbine Building
13. 35TBSWGRM	Switchgear Room, located on the 35' elevation of the Turbine Building - contains 4kV, 480 VAC, and DC buses
14. 43RB	43' elevation of the Reactor Building
15. 43RBPMPRM	Reactor Water Cleanup Pump Room, located on the 43' elevation of the Reactor Building
16. 43RBSHDNHXRM	Shutdown Heat Exchanger Room, located on the 43' elevation of the Reactor Building
17. 66RB	66' elevation of the Reactor Building

Table 4-1. Definition of Millstone 1 Building and Location Codes (Continued)

<u>Codes</u>	<u>Descriptions</u>
18. 83RB	83' elevation of the Reactor Building
19. 109RB	109' elevation of the Reactor Building - Spent Fuel Pool
20. BATT1	Battery Room 1
21. BATT1A	Battery Room 1A
22. CBLVLT	Cable Vault, located on the 25' elevation of the Control Building
23. CR	Control Room located on the 35' elevation of the Control Building
24. CST	Condensate Storage Tank
25. CX	Reactor Containment
26. GTBLDG	Gas Turbine Building
27. MCC11A2	Motor Control Center 11A2, located on the 43' elevation of the Reactor Building
28. SCREENHS	Screenhouse (Intake Structure)
29. STRAINPT	Strainer Room for Service Water
30. TBROOF	Roof of the Turbine Building

Table 4-2. Partial Listing of Components by Location at Millstone 1

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
-26RBNECRM	ECCS	LPCI-15B	XV
-26RBNECRM	ECCS	LPCI-7B	MOV
-26RBNECRM	ECCS	LPCI-PD	MDP
-26RBNECRM	ECCS	LPCI-PB	MDP
-26RBNECRM	ECCS	CS-PB	MDP
-26RBNECRM	ECCS	LPCI-17B	XV
-26RBNECRM	ECCS	LPCI-7D	MOV
-26RBSWCRM	ECCS	LPCI-15A	XV
-26RBSWCRM	ECCS	LPCI-7A	MOV
-26RBSWCRM	ECCS	LPCI-PC	MDP
-26RBSWCRM	ECCS	LPCI-PA	MDP
-26RBSWCRM	ECCS	CS-PA	MDP
-26RBSWCRM	ECCS	LPCI-17A	XV
-26RBSWCRM	ECCS	LPCI-7C	MOV
-26RBTORRM	ECCS	TORUS	TANK
-26RBTORRM	ECCS	TORUS	TANK
-26RBTORRM	ECCS	TORUS	TANK
-26RBTORRM	ECCS	TORUS	TANK
-8RBNWCRM	ECCS	FWCI-143	MOV
-8RBNWCRM	ECCS	FWCI-P28	MDP
15RB	CRD	CRD-1A	MDP
15RB	CRD	CRD-1B	MDP
15RB	ECCS	CS-24A	MOV
15RB	ECCS	CS-4A	MOV
15FB	ECCS	CS-3A	MOV
15RB	ECCS	CS-24B	MOV
15RB	ECCS	CS-4B	MOV
15RB	ECCS	CS-3B	MOV
15RB	ECCS	LPCI-29A	MOV
15RB	ECCS	LPCI-26A	MOV

Table 4-2. Partial Listing of Components by Location at Millstone 1

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
15RB	ECCS	LPCI-47A	MOV
15RB	ECCS	LPCI-35A	MOV
15RB	ECCS	LPCI-36A	MOV
15RB	ECCS	LPCI-46B	MOV
15RB	ECCS	LPCI-47B	MOV
15RB	ECCS	LPCI-26B	MCV
15RB	ECCS	LPCI-35B	MOV
15RB	ECCS	LPCI-36B	MOV
15RB	ECCS	CS-25A	MOV
15RB	ECCS	CS-25B	MOV
15RB	ECCS	LPCI-46A	MOV
15RB	ECCS	LPCI-29B	MOV
15RB	EP	MCC-101AB2	MCC
15RB	EP	MCC-101AB2	MCC
15RB	EP	MCC-2-3NE	MCC
15RB	EP	MCC-2A-3NE	MCC
15RBSDNPMPR M	RCS	RCS-2A	MOV
15RBSDNPMPR M	RCS	RCS-2B	MOV
15RBSTMTN	RCS	MSIV-2A	NV
15RBSTMTN	RCS	MSIV-2B	NV
15RBSTMTN	RCS	MSIV-2C	NV
15RBSTMTN	RCS	MSIV-2D	NV
15TB	ECCS	FWCI-35A	MOV
15TB	ECCS	FWCI-35B	MOV
15TB	ECCS	FWCI-P6A	MDP
15TB	ECCS	FWCI-P6B	MDP
15TB	ECCS	FWCI-P6C	MDP
15TB	ECCS	FWCI-P7A	MDP
15TB	ECCS	FWCI-P7B	MDP
15TB	ECCS	FWCI-P7C	MDP

Table 4-2. Partial Listing of Components by Location at Millstone 1

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
15TB	ECCS	FWCI-P10A	MDP
15TB	ECCS	FWCI-P10B	MCP
15TB	ECCS	FWCI-P10C	MDP
15TB	EP	MCC-2-4	MCC
15TB	EP	MCC-2A-4	MCC
15TB	SCCW	SCCW-P15A	MDP
15TB	SCCW	SCCW-P15B	MDP
15TB	SCCW	SCCW-HXA	HX
15TB	SCCW	SCCW-HXB	HX
15TBDGRM	EP	DG-15G11U	LG
35TB	ECCS	FWCI-643	NV
35TB	ECCS	FWCI-642A	NV
35TB	ECCS	FWCI-642B	NV
35TBSWGRM	EP	BUS-14F	BUS
35TBSWGRM	EP	CB-14F	CB
35TBSWGRM	EP	BUS-14E	BUS
35TBSWGRM	EP	BUS-14C	BUS
35TBSWGRM	EP	BUS-14A	BUS
35TBSWGRM	EP	BUS-14G	BUS
35TBSWGRM	EP	BUS-12F	BUS
35TBSWGRM	EP	DC-1A	BUS
35TBSWGRM	EP	BC-1A	BC
35TBSWGRM	EP	DC-1	BUS
35TBSWGRM	EP	BC-1	BC
35TBSWGRM	EP	TRAN-12F	TRAN
35TBSWGRM	EP	BUS-12E	BUS
35TBSWGRM	EP	TRAN-12E	TRAN
35TBSWGRM	EP	DC-1	BUS
35TBSWGRM	EP	DC-1	BUS
35TBSWGRM	EP	DC-1A	BUS

Table 4-2. Partial Listing of Components by Location
at Millstone 1

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
35TBSWGRM	EP	DC-1A	BUS
35TBSWGRM	EP	BUS-VAC-1	BUS
35TBSWGRM	EP	BUS-VAC-1	BUS
35TBSWGRM	EP	BUS-IAC-1	BUS
35TBSWGRM	EP	BUS-IAC-1	BUS
35TBSWGRM	EP	MG-1	MG
35TBSWGRM	EP	MG-1	MG
35TBSWGRM	EP	MCC-2-5	MCC
35TBSWGRM	EP	TR-IV-1	ATS
35TBSWGRM	EP	MCC-2A-5	MCC
35TBSWGRM	EP	TR-IRP-1	ATS
35TBSWGRM	EP	BUS-14D	BUS
35TBSWGRM	EP	BUS-14B	BUS
35TBSWGRM	EP	BUS-12C	BUS
35TBSWGRM	EP	TRAN-12C	TRAN
35TBSWGRM	EP	BUS-12D	BUS
35TBSWGRM	EP	TRAN-12D	TRAN
35TBSWGRM	EP	MCC-101AB3	MCC
35TBSWGRM	EP	MCC-101AB3	MCC
35TBSWGRM	EP	MCC-2A-3	MCC
35TBSWGRM	EP	MCC-2-3	MCC
35TBSWGRM	EP	MCC-2-5	MCC
43RB	ECCS	IC-3	MOV
66RB	ECCS	IC-2	MOV
83RB	ECCS	IC-HX	HX
83RB	EP	MCC-2-1	MCC
83RB	FIRE	IC-10	MOV
BATT1	EP	BATT-1	BATT
BATT1A	EP	BATT-1A	BATT
CST	CRD	FWCI-CST	TANK

Table 4-2. Partial Listing of Components by Location
at Millstone 1

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
CST	ECCS	FWCI-CST	TANK
CX	ECCS	IC-1	MOV
CX	ECCS	IC-4	MOV
CX	ECCS	RCS-RV	RV
CX	ECCS	RCS-3A	SRV
CX	ECCS	RCS-RV	RV
CX	ECCS	RCS-RV	RV
CX	ECCS	RCS-3C	SRV
CX	ECCS	RCS-3D	SRV
CX	ECCS	RCS-3F	SRV
CX	RCS	RCS-RV	RV
CX	RCS	RCS-2	MOV
CX	RCS	RCS-3A	SRV
CX	RCS	RCS-1	MOV
CX	RCS	RCS-3A	SRV
CX	RCS	RCS-5	MOV
CX	FCS	MSIV-1A	NV
CX	RCS	IC-1	MOV
CX	RCS	IC-4	MOV
CX	RCS	MSIV-1B	NV
CX	RCS	MSIV-1C	NV
CX	RCS	MSIV-1D	NV
CX	RCS	RCS-3C	SRV
CX	RCS	RCS-3D	SRV
CX	RCS	RCS-3F	SRV
CX	RCS	RCS-3C	SRV
CX	RCS	RCS-3D	SRV
CX	RCS	RCS-3F	SRV
FIREMPHSE	EP	MC-22A-2	MCC
FIREMPHSE	FIRE	FI-P8	MDP

Table 4-2. Partial Listing of Components by Location
at Millstone 1

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
FIREPMHSE	FIRE	FI-P7	DDP
GTBLDG	EP	GT-15G10U	GT
GTBLDG	EP	CB-14G	CB
MCC11A2	EP	MCC-11A-2	MCC
MCC11A2	EP	MCC-11A-2	MCC
SCREENHS	SW	SW-P7A	MDP
SCREENHS	SW	SW-P7B	MDP
SCREENHS	SW	SW-P7C	MDP
SCREENHS	SW	SW-P7D	MDP

5. BIBLIOGRAPHY FOR MILLSTONE 1

1. NUREG-0824, "Integrated Plant Safety Assessment, Systematic Evaluation Program for Millstone Nuclear Power Station, Unit 1," USNRC
2. NUREG-1143, "Safety Evaluation Report Related to the Full-term Operating License for Millstone Nuclear Power Station, Unit No. 1," USNRC, October 1985
3. NUREG-1184, "Integrated Safety Assessment Report, Integrated Safety Assessment Program - Millstone Nuclear Power Station, Unit 1," USNRC
4. NUREG/CR-2024, "Seismic Review of Millstone 1 Nuclear Power Plant as Part of the Systematic Evaluation Program," Lawrence Livermore National Laboratory, July 1981
5. NUREG/CR-3085, "Interim Reliability Evaluation Program: Analysis of the Millstone Point Unit 1 Nuclear Power Plant," Science Application International Corporation, February 1983
6. NUREG/CR-3233, "The Effect of Resolution of the Millstone Point Unit 1, Systematic Evaluation Program Issues on Probabilistic Calculations of Risk," Sandia National Laboratories and Science Applications International Corporation, December 1983

APPENDIX A DEFINITION OF SYMBOLS USED IN THE SYSTEM AND LAYOUT DRAWINGS

A1. SYSTEM DRAWINGS

A1.1 Fluid System Drawings

The simplified system drawings are accurate representations of the major flow paths in a system and the important interfaces with other fluid systems. As a general rule, small fluid lines that are not essential to the basic operation of the system are not shown in these drawings. Lines of this type include instrumentation lines, vent lines, drain lines, and other lines that are less than 1/3 the diameter of the connecting major flow path. There usually are two versions of each fluid system drawing; a simplified system drawing, and a comparable drawing showing component locations. The drawing conventions used in the fluid system drawings are the following:

- Flow generally is left to right.
 - Water sources are located on the left and water "users" (i.e., heat loads) or discharge paths are located on the right.
 - One exception is the return flow path in closed loop systems which is right to left.
 - Another exception is the Reactor Coolant System (RCS) drawing which is "vessel-centered", with the primary loops on both sides of the vessel.
 - Horizontal lines always dominate and break vertical lines.
- Component symbols used in the fluid system drawings are defined in Figure A-1.
 - Most valve and pump symbols are designed to allow the reader to distinguish among similar components based on their support system requirements (i.e., electric power for a motor or solenoid, steam to drive a turbine, pneumatic or hydraulic source for valve operation, etc.)
 - Valve symbols allow the reader to distinguish among valves that allow flow in either direction, check (non-return) valves, and valves that perform an overpressure protection function. No attempt has been made to define the specific type of valve (i.e., as a globe, gate, butterfly, or other specific type of valve).
 - Pump symbols distinguish between centrifugal and positive displacement pumps and between types of pump drives (i.e., motor, turbine, or engine).
- Locations are identified in terms of plant location codes defined in Section 4 of this Sourcebook.
 - Location is indicated by shaded "zones" that are not intended to represent the actual room geometry.
 - Locations of discrete components represent the actual physical location of the component.
 - Piping locations between discrete components represent the plant areas through which the piping passes (i.e. including pipe tunnels and underground pipe runs).
 - Component locations that are not known are indicated by placing the components in an unshaded (white) zone.
 - The primary flow path in the system is highlighted (i.e., bold white line) in the location version of the fluid system drawings.

A1.2 Electrical System Drawings

The electric power system drawings focus on the Class 1E portions of the plant's electric power system. Separate drawings are provided for the AC and DC portions of the Class 1E system. There often are two versions of each electrical system drawing: a simplified system drawing, and a comparable drawing showing component locations. The drawing conventions used in the electrical system drawings are the following:

- Flow generally is top to bottom
 - In the AC power drawings, the interface with the switchyard and/or offsite grid is shown at the top of the drawing.
 - In the DC power drawings, the batteries and the interface with the AC power system are shown at the top of the drawing.
 - Vertical lines dominate and break horizontal lines.
- Component symbols used in the electrical system drawings are defined in Figure A-2.
- Locations are identified in terms of plant location codes defined in Section 4 of this Sourcebook.
 - Locations are indicated by shaded "zones" that are not intended to represent the actual room geometry.
 - Locations of discrete components represent the actual physical location of the component.
 - The electrical connections (i.e., cable runs) between discrete components, as shown on the electrical system drawings, DO NOT represent the actual cable routing in the plant.
 - Component locations that are not known are indicated by placing the discrete components in an unshaded (white) zone.

A2. SITE AND LAYOUT DRAWINGS

A2.1 Site Drawings

A general view of each reactor site and vicinity is presented along with a simplified site plan showing the arrangement of the major buildings, tanks, and other features of the site. The general view of the reactor site is obtained from ORNL-NSIC-55 (Ref. 1). The site drawings are approximately to scale, but should not be used to estimate distances on the site. As-built scale drawings should be consulted for this purpose.

Labels printed in bold uppercase correspond to the location codes defined in Section 4 and used in the component data listings and system drawings in Section 3. Some additional labels are included for information and are printed in lowercase type.

A2.2 Layout Drawings

Simplified building layout drawings are developed for the portions of the plant that contain components and systems that are described in Section 3 of this Sourcebook. Generally the following buildings are included: reactor building, auxiliary building, fuel building, diesel building, and the intake structure or pumphouse. Layout drawings generally are not developed for other buildings.

Symbols used in the simplified layout drawings are defined in Figure A-3. Major rooms, stairways, elevators, and doorways are shown in the simplified layout drawings however, many interior walls have been omitted for clarity. The building layout

drawings, are approximately to scale, should not be used to estimate room size or distances. As-built scale drawings for should be consulted his purpose.

Labels printed in uppercase bolded also correspond to the location codes defined in Section 4 and used in the component data listings and system drawings in Section 3. Some additional labels are included for information and are printed in lowercase type.

A3. APPENDIX A REFERENCES

1. Heddleson, F.A., "Design Data and Safety Features of Commercial Nuclear Power Plants.", ORNL-NSIC-55, Volumes 1 to 4. Oak Ridge National Laboratory, Nuclear Safety Information Center, December 1973 (Vol.1), January 1972 (Vol. 2), April 1974 (Vol. 3), and March 1975 (Vol. 4)

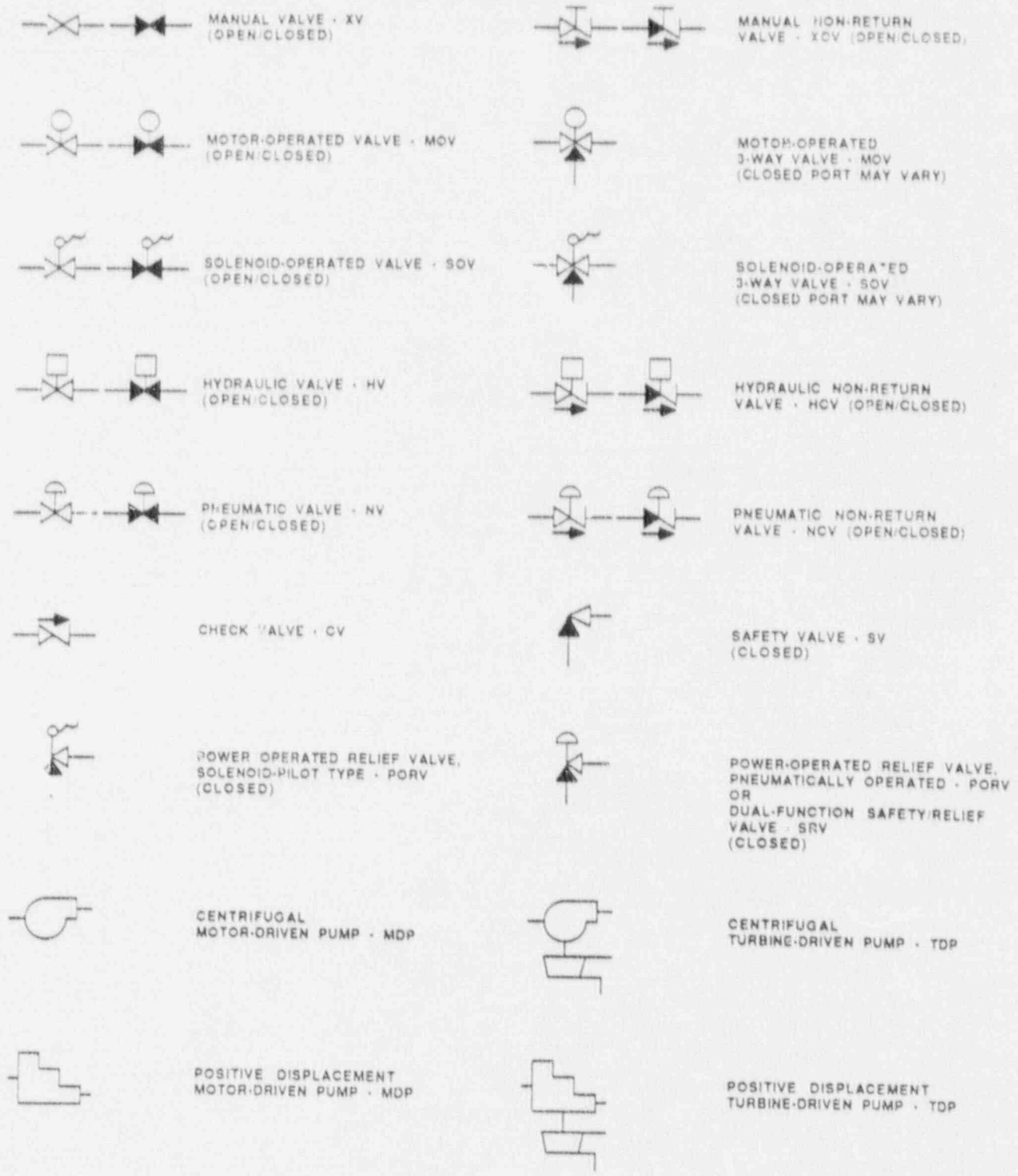


Figure A-1. Key To Symbols In Fluid System Drawings

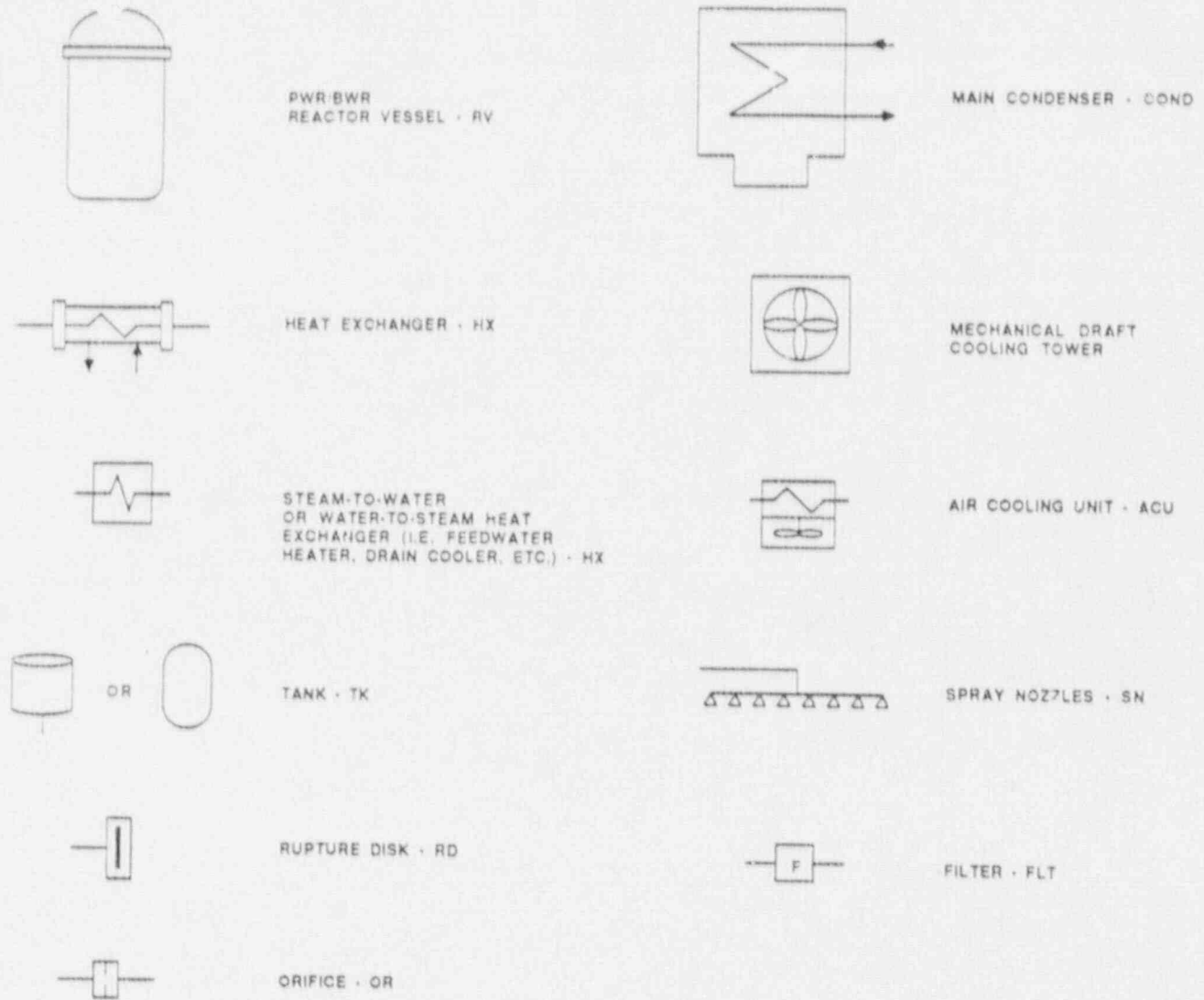


Figure A-1. Key To Symbols In Fluid System Drawings
(Continued)

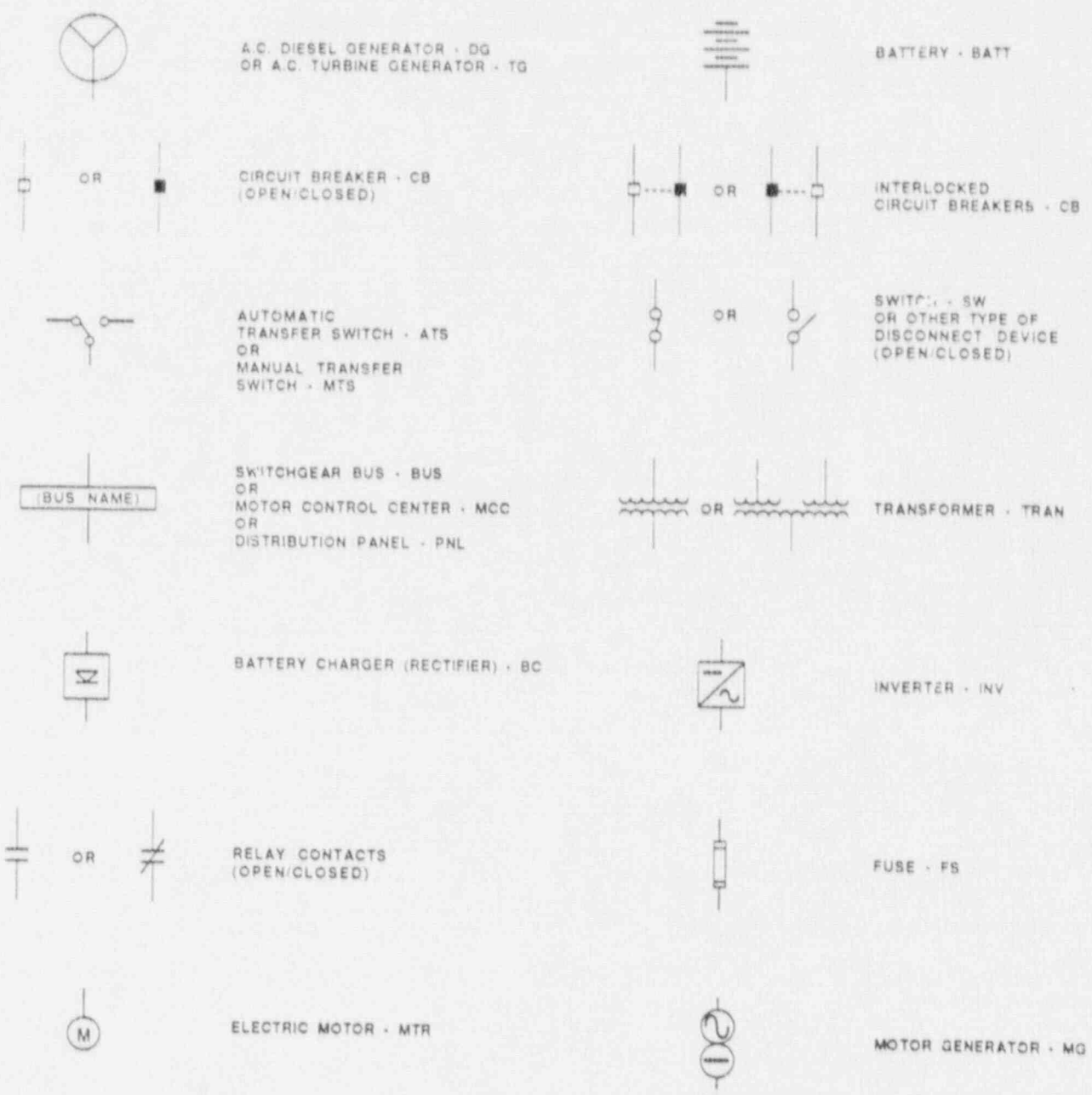


Figure A-2. Key To Symbols In Electrical System Drawings












	STAIRS U = Up D = Down		SPIRAL STAIRCASE
	LADDER U = Up D = Down		ELEVATOR
	HATCH OR GRATING DECK		OPEN AREA (NO FLOOR)
	PERSONNEL DOOR		EQUIPMENT DOOR
	RAILROAD TRACKS		FENCE LINE
	TANK/WATER AREA		

Figure A-3. Key To Symbols In Facility Layout Drawings

APPENDIX B DEFINITION OF TERMS USED IN THE DATA TABLES

Terms appearing in the data tables in Sections 3 and 4 of this Sourcebook are defined as follows:

SYSTEM (also **LOAD SYSTEM**) - All components associated with a particular system description in the Sourcebook have the same system code in the data base. System codes used in this Sourcebook are the following:

<u>Code</u>	<u>Definition</u>
RCS	Reactor Coolant System
ECCS	Emergency Core Cooling Systems (including FWCI, core spray, LPCI, and isolation condenser systems)
FIRE	Fire Water System
CRD	Control Rod Drive Hydraulic System
EP	Electric Power System
SCCW	Turbine Building Secondary Closed Cooling Water System
SW	Service Water System

COMPONENT ID (also **LOAD COMPONENT ID**) - The component identification (ID) code in a data table matches the component ID that appears in the corresponding system drawing. The component ID generally begins with a system preface followed by a component number. The system preface is not necessarily the same as the system code described above. For component IDs, the system preface corresponds to what the plant calls the component (e.g. HPI, RHR). An example is HPI-730, denoting valve number 730 in the high pressure injection system, which is part of the ECCS. The component number is a contraction of the component number appearing in the plant piping and instrumentation drawings (P&IDs) and electrical one-line system drawings.

LOCATION (also **COMPONENT LOCATION** and **POWER SOURCE LOCATION**) - Refer to the location codes defined in Section 4.

COMPONENT TYPE (COMP TYPE) - Refer to Table B-1 for a list of component type codes.

POWER SOURCE - The component ID of the power source is listed in this field (see **COMPONENT ID**, above). In this data base, a "power source" for a particular component (i.e. a load or a distribution component) is the next higher electrical distribution or generating component in a distribution system. A single component may have more than one power source (i.e. a DC bus powered from a battery and a battery charger).

POWER SOURCE VOLTAGE (also **VOLTAGE**) - The voltage "seen" by a load of a power source is entered in this field. The downstream (output) voltage of a transformer, inverter, or battery charger is used.

EMERGENCY LOAD GROUP (EMERG LOAD GROUP) - AC and DC load groups (or electrical divisions) are defined as appropriate to the plant. Generally, AC load groups are identified as AC/A, AC/B, etc. The emergency load group for a third-of-a-kind load (i.e. a "swing" load) that can be powered from either of two AC load groups would be identified as AC/AB. DC load group follows similar naming conventions.

TABLE B-1. COMPONENT TYPE CODES

<u>COMPONENT</u>	<u>COMP TYPE</u>
VALVES:	
Motor-operated valve	MOV
Pneumatic (air-operated) valve	NV or AOV
Hydraulic valve	HV
Solenoid-operated valve	SOV
Manual valve	XV
Check valve	CV
Pneumatic non-return valve	NCV
Hydraulic non-return valve	HCV
Safety valve	SV
Dual function safety/relief valve	SRV
Power-operated relief valve (pneumatic or solenoid-operated)	PORV
PUMPS:	
Motor-driven pump (centrifugal or PD)	MDP
Turbine-driven pump (centrifugal or PD)	TDP
Diesel-driven pump (centrifugal or PD)	DDP
OTHER FLUID SYSTEM COMPONENTS:	
Reactor vessel	RV
Steam generator (U-tube or once-through)	SG
Heat exchanger (water-to-water HX, or water-to-air HX)	HX
Cooling tower	CT
Tank	TANK or TK
Sump	SUMP
Rupture disk	RD
Orifice	ORIF
Filter or strainer	FLT
Spray nozzle	SN
Heaters (i.e. pressurizer heaters)	HTR
VENTILATION SYSTEM COMPONENTS:	
Fan (motor-driven, any type)	FAN
Air cooling unit (air-to-water HX, usually including a fan)	ACU or FCU
Condensing (air-conditioning) unit	COND
EMERGENCY POWER SOURCES:	
Diesel generator	DG
Gas turbine generator	GT
Battery	BATT

TABLE B-1. COMPONENT TYPE CODES (Continued)

<u>COMPONENT</u>	<u>COMP TYPE</u>
ELECTRIC POWER DISTRIBUTION EQUIPMENT:	
Bus or switchgear	BUS
Motor control center	MCC
Distribution panel or cabinet	PNL or CAB
Transformer	TRAN or XFMR
Battery charger (rectifier)	BC or RECT
Inverter	INV
Uninterruptible power supply (a unit that may include battery, battery charger, and inverter)	UPS
Motor generator	MG
Circuit breaker	CB
Switch	SW
Automatic transfer switch	ATS
Manual transfer switch	MTS