UNITED STATES NUCLEAR REGULATORY COMMISSION

NUCLEAR POWER PLANT SYSTEM SOURCEBOOK

MILLSTONE 3

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NUCLEAR POWER PLANT SYSTEM SOURCEBOOK

MILLSTONE 3

50-423

Editor: Peter Lobner
Author: Stephen Finn

Prepared for:

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CAUTION

The information in this repo 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:

Mr. Mark Rubin
U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Engineering and Systems Technology
Mail stop 7E4
Washington, D.C. 20555

With copy to:

Mr. Peter Lobner
Manager, Systems Engineering Division
Science Applications International Corporation
10210 Campus Point Drive
San Diego, CA 92131
(619) 458-2673

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 3
RECORD OF REVISIONS

REVISION	ISSUE	COMMENTS
0	1/89	Original report

MILLSTONE 3 SYSTEM SOURCEBOOK

This sourcebook contains summary information on Millstone 3. 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 3 nuclear power plant is listed below:

- Docket number	50-423
- Operator	Northeast Utilities
- Location	New London, CT
- Commercial operation date	4/86
- Reactor type	PWR
- NSSS vendor	Westinghouse
- Number of loops	4
- Power (MWt/MWe)	3411/1150
- Architect-engineer	Stone and Webster
- Containment type	Reinforced concrete cylinder with steel liner, subatmospheric

2. IDENTIFICATION OF SIMILAR NUCLEAR POWER PLANTS

Millstone 3 unit has a Westinghouse PWR four-loop nuclear steam supply system (NSSS). Other four-loop Westinghouse plants in the United States include:

- Braidwood 1 and 2
- Byron 1 and 2
- Callaway
- Catawba 1 and 2
- Comanche Peak 1 and 2
- Donald C. Cook 1 and 2 (ice condenser containment)
- Diablo Canyon 1 and 2
- Haddam Neck
- Indian Point 2 and 3
- McGuire 1 and 2 (ice condenser containment)
- Salem 1 and 2
- Seabrook 1
- Sequoyah 1 and 2 (ice condenser containment)
- Shearon Harris 1 and 2
- South Texas 1 and 2
- Trojan
- Vogtle 1 and 2
- Watts Bar 1 and 2
- Wolf Creek
- Yankee Rowe
- Zion 1 and 2

Millstone 3 differs from the majority of Westinghouse plants in that it contains three centrifugal charging pumps whereas most other plants contain at least one positive displacement charging pump. Millstone 3 is similar to other plants in the number and type of auxiliary feedwater and high pressure injection pumps.

3. SYSTEM INFORMATION

This section contains descriptions of selected systems at Millstone 3 in terms of general function, operation, system success criteria, major components, and support system requirements. A summary of major systems at the Millstone 3 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 3 Systems Covered in this Report

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Reactor Heat Removal Systems			
- Reactor Coolant System (RCS)	Same	3.1	5
- Auxiliary Feedwater (AFW) and Secondary Steam Relief (SSR) Systems	Same	3.2	10.4.9
- Emergency Core Cooling Systems (ECCS)			
- High-Pressure Injection & Recirculation - Low-pressure Injection & Recirculation	Safety Injection System	3.3	6.3
- Decay Heat Removal (DHR) System (Residual Heat Removal (RHR) System)	Residual Heat Removal (RHR) System	3.3	6.3
- Main Steam and Power Conversion Systems	Main Steam System, Condensate and Feedwater System, Circulating Cooling Water System	X	10.3, 10.4
- Other Heat Removal Systems	None identified	X	
Reactor Coolant Inventory Control Systems			
- Chemical and Volume Control System (CVCS) (Charging System)	Charging System	3.4	6.3
ECCS	See ECCS, above	-	-

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

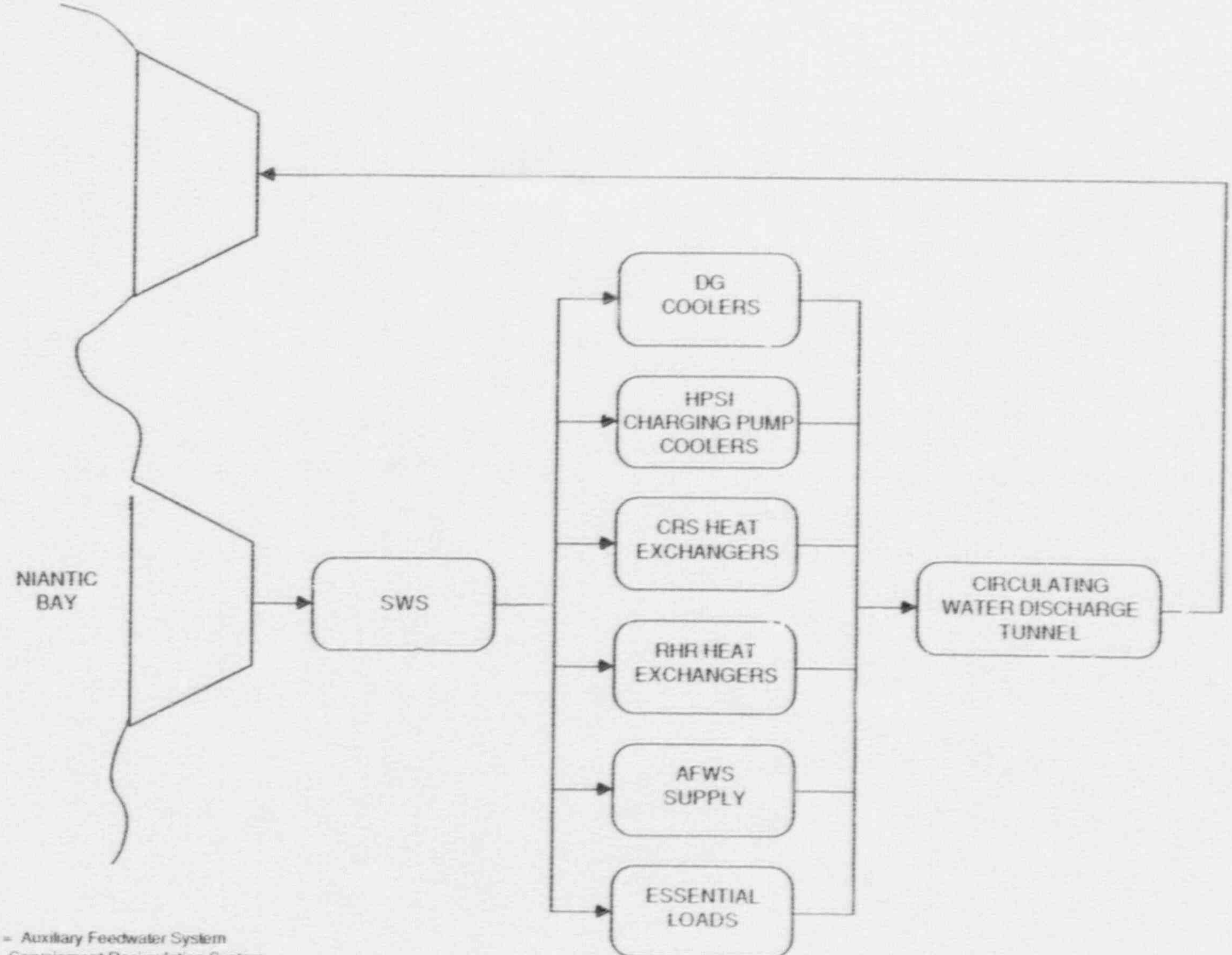
Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Containment Systems			
- Containment	Same	X	6.2
- Containment Heat Removal Systems			
- Containment Spray System	Quench Spray System, Containment Recirculation System	3.5	6.2.2
- Containment Fan Cooler System	None	-	-
- Containment Normal Ventilation Systems	Containment Structure Ventilation System	X	9.4.7
- Combustible Gas Control Systems	DBA Hydrogen Recombiner System, Hydrogen Monitoring System	X	6.2.5
Reactor and Reactivity Control Systems			
- Reactor Core	Same	X	4
- Control Rod System	Control Rod Drive System	X	4.6
- Boration Systems	See CVCS, above	-	-
Instrumentation & Control (I&C) Systems			
- Reactor Protection System (RPS)	Reactor Trip System	3.6	7.2
- Engineered Safety Feature Actuation System (ESFAS)	Engineered Safety Feature System	3.6	7.3
- Remote Shutdown System	Auxiliary Shutdown Panel	3.6	7.4.1.3

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

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Instrumentation & Control (I&C) Systems (continued)			
- Other I&C Systems	Various Systems	3.6	7.4, 7.5, 7.6, 7.7
Support Systems			
- Class 1E Electric Power System	Same	3.7	8.1.5, 8.3
- Non-Class 1E Electric Power System	Same	3.7	8.2, 8.3
- Diesel Generator Auxiliary Systems	Same	3.7	8.3.1.1.3, 9.4.6, 9.5.5, 9.5.6
- Component Cooling Water (CCW) System	Same		9.2.2.1
- Service Water System (SWS)	Same		9.2.1
- Other Cooling Water Systems	Turbine Plant Component Cooling Water System, Neutron Shield Tank Cooling System, Charging Pumps Cooling System, Safety Injection Pumps Cooling System, Condensate Demineralizer Component Cooling Water System	X	9.2.2.3 to 9.2.2.6, 9.2.7
- Fire Protection Systems	Same	X	9.5.1
- Room Heating, Ventilating, and Air-Conditioning (HVAC) Systems	Same	X	9.4
- Instrument and Service Air Systems	Same	X	9.3.1

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

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
- Refueling and Spent Fuel Systems	Fuel Storage and Handling Systems	X	9.1
- Radioactive Waste Systems	Radioactive Waste Management Systems	X	11
- Radiation Protection Systems	Same	X	12



AFWS = Auxiliary Feedwater System
CRS = Containment Recirculation System
SWS = Service Water System

Figure 3-1. Cooling Water Systems Functional Diagram for Millstone 3

3.1 REACTOR COOLANT SYSTEM (RCS)

3.1.1 System Function

The RCS transfers heat from the reactor core to the secondary coolant system via the steam generators. 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) reactor coolant loops, (c) reactor coolant pumps, (d) the primary side of the steam generators, (e) pressurizer, and (f) connected piping out to a suitable isolation valve boundary. An isometric drawing of a 4-loop Westinghouse RCS is shown in Figure 3.1-1. Simplified diagrams of the RCS and important system interfaces are shown in Figures 3.1-2 and 3.1-3. 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 reactor coolant pump in each of the four reactor coolant loops. RCS pressure is maintained within a prescribed band by the combined action of pressurizer heaters and pressurizer spray. RCS coolant inventory is measured by pressurizer water level which is maintained within a prescribed band by the chemical and volume control system (charging system).

At power, core heat is transferred to secondary coolant (feedwater) in the steam generators. The heat transfer path to the ultimate heat sink is completed by the main steam and power conversion system and the circulating water system.

Following a transient or small LOCA (if RCS inventory is maintained), reactor core heat is still transferred to secondary coolant in the steam generators. Flow in the RCS is maintained by the reactor coolant pumps or by natural circulation. The heat transfer path to the ultimate heat sink can be established by using the secondary steam relief system (see Section 3.2) to vent main steam to atmosphere when the power conversion and circulating water systems are not available. If reactor core heat removal by this alternate path is not adequate, the RCS pressure will increase and a heat balance will be established in the RCS by venting steam or reactor coolant to the containment through the pressurizer relief valves. There are two power-operated relief valves and three safety valves on the pressurizer. A continued inability to establish adequate heat transfer to the steam generators will result in a LOCA-like condition (i.e., continuing loss of reactor coolant through the pressurizer relief valves). Repeated cycling of these relief valves has resulted in valve failure (i.e., relief valve stuck open).

Following a LOCA, reactor core heat is dumped to the containment as reactor coolant and ECCS makeup water spills from the break. For a short-term period, the containment can act as a heat sink; however, the containment cooling systems must operate in order to complete a heat transfer path to the ultimate heat sink (see Section 3.5).

3.1.4 System Success Criteria

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

- An unmitigatible LOCA is not initiated.
- If a mitigatible 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. Volume: 12,240 ft^3, including pressurizer
   2. Normal operating pressure: 2250 psia

B. Pressurizer
   1. Volume: 1400 ft^3

C. Safety Valves (3)
   1. Set pressure: 2485 psig
   2. Relief capacity: 420,000 lb/hr each

D. Power-Operated Relief Valves (2)
   1. Set pressure: 2335 psig
   2. Relief capacity: 210,000 lb/hr each

E. Steam Generators
   1. Type: Vertical shell and U-Tube
   2. Model: Westinghouse 51 Series

F. Pressurizer Heaters
   1. Capacity: 1800 kW

3.1.6 Support Systems and Interfaces

A. Motive Power
   1. The pressurizer heaters are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.7.
   2. The reactor coolant pumps are supplied from Non-Class 1E switchgear.

B. Reactor Coolant Pump Seal Injection Water System
   The chemical and volume control system supplies seal water to cool the reactor coolant pump shaft seals and to maintain a controlled inleakage of seal water into the RCS. Loss of seal water flow may result in RCS leakage through the pump shaft seals which will resemble a small LOCA.

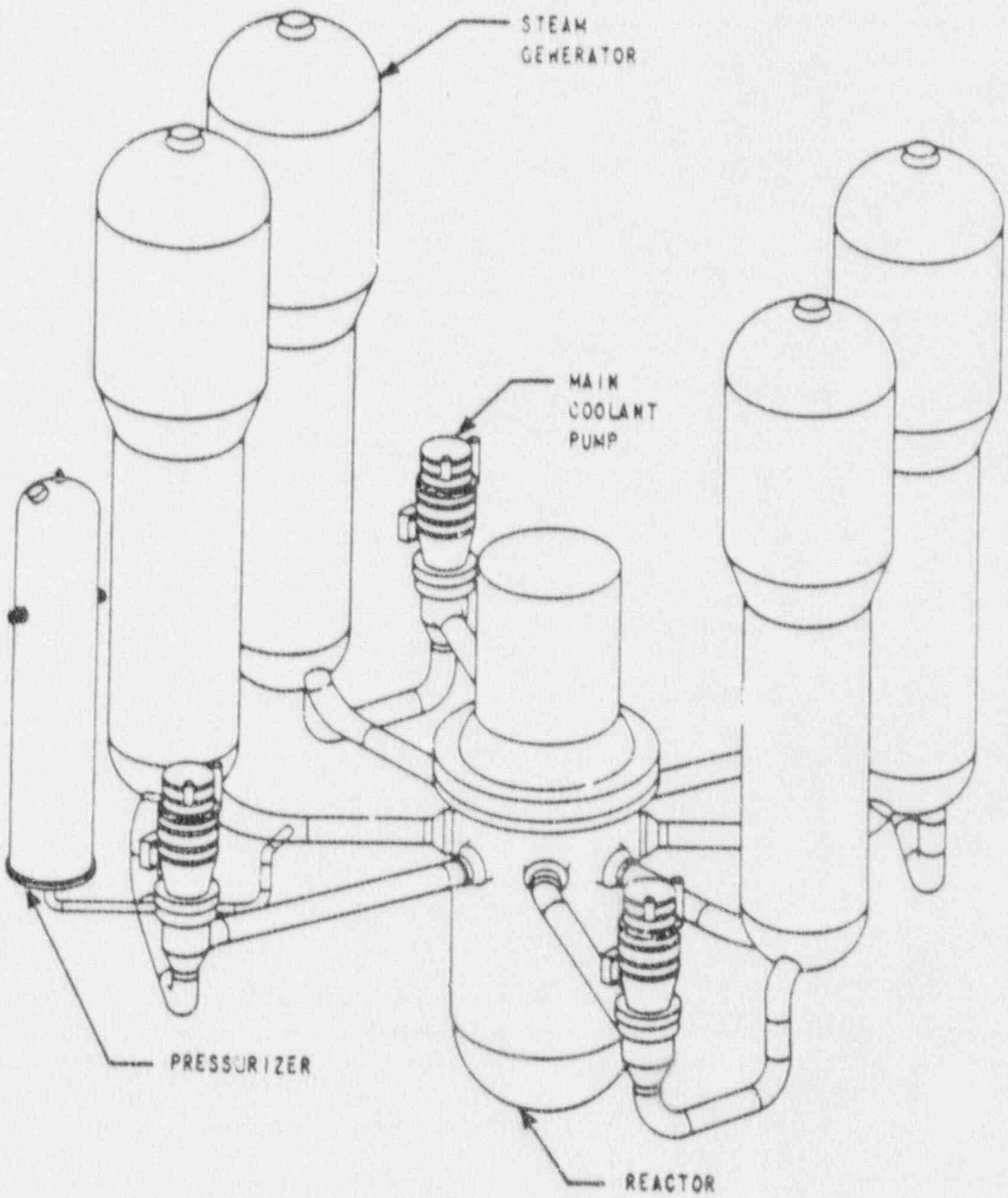


Figure 3.1-1. Isometric View of a 4-Loop Westinghouse RCS.

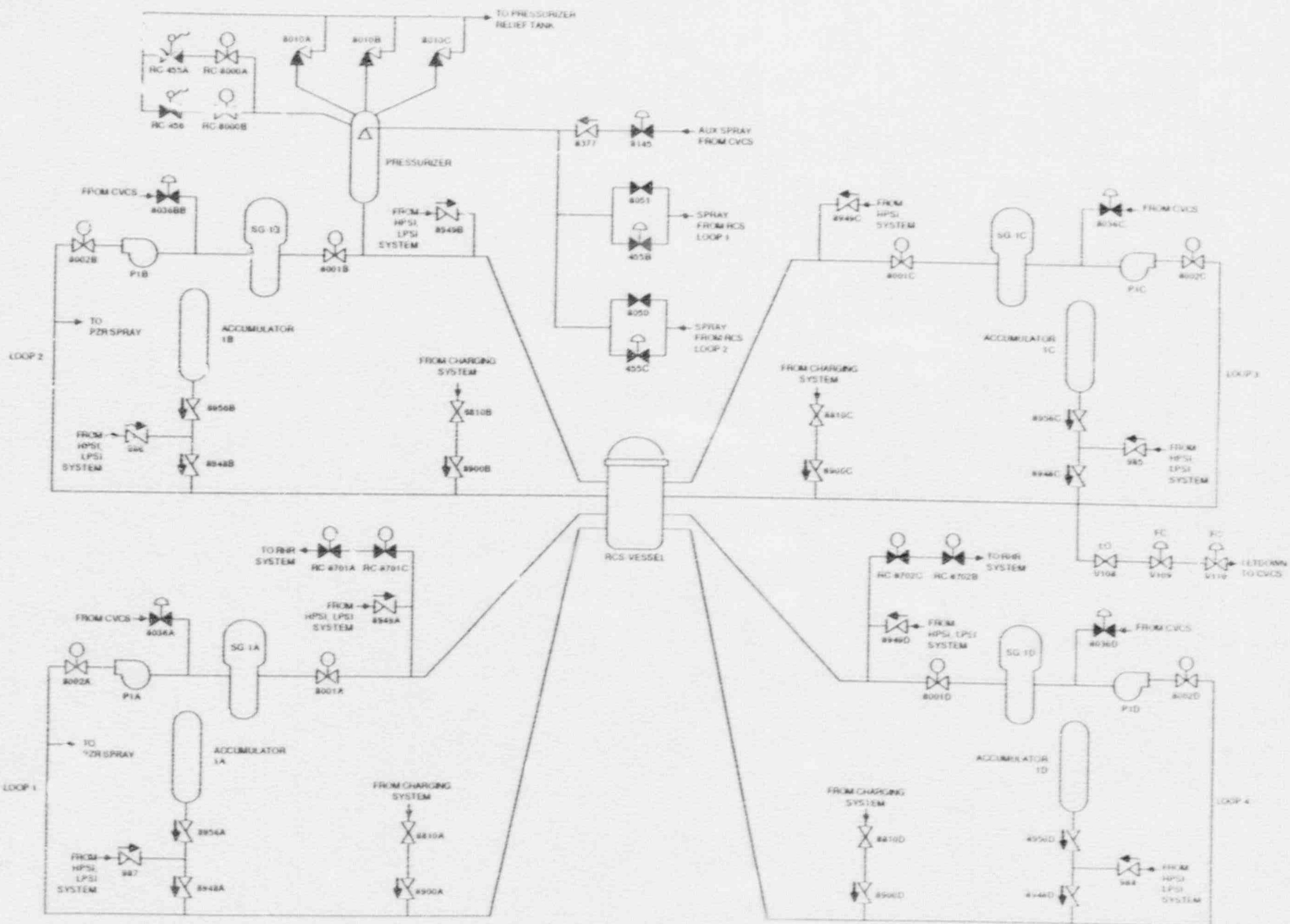


Figure 3.1-2. Millstone 3 Reactor Coolant System

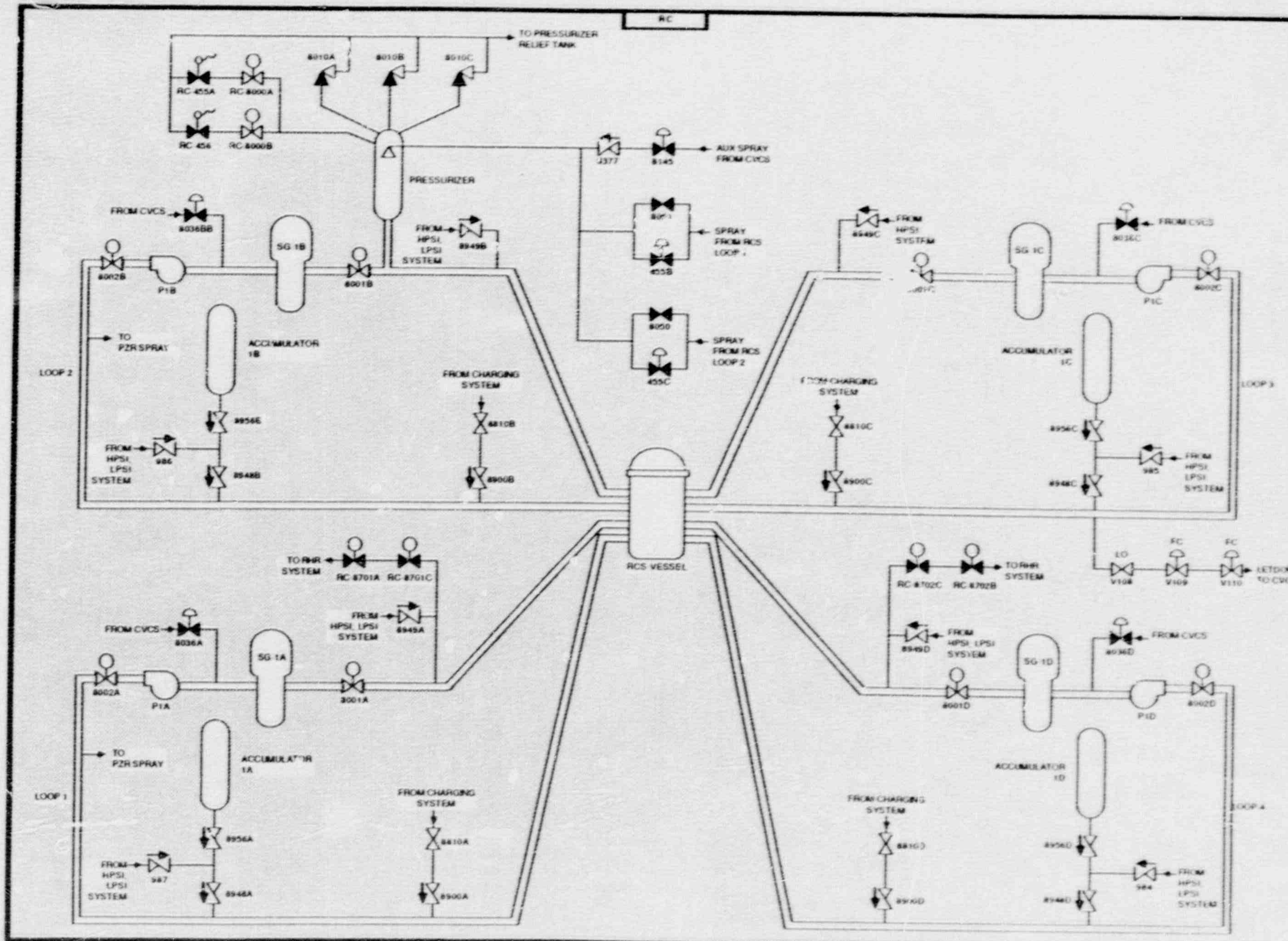


Figure 3.1-3. Millstone 3 Reactor Coolant System Showing Component Locations

Table 3.1-1. Millstone 3 Reactor Coolant System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RC-455A	NV	RC				
RC-456	NV	RC				
RC-8000A	MOV	RC	MCC-3A2	480	AB5	AC/A
RC-8000B	MOV	RC	MCC-3B2	480	AB6	AC/B
RC-8701A	MOV	RC	MCC-3A2	480	AB5	AC/A
RC-8701C	MOV	RC	MCC-3A2	480	AB5	AC/A
RC-8702B	MOV	RC	MCC-3B2	480	AB6	AC/B
RC-8702C	MOV	RC	MCC-3B2	480	AB6	AC/B
RCS-VESSEL	RV	RC				

3.2 AUXILIARY FEEDWATER (AFW) SYSTEM AND SECONDARY RELIEF (SSR) SYSTEM

3.2.1 System Function

The AFW system provides a supply of high-pressure feedwater to the secondary side of the steam gene.ators to remove heat from the reactor coolant system (RCS) when: (a) the main feedwater system is not available, and (b) RCS pressure is too high to permit heat removal by the residual heater removal (RHR) system. The SSR system provides a steam vent path from the steam generators to the atmosphere, thereby completing the heat transfer path to an ultimate heat sink when the main steam and power conversion systems are not available. Together, the AFW and SSR systems constitute an open-loop fluid system that provides for heat transfer from the RCS following transients and a small-break LOCAs.

3.2.2 System Definition

The AFW system consists of two motor-driven pumps and one turbine-driven pump. The normal water sources for the pumps is the demineralized water storage tank (DWST). An alternate source of water is the condensate storage tank (CST). The turbine-driven pump can supply all four steam generators while each motor-driven pump can supply two steam generators. The turbine-driven pump can be supplied with steam from three of the four main steam lines.

The SSR system includes five safety valves and one power-operated pressure control valve on each of the four main steam lines.

Simplified drawings of the AFW and SSR systems are shown in Figures 3.2-1 and 3.2-2. A summary of data on selected AFW system components is presented in Table 3.2-1.

3.2.3 System Operation

During normal operation the AFW system is in standby. Ordinarily, the AFW system is required to operate for about 6 hours to cool the unit down to 350°F, below which temperature the low pressure residual heat removal system operates.

Motor-driven pump 1B is automatically actuated on either two of four low-low level signals in any steam generator, a safety injection signal (SIS), loss of power, or a containment depressurization actuation (CDA) signal. Motor-driven pump 1A is automatically actuated whenever any of the above conditions occur and control is not in LOCAL. The turbine-driven pump is automatically actuated on loss of power or two of four low-low water level signals in any two of four steam generators. The system can also be manually started from the control room.

The primary suction source is the demineralized water storage tank. The DWST is designed to support the plant for 10 hours in a hot standby condition. An additional source of water is the condensate storage tank. However, this source is not safety related and is not considered available for safety related purposes. The normally closed air operated valves connecting the CST to the motor-driven AFW pumps are closed automatically on receipt of an SIS, CDA, AFW pump auto start, or loss of electrical power (LOP) signal. The turbine-driven pump is isolated from the CST by an administratively locked closed valve. The service water system can also provide water to the AFW pumps. However, spool pieces must be installed to connect the two systems.

Flow from each pump goes to all four steam generators through independent paths. Flow is regulated by control valves which are manually adjusted from the control room or the auxiliary shutdown panel.

3.2.4 System Success Criteria

For the decay heat removal function to be successful, both the AFW system and the SSR system must operate successfully. The AFW success criteria are the following (Ref. 1, Section 10.4.9):

- Two motor-driven pumps or the turbine driven pump can provide adequate flow.
- Water must be provided from the demineralized water storage tank or the CST to the AFW pump suctions . Note that the CST is not a safety related source.
- Makeup to any two steam generators provide adequate decay heat removal from the reactor coolant system.

In NUREG/CR-4142 (Ref. 2), different system success criteria is described as follows:

- Deliver 235 gpm to at least 3 of 4 steam generators

Conflicting references are made in NUREG/CR-4142 (Ref. 2) and in NUREG-1152 (Ref. 3) that any one AFW pump can provide adequate makeup to the steam generators, even though each motor-drive pump only supplies two steam generators.

The SSR system must operate to complete the heat transfer path to the environment. The number of safety valves or secondary steam relief valves that must open for the decay heat removal function is not known.

3.2.5 Component Information

A. Motor-driven AFW pumps 1A and 1B
   1. Rated flow: 575 gpm @ 2975 ft. head (1290 psid)
   2. Rated capacity: 100% each
   3. Type: Centrifugal

B. Turbine-driven AFW pump 2
   1. Rated flow: 1150 gpm @ 2975 ft. head (1290 psid)
   2. Rated capacity: 200%
   3. Type: Centrifugal

C. Demineralized water storage tank
   1. Capacity: 340,000 gallons
   2. Design pressure: Atmospheric

D. Condensate storage tank
   1. Capacity: 300,000 gallons
   2. Design pressure: Atmospheric

E. Secondary steam relief valves
   1. Five safety valves per main steam line
   2. One power-operated pressure control valve per main steam line

3.2.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      Motor-driven AFW pumps 1B is automatically actuated based on the following signals:

- two of four low-low water level in any one steam generator
- safety injection signal (SIS)
- loss of power (LOP)
- containment depressurization actuation (CDA)

Motor-driven pump 1A is automatically actuated on the above signals when control is not in LOCAL. The turbine-driven pump is automatically actuated on LOP or two of four low-low water level in two of four steam generators.

2. Remote manual
The AFW system can be actuated by remote manual means from the main control room and from the auxiliary shutdown panel.

B. Motive power
1. The AFW motor-driven pumps and motor-operated valves are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.7. Redundant loads are supplied from separate load groups.
2. The AFW turbine-driven pump is supplied with steam from three of four main steam lines

C. Other
1. Lubrication, cooling, and ventilation are provided locally for the pumps.

3.2.7 Section 3.2 References

1. Millstone 3 Final Safety Analysis Report.

2. NUREG/CR-4142, "A Review of the Millstone 3 Probabilistic Safety Study," Lawrence Livermore National Laboratory, April 1986.

3. NUREG-1152, "Millstone 3 Risk Evaluation Report," USNRC, June 1986.

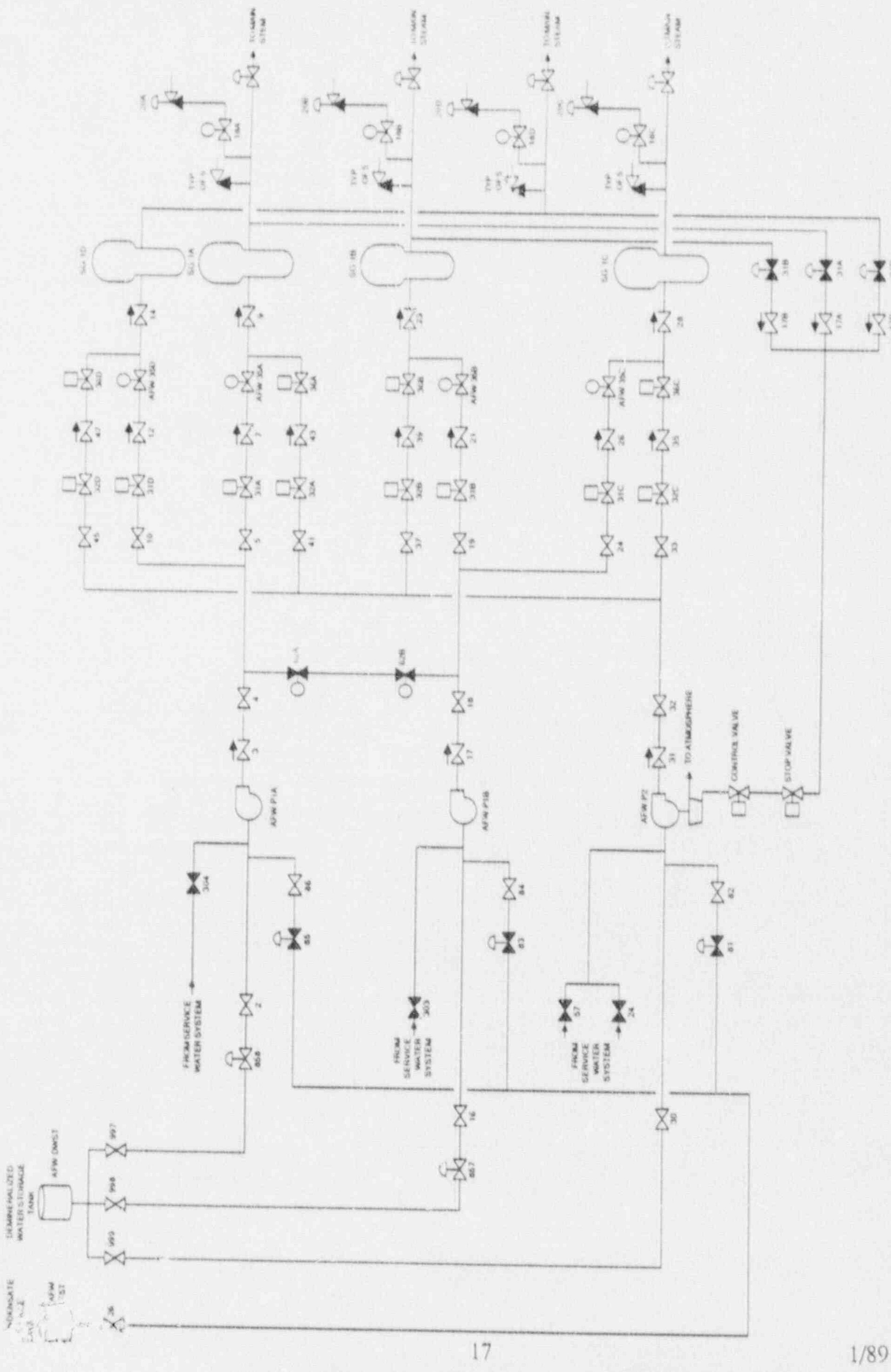


Figure 3.2-1. Millstone 3 Auxiliary Feedwater System

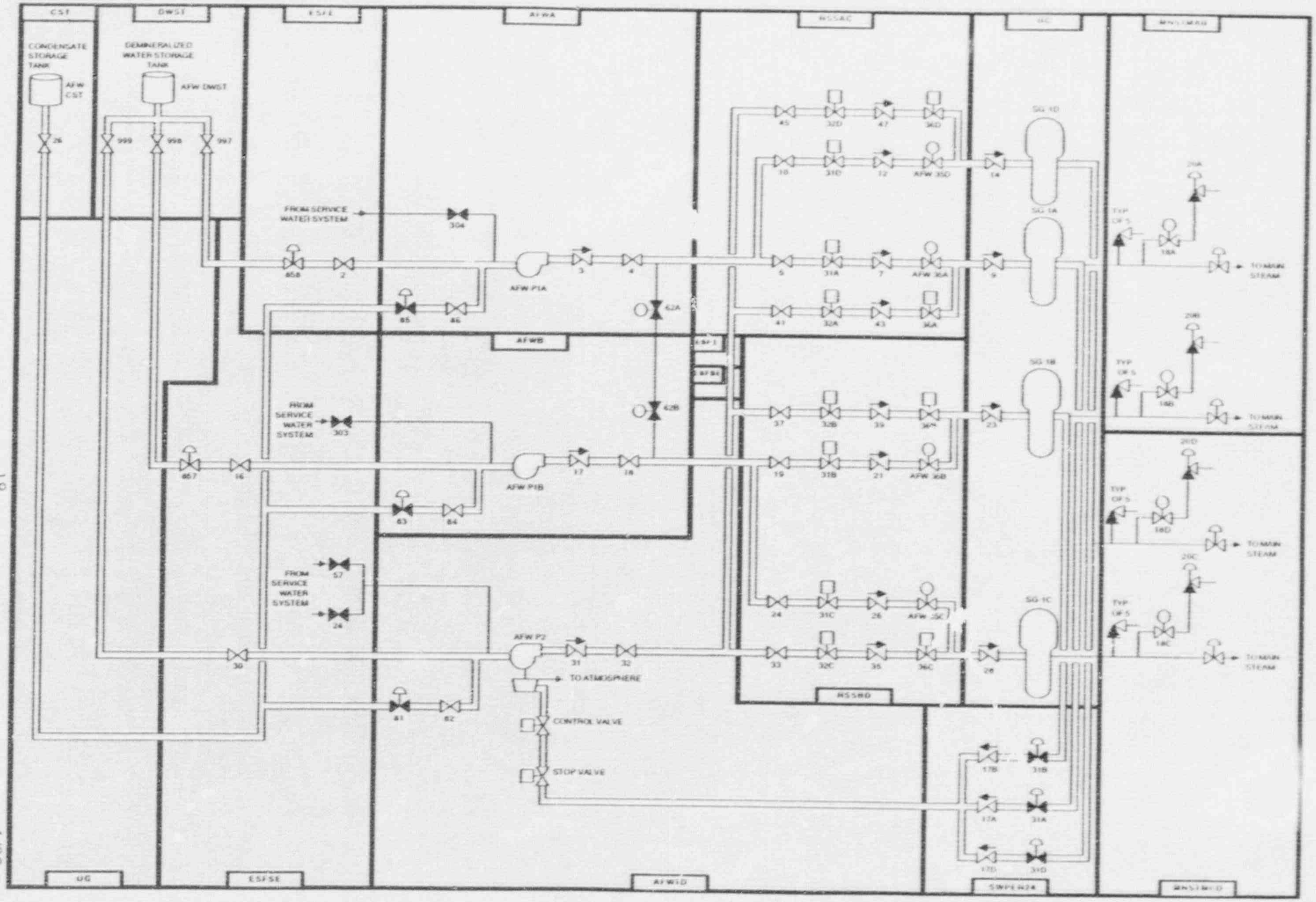


Figure 3.2-2. Millstone 3 Auxiliary Feedwater System Showing Component Locations

Table 3.2-1. Millstone 3 Auxiliary Feedwater System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
AFW-35A	MOV	RSSAC	MCC-1B4	480	ESFSE36	AC/B
AFW-35B	MOV	RSSBD	MCC-1A4	480	ESFE36	AC/A
AFW-35C	MOV	RSSBD	MCC-1A4	480	ESFE36	AC/A
AFW-35D	MOV	RSSAC	MCC-1B4	480	ESFSE36	AC/B
AFW-CST	TANK	CST				
AFW-DWST	TANK	DWST				
AFW-P1A	MDP	AFWA	BUS-34C	4160	CB2	AC/A
AFW-P1B	MDP	AFWB	BUS-34D	4160	CB1	AC/B
AFW-P2	TDP	AFWTD				
SG-1A	SG	RC				
SG-1B	SG	RC				
SG-1C	SG	RC				
SG-1D	SG	RC				

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 coolant injection function is performed during a relatively short-term period after LOCA initiation, followed by realignment to a recirculation mode of operation to maintain long-term, post-LOCA core cooling. Heat from the reactor core is transferred to the containment. The heat transfer path to the ultimate heat sink is completed by the containment cooling systems (see Section 3.5).

3.3.2 System Definition

The emergency coolant injection (ECI) function is performed by the following ECCS subsystems:

- Passive cold leg accumulators
- Charging system (CVCS)
- High pressure safety injection (HPSI) system
- Residual heat removal (RHR) system

The charging function of the CVCS is described in Section 3.4.

The HPSI system provides high pressure coolant injection capability. The RHR pumps perform the low pressure injection function. The Refueling Water Storage Tank (RWST) is the water source for both the high and low pressure injection systems. Both systems inject coolant into all four RCS cold legs. The HPSI system can also inject into all four hot legs, while the RHR system can inject into two hot legs.

After the injection phase is completed, recirculation (ECR) is performed by the RHR pumps drawing suction from the containment sump and discharging into the RCS cold legs. Heat is transferred to the component cooling water system by the RHR heat exchangers. The RHR pumps can also deliver water to the suction of the HPSI and charging pumps during recirculation.

Long-term containment and core decay heat removal is performed by the containment recirculation system (see Section 3.5).

Simplified drawings of the high pressure safety injection system are shown in Figures 3.3-1 and 3.3-2. The low pressure safety injection (RHR) system is shown in Figures 3.3-3 and 3.3-4. Interfaces between the accumulators, the ECCS injection and recirculation subsystems, and the RCS are shown in Section 3.1. A summary of data on selected ECCS components is presented in Table 3.3-1.

3.3.3 System Operation

During normal operation, the ECCS is in standby. Following a LOCA, the four cold leg injection accumulators (one for each loop) supply borated water to the RCS as soon as RCS pressure drops below accumulator pressure (approximately 650 psig). A safety injection signal (SIS) automatically starts the charging pumps, the safety injection pumps, and the RHR pumps, and aligns the charging pumps for injection. The charging pumps inject through the boron injection tank (BIT) into the four RCS cold legs. The HPSI and RHR pumps can inject into either the cold legs or the hot legs. All pumps are aligned to take suction on the RWST.

For small breaks, operator action can be taken to augment the RCS depressurization by utilizing the secondary steam dump capability and the auxiliary feedwater (AFW) system (i.e., depressurization due to rapid heat transfer from the RCS).

When the RWST water level drops to a prescribed low level setpoint, the RHR pumps are realigned to draw a suction from the containment sump and deliver water to the RCS. If depressurization of the RCS proceeds slowly, high pressure recirculation can be

accomplished by manually aligning the discharge of the RHR pumps to the suction of the charging and HPSI pumps.

3.3.4 System Success Criteria

LOCA mitigation requires that both the emergency coolant injection and emergency coolant recirculation functions be accomplished. The ECI success criteria for LOCAs are not clear in the Millstone 3 FSAR, however, the following is noted:

- A .375 inch diameter break is the maximum break size for which the normal makeup system can maintain the pressurizer level and the normal reactor coolant system pressure of 2250 psia. For a break of this size, one charging pump is adequate to sustain pressure level at an RCS pressure of 2250 psia. This break results in a loss of approximately 17.5 lb/sec (127 gpm at 130°F and 2250 psia) (Ref. 1).

- For a small break LOCA (less than 1.0 ft^2) the high head portion of the ECCS, together with the accumulators, provide sufficient core flooding (Ref. 1).

- For a large break LOCA (greater than 1.0 ft^2) in which the break is in one injection path, three accumulators, one charging pump, one safety injection pump, and one residual heat removal pump provide sufficient core flooding (Ref. 2).

3.3.5 Component Information

A. High pressure safety injection pumps 1A and 1B
   1. Rated flow: 425 gpm @ 2850 ft head (1235 psid)
   2. Rated capacity: 100%
   3. Discharge pressure at shutoff head: 4037 ft head (1750 psig)
   4. Type: horizontal centrifugal

B. Low pressure safety injection (RHR) pumps 1A and 1B
   1. Rated flow: 4000 gpm @ 350 ft. head (152 psid)
   2. Rated capacity: 100%
   3. Type: vertical centrifugal

C. Cold leg injection accumulators (4)
   1. Accumulator volume: 1350 ft^3
   2. Minimum water volume: 950 ft^3
   3. Normal operating pressure: 650 psig
   4. Nominal boric acid concentration: 2000 ppm

D. Refueling water storage tank
   1. Capacity: 1,166,000 gallons
   2. Design pressure: Atmospheric
   3. Minimum boron concentration: 2000 ppm

E. RHR heat exchangers 1A and 1B
   1. Design duty: 35.27 x 10^6 Btu/hr
   2. Type: Vertical, shell and U-tube

3.3.6 Support Systems and Interfaces

A. Control signals
   1. Automatic
      The ECCS injection subsystems are automatically actuated by a safety injection signal (SIS). Conditions initiating an SIS trip are:

      a. Low pressurizer pressure
      b. Low steam line pressure
      c. High containment pressure
      d. Manual actuation

      The SIS automatically initiates the following actions:

      - starts the diesel generators
      - starts the charging, SI, and RHR pumps
      - aligns the charging pumps for injection
      - trips the main feedwater pumps

      Switchover to the recirculation mode occurs automatically on low-low level in the RWST.

   2. Remote manual
      An SIS signal can be initiated by remote manual means from the main control room. The transition from the injection to the recirculation phase of ECCS operation can be initiated by remote manual means. Manual action is required to realign the charging and safety injection pumps for recirculation.

B. Motive Power
   1. The ECCS motor-driven pumps and motor-operated valves are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.7.

C. Other
   1. Each HPSI and charging pump is cooled by the Service Water system (see Section 3.8).
   2. The RHR pumps and heat exchangers are cooled by the Component Cooling Water system.
   3. Lubrication and ventilation are provided locally for the HPSI, RHR, and charging pumps and motors.

3.3.7 Section 3.3 References

1. Millstone 3 Nuclear Station FSAR, Section 6.3.

2. Reference Safety Analysis Report 3S, Westinghouse Nuclear Energy Systems, Section 6.3.3.2.

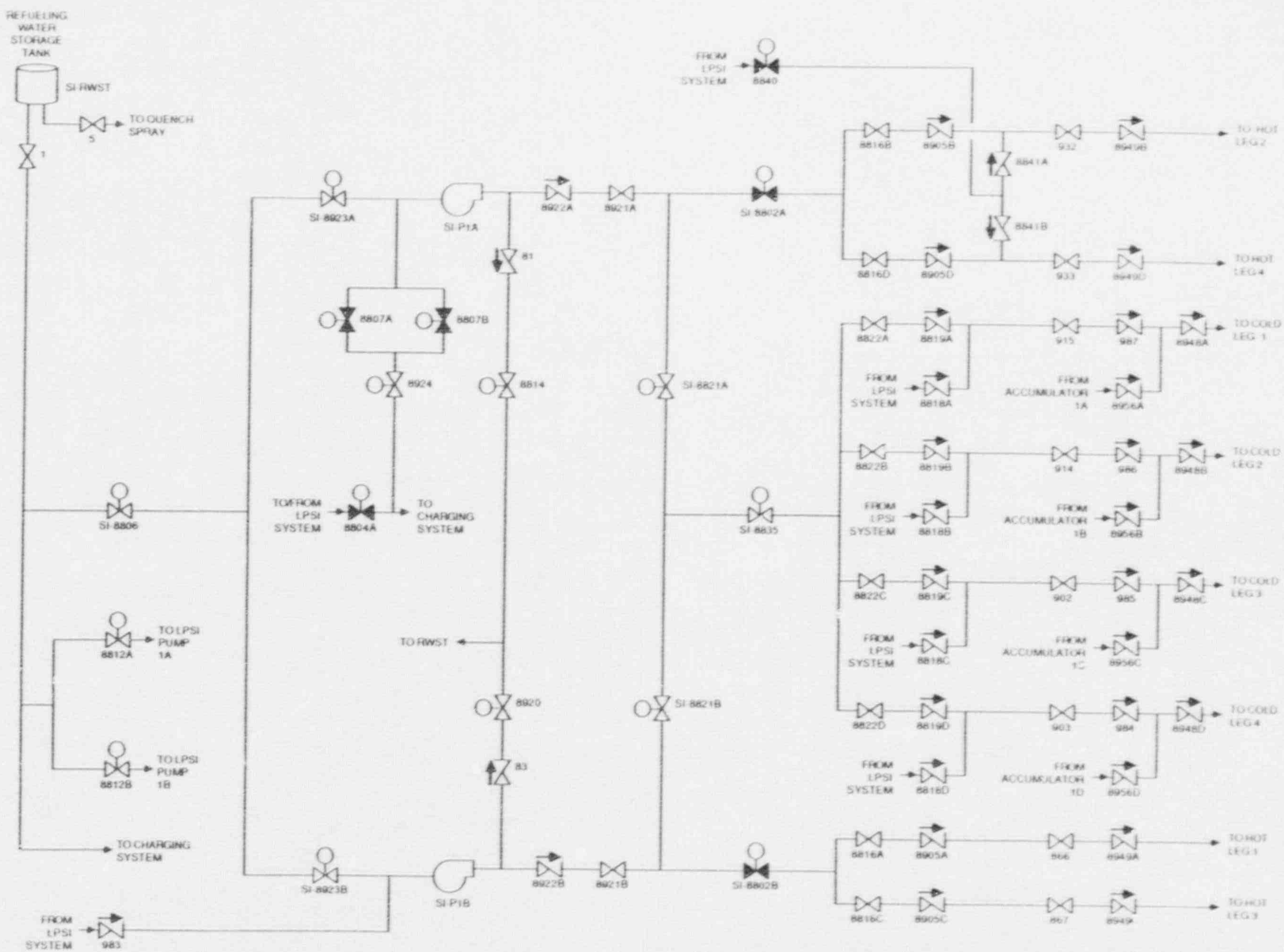


Figure 3.3-1. Millstone 3 High Pressure Safety Injection System

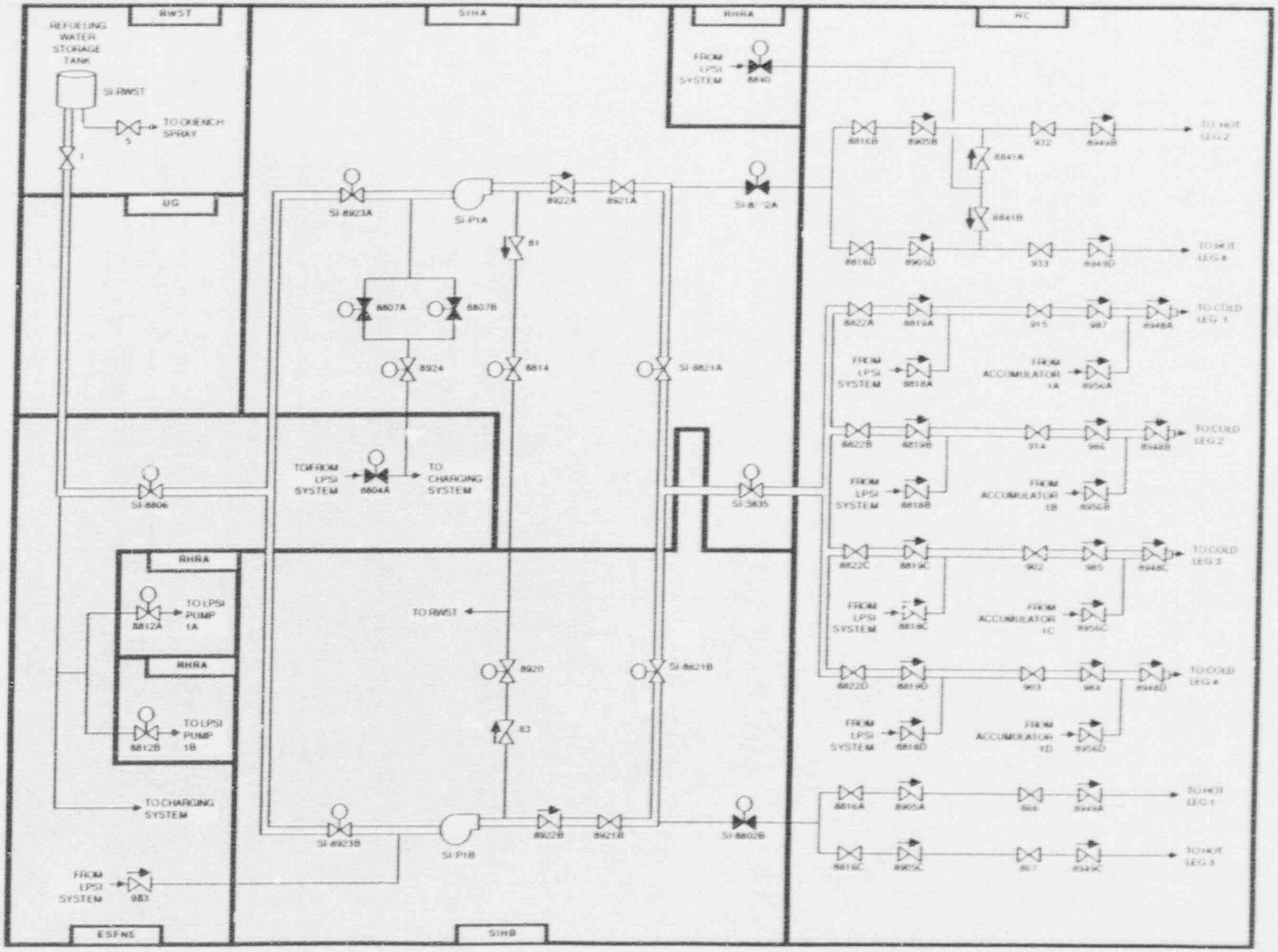


Figure 3.3-2. Millstone 3 High Pressure Safety Injection System Showing Compoment Locations

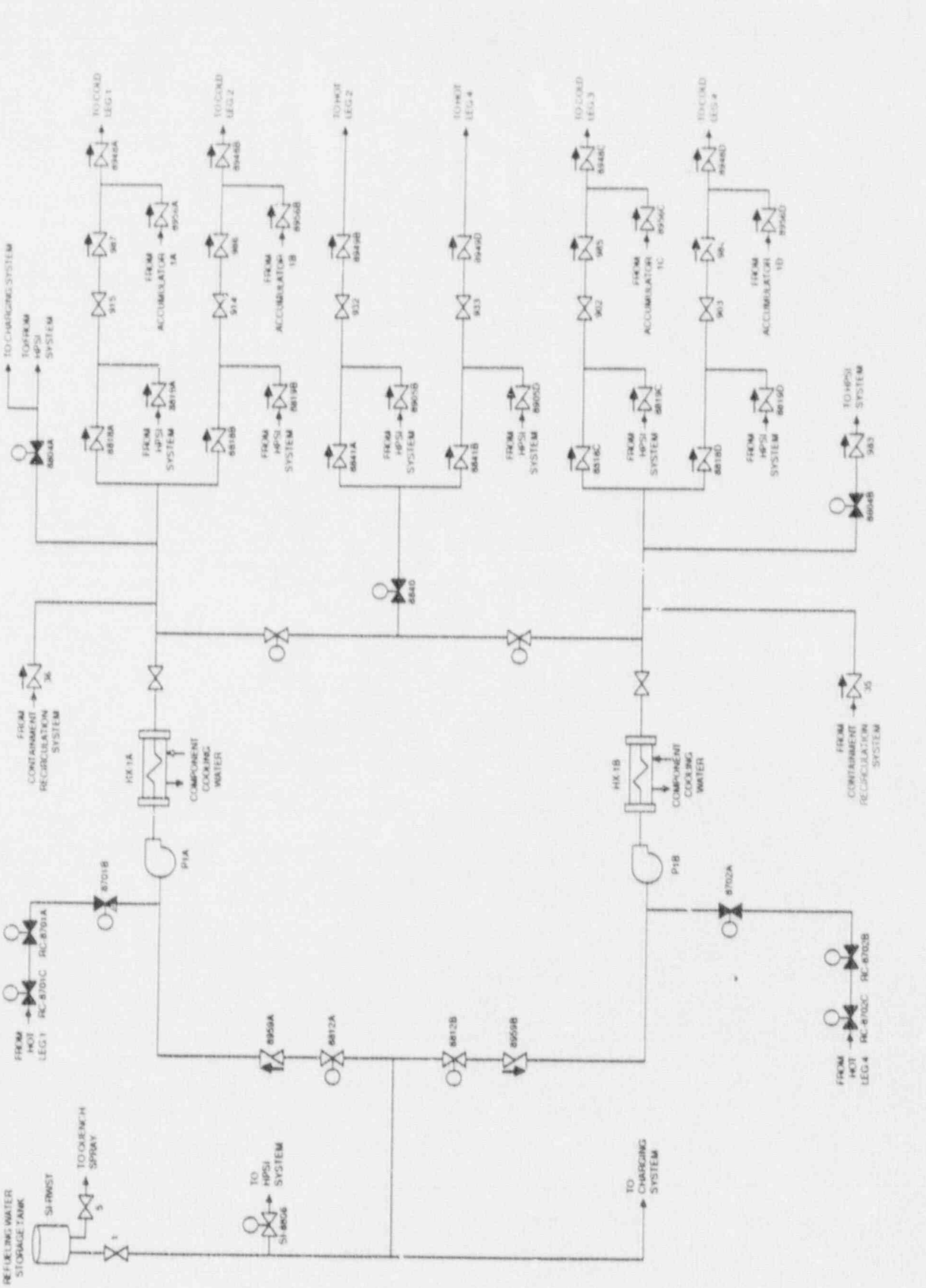


Figure 3.3-3. Millstone 3 Low Pressure Safety Injection System

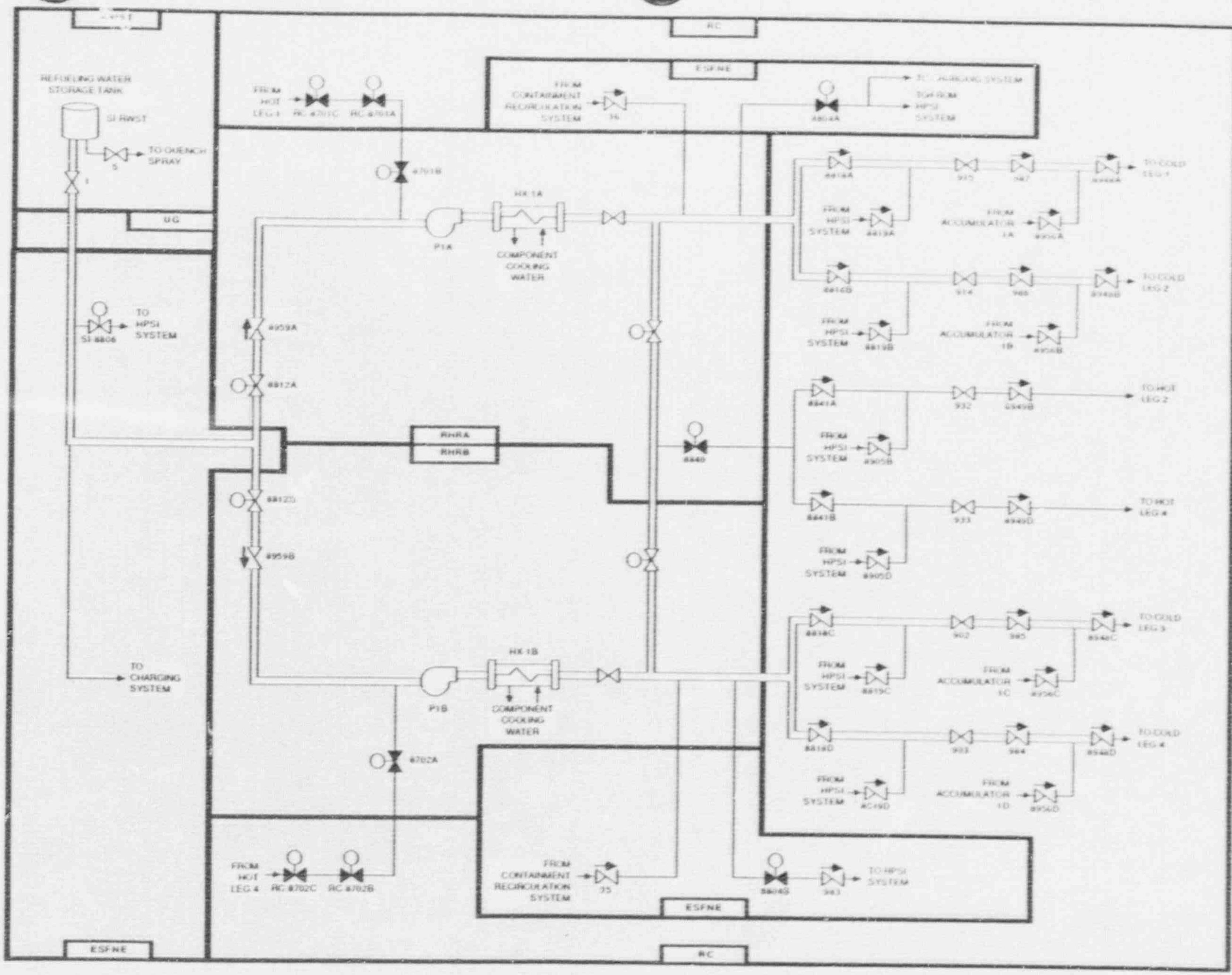


Figure 3.3-4. Millstone 3 Low Pressure Safety Injection System Showing Component Locations

Table 3.3-1. Millstone 3 Emergency Core Cooling System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RWST	TANK	RWST				
SI-8802A	MOV	SIHA	MCC-1A4	480	ESFE36	AC/A
SI-8802B	MOV	SIHB	MCC-1B3	480	ESFN36	AC/B
SI-8806	MOV	ESFNE	MCC-1B3	480	ESFN36	AC/B
SI-8821A	MOV	SIHA	MCC-1A4	480	ESFE36	AC/A
SI-8821A	MOV	SIHA	MCC-1A4	480	ESFE36	AC/A
SI-8821B	MOV	SIHB	MCC-1B3	480	ESFN36	AC/B
SI-8821B	MOV	SIHB	MCC-1B3	480	ESFN36	AC/B
SI-8835	MOV	SIHA	MCC-1A4	480	ESFE36	AC/A
SI-8923A	MOV	SIHA	MCC-1A4	480	ESFE36	AC/A
SI-8923B	MOV	SIHB	MCC-1B3	480	ESFN36	AC/A
SI-P1A	MDP	SIHA	BUS-34C	4160	AC/A	
SI-P1B	MDP	SIHB	BUS-34D	4160	CB1	AC/B

3.4 CHARGING SYSTEM

3.4.1 System Function

The charging system is part of the Chemical and Volume Control System (CVCS). The CVCS is responsible for maintaining the proper water inventory in the Reactor Coolant System and maintaining water purity and the proper concentration of neutron absorbing and corrosion inhibiting chemicals in the reactor coolant. The makeup function of the CVCS is assumed to be required to maintain the plant in a long-term (8 hours) hot shutdown condition. The charging pumps also operate as part of the ECCS in the event of a LOCA.

3.4.2 System Definition

The CVCS provides a means for injection of control poison in the form of boric acid solution, chemical additions for corrosion control, and reactor coolant cleanup and degasification. This system also maintains the required water inventory in the RCS, reprocesses water that is letdown from the RCS, provides seal water injection to the reactor coolant pump seals, and performs an emergency core cooling function.

The CVCS consists of several subsystems: the charging, letdown, and seal water system, the reactor coolant purification and chemistry control system, the reactor makeup control system, and the boron thermal regeneration system. The functions of the CVCS are performed by the following components: (a) the charging pumps, (b) boric acid transfer pumps, (c) volume control tank, (d) boric acid tanks, and (e) various heat exchangers and demineralizers.

Simplified drawings of the CVCS, focusing on the charging portion of the system, are shown in Figures 3.4-1 and 3.4-2. A summary of data on selected charging system components is presented in Table 3.4-1.

3.4.3 System Operation

During normal plant operation, one charging pump is running with its suction aligned to the Volume Control Tank (VCT). The letdown flow from a RCS cold leg is cooled in the shell side of the regenerative heat exchanger, then directed to the VCT. The reactor makeup control system maintains the desired inventory in the VCT. The bulk of the charging flow is pumped back to the RCS through the tube side of the regenerative heat exchanger via two charging lines. Portions of the charging flow are directed to the reactor coolant pumps through a seal water injection filter, and to pressurizer spray.

Two of the three centrifugal charging pumps also provide high-head injection as part of the ECCS (see Section 3.3). During a LOCA the CVCS is isolated except for the charging pumps and the piping in the safety injection path. The pumps take suction on the Refueling Water Storage Tank (RWST) and inject via the Boron Injection Tank into all four cold legs.

3.4.4 System Success Criteria

For post-transient makeup to the RCS the following charging system success criteria are assumed:

- A long-term water source must be availab.e to the charging pumps. Available water sources include (insert actual sources)
- One of three charging pumps is available.
- A makeup path to the RCS is available.

3.4.5 Component Information

A. Centrifugal charging pumps 3A, 3B, 3C
   1. Rated flow: 150 @ 5800 ft head (2514 psid)
   2. Rated capacity: 100% for RCS makeup
   3. Type: centrifugal

3.4.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      a. The charging pumps are automatically actuated by a safety injection signal (SIS).

      b. The charging pumps are automatically aligned for safety injection by a SIS.

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

B. Motive Power
   1. The centrifugal charging pumps and motor operated valves of the CVCS are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.7.

C. Other
   1. The centrifugal charging pumps are cooled by the Service Water System (see Section 3.8).
   2. Pump lubrication and ventilation are provided locally.

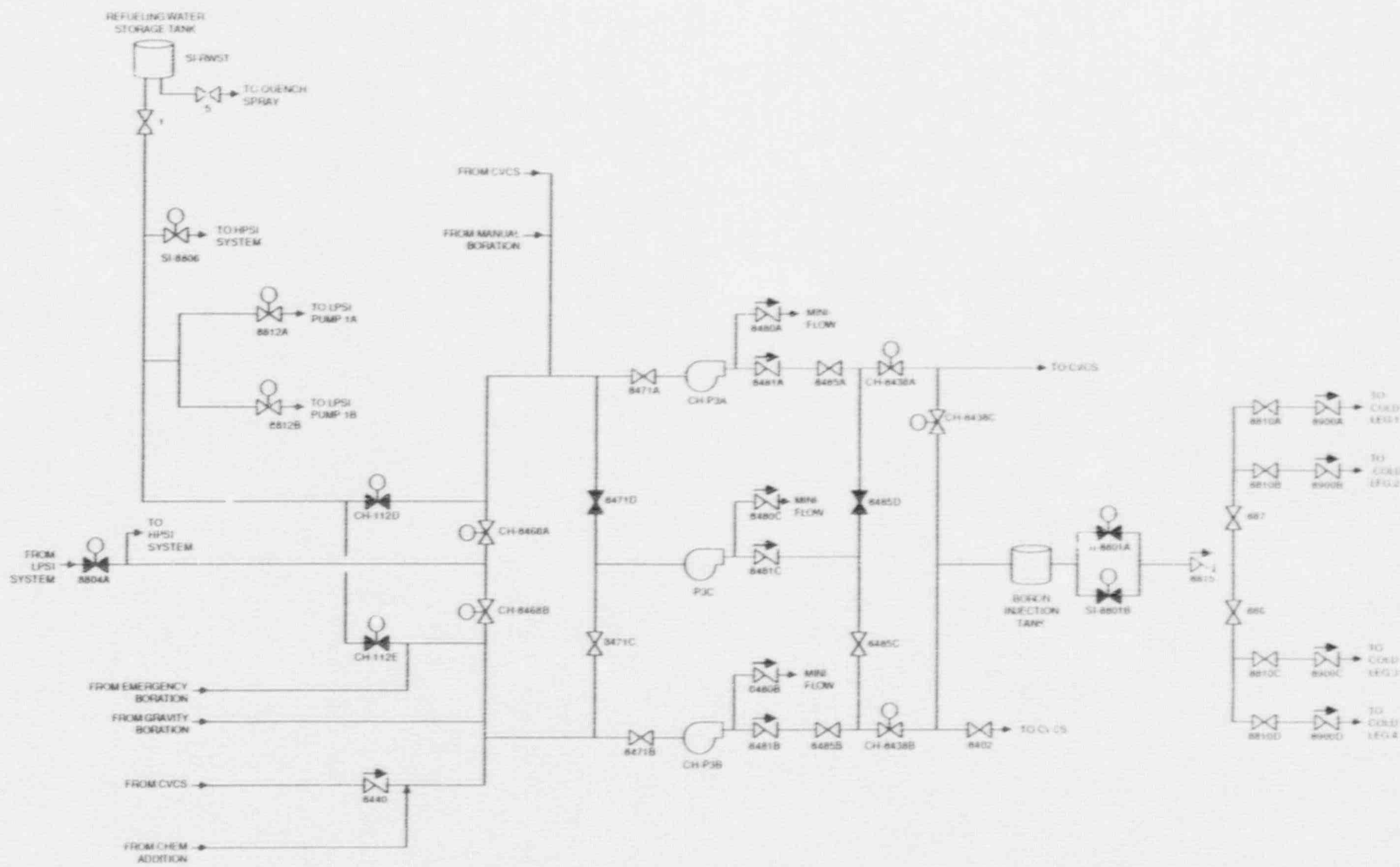


Figure 3.4-1. Millstone 3 Charging System

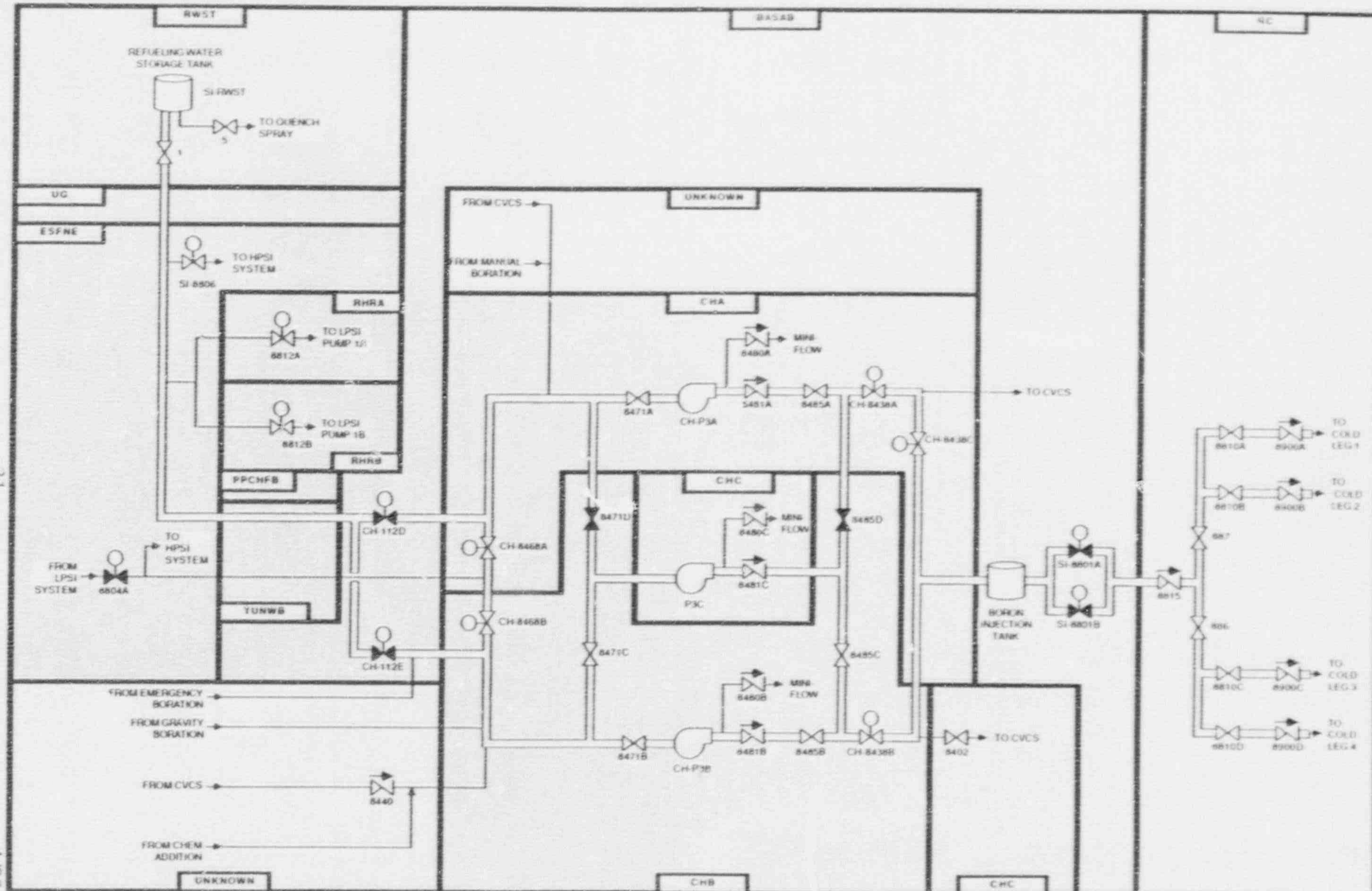


Figure 3.4-2. Millstone 3 Charging System Showing Component Locations

Table 3.4-1. Millstone 3 Charging System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
CH-112D	MOV	BASAB	MCC-3A1	480	AB5	AC/A
CH-112E	MOV	BASAB	MCC-3B1	480	AB6	AC/B
CH-8438A	MOV	CHA	MCC-3A1	480	AB5	AC/A
CH-8438B	MOV	CHB	MCC-3B1	480	AB6	AC/B
CH-8438C	MOV	CHA	MCC-3A1	480	AB5	AC/A
CH-8468A	MOV	CHA	MCC-3A1	480	AB5	AC/A
CH-8469B	MOV	CHB	MCC-3B1	480	AB6	AC/B
CH-P3A	MDP	CHA	BUS-34C	4160	CB2	AC/A
CH-P3B	MDP	CHB	BUS-34D	4160	CB1	AC/B
SI-8801A	MOV	BASAB	MCC-3A1	480	AB5	AC/A
SI-8801B	MOV	BASAB	MCC-3B1	480	AB6	AC/B

3.5 CONTAINMENT HEAT REMOVAL SYSTEM

3.5.1 System Function

The containment heat removal system is an integrated set of subsystems that provide the functions of containment heat removal and containment pressure control following a loss of coolant accident. In conjunction with the ECCS, the containment heat removal system completes the post-LOCA heat transfer path from the reactor core to the ultimate heat sink.

3.5.2 System Definition

The containment heat removal system consists of two separate subsystems:

- Quench Spray System (QSS)
- Containment Recirculation System (CRS)

The QSS consists of two parallel redundant subsystems, each feeding one 360 degree spray header. Each QSS subsystem consists of one horizontal centrifugal pump drawing suction from the Refueling Water Storage Tank (RWST). The CRS consists of two parallel redundant subsystems, each feeding two 360 degree spray headers. Each CRS subsystem consists of two vertical centrifugal pumps and two heat exchangers, which transfer heat to the service water system. The four CRS pumps take suction from a common containment sump. In each subsystem the two spray headers are shared between the two pumps.

Simplified drawings of the Containment Recirculation System are shown in Figures 3.5-1 and 3.5-2. The interface between the CRS heat exchanger and the service water system is shown on the SW system drawings in Section 3.8. The interfaces are through motor operated valves CRS-54A through CRS-54D, and CRS-57A through CRS-57D. A summary of data on selected containment heat removal system components is presented in Table 3.5-1.

3.5.3 System Operation

During normal operation, the QSS and CRS are in standby. Following a LOCA the QSS is activated immediately upon receipt of a Containment Depressurization Actuation (CDA) signal. This signal is initiated when containment pressure reaches 24.7 psia. Each QSS pump draws water independently from the RWST. Sodium hydroxide is added to the water by direct gravity feed from the chemical addition tank. If both pumps operate the system fill time (time for water to reach the spray headers) is 33 seconds. If one pump operates system fill time is 64 seconds (Ref. 1).

The CRS pumps are started approximately 670 seconds after the CDA signal. The four CRS pumps take suction from a common containment sump and pump water through the CRS heat exchangers to the four spray headers. At the heat exchangers CRS water flows through the shell where it is cooled by service water flowing in the tubes. Each CRS spray header is fed by two risers, each riser running from one of the two CRS heat exchangers in each subsystem.

Heat is transferred from the containment atmosphere to the quench and containment recirculation system spray water. Heat is transferred from the containment to the service water system through the CRS heat exchangers.

3.5.4 System Success Criteria

One of two pumps must operate for QSS success. It is stated in Ref. 1 (Table 6.2.61) that two of four pumps must operate for CRS success. However, Section 6.3.2 of Ref. 1 states one pump and one heat exchanger must operate for CRS success. It could not be determined whether both the QSS and CRS must operate for the containment heat removal function to be successful following a large LOCA.

3.5.5 Component Information

A. Containment Recirculation Pumps 1A, 1B, 1C and 1D
   1. Rated flow: 3950 gpm @ 342 ft. head (148 psid)
   2. Rated capacity: 100%
   3. Type: vertical centrifugal

B. Containment Recirculation Heat Exchangers (4)
   1. Design duty: 3.79×10^6 Btu/hr
   2. Type: shell and tube

C. Quench Spray Pumps (2)
   1. Rated flow: 4000 gpm @ 291 ft. head (126 psid)
   2. Rated capacity: 100%
   3. Type: horizontal centrifugal

3.5.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The QSS pumps are automatically actuated by a CDA signal. The CRS pumps are automatically actuated approximately 670 seconds after a CDA signal.
   2. Remote manual
      The QSS and CRS can be actuated by remote manual means from the control room.

B. Motive Power
   1. The QSS and CRS pumps and motor-operated valves are Class 1E AC loads that can be supplied from the standby diesel generators, as described in Section 3.7. Redundant loads are supplied from separate load groups.

C. Cooling Water
   1. The CRS heat exchangers are cooled by the Service Water System (see Section 3.8).

D. Other
   1. Lubrication, ventilation, and pump cooling are provided locally for the QSS and CRS pumps.

3.5.7 Section 3.5 References

1. Millstone Nuclear Power Station, Unit No. 3 Final Safety Analysis Report, Northeast Utilities Service Co., Hartford Ct..

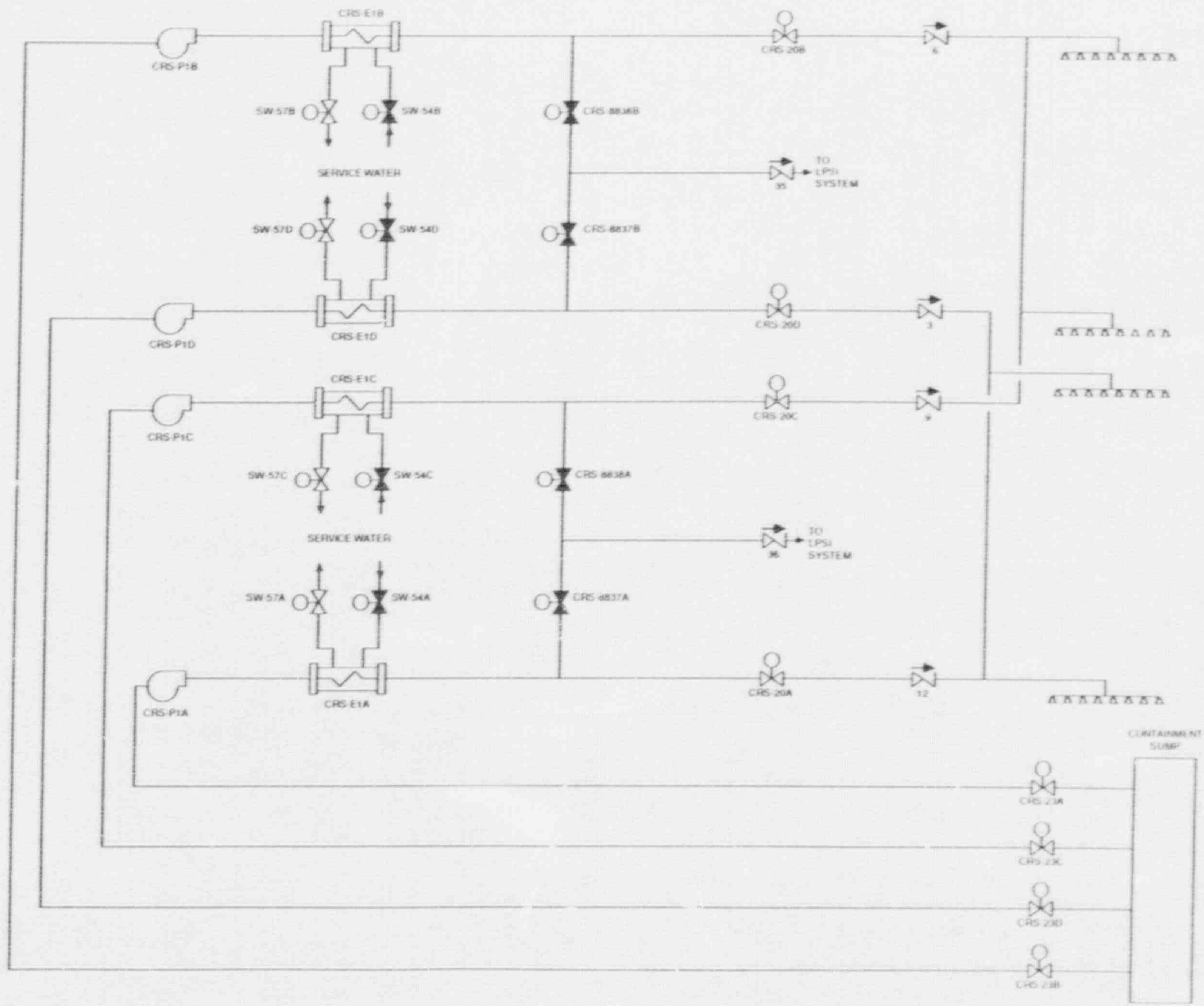


Figure 3.5-1. Millstone 3 Containment Recirculation System

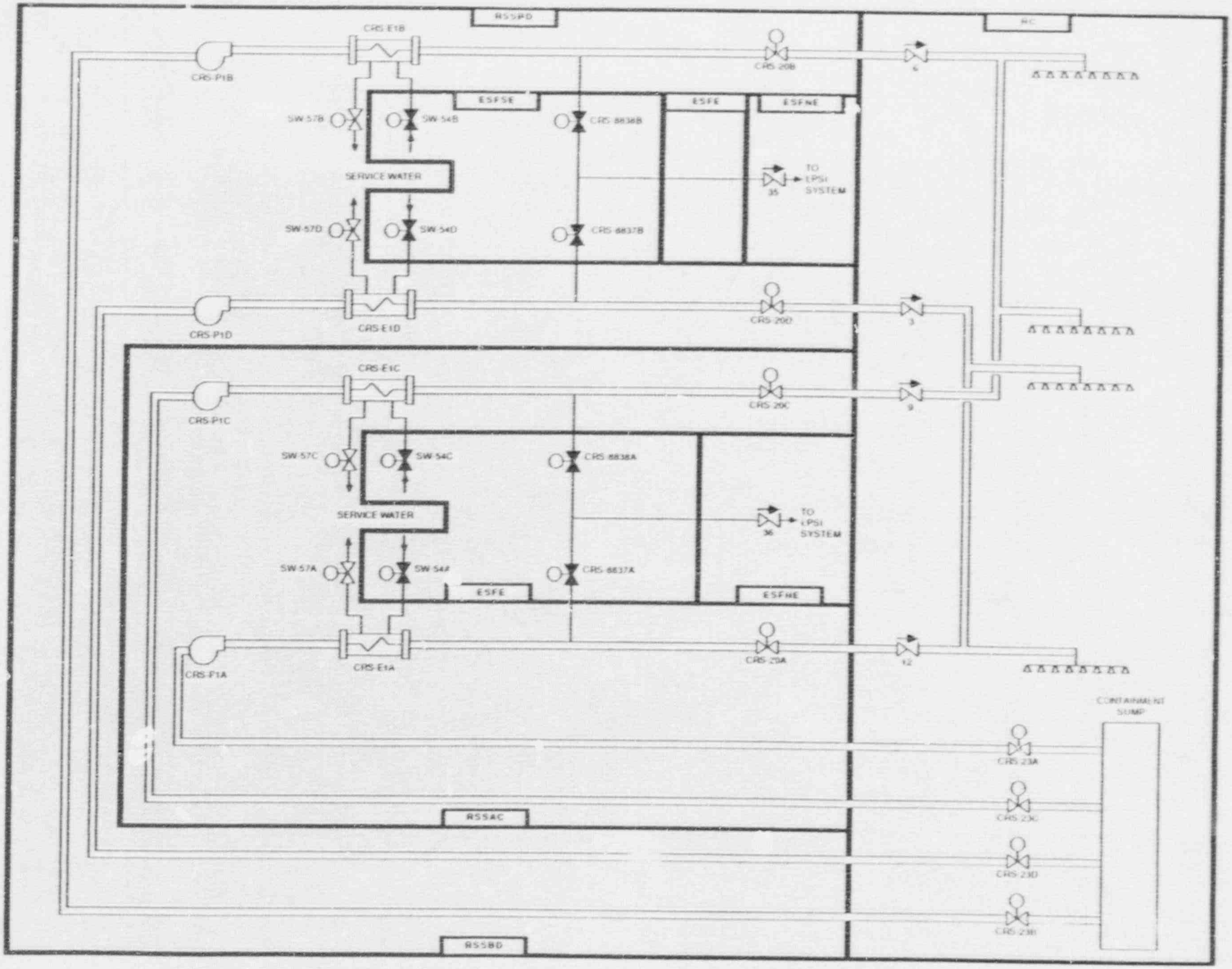


Figure 3.5-2. Millstone 3 Containment Recirculation System Showing Component Locations

Table 3.5-1. Millstone 3 Containment Heat Removal System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
CRS-20A	MOV	RSSAC	MCC-1A4	480	ESFE36	AC/A
CRS-20B	MOV	RSSBD	MCC-1B4	480	ESFSE36	AC/B
CRS-20C	MOV	RSSAC	MCC-1A4	480	ESFE36	AC/A
CRS-20D	MOV	RSSBD	MCC-1B4	480	ESFSE36	AC/B
CRS-23A	MOV	RSSAC	MCC-1A4	480	ESFE36	AC/A
CRS-23B	MOV	RSSBD	MCC-1B4	480	ESFSE36	AC/B
CRS-23C	MOV	RSSAC	MCC-1A4	480	ESFE36	AC/A
CRS-23D	MOV	RSSBD	MCC-1B4	480	ESFSE36	AC/B
CRS-8837A	MOV	ESFE	MCC-1A4	480	ESFE36	AC/A
CRS-8837B	MOV	ESFSE	MCC-1B4	480	ESFSE36	AC/B
CRS-8838A	MOV	ESFE	MCC-1A4	480	ESFE36	AC/A
CRS-8838B	MOV	ESFSE	MCC-1B4	480	ESFSE36	AC/B
CRS-E1A	HX	RSSAC				
CRS-E1B	HX	RSSBD				
CRS-E1C	HX	RSSAC				
CRS-E1D	HX	RSSBD				
CRS-P1A	MDP	RSSAC	BUS-34C	4160	CB2	AC/A
CRS-P1B	MDP	RSSBD	BUS-34D	4160	CB1	AC/B
CRS-P1C	MDP	RSSAC	BUS-34D	4160	CB2	AC/A
CRS-P1D	MDP	RSSBD	BUS-34D	4160	CB1	AC/B
SW-54A	MOV	ESFE	MCC-1A4	480	ESFE36	AC/A
SW-54B	MOV	ESFSE	MCC-1B4	480	ESFSE36	AC/B
SW-54C	MOV	ESFE	MCC-1A4	480	ESFE36	AC/A
SW-54D	MOV	ESFSE	MCC-1B4	480	ESFSE36	AC/B
SW-57A	MOV	RSSAC	MCC-1A4	480	ESFE36	AC/A
SW-57B	MOV	RSSBD	MCC-1B4	480	ESFSE36	AC/B
SW-57C	MOV	RSSAC	MCC-1A4	480	ESFE36	AC/A

Table 3.5-1. Millstone 3 Containment Heat Removal System Data Summary for Selected Components (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
SW-57D	MOV	RSSBD	MCC-1B4	480	ESFSE36	AC/B

3.6 INSTRUMENTATION AND CONTROL (I & C) SYSTEMS

3.6.1 System Function

The instrumentation and control systems consist of the Reactor Protection System (RPS), the Engineered Safety Features Actuation System (ESFAS), and systems for the display of plant information to the operators. The RPS and ESFAS monitor the reactor plant, an[illegible] the operator to take corrective action before specified limits are exceeded. The R[illegible] initiate an automatic reactor trip (scram) to rapidly shutdown the reactor when plant [illegible]ditions exceed one or more specified limits. The ESFAS will automatically actuate selected 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.

3.6.2 System Definition

The RPS includes sensor and transmitter units, logic units, and output trip relays that operate reactor trip circuit breakers to cause a reactor scram. The ESFAS includes independent sensor and transmitter units, logic units and relays that interface with the control circuits for the many different sets of components that can be actuated by the ESFAS. Operator instrumentation display systems consist of display panels in the control room that are powered by the 120 VAC electric power system (see Section 3.7). The remote shutdown capability is provided by the auxiliary shutdown panel (ASP) in conjunction with normal automatic systems and local controls outside the main control room.

3.6.3 System Operation

A. RPS

The Westinghouse RPS (or Reactor Trip System, RTS) has two to four redundant input instrument channels for each sensed parameter and two output actuation trains (A and B). The A and B logic trains independently generate a reactor trip command when prescribed parameters are outside the safe operating range. Either RPS train is capable of opening a separate and independent reactor trip circuit breaker to cause a scram. The manual scram A and B circuits bypass the RPS logic trains and send a reactor trip command directly to shunt trip circuitry in the reactor trip circuit breakers.

B. ESFAS

The ESFAS has three or four input instrument channels for each sensed parameter, and two output actuation trains (A and B). In general, each train controls equipment powered from different Class 1E AC electrical buses. An individual component usually receives an actuation signal from only one ESFAS train. The ESFAS generates the following signals: (a) reactor trip, provided one has not already been generated by the RPS, (b) safety injection signal (SIS), (c) containment isolation, (d) main steam line isolation, (e) main feedwater line isolation, (f) emergency diesel start, (g) control room isolation, and (h) containment depressurization actuation (CDA) signal. The control room operators can manually trip the various ESFAS logic subsystems. Details regarding ESFAS actuation logic are included in the system description for the actuated system.

C. Remote Shutdown

The remote shutdown system provides redundant safety grade capability to achieve and maintain a safe shutdown condition from location(s) remote from the control room. The controls available on the ASP provide the capabilities of achieving and maintaining a safe shutdown when the main control room is in accessible. the controls necessary for immediate operator action to establish a stable plant condition are available on the ASP or the adjacent emergency switchgear rooms. The controls provide a means of sustaining the capability for boration, letdown, residual heat removal, natural circulation, continuing reactor coolant pump seal injection and for thermal barrier cooling water flow, and depressurization.

Panels and associated equipment used in the event of control room evacuation are located at elevation 4 feet-6 inches in the control building. Also at this location are the emergency switchgear for each train, along with two transfer switch panels (TSP) and the ASP. Safety related equipment with controls located on the TSP and ASP are listed in Table 3.6-1. Most pumps have their controls located at their respective emergency switchgear. Two rooms are provided to separate the redundant emergency switchgear and the transfer switch panels. The ASP panel is located in the purple switchgear room (Train B) and the two trains (A and B) of the ASP are separated by a non-train panel. All controls and instrumentation required for the reactor hot and cold shutdown from ASP are decoupled from those normally used in the main control room in order to ensure that the control room evacuation event does not defeat the operation of equipment and controls necessary for remote shutdown in case of failure of equipment in the main control room.

Controls located outside the control room are provided with REMOTE/LOCAL selector switches. An annunciator is alarmed in the main control room and the indicator lights in the main control room are turned off when LOCAL CONTROL is selected. There are no cases in which transfer from the main control room to the auxiliary shutdown panel requires a jumper or other special equipment. The design is such that transfer of equipment from the main control room to the alternate shutdown area will not change the status of the equipment. Loss of offsite power will not negate shutdown capability from the remote shutdown area. The design is such that access to the remote shutdown stations at the ASP, the TSPs and the 4 kV switchgear requires keys for operation of equipment. Access to these areas are under administrative control.

3.6.4 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 usually is implemented by the scram circuit breakers which must open in response to a scram signal. Typically, there are two series scram circuit

breakers in the power path to the scram rods. In this case, one of two circuit breakers must open. Details of the scram system for Millstone 3 have not been determined.

B. ESFAS
A single component usually receives a signal from only one ESFAS output train. ESFAS Trains A and B must be available in order to automatically actuate their respective components. ESFAS typically uses 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 ESFAS output channels to send an actuation signal. Note that there may be some ESFAS 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 ESFAS system for Millstone 3 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 an ESFAS subsystem. The control room operators also may send qualified persons into the plant to operate components locally or from some other remote control location (i.e., the remote shutdown panel or a motor control center). To make these judgments, data on key plant parameters must be available to the operators.

3.6.5 Support Systems and Interfaces

A. Control Power
1. RPS
The RPS input instrument channels are powered from the 120 VAC vital buses (see Section 3.7). It is assumed that the RPS A and B output logic trains are powered from separate 125 VDC distribution panels.
2. ESFAS
The ESFAS input instrument channels are powered from 120 VAC vital buses. It is assumed that the ESFAS A and B output logic trains are powered from separate 125 VDC distribution panels.
3. Operator Instrumentation
Operator instrumentation displays are powered from the 120 VAC instrument buses.

3.6.6 Section 3.6 References

1. Millstone 3 Final Safety Analysis Report, Section 7.4.1.

Table 3.6-1. Millstone 3 Safety-Related Equipment With Control Switches on ASP

Description	ASP Section 1 Electrical Train A	ASP Section 3 Electrical Train B	Notes
Auxiliary Feedwater Control Valves (Throttling)	31A, 31D 32A, 32D 36B, 36C	31B, 31C 32B, 32C 36A, 36B	
Auxiliary Feedwater Isolation Valves	35B, 35C	35A, 35D	
Auxiliary Feedwater Pump Alternate Suction Valve	23A	23B	
Auxiliary Feedwater/DWST Isolation Valve	61A	61B	
Auxiliary Feedwater Motor Driven Pump Cross Connect Valve	62A	62B	
Turbine Driven Auxiliary Feedwater Pump Steam Supply Valves	31A	31B, 31D	Note 1
Main Steam Pressure Relieving Valve Isolation Valves	18A, 18C	18B, 18D	
Main Steam Pressure Relieving Valve Bypass Valves	74B, 74D	74A, 74C	
Pressurizer Power-Operated Relief Valve	445A	456	
Pressurizer Relief Isolation Valve	8000B	8000A	
Pressurizer Auxiliary Spray Valve	8145		Note 2
Reactor Vessel Head Vent Isolation Valves	8095A, 8096A	8095B, 8096B	
Reactor Vessel-to-Excess Letdown Valve	8098		Note 3
Reactor Vessel-to-Pressurizer Relief Tank Letdown Valve	442A	442B	
Pressurizer Level Control Valves	459, 460		Note 4
Letdown Orifice Isolation Valves	8149A, 8149B, 8149C		Note 5

Table 3.6-1. Millstone 3 Safety-Related Equipment With Control Switches on ASP (Continued)

Description	ASP Section 1 Electrical Train A	ASP Section 3 Electrical Train B	Notes
Letdown to CVT/CWS Divert Valve	112A		Note 6
Volume Control Tank Outlet Isolation Valve	112B	112C	
RWST to Charging Pump Suction Valve	112D	112E	
Charging System to RCS Isolation Valve	8147	8146	
Boric Acid Gravity Feed Valve	8507A	8507B	
Charging Header Isolation Valves	8438A, 8438C	8438B	Note 7
Charging Pump A Recirculation Valve		8111A	Note 8
Charging Pump B Recirculation Valve		8111B	Note 8
Charging Pump C Recirculation Valve		8111C	Note 8
LPSI to Charging Pumps Suction Valve	8468A	8468B	
Charging Header Flow Control Valve	190A	190B	
Charging Header Isolation Bypass Valve	8116		Note 9
Charging Pump to RCS Isolation Valve	8105	8106	
Charging Pump Miniflow Control Valve	8511A	8511B	
RHS Heat Exchanger Component Cooling Water Outlet Valve	66A	66B	
RHS to Cold Leg Isolation Valve	8809A	8809B	
RWST to RHR Pump Suction Valve	8812A	8812B	
Safety Injection Accumulator Tank Isolation Valves	8808A,8808 C	8808B, 8808D	

Table 3.6-1. Millstone 3 Safety-Related Equipment With Control Switches on ASP (Continued)

Description	ASP Section 1 Electrical Train A	ASP Section 3 Electrical Train B	Notes
Safety Injection Accumulator Tank 1 Nitrogen Supply	8875A	8875E	
...Safety Injection Accumulator Tank 2 Nitrogen Supply	8875B	8875F	
Safety Injection Accumulator Tank 3 Nitrogen Supply	8875C	8875G	
Safety Injection Accumulator Tank 4 Nitrogen Supply	8875D	8875H	
Safety Injection Accumulator Vent Control	943A	943B	
RHS Inlet Isolation Valves	8701A, 8701C, 8702A	8701B, 8702B, 8702C	
Charging Pump Cooling Pump	1A	1B	
Pressurizer Heater Backup	1A (Group A)	1B (Group B)	
Cold Shutdown Air Compressor	2A	2B	
Air Conditioning Unit for SI, QS, and RHR Pump Area	1A	1B	
Main Steam Line Safety Injection Block/Reset	Train A	Train B	
Pressurizer Pressure Safety Injection Block/Reset	Train A	Train B	
Sequencer LOP Reset	Train A	Train B	
RCS Cold Overpressure Mitigating Arm/Block	Train A	Train B	

Table 3.6-1. Millstone 3 Safety-Related Equipment With Control Switches on ASP (Continued)

NOTES:

1. There are three steam supply valves for the turbine-driven auxiliary feedwater pump; one is Train A and two are Train B.

2. The pressurizer auxiliary spray valve is Train A only.

3. There is no Train B reactor vessel-to-excess letdown valve.

4. Valves 459 and 460 are in series; both are Train A letdown valves.

5. The three letdown orifice isolation valves are all Train A.

6. Valve 112A is Train A; Valve up-stream of 112A is non-train and can be controlled from the main board or gaseous waste panel.

7. Valve 8438C is is Train A only; it is the charging header cross-connect valve.

8. Valves 8111A, B, and C (charging pump recirculation valves) are all Train B. Valve 8110 is the Train A common recirculation valve and can be operated from the main control board; it is normally OPEN.

9. The charging header isolation bypass valve is Train A only.

3.7 ELECTRIC POWER SYSTEM

3.7.1 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.

3.7.2 System Definition

The onsite Class 1E electric power system consists of two 4160 switchgear buses, designated 34C and 34D. There are two standby diesel generators connected to the buses. Diesel generator 1A is connected to bus 34C, and diesel generator 1B is connected to bus 34D. There are also six 480 VAC switchgear buses, designated 32R, 32S, 32T, 32U, 32V, and 32W. Buses 32R, 32S, and 32T are connected to 4160 bus 34C through transformers, and buses 32U, 32V, and 32W are connected to 4160 bus 34D through transformers. Various motor control centers receive their power from the 480 VAC buses.

Emergency power for vital instruments, control, and emergency lighting is supplied by four 125 VDC station batteries. The batteries energize four DC buses. Four 120 VAC vital buses are connected to the DC buses through inverters, and to 480 VAC buses through transformers and rectifiers.

Simplified one-line diagrams of the electric power system are shown in Figures 3.7-1 and 3.7-2. A summary of data on selected electric power system components is presented in Table 3.5-1. A partial listing of electrical sources and loads is presented in Table 3.5-2.

3.7.3 System Operation

During normal operation, the Class 1E electric power system is supplied from the unit generator through normal station service transformer A, via normal 4160 volt buses 34A and 34B. An alternate source of power is also from the 345 kV switchyard (offsite power). The emergency sources of AC power are the diesel generators. The transfer from the normal power source to the diesel generators is accomplished automatically by opening the normal source circuit breakers and then reenergizing the Class 1E portion of the electric power system from the diesel generators.

The DC power system normally is supplied through the battery chargers, with the batteries "floating" on the system, maintaining a full charge. Upon loss of AC power, the entire DC load draws from the batteries. The batteries are sized to supply the connected safety related loads for a minimum of two hours without the use of the battery chargers.

The 120 VAC vital buses normally receive power from an inverter. The normal source of power to each inverter is from a separate 480 VAC bus through a rectifier. The alternate source of power to the inverter is a 125 VDC bus. When the inverter is out of service an alternate source of power to the 120 VAC vital bus is from the 480 VAC system through transformers.

Redundant safeguards equipment such as motor driven pumps and motor operated valves are supplied by different VAC buses. For the purpose of discussion, this equipment has been grouped into "load groups". Load group "AC/A" contains components receiving electric power either directly or indirectly from 4160 bus 34C. Load group "AC/B" contains components powered either directly or indirectly from 4160 bus 34D. Components receiving DC power are assigned to load groups "DC/1" to "DC/4", based on the battery power source.

3.7.4 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)
- Power distribution paths to essential loads are intact
- Power to the battery chargers is restored before the batteries are exhausted

3.7.5 Component Information

A. Standby diesel generators (2)
   1. Maximum continuous rating: 4986 kW
   2. 2 hour rating: 5335 kW
   3. Rated voltage: 4160 VAC
   4. Manufacturer: Fairbanks Morse

B. Batteries (2)
   1. Rated voltage: 125 VDC
   2. Type: 60 cell
   3. Capacity: 2 hours with design loads

3.7.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The standby diesel generators are automatically started based on:
      - Undervoltage on the normal bus
      - Safety injection signal (SIS, see Section 3.3)
      - Containment depressurization actuation signal (CDA, see Section 3.5)
   2. Remote manual
      The diesel generators can be started, and many distribution circuit breakers can be operated, from the main control room.

B. Diesel Generator Auxiliary Systems
   1. Diesel Cooling Water System
      Heat is transferred through a shell and tube heat exchanger to the Service Water System. Each diesel receives redundant cooling water supplies from the SW "A" and "B" headers (see Section 3.8).
   2. Diesel Starting System
      Each diesel has an air starting system.
   3. Diesel Fuel Oil Transfer and Storage System
      A 550 gallon "day tank" supplies the relatively short-term (approximately 90 minutes) fuel needs of each diesel. Each day tank is replenished from two underground 35,000 gallon storage tanks during engine operation.
   4. Diesel Lubrication System
      Each diesel generator has its own lubrication system.
   5. Combustion Air Intake and Exhaust System
      This system supplies fresh air to the diesel intake, and directs the diesel exhaust outside of the diesel building.

6. Diesel Room Ventilation System
   This system maintains the environmental conditions in the diesel room within limits for which the diesel generator and switchgear have been qualified. This system may be needed for long-term operation of the diesel generator.

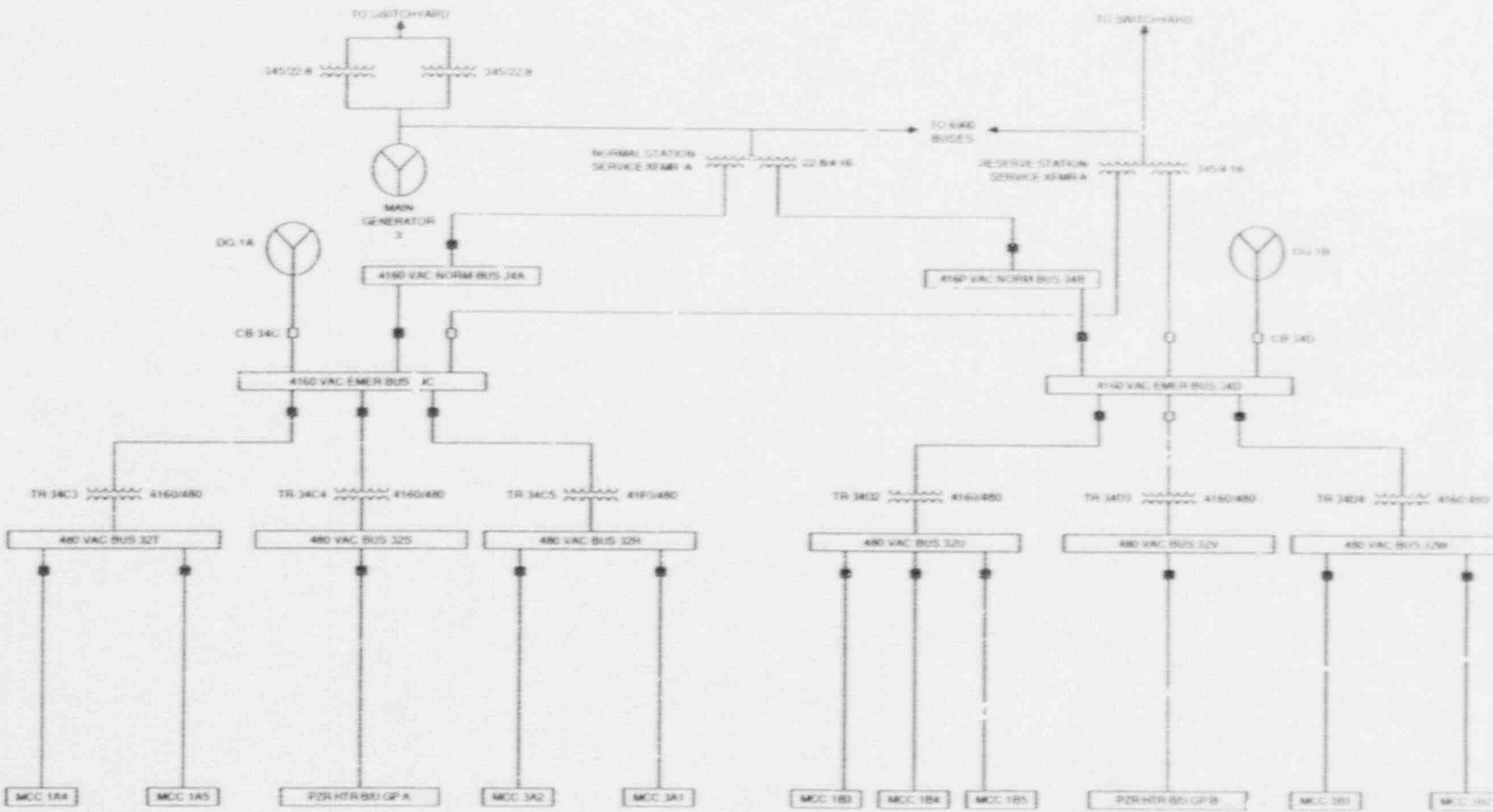
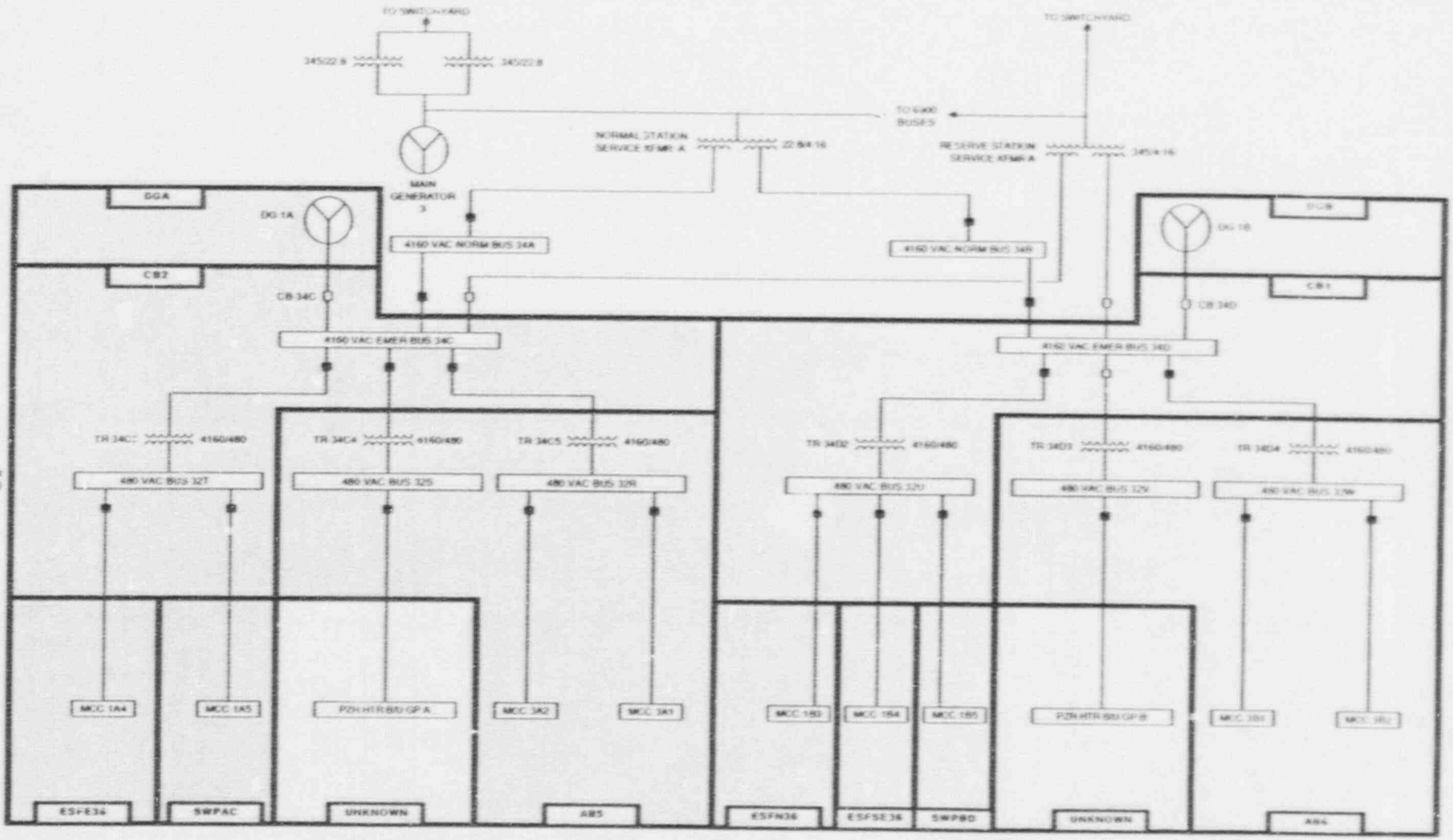


Figure 3.7-1. Millstone 3 4160 and 480 VAC Electric Power Distribution System



NOTE: LINES MAY NOT REPRESENT ACTUAL CABLE ROUTING BETWEEN ROOMS

Figure 3.7-2. Millstone 3 4160 and 480 VAC Electric Power Distribution System Showing Component Locations

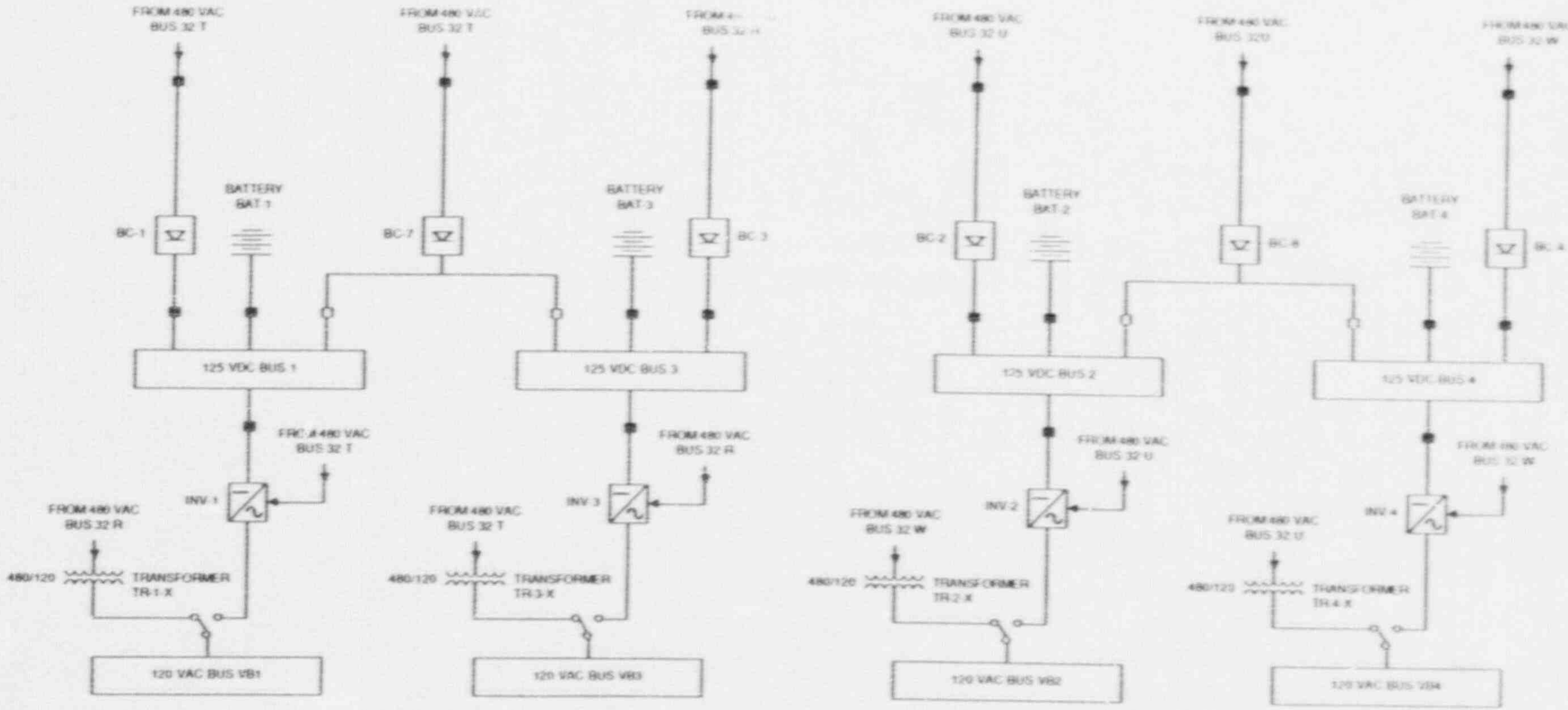
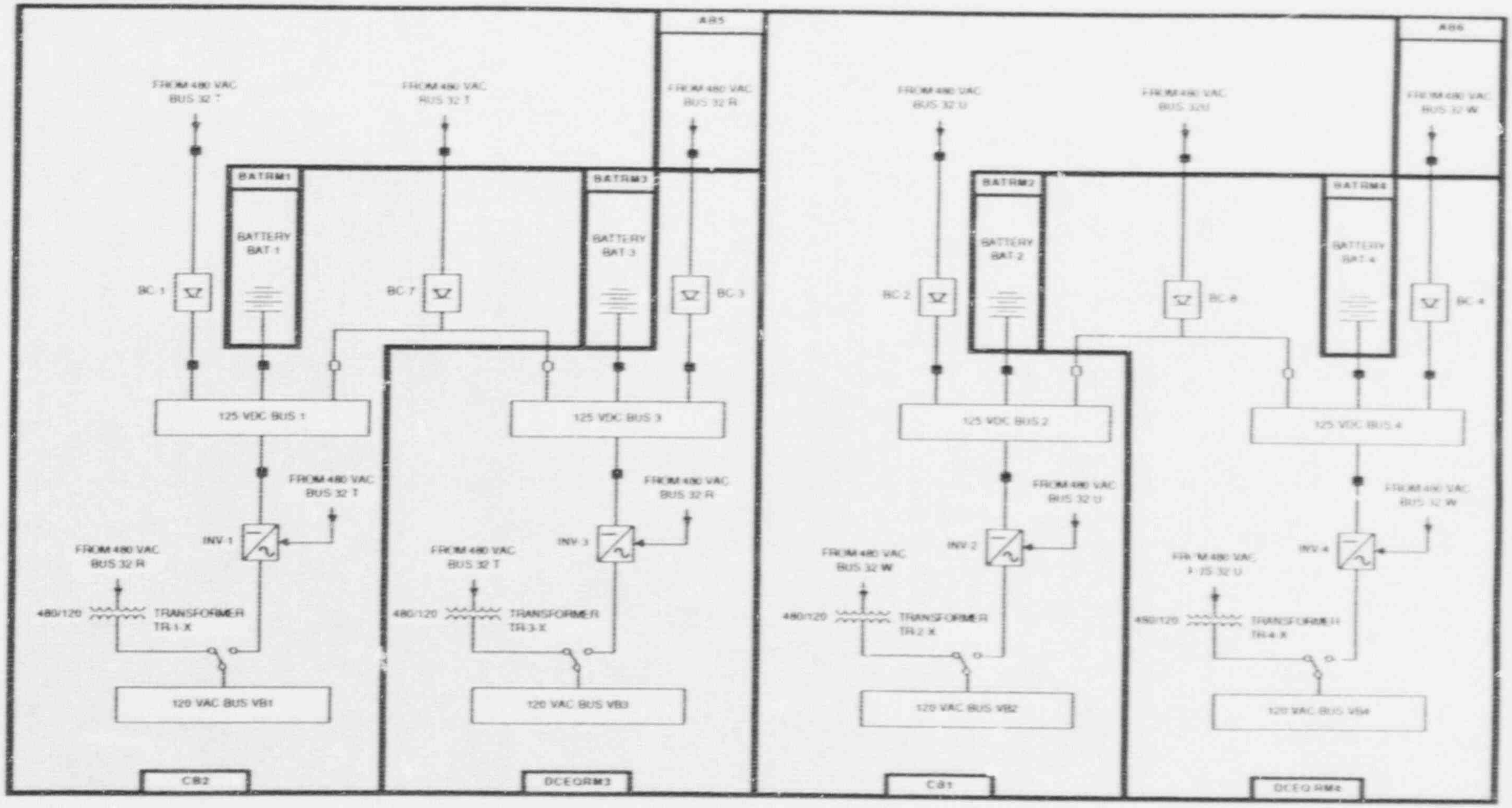


Figure 3.7-3. Millstone 3 125 VDC and 120 VAC Electric Power Distribution System



NOTE: LINES MAY NOT REPRESENT ACTUAL CABLE ROUTING BETWEEN ROOMS

Figure 3.7-4. Millstone 3 125 VDC and 120 VAC Electric Power Distribution System Showing Component Locations

Table 3.7-1. Millstone 3 Electric Power System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG LOAD GRP
BAT-1	BATT	BATRM1		125		DC/1
BAT-2	BATT	BATRM2		125		DC/2
BAT-3	BATT	BATRM3		125		DC/3
BAT-4	BATT	BATRM4		125		DC/4
BC-1	BC	CB2	BUS-32T	480	CB2	AC/A
BC-2	BC	CB1	BUS-32U	480	CB1	AC/B
BC-3	BC	DCEQRM3	BUS-32R	480	AB5	AC/A
BC-4	BC	DCEQRM4	BUS-32W	480	AB6	AC/B
BC-7	BC	CB2	BUS-32T	480	CB2	AC/A
BC-8	BC	DCEQRM4	BUS-32U	480	CB1	AC/B
BUS-1	BUS	CB2	BAT-1	125	BATRM1	DC/1
BUS-1	BUS	CB2	BC-1	125	CB2	DC/1
BUS-1	BUS	CB2	BC-7	125	CB2	DC/1
BUS-2	BUS	CB1	BAT-2	125	BATRM2	DC/2
BUS-2	BUS	CB1	BC-2	125	CB1	DC/2
BUS-2	BUS	CB1	BC-8	125	DCEQRM4	DC/2
BUS-3	BUS	DCEQRM3	BAT-3	125	BATRM3	DC/3
BUS-3	BUS	DCEQRM3	BC-3	125	DCEQRM3	DC/3
BUS-3	BUS	DCEQRM3	BC-7	125	CB2	DC/3
BUS-32R	BUS	AB5	TR-34C5	480	AB5	AC/A
BUS-32T	BUS	CB2	TR-34C3	480	CB2	AC/A
BUS-32U	BUS	CB1	TR-34D2	480	CB1	AC/B
BUS-32W	BUS	AB6	TR-34D4	480	AB6	AC/B
BUS-34C	BUS	CB2	DG-1A	4160	DGA	AC/A
BUS-34D	BUS	CB1	DG-1B	4160	DGB	AC/B
BUS-4	BUS	DCEQRM4	BAT-4	125	BATRM4	DC/4
BUS-4	BUS	DCEQRM4	BC-4	125	DCEQRM4	DC/4

Table 3.7-1. Millstone 3 Electric Power System Data Summary for Selected Components (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG LOAD GRP.
BUS-4	BUS	DCEQRM4	BC-8	125	DCEQRM4	DC/4
BUS-VB1	BUS	CB2	INV-1	120	CB2	AC/A
BUS-VB1	BUS	CB2	TR-1-X	120	CB2	AC/A
BUS-VB2	BUS	CB1	INV-2	120	CB1	AC/B
BUS-VB2	BUS	CB1	TR-2-X	120	CB1	AC/B
BUS-VB3	BUS	DCEQRM3	INV-3	120	DCEQRM3	AC/A
BUS-VB3	BUS	DCEQRM3	TR-3-X	120	DCEQRM3	AC/A
BUS-VB4	BUS	DCEQRM4	INV-4	120	DCEQRM4	AC/B
BUS-VB4	BUS	DCEQRM4	TR-4-X	120	DCEQRM4	AC/B
CB-34C	CB	CB2	DG-1A	4160	DGA	AC/A
CB-34D	CB	CB1	DG-1B	4160	DGB	AC/B
DG-1A	DG	DGA		4160		AC/A
DG-1B	DG	DGB		4160		AC/B
INV-1	INV	CB2	BUS-1	120	CB2	DC/1
INV-1	INV	CB2	BUS-32T	120	CB2	DC/1
INV-2	INV	CB1	BUS-2	120	CB/1	DC/2
INV-2	INV	CB1	BUS-32U	120	CB1	DC/2
INV-3	INV	DCEQRM3	BUS-3	120	DCEQRM3	DC/3
INV-3	INV	DCEQRM3	BUS-32R	120	AB5	DC/3
INV-4	INV	DCEQRM4	BUS-4	120	DCEQRM4	DC/4
INV-4	INV	DCEQRM4	BUS-32W	120	AB6	DC/4
MCC-1A4	MCC	ESFE36	BUS-32T	480	CB2	AC/A
MCC-1A5	MCC	SWPAC	BUS-32T	480	CB2	AC/A
MCC-1B3	MCC	ESFN36	BUS-32U	480	CB1	AC/B
MCC-1B4	MCC	ESFSE36	BUS-32U	480	CB1	AC/B
MCC-1B5	MCC	SWPBD	BUS-32U	480	CB1	AC/B
MCC-3A1	MCC	AB5	BUS-32R	480	AB5	AC/A

Table 3.7-1. Millstone 3 Electric Power System Data Summary for Selected Components (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
MCC-3A2	MCC	AB5	BUS-32R	480	AB5	AC/A
MCC-3B1	MCC	AB6	BUS-32W	480	AB6	AC/B
MCC-3B2	MCC	AB6	BUS-32W	480	AB6	AC/B
TR-1-X	TRAN	CB2	BUS-32R	120	AB5	AC/A
TR-2-X	TRAN	CB1	BUS-32W	120	AB6	AC/B
TR-3-X	TRAN	DCEQRM3	BUS-32T	120	DCEQRM3	AC/A
TR-34C3	TRAN	CB2	BUS-34C	480	CB2	AC/A
TR-34C5	TRAN	AB5	BUS-34C	480	CB2	AC/A
TR-34D2	TRAN	CB1	BUS-34D	480	CB1	AC/B
TR-34D4	TRAN	AB6	BUS-34D	480	CB1	AC/B
TR-4-X	TRAN	DCEQRM4	BUS-32U	120	DCEQRM4	AC/B

Table 3.7-2. Partial Listing of Electrical Sources and Loads at Millstone 3

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BAT-1	125	DC/1	BATRM1	EP	BUS-1	BUS	CB2
BAT-1	125	DC/1	BATRM1	EP	BUS-1	BUS	CB2
BAT-2	125	DC/2	BATRM2	EP	BUS-2	BUS	CB1
BAT-2	125	DC/2	BATRM2	EP	BUS-2	BUS	CB1
BAT-3	125	DC/3	BATRM3	EP	BUS-3	BUS	DCEQRM3
BAT-4	125	DC/4	BATRM4	EP	BUS-4	BUS	DCEQRM4
BC-1	125	DC/1	CB2	EP	BUS-1	BUS	CB2
BC-1	125	DC/1	CB2	EP	BUS-1	BUS	CB2
BC-2	125	DC/2	CB1	EP	BUS-2	BUS	CB1
BC-2	125	DC/2	CB1	EP	BUS-2	BUS	CB1
BC-3	125	DC/3	DCEQRM3	EP	BUS-3	BUS	DCEQRM3
BC-4	125	DC/4	DCEQRM4	EP	BUS-4	BUS	DCEQRM4
BC-7	125	DC/1	CB2	EP	BUS-1	BUS	CB2
BC-7	125	DC/1	CB2	EP	BUS-1	BUS	CB2
BC-7	125	DC/3	CB2	EP	BUS-3	BUS	DCEQRM3
BC-8	125	DC/2	DCEQRM4	EP	BUS-2	BUS	CB1
BC-8	125	DC/2	DCEQRM4	EP	BUS-2	BUS	CB1
BC-8	125	DC/4	DCEQRM4	EP	BUS-4	BUS	DCEQRM4
BUS-1	120	DC/1	CB2	EP	INV-1	INV	CB2
BUS-2	120	DC/2	CB/1	EP	INV-2	INV	CB1
BUS-3	120	DC/3	DCEQRM3	EP	INV-3	INV	DCEQRM3
BUS-32R	480	AC/A	AB5	EP	BC-3	BC	DCEQRM3
BUS-32R	120	DC/3	AB5	EP	INV-3	INV	DCEQRM3
BUS-32R	480	AC/A	AB5	EP	MCC-3A1	MCC	AB5
BUS-32R	480	AC/A	AB5	EP	MCC-3A2	MCC	AB5
BUS-32R	120	AC/A	AB5	EP	TR-1-X	TRAN	CB2
BUS-32T	480	AC/A	CB2	EP	BC-1	BC	CB2
BUS-32T	480	AC/A	CB2	EP	BC-7	BC	CB2
BUS-32T	480	AC/A	CB2	EP	BC-7	BC	CB2
BUS-32T	120	DC/1	CB2	EP	INV-1	INV	CB2
BUS-32T	480	AC/A	CB2	EP	MCC-1A4	MCC	ESFE36

Table 3.7-2. Partial Listing of Electrical Sources and Loads at Millstone 3 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BUS-32T	480	AC/A	CB2	EP	MCC-1A5	MCC	SWPAC
BUS-32T	120	AC/A	DCEQRM3	EP	TR-3-X	TRAN	DCEQRM3
BUS-32U	480	AC/B	CB1	EP	BC-2	BC	CB1
BUS-32U	480	AC/B	CB1	EP	BC-6	BC	DCEQRM4
BUS-32U	480	AC/B	CB1	EP	BC-8	BC	DCEQRM4
BUS-32U	120	DC/2	CB1	EP	INV-2	INV	CB1
BUS-32U	480	AC/B	CB1	EP	MCC-1B3	MCC	ESFN36
BUS-32U	480	AC/B	CB1	EP	MCC-1B4	MCC	ESFSE36
BUS-32U	480	AC/B	CB1	EP	MCC-1B5	MCC	SWPBD
BUS-32U	120	AC/B	DCEQRM4	EP	TR-4-X	TRAN	DCEQRM4
BUS-32W	480	AC/B	AB6	EP	BC-4	BC	DCEQRM4
BUS-32W	120	DC/4	AB6	EP	INV-4	INV	DCEQRM4
BUS-32W	480	AC/B	AB6	EP	MCC-3B1	MCC	AB6
BUS-32W	480	AC/B	AB6	EP	MCC-3B2	MCC	AB6
BUS-32W	120	AC/B	AB6	EP	TR-2-X	TRAN	CB1
BUS-34C	4160	AC/A	CB2	AFW	AFW-P1A	MDP	AFWA
BUS-34C	4160	AC/A	CB2	CVCS	CH-P3A	MDP	CHA
BUS-34C	4160		AC/A	ECCS	SI-P1A	MDP	SIHA
BUS-34C	480	AC/A	CB2	EP	TR-34C3	TRAN	CB2
BUS-34C	480	AC/A	CB2	EP	TR-34C5	TRAN	AB5
BUS-34C	4160	AC/A	CB2	PAHRS	CRS-P1A	MDP	RSSAC
BUS-34C	4160	AC/A	CB2	SW	SW-P1A	MDP	SWPAC
BUS-34C	4160	AC/A	CB2	SW	SW-P1C	MDP	SWPAC
BUS-34D	4160	AC/B	CB1	AFW	AFW-P1B	MDP	AFWB
BUS-34D	4160	AC/B	CB1	CVCS	CH-P3B	MDP	CHB
BUS-34D	4160	AC/B	CB1	ECCS	SI-P1B	MDP	SIHB
BUS-34D	480	AC/B	CB1	EP	TR-34D2	TRAN	CB1
BUS-34D	480	AC/B	CB1	EP	TR-34D4	TRAN	AB6
BUS-34D	4160	AC/B	CB1	PAHRS	CRS-P1B	MDP	RSSBD
BUS-34D	4160	AC/A	CB2	PAHRS	CRS-P1C	MDP	RSSAC
BUS-34D	4160	AC/B	CB1	PAHRS	CRS-P1D	MDP	RSSBD

Table 3.7-2. Partial Listing of Electrical Sources and Loads at Millstone 3 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BUS-34D	4160	AC/B	CB1	SW	SW-P1B	MDP	SWPBD
BUS-34D	4160	AC/B	CB1	SW	SW-P1D	MDP	SWPBD
BUS-4	120	DC/4	DCEQRM4	EP	INV-4	INV	DCEQRM4
DG-1A	4160	AC/A	DGA	EP	BUS-34C	BUS	CB2
DG-1A	4160	AC/A	DGA	EP	BUS-34C	BUS	CB2
DG-1A	4160	AC/A	DGA	EP	CB-34C	CB	CB2
DG-1B	4160	AC/B	DGB	EP	BUS-34D	BUS	CB1
DG-1B	4160	AC/B	DGB	EP	BUS-34D	BUS	CB1
DG-1B	4160	AC/B	DGB	EP	CB-34D	CB	CB1
INV-1	120	AC/A	CB2	EP	BUS-VB1	BUS	CB2
INV-2	120	AC/B	CB1	EP	BUS-VB2	BUS	CB1
INV-3	120	AC/A	DCEQRM3	EP	BUS-VB3	BUS	DCEQRM3
INV-4	120	AC/B	DCEQRM4	EP	BUS-VB4	BUS	DCEQRM4
MCC-1A4	480	AC/A	ESFE36	AFW	AFW-35B	MOV	RSSBD
MCC-1A4	480	AC/A	ESFE36	AFW	AFW-35C	MOV	RSSBD
MCC-1A4	480	AC/A	ESFE36	ECCS	SI-8802A	MOV	SIHA
MCC-1A4	480	AC/A	ESFE36	ECCS	SI-8821A	MOV	SIHA
MCC-1A4	480	AC/A	ESFE36	ECCS	SI-8821A	MOV	SIHA
MCC-1A4	480	AC/A	ESFE36	ECCS	SI-8835	MOV	SIHA
MCC-1A4	480	AC/A	ESFE36	ECCS	SI-8923A	MOV	SIHA
MCC-1A4	480	AC/A	ESFE36	PAHRS	CRS-20A	MOV	RSSAC
MCC-1A4	480	AC/A	ESFE36	PAHRS	CRS-20C	MOV	RSSAC
MCC-1A4	480	AC/A	ESFE36	PAHRS	CRS-23A	MOV	RSSAC
MCC-1A4	480	AC/A	ESFE36	PAHRS	CRS-23C	MOV	RSSAC
MCC-1A4	480	AC/A	ESFE36	PAHRS	CRS-8837A	MOV	ESFE
MCC-1A4	480	AC/A	ESFE36	PAHRS	CRS-8838A	MOV	ESFE
MCC-1A4	480	AC/A	ESFE36	PAHRS	SW-54A	MOV	ESFE
MCC-1A4	480	AC/A	ESFE36	PAHRS	SW-54C	MOV	ESFE
MCC-1A4	480	AC/A	ESFE36	PAHRS	SW-57A	MOV	RSSAC
MCC-1A4	480	AC/A	ESFE36	PAHRS	SW-57C	MOV	RSSAC
MCC-1A5	480	AC/A	SWPAC	EP	SW-102C	MOV	SWPAC

Table 3.7-2. Partial Listing of Electrical Sources and Loads at Millstone 3 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC-1A5	480	AC/A	SWPAC	SW	SW-102A	MOV	SWPAC
MCC-1A5	480	AC/A	SWPAC	SW	SW-102C	MOV	SWPAC
MCC-1B3	480	AC/B	ESFN36	ECCS	SI-8802B	MOV	SIHB
MCC-1B3	480	AC/B	ESFN36	ECCS	SI-8806	MOV	ESFNE
MCC-1B3	480	AC/B	ESFN36	ECCS	SI-8821B	MOV	SIHB
MCC-1B3	480	AC/B	ESFN36	ECCS	SI-8821B	MOV	SIHB
MCC-1B3	480	AC/A	ESFN36	ECCS	SI-8923B	MOV	SIHB
MCC-1B4	480	AC/B	ESFSE36	AFW	AFW-35A	MOV	RSSAC
MCC-1B4	480	AC/B	ESFSE36	AFW	AFW-35D	MOV	RSSAC
MCC-1B4	480	AC/B	ESFSE36	PAHRS	CRS-20B	MOV	RSSBD
MCC-1B4	480	AC/B	ESFSE36	PAHRS	CRS-20D	MOV	RSSBD
MCC-1B4	480	AC/B	ESFSE36	PAHRS	CRS-23B	MOV	RSSBD
MCC-1B4	480	AC/B	ESFSE36	PAHRS	CRS-23D	MOV	RSSBD
MCC-1B4	480	AC/B	ESFSE36	PAHRS	CRS-8837B	MOV	ESFSE
MCC-1B4	480	AC/B	ESFSE36	PAHRS	CRS-8838B	MOV	ESFSE
MCC-1B4	480	AC/B	ESFSE36	PAHRS	SW-54B	MOV	ESFSE
MCC-1B4	480	AC/B	ESFSE36	PAHRS	SW-54D	MOV	ESFSE
MCC-1B4	480	AC/B	ESFSE36	PAHRS	SW-57B	MOV	RSSBD
MCC-1B4	480	AC/B	ESFSE36	PAHRS	SW-57D	MOV	RSSBD
MCC-1B5	480	AC/B	SWPBD	EP	SW-102D	MOV	SWPBD
MCC-1B5	480	AC/B	SWPBD	SW	SW-102B	MOV	SWPBD
MCC-1B5	480	AC/B	SWPBD	SW	SW-102D	MOV	SWPBD
MCC-3A1	480	AC/A	AB5	CVCS	CH-112D	MOV	BASAB
MCC-3A1	480	AC/A	AB5	CVCS	CH-8438A	MOV	CHA
MCC-3A1	480	AC/A	AB5	CVCS	CH-8438C	MOV	CHA
MCC-3A1	480	AC/A	AB5	CVCS	CH-8468A	MOV	CHA
MCC-3A1	480	AC/A	AB5	CVCS	SI-8801A	MOV	BASAB
MCC-3A2	480	AC/A	AB5	RCS	RC-8000A	MOV	RC
MCC-3A2	480	AC/A	AB5	RCS	RC-8701A	MOV	RC
MCC-3A2	480	AC/A	AB5	RCS	RC-8701C	MOV	RC
MCC-3B1	480	AC/B	AB6	CVCS	CH-112E	MOV	BASAB

Table 3.7-2. Partial Listing of Electrical Sources and Loads at Millstone 3 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC-3B1	480	AC/B	AB6	CVCS	CH-8438B	MOV	CHB
MCC-3B1	480	AC/B	AB6	CVCS	CH-8469B	MOV	CH[illegible]
MCC-3B1	480	AC/B	AB6	CVCS	SI-8801B	MOV	BASAB
MCC-3B2	480	AC/B	AB6	RCS	RC-8000B	MOV	RC
MCC-3B2	480	AC/B	AB6	RCS	RC-8702B	MOV	RC
MCC-3B2	480	AC/B	AB6	RCS	RC-8702C	MOV	RC
TR-1-X	120	AC/A	CB2	EP	BUS-VB1	BUS	CB2
TR-2-X	120	AC/B	CB1	EP	BUS-VB2	BUS	CB1
TR-3-X	120	AC/A	DCEQRM3	EP	BUS-VB3	BUS	DCEQRM3
TR-34C3	480	AC/A	CB2	EP	BUS-32T	BUS	CB2
TR-34C5	480	AC/A	AB5	EP	BUS-32R	BUS	AB5
TR-34D2	480	AC/B	CB1	EP	BUS-32U	BUS	CB1
TR-34D4	480	AC/B	AB6	EP	BUS-32W	BUS	AB6
TR-4-X	120	AC/B	DCEQRM4	EP	BUS-VB4	BUS	DCEQRM4

3.8 SERVICE WATER (SW) SYSTEM

3.8.1 System Function

The Service Water System supplies cooling water from the ultimate heat sink to various heat loads in both the primary and secondary portions of the plant. The system is designed to provide a continuous flow of cooling water to those loads which are safety-related or essential to the safe shutdown of the reactor.

3.8.2 System Definition

The Service Water System contains two open-loop headers, each supplied by two motor-driven pumps. The source of water for the system is Niantic Bay. Strainers are provided to remove impurities from the raw water before it enters the SW pumps. After serving the various heat loads in the plant, service water is discharged to the circulating water discharge tunnel which returns to Niantic Bay.

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

3.8.3 System Operation

During normal operation, one SW pump in each redundant header is in continuous operation providing cooling water to various heat loads. Heat loads supported by the SW system include the following:

- Diesel generator coolers
- HPSI and charging pump coolers
- CRS heat exchangers
- Component Cooling Water heat exchangers.

The SW system can also be aligned to supply water to the Auxiliary Feedwater System pumps. It also provides an emergency source of makeup water to the fuel pool.

3.8.4 System Success Criteria

The system success criteria for the Service Water System is defined on a per train basis. For each train of the SWS, the following must be available:

- A source of coolant water from the Niantic Bay
- 1 of 2 pumps
- An adequate flow path from the pump discharge to the heat sources and to the circulating water discharge tunnel

3.8.5 Component Information

A. Service Water Pumps 1A, 1B, 1C and 1D
   1. Rated flow: 15,000 gpm @ 120 ft head (52 psid)
   2. Rated capacity: 50%
   3. Type: vertical centrifugal

B. Ultimate Heat Sink - Long Island Sound

3.8.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The SW pumps are not automatically actuated.
   2. Remote Manual
      The SW pumps can be actuated by remote manual means from the control room.

B. Motive Power
   The SW motor driven pumps and motor operated valves are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.7.

C. Other
   1. Lubrication, ventilation, and cooling are provided locally for the SW pumps.

3.8.7 Section 3.8 References

1. Millstone 3 Final Safety Analysis Report, Section 9.2.1.

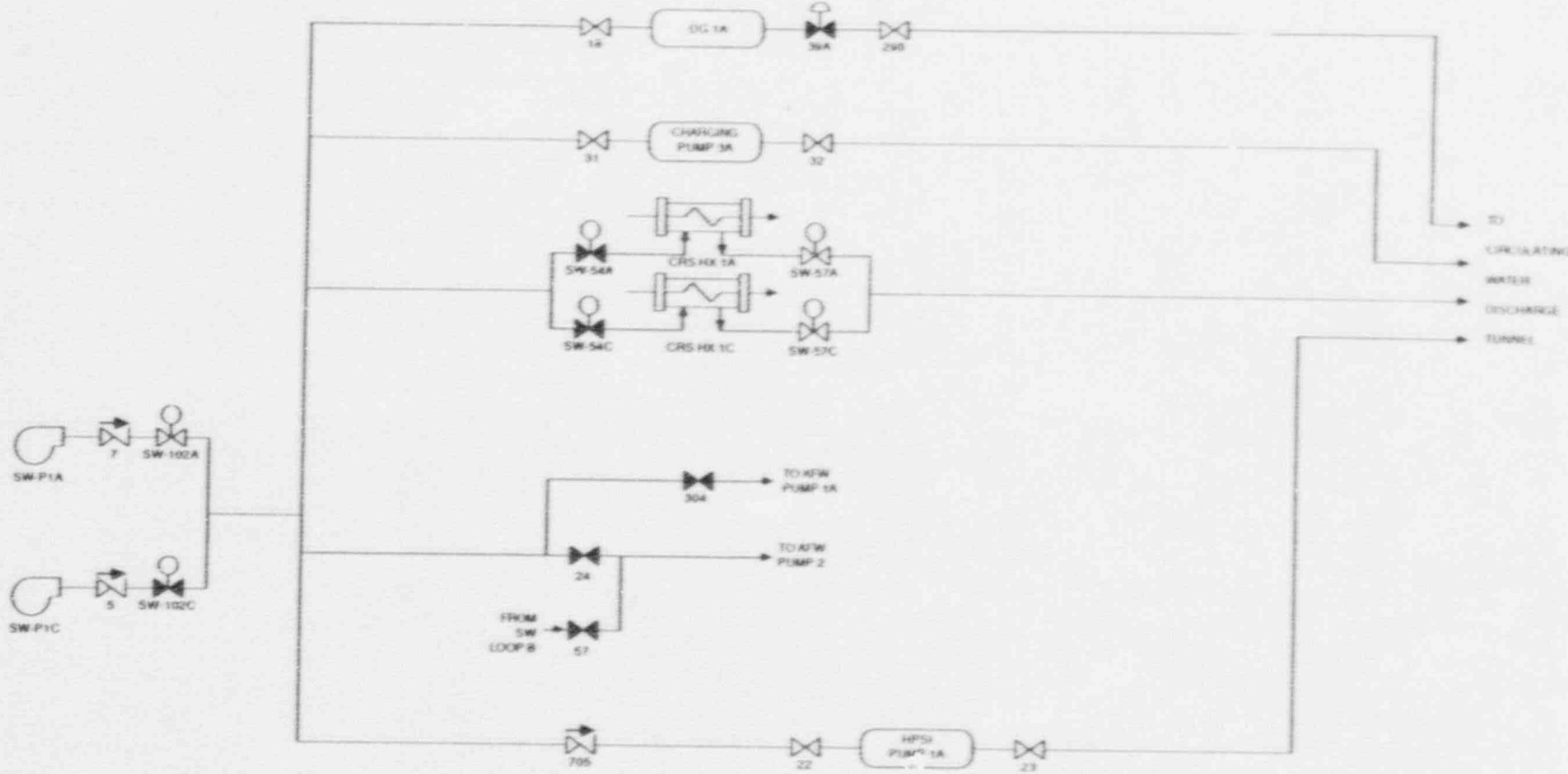


Figure 3.8-1. Millstone 3 Service Water System Loop A

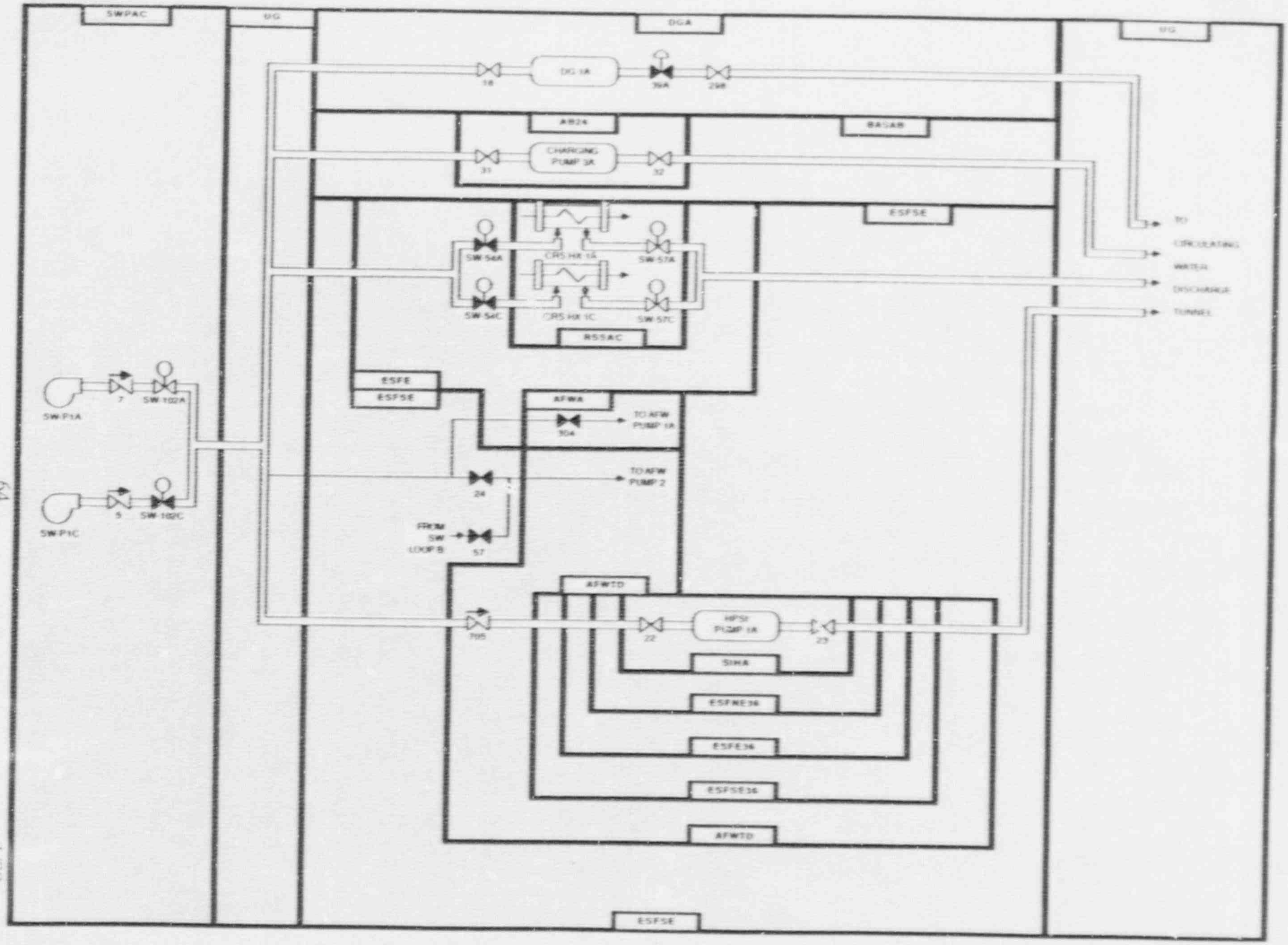


Figure 3.8-2. Millstone 3 Service Water System Loop A Showing Component Locations

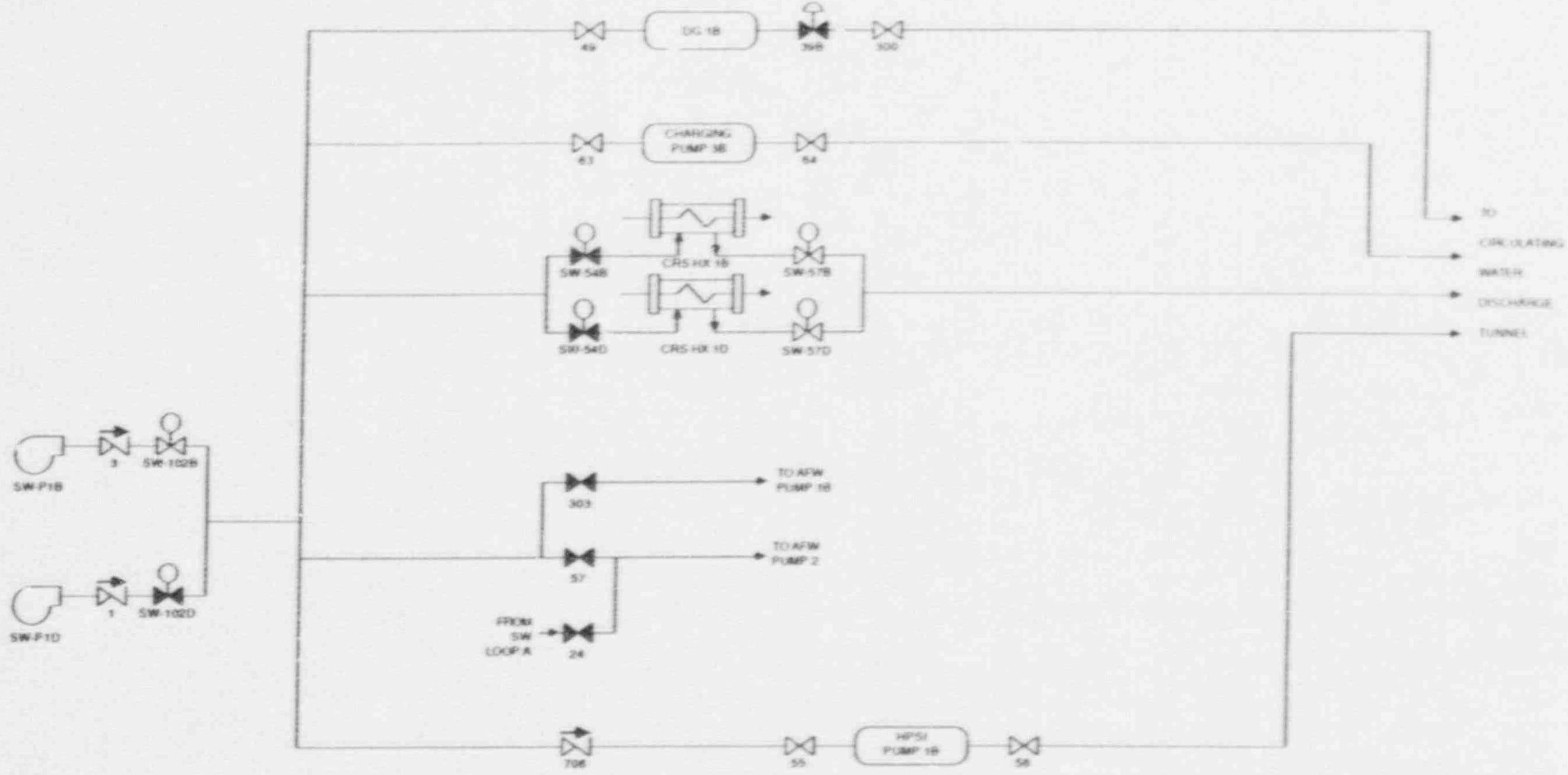


Figure 3.8-3. Millstone 3 Service Water System Loop B

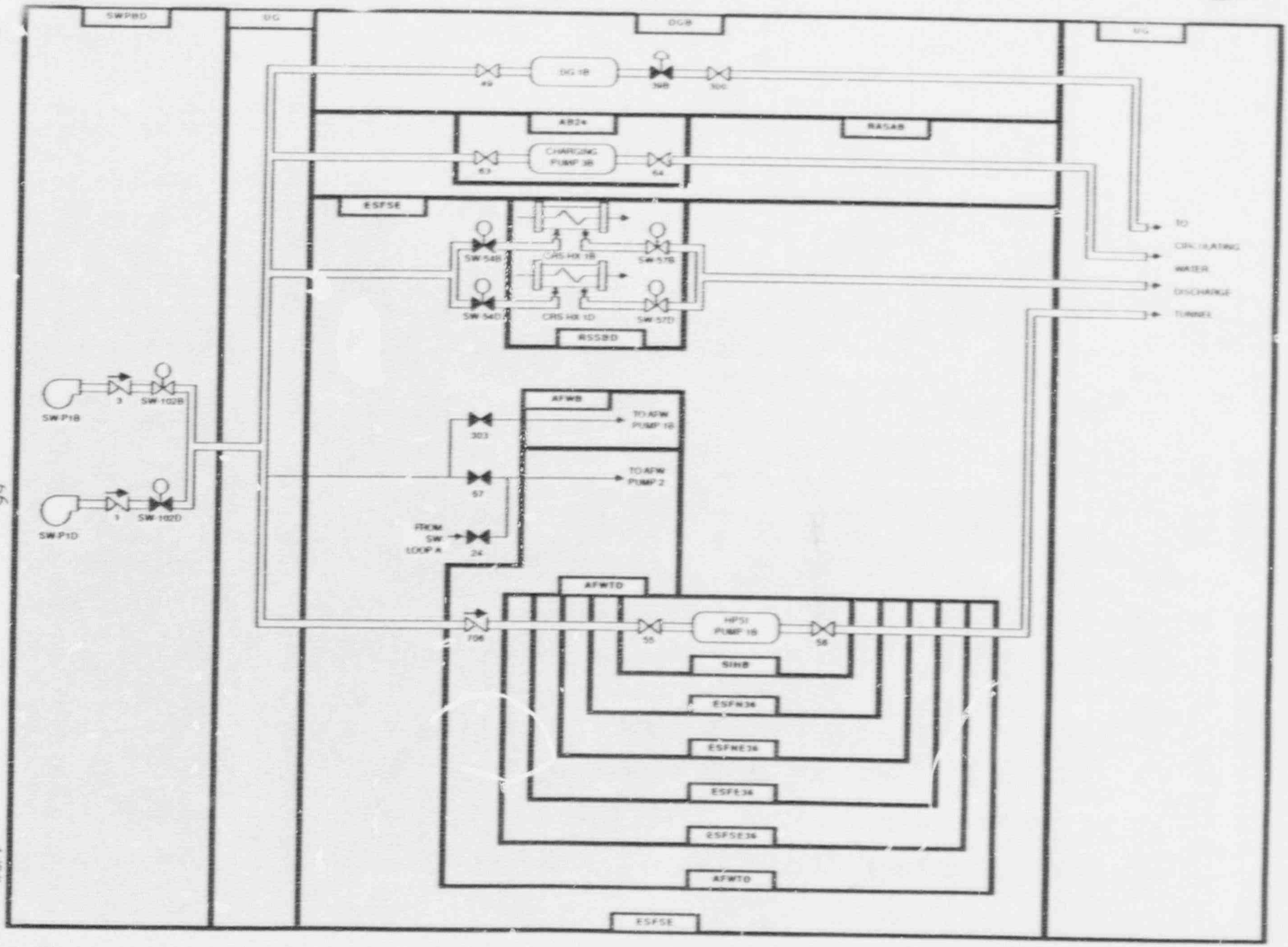


Figure 3.8-4. Millstone 3 Service Water System Loop B Showing Component Locations

Table 3.8-1. Millstone 3 Service Water System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP
SW-102A	MOV	SWPAC	MCC-1A5	480	SWPAC	AC/A
SW-102B	MOV	SWPBD	MCC-1B5	480	SWPBD	AC/B
SW-102C	MOV	SWPAC	MCC-1A5	480	SWPAC	AC/A
SW-102D	MOV	SWPBD	MCC-1B5	480	SWPBD	AC/B
SW-P1A	MDP	SWPAC	BUS-34C	4160	CB2	AC/A
SW-P1B	MDP	SWPBD	BUS-34D	4160	CB1	AC/B
SW-P1C	MDP	SWPAC	BUS-34C	4160	CB2	AC/A
SW-P1D	MDP	SWPBD	BUS-34D	4160	CB1	AC/B

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 on the west and Jordon Cove on 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 3 is located immediately north of Units 1 and 2. No systems are shared between Unit 3 and the other two units at the site. Figure 4-1 (from Ref. 1) is a general view of the plant and vicinity.

The major structures at this unit include the containment building, turbine building, auxiliary building, fuel building, main steam valve building, engineered safety features building, control building, and circulating and service water pump house. A site plot plan is shown in Figure 4-2.

The containment structure is a reinforced concrete cylinder with a steel liner. The containment contains the reactor vessel, reactor coolant pumps, steam generators, and pressurizer. Pumps, piping, and valving for the reactor coolant system is completely contained within the containment structure. Piping and electrical penetration areas are on various levels of the auxiliary building and engineered safety features building.

The turbine building, located west of the containment, houses the turbine generator and the associated power generating auxiliaries.

The auxiliary building is located northwest of the containment and contains components of the CVCS and electric power system.

The fuel building is northeast of the containment and houses the spent fuel pool.

The main steam valve building is located between the turbine building and containment and contains the main steam lines and isolation valves.

The engineered safety features building is located east of the containment and contains much of the plant's safety related equipment, specifically components of the AFW, HPSI, RHR, CRS systems, and motor control centers supplying power to safety system components. This building is divided into several areas.

The control building is located north of the turbine building and contains the main control room, cable spreading room, and switchgear rooms.

The circulating and service water pump house is located southwest of the containment on Long Island Sound and contains the service water pumps and intake structure.

4.2 FACILITY LAYOUT DRAWINGS

Figures 4-3 through 4-8 are simplified building elevation drawings for Millstone 3. Details of the turbine building and many of the outlying buildings are not shown on these drawings. 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 III, Oak Ridge National Laboratory, Nuclear Safety Information Center, April 1974.

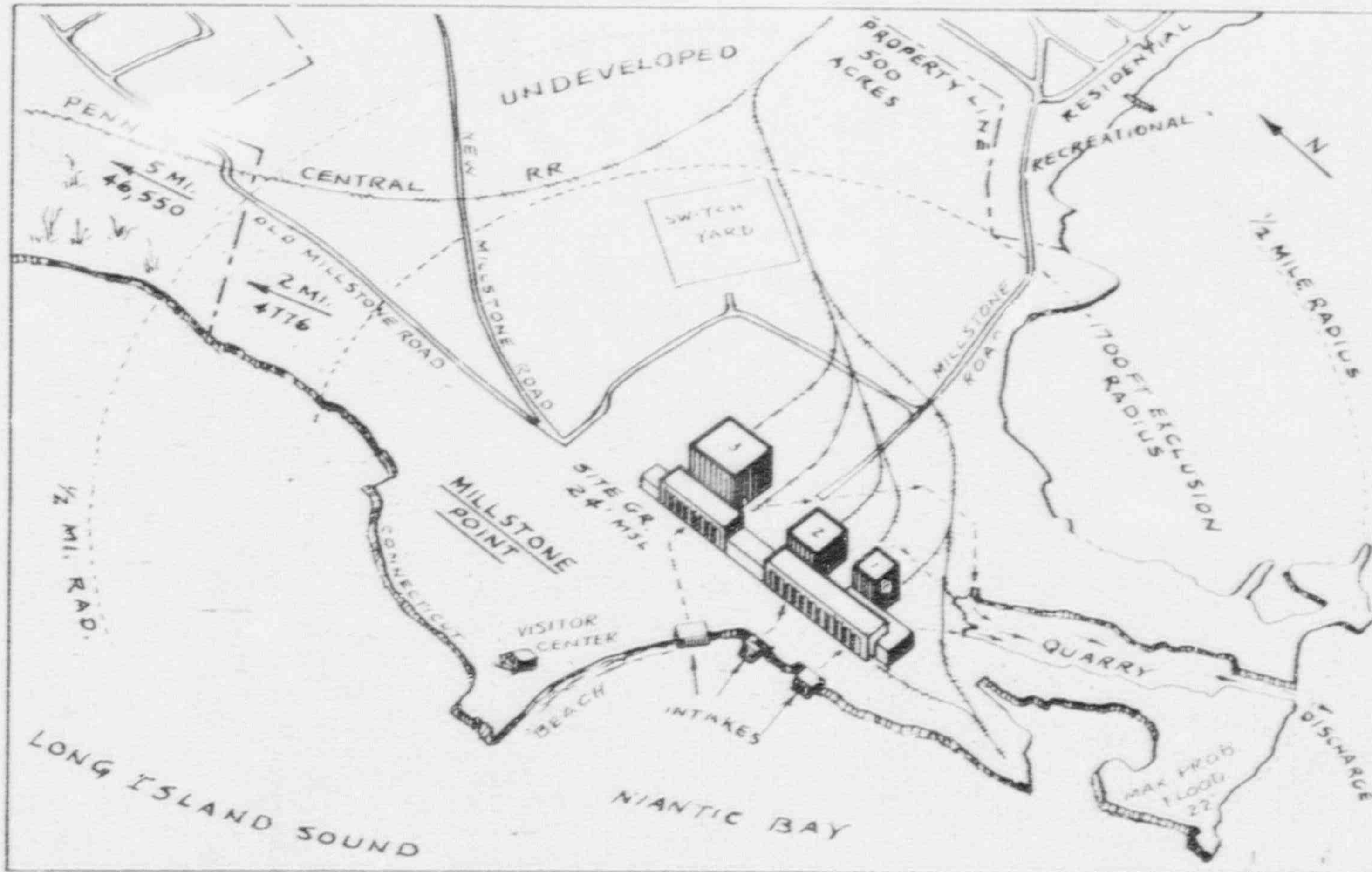


Figure 4-1. General View of Millstone Station and Vicinity

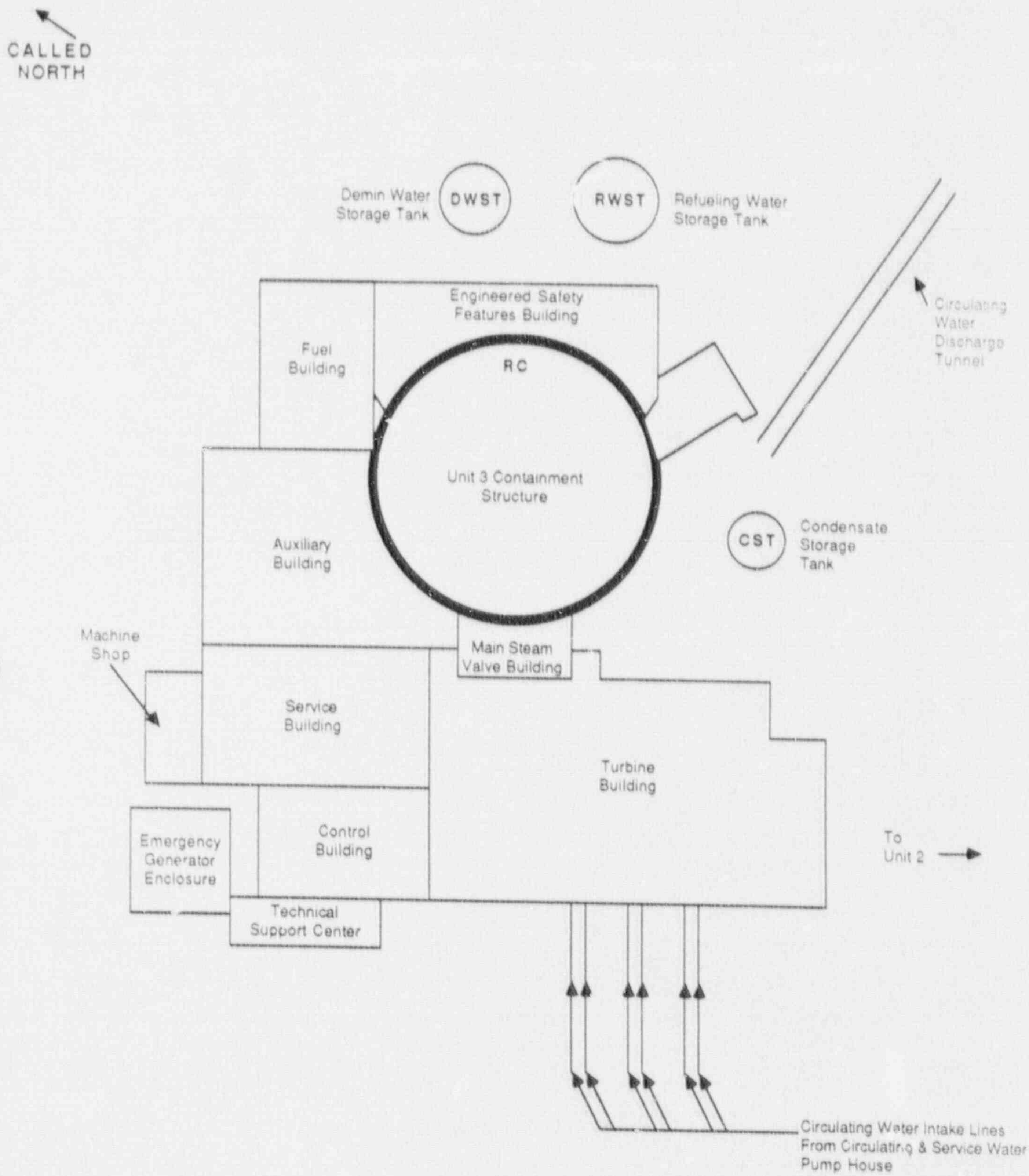


Figure 4-2. Millstone 3 Plot Plan

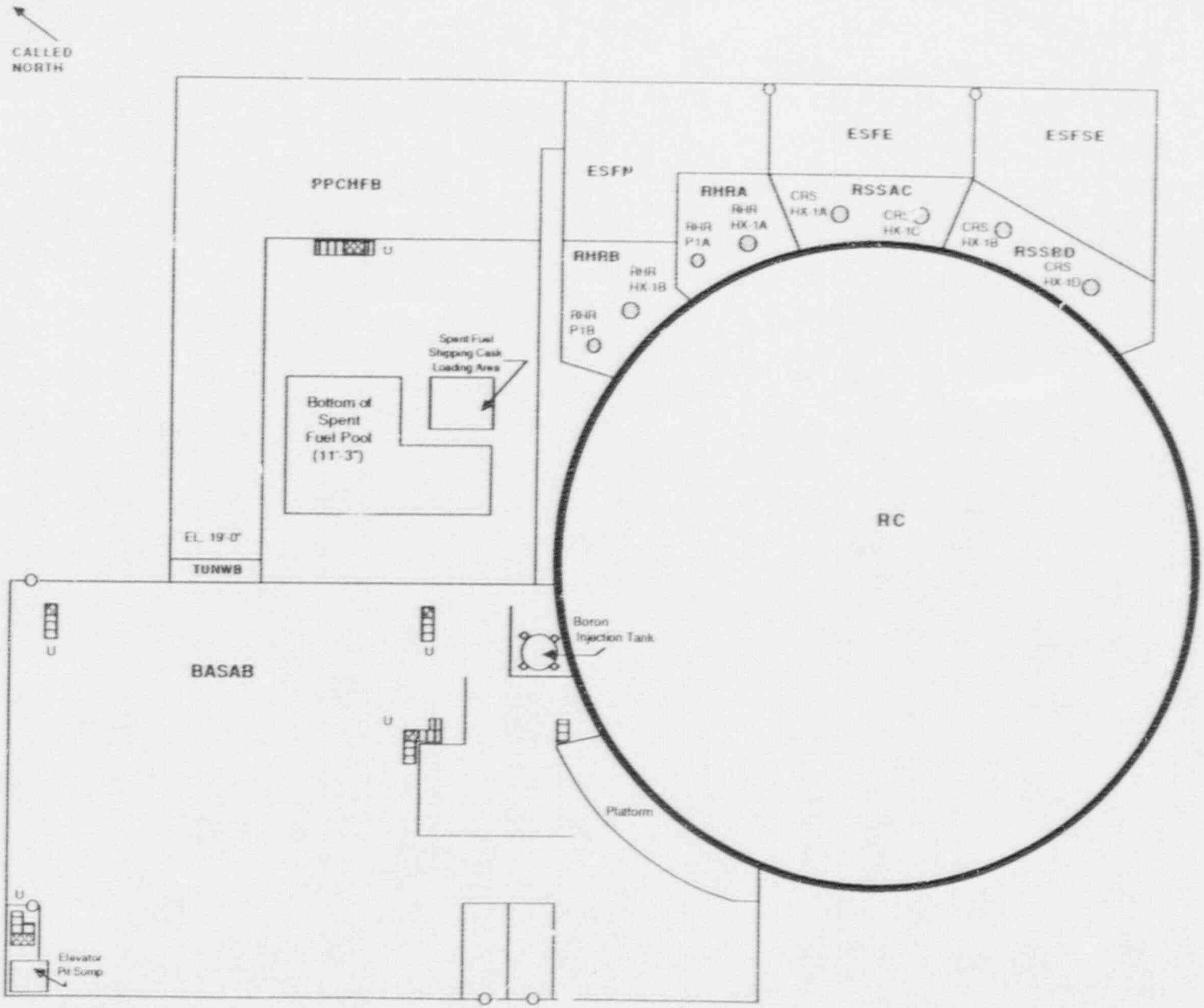


Figure 4-3. Millstone 3 General Arrangement, ESF, Fuel, and Auxiliary Buildings, Elevation 3'-8".

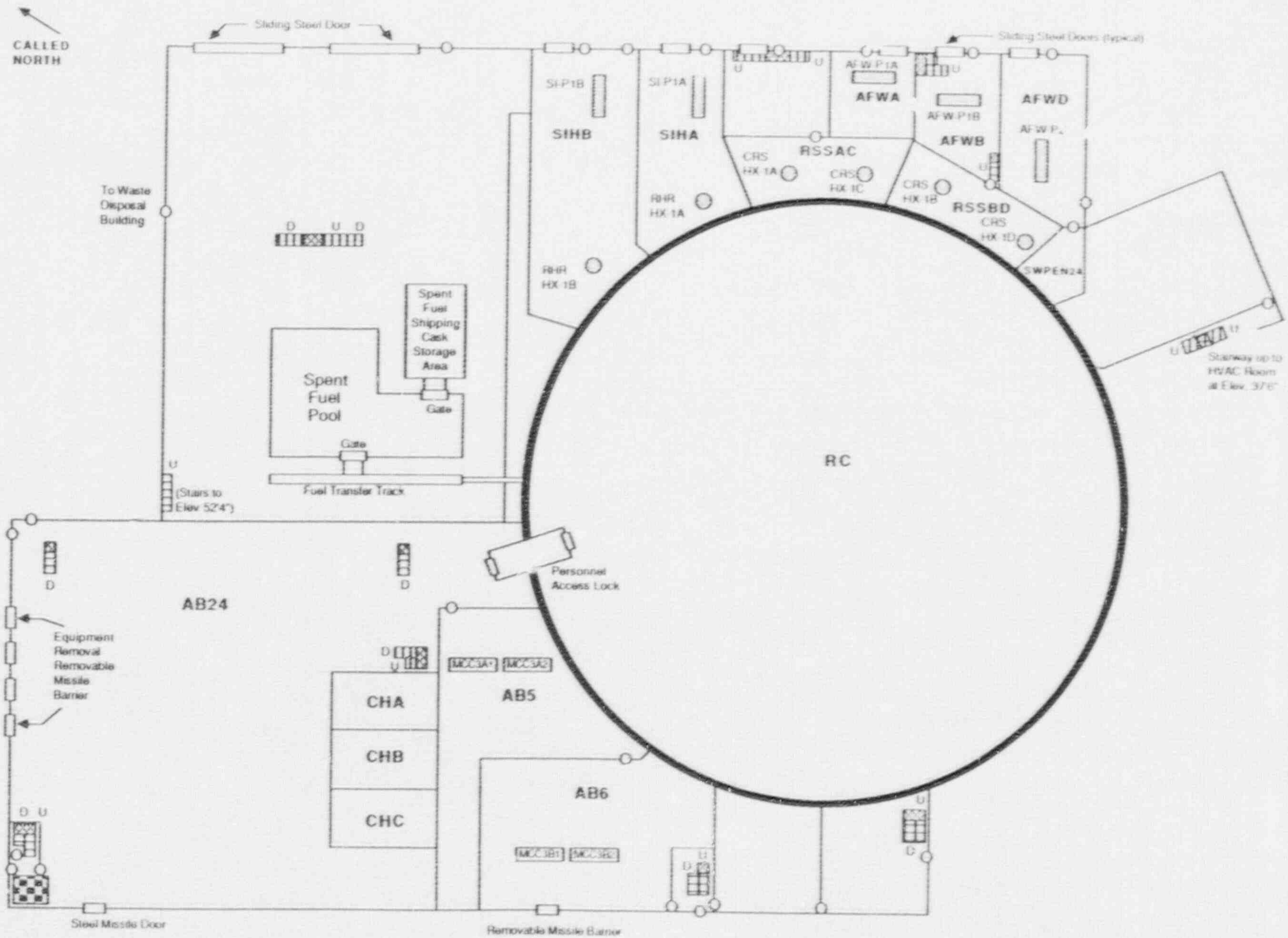


Figure 4-4. Millstone 3 General Arrangement, ESF, Fuel, and Auxiliary Buildings, Elevation 24'-6".

1/89

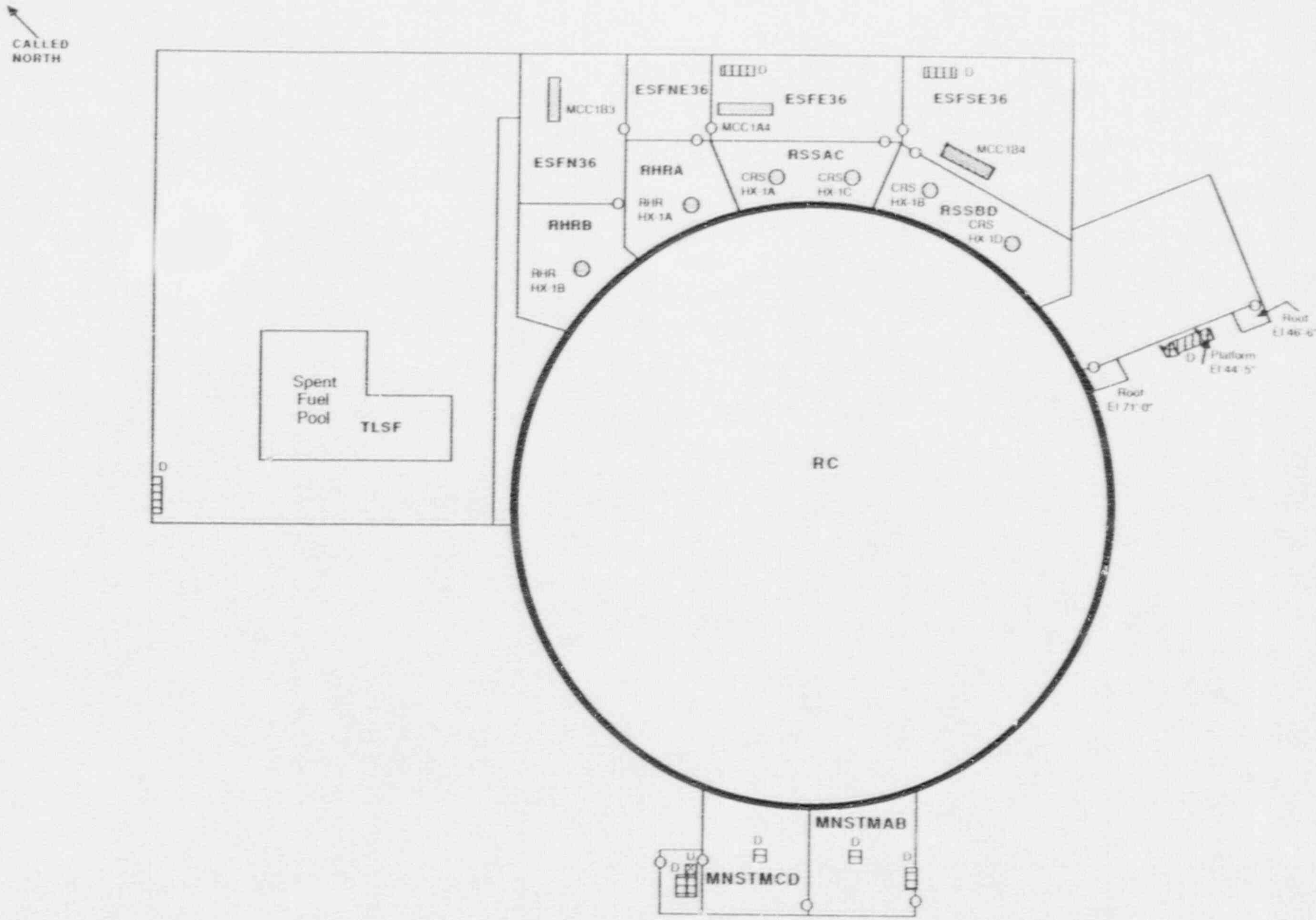


Figure 4-5. Millstone 3 General Arrangement, ESF and Fuel Buildings, Elevation 51'-4".

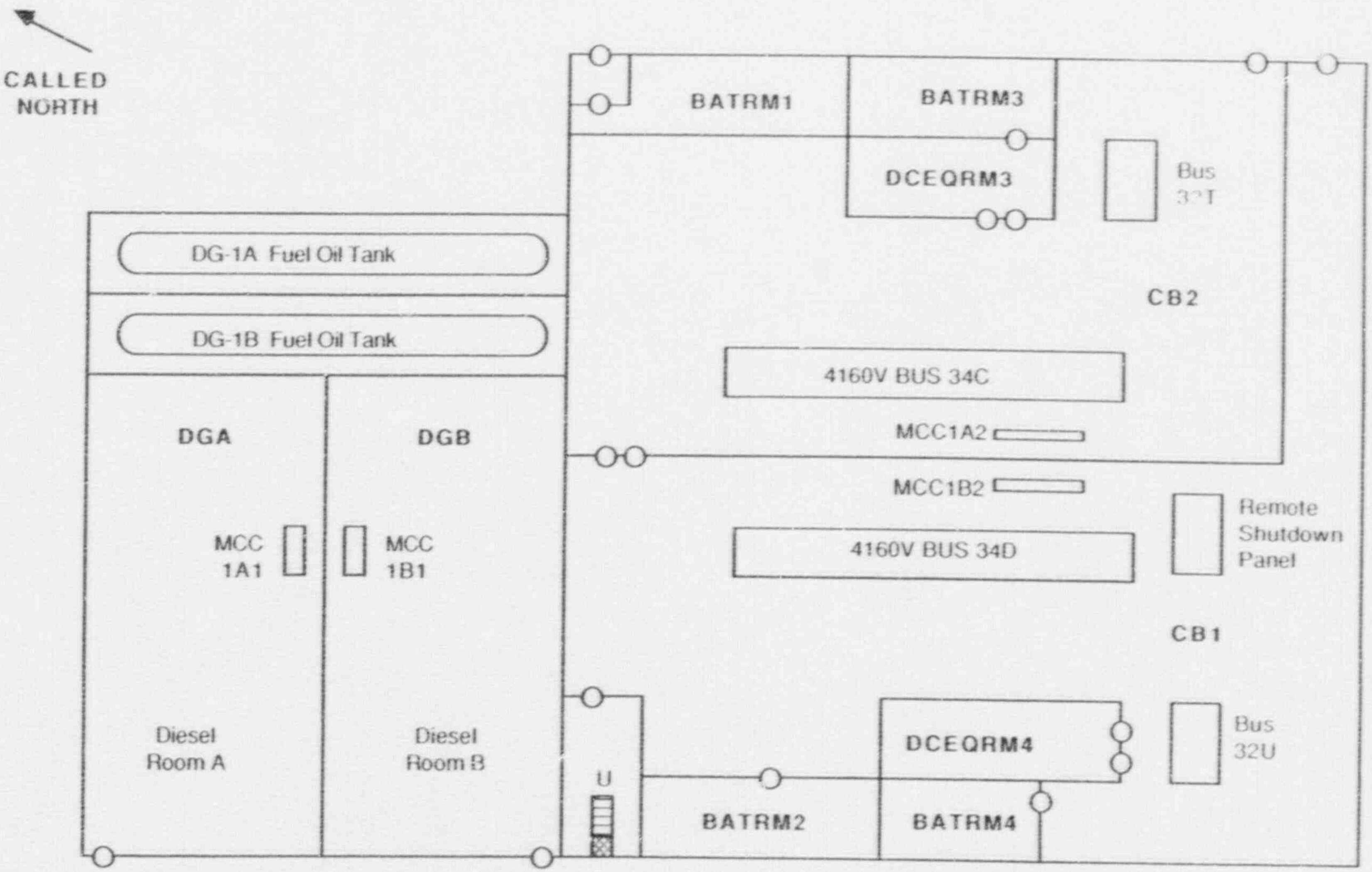


Figure 4-6. Millstone 3 General Arrangement, Control Building and Emergency Diesel Generator Enclosure, Elevation 4' -6".

CALLED
NORTH

CSR	Located Beneath This Elevation
CB66	Located Above This Elevation

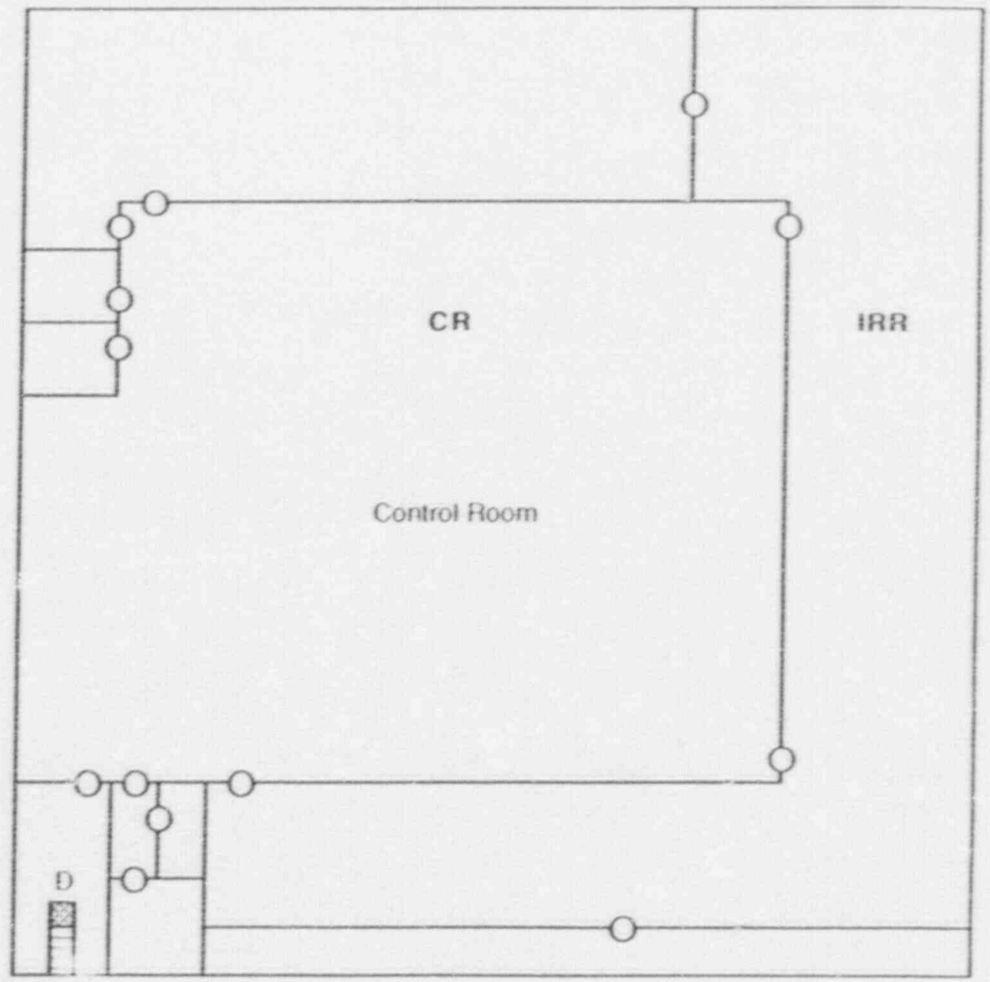


Figure 4-7. Millstone 3 General Arrangement, Control Building Elevation 47'-6"

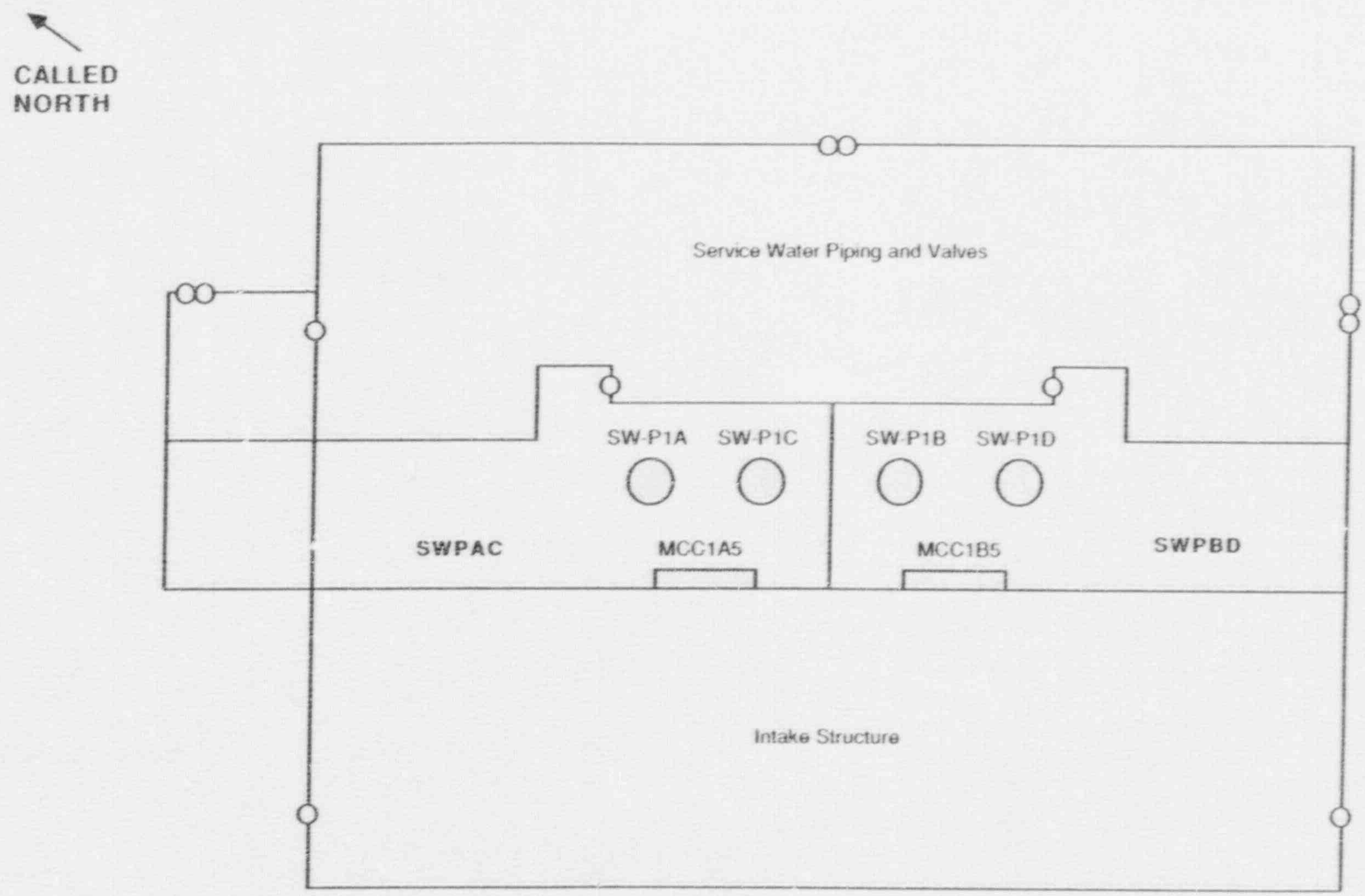


Figure 4-8. Millstone 3 General Arrangement, Circulating and Service Water Pump House, Elevation 14'-6"

Table 4-1. Definition of Millstone 3 Building and Location Codes

Codes		Descriptions
1.	AB24	Located on the 24'-6" elevation of the Auxiliary Building
2.	AB5	Auxiliary Building Switchgear Room 5, located on the 24'-6" elevation of the Auxiliary Building
3.	AB6	Auxiliary Building Switchgear Room 6, located on the 24'-6" elevation of the Auxiliary Building
4.	AFWA	Auxiliary Feedwater Pump A, located on the 21'-6" elevation of the Engineered Safety Features Building - east side
5.	AFWB	Auxiliary Feedwater Pump B, located on the 21'-6" elevation of the Engineered Safety Features Building - east side
6.	AFWTD	Turbine Driven Auxiliary Feedwater Pump, located on the 21'-6" elevation of the Engineered Safety Features Building - southeast side
7.	BASAB	Basement, located on the 4'-6" elevation of the Auxiliary Building
8.	BATRM1	Battery Room 1, located on the 4'-6" elevation of the Control Building
9.	BATRM2	Battery Room 2, located on the 4'-6" elevation of the Control Building
10.	BATRM3	Battery Room 3, located on the 4'-6" elevation of the Control Building
11.	BATRM4	Battery Room 4, located on the 4'-6" elevation of the Control Building
12.	CB1	Control Building Room 1, located on the 4'-6" elevation of the Control Building - west side
13.	CB2	Control Building Room 2, located on the 4'-6" elevation of the Control Building - east side
14.	CB66	Located on the 66' elvation of the Control Building
15.	CHA	Charging Pump Room A, located on the 24'-6" elevation of the Auxiliary Building - southeast side
16.	CHB	Charging Pump Room B, located on the 24'-6" elevation of the Auxiliary Building - south side

Table 4-1. Definition of Millstone 3 Building and Location Codes (Continued)

Codes	Descriptions
17. CHC	Charging Pump Room C, located on the 24'-6" elevation of the Auxiliary Building - southwest side
18. CR	Control Room, located on the 47'-6" elevation of the Control Building
19. CSR	Cable Spreading Room, located beneath the Control Room on the 24'-6" elevation
20. CST	Condensate Storage Tank, located south of the Containment Structure
21. DCEQRM3	DC Equipment Room 3, located on the 4'-6" elevation of the Control Building
22. DCEQRM4	DC Equipment Room 4, located on the 4'-6" elevation of the Control Building
23. DGA	Diesel Generator A
24. DGB	Diesel Generator B
25. DWST	Demineralized Water Storage Tank, located east of the Engineered Safety Features Building
26. ESFE	East side of the Engineered Safety Features Building on the 4'-6" elevation
27. ESFE36	North side of the Engineered Safety Features Building on the 36'-6' elevation
28. ESFN36	North side of the Engineered Safety Features Building on the 36'-6" elevation
29. ESFNE	Northeast side of the Engineered Safety Features Building on the 4'-6" elevation
30. ESFNE36	Northeast side of the Engineered Safety Features Building on the 36'-6" elevation
31. ESFSE	Southeast side of the Engineered Safety Features Building on the 4'-6" elevation
32. ESFSE36	Southeast side of the Engineered Safety Features Building on the 36'-6" elevation

Table 4-1. Definition of Millstone 3 Building and Location Codes (Continued)

Codes		Descriptions
33.	IRR	Instrument Rack Room, located on the 47'-6" elevation in the Control Building - south side
34.	MNSTMAB	Main Steam Penetration Room AB, located in the Main Steam Valve Building - south side
35.	MNSTMCD	Main Steam Penetration Room CD, located in the Main Steam Valve Building - north side
36.	PPCHFB	Pipe Chase, located in the Fuel Building
37.	RC	Reactor Containment
38.	RHRA	Residual Heat Removal Heat Exchanger Room A, located on the 4'-6" elevation in the Engineered Safety Features Building - north side
39.	RHRB	Residual Heat Removal Heat Exchanger Room B located on the 4'-6" elevation in the Engineered Safety Features Building - north side
40.	RSSAC	Reactor Spray System Room AC, located next to Containmnet in the Engineered Safety Features Building from elevation 4'-6" to 36'-6" (Contains RSS Heat Exchangers and RSS Pumps B and D)
41.	RSSBD	Reactor Spray System Room BD, located next to Containmnet in the Engineered Safety Features Building from elevation 4'-6" to 36'-6" (Contains RSS Heat Exchangers and RSS Pumps B and D)
42.	RWST	Refueling Water Storage Tank, located east of the Engineered Safety Features Building
43.	SIHA	High Pressure Safety Injection Pump Room A, located on the 21'-6" in the Engineered Safety Feature Building - north side
44.	SIHB	High Pressure Safety Injection Pump Room B, located on the 21'-6" in the Engineered Safety Feature Building - north side
45.	SWPAC	Service Water Pump Room A, located on the 14'-6" elevation in the Pump House (Contains Service Water Pumps A and C)
46.	SWPBD	Service Water Pump Room B located on the 14'-6" elevation in the Pump House (Contains Service Water Pumps A and C)

Table 4-1. Definition of Millstone 3 Building and Location Codes (Continued)

Codes	Descriptions
47. SWPEN24	Sourthwest Pipe Penetration Area 24, located on the 21' elevation in the Engineered Safety Features Building - southwest side
48. TLSF	Spent fuel pool operating floor, located on the 52'-6" in the Fuel Building
49. TUNWB	Pipe Tunnel, located underneath the Waste Disposal Building and the Fuel Building
50. UG	Underground

Table 4-2. Partial Listing of Components by Location at Millstone 3

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
AB5	EP	BUS-32R	BUS
AB5	EP	TR-34C5	TRAN
AB5	EP	MCC-3A2	MCC
AB5	EP	MCC-3A1	MCC
AB6	EP	BUS-32W	BUS
AB6	EP	TR-34D4	TRAN
AB6	EP	MCC-3B1	MCC
AB6	EP	MCC-3B2	MCC
AFWA	AFW	AFW-P1A	MDP
AFWB	AFW	AFW-P1B	MDP
AFWTD	AFW	AFW-P2	TDP
BASAB	CVCS	CH-112D	MOV
BASAB	CVCS	CH-112E	MOV
BASAB	CVCS	SI-8801A	MOV
BASAB	CVCS	SI-8801B	MOV
BATRM1	EP	BAT-1	BATT
BATRM1	EP	BAT-1	BATT
BATRM2	EP	BAT-2	BATT
BATRM2	EP	BAT-2	BATT
BATRM3	EP	BAT-3	BATT
BATRM4	EP	BAT-4	BATT
CB1	EP	BUS-34D	BUS
CB1	EP	CB-34D	CB
CB1	EP	BC-2	BC
CB1	EP	BUS-2	BUS
CB1	EP	BUS-34D	BUS
CB1	EP	BUS-2	BUS
CB1	EP	BUS-32U	BUS
CB1	EP	TR-34D2	TRAN
CB1	EP	BUS-2	BUS
CB1	EP	BUS-2	BUS

Table 4-2. Partial Listing of Components by Location at Millstone 3 (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
CB1	EP	BUS-2	BUS
CB1	EP	BUS-2	BUS
CB1	EP	BUS-VB2	BUS
CB1	EP	BUS-VB2	BUS
CB1	EP	INV-2	INV
CB1	EP	INV-2	INV
CB1	EP	TR-2-X	TRAN
CB2	EP	BUS-34C	BUS
CB2	EP	CB-34C	CB
CB2	EP	BC-1	BC
CB2	EP	BC-7	BC
CB2	EP	BUS-1	BUS
CB2	EP	BUS-34C	BUS
CB2	EP	BUS-1	BUS
CB2	EP	BUS-32T	BUS
CB2	EP	TR-34C3	TRAN
CB2	EP	BUS-1	BUS
CB2	EP	BUS-1	BUS
CB2	EP	BUS-1	BUS
CB2	EP	BUS-1	BUS
CB2	EP	BUS-VB1	BUS
CB2	EP	BUS-VB1	BUS
CB2	EP	INV-1	INV
CB2	EP	INV-1	INV
CB2	EP	TR-1-X	TRAN
CB2	EP	BC-7	BC
CHA	CVCS	CH-8468A	MOV
CHA	CVCS	CH-8438A	MOV
CHA	CVCS	CH-8438C	MOV
CHA	CVCS	CH-P3A	MDP
CHB	CVCS	CH-8469B	MOV

Table 4-2. Partial Listing of Components by Location at Millstone 3 (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
CHB	CVCS	CH-8438B	MOV
CHB	CVCS	CH-P3B	MDP
CST	AFW	AFW-CST	TANK
DCEQRM3	EP	BC-3	BC
DCEQRM3	EP	BUS-3	BUS
DCEQRM3	EP	BUS-3	BUS
DCEQRM3	EP	BUS-3	BUS
DCEQRM3	EP	BUS-VB3	BUS
DCEQRM3	EP	BUS-VB3	BUS
DCEQRM3	EP	INV-3	INV
DCEQRM3	EP	INV-3	INV
DCEQRM3	EP	TR-3-X	TRAN
DCEQRM4	EP	BC-4	BC
DCEQRM4	EP	BC-8	BC
DCEQRM4	EP	BUS-4	BUS
DCEQRM4	EP	BUS-4	BUS
DCEQRM4	EP	BUS-4	BUS
DCEQRM4	EP	BUS-VB4	BUS
DCEQRM4	EP	BUS-VB4	BUS
DCEQRM4	EP	INV-4	INV
DCEQRM4	EP	INV-4	INV
DCEQRM4	EP	TR-4-X	TRAN
DCEQRM4	EP	BC-8	BC
DGA	EP	DG-1A	DG
DGA	EP	DG-1A	DG
DGB	EP	DG-1B	DG
DGB	EP	DG-1B	DG
DWST	AFW	AFW-DWST	TANK
ESFE	PAHRS	CRS-8837A	MOV
ESFE	PAHRS	CRS-8838A	MOV
ESFE	PAHRS	SW-54A	MOV

Table 4-2. Partial Listing of Components by Location at Millstone 3 (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
ESFE	PAHRS	SW-54C	MOV
ESFE36	EP	MCC-1A4	MCC
ESFN36	EP	MCC-1P[illegible]	MCC
ESFNE	ECCS	SI-8806	MOV
ESFSE	PAHRS	CRS-8637B	MOV
ESFSE	PAHRS	CRS-8838B	MOV
ESFSE	PAHRS	SW-54B	MOV
ESFSE	PAHRS	SW-54D	MOV
ESFSE36	EP	MCC-1B4	MCC
RC	AFW	SG-1B	SG
RC	AFW	SG-1A	SG
RC	AFW	SG-1A	SG
RC	AFW	SG-1B	SG
RC	AFW	SG-1C	SG
RC	AFW	SG-1D	SG
RC	AFW	SG-1D	SG
RC	AFW	SG-1C	SG
RC	CVCS	RCS-VESSEL	RV
RC	CVCS	RCS-VESSEL	RV
RC	ECCS	RCS-VESSEL	RV
RC	ECCS	RCS-VESSEL	RV
RC	PAHRS	RCS-VESSEL	RV
RC	PAHRS	RCS-VESSEL	RV
RC	PAHRS	RCS-VESSEL	RV
RC	PAHRS	RCS-VESSEL	RV
RC	RCS	RC-8701A	MOV
RC	RCS	RC-8701C	MOV
RC	RCS	RC-8702B	MOV
RC	RCS	RC-8702C	MOV
RC	RCS	RCS-VESSEL	RV
RC	RCS	RC-455A	NV

Table 4-2. Partial Listing of Components by Location at Millstone 3 (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
RC	RCS	RC-456	NV
RC	RCS	RC-8000A	MOV
RC	RCS	RC-8000B	MOV
RSSAC	AFW	AFW-35A	MOV
RSSAC	AFW	AFW-35D	MOV
RSSAC	PAHRS	CRS-20A	MOV
RSSAC	PAHRS	CRS-20C	MOV
RSSAC	PAHRS	CRS-23A	MOV
RSSAC	PAHRS	CRS-23C	MOV
RSSAC	PAHRS	CRS-E1A	HX
RSSAC	PAHRS	CRS-P1A	MDP
RSSAC	PAHRS	SW-57A	MOV
RSSAC	PAHRS	CRS-E1C	HX
RSSAC	PAHRS	CRS-P1C	MDP
RSSAC	PAHRS	SW-57C	MOV
RSSBD	AFW	AFW-35B	MOV
RSSBD	AFW	AFW-35C	MOV
RSSBD	PAHRS	CRS-20B	MOV
RSSBD	PAHRS	CRS-20D	MOV
RSSBD	PAHRS	CRS-23B	MOV
RSSBD	PAHRS	CRS-23D	MOV
RSSBD	PAHRS	CRS-E1B	HX
RSSBD	PAHRS	CRS-P1B	MDP
RSSBD	PAHRS	SW-57B	MOV
RSSBD	PAHRS	CRS-E1D	HX
RSSBD	PAHRS	CRS-P1D	MDP
RSSBD	PAHRS	SW-57D	MOV
RWST	CVCS	SI-RWST	TANK
RWST	CVCS	SI-RWST	TANK
RWST	ECCS	RWST	TANK
RWST	ECCS	SI-RWST	TANK

Table 4-2. Partial Listing of Components by Location at Millstone 3 (Continued)

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
SIHA	ECCS	SI-8802A	MOV
SIHA	ECCS	SI-8821A	MOV
SIHA	ECCS	SI-8821A	MOV
SIHA	ECCS	SI-8835	MOV
SIHA	ECCS	SI-8923A	MOV
SIHA	ECCS	SI-P1A	MDP
SIHB	ECCS	SI-8802B	MOV
SIHB	ECCS	SI-8821B	MOV
SIHB	ECCS	SI-8821B	MOV
SIHB	ECCS	SI-8923B	MOV
SIHB	ECCS	SI-P1B	MDP
SWPAC	EP	SW-102C	MOV
SWPAC	EP	MCC-1A5	MCC
SWPAC	SW	SW-102A	MOV
SWPAC	SW	SW-102C	MOV
SWPAC	SW	SW-P1A	MDP
SWPAC	SW	SW-P1C	MDP
SWPBD	EP	SW-102D	MOV
SWPBD	EP	MCC-1B5	MCC
SWPBD	SW	SW-102B	MOV
SWPBD	SW	SW-102D	MOV
SWPBD	SW	SW-P1B	MDP
SWPBD	SW	SW-P1D	MDP

5. BIBLIOGRAPHY FOR MILLSTONE 3

1. NUREG-1031, "Safety Evaluation Report Related to the Operation of Millstone Nuclear Power Station, Unit No. 3," USNRC.

2. NUREG-1064, " Final Environmental Statement Related to the Operation of Millstone Nuclear Power Station, Unit No. 3," USNRC, December 1984.

3. NUREG-1152, "Millstone 3 Risk Evaluation Report," USNRC, June 1986

4. NUREG-1176, "Technical Specifications for Millstone Nuclear Power Station, Unit 3," USNRC.

5. NUREG/CR-4142, "A Review of the Millstone 3 Probabilistic Safety Study," Lawrence Livermore National Laboratory, April 1986.

6. NUREG/CR-4143, "Review and Evaluation of the Millstone Unit 3 Probabilistic Safety Study," Brookhaven National Laboratory, September 1985.

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)

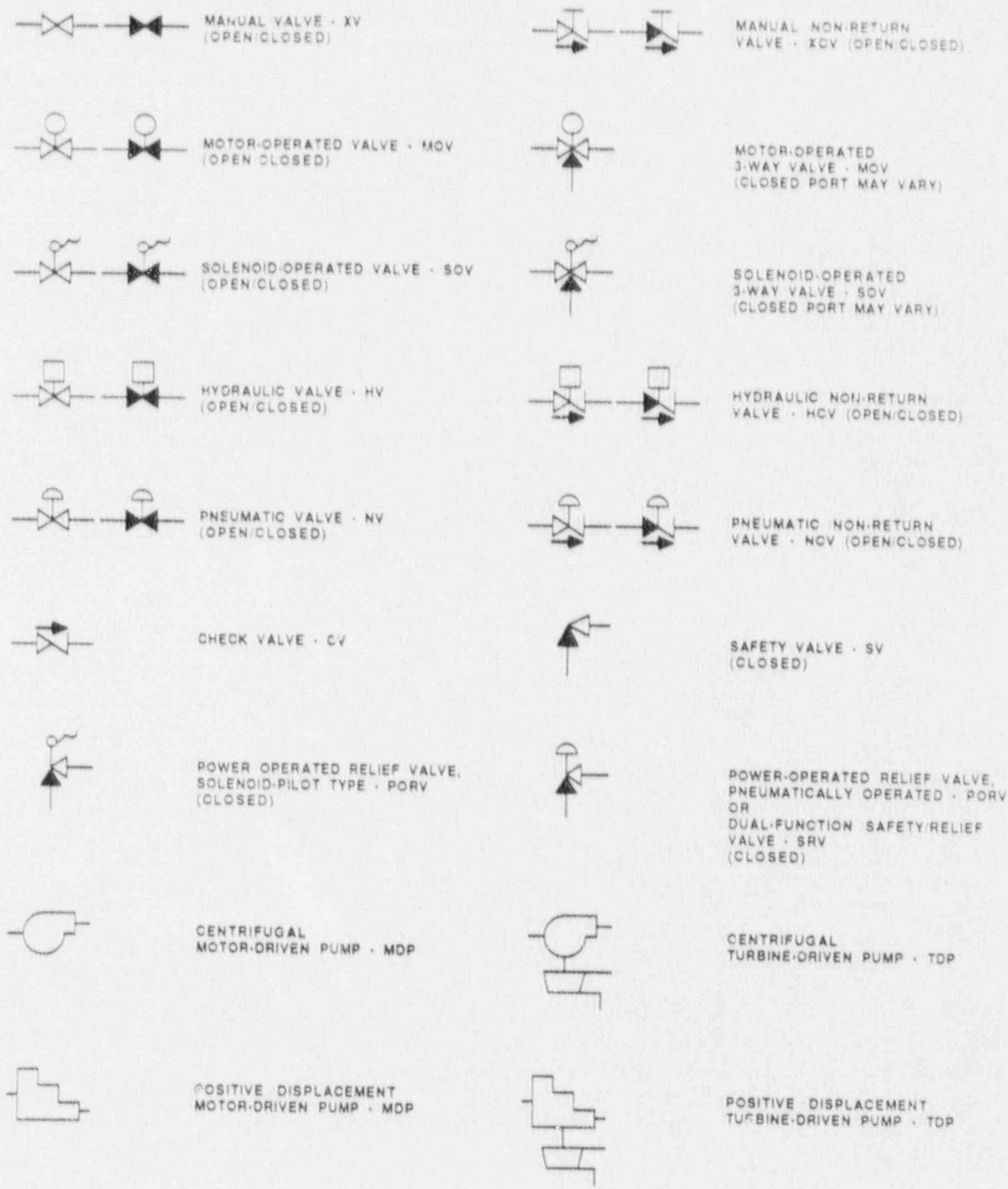


Figure A-1. Key To Symbols In Fluid System Drawings

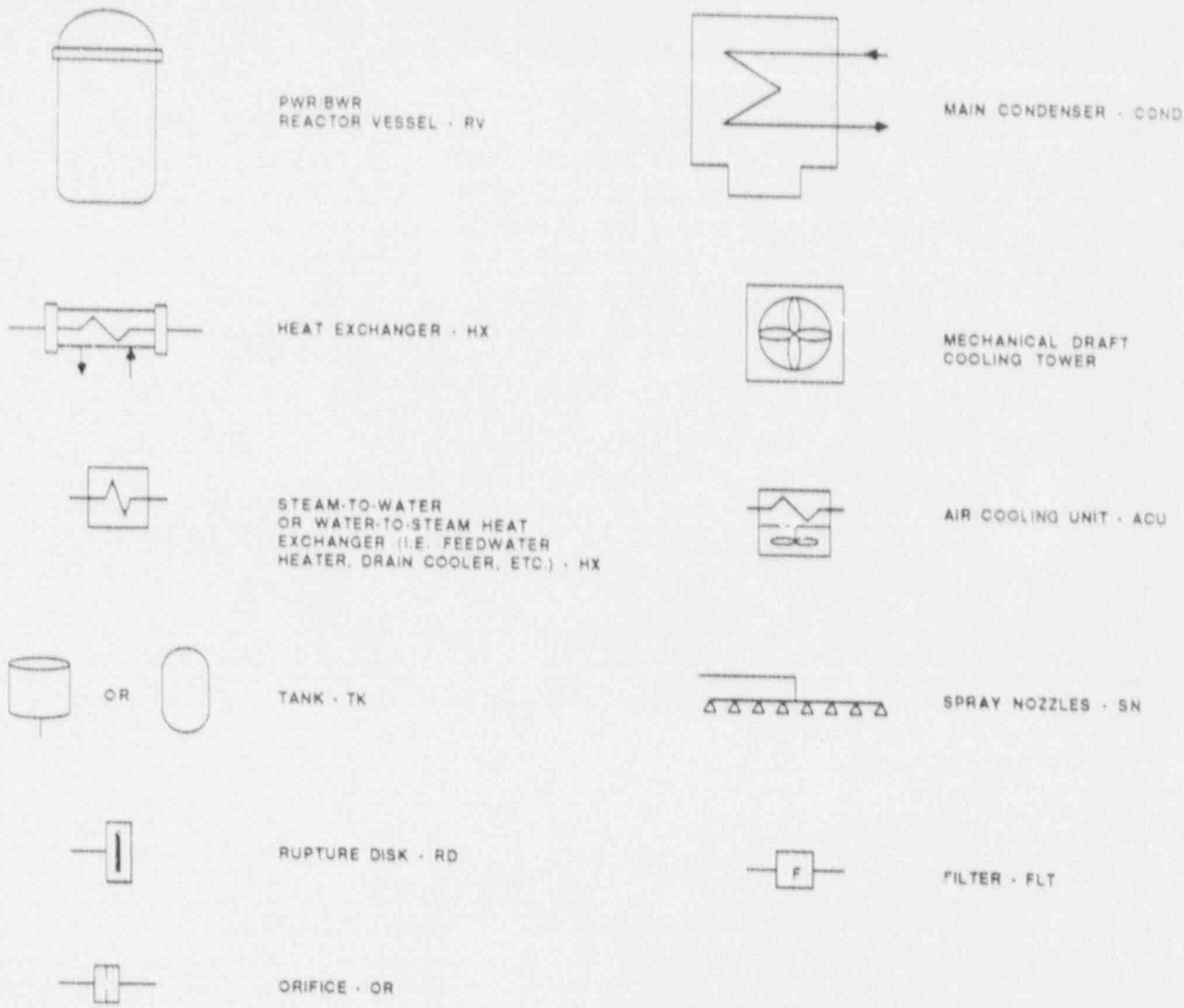


Figure A-1. Key To Symbols In Fluid System Drawings (Continued)

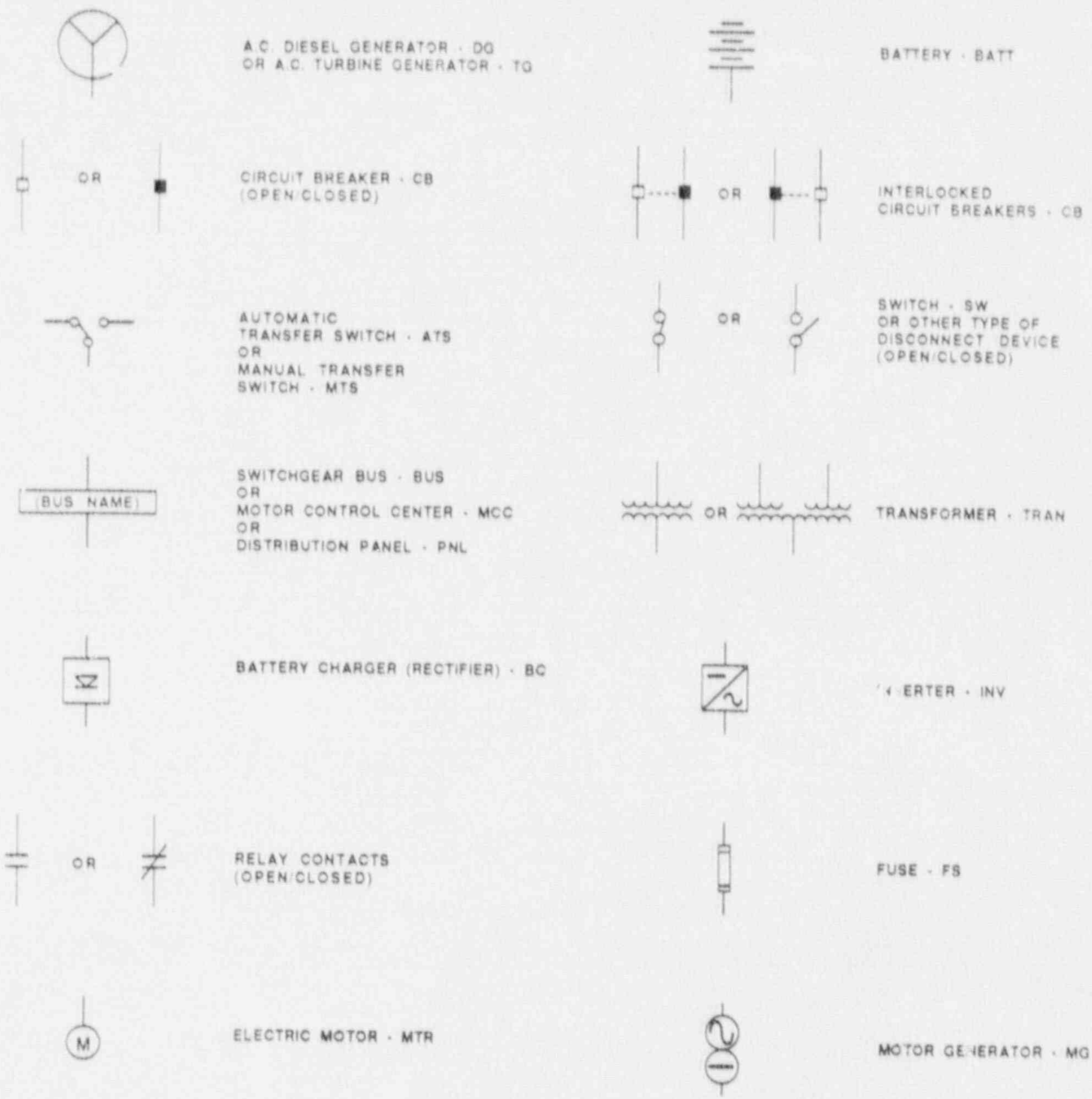


Figure A-2. Key To Symbols In Electrical System Drawings

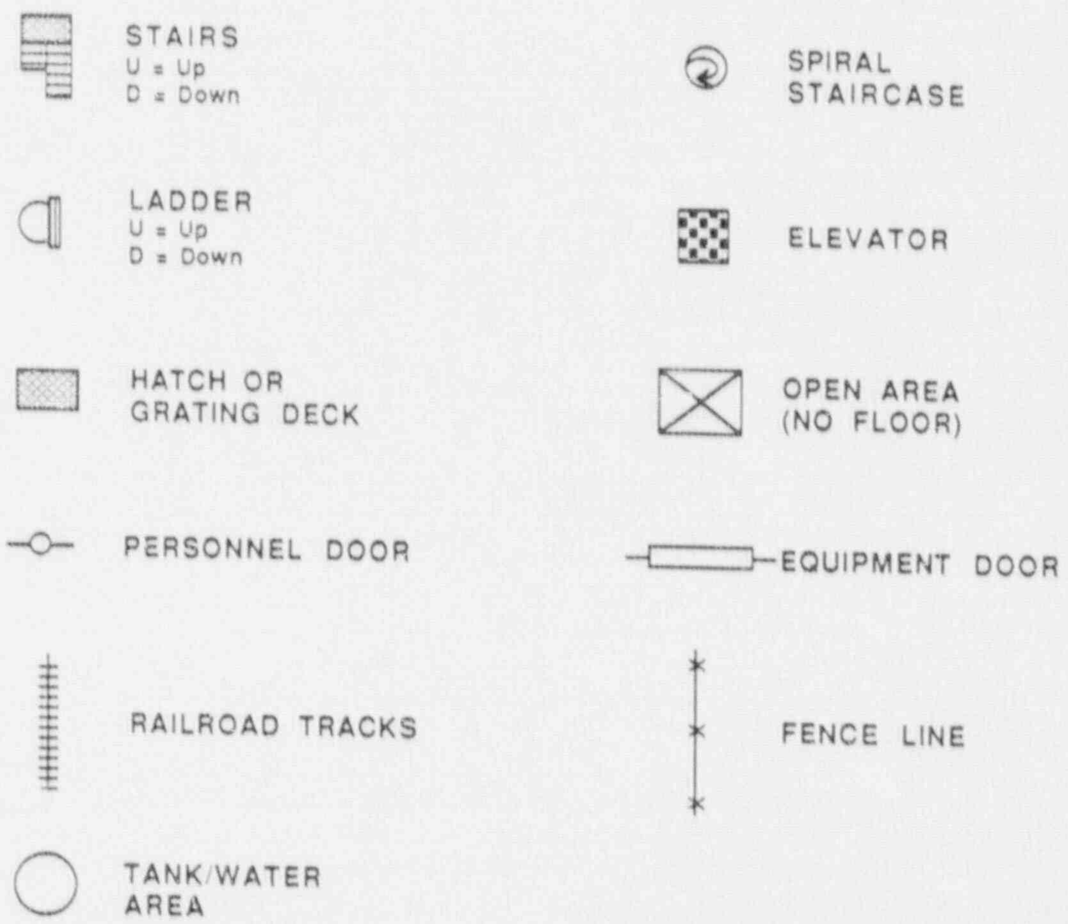


Figure A-3. Key To Symbols In Facility Layout Drawings

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:

Code	Definition
RCS	Reactor Coolant System
AFW	Auxiliary Feedwater System
ECCS	Emergency Core Cooling System (including HPSI and LPSI)
PAHRS	Containment Heat Removal Systems
CVCS	Charging System
EP	Electric Power 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

COMPONENT	COMP TYPE
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 of PD)	TDP
Diesel-driven pump (centrifugal of 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)

COMPONENT	COMP TYPE
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