UNITED STATES NUCLEAR REGULATORY COMMISSION

NUCLEAR POWER PLANT SYSTEM SOURCEBOOK

FITZPATRICK

~~50-482~~
50-333

SAIC

8904050158 XA 120pp

SAIC 89/1024

NUCLEAR POWER PLANT SYSTEM SOURCEBOOK

FITZPATRICK

50-482

Editor: Peter Lobner
Author: Patricia Saylor

Prepared for:

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Contract NRC-03-87-029
FIN D-1763

SAIC

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES (continued)

LIST OF FIGURES (continued)

LIST OF TABLES

CAUTION

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

NOTICE

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

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.

FITZPATRICK
RECORD OF REVISIONS

REVISION	ISSUE	COMMENTS
0	2/89	Original report

FITZPATRICK SYSTEM SOURCEBOOK

This sourcebook contains summary information on the James A. Fitzpatrick nuclear power plant. 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 Fitzpatrick nuclear plant is listed below:

- Docket number	50-482
- Operator	New York Power Authority
- Location	Nine Mile Point on Lake Ontario in Oswego County
- Commercial operation date	7/28/75
- Reactor type	BWR/4
- NSSS vendor	General Electric
- Power (MWt/MWe)	2436/821
- Architect-engineer	Stone and Webster
- Containment type	Steel drywell (Mark I)

2. IDENTIFICATION OF SIMILAR NUCLEAR POWER PLANTS

The Fitzpatrick nuclear plant has one General Electric BWR/4 nuclear steam supply system on the site. The unit has a Mark I BWR containment incorporating the drywell/pressure suppression concept, and has a secondary containment structure of reinforced concrete. Other BWR/4 plants in the United States are as follows:

Vermont Yankee
Browns Ferry Units 1, 2 and 3
Hatch Units 1 and 2
Cooper Nuclear Station
Duane Arnold
Peach Bottom 2 and 3
Brunswick Units 1 and 2
Fermi Unit 2
Hope Creek Unit 1
Limerick Units 1 and 2 (Mark II Containment)
Shoreham (Mark II Containment)
Susquehanna Units 1 and 2 (Mark II Containment)

The Fitzpatrick plant has a high pressure coolant injection system, a reactor core isolation cooling system capable of steam-condensing operation in conjunction with the RHR system, a low pressure core spray system and a multi-mode RHR system.

3. SYSTEM INFORMATION

This section contains descriptions of selected systems at Fitzpatrick in terms of general function, operation, system success criteria, major components, and support system requirements. A summary of major systems at Fitzpatrick 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 Fitzpatrick 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	4
- Reactor Core Isolation Cooling (RCIC) Systems	Same	3.2	4.7
- Emergency Core Cooling Systems (ECCS)	Same		
- High-Pressure Injection & Recirculation	High-Pressure Coolant Injection (HPCI) System	3.3	6.4.1, 6.5.2.2
- Low-pressure Injection & Recirculation	Core Spray (CS) System,	3.3	6.4.3, 6.5.2.4
	Low-Pressure Coolant Injection (LPCI) Mode (an operating mode of the RHR system)	3.3	4.8.6.1, 6.4.4, 6.5.2.5
- Automatic Depressurization System (ADS)	Same	3.3	6.4.2, 6.5.2.3
- Decay Heat Removal (DHR) System (Residual Heat Removal (RHR) System)	Residual Heat Removal (RHR) System (a multi-mode system)	3.3	4.8
- Main Steam and Power Conversion Systems	Main Steam System,	X	4.11
	Condensate and Feedwater System,	X	10.8
	Circulating Water System	X	10.6
- Other Heat Removal Systems	Steam-condensing RHR/RCIC operation (Reactor Isolation (Condensing Mode))	3.2	4.8.6.3
	Containment Flooding System	X	5.2.3.11

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

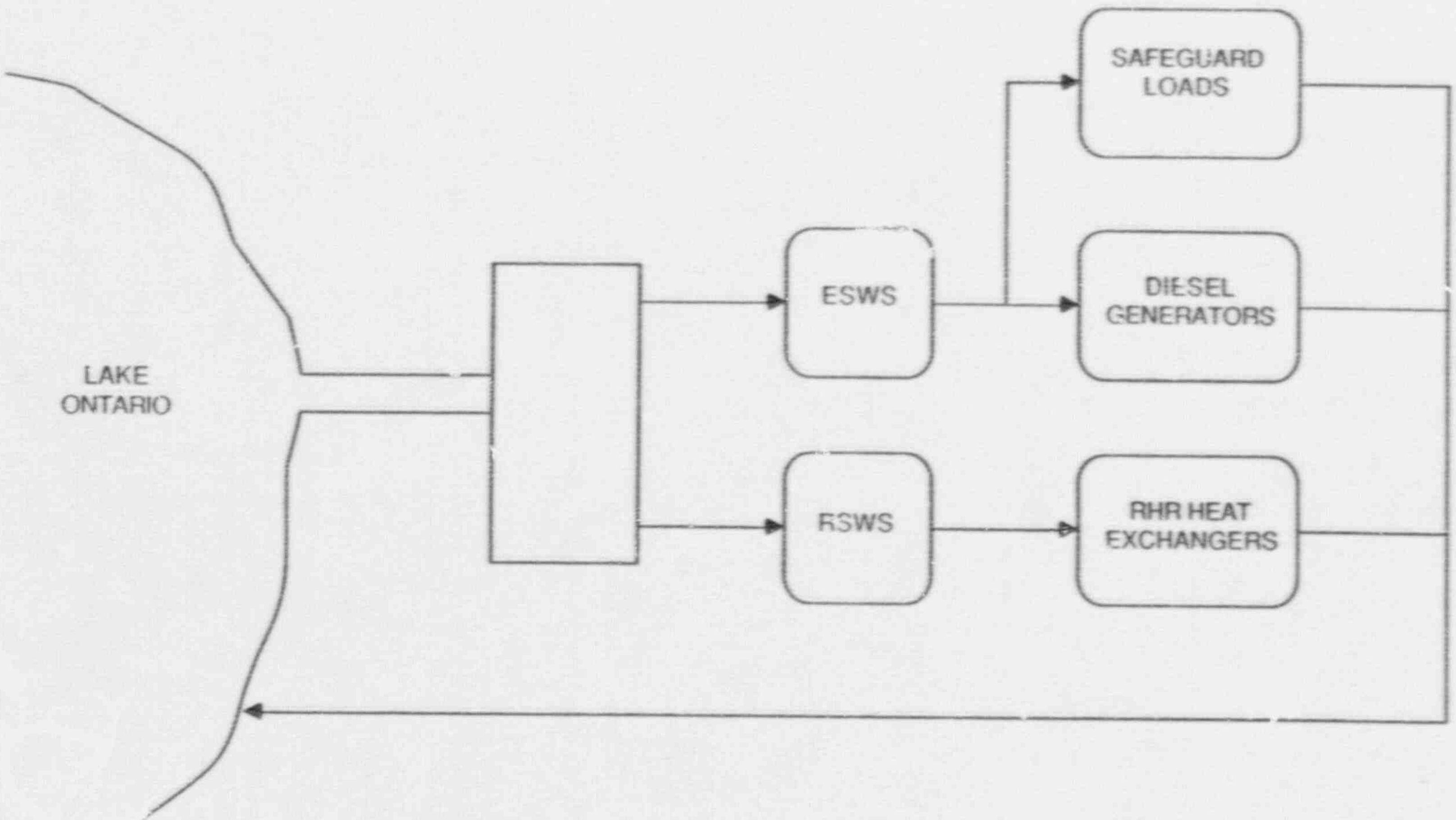
Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Reactor Coolant Inventory Control Systems			
- Reactor Water Cleanup (RWCU) System	Same	X	4.9
- ECCS	See above	-	-
- Control Rod Drive Hydraulic System (CRDHS)	Same	3.6	3.5.5.2
Containment Systems			
- Primary Containment	Same (drywell and pressure suppression chamber)	X	5.2
- Secondary Containment	Same	X	5.3
- Standby Gas Treatment System (SGTS)	Same	X	5.3.3.4
- Containment Heat Removal Systems			
- Suppression Pool Cooling System	Same (an operating mode of the RHR system)	3.3	4.8.5, 4.8.6.2
- Containment Spray System	Same (an operating mode of the RHR system)	3.3	4.8.6.2
- Containment Fan Cooler System	Primary Containment Cooling and Ventilation System	X	5.2.3.7
- Containment Normal Ventilation Systems	Primary Containment Cooling and Ventilation System,	X	5.2.3.7
	Reactor Building Ventilation System	X	9.3.3.3
- Combustible Gas Control Systems	Primary Containment Atmosphere Control and Dilution System	X	5.2.3.8

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

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Reactor and Reactivity Control Systems			
- Reactor Core	Same	X	3
- Control Rod System	Control Rod Drive Mechanisms	X	3.4.3.5
- Chemical Poison System	Standby Liquid Control System (SLCS)	X	3.9
Instrumentation & Control (I&C) Systems			
- Reactor Protection System (RPS)	Same	3.4	7.2
- Engineered Safety Feature Actuation System (ESFAS)	Primary Containment and Reactor Vessel Isolation Control System, Core Standby Cooling System Control and Instrumentation,	3.4	7.3 7.4
- Remote Shutdown System	Various local control panels	3.4	7
- Other I&C Systems	Various other systems	X	7.5 to 7.17
Support Systems			
- Class 1E Electric Power System	Same	3.5	8
- Non-Class 1E Electric Power System	Same	3.5	8
- Diesel Generator Auxiliary Systems	Same	3.5	8.6.3, 8.6.4, 9.9.3.9
- Component Cooling Water (CCW) System	Reactor Building Closed Cooling Water (RBCCW) System	X	9.5

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

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Support Systems (continued)			
- Service Water System (SWS)	Emergency Service Water System	3.7	9.7.1
	Normal Service Water System	X	9.7.2
- Residual Heat Removal Service Water (RHRSW) System	Same	3.8	9.7.3
- Other Cooling Water Systems	Turbine Building Closed Cooling Water (TBCCW) System	X	9.6
- Fire Protection Systems	Same	X	9.8
- Room Heating, Ventilating, and Air-Conditioning (HVAC) Systems	Same, also	X	9.9
	Emergency Ventilation System	3.9	9.9.3.6, 9.9.3.9 9.9.3.11
- Instrument and Service Air Systems	Breathing, Instrument, and Service Air Systems	X	10.11
- Refueling and Fuel Storage Systems	New and Spent Fuel Storage Systems	X	9.2, 9.3
	Fuel Pool Cooling and Cleanup System	X	9.4
- Radioactive Waste Systems	Same	X	11.1 to 11.4
- Radiation Protection Systems	Shielding and Radiation Protection	X	11.5



ESWS = Emergency Service Water System
RSWS = RHR Service Water System

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

3.1 REACTOR COOLANT SYSTEM (RCS)

3.1.1 System Function

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

3.1.2 System Definition

The RCS includes: (a) the reactor vessel, (b) two recirculation loops, (c) two recirculation pumps, (d) 11 safety/relief valves, and (e) connected piping out to a suitable isolation valve boundary. Simplified diagrams of the RCS and important system interfaces are shown in Figures 3.1-1 and 3.1-2. A summary of data on selected RCS components is presented in Table 3.1-1.

3.1.3 System Operation

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

About 1/3 of the liquid in the downcomer region of the reactor vessel is drawn off by the recirculation pumps. The discharge of these pumps is returned to the inlet nozzles of the jet pumps at high velocity. As the liquid enters the jet pumps, the slow moving liquid in the upper region of the downcomer is induced to flow through the jet pumps, producing reactor coolant circulation.

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

Following a transient that involves the loss of the main condenser or loss of feedwater, heat from the RCS is dumped to the suppression chamber via safety/relief valves on the main steam lines. A LOCA inside containment or operation of the Automatic Depressurization System (ADS) also dumps heat to the suppression chamber. Makeup to the RCS is provided by the Reactor Core Isolation Cooling (RCIC) system (see Section 3.2) or by the Emergency Core Cooling System (ECCS, see Section 3.3). Heat is transferred from the containment by the Residual Heat Removal (RHR) System operating in the containment cooling mode. The RHR Service Water System completes the heat transfer path from the containment to the ultimate heat sink (see Section 3.8). Actuation systems provide for automatic closure of the MSIVs and isolation of other lines connected to the RCS.

RCS overpressure protection is provided by eleven safety/relief valves which discharge to the suppression pool.

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. Total volume: Unknown
2. Water volume: Unknown
3. Steam volume: Unknown
4. Steam flow: 17.1 x 10^6 lb/hr.
5. Normal operating pressure: 1020 psia

B. Safety/relief Valves (11)

Quantity	Set Pressure(psia)	Relief Capacity (lb/hr each)
2	1090	818,000
2	1105	829,000
7	1140	855,000

C. Recirculation Pumps (2)
1. Rated flow: 45,200 gpm @ 530 ft head (230 psid)
2. Type: Vertical centrifugal

D. Jet Pumps (20)
1. Total flow: 75.6 x 10^6 lb/hr @ 80.5 ft head (35 psid)

3.1.6 Support Systems and Interfaces

A. Motive Power
1. The recirculation pumps are supplied by non-Class 1E power.

B. MSIV Operating Power
The instrument air system and the instrument nitrogen system support normal operation of the MSIVs outside containment and inside containment, respectively. Valve operation is controlled by an AC and a DC solenoid pilot valve. Both solenoid valves must be deenergized to cause MSIV closure. This design prevents spurious closure of an MSIV if a single solenoid valve should fail. MSIVs are designed to fail closed if the pneumatic supply is lost or if both AC and DC control power is lost to the solenoid pilot valves. This is achieved by a local dedicated air accumulator for each MSIV and an independent valve closing spring.

C. Recirculation Pump Cooling
The reactor building closed cooling water (RBCCW) system provides cooling water to the recirculation pump coolers.

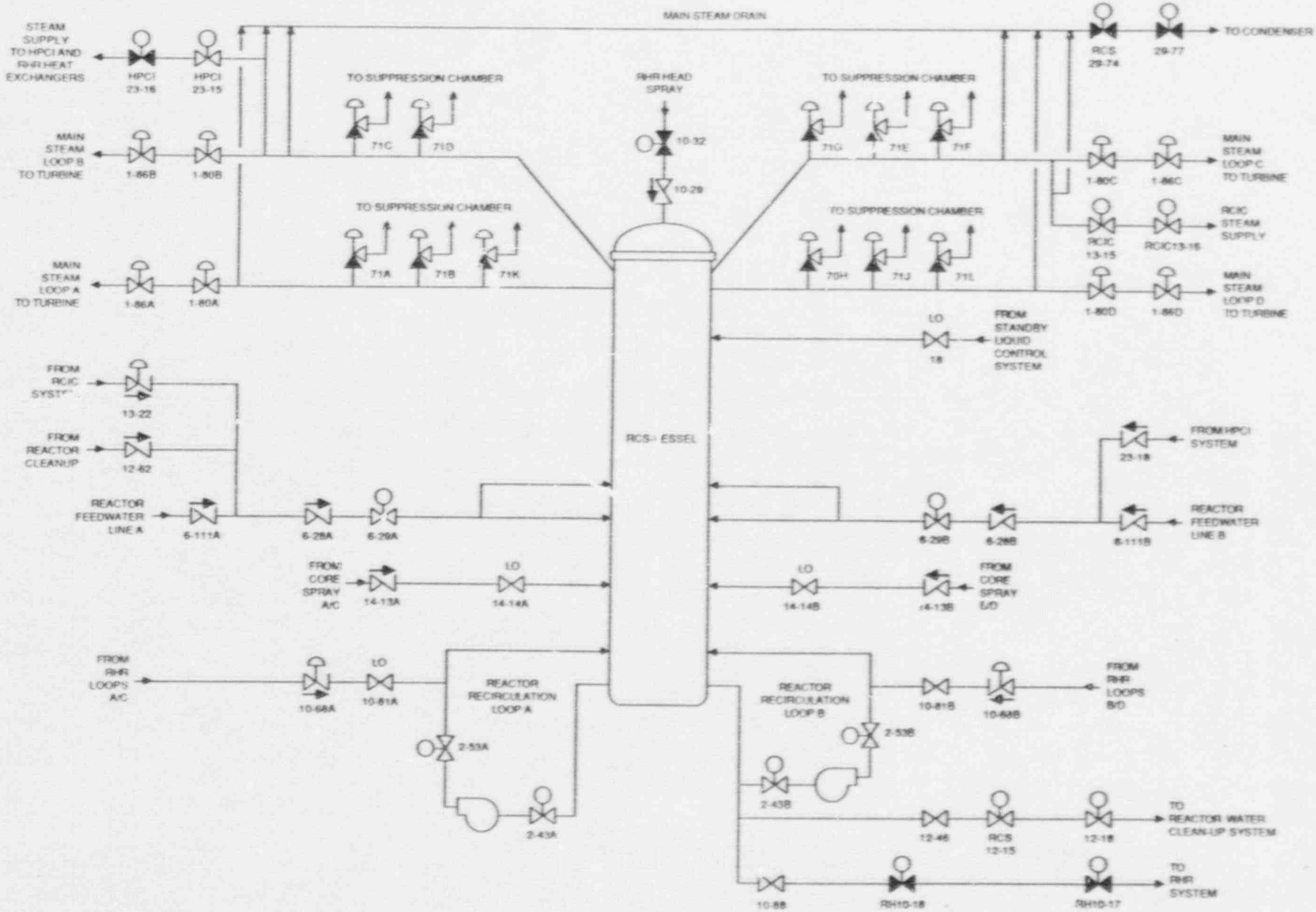


Figure 3.1-1. Fitzpatrick Reactor Coolant System

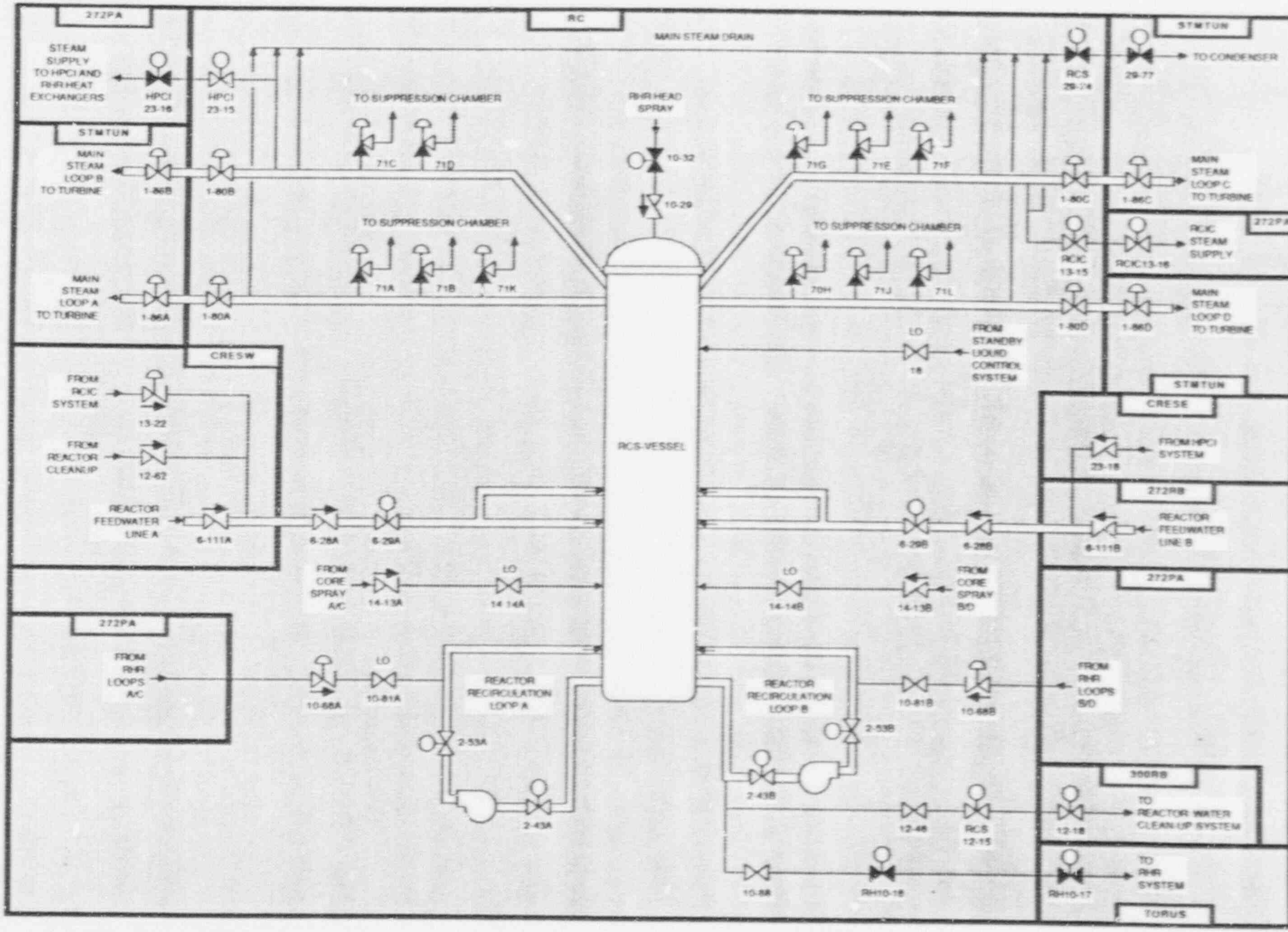


Figure 3.1-2. Fitzpatrick Reactor Coolant System Showing Component Locations

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
HPCI23-15	MOV	RC	MCC153	600	CRESW	AC/A
HPCI23-16	MOV	272PA	BMCC6	125	272RB	DC/B
RCIC13-15	MOV	RC	MCC163	600	CRESE	AC/B
RCIC13-16	MOV	272PA	BMCC1	125	CRESW	DC/A
RCS12-15	MOV	RC	MCC152	600	272RB	AC/A
RCS29-74	MOV	RC	MCC152	600	272RB	AC/A
RH10-17	MOV	TORUS	BMCC4	125	CRESE	DC/B
RH10-18	MOV	RC	MCC151	600	272RB	AC/A

3.2 REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM

3.2.1 System Function

The reactor core isolation cooling system provides adequate core cooling in the event that reactor isolation is accompanied by loss of feedwater flow. This system provides makeup at reactor operating pressure and does not require RCS depressurization. The RCIC system is not considered to be part of the Emergency Core Cooling System (ECCS, see Section 3.3) and does not have a LOCA mitigating function. The RCIC system is designed to operate in conjunction with the RHR system to provide a high-pressure decay heat removal capability.

3.2.2 System Definition

The reactor core isolation cooling system consists of a steam-driven turbine pump and associated valves and piping for delivering makeup water from the condensate storage tank or the suppression pool to the reactor pressure vessel. The RCIC system can also operate in conjunction with the RHR system in a steam condensing mode for high-pressure decay heat removal. In this mode, steam from the reactor vessel is condensed in the RHR heat exchanger, and delivered to the RCIC pump suction for return to the RCS.

Simplified drawings of the reactor core isolation cooling system are shown in Figures 3.2-1 and 3.2-2. A summary of data on selected RCIC system components is presented in Table 3.2-1.

3.2.3 System Operation

During normal operation the RCIC is in standby with the steam supply valve to the RCIC turbine driven pump closed and the pump suction aligned to the condensate storage tank.

Upon receipt of a reactor pressure vessel (RPV) low water level signal, the turbine-pump steam supply valve is opened and makeup water is supplied to the RPV. The primary water supply for the RCIC is the condensate storage tank. The suppression pool is used as a backup water supply. Reactor core heat is dumped to the suppression pool via the safety/relief valves which cycle as needed to limit RCS pressure. The RCIC turbine also exhausts to the suppression pool.

The RCIC can also operate in conjunction with the RHR system in the steam condensing mode, in which condensed steam is delivered from the RHR heat exchanger outlets to the RCIC pump suction for return to the RCS. In this mode of operation, reactor decay heat is transferred to the RHR Service Water System via the RHR heat exchangers rather than to the suppression pool. The RCIC turbine still exhausts to the suppression pool.

The RCIC system is designed to operate on DC power only for an unspecified length of time. DC power is required for control and to operate most of the motor-operated valves in the system. The only valve requiring AC power is normally open steam supply valve 1315.

3.2.4 System Success Criteria

For the RCIC system to be successful there must be at least one water source and supply path to the turbine-driven pump, an open steam supply path to the turbine, an open discharge path to the RCS, and an open turbine exhaust path to the suppression pool.

3.2.5 Component Information

A. Steam turbine-driven RCIC pump:
   1. Rated Flow: 600 gpm @ 2800 ft head (1214 psid)
   2. Rated Capacity: 100%
   3. Type: centrifugal

B. Condensate Storage Tanks (2)
   1. Total Capacity: 400,000 gal (both tanks)
   2. RCIC reserve capacity: 200,000 gal

3.2.6 Support System and Interfaces

A. Control Signals
   1. Automatic
      a. The RCIC pump is automatically actuated on a reactor vessel low water level signal.
      b. The RCIC pump is automatically shut down on a reactor vessel high water level signal by closing the steam supply valve. This valve automatically reopens on a subsequent reactor vessel low water level signal to restart the RCIC pump.
      c. The RCIC system will be automatically shutdown by closing the turbine trip valve if any of the following conditions exist; however, the system must be manually restarted:
         - Turbine overspeed
         - Pump low suction pressure
         - High exhaust pressure from RCIC turbine
      d. The RCIC steam line is automatically isolated if any of the following conditions exist:
         - RCIC equipment space high temperature
         - RCIC turbine high steam flow
         - RCIC turbine steam line pressure low
      e. The RCIC pump suction is automatically realigned to the suppression pool if the CST is unavailable.
   2. Remote Manual
      The RCIC system can be actuated and controlled by remote manual means from the main control room.

B. Motive Power
   1. The RCIC turbine driven pump is supplied with steam from main steam loop C, upstream of the main steam isolation valves.
   2. All RCIC valves and supporting equipment are Class 1E loads that are supplied from the DC and AC power systems as described in Section 3.5. The RCIC system is designed to be operable on DC power only. Valves that must open to start the system are DC-powered. Normally open isolation valve 13-15 is AC-powered.

C. Other

1. Lubrication for the turbine-driven pump is supplied locally.
2. The RCIC turbine lube oil cooler is cooled by water diverted from the RCIC pump discharge and returned to the barometric condenser. Design maximum lube oil cooling water temperature for the RCIC pump is not known.
3. RCIC pump gland seal leakoff is collected, condensed and returned to the pump suction. A vacuum pump maintains condenser vacuum.
4. The RCIC pump is located in the West Crescent Room which has area coolers supplied by the ESW system (see Section 3.7)

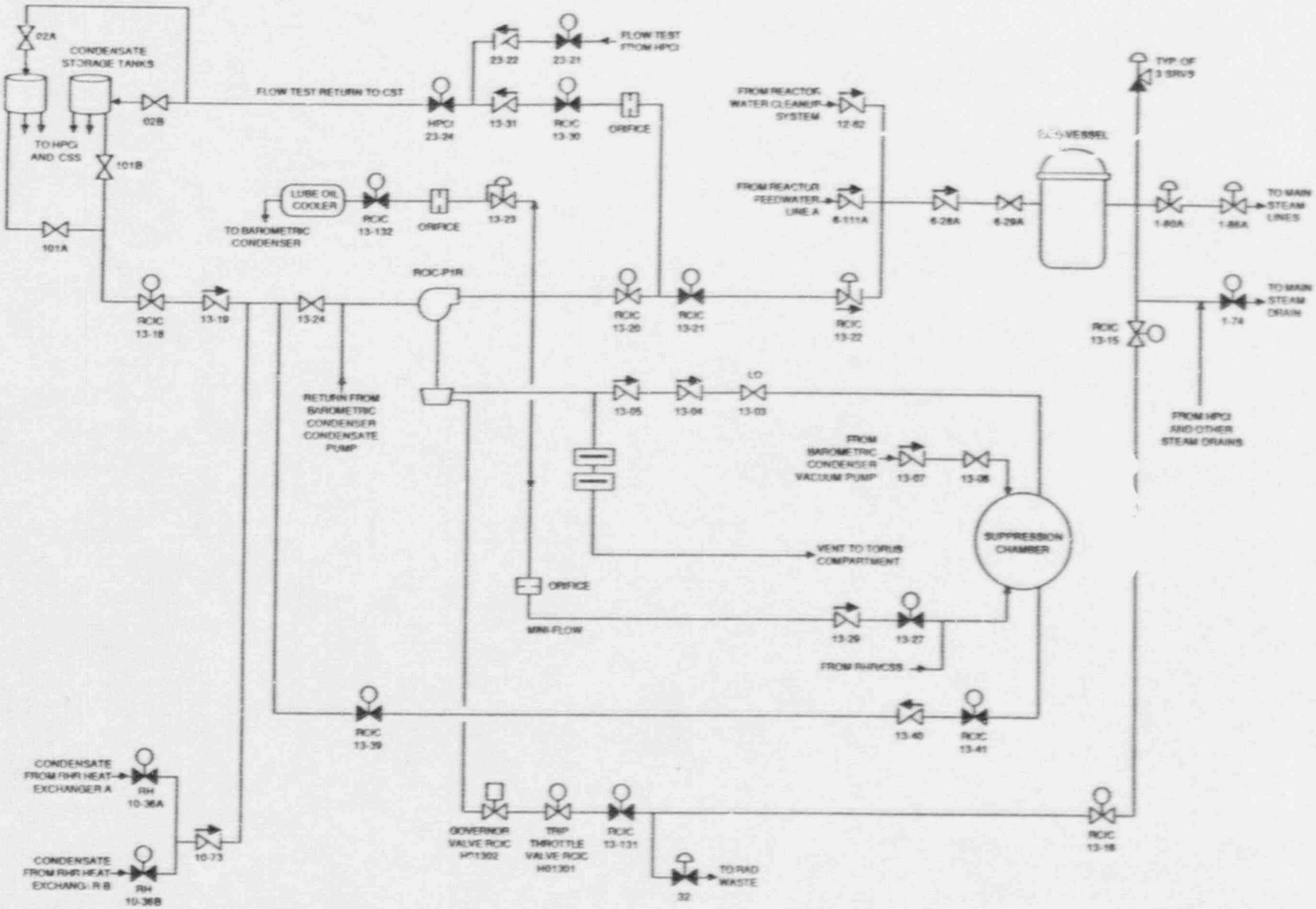


Figure 3.2-1. Fitzpatrick Reactor Core Isolation Cooling (RCIC) System

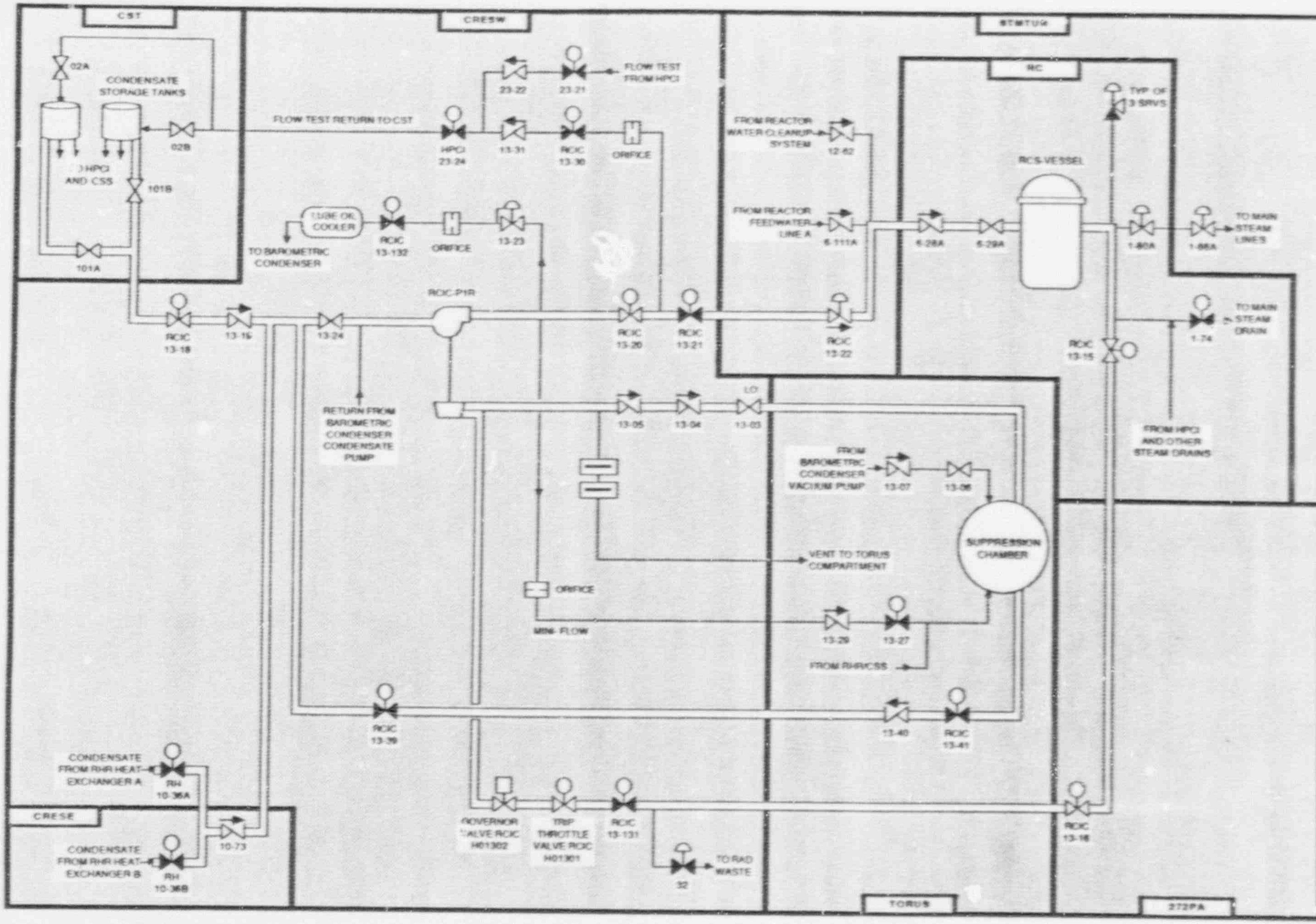


Figure 3.2-2. Fitzpatrick Reactor Core Isolation Cooling (RCIC) System Showing Component Locations

Table 3.2-1. Fitzpatrick Reactor Core Isolation Cooling System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
CST	TK	CST				
RCIC-P1R	TDP	CRESW				
RCIC13-131	MOV	CRESW	BMCC3	125	CRESW	DC/A
RCIC13-132	MOV	CRESW	BMCC3	125	CRESW	DC/A
RCIC13-15	MOV	RC	MCC163	600	CRESE	AC/B
RCIC13-16	MOV	272PA	BMCC1	125	CRESW	DC/A
RCIC13-18	MOV	CRESW	BMCC1	125	CRESW	DC/A
RCIC13-20	MOV	CRESW	BMCC1	125	CRESW	DC/A
RCIC13-21	MOV	CRESW	BMCC1	125	CRESW	DC/A
RCIC13-27	MOV	TORUS	BMCC1	125	CRESW	DC/A
RCIC13-30	MOV	CRESW	BMCC1	125	CRESW	DC/A
RCIC13-39	MOV	CRESW	BMCC3	125	CRESW	DC/A
RCIC13-41	MOV	TORUS	BMCC3	125	CRESW	DC/A
RCICH01301	MOV	CRESW	BATA	125	125A	DC/A
RCICH01302	HV	CRESW	BATA	125	125A	DC/A
SUP. POOL	TK	TORUS				

3.3 EMERGENCY CORE COOLING SYSTEM (ECCS)

3.3.1 System Function

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

3.3.2 System Definition

The emergency core cooling system consists of the following subsystems:

- High-pressure Coolant Injection (HPCI) System
- Automatic Depressurization System (ADS)
- Core Spray System (CSS)
- Low-pressure Coolant Injection (LPCI) System

The HPCI system provides make-up water to the reactor pressure vessel (RPV) in the event of a small break LOCA which does not result in a rapid depressurization of the reactor vessel. The HPCI system consists of a steam-turbine driven pump, system piping, valves and controls. The Condensate Storage Tank (CST) is a water source for the HPCI system.

The automatic depressurization system (ADS) provides automatic RPV depressurization following a small break LOCA or transient so that the low pressure systems (LPCI and CSS) can provide makeup to the RCS. The ADS utilizes 5 of the 11 safety/relief valves that perform the RCS overpressure protection function and discharge the high pressure steam to the suppression pool.

The core spray system supplies make-up water to the reactor vessel at low pressure. The system consists of two independent trains, each of which has one 100% capacity motor-driven pump to supply water from the suppression pool to a spray sparger in the reactor vessel above the core.

The low-pressure coolant injection system is an operating mode of the Residual Heat Removal (RHR) system, and provides make-up water to the reactor vessel at low pressure. The LPCI system consists of two independent trains, each with two motor-driven pumps which deliver water from the suppression pool to one of the RCS recirculation loops. The RHR system can be manually realigned as needed to perform suppression pool cooling or containment spray as part of the basic emergency core cooling function. The RHR heat exchangers can also be aligned for steam condensing operation in conjunction with the RCIC system (see Section 3.2). This is not an ECCS function.

The HPCI system is shown in Figures 3.3-1 and 3.3-2. Simplified diagrams of the LPCI system are presented in Figures 3.3-3 through 3.3-6 and the Core Spray System is shown in Figures 3.3-7 and 3.3-8. Interfaces between these systems 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

All ECCS systems normally are in standby. The manner in which the ECCS operates to protect the reactor core is a function of the rate at which coolant is being lost from the RCS. The HPCI system is normally aligned to take a suction on the Condensate Storage Tank (CST). The HPCI system is automatically started in response to decreasing RPV water level, and will serve as the primary source of makeup if RCS pressure remains high. Reactor core heat is dumped to the suppression pool via the safety/relief valves which cycle as needed to limit RCS pressure. The HPCI flow controller maintains constant water flow over the pressure range of HPCI operation. The HPCI turbine also exhausts to the suppression pool. Operation of the HPCI system is not directly dependent on AC electric power. If the LOCA is of such a size that the coolant loss exceeds the HPCI system capacity or if reactor pressure is too low to operate the steam turbine-driven HPCI pump, then the CSS and LPCI systems can provide higher capacity makeup to the reactor vessel at low pressure.

Automatic depressurization is provided to automatically reduce RCS pressure if a small break has occurred and RPV water level is not maintained by the HPCI system. Rapid depressurization permits flow from the CSS or LPCI systems to enter the vessel. Water is taken from the suppression pool by each of these systems for injection into the core. The CSS can be manually aligned to take a suction on the CST.

A large LOCA results in rapid depressurization of the RCS. This class of LOCA is mitigated by the CSS or LPCI systems without the need for the ADS. RHR loops A and/or B can be aligned for suppression pool cooling, with heat being transferred to the RHR service water system (see Section 3.8) via the RHR heat exchangers. One RHR loop can be aligned for suppression pool cooling while the other loop continues to function in the LPCI mode.

3.3.4 System Success Criteria

LOCA mitigation requires that both the emergency coolant injection (ECI) and emergency coolant recirculation (ECR) functions be accomplished. The ECCS success criteria are not clearly defined in the Fitzpatrick FSAR but can be inferred from pump capacities that are defi ·ed based on certain design basis accidents that are considered in the licensing process based on licensing considerations. The ECI system success criteria for a large LOCA are the following:

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

The ECI system success criteria for a small LOCA are the following:

- The high-pressure coolant injection (HPCI) pump with a suction on the suppression pool or the condensate storage tank, or
- The automatic depressurization system (ADS) and 3 of 4 LPCI pumps with a suction on the suppression pool, or
- The automatic depressurization system and 1 of 2 core spray pumps with a suction on the suppression pool.

The success criterion for the ADS is the use of any 1 of 2 ADS trains. It is possible that the coolant inventory control function for some small LOCAs can be satisfied by low-capacity high-pressure injection systems such as the control rod drive hydraulic system (see Section 3.6). The ECR success criteria for LOCAs are related to the ECI success criteria above. All injection systems essentially are operating in a recirculation mode when drawing water from the suppression pool.

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

- Either the reactor core isolation cooling (RCIC) system (not part of the ECCS, see Section 3.2), or
- Small LOCA mitigating systems

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

3.3.5 Component Information

A. Steam turbine-driven HPCI pump
   1. Rated flow: 4250 gpm @ unknown head
   2. Rated capacity: 100%
   3. Type: centrifugal

B. Low-pressure Coolant Injection (LPCI) Pumps (4)
   1. Rated flow (3 out of 4 pumps): 23,100 gpm @ 450 psid
   2. Rated capacity (3 out of 4 pumps): 100%
   3. Type: vertical turbine

C. Core spray pumps (2)
   1. Rated flow: 4625 gpm @ 113 psid
   2. Rated capacity: 100%
   3. Type: centrifugal

D. Automatic-depressurization valves (7)
   1. Rated flow: 855,000 lb/hr @ 1140 psid (each)

E. Pressure suppression chamber
   1. Design pressure: 56 psig
   2. Design temperature: 220°F
   3. Maximum operating water temperature: 170°F
   4. Minimum water volume: 105,600 ft^3

F. RHR heat exchangers (2)
   1. Rated capacity: 100%
   2. Heat rate: 70 x 10^6 Btu/hr each
   3. Type: Shell-and-tube

G. Condensate storage tank
   1. Reserve capacity for ECCS: 200,000 gallons

3.3.6 Support Systems and Interfaces

A. Actuation and Control
   1. HPCI Actuation and Control
      a. The HPCI pump is actuated by high drywell pressure or low reactor water level.
      b. The HPCI turbine is automatically shutdown on a reactor vessel high water level signal. It is not known if the system (Ref. 1, Section 6.4) is capable of automatic restart. Other conditions resulting in turbine shutdown are:
         - Turbine overspeed
         - Low suction pressure
         - High turbine exhaust pressure
         - Automatic isolation
      c. The HPCI pump suction is automatically switched to the suppression pool on high suppression pool water level or low CST level.

d. HPCI control power requirements are described in Section 3.4.

2. ADS Actuation and Control
   a. The ADS system is actuated upon coincident signals of the reactor vessel low water level, drywell high pressure and discharge pressure indication on at least one LPCI or two CSS pumps.
   b. The ADS valves fail closed on loss of 125 VDC control power, loss of 125 VDC solenoid pilot valve power or loss of pneumatic pressure (Ref. 1, Section 7.4).
3. LPCI and Core Spray Actuation and Control
   a. The LPCI and Core Spray Systems are automatically actuated on receipt of: (1) low reactor water level, or (2) high drywell pressure coincident with low RCS pressure.
   b. LPCI initiation automatically causes all RHR components to perform their function under the LPCI mode.
   c. LPCI and CSS control power requirements are described in Section 3.4.

B. Motive Power
   1. The ECCS motor-driven pumps and motor-operated valves are Class 1E AC and DC loads that can be supplied from the emergency diesel generators or station batteries, as described in Section 3.5.
   2. The steam supply valves to the HPCI turbine are Class 1E loads. Valves that must open to start the pump are DC-powered. Normally open isolation valve 23-15 is AC-powered.
   3. The HPCI turbine-driven pump is supplied with steam from main steam loop B, upstream of the main steam isolation valves.

C. Cooling Water
   1. Lubrication and cooling for the HPCI turbine-driven pump are supplied locally. It should be noted that the pump lube oil cooler is cooled by water diverted from the HPCI pump discharge and returned to the pump suction. Design maximum cooling water temperature for the HPCI pump is not known.
   2. The LPCI pump seals are cooled by the Emergency Service Water System (ESWS) (see Section 3.7).
   3. CSS pumps are cooled locally.
   4. RHR heat exchangers are cooled by the RHR Service Water System (RSWS) (see Section 3.8).

D. Other
   1. The hydraulic steam turbine stop and control valves for the HPCI pump are normally closed. These valves must be opened by a DC-powered auxiliary oil pump in order to start the HPCI pump. A shaft-driven oil pump provides hydraulic pressure to maintain these valves open once the HPCI pump is operating.
   2. HPCI pump and valve leakoff is collected and condensed in a gland seal condenser. A condensate pump returns the condensate to the HPCI pump suction. A vacuum pump maintains condenser vacuum. The vacuum pump exhausts to the standby gas treatment system.

3.3.7 Section 3.3. References

1. Fitzpatrick FSAR.

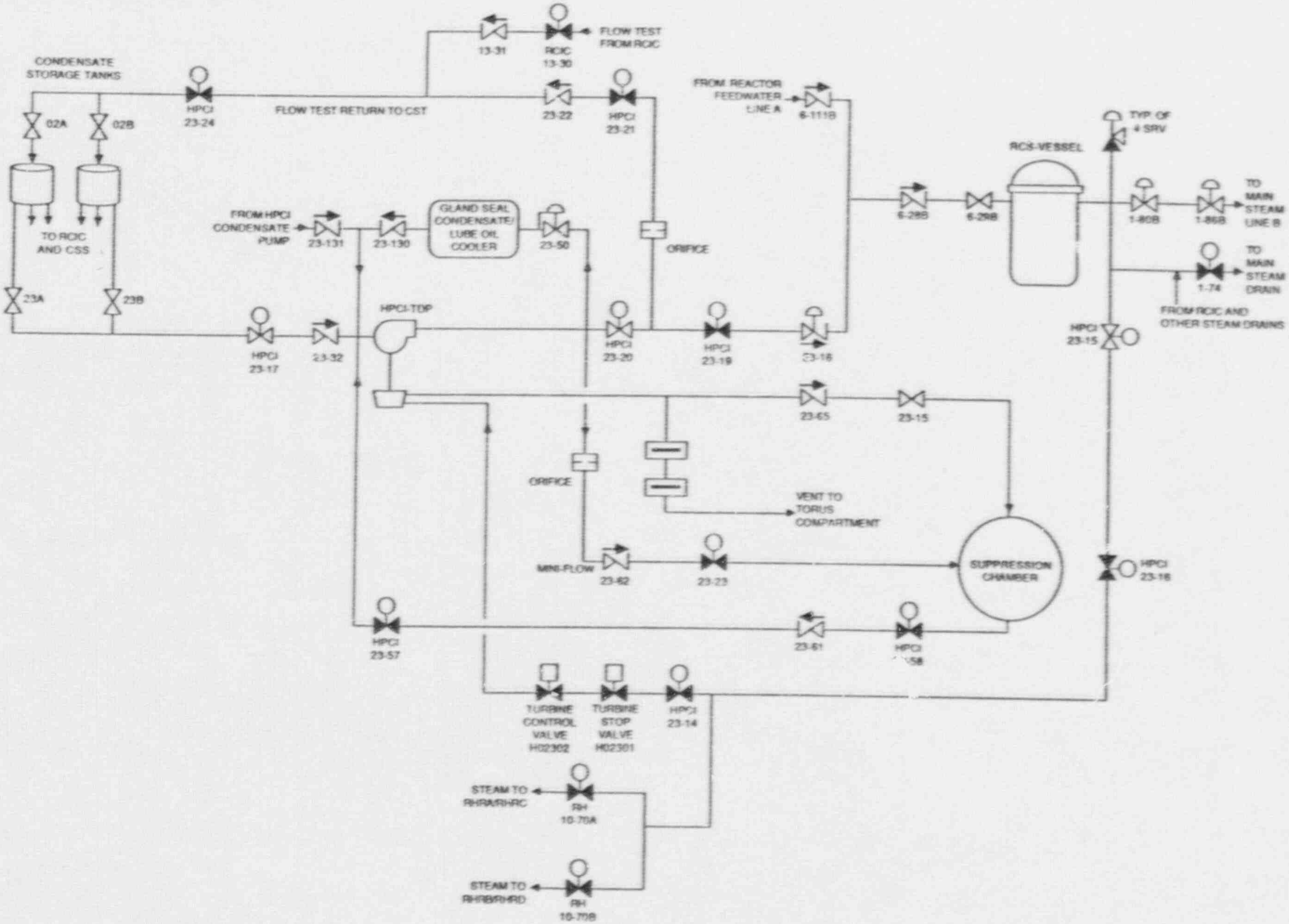


Figure 3.3-1. Fitzpatrick High Pressure Coolant Injection (HPCI) System

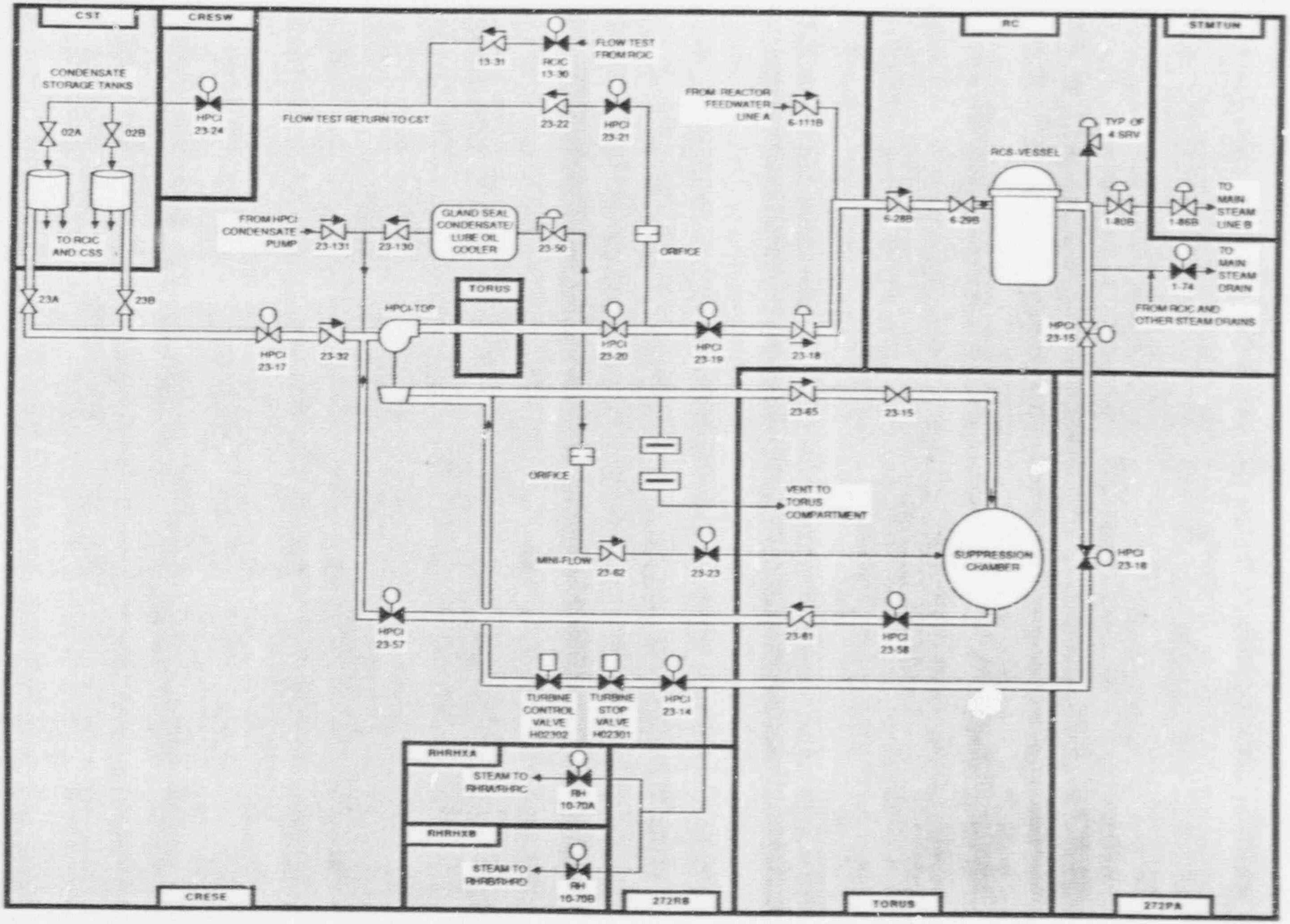


Figure 3.3-2. Fitzpatrick High Pressure Coolant Injection (HPCI) System Showing Component Locations

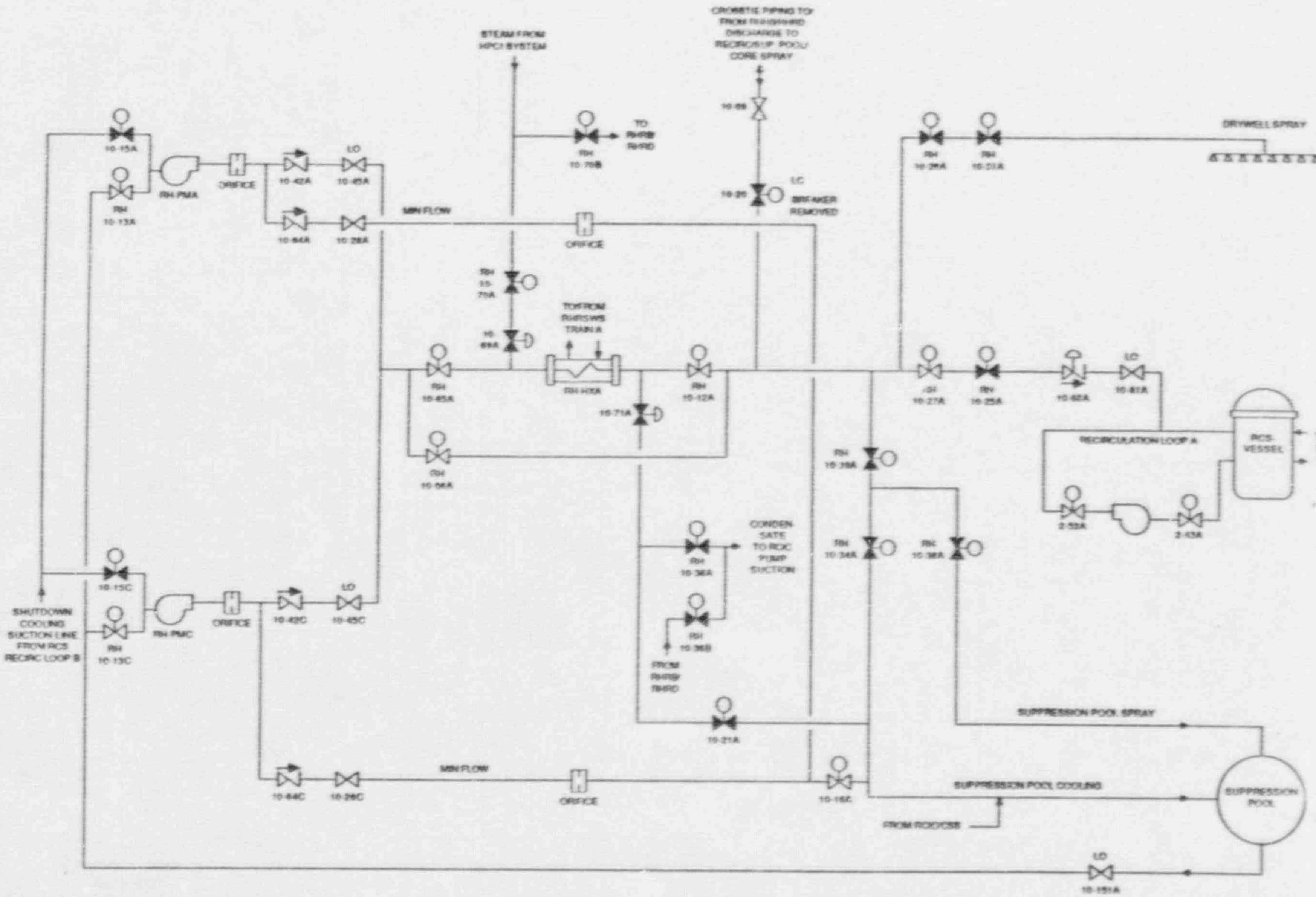


Figure 3.3-3. Fitzpatrick Low Pressure Coolant Injection Pump System A and C (LPCIA and LPCIC)

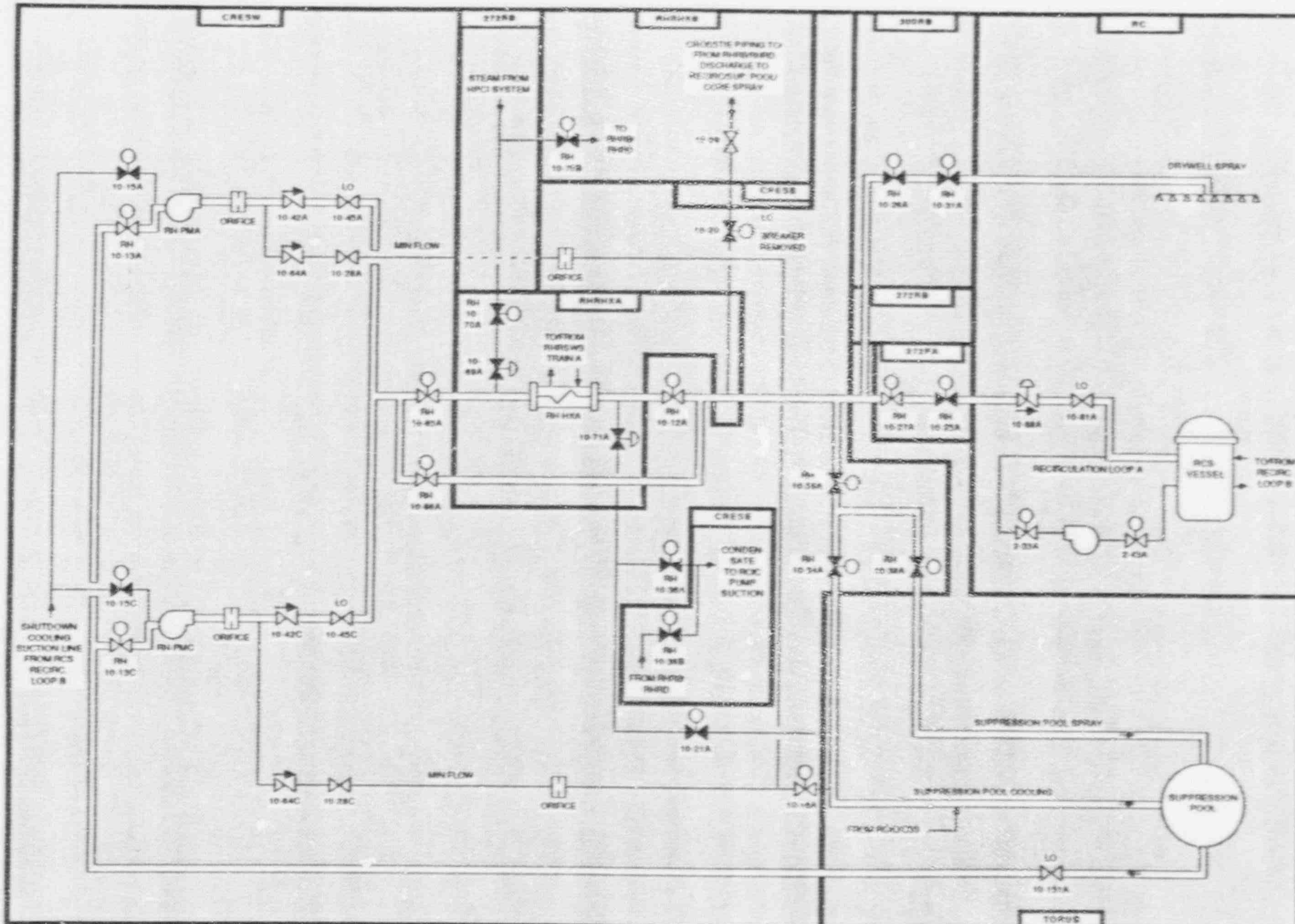


Figure 3.3-4. Fitzpatrick Low Pressure Coolant Injection Pump System A and C (LPCIA and LPCIC) Showing Component Locations

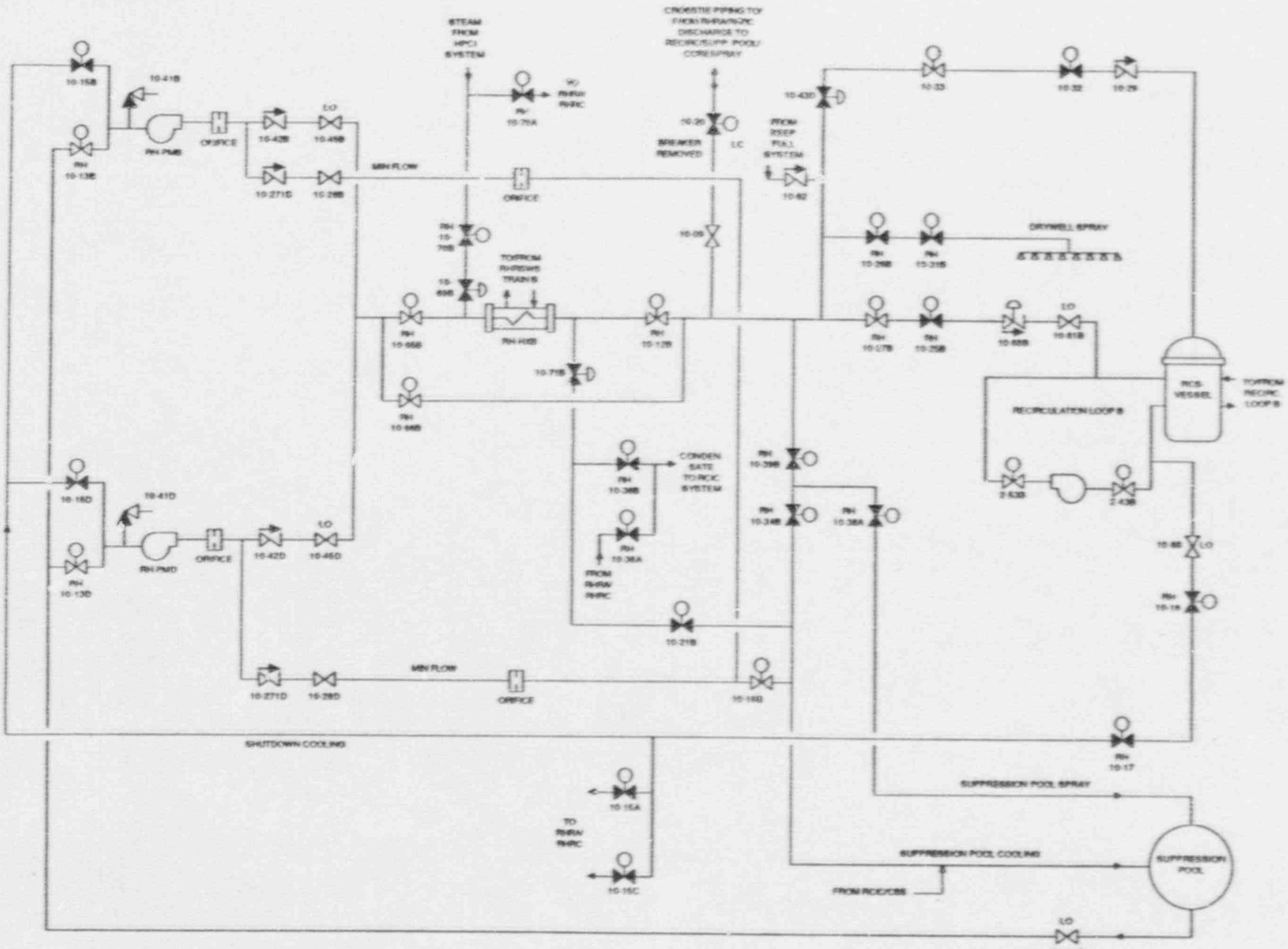


Figure 3.3-5. Fitzpatrick Low Pressure Coolant Injection Pump System B and D (LPCIB and LPCID)

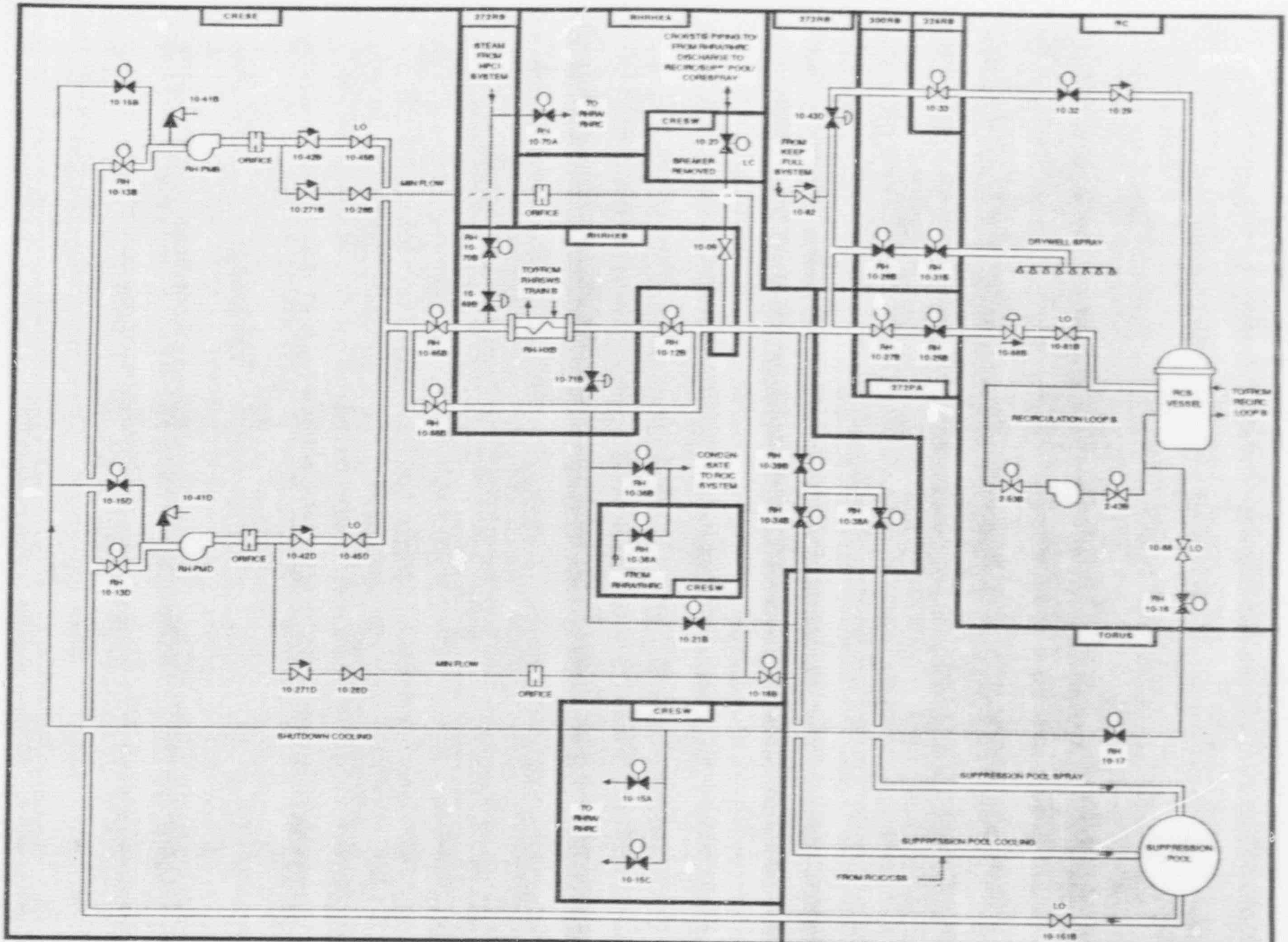


Figure 3.3-6. Fitzpatrick Low Pressure Coolant Injection Pump System B and D (LPCI3 and LPCID) Showing Component Locations

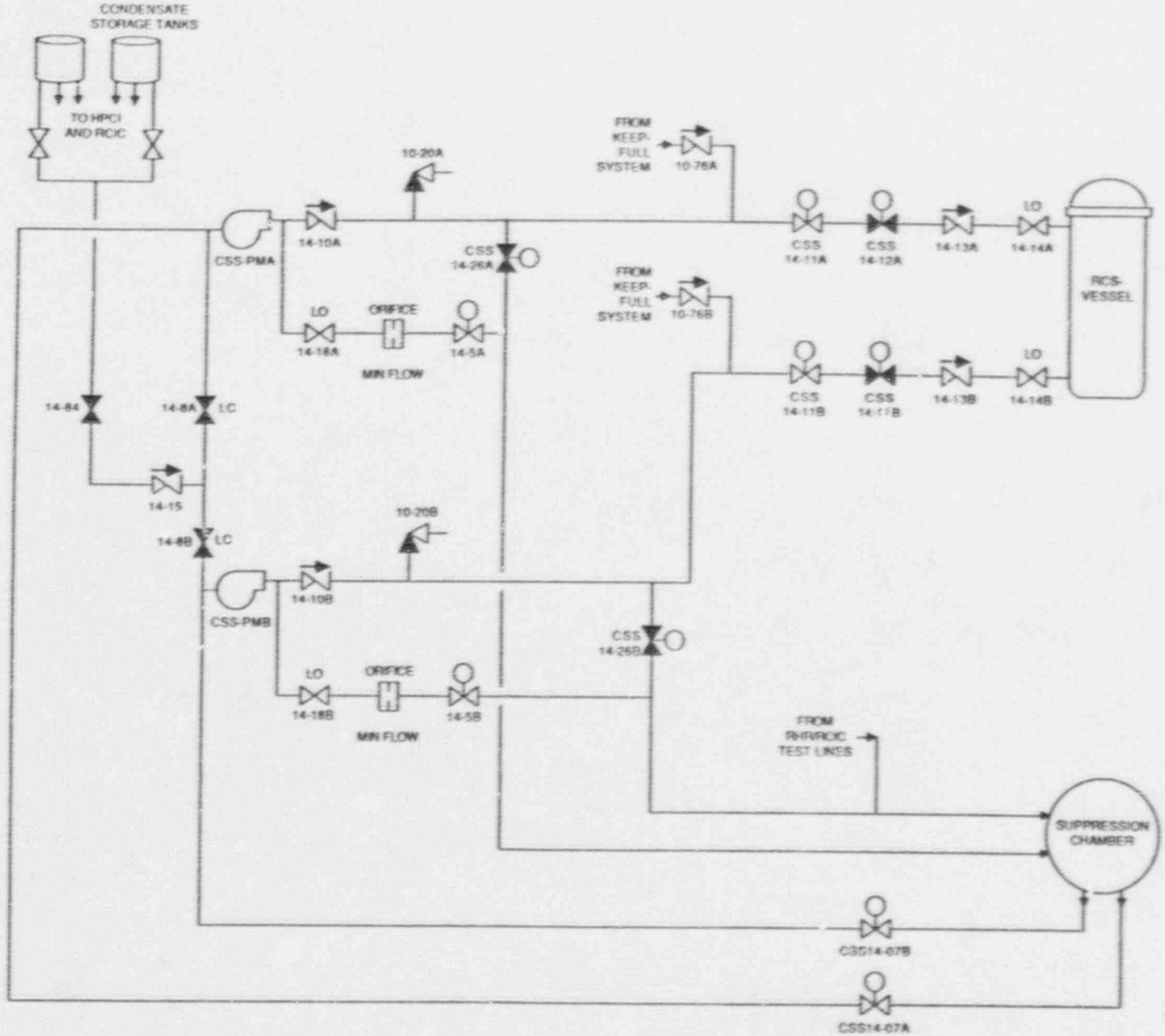


Figure 3.3-7. Fitzpatrick Core Spray System Train A and Train B

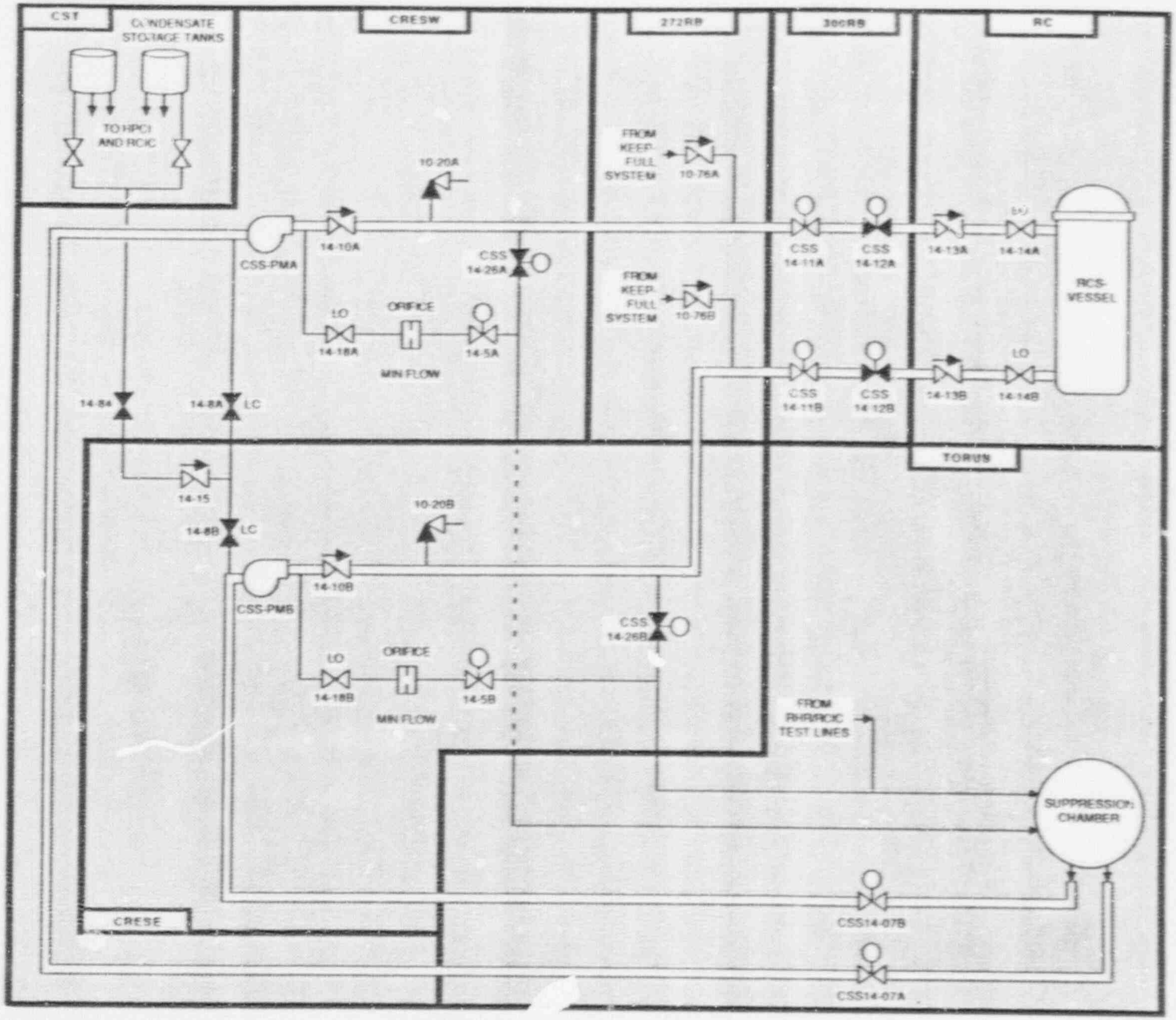


Figure 3.3-8. Fitzpatrick Core Spray System Train A and Train B Showing Component Locations

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
CONTROL VALVE	HV	CRESE				
CSS-PMA	MDP	CRESW	BUS105	4160	DIE-SGRS	AC/A
CSS-PMB	MDP	CRESE	BUS106	4160	DIE-SGRN	AC/B
CSS14-07A	MOV	TORUS	MCC153	600	CRESW	AC/A
CSS14-07B	MOV	TORUS	MCC163	600	CRESE	AC/B
CSS14-11A	MOV	300RB	MCC152	600	272RB	AC/A
CSS14-11B	MOV	300RB	MCC162	600	272RB	AC/B
CSS14-12A	MOV	300RB	MCC152	600	272RB	AC/A
CSS14-12B	MOV	300RB	MCC162	600	272RB	AC/B
CSS14-26A	MOV	CRESW	MCC153	600	CRESW	AC/A
CSS14-26B	MOV	CRESE	MCC163	600	CRESE	AC/B
CST	TK	CST				
HPCI23-14	MOV	CRESE	BMCC2	125	CRESE	DC/B
HPCI23-15	MOV	RC	MCC153	600	CRESW	AC/A
HPCI23-16	MOV	272PA	BMCC6	125	272RB	DC/B
HPCI23-17	MOV	CRESE	BMCC2	125	CRESE	DC/B
HPCI23-19	MOV	CRESE	BMCC6	125	272RB	DC/B
HPCI23-21	MOV	CRESE	BMCC6	125	272RB	DC/B
HPCI23-24	MOV	CRESW	BMCC4	125	CRESE	DC/B
HPCI23-30	MOV	CRESE	BMCC6	125	272RB	DC/B
HPCI23-57	MOV	CRESE	BMCC4	125	CRESE	DC/B
HPCI23-58	MOV	TORUS	BMCC4	125	CRESE	DC/B
RH-HXA	HX	RHRHXA				
RH-HXB	HX	RHRHXB				
RH-PMA	MDP	CRESW	BUS105	4160	DIE-SGRS	AC/A
RH-PMB	MDP	CRESE	BUS106	4160	DIE-SGRN	AC/B
RH-PMC	MDP	CRESW	BUS105	4160	DIE-SGRS	AC/A

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RH-PMD	MDP	CRESE	BUS106	4160	DIE-SGRN	AC/B
RH10-12A	MOV	CRESW	MCC151	600	272RB	AC/A
RH10-12B	MOV	CRESE	MCC161	600	272RB	AC/B
RH10-13A	MOV	CRESW	MCC153	600	CRESW	AC/A
RH10-13B	MOV	CRESE	MCC163	600	CRESE	AC/B
RH10-13C	MOV	CRESW	MCC153	600	CRESW	AC/A
RH10-13D	MOV	CRESE	MCC163	600	CRESE	AC/B
RH10-25A	MOV	272PA	MCC153	600	CRESW	AC/A
RH10-25B	MOV	272PA	MCC163	600	CRESE	AC/B
RH10-26A	MOV	300RB	MCC152	600	272RB	AC/A
RH10-26A	MOV	300RB	MCC152	600	272RB	AC/A
RH10-26B	MOV	300RB	MCC161	600	272RB	AC/B
RH10-26B	MOV	300RB	MCC161	600	272RB	AC/B
RH10-27A	MOV	272PA	MCC153	600	CRESW	AC/A
RH10-27B	MOV	272PA	MCC163	600	CRESE	AC/B
RH10-31A	MOV	300RB	MCC152	600	272RB	AC/A
RH10-31A	MOV	300RB	MCC152	600	272RB	AC/A
RH10-31B	MOV	300RB	MCC161	600	272RB	AC/B
RH10-31B	MOV	300RB	MCC161	600	272RB	AC/B
RH10-34A	MOV	CRESW	MCC153	600	CRESW	AC/A
RH10-34A	MOV	CRESW	MCC153	600	CRESW	AC/A
RH10-34B	MOV	CRESE	MCC163	600	CRESE	AC/B
RH10-34B	MOV	CRESE	MCC163	600	CRESE	AC/B
RH10-36A	MOV	CRESW	MCC153	600	CRESW	AC/A
RH10-36B	MOV	CRESE	MCC163	600	CRESE	AC/B
RH10-38A	MOV	CRESW	MCC153	600	CRESW	AC/A
RH10-38A	MOV	CRESW	MCC153	600	CRESW	AC/A

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RH10-38B	MOV	CRESE	MCC163	600	CRESE	AC/B
RH10-38B	MOV	CRESE	MCC163	600	CRESE	AC/B
RH10-39A	MOV	CRESW	MCC153	600	CRESW	AC/A
RH10-39A	MOV	CRESW	MCC153	600	CRESW	AC/A
RH10-39B	MOV	CRESE	MCC163	600	CRESE	AC/B
RH10-39B	MOV	CRESE	MCC163	600	CRESE	AC/B
RH10-65A	MOV	CRESW	MCC153	600	CRESW	AC/A
RH10-65B	MOV	CRESE	MCC163	600	CRESE	AC/B
RH10-66A	MOV	CRESW	MCC153	600	CRESW	AC/A
RH10-66A	MOV	CRESW	MCC153	600	CRESW	AC/A
RH10-66B	MOV	CRESE	MCC163	600	CRESE	AC/B
RH10-66B	MOV	CRESE	MCC163	600	CRESE	AC/B
RH10-70A	MOV	RHRHXA	MCC151	600	272RB	AC/A
RH10-70B	MOV	RHRHXB	MCC161	600	272RB	AC/B
STOP VALVE	HV	CRESE				
SUP. POOL	TK	TORUS				

3.4 INSTRUMENTATION AND CONTROL (I&C) SYSTEMS

3.4.1 System Function

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

3.4.2 System Definition

The RPS includes sensor and transmitter units, logic units, and output trip relays that interface with the control circuits for components in the scram portion of the Control Rod Drive Hydraulic System (see Section 3.6). Other actuation and control systems include independent sensor and transmitter units and relay units that interface with the control circuits of many different components in safety systems. Operator instrumentation display systems consist of display panels that are powered from various DC buses (see Section 3.5). Remote shutdown capability is provided by the auxiliary shutdown panels.

3.4.3 System Operation

A. RPS

The RPS has four input instrument channels and two output actuation trains. RPS inputs are listed below:

- Neutron monitoring system
- RCS high pressure
- Low water level in reactor vessel
- Turbine stop valve closure
- Turbine control valve fast closure
- Main steam line isolation signal
- Scram discharge volume high water level
- Primary containment high pressure
- Main steam line high radiation
- Main condenser low vacuum
- Mode Switch in SHUTDOWN

In addition, the operator can manually initiate a scram.

Both output channels must be de-energized to initiate a scram. The failure of a single component or power supply does not prevent a desired scram or cause an unwanted scram.

B. Other Actuation and Control Systems

Other actuation and control systems cause the various safety systems to be started, stopped or realigned as needed to respond to abnormal plant conditions. Details regarding actuation logic are included in the system description of the actuated system.

C. Remote Shutdown
The capability for safe shutdown from outside the control room has been provided by Remote Shutdown Panel 25RSP, a manual ADS panel, and by the Auxiliary Shutdown panels 25ASP-1, 25ASP-2 and 25ASP-3. This capability is provided to permit safe shutdown of the reactor in the unlikely event of fire in the Control Room, Relay Room and/or Cable Spreading Room. The necessary controls and identification are located on and/or within view of the panels including a dedicated intercom telephone system, with an independent power supply, to allow communications between the panels. Other than ADS valve control stated in the Fitzpatrick Final Safety Analysis Report, details of the components and instrumentation controlled by these panels are not known.

3.4.4 System Success Criteria

A. RPS
The RPS uses hindrance logic (normal = 1, trip = 0) in both the input and output logic. Therefore, a channel will be in a trip state when input signals are lost, when control power is lost, or when the channel is temporarily removed from service for testing or maintenance (i.e. the channel has a fail-safe failure mode). A reactor scram will occur upon loss of control power to the RPS. A reactor scram is implemented by the scram pilot valves in the control rod drive hydraulic system (see Section 3.6). Details of the RPS for Fitzpatrick have not been determined.

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

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

3.4.5 Support Systems and Interfaces

A. Control Power
   1. RPS
      The RPS is powered via motor-generator sets from the 600 VAC Class 1E electric power system (see Section 3.5).
   2. Other actuation and control systems
      Control power sources for various systems are summarized in Table 3.4-1.
   3. Operator instrumentation
      Essential instrumentation appears to be powered from the 120 VAC system.

Table 3.4-1. Matrix of Fitzpatrick Control Power Sources

SYSTEM	TRAIN A	TRAIN B
RCIC	■	
HPCI		■
ADS A LOGIC	■	
ADS B LOGIC		■
LPCI A LOGIC	■	
LPCI B LOGIC		■
CORE SPRAY A LOGIC	■	
CORE SPRAY B LOGIC		■
DGA DIESEL CONTROL	■	
DGB DIESEL CONTROL		■
DGC DIESEL CONTROL	■	
DGD DIESEL CONTROL		■
BACKUP SCRAM VALVES A	■	
BACKUP SCRAM VALVES B		■
ESWS A	■	
ESWS B		■
OUTBOARD MSIV'S		■
INBOARD MSIV'S	■	

3.5 ELECTRIC POWER SYSTEM

3.5.1 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.

3.5.2 System Definition

The onsite Class 1E AC electric power system consists of two AC load groups. There are a total of four diesel generators which operate in parallel in sets of two, to supply each of the two AC load groups. Each load group consists of one 4160 VAC bus and two 600 VAC buses. In addition, there are m[illegible] VAC motor control centers. The Class 1E plant DC power sources consist of two [illegible] batteries. Each battery is connected to supply a separate 125 VDC distribution [illegible] which supplies DC loads. A 120 VAC system is supplied via the 600 VAC system.

The 4160 and 600 VAC electric power distribution system at Fitzpatrick is shown in Figures 3.5-1 and 3.5-2. The 125 VDC electric power distribution system is shown in Figures 3.5-3 and 3.5-4. The 120 VAC instrumentation power system is shown in Figure 3.5-5 and 3.5-6. 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.

3.5.3 System Operation

During normal operation, the Class 1E electric power system is supplied from the 345 kV switchyard through three system auxiliary transformers. Two reserve power supplies are a 115 kV switchyard at Lighthouse Hill and a 115 kV switchyard at the Nine Mile Point Nuclear Station.

Each redundant system of the Emergency AC Power System consists of two diesel generator units, 4160 V switchgear, and interconnecting cables. Each diesel generator is capable of either synchronous or independent operation and is provided with independent air starting and fuel oil systems. The switchgear associated with each of the redundant emergency power sources contains an individual output breaker for each of the diesel generator units and a common tie breaker. The diesel generators are automatically started and connected to their respective buses when rated voltage and frequency conditions have been established by the generator (about 10 seconds after a start command). Essential loads are then automatically reenergized in a predetermined sequence. Nonessential loads are not reenergized.

If either diesel generator of an emergency AC power source fails to start in response to the automatic transfer signal, closure of the tie breaker is inhibited, and a limited complement of engineered safeguard loads are automatically connected to the respective emergency bus in a prescribed manner. If the diesel generators are supplying emergency bus loads during a postulated accident or shutdown, and one of the diesel generator engines fails such that it is being motorized by its companion unit, then the reverse power relay will trip the failed diesel generator before the companion diesel generator trips on overload.

There are two independent 125 VDC power divisions. Each division includes one 125 VDC battery with its own battery charger. The two divisions are considered to be redundant based on the distribution of DC loads between the two divisions.

The 120 VAC system provides power for essential instrumentation and for control relays for inboard and outboard RCS and containment isolation valves. This system is powered from 600 VAC MCCs or from a 125 VDC distribution panel as shown in Figures 3.5-5 and 3.5-6.

The redundant safeguards equipment has been divided into "load groups." Load group AC/A contains components powered either directly or indirectly from 4160 bus B105. Load group AC/B contains components powered either directly or indirectly from 4160 bus B106. Components receiving DC power are assigned to load groups DC/A or DC/B, based on the battery power source.

3.5.4 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

3.5.5 Component Information

A. Standby diesel generators (DGA, DGB, DGC, and DGD)
   1. Power rating: 2600 kW continuous
   2. Rated voltage: 4160 VAC
   3. Manufacturer: Bruce GM

B. Station batteries (A and B)
   1. Rated voltage: 125 VDC
   2. Rated capacity: unknown

3.5.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The standby diesel generators are automatically started on the following signals:
      - Loss of offsite power
      - Accident signal (drywell high pressure or reactor low low water level)
   2. Remote manual
      The diesel generators can be started, and connected to the emergency buses from the main control room.
   3. Local
      The diesel generators can be started locally, but not connected to the emergency buses.

B. Diesel Generator Auxiliary Systems
   The following auxiliaries are provided for the emergency diesel generator:
   1. Cooling
      The emergency service water system provides for diesel cooling (see Section 3.7).
   2. Fueling
      a. An individual day tank is provided for each diesel generator. The day tank has a capacity for 2.5 hours of diesel generator operation at full load.

b. A long-term diesel fuel supply is provided underground, near the diesel building. This fuel supply is designed to support the operation of the diesel generators for seven days.

3. Lubrication
Each diesel generator has a self-contained lubrication system.

4. Starting
Two independent and redundant starting air systems are provided for each diesel generator. Each air accumulator is capable of storing air for ten normal starts of a diesel engine.

5. Control power
Each diesel generator is dependent on 125 VDC power from a station battery for control power, as follows:

Diesel Generator	DC Distribution Panel	Battery
A and C	2A	A
B and D	2B	B

6. Diesel room ventilation
Ventilation is supplied to each emergency generator room by separate intake/exhaust fans and ductwork which maintain the environmental conditions in the rooms within the limits for which the diesel generator and switchgear have been qualified. This system may be needed for long term operation of the diesel generator.

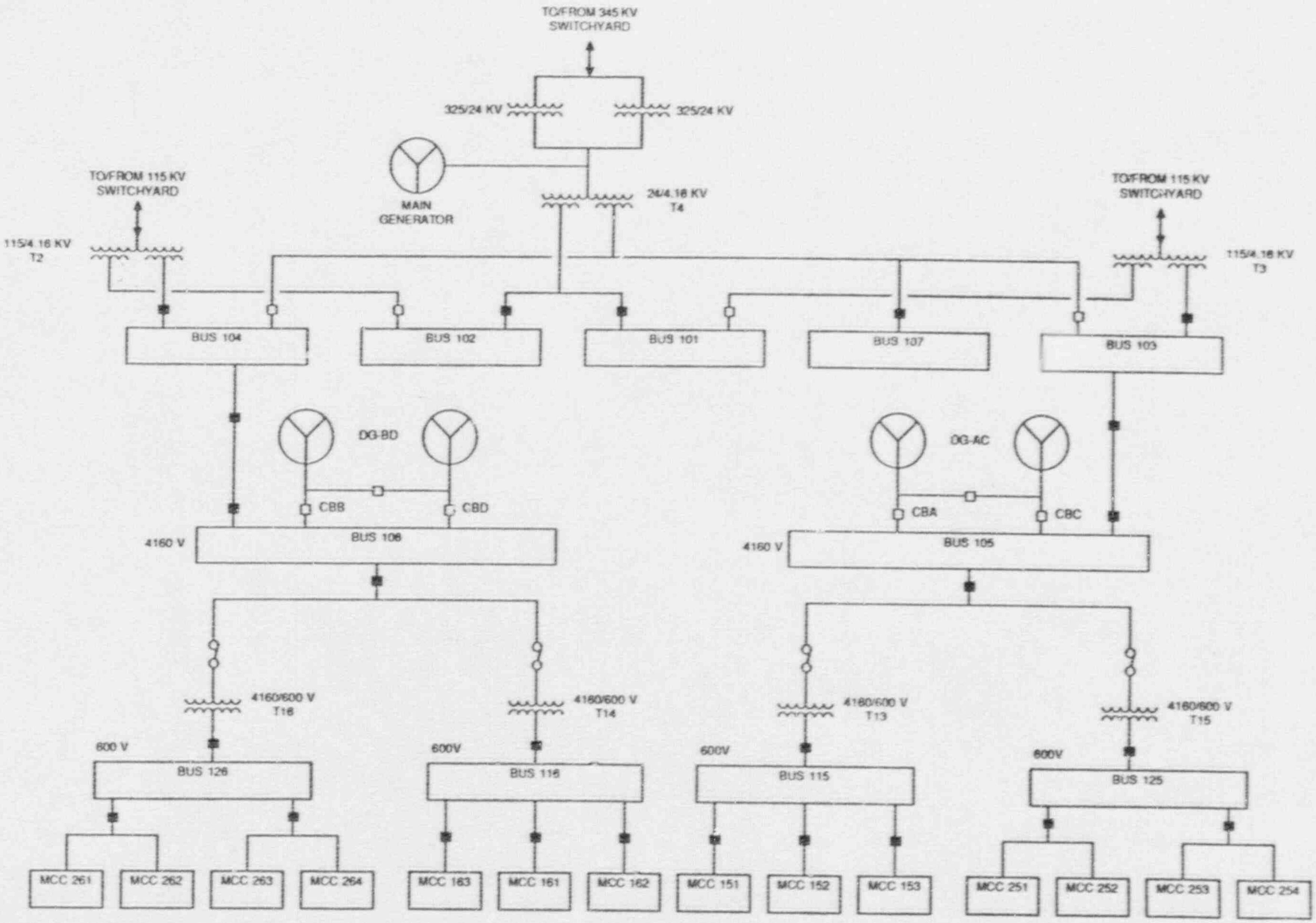
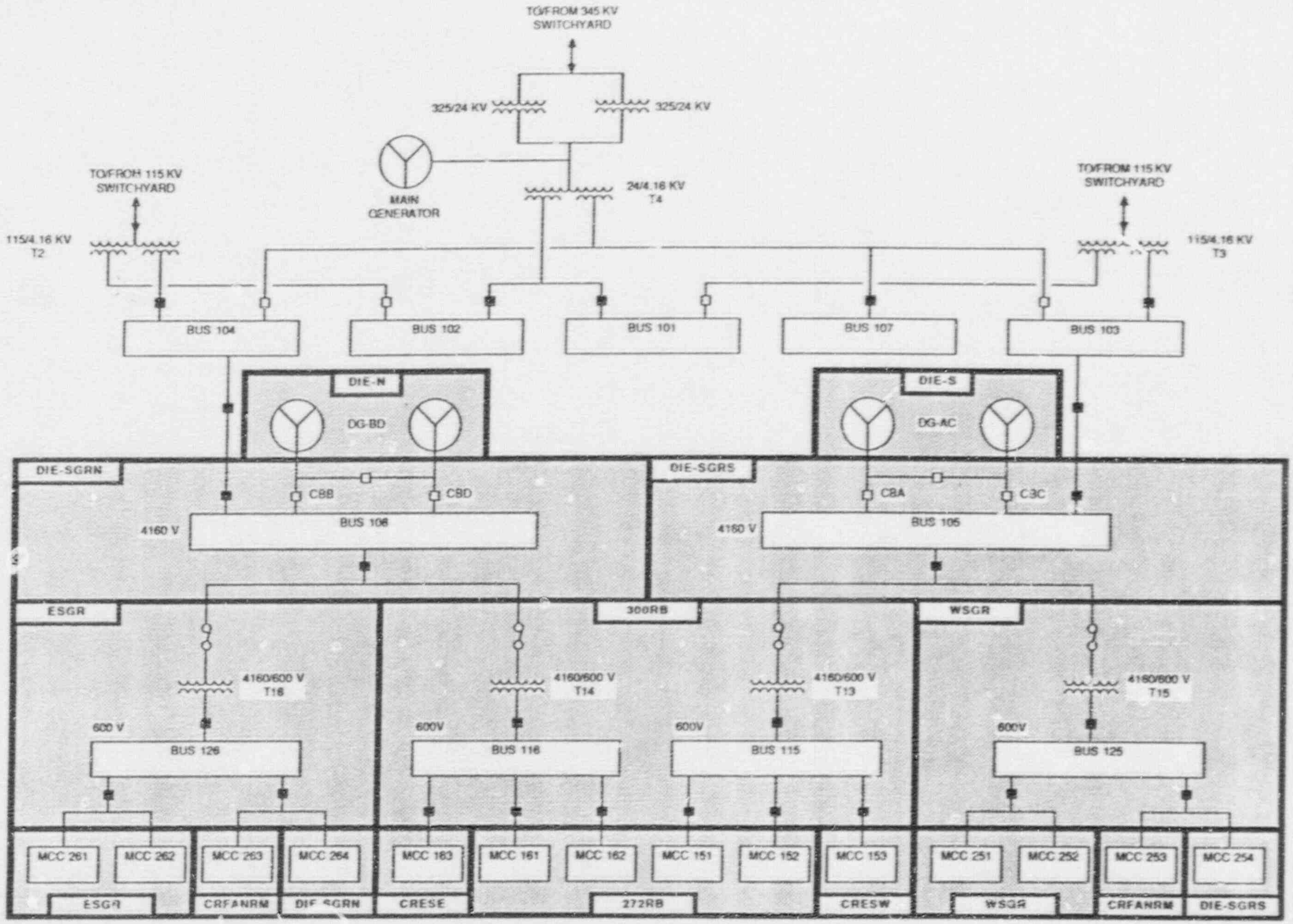


Figure 3.5-1. Fitzpatrick 4160 and 600 VAC Electric Power Distribution System



NOTE: LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS.

Figure 3.5-2. Fitzpatrick 4160 and 600 VAC Electric Power Distribution System Showing Component Locations

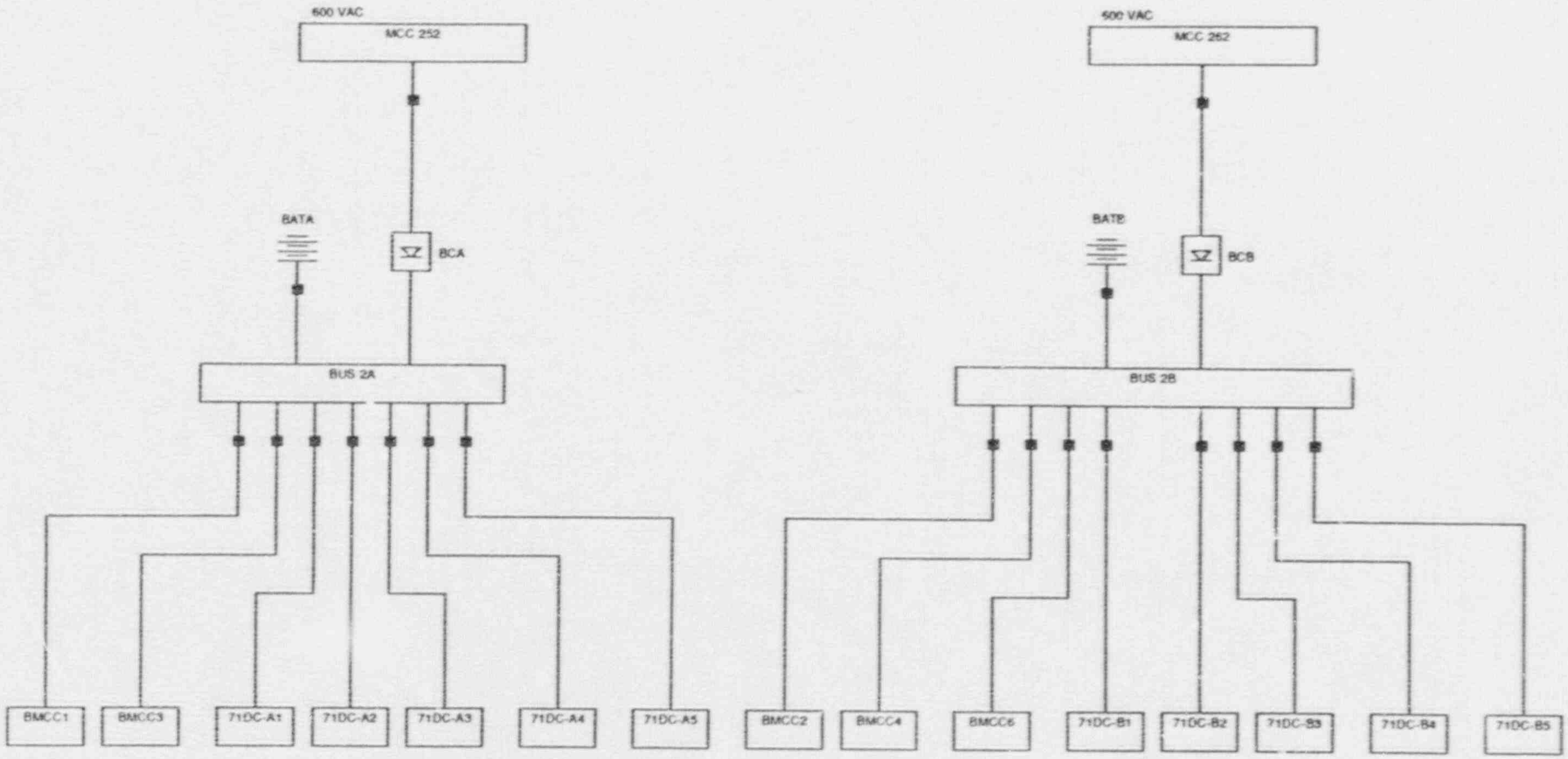
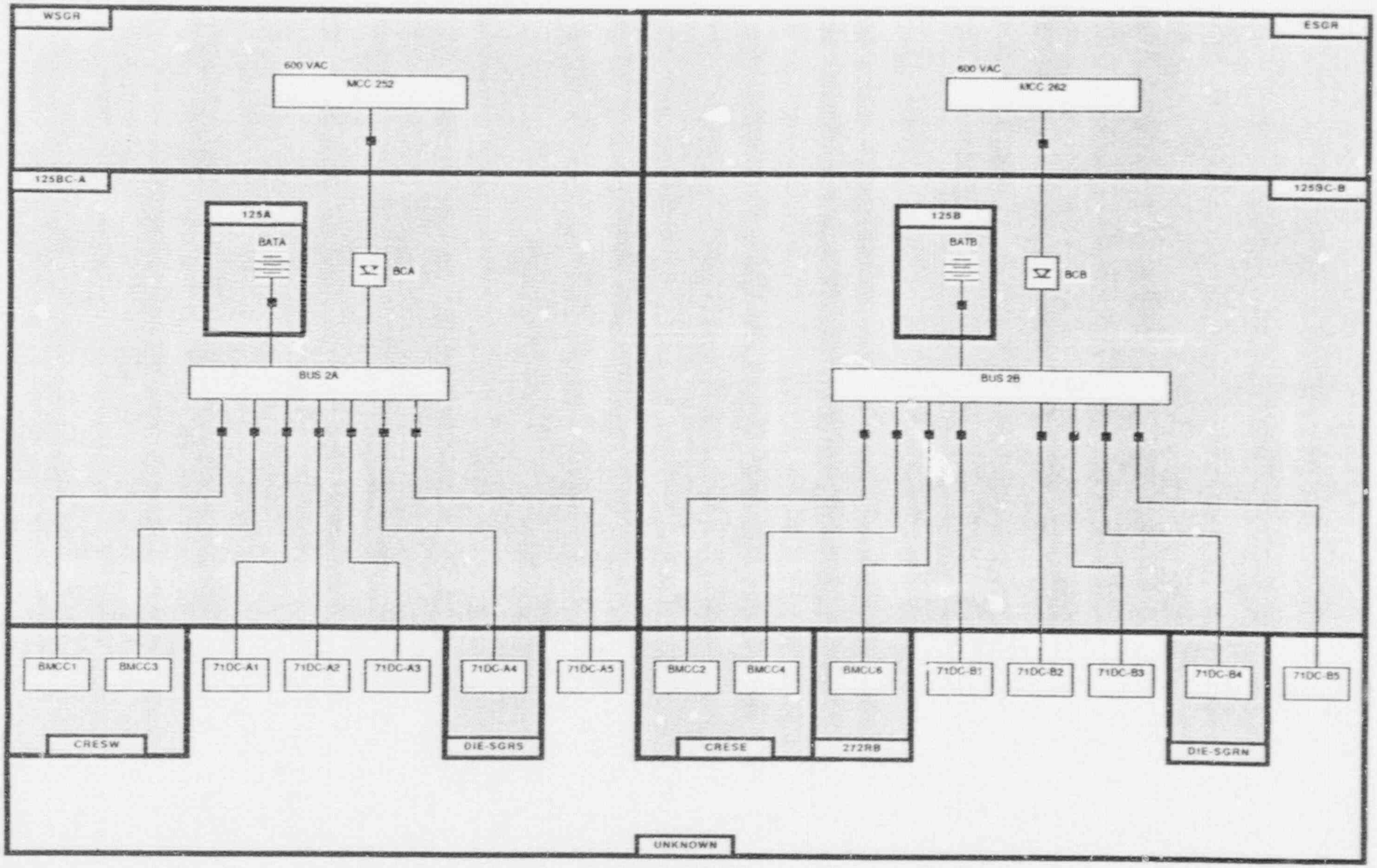
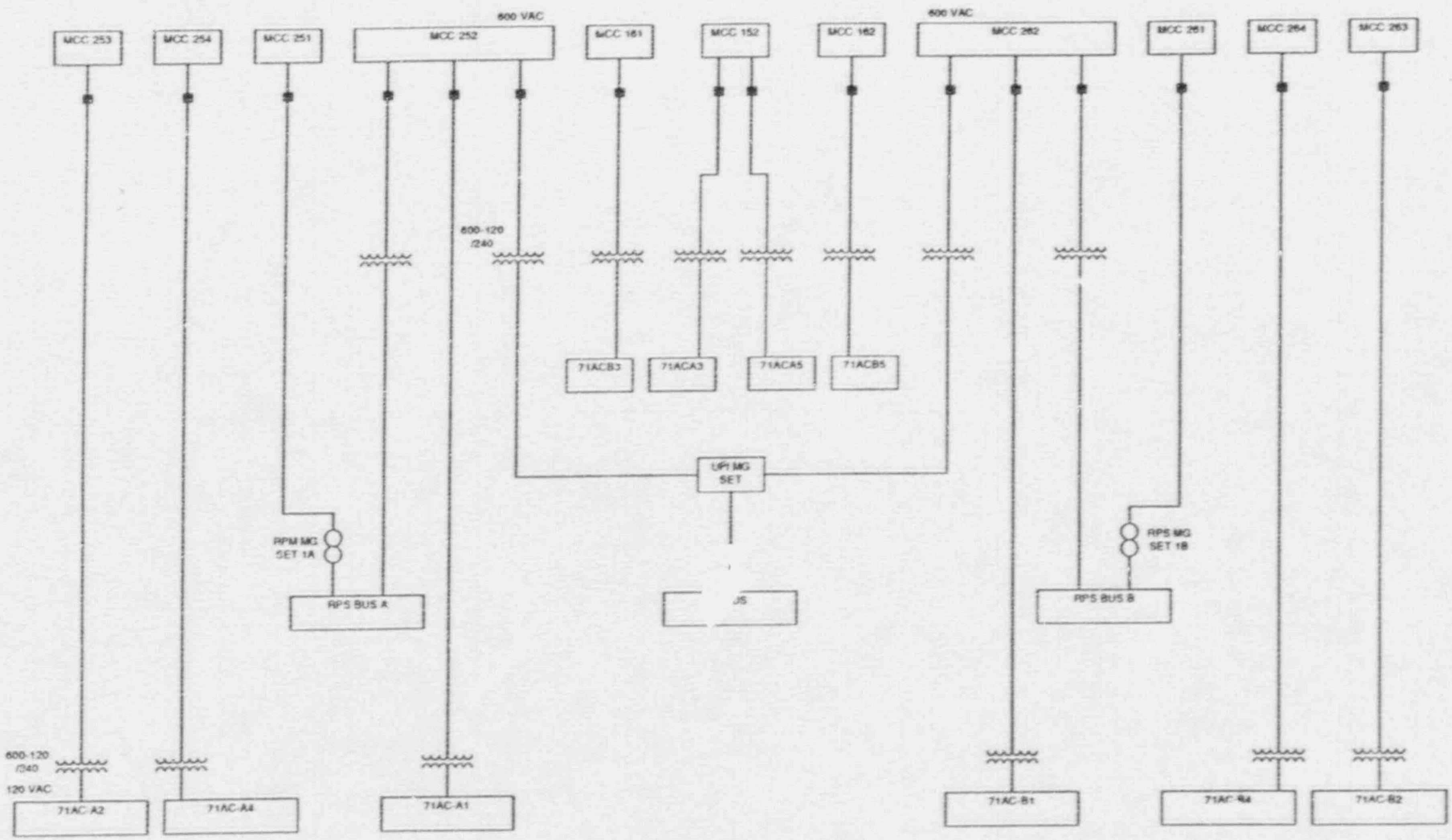


Figure 3.5-3. Fitzpatrick 125 VDC Electric Power Distribution System



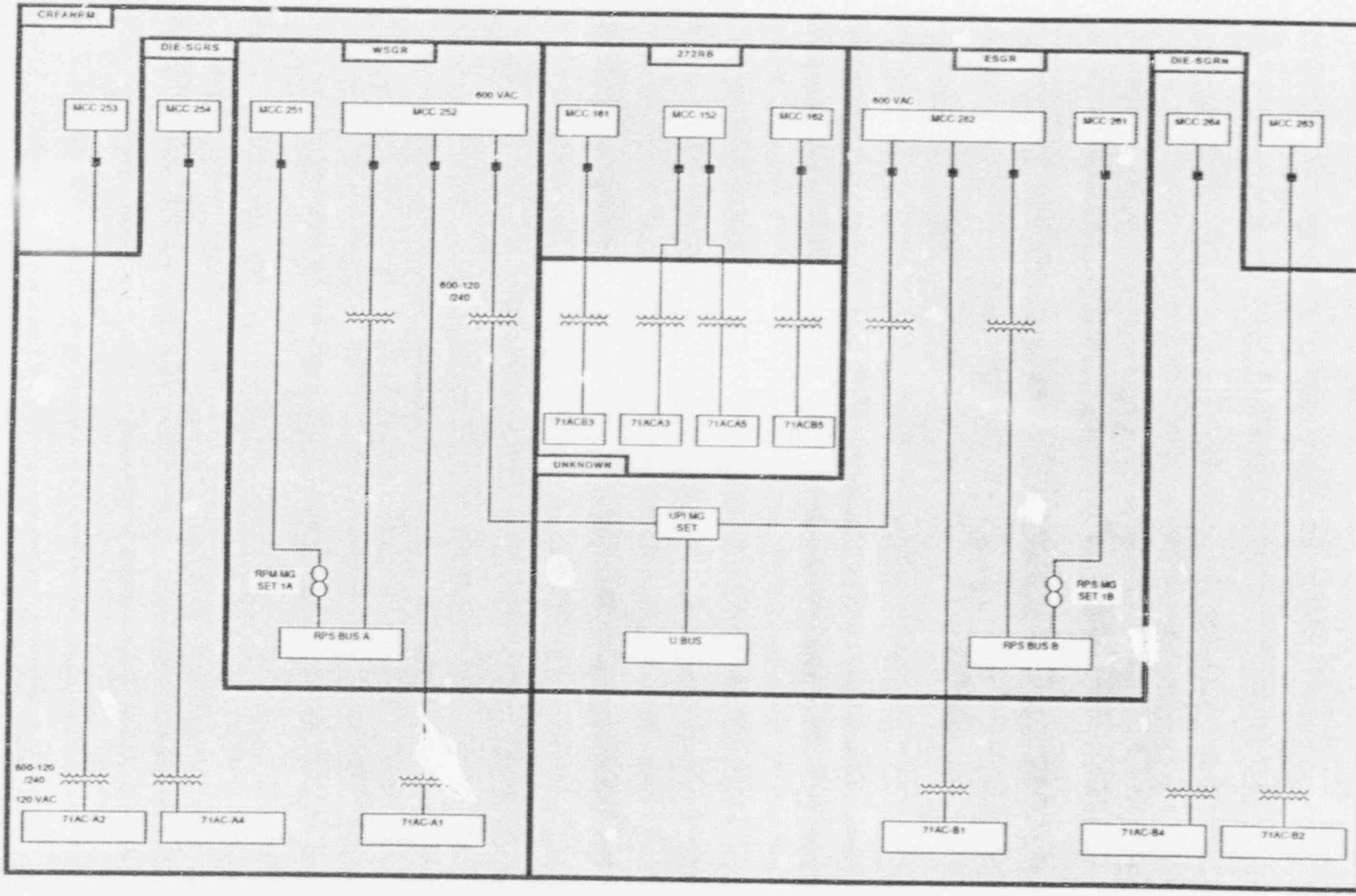
NOTE: LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS.

Figure 3.5-4. Fitzpatrick 125 VDC Electric Power Distribution System Showing Component Locations



NOTE (1): DETAILS OF THE MG SET ARE NOT KNOWN

Figure 3.5-5. Fitzpatrick 120 VAC Instrumentation Power System



NOTE (1): DETAILS OF THE MG SET ARE NOT KNOWN.

NOTE (2): LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS.

Figure 3.5-6. Fitzpatrick 120 VAC Instrumentation Power System Showing Component Locations

Table 3.5-1. Fitzpatrick Electric Power System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
71DCA4	PNL	DIE-SGRS	BUS2A	125	125BC-A	DC/A
71DCB4	PNL	DIE-SGRN	BUS2B	125	125BC-B	DC/B
BATA	BATT	125A		125		DC/A
BATB	BATT	125B		125		DC/B
BCA	BC	125BC-A	MCC252	600	WSGR	AC/A
BCB	BC	125BC-B	MCC262	600	ESGR	AC/B
BMCC1	PNL	CRESW	BUS2A	125	125BC-A	DC/A
BMCC2	PNL	CRESE	BUS2B	125	125BC-B	DC/B
BMCC3	PNL	CRESW	BUS2A	125	125BC-A	DC/A
BMCC4	PNL	CRESE	BUS2B	125	125BC-B	DC/B
BMCC6	PNL	272RB	BUS2B	125	125BC-B	DC/B
BUS 105	BUS	DIE-SGRS	DG-AC	4160	DIE-SGRS	AC/A
BUS 106	BUS	DIE-SGRN	DG-BD	4160	DIE-SGRN	AC/B
BUS 115	BUS	300RB	BUS105	4160	DIE-SGRS	AC/A
BUS 116	BUS	300RB	BUS106	4160	DIE-SGRN	AC/B
BUS 125	BUS	WSGR	BUS105	4160	DIE-SGRS	AC/A
BUS 126	BUS	ESGR	BUS106	4160	DIE-SGRN	AC/B
BUS 2A	PNL	125BC-A	BCA	125	125BC-A	DC/A
BUS 2A	PNL	125BC-A	BATA	125	125A	DC/A
BUS 2B	PNL	125BC-B	BCB	125	125BC-B	DC/B
BUS 2B	PNL	125BC-B	BATB	125	125B	DC/B
CBA, CBC	CB	DIE-SGRS				AC/A
CBB, CBD	CB	DIE-SGRN				AC/B
DG-AC	DG	DIE-S	BUS105	4160	DIE-SGRS	AC/A
DG-BD	DG	DIE-N	BUS106	4160	DIE-SGRN	AC/B
MCC 151	BUS	272RB	BUS115	600	300RB	AC/A
MCC 152	BUS	272RB	BUS115	600	300RB	AC/A

Table 3.5-1. Fitzpatrick Electric Power System Data Summary for Selected Components (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
MCC 153	BUS	CRESW	BUS115	600	300RB	AC/A
MCC 161	BUS	272RB	BUS116	600	300RB	AC/B
MCC 162	BUS	272RB	BUS116	600	300RB	AC/B
MCC 163	BUS	CRESE	BUS116	600	300RB	AC/B
MCC 252	BUS	WSGR	BUS125	600	WSGR	AC/A
MCC 262	BUS	ESGR	BUS126	600	ESGR	AC/B
T13	TRAN	300RB	BUS105	4160	DIE-SGRS	AC/A
T14	TRAN	300RB	BUS106	4160	DIF-SGRN	AC/B
T15	TRAN	WSGR	BUS105	4160	DIE-SGRS	AC/A
T16	TRAN	ESGR	BUS106	4160	DIE-SGRN	AC/B

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Fitzpatrick

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BATA	125	DC/A	125A	EP	BUS 2A	PNL	125BC-A
BATA	125	DC/A	125A	RCIC	RCICH01301	MOV	CRESW
BATA	125	DC/A	125A	RCIC	RCICH01302	HV	CRESW
BATB	125	DC/B	125B	EP	BUS 2B	PNL	125BC-B
BCA	125	DC/A	125BC-A	EP	BUS 2A	PNL	125BC-A
BCB	125	DC/B	125BC-B	EP	BUS 2B	PNL	125BC-B
BMCC1	125	DC/A	CRESW	RCIC	RCIC13-16	MOV	272PA
BMCC1	125	DC/A	CRESW	RCIC	RCIC13-18	MOV	CRESW
BMCC1	125	DC/A	CRESW	RCIC	RCIC13-20	MOV	CRESW
BMCC1	125	DC/A	CRESW	RCIC	RCIC13-21	MOV	CRESW
BMCC1	125	DC/A	CRESW	RCIC	RCIC13-27	MOV	TORUS
BMCC1	125	DC/A	CRESW	RCIC	RCIC13-30	MOV	CRESW
BMCC1	125	DC/A	CRESW	RCS	RCIC13-16	MOV	272PA
BMCC2	125	DC/B	CRESE	ECCS	HPCI23-14	MOV	CRESE
BMCC2	125	DC/B	CRESE	ECCS	HPCI23-17	MOV	CRESE
BMCC3	125	DC/A	CRESW	RCIC	RCIC13-131	MOV	CRESW
BMCC3	125	DC/A	CRESW	RCIC	RCIC13-132	MOV	CRESW
BMCC3	125	DC/A	CRESW	RCIC	RCIC13-39	MOV	CRESW
BMCC3	125	DC/A	CRESW	RCIC	RCIC13-41	MOV	TORUS
BMCC4	125	DC/B	CRESE	ECCS		MDP	CRESE
BMCC4	125	DC/B	CRESE	ECCS	HPCI23-24	MOV	CRESW
BMCC4	125	DC/B	CRESE	ECCS	HPCI23-57	MOV	CRESE
BMCC4	125	DC/B	CRESE	ECCS	HPCI23-58	MOV	TORUS
BMCC	125	DC/B	CRESE	RCIC	RCIC23-24	MOV	CRESW
BMCC4	125	DC/B	CRESE	RCS	RH10-17	MOV	TORUS
BMCC6	125	DC/B	272RB	ECCS	HPCI23-16	MOV	272PA
BMCC6	125	DC/B	272RB	ECCS	HPCI23-19	MOV	CRESE
BMCC6	125	DC/B	272RB	ECCS	HPCI23-21	MOV	CRESE
BMCC6	125	DC/B	272RB	ECCS	HPCI23-30	MOV	CRESE
BMCC6	125	DC/B	272RB	RCS	HPCI23-16	MOV	272PA
BUS105	4160	AC/A	DIE-SGRS	ECCS	CSS-PMA	MDP	CRESW

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Fitzpatrick (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BUS105	4160	AC/A	DIE-SGRS	ECCS	RH-PMA	MDP	CRESW
BUS105	4160	AC/A	DIE-SGRS	ECCS	RH-PMC	MDP	CRESW
BUS105	4160	AC/A	DIE-SGRS	EP	BUS 115	BUS	300RB
BUS105	4160	AC/A	DIE-SGRS	EP	BUS 125	BUS	WSGR
BUS105	4160	AC/A	DIE-SGRS	EP	DG-AC	DG	DIE-S
BUS105	4160	AC/A	DIE-SGRS	EP	T13	TRAN	300RB
BUS105	4160	AC/A	DIE-SGRS	EP	T15	TRAN	WSGR
BUS105	4160	AC/A	DIE-SGRS	ESWS	DG-AC	DG	DIE-S
BUS105	4160	AC/A	DIE-SGRS	ESWS	RH-PMAC	MDP	CRESW
BUS105	4160	AC/A	DIE-SGRS	RSWS	RSW-P1A	MDP	PUMPHS
BUS105	4160	AC/A	DIE-SGRS	RSWS	RSW-P1C	MDP	PUMPHS
BUS106	4160	AC/B	DIE-SGRN	ECCS	CSS-PMB	MDP	CRESE
BUS106	4160	AC/B	DIE-SGRN	ECCS	RH-PMB	MDP	CRESE
BUS106	4160	AC/B	DIE-SGRN	ECCS	RH-PMD	MDP	CRESE
BUS106	4160	AC/B	DIE-SGRN	EP	BUS 116	BUS	300RB
BUS106	4160	AC/B	DIE-SGRN	EP	BUS 126	BUS	ESGR
BUS106	4160	AC/B	DIE-SGRN	EP	DG-BD	DG	DIE-N
BUS106	4160	AC/B	DIE-SGRN	EP	T14	TRAN	300RB
BUS106	4160	AC/B	DIE-SGRN	EP	T16	TRAN	ESGR
BUS106	4160	AC/B	DIE-SGRN	ESWS	DG-BD	DG	DIE-N
BUS106	4160	AC/B	DIE-SGRN	ESWS	RH-PMBD	MDP	CRESE
BUS106	4160	AC/B	DIE-SGRN	RSWS	RSW-P1B	MDP	PUMPHS
BUS106	4160	AC/B	DIE-SGRN	RSWS	RSW-P1D	MDP	PUMPHS
BUS115	600	AC/A	300RB	EP	MCC 151	BUS	272RB
BUS115	600	AC/A	300RB	EP	MCC 152	BUS	272RB
BUS115	600	AC/A	300RB	EP	MCC 153	BUS	CRESW
BUS116	600	AC/B	300RB	EP	MCC 161	BUS	272RB
BUS116	600	AC/B	300RB	EP	MCC 162	BUS	272RB
BUS116	600	AC/B	300RB	EP	MCC 163	BUS	CRESE
BUS125	600	AC/A	WSGR	EP	MCC 252	BUS	WSGR
BUS125	600	AC/A	WSGR	ESWS	ESW-P2A	MDP	PUMPHS

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Fitzpatrick (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BUS126	600	AC/B	ESGR	EP	MCC 262	BUS	ESGR
BUS126	600	AC/B	ESGR	ESWS	ESW-P2B	MDP	PUMPHS
BUS2A	125	DC/A	125BC-A	EP	71DCA4	PNL	DIE-SGRS
BUS2A	125	DC/A	125BC-A	EP	BMCC1	PNL	CRESW
BUS2A	125	DC/A	125BC-A	EP	BMCC3	PNL	CRESW
BUS2B	125	DC/B	125BC-B	EP	71DCB4	PNL	DIE-SGRN
BUS2B	125	DC/B	125BC-B	EP	BMCC2	PNL	CRESE
BUS2B	125	DC/B	125BC-B	EP	BMCC4	PNL	CRESE
BUS2B	125	DC/B	125BC-B	EP	BMCC6	PNL	272RB
DG-AC	4160	AC/A	DIE-SGRS	EP	BUS 105	BUS	DIE-SGRS
DG-BD	4160	AC/B	DIE-SGRN	EP	BUS 106	BUS	DIE-SGRN
MCC151	600	AC/A	272RB	ECCS	RH10-12A	MOV	CRESW
MCC151	600	AC/A	272RB	ECCS	RH10-70A	MOV	RHRHXA
MCC151	600	AC/A	272RB	RCS	RH10-18	MOV	RC
MCC151	600	AC/A	272RB	RSWS	RSW10-148A	MOV	272RB
MCC151	600	AC[illegible]	272RB	RSWS	RSW10-149A	MOV	272RB
MCC151	600	[illegible]A	272RB	RSWS	RSW10-89A	MOV	RHRHXA
MCC152	600	AC/A	272RB	ECCS	CSS14-11A	MOV	300RB
MCC152	600	AC/A	272RB	ECCS	CSS14-12A	MOV	300RB
MCC152	600	AC/A	272RB	ECCS	RH10-26A	MOV	300RB
MCC152	600	AC/A	272RB	ECCS	RH10-26A	MOV	300RB
MCC152	600	AC/A	272RB	ECCS	RH10-31A	MOV	300RB
MCC152	600	AC/A	272RB	ECCS	RH10-31A	MOV	300RB
MCC152	600	AC/A	272RB	ESWS	ESWI5-175A	MOV	272RB
MCC152	600	AC/A	272RB	RCS	RCS12-15	MOV	RC
MCC152	600	AC/A	272RB	RCS	RCS29-74	MOV	RC
MCC153	600	AC/A	CRESW	ECCS	CSS14-07A	MOV	TORUS
MCC153	600	AC/A	CRESW	ECCS	CSS14-26A	MOV	CRESW
MCC153	600	AC/A	CRESW	ECCS	HPCI23-15	MOV	RC
MCC153	600	AC/A	CRESW	ECCS	RH10-13A	MOV	CRESW
MCC153	600	AC/A	CRESW	ECCS	RH10-13C	MOV	CRESW

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Fitzpatrick (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC153	600	AC/A	CRESW	ECCS	RH10-25A	MOV	272PA
MCC153	600	AC/A	CRESW	ECCS	RH10-27A	MOV	272PA
MCC153	600	AC/A	CRESW	ECCS	RH10-34A	MOV	CRESW
MCC153	600	AC/A	CRESW	ECCS	RH10-34A	MOV	CRESW
MCC153	600	AC/A	CRESW	ECCS	RH10-36A	MOV	CRESW
MCC153	600	AC/A	CRESW	ECCS	RH10-38A	MOV	CRESW
MCC153	600	AC/A	CRESW	ECCS	RH10-38A	MOV	CRESW
MCC153	600	AC/A	CRESW	ECCS	RH10-39A	MOV	CRESW
MCC153	600	AC/A	CRESW	ECCS	RH10-39A	MOV	CRESW
MCC153	600	AC/A	CRESW	ECCS	RH10-65A	MOV	CRESW
MCC153	600	AC/A	CRESW	ECCS	RH10-66A	MOV	CRESW
MCC153	600	AC/A	CRESW	ECCS	RH10-66A	MOV	CRESW
MCC153	600	AC/A	CRESW	RCS	HPCI23-15	MOV	RC
MCC161	600	AC/B	272RB	ECCS	RH10-12B	MOV	CRESE
MCC161	600	AC/B	272RB	ECCS	RH10-26B	MOV	300RB
MCC161	600	AC/B	272RB	ECCS	RH10-26B	MOV	300RB
MCC161	600	AC/B	272RB	ECCS	RH10-31B	MOV	300RB
MCC161	600	AC/B	272RB	ECCS	RH10-31B	MOV	300RB
MCC161	600	AC/B	272RB	ECCS	RH10-70B	MOV	RHRHXB
MCC161	600	AC/B	272RB	RSWS	RSW10-148B	MOV	272RB
MCC161	600	AC/B	272RB	RSWS	RSW10-149B	MOV	272RB
MCC161	600	AC/B	272RB	RSWS	RSW10-89B	MOV	RHRHXB
MCC162	600	AC/B	272RB	ECCS	CSS14-11B	MOV	300RB
MCC162	600	AC/B	272RB	ECCS	CSS14-12B	MOV	300RB
MCC162	600	AC/B	272RB	ESWS	ESWI5-175B	MOV	272RB
MCC163	600	AC/B	CRESE	ECCS	CSS14-07B	MOV	TORUS
MCC163	600	AC/B	CRESE	ECCS	CSS14-26B	MOV	CRESE
MCC163	600	AC/B	CRESE	ECCS	RH10-13B	MOV	CRESE
MCC163	600	AC/B	CRESE	ECCS	RH10-13D	MOV	CRESE
MCC163	600	AC/B	CRESE	ECCS	RH10-25B	MOV	272PA
MCC163	600	AC/B	CRESE	ECCS	RH10-27B	MOV	272PA

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Fitzpatrick (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC163	600	AC/B	CRESE	ECCS	RH10-34B	MOV	CRESE
MCC163	600	AC/B	CRESE	ECCS	RH10-34B	MOV	CRESE
MCC163	600	AC/B	CRESE	ECCS	RH10-36B	MOV	CRESE
MCC163	600	AC/B	CRESE	ECCS	RH10-38B	MOV	CRESE
MCC163	600	AC/B	CRESE	ECCS	RH10-38B	MOV	CRESE
MCC163	600	AC/B	CRESE	ECCS	RH10-39B	MOV	CRESE
MCC163	600	AC/B	CRESE	ECCS	RH10-39B	MOV	CRESE
MCC163	600	AC/B	CRESE	ECCS	RH10-65B	MOV	CRESE
MCC163	600	AC/B	CRESE	ECCS	RH10-66B	MOV	CRESE
MCC163	600	AC/B	CRESE	ECCS	RH10-66B	MOV	CRESE
MCC163	600	AC/B	CRESE	RCIC	RCIC13-15	MOV	RC
MCC163	600	AC/B	CRESE	RCS	RCIC13-15	MOV	RC
MCC252	600	AC/A	WSGR	EP	BCA	BC	125BC-A
MCC252	600	AC/A	WSGR	ESWS	ESW46-101A	MOV	CBLTUN
MCC252	600	AC/A	WSGR	ESWS	ESW46-101A	MOV	CBLTUN
MCC262	600	AC/B	ESGR	EP	BCB	BC	125BC-B
MCC262	600	AC/B	ESGR	ESWS	ESW46-101B	MOV	CBLTUN
MCC262	600	AC/B	ESGR	ESWS	ESW46-101B	MOV	CBLTUN

3.6 CONTROL ROD DRIVE HYDRAULIC SYSTEM (CRDHS)

3.6.1 System Function

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

3.6.2 System Definition

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

Details of the scram portion of typical BWR CRDHS are shown in Figure 3.6-1 (adapted from Ref. 1).

3.6.3 System Operation

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

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

Although not intended as a makeup system, the CRDHS can provide a source of cooling water to the RCS during vessel isolation. It is noted in NUREG-0626 (Ref. 2), that this function is particularly important for some BWR/1 and BWR/2 plants for which the CRDHS is the primary source of makeup on vessel isolation. In later model BWR plants, such as Fitzpatrick, RCS makeup at high pressure is performed by the RCIC (see Section 3.2) and HPCI (see Section 3.3) systems. The maximum RCS makeup rate of the CRDHS with both pumps operating at Fitzpatrick is about 210 gpm with the RCS at operating pressure and approximately 300 gpm when the RCS is depressurized (Ref. 3).

3.6.4 System Success Criteria

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

- A scram signal must be transmitted by the RPS to the actuated devices (i.e., pilot valves) in the CRDHS.
- The pneumatic inlet scram valve and outlet scram valve must open in the hydraulic control units (HCUs) for the individual control rod drives. This is accomplished by venting the instrument air supply to each valve as follows:
  - Both scram pilot valves in each HCU must be deenergized, or
  - Either backup scram pilot valve must be energized.
- A high-pressure water source must be available from the scram accumulator in each HCU.
- A hydraulic vent path to the scram discharge volume must be available and sufficient collection volume must exist in the scram discharge volume.
- A specified number of control rods must responds and insert into the reactor core (specific number needed is not known).

3.6.5 Component Information

A. Control rod drive pumps
   1. Rated capacity: 100% (for control rod drive function)
   2. Flow rate: 100 gpm @ 3675 ft. head, est. (1593 psid, est.)
   3. Type: centrifugal

B. Condensate Storage Tanks
   1. Capacity: 200,000 gallons

3.6.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The RPS transmits scram commands to solenoid pilot valves which control the pneumatic scram valves.
   2. Remote Manual
      a. A reactor scram can be initiated manually from the control room.
      b. The CRDHS can be operated manually from the control room to insert and withdraw rods, or to inject water into the RCS.

B. Motive Power
   1. The CRDHS pumps are Class 1E AC loads that can be powered from 600 VAC buses.

3.6.7 Section 3.6 References

1. NEDO-24708A, "Additional Information Required for NRC Staff Generic Report on Boiling Water Reactors," General Electric Company, December 1980.

2. NUREG-0626, "Generic Evaluation of Feedwater Transients and Small Break Loss-of-Coolant-Accidents in GE-designed Operating Plants and Near-term Operating License Applications," USNRC, January 1980.

3. Fitzpatrick FSAR, Section 3.5.

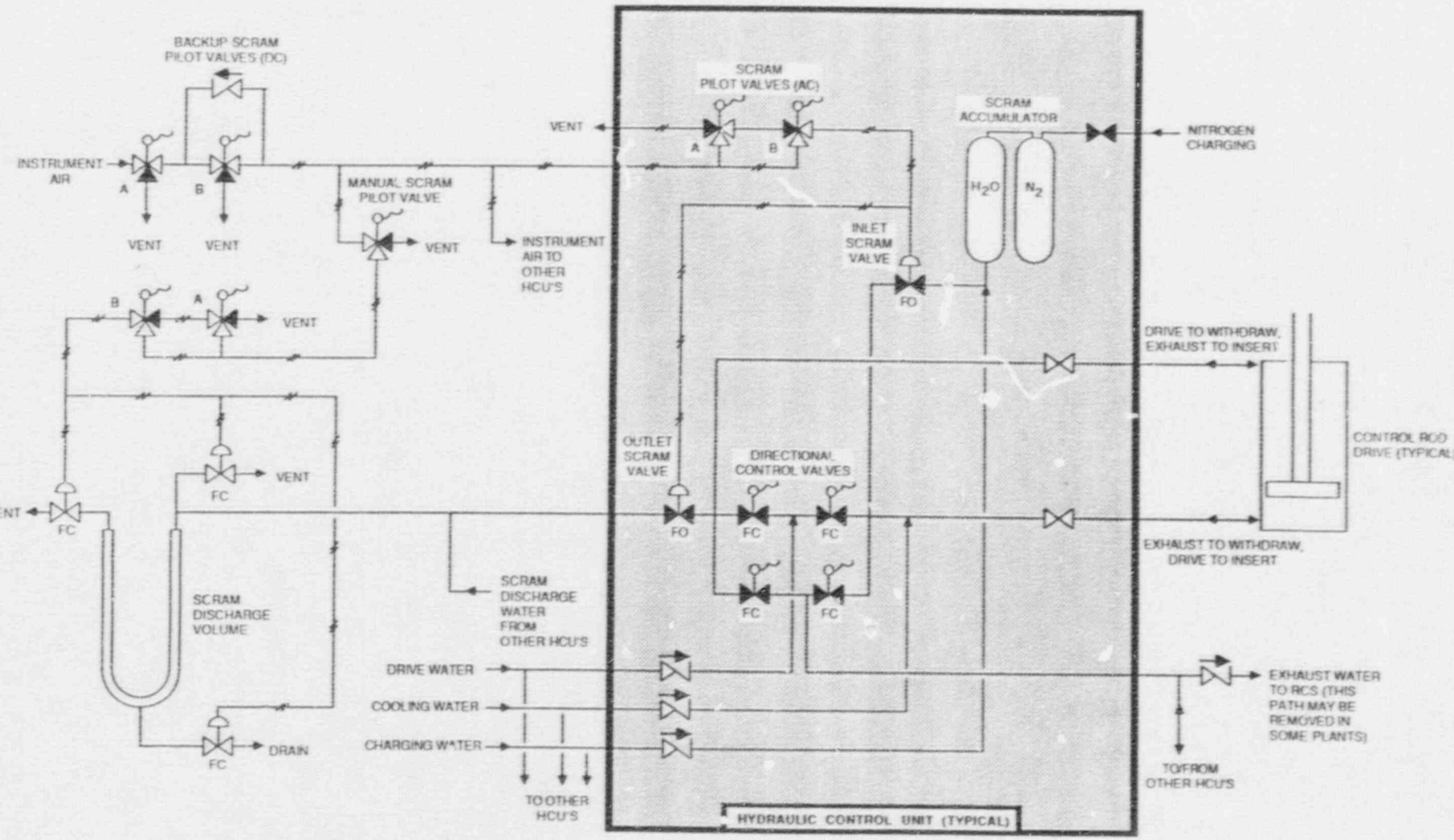


Figure 3.6-1. Simplified Diagram Of Portions Of The Control Rod Drive Hydraulic System That Are Related To The Scram Function

3.7 EMERGENCY SERVICE WATER SYSTEM (ESWS)

3.7.1 System Function

The ESWS provides cooling water from the ultimate heat sink (Lake Ontario) to various component heat loads in the plant, including the diesel generators, RHR pumps, and various other heat loads. The ESWS also serves as a backup for the service water system which is the normal water source for some operating systems.

3.7.2 System Definition

The ESWS consists of two independent supply loops. Each loop contains one motor-driven emergency service water pump and associated valves and piping. Cooling water is returned to the ultimate heat sink via a screenwell in the service water area.

Simplified drawings of the ESWS are shown in Figures 3.7-1 and 3.7-2. A summary of data on selected ESWS components is presented in Table 3.7-1.

3.7.3 System Operation

The ESWS is normally in standby, with the system aligned for open-loop operation. The ESWS is initiated in the event of a start of the diesel generators or loss of Reactor Building closed loop cooling water pressure (one-of-two-twice logic). When the system is placed in operation, water is drawn by the ESW pump in a separate bay in the screen pumphouse and supplied to various system heat loads. Cooling water is returned to the ultimate heat sink via the service water return area.

3.7.4 System Success Criteria

Adequate cooling water flow to the components served by a particular ESW train can be provided by the one ESW pump in the train. A complete open-loop flow path must exist from the respective pump to a suitable discharge point.

3.7.5 Component Information

A. ESW Pumps (2)
   1. Rated flow: 3700 gpm @ 168 ft. head (73 psid)
   2. Shutoff head: 270 ft. (117 psid)
   3. Rated capacity: 100%
   4. Type: vertical turbine

3.7.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The ESW pumps automatically start when the diesel generators are started or in the event of a loss of Reactor Building closed loop cooling water pressure.
   2. Remote manual
      The ESW system can be controlled by remote manual means from the control room.

B. Motive Power
   The ESW pumps and valves are Class 1E AC loads that can be powered from the diesel generators as described in Section 3.5.

C. Other

1. It is assumed that ESW pump cooling and lubrication are provided locally at the pumps.
2. Provisions for ESW pump room cooling have not been identified.

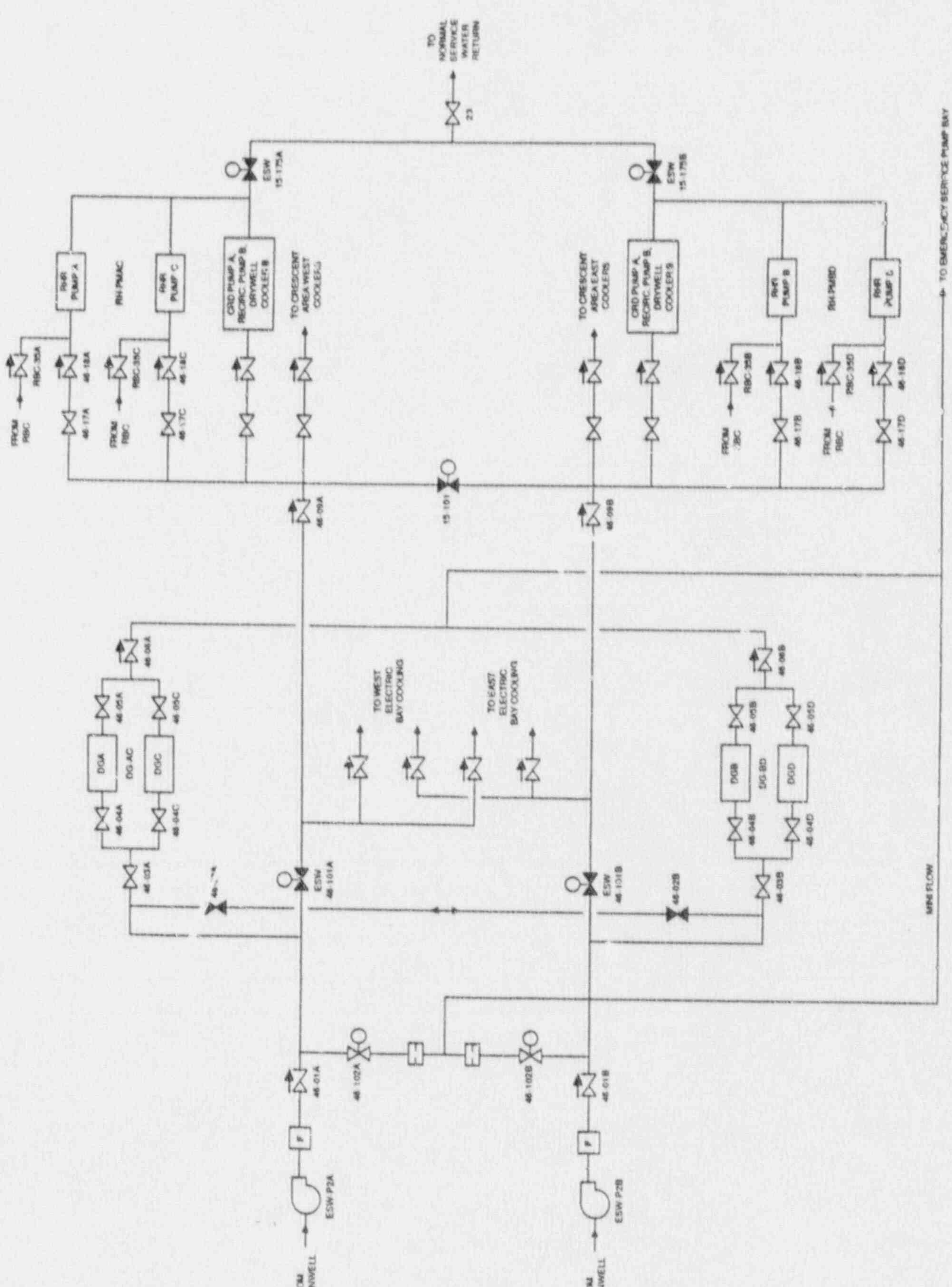


Figure 3.7-1. Fitzpatrick Emergency Service Water System

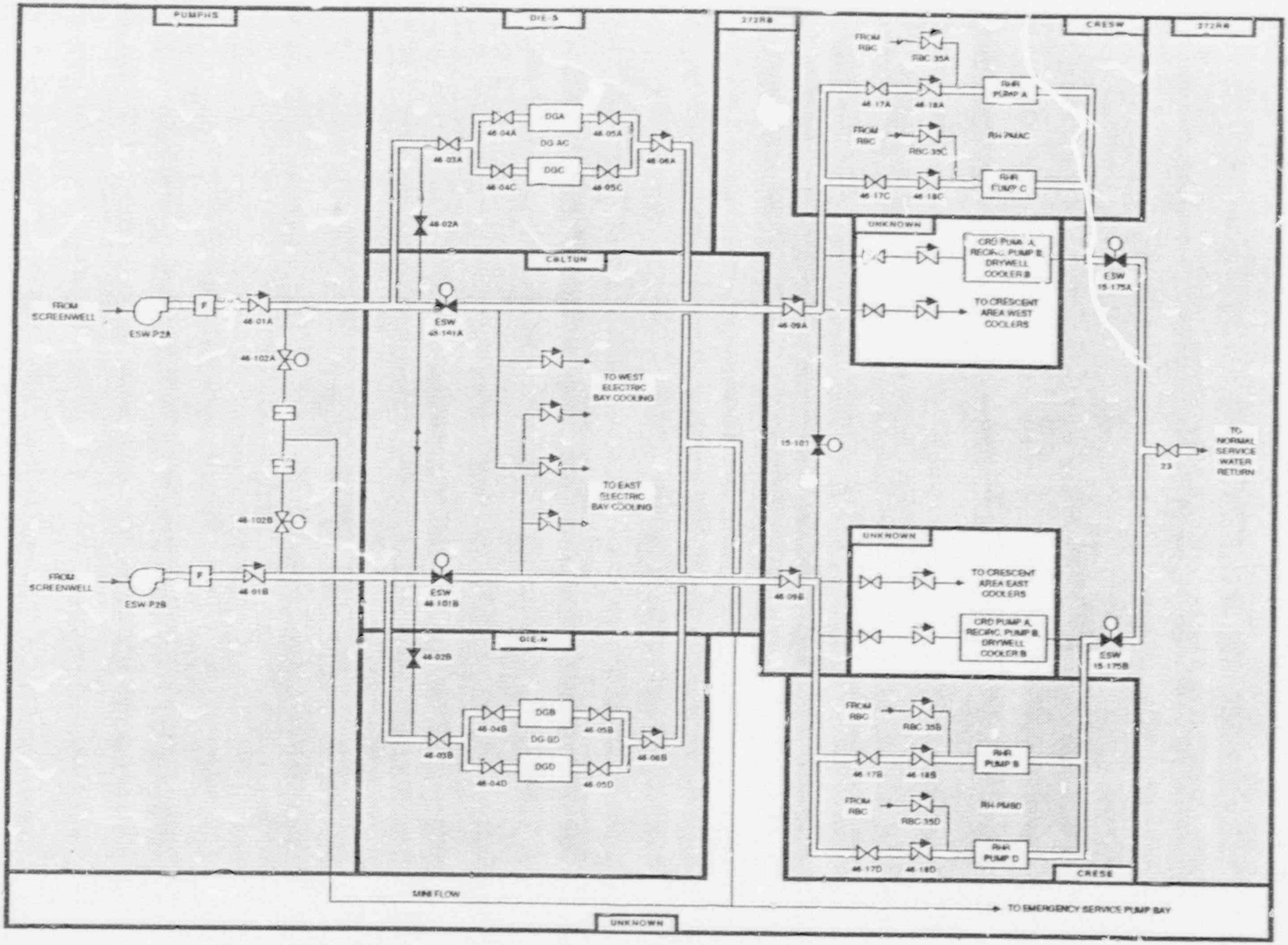


Figure 3.7-2. Fitzpatrick Emergency Service Water System Showing Component Locations

Table 3.7-1. Fitzpatrick Emergency Service Water System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
ESW-P2A	MDP	PUMPHS	BUS125	600	WSGR	AC/A
ESW-P2B	MDP	PUMPHS	BUS126	600	ESGR	AC/B
ESW46-101A	MOV	CBLTUN	MCC252	600	WSGR	AC/A
ESW46-101A	MOV	CBLTUN	MCC252	600	WSGR	AC/A
ESW46-101B	MOV	CBLTUN	MCC262	600	ESGR	AC/B
ESW46-101B	MOV	CBLTUN	MCC262	600	ESGR	AC/B
ESWI5-175A	MOV	272RB	MCC152	600	272RB	AC/A
ESWI5-175B	MOV	272RB	MCC162	600	272RB	AC/B

3.8 RESIDUAL HEAT REMOVAL SERVICE WATER SYSTEM (RSWS)

3.8.1 System Function

The residual heat removal service water system (RSWS) provides cooling water from the ultin.. 'e heat sink (Lake Ontario) to remove rea decay heat via the RHR heat exchangers. ... means of a cross-tie with the RHR s... the RSWS also can supply makeup to the RCS when all emergency core cooling sys... ...ve failed.

3.8.2 System Definition

The RSWS consists of two independent loops. Each loop has two motor-driven pumps that take a suction through strainers and sluice gates in the intake structure and discharge into a header that supplies cooling water to the respective RHR heat exchanger. Cooling water is returned to the ultimate heat sink.

Simplified diagrams of the RSWS are shown in Figures 3.8-1 through 3.8-4. A summary of data on selected RSWS components is presented in Table 3.8-1.

3.8.3 System Operation

The RSWS normally is in standby, with the system aligned for open-loop operation. When needed, the system is placed in operation manually.

In the event of failure of both normal and reserve power or in the event of a LOCA, both pairs of RSWS pumps are manually started after the emergency diesel generators have attained operating speed and the emergency buses have been energized. Residual heat removal service water flow to the RHR heat exchangers is not required immediately following a LOCA (i.e. heat removal from the containment is not required during the initial plant response to a LOCA). When operating, the RSWS supplies cooling water from the service water screenwell through two 100 percent capacity, totally independent supply loops, to the two RHR heat exchangers. System cooling water is returned to the service water screenwell area.

3.8.4 System Success Criteria

The success criteria for the RSWS are defined on a per train basis. For each train of the RSWS, two RSWS pumps must operate and the flow path to the RHR heat exchanger must be open.

3.8.5 Component Information

A. RHR Service Water Pumps (4)
   1. Rated flow: 4000 gpm @ 267 ft. head each (116 psid)
   2. Shutoff head: 1000 ft. head (434 psid)
   3. Rated capacity: 100% for two pumps
   4. Type: vertical turbine

3.8.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      None
   2. Remote manual
      The RSWS pumps are placed in service by remote manual means from the control room.

B. Motive Power
The RSWS pump and valves are Class 1E AC loads that can be powered from the diesel generators as described in Section 3.5.

C. Other
1. It is assumed that RSWS pump cooling and lubrication are provided locally at the pumps.
2. Provisions for RSWS pump room cooling have not been identified.

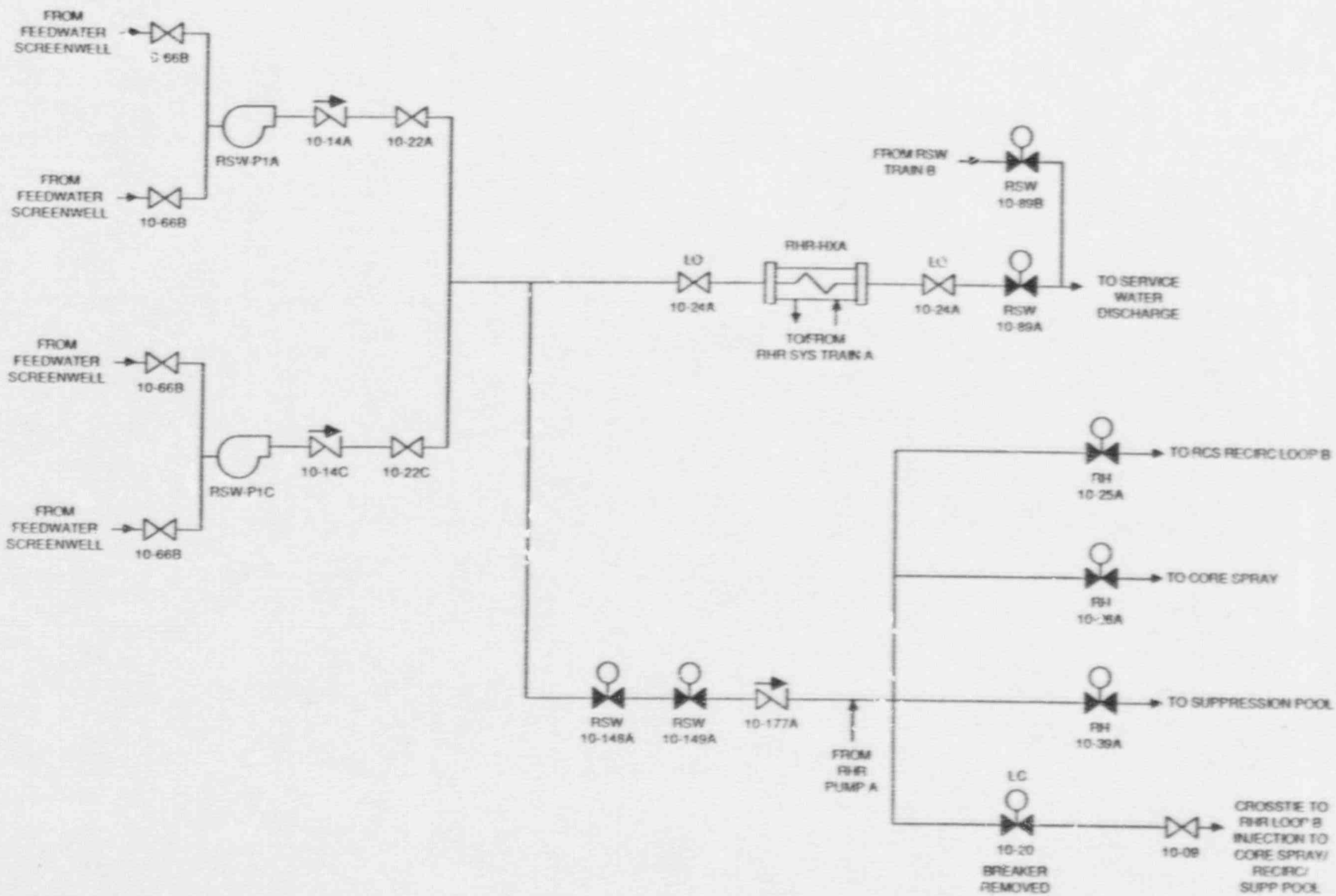


Figure 3.8-1. Fitzpatrick Residual Heat Removal Service Water System Train A

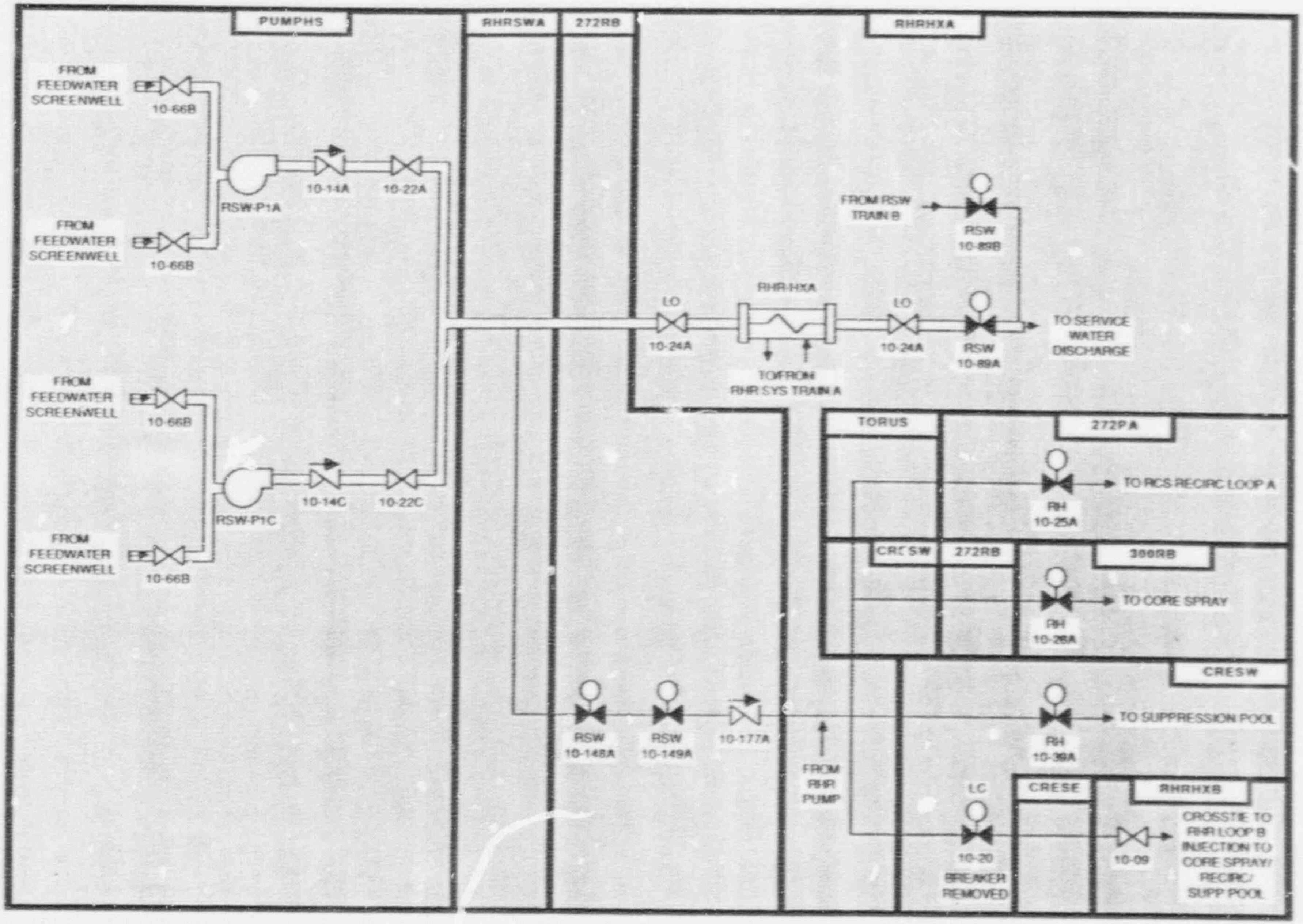


Figure 3.8-2. Fitzpatrick Residual Heat Removal Service Water System Train A Showing Component Locations

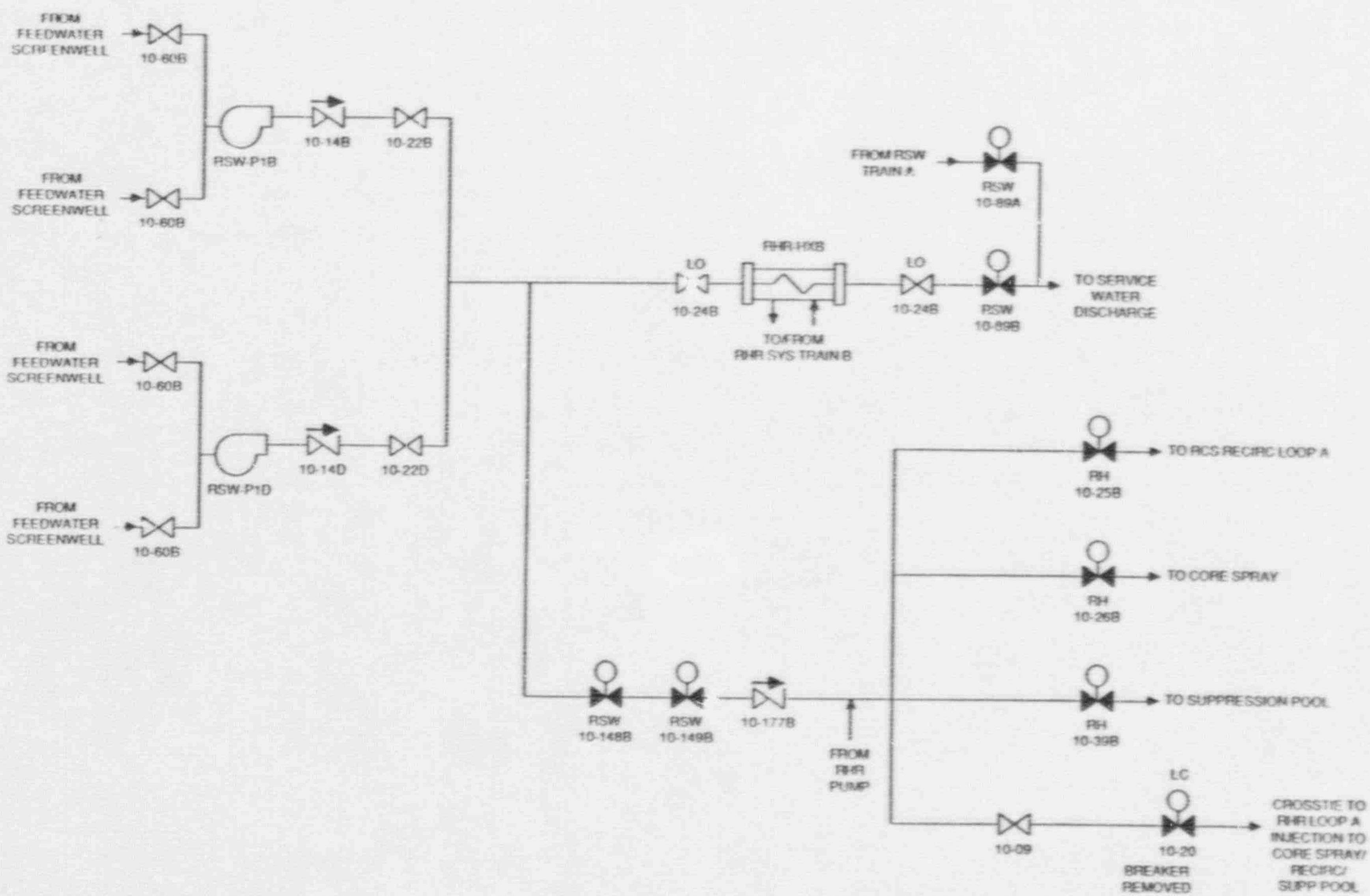


Figure 3.8-3. Fitzpatrick Residual Heat Removal Service Water System Train B

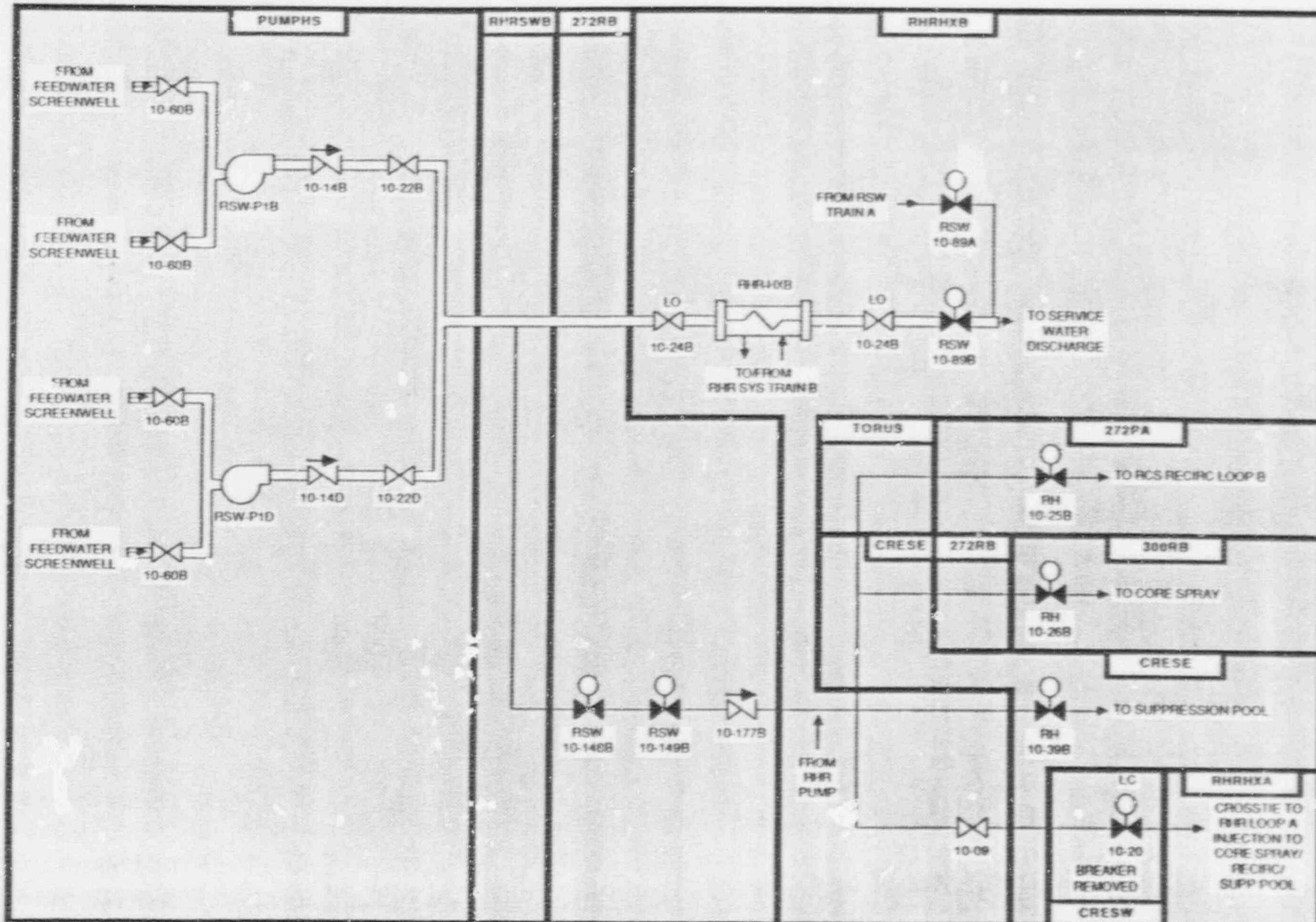


Figure 3.8-4. Fitzpatrick Residual Heat Removal Service Water System Train B Showing Component Locations

Table 3.8-1. Fitzpatrick Residual Heat Removal Service Water System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RSW-P1A	MDP	PUMPHS	BUS105	4160	DIE-SGRS	AC/A
RSW-P1B	MDP	PUMPHS	BUS106	4160	DIE-SGRN	AC/B
RSW-P1C	MDP	PUMPHS	BUS105	4160	DIE-SGRS	AC/A
RSW-P1D	MDP	PUMPHS	BUS106	4160	DIE-SGRN	AC/B
RSW10-148A	MOV	272RB	MCC151	600	272RB	AC/A
RSW10-148B	MOV	272RB	MCC161	600	272RB	AC/B
RSW10-149A	MOV	272RB	MCC151	600	272RB	AC/A
RSW10-149B	MOV	272RB	MCC161	600	272RB	AC/B
RSW10-89A	MOV	RHRHXA	MCC151	600	272RB	AC/A
RSW10-89B	MOV	RHRHXB	MCC161	600	272RB	AC/B

4. PLANT INFORMATION

4.1 SITE AND BUILDING SUMMARY

The Fitzpatrick site is located at Nine Mile Point on Lake Ontario in Oswego County approximately 3,000 feet east of the Niagra Mohawk Nine Mile Point Nuclear Station. The site contains a single BWR/4 plant. A site map showing the Fitzpatrick and Nine Mile Point plants are shown in Figure 4-1 and a more detailed site plan of Fitzpatrick is shown in Figure 4-2.

The major structures of the plant include the reactor building, the administration and control buildings, the turbine building, the diesel generator building, and the screenwell building.

The reactor building contains the reactor vessel, reactor coolant pumps, and the suppression pool. Piping and valving for the reactor coolant system are completely housed within the containment structure inside the reactor building.

The east crescent room within the reactor building contains DC motor control centers, core spray train A and LPCIA/LPCIC pumps, valves and piping and RCIC piping. The west crescent room within the reactor building contains DC motor control centers, core spray train B and LPCIB/LPCID pumps, valves and piping and HPCI valves and piping.

The administration building, adjacent to and north of the reactor building, contains RCIC and HPCI valves and piping, LPCI piping, the control room, upper and lower cable spreading rooms, the relay room and the cable spreading room.

The turbine building, located north of the administration building, houses the turbine generator with its associated power generating auxiliaries, emergency batteries, battery chargers and some of the 600 volt switchgear.

The diesel generator building is located northwest of the turbine building and contains the emergency diesel generators and their auxiliaries and well as some DC panels, 4160 volt emergency buses and other electrical components.

The screenwell building, east of the diesel generator building, contains the residual heat removal service water pumps and the essential service water pumps as well as associated piping.

The condensate water storage tanks are located west of the reactor building.

4.2 FACILITY LAYOUT DRAWINGS

Numerous elevation views of the Fitzpatrick Reactor Building are shown in Figure 4-3. Simplified layout drawings are presented in Figures 4-4 through 4-14. An elevation view of the Diesel Generator Building is presented in Figure 4-15. A simplified layout drawing of the Diesel Generator Building is shown in Figure 4-16. An elevation view of the Screenwell and Water Treatment Building is presented in Figure 4-17 and simplified layout drawings of the Screenwell, Water Treatment and Radwaste Buildings are shown in Figure 4-18 and 4-19. 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.

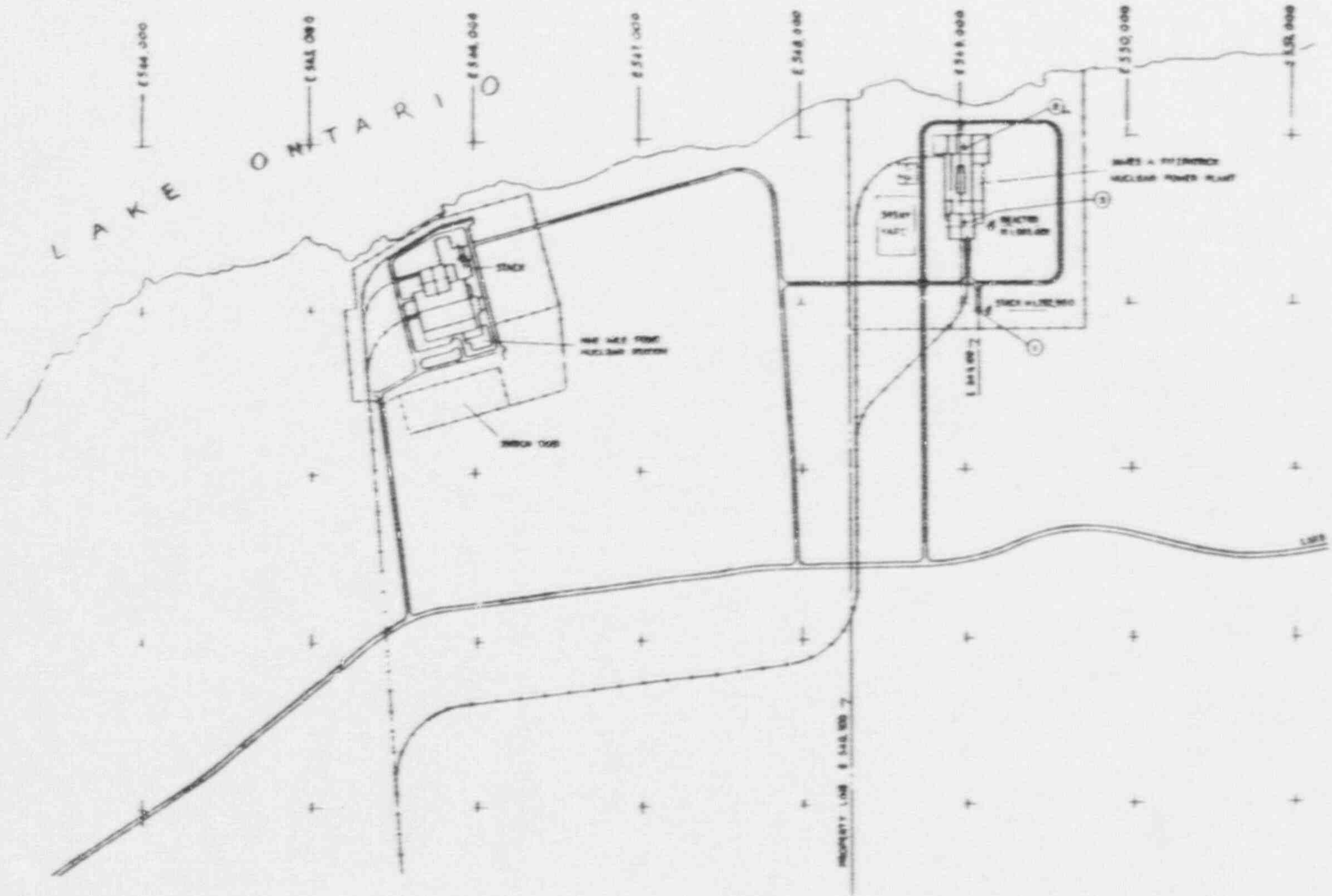


Figure 4-1. Site Map Showing the Fitzpatrick and Nine Mile Point Plants

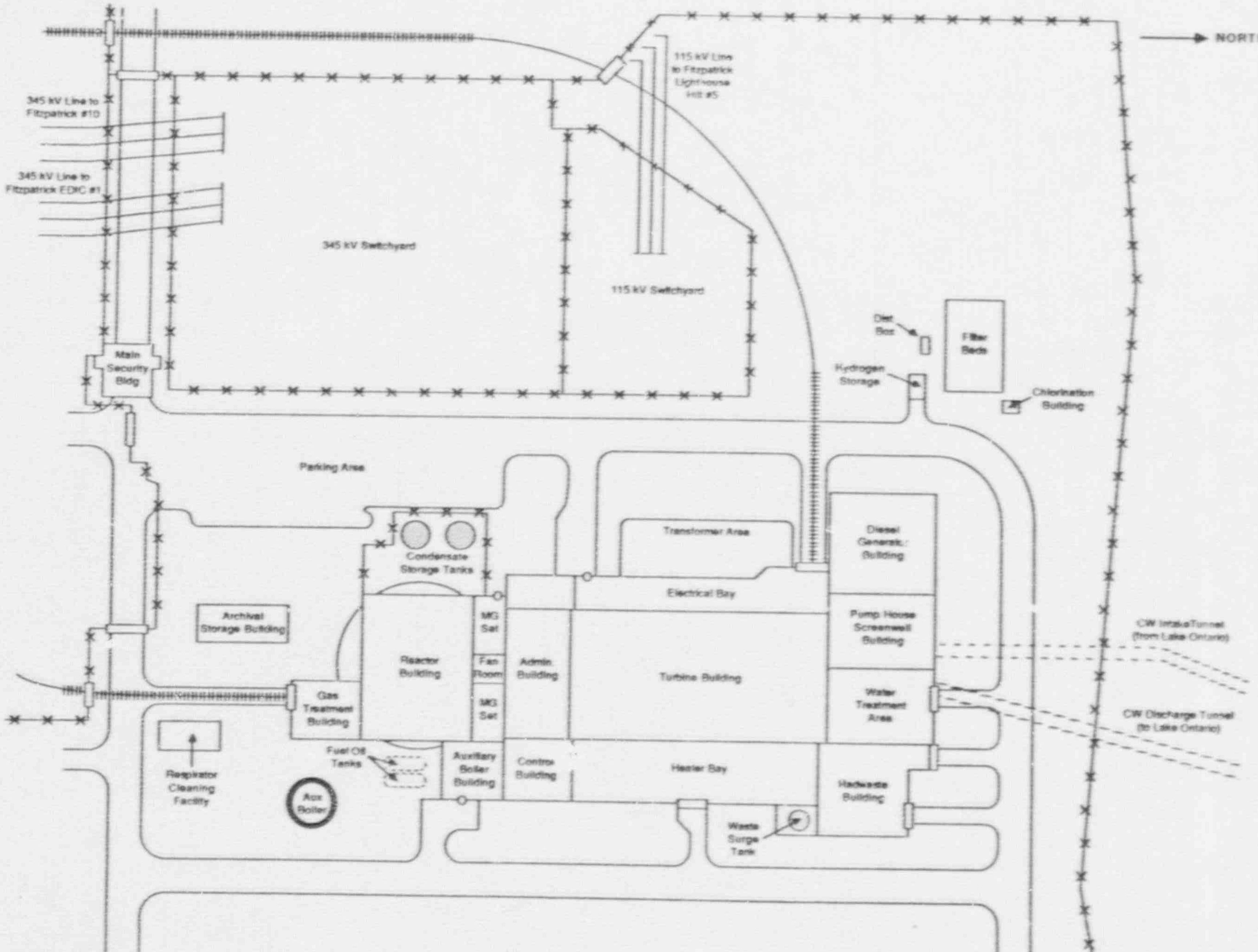


Figure 4-2. Fitzpatrick Simplified Site Plan

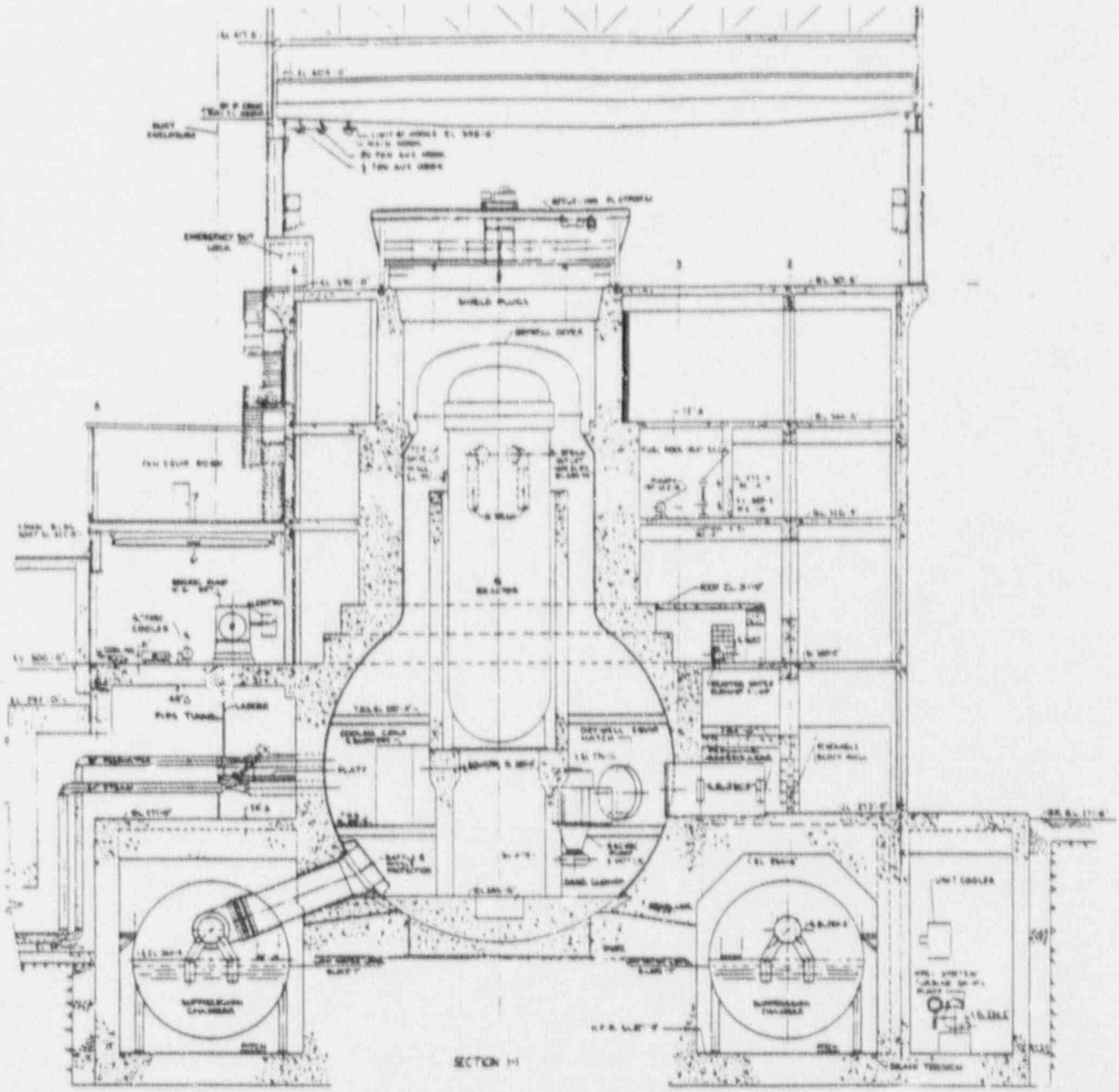


Figure 4-3. Fitzpatrick Reactor Building Elevation Views
(page 1 of 5)

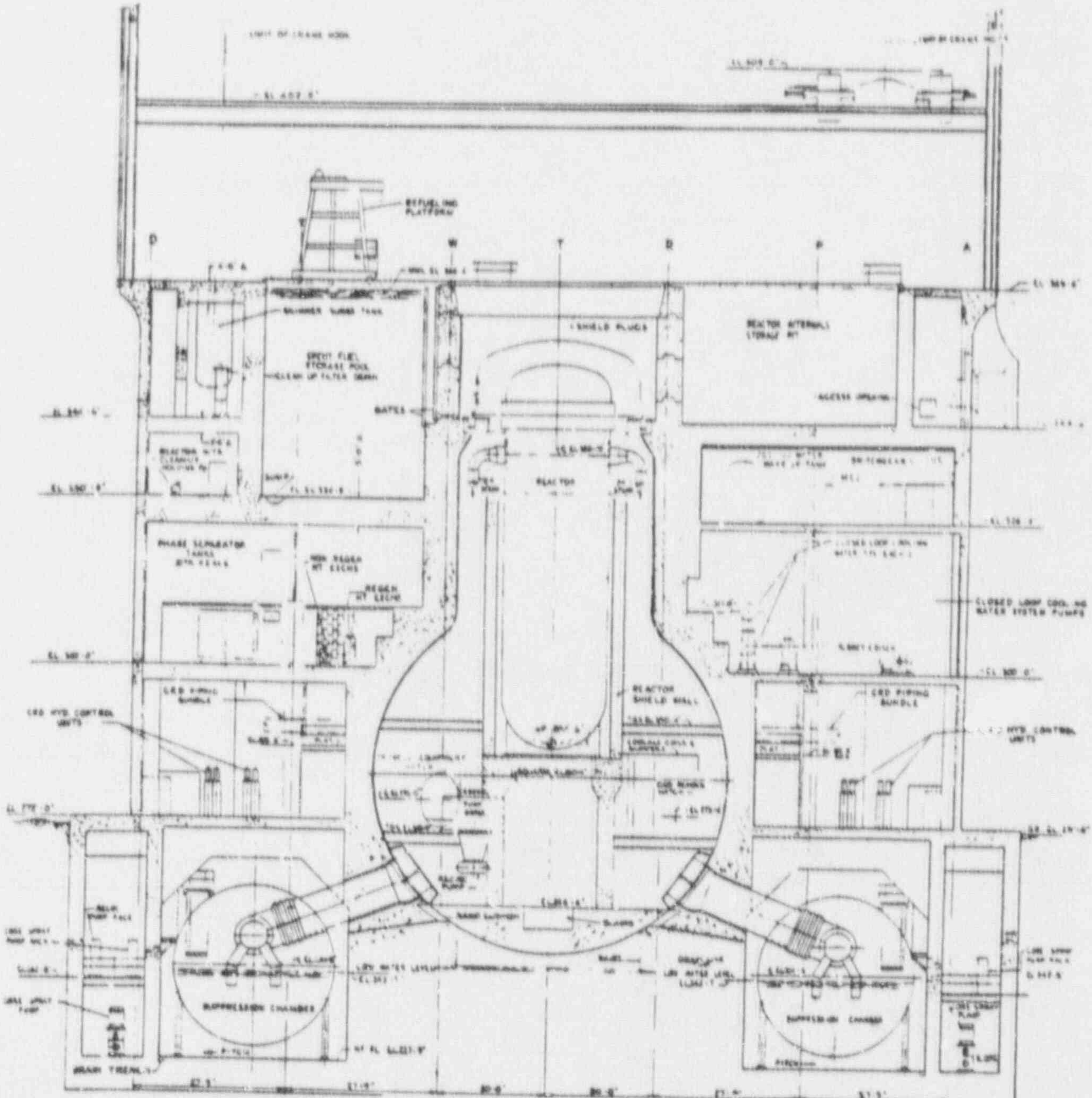


Figure 4-3. Fitzpatrick Reactor Building Elevation Views
(page 2 of 5)

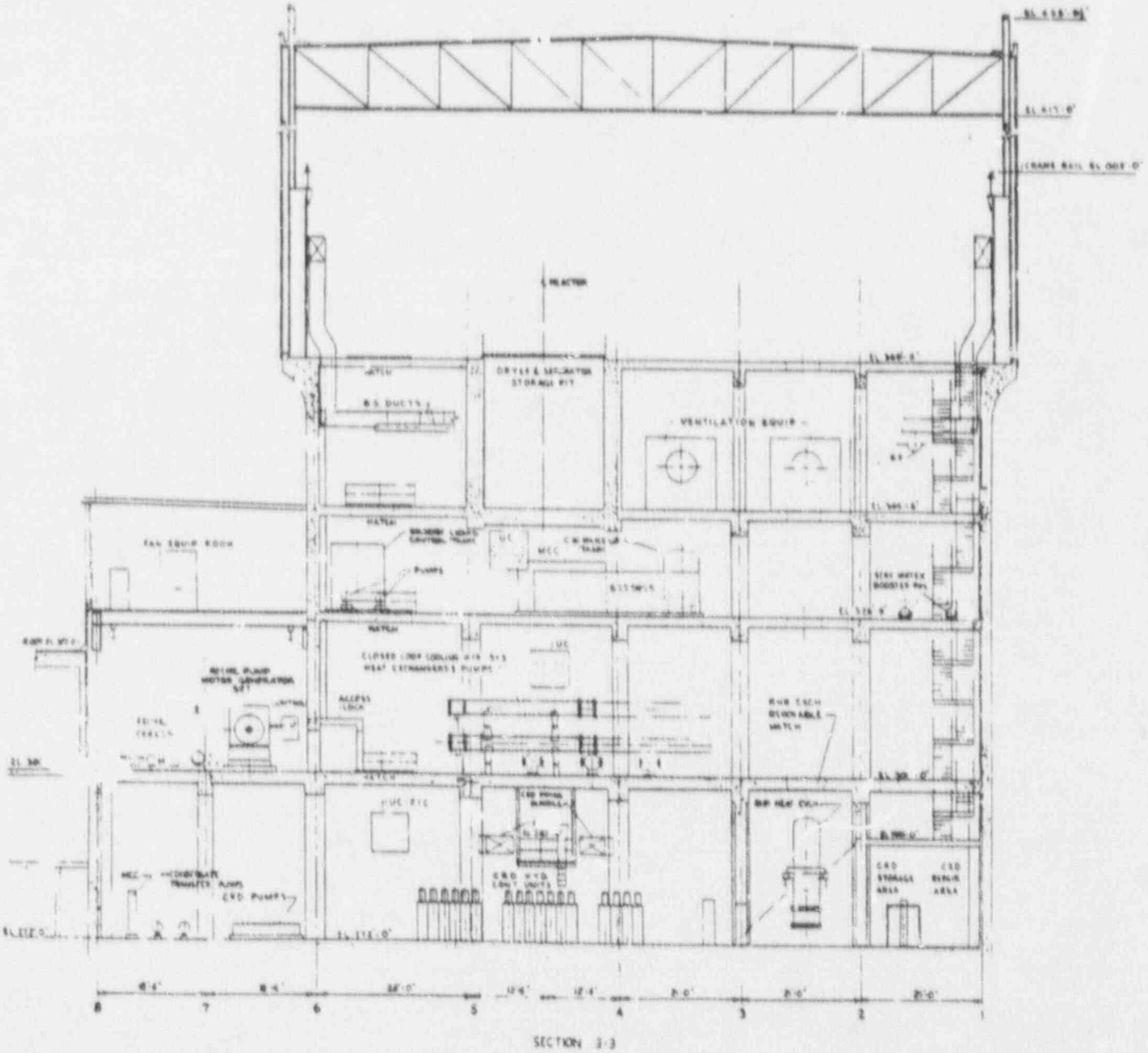


Figure 4-3. Fitzpatrick Reactor Building Elevation Views
(page 3 of 5)

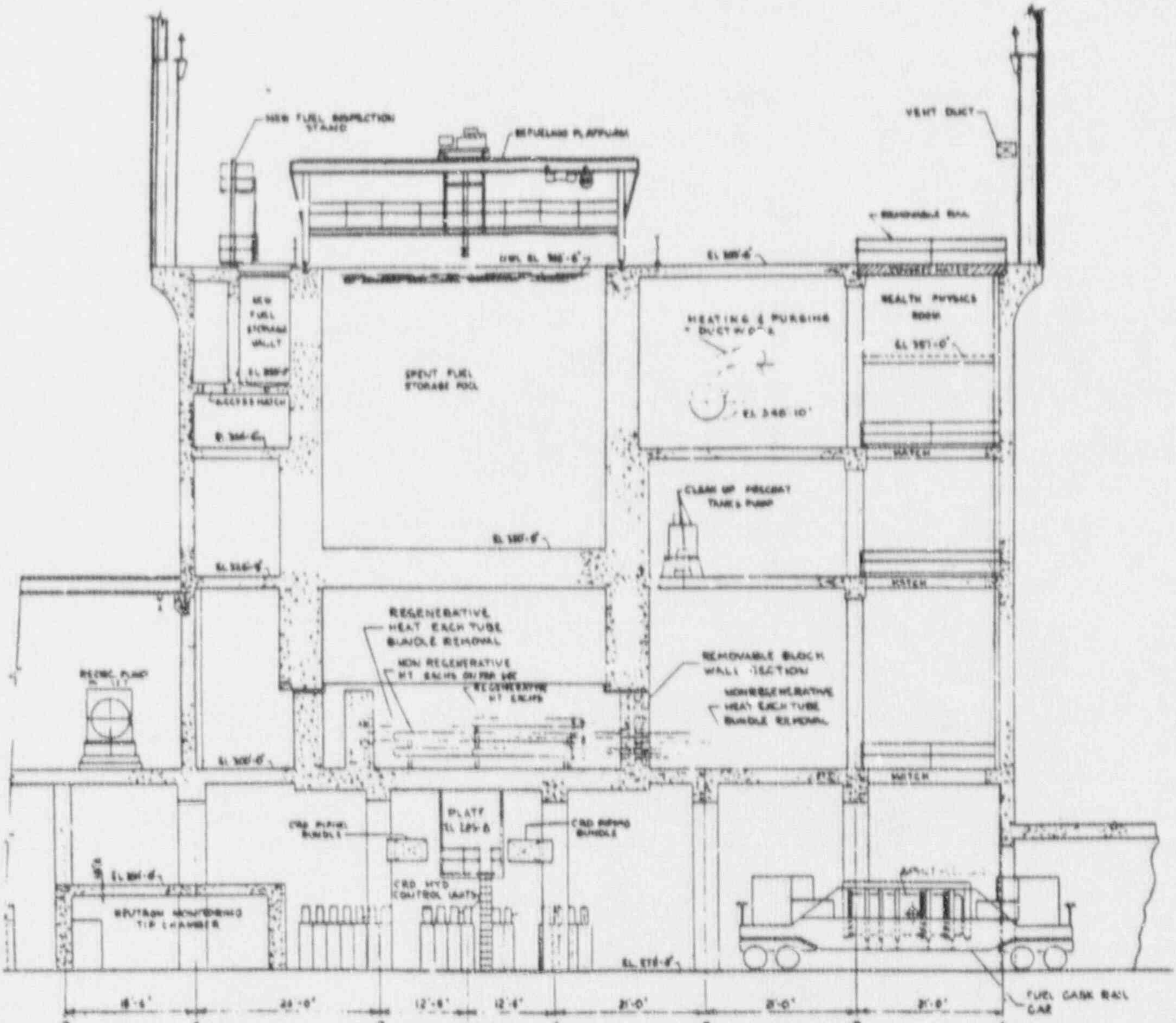


Figure 4-3. Fitzpatrick Reactor Building Elevation Views (page 4 of 5)

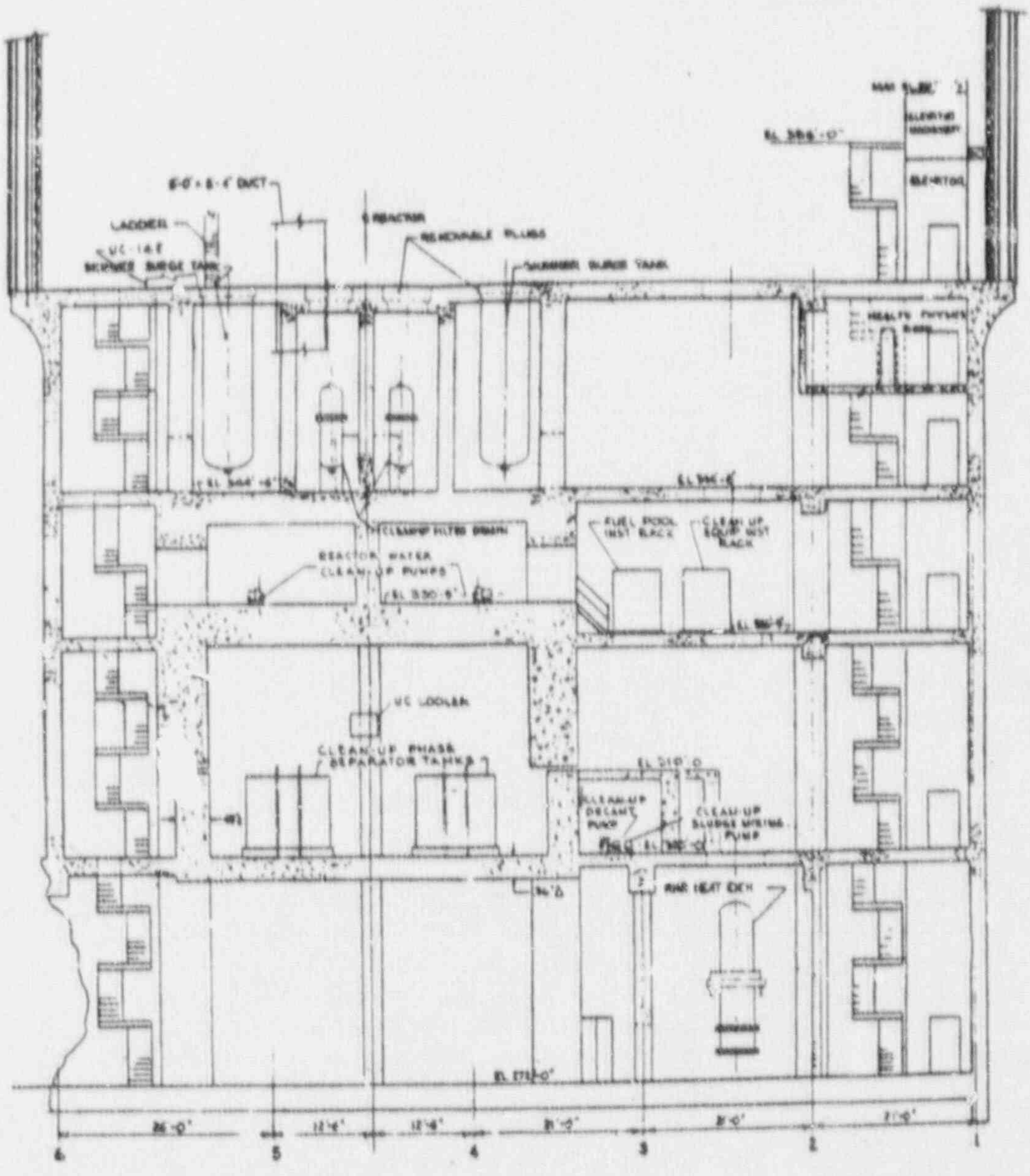


Figure 4-3. Fitzpatrick Reactor Building Elevation Views
(page 5 of 5)

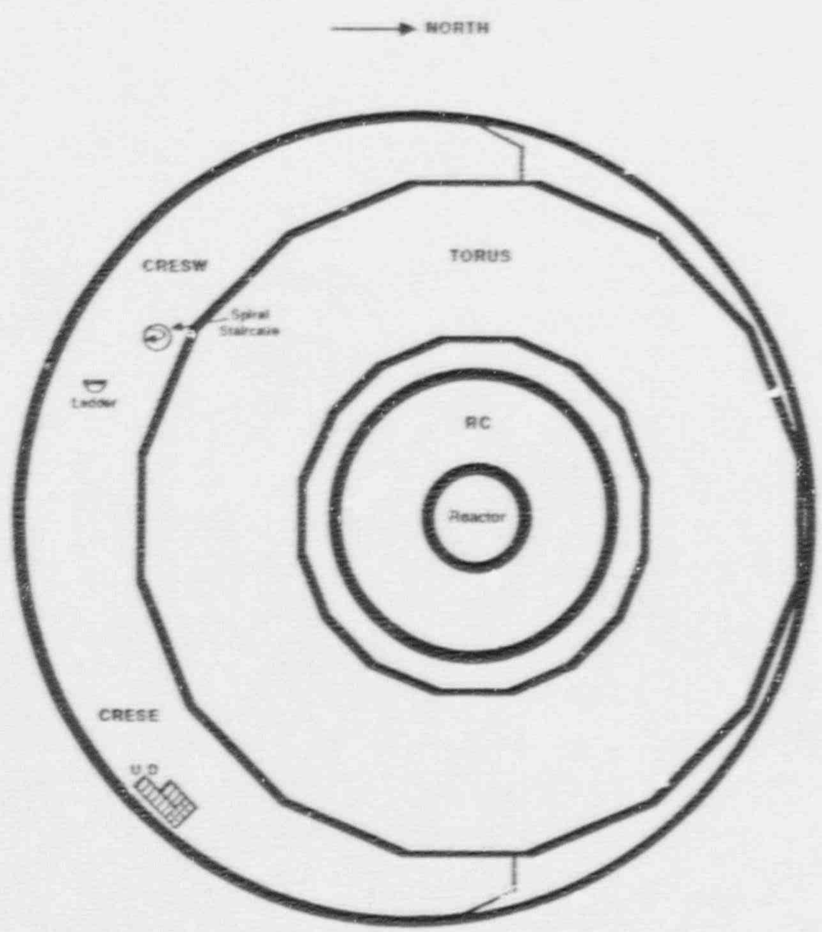


Figure 4-4. Reactor Building, Elevation 227'6"

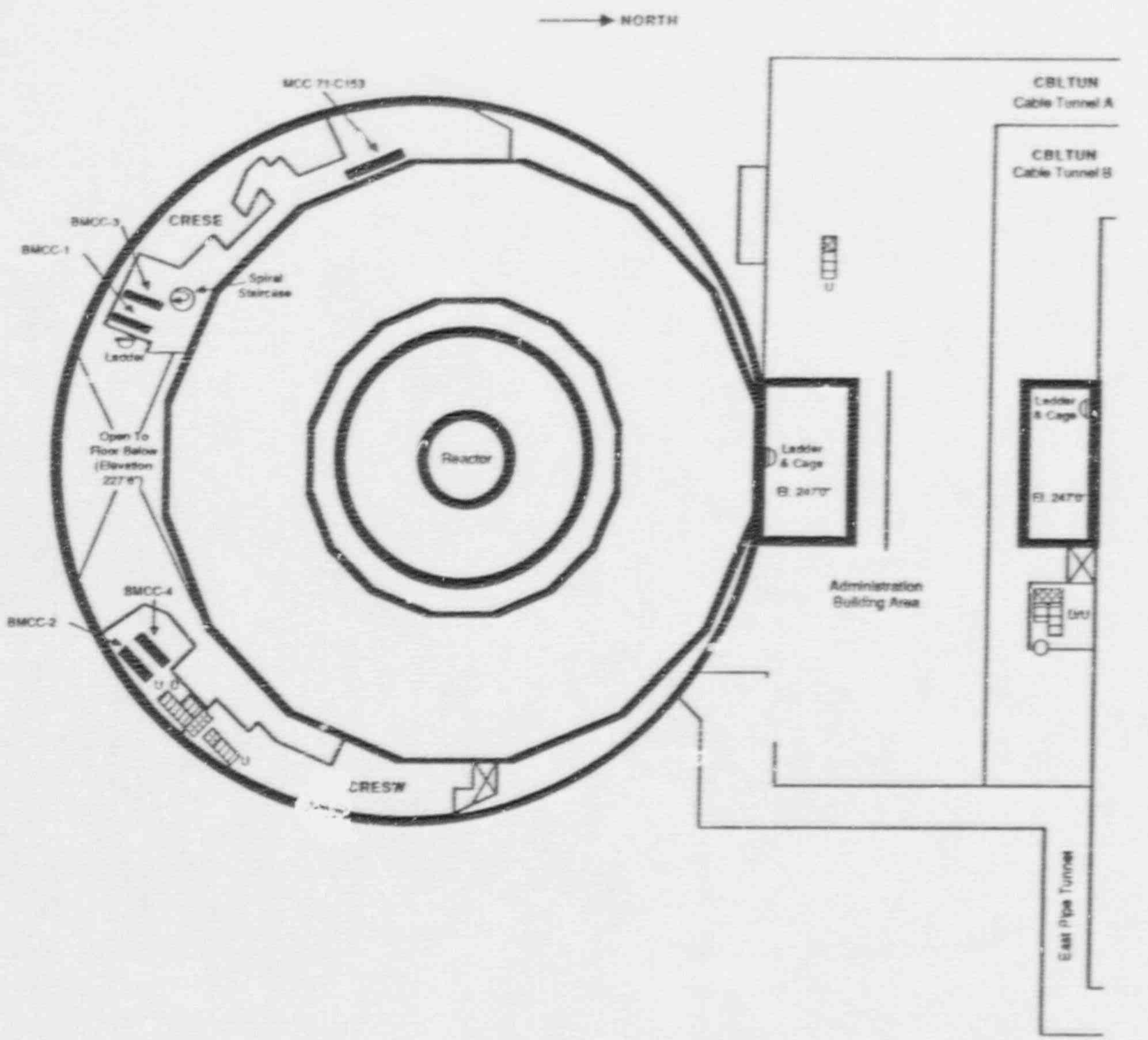


Figure 4-5. Reactor Building, Elevation 242'6", and Administration Building, Elevation 260'0"

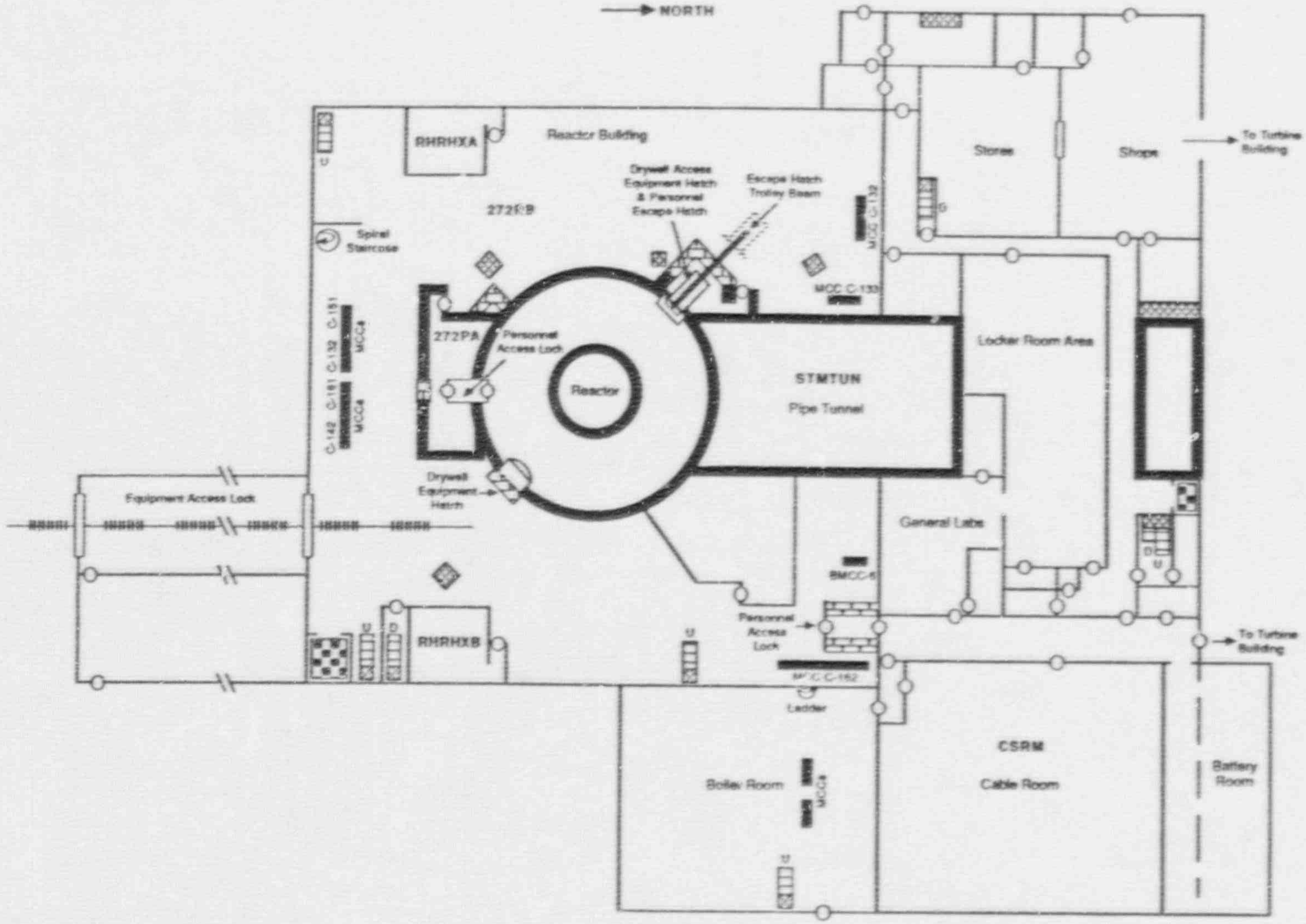


Figure 4-6. Reactor and Administration Buildings, Elevation 272'0"

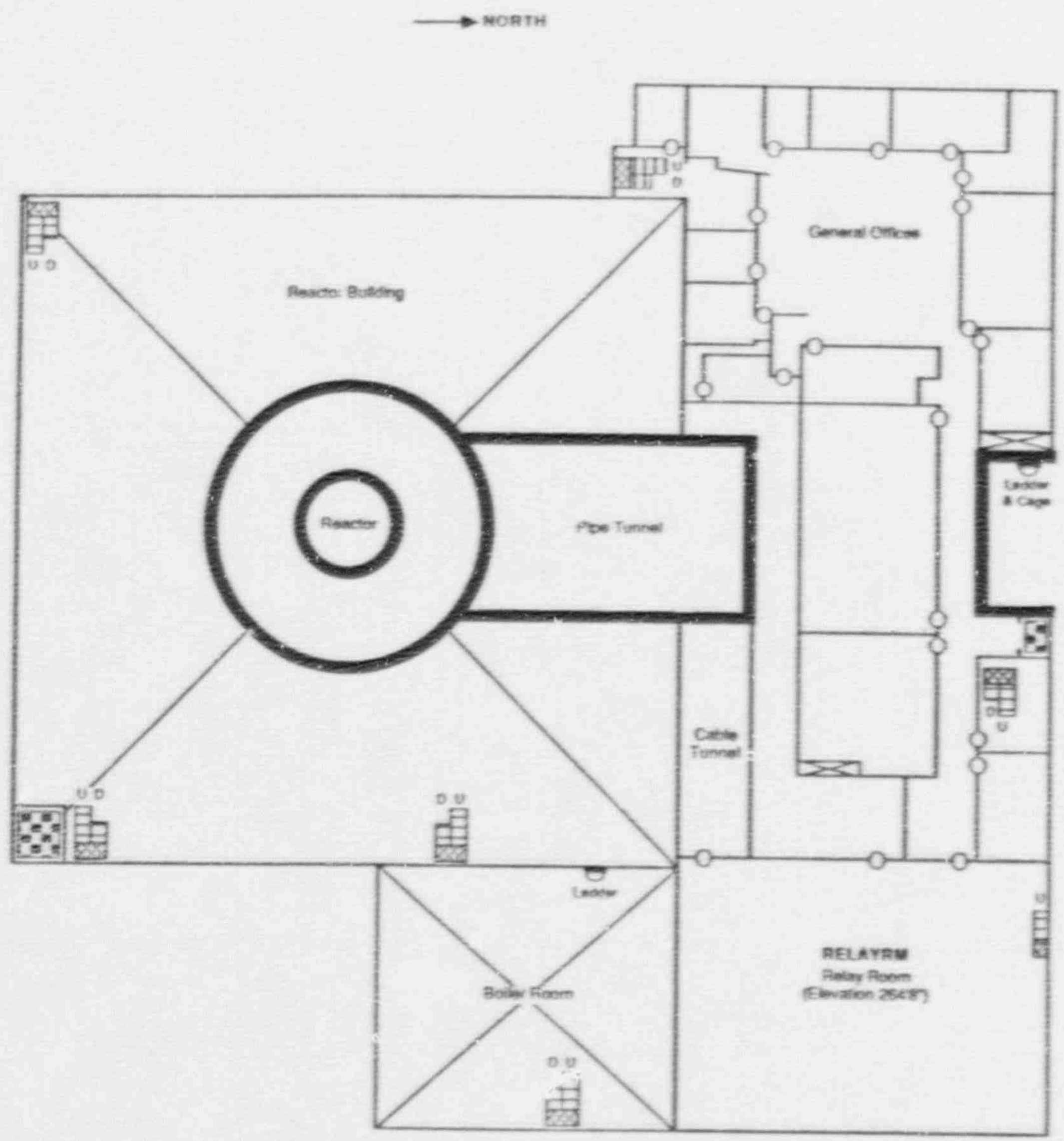


Figure 4-7. Reactor and Administration Buildings, Elevation 286'0"

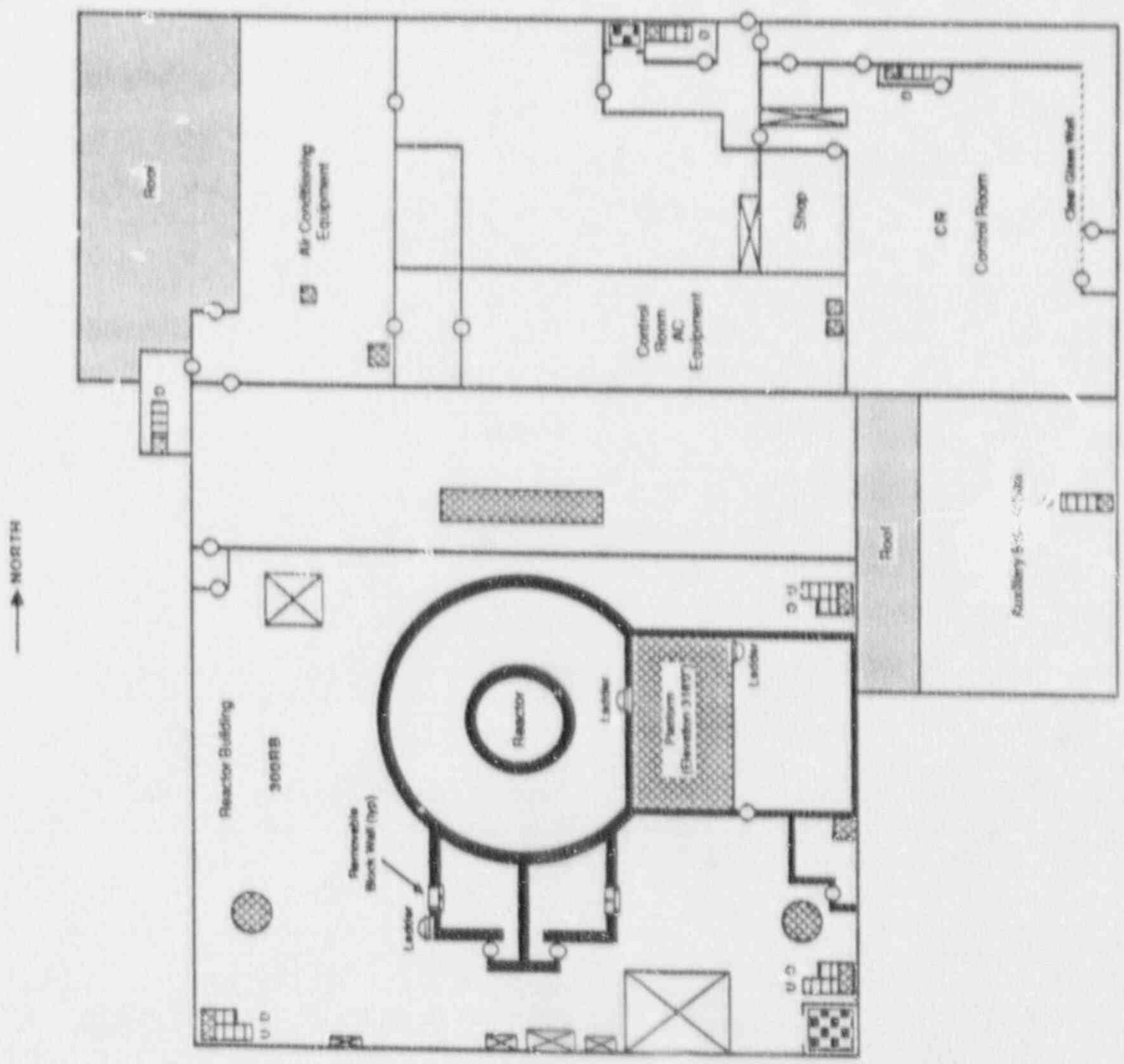


Figure 4-8. Reactor and Administration Buildings, Elevation 300'0"

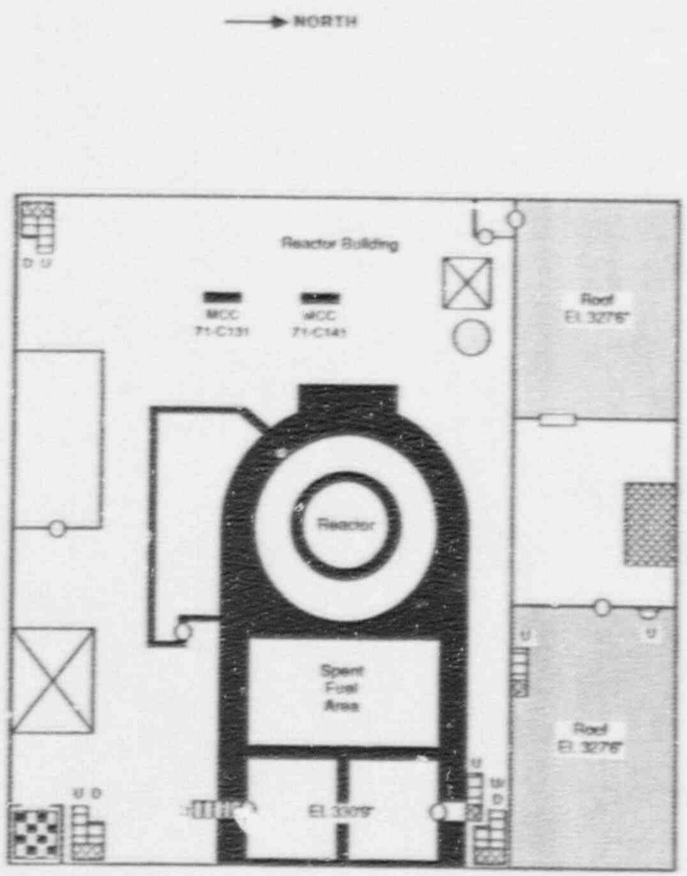


Figure 4-9. Reactor and Adm.nistration Buildings, Elevation 326'9"

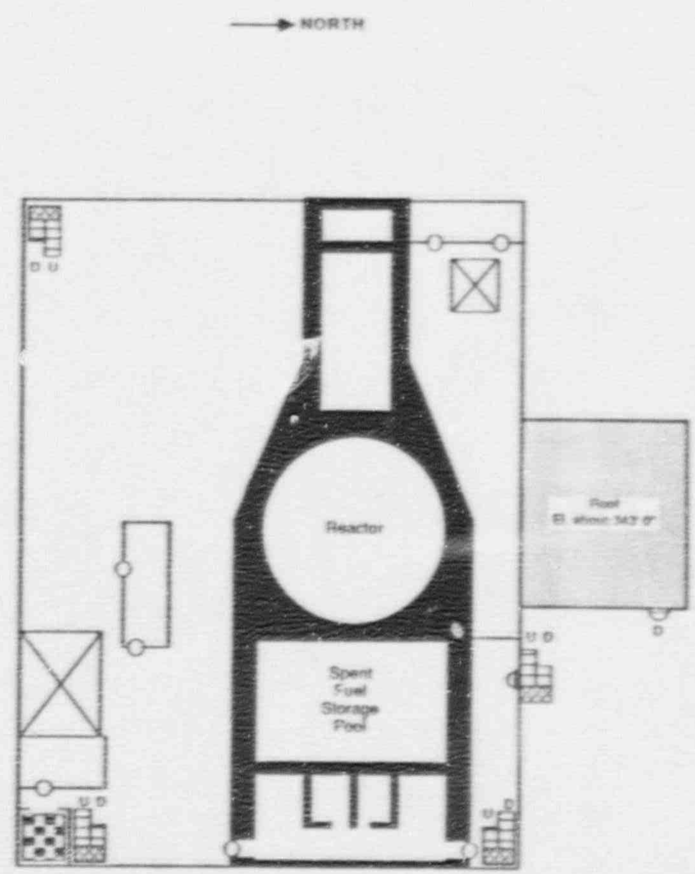


Figure 4-1[illegible] Reactor Building, Elevation 344'6"

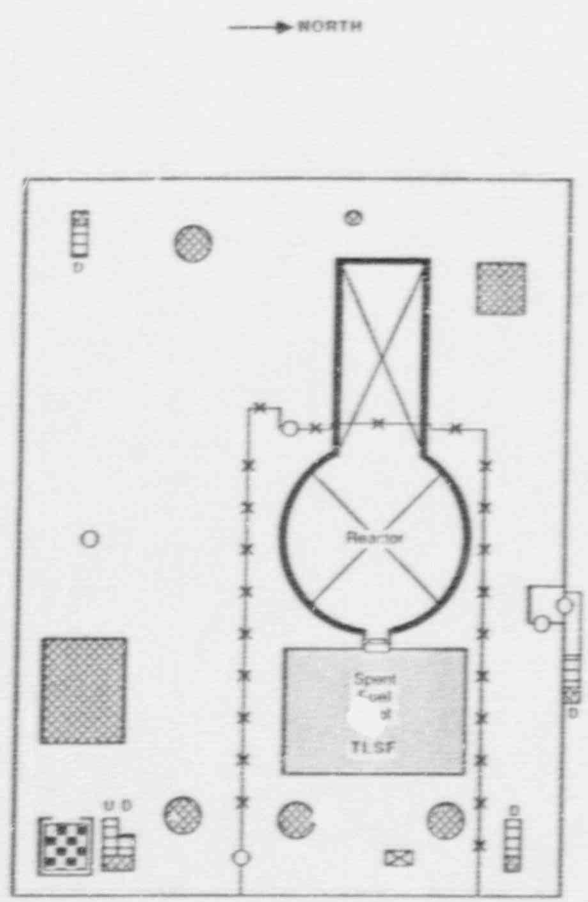


Figure 4-11. Reactor Building, Elevation 369'6"

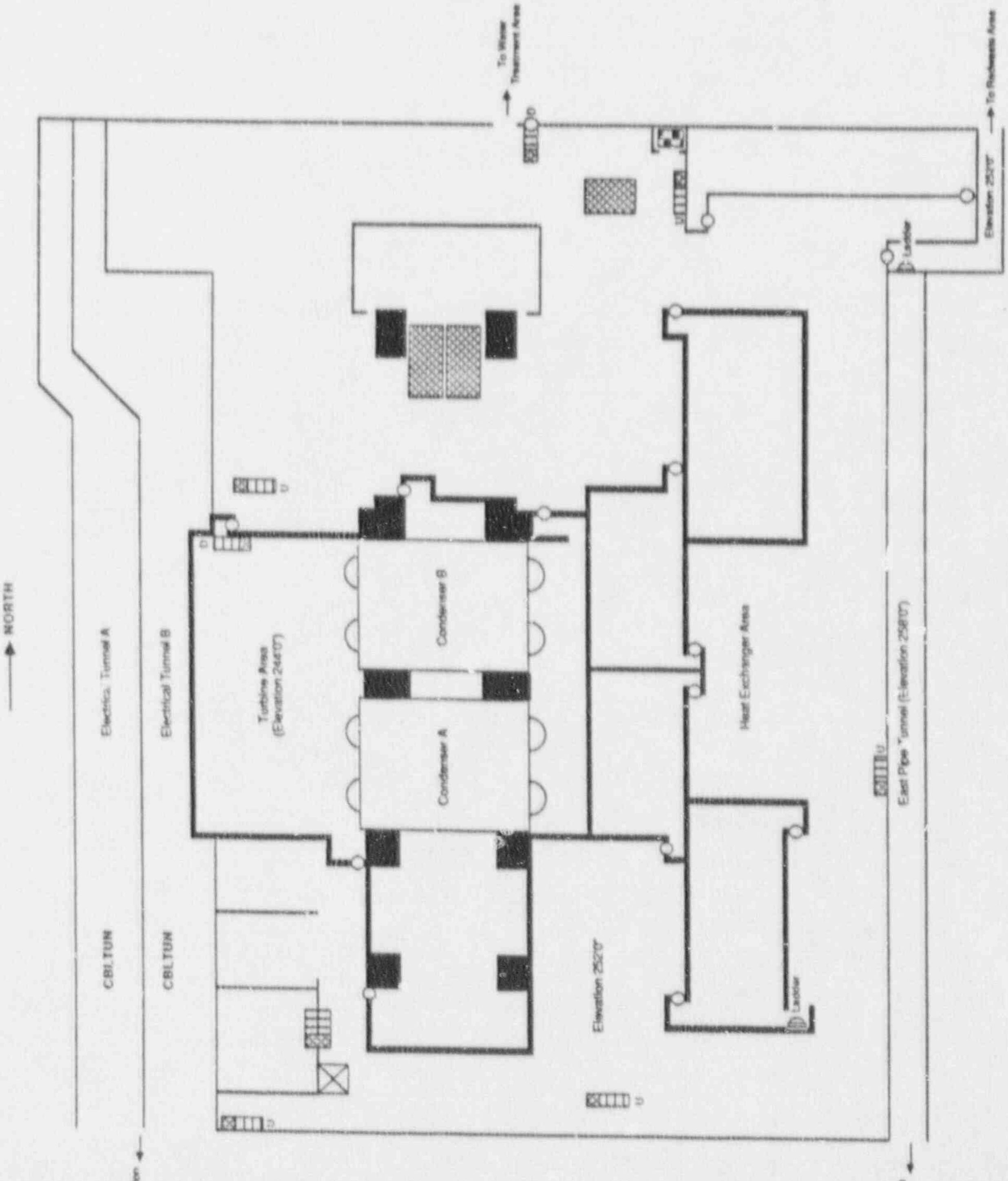


Figure 4-12. Turbine Building, Elevation 244'0" to 258'0"

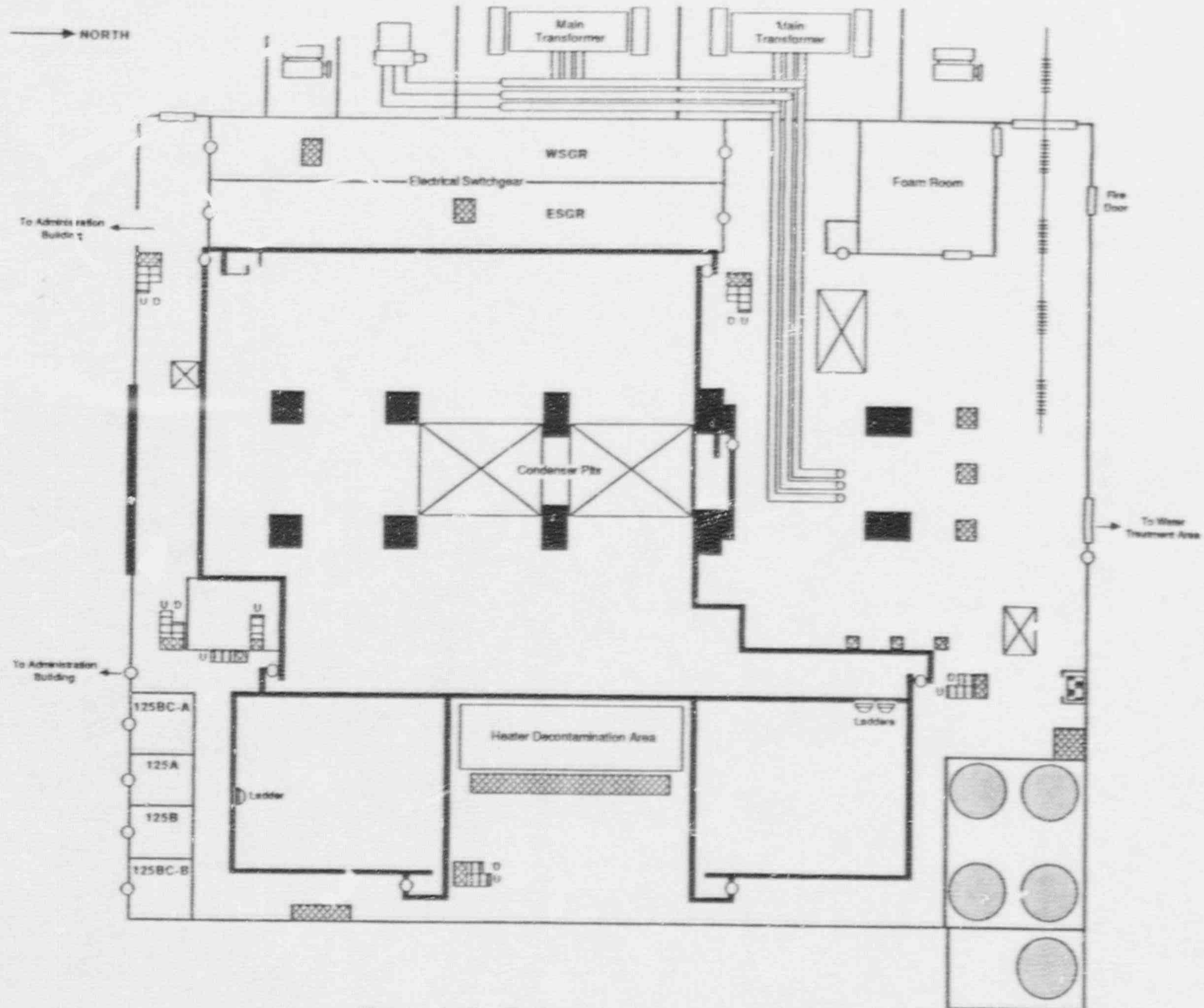


Figure 4-13. Turbine Building, Elevation 272'0"

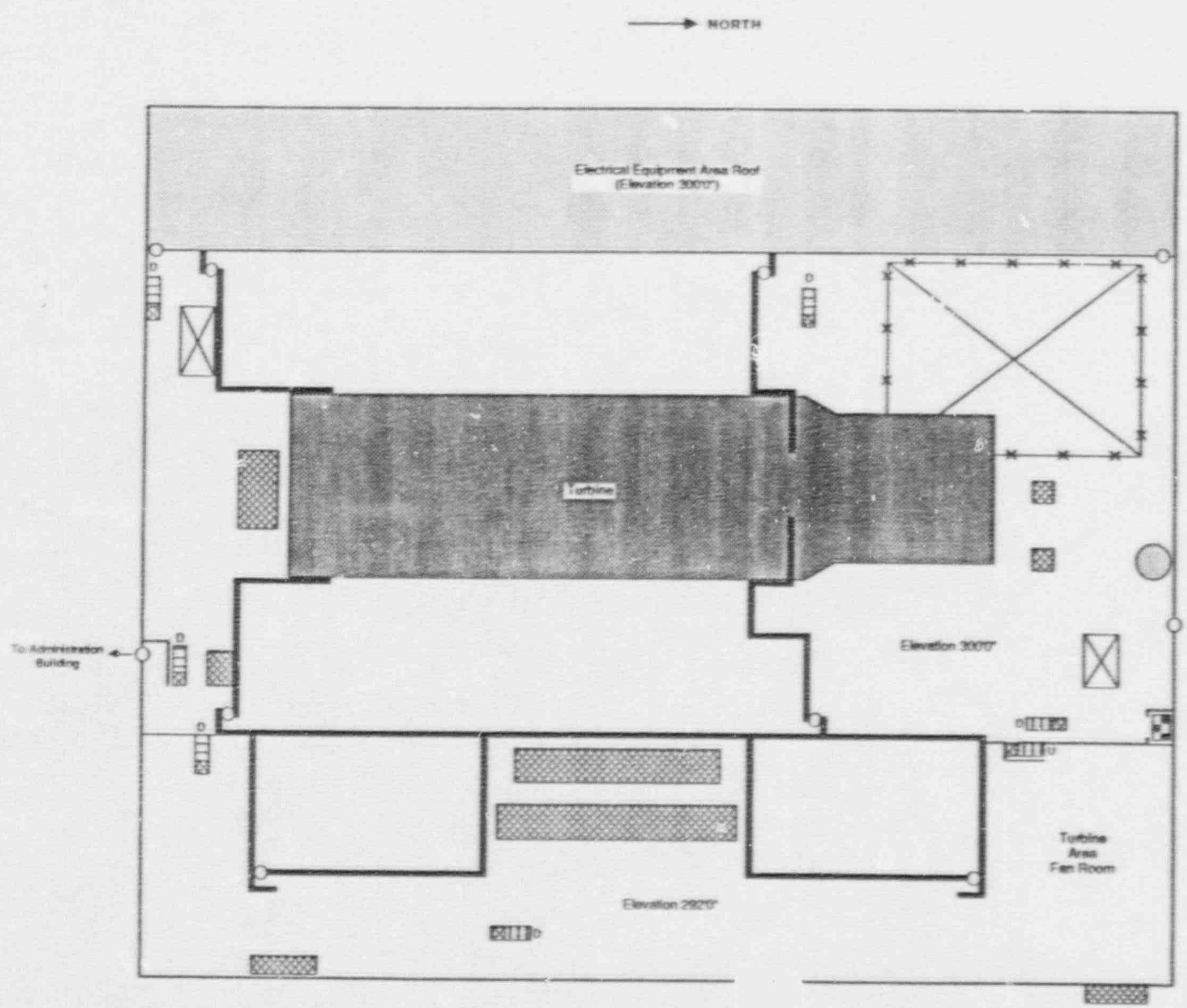


Figure 4-14. Turbine Building, Elevation 300'0"

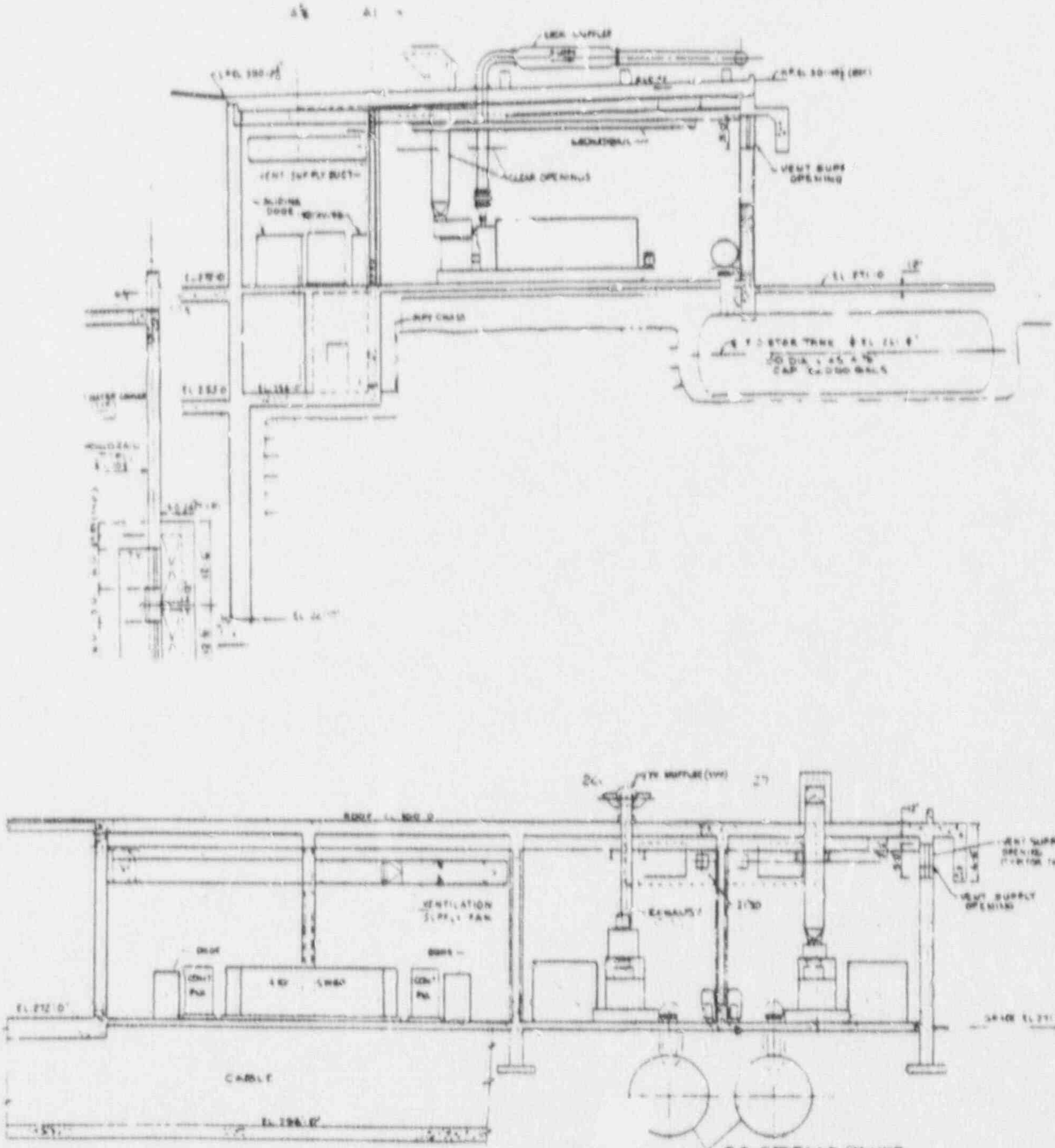
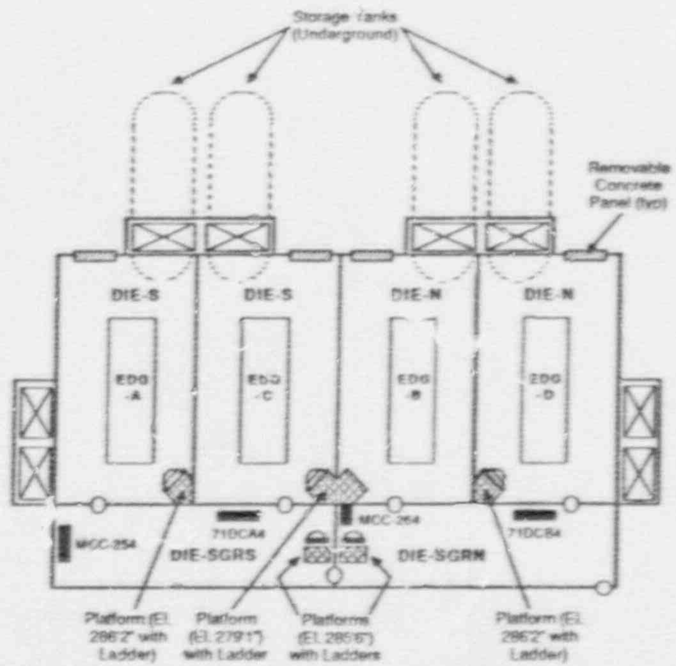
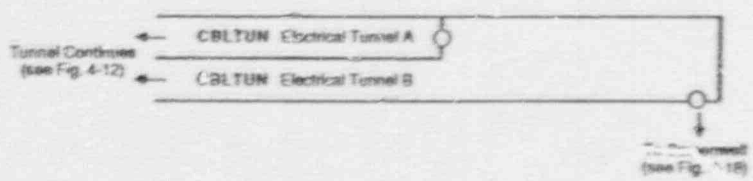


Figure 4-15. Fitzpatrick Diesel Generator Building, Elevation Views



Elevation 272'0"



Elevation 256'0"

Figure 4-16. Diesel Generator Building, Elevations 256'0" and 272'0"

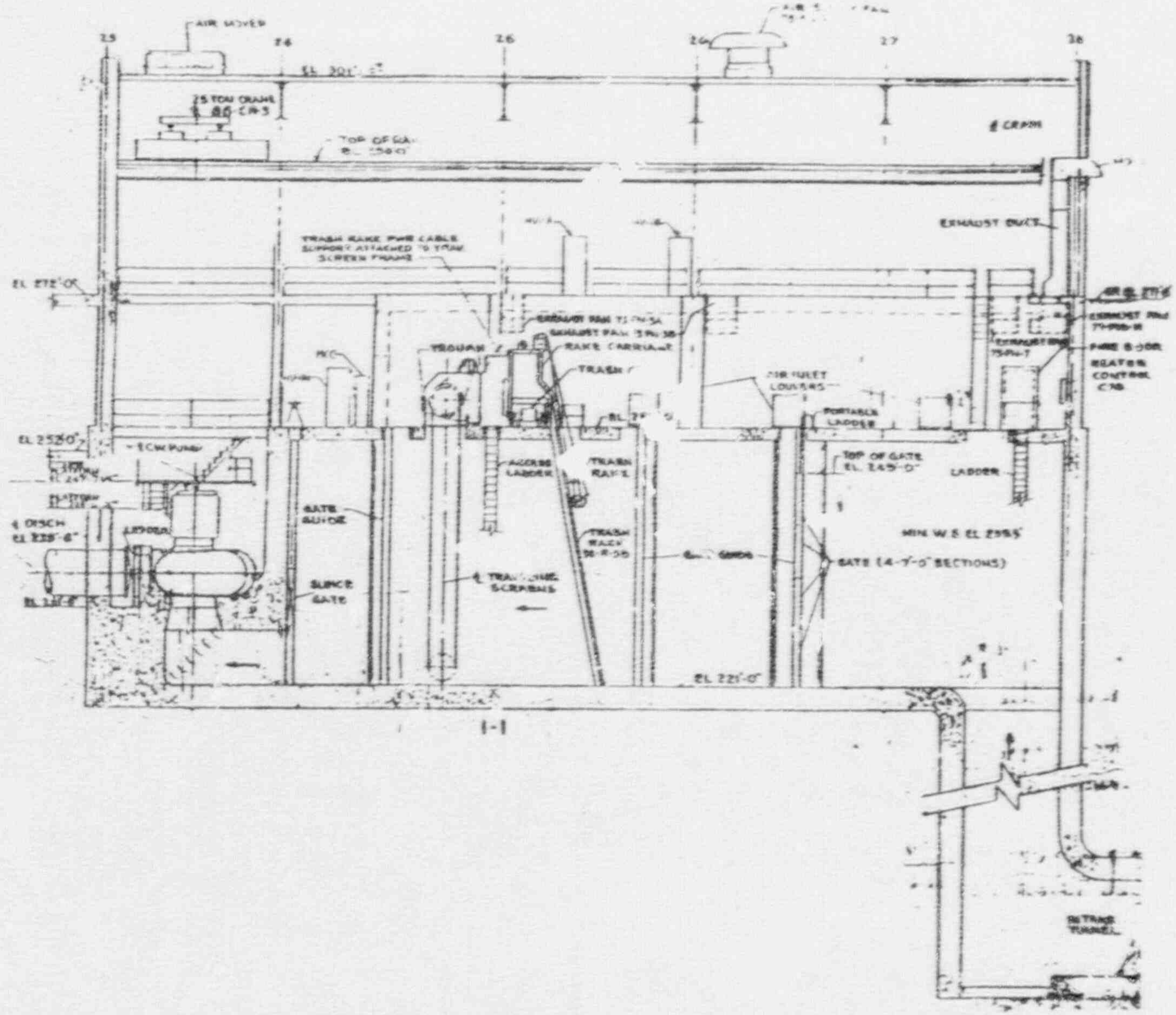


Figure 4-17. Fitzpatrick Screenwell and Water Treatment Building, Elevation View

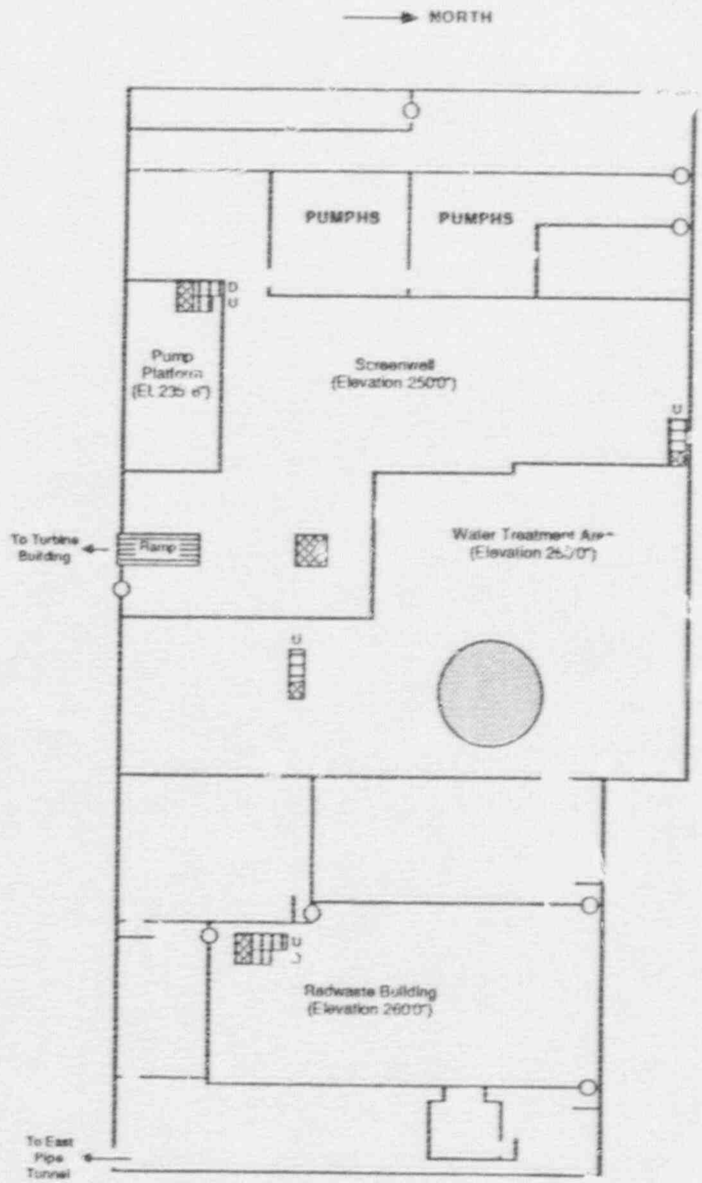


Figure 4-18. Screenwell and Water Treatment Building, Elevations 235'6" and 260'0", and Radwaste Building, Elevation 250'0"

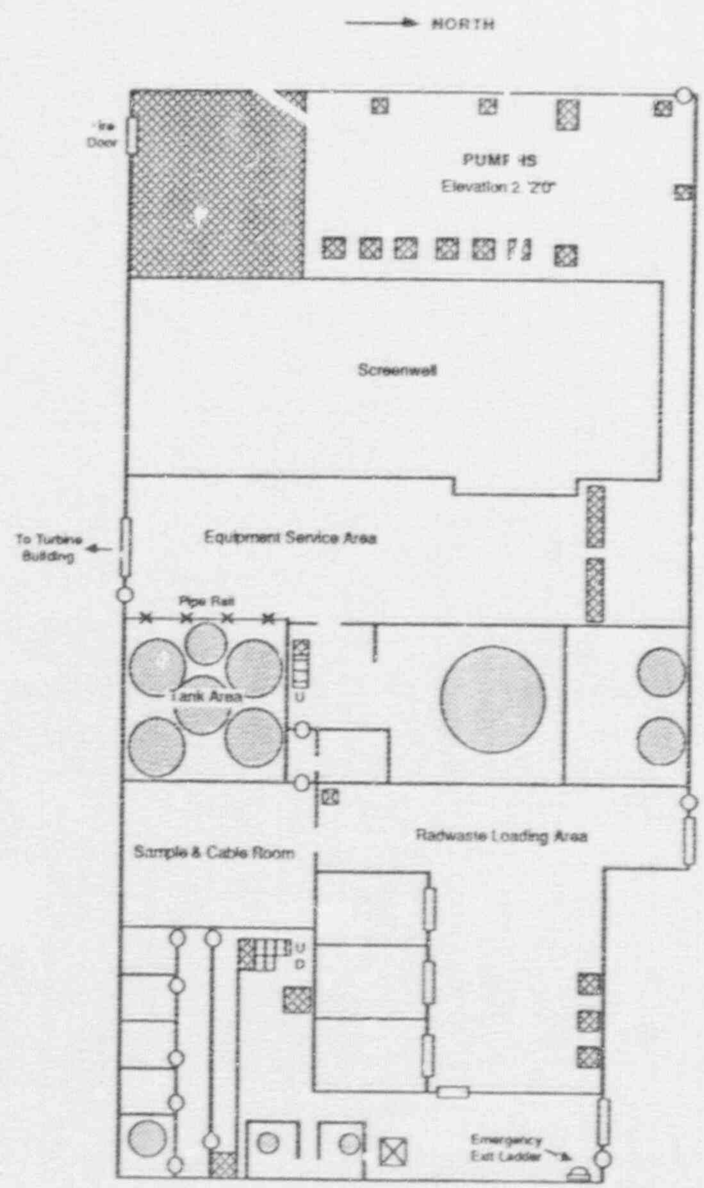


Figure 4-19. Screenwell, Water Treatment, and Radwaste Buildings, Elevation 272'0"

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

	Codes	Descriptions
1.	125A	125 V Battery Room A, located on the 272' elevation of the Turbine Area.
2.	125B	125 V Battery Room B, located on the 272' elevation of the Turbine Area.
3.	125BC-A	125 V Battery Control Board A, located on the 272' elevation of the Turbine Area.
4.	125BC-B	125 V Battery Control Board B, located on the 272' elevation of the Turbine Area.
5.	272PA	272 Personnel Access, located on the 272' elevation of the Reactor Building.
6.	272RB	272' elevation of the Reactor Building.
7.	300RB	300' elevation of the Reactor Building.
8.	CBLTUN	Cable Tunnel, located on the 256' elevation of the Emergency Diesel Generator Building.
9.	CRESE	Crescent Room East, located on the 227'-6" elevation of the Reactor Building.
10.	CRESW	Crescent Room West, located on the 227'-6" elevation of the Reactor Building.
11.	CSRM	Cable Spreading Room, located on the 272' elevation - just below the Control Room.
12.	CR	Control Room, located on the 300' elevation of the Control Building.
13.	CST	Condensate Storage Tank
14.	DIE-N	Diesel Generator Room-North, located in the Emergency Generator Building and houses Diesel Generators B and D.
15.	DIE-S	Diesel Generator Room-South, located in the Emergency Generator Building and houses Diesel Generators A and C.
16.	DIE-SGRN	Diesel Switchgear Room North, located in Emergency Generator Building - houses 4160 V switchgear HO6.
17.	DIE-SGRS	Diesel Switchgear Room South, located in Emergency Generator Building - houses 4160 V switchgear H[illegible].

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

	Codes	Descriptions
18.	ESGR	East Switchgear Room, located on the 272' elevation of Turbine Building - houses the 600 V load center L-26.
19.	PUMPHS	Pump House, located on the Screenwe.. and Water Treating Area.
20.	RC	Reactor Containment.
21.	RELAYRM	Relay Room, located on the 272' elevation of the Control Building.
22.	RHRHXA	Residual Heat Exchanger A Room, located on the 272' elevation of the Reactor Building - west side.
23.	RHRHXB	Residual Heat Exchanger B Room, located on the 272' elevation of the Reactor Building - east side.
24.	RHRSWA	Located on the 260' elevation of the Administration Building and the 244' elevation of the Turbine Building.
25.	RHRSWB	Located on the 260' elevation of the Administration Building and the 244' elevation of the Turbine Building.
26.	STMTUN	Steam Tunnel, located on the 272' elevation of the Reactor Building.
27.	TLSF	Spent fuel pool operating floor, located on the 368' elevation of the Reactor Building.
28.	TORUS	Suppression Chamber, located below the 264' elevation of the Reactor Building.
29.	WSGR	West Switchgear Room, located on the 272' elevation of the Turbine Building - houses the 600 V load center L-25.

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
125A	EP	BATA	BATT
125B	EP	BATB	BATT
125BC-A	EP	BUS 2A	PNL
125BC-A	EP	BCA	BC
125BC-A	EP	BUS 2A	PNL
125BC-B	EP	BUS 2B	PNL
125BC-B	EP	[illegible]	BC
125BC-B	EP	BUS 2B	PNL
272PA	ECCS	HPCI23-16	MOV
272PA	ECCS	RH10-27A	MOV
272PA	ECCS	RH10-25A	MOV
272PA	ECCS	RH10-27B	MOV
272PA	ECCS	RH10-25B	MOV
[illegible]	RCIC	RCIC13-16	MOV
[illegible]	RCS	HPCI23-16	MOV
[illegible]	RCS	RCIC13-16	MOV
[illegible]	[illegible]	MCC 151	BUS
[illegible]	[illegible]	[illegible] 152	BUS
[illegible]	[illegible]	[illegible] 161	BUS
[illegible]	[illegible]	[illegible]C 162	BUS
[illegible]	[illegible]	BMCC[illegible]	PNL
[illegible]	[illegible]	ESWI5-175A	MOV
[illegible]	[illegible]S	ESWI5-175B	MOV
[illegible]	RSWS	RSW10-148A	MOV
[illegible]	RSWS	RSW10-149A	MOV
[illegible]	RSWS	RSW10-148B	MOV
[illegible]	RSWS	RSW10-149B	MOV
[illegible]	ECCS	RH10-26A	MOV
[illegible]RB	ECCS	RH10-[illegible]1A	MOV
[illegible]00RB	ECCS	RH10-26B	MOV

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

	Codes	Descriptions
18.	ESGR	East Switchgear Room, located on the 272' elevation of Turbine Building - houses the 600 V load center L-26.
19.	PUMPHS	Pump House, located on the Screenwell and Water Treating Area.
20.	RC	Reactor Containment.
21.	RELAYRM	Relay Room, located on the 272' elevation of the Control Building.
22.	RHRHXA	Residual Heat Exchanger A Room, located on the 272' elevation of the Reactor Building - west side.
23.	RHRHXB	Residual Heat Exchanger B Room, located on the 272' elevation of the Reactor Building - east side.
24.	RHRSWA	Located on the 260' elevation of the Administration Building and the 244' elevation of the Turbine Building.
25.	RHRSWB	Located on the 260' elevation of the Administration Building and the 244' elevation of the Turbine Building.
26.	STMTUN	Steam Tunnel, located on the 272' elevation of the Reactor Building.
27.	TLSF	Spent fuel pool operating floor, located on the 368' elevation of the Reactor Building.
28.	TORUS	Suppression Chamber, located below the 264' elevation of the Reactor Building.
29.	WSGR	West Switchgear Room, located on the 272' elevation of the Turbine Building - houses the 600 V load center L-25.

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
125A	EP	BATA	BATT
125B	EP	BATB	BATT
125BC-A	EP	BUS 2A	PNL
125BC-A	EP	BCA	BC
125BC-A	EP	BUS 2A	PNL
125BC-B	EP	BUS 2B	PNL
125BC-B	EP	BCB	BC
125BC-B	EP	BUS 2B	PNL
272PA	ECCS	HPCI23-16	MOV
272PA	ECCS	RH10-27A	MOV
272PA	ECCS	RH10-25A	MOV
272PA	ECCS	RH10-27B	MOV
272PA	ECCS	RH10-25B	MOV
272PA	RCIC	RCIC13-16	MOV
272PA	RCS	HPCI23-16	MOV
272PA	RCS	RCIC13-16	MOV
272RB	EP	MCC 151	BUS
272RB	EP	MCC 152	BUS
272RB	EP	MCC 161	BUS
272RB	EP	MCC 162	BUS
272RB	EP	BMCC6	PNL
272RB	ESWS	ESWI5-175A	MOV
272RB	ESWS	ESWI5-175B	MOV
272RB	RSWS	RSW10-148A	MOV
272RB	RSWS	RSW10-149A	MOV
272RB	RSWS	RSW10-148B	MOV
272RB	RSWS	RSW10-149B	MOV
300RB	ECCS	RH10-26A	MOV
300RB	ECCS	RH10-31A	MOV
300RB	ECCS	RH10-26B	MOV

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
300RB	ECCS	RH10-31[illegible]	MOV
300RB	ECCS	CSS14-11A	MOV
300RB	ECCS	CSS14-12[illegible]	MOV
300RB	ECCS	CSS14-11B	MOV
300RB	ECCS	CSS14-12B	MOV
300RB	ECCS	RH10-26A	MOV
300RB	ECCS	RH10-31A	MOV
300RB	ECCS	RH10-26B	MOV
300RB	ECCS	RH10-31B	MOV
300RB	EP	BUS 115	BUS
300RB	EP	T13	TRAN
300RB	EP	BUS 116	BUS
300RB	EP	T14	TRAN
CBLTUN	ESWS	ESW46-101A	MOV
CBLTUN	ESWS	ESW46-101B	MOV
CBLTUN	ESWS	ESW46-101A	MOV
CBLTUN	ESWS	ESW46-101B	MOV
CRESE	ECCS	HPCI23-17	MOV
CRESE	ECCS	HPCI23-30	MOV
CRESE	ECCS	HPCI23-19	MOV
CRESE	ECCS	HPCI23-21	MOV
CRESE	ECCS	HPCI23-57	MOV
CRESE	ECCS	CONTROL VALVE	HV
CRESE	ECCS	STOP VALVE	HV
CRESE	ECCS	HPCI23-14	MOV
CRESE	ECCS	RH10-13B	MOV
CRESE	ECCS	RH10-66B	MOV
CRESE	ECCS	RH10-[illegible]3B	MOV
CRESE	ECCS	RH10-12B	MOV
CRESE	ECCS	RH10-34B	MOV

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
CRESE	ECCS	RH10-39B	MOV
CRESE	ECCS	RH-PMD	MDP
CRESE	ECCS	RH-PMB	MDP
CRESE	ECCS	CSS14-26B	MOV
CRESE	ECCS	CSS-PMB	MDP
CRESE	ECCS	RH10-38B	MOV
CRESE	ECCS	RH10-36B	MOV
CRESE	ECCS	RH10-13D	MOV
CRESE	ECCS	RH10-66B	MOV
CRESE	ECCS	RH10-39B	MOV
CRESE	ECCS	RH10-38B	MOV
CRESE	ECCS	RH10-34B	MOV
CRESE	EP	MCC 163	BUS
CRESE	EP	BMCC2	PNL
CRESE	EP	BMCC4	PNL
CRESE	ESWS	RH-PMBD	MDP
CRESW	ECCS	RH10-13C	MOV
CRESW	ECCS	RH10-13A	MOV
CRESW	ECCS	RH10-66A	MOV
CRESW	ECCS	RH10-65A	MOV
CRESW	ECCS	RH10-12A	MOV
CRESW	ECCS	RH10-39A	MOV
CRESW	ECCS	RH10-34A	MOV
CRESW	ECCS	RH-PMC	MDP
CRESW	ECCS	RH-PMA	MDP
CRESW	ECCS	CSS14-26A	MOV
CRESW	ECCS	CSS-PMA	MDP
CRESW	ECCS	RH10-38A	MOV
CRESW	ECCS	RH10-36A	MOV
CRESW	ECCS	HPCI23-24	MOV

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
CRESW	ECCS	RH10-66A	MOV
CRESW	ECCS	RH10-39A	MOV
CRESW	ECCS	RH10-38A	MOV
CRESW	ECCS	RH10-34A	MOV
CRESW	EP	MCC 153	BUS
CRESW	EP	BMCC1	PNL
CRESW	EP	BMCC3	PNL
CRESW	ESWS	RH-PMAC	MDP
CRESW	RCIC	RCIC13-18	MOV
CRESW	RCIC	RCIC13-20	MOV
CRESW	RCIC	RCIC13-30	MOV
CRESW	RCIC	RCIC23-24	MOV
CRESW	RCIC	RCIC13-21	MOV
CRESW	RCIC	RCIC13-39	MOV
CRESW	RCIC	RCIC-P1R	TDP
CRESW	RCIC	RCICH01302	HV
CRESW	RCIC	RCIC13 131	MOV
CRESW	RCIC	RCICH01301	MOV
CRESW	RCIC	RCIC13-132	MOV
CST	ECCS	CST	TK
CST	RCIC	CST	TK
DIE-N	EP	DG-BD	DG
DIE-N	ESWS	DG-BD	DG
DIE-S	EP	DG-AC	DG
DIE-S	ESWS	DG-AC	DG
DIE-SGRN	EP	BUS 106	BUS
DIE-SGRN	EP	CBB, CBD	CB
DIE-SGRN	EP	71DCB4	PNL
DIE-SGRS	EP	BUS 105	BUS
DIE-SGRS	EP	CBA, CBC	CB

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
DIE-SGRS	EP	71DCA4	PNL
ESGR	EP	BUS 126	BUS
ESGR	EP	T16	TRAN
ESGR	EP	MCC 262	BUS
PUMPHS	ESWS	ESW-P2A	MDP
PUMPHS	ESWS	ESW-P2B	MDP
PUMPHS	RSWS	RSW-P1A	MDP
PUMPHS	RSWS	RSW-P1C	MDP
PUMPHS	RSWS	RSW-P1B	MDP
PUMPHS	RSWS	RSW-P1D	MDP
RC	ECCS	RCS-VESSEL	RV
RC	ECCS	HPCI23-15	MOV
RC	ECCS	RCS-VESSEL	RV
RC	ECCS	RCS-VESSEL	RV
RC	ECCS	RCS-VESSEL	RV
RC	ECCS	RCS-VESSEL	RV
RC	RCIC	RCS-VESSEL	RV
RC	RCIC	RCIC13-15	MOV
RC	RCS	RCS12-15	MOV
RC	RCS	RH10-18	MOV
RC	RCS	RCS29-74	MOV
RC	RCS	HPCI23-15	MOV
RC	RCS	RCIC13-15	MOV
RHRHXA	ECCS	RH10-70A	MOV
RHRHXA	ECCS	RH-HXA	HX
RHRHXA	RSWS	RSW10-89A	MOV
RHRHXB	ECCS	RH10-70B	MOV
RHRHXB	ECCS	RH-HXB	HX
RHRHXB	RSWS	RSW10-89B	MOV
TORUS	ECCS	HPCI23-58	MOV

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
TORUS	ECCS	SUP. POOL	TK
TORUS	ECCS	CSS14-07A	MOV
TORUS	ECCS	CSS14-07B	MOV
TORUS	RCIC	SUP. POOL	TK
TORUS	RCIC	RCIC13-41	MOV
TORUS	RCIC	RCIC13-27	MOV
TORUS	RCS	RH10-17	MOV
WSGR	EP	BUS 125	BUS
WSGR	EP	T15	TRAN
WSGR	EP	MCC 252	BUS

5. BIBLIOGRAPHY FOR FITZPATRICK

No references identified.

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 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)

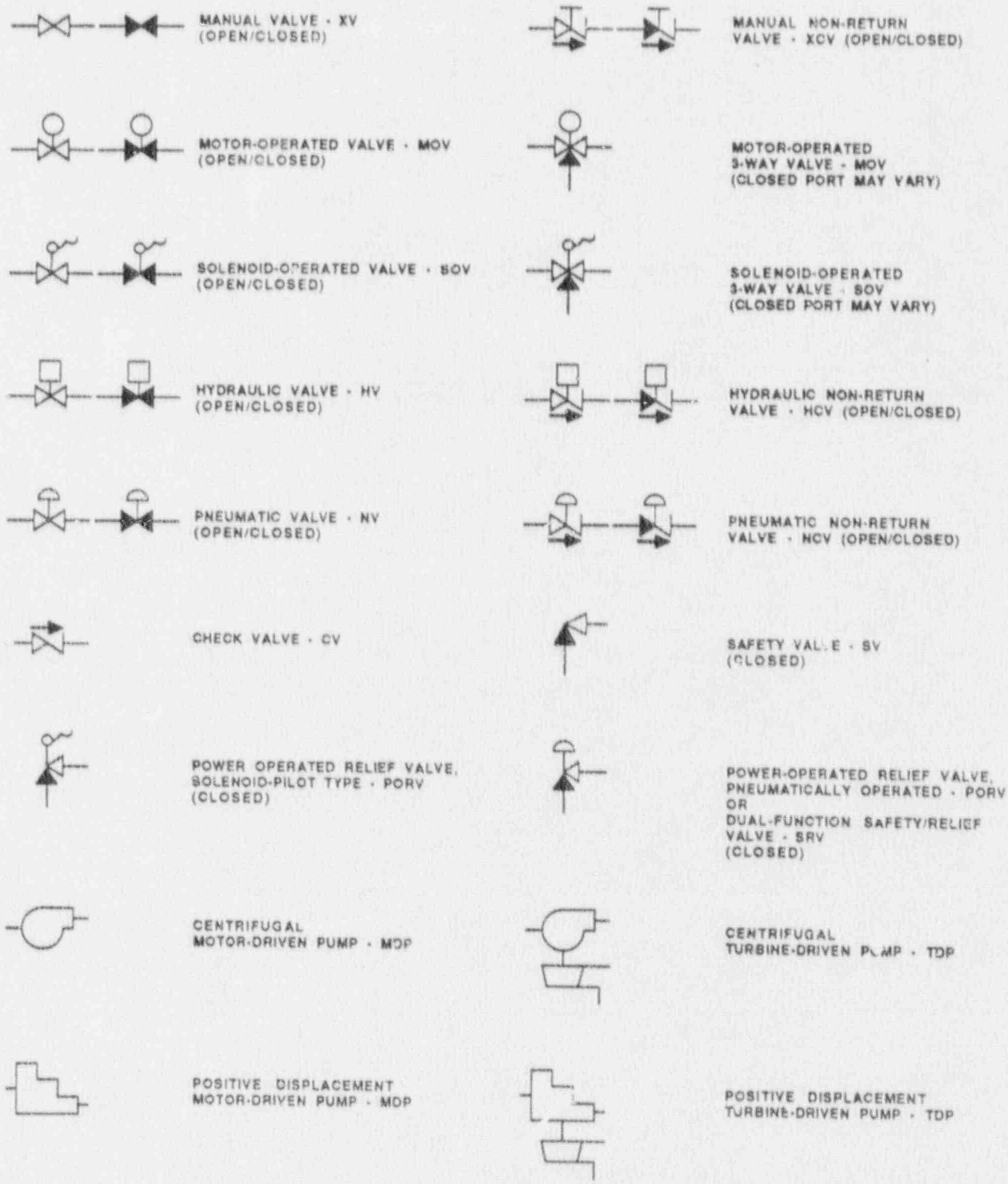


Figure A-1. Key To Symbols In Fluid System Drawings

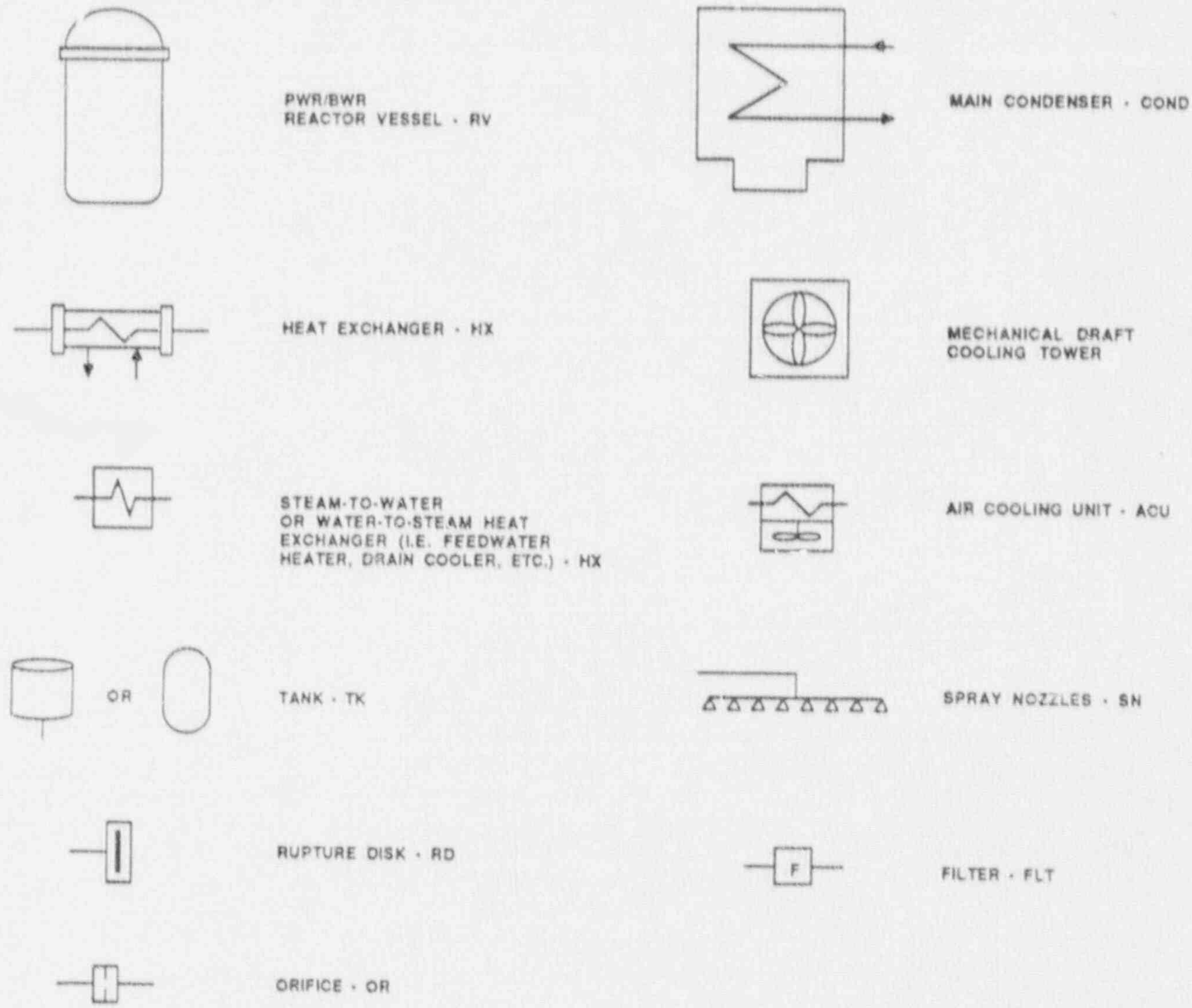


Figure A-1. Key To Symbols In Fluid System Drawings
(Continued)

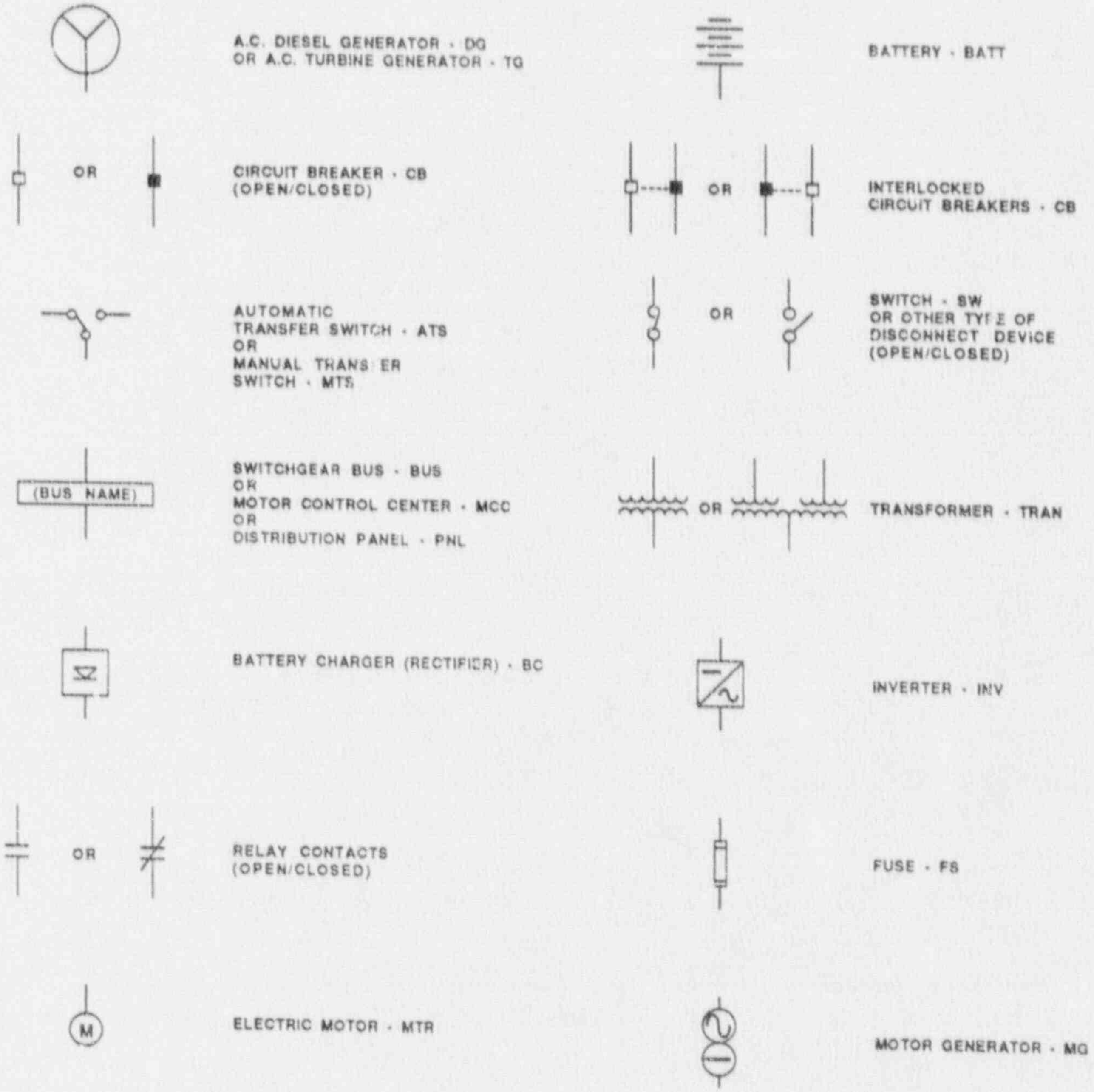


Figure A-2. Key To Symbols In Electrical System Drawings

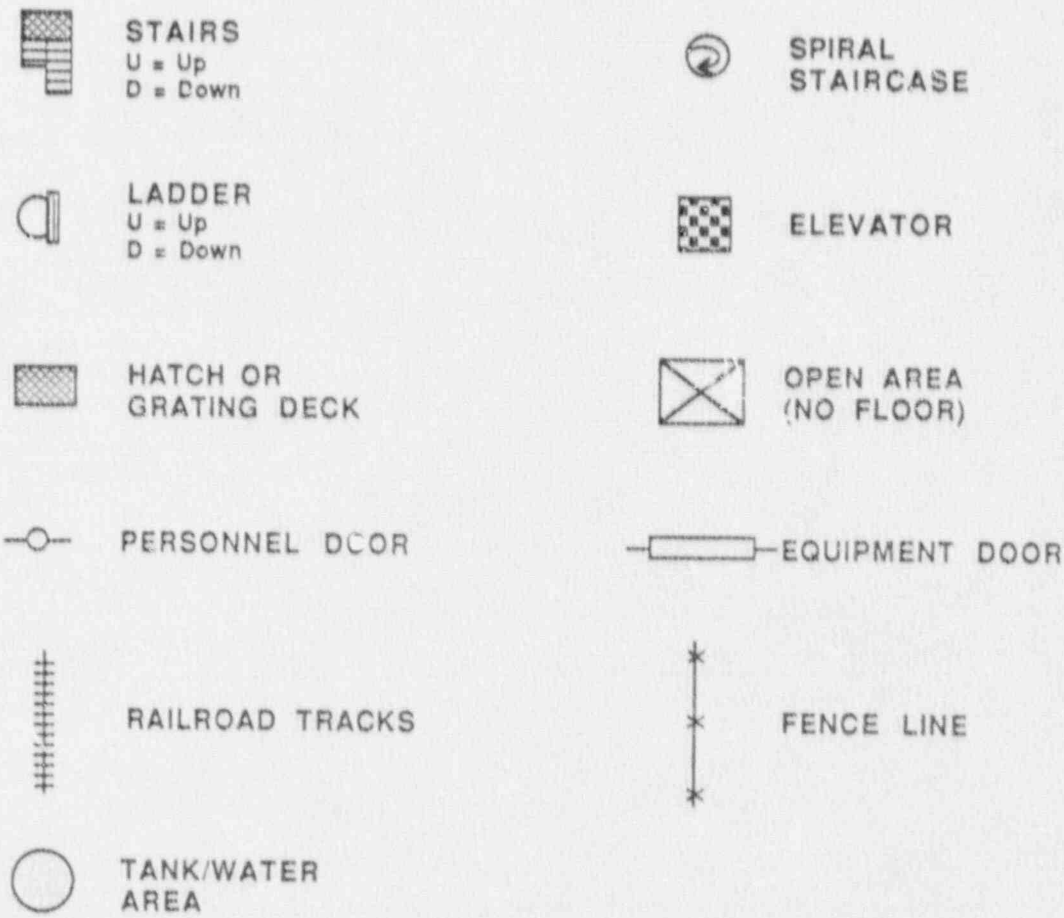


Figure A-3. Key To Symbols In Facility Layout Drawings

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
RCIC	Reactor Core Isolation Cooling System
ECCS	Emergency Core Cooling Systems (including HPCI, LPCI, LPCS and ADS)
EP	Electric Power System
ESWS	Emergency Service Water System
RSWS	RHR 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